Hawaii-Southern California Training and Testing Activities Draft Environmental Impact Statement/ Overseas Environmental Impact Statement

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3.6 SEABIRDS

SEABIRDS SYNOPSIS

The United States Department of the Navy considered all potential stressors and the following have been analyzed for birds:

- Acoustic (tactical acoustic sonar and other acoustic devices, explosions, pile driving, swimmer defense airguns, vessel noise, and aircraft noise)
- Energy (electromagnetic)
- Physical disturbance and strikes (aircraft, vessels and in-water devices, and military expended materials)
- Ingestion (munitions and military expended materials other than munitions)

Preferred Alternative

- Per the Endangered Species Act (ESA), acoustic sources may affect but are not likely to adversely affect ESA-listed seabirds. Acoustic sources would not affect critical habitat.
- Per the ESA, energy sources may affect but are not likely to adversely affect ESA-listed seabirds. Energy sources would not affect critical habitat.
- Per the ESA, physical disturbance and strike sources may affect but are not likely to adversely affect ESA-listed seabirds. Physical disturbance and strike sources would not affect critical habitat.
- Per the ESA, ingestion sources may affect but are not likely to adversely affect ESA-listed seabirds. Ingestion sources would not affect critical habitat.

3.6.1 INTRODUCTION

This chapter provides the analysis of potential impacts on seabirds that are found in the Hawaii-Southern California Training and Testing (HSTT) Study Area (Study Area). This section provides an introduction to the species and taxonomic groups that occur in the Study Area. Section 3.6.2 provides detailed information on the baseline affected environment. The complete analysis and summary of potential impacts of the proposed action on seabirds are found in Sections 3.6.3 and 3.6.4 through 3.6.6, respectively.

Seabirds are found throughout the HSTT Study Area. This section introduces the Endangered Species Act (ESA)–listed species, the major taxonomic groups of seabirds that occur in the Study Area, species protected under the Migratory Bird Treaty Act, and United States (U.S.) Fish and Wildlife Service Birds of Conservation Concern, and a general description of major species groups of seabirds in the Study Area.

3.6.1.1 Endangered Species Act Species

Five seabird species that occur in the Study Area are listed under the ESA as endangered or threatened species. The status, presence, and nesting occurrence of ESA-listed seabirds in the Study Area are listed in Table 3.6-1. These species will be further discussed in detailed species profiles (Section 3.6.1.3 U.S. Fish and Wildlife Service Birds of Conservation Concern).

Table 3.6-1: Endangered Species Act Listed Seabird Species Found in the Study Area

Species Name and Regulatory Status[1]			Presence in Study Area[2]		
Common Name	**Scientific Name**	**Endangered Species Act- Listing**	**Open Ocean Area**	**Large Marine Ecosystem**	**Bays, Estuaries, and Rivers**
California least tern	*Sterna antillarum browni*	Endangered	None	California Current (nesting)	San Diego Bay
Hawaiian petrel	*Pterodroma sandwichensis*	Endangered	North Pacific Subtropical Gyre	Insular Pacific-Hawaiian (nesting)	None
Short-tailed albatross	*Phoebastria albatrus*	Endangered	North Pacific Subtropical Gyre	California Current, Insular Pacific-Hawaiian	None
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	None	California Current	None
Newell's shearwater	*Puffinus auricularis newelli*	Threatened	North Pacific Subtropical Gyre	Insular Pacific-Hawaiian (nesting)	None

[1]ESA listing status.
[2]Presence in the Study Area indicates open ocean areas (North Pacific Subtropical Gyre) and coastal waters of large marine ecosystems (California Current, Insular Pacific-Hawaiian) in which the species are found. Nesting in the Study Area is indicated in parentheses.

3.6.1.2 Major Bird Groups

There are three major taxonomic groups of seabirds represented in the Study Area (Table 3.6-2). These seabirds may be found in air, at the water's surface, or in the water column of the Study Area. The vertical distribution descriptions provided in Table 3.6-2 are meant to provide a representative description of the taxonomic group; however, due to variations in species behavior, may not apply to all species within each group. Distribution in the water column is indicative of a species that is known to dive under the surface of the water (for example, during foraging). More detailed species descriptions, including diving behavior, are provided in Sections 3.6.2.10 (Order Procellariiformes), 3.6.2.11 (Order Pelecaniformes) through 3.6.2.12 (Orders Charadriiformes).

All three major groups of seabirds in the Study Area occur either in open-ocean areas (North Pacific Subtropical Gyre and North Pacific Transition Zone) or coastal waters of large marine ecosystems (California Current and Insular Pacific-Hawaiian) or coastal bays or estuaries (San Diego Bay) (see map of the Study Area in Figure 3.0-2).

3.6.1.3 Migratory Bird Treaty Act Species

A variety of seabird species would be encountered in the Study Area including those listed under the Migratory Bird Treaty Act (United States Fish and Wildlife Service 2010b). The Migratory Bird Treaty Act established federal responsibilities for protecting nearly all migratory species of seabirds, eggs, and nests. Bird migration is defined as the periodic seasonal movement of seabirds from one geographic region to another, typically coinciding with available food supplies or breeding seasons. Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 Code of Federal Regulations [C.F.R.] Part 21), the U.S. Fish and Wildlife Service has promulgated a rule that permits the incidental take of migratory seabirds under certain circumstances (see Section 3.0.1 [Regulatory Framework]). Of the 1,007 species protected under the Migratory Bird Treaty Act, 105 species occur in the Study Area. These species are not analyzed individually, but rather are grouped based on taxonomic or behavioral similarities based on the stressor that is being analyzed. Conclusions of potential impacts on species protected under the Migratory Bird Treaty Act are presented at the conclusion of each stressor subsection as well as in Section 3.6.5 (Summary of Potential Impacts [Combined Impacts of All Stressors] on Seabirds).

Table 3.6-2: Descriptions and Examples of Major Taxonomic Groups within the Study Area

Major Bird Groups[1]		Vertical Distribution in the Study Area		
Common Name (Taxonomic Group)	**Description**	**Open Ocean Areas[2]**	**Large Marine Ecosystem[2]**	**Bays, Estuaries, and Rivers**
Albatrosses, petrels, shearwaters, and storm-petrels (order Procellariiformes)	Group of largely pelagic seabirds, fly nearly continuously when at sea, soar low over the water surface to find prey, some species dive below the surface.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column
Tropicbirds, boobies, pelicans, cormorants, and frigatebirds (order Pelecaniformes)	Diverse group of large, fish-eating seabirds with four toes joined by webbing, often occur in large flocks near high concentrations of bait fish.	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column
Phalaropes, gulls, noddies, terns, skua, jaegers, and alcids (order Charadriiformes)	Diverse group of small to medium sized shorebirds, seabirds and allies inhabiting coastal, nearshore, and open-ocean waters	Airborne, surface, water column	Airborne, surface, water column	Airborne, surface, water column

[1] Major taxonomic groups based on American Ornithologists' Union (American Ornithologists' Union 1998), Sibley (Sibley 2000).
[2] Presence in the Study Area includes open ocean areas (North Pacific Subtropical Gyre and North Pacific Transition Zone) and coastal waters of two Large Marine Ecosystems (California Current and Insular Pacific-Hawaiian).

3.6.1.4 United States Fish and Wildlife Service Birds of Conservation Concern

Birds of Conservation Concern are species, subspecies, and populations of migratory and nonmigratory birds that the U.S. Fish and Wildlife Service has determined to be the highest priority for conservation actions (U.S. Fish and Wildlife Service 2008). The purpose of the Birds of Conservation Concern list is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions needed to conserve these species. Of the 105 species that occur within the Study Area, 13 are considered Birds of Conservation Concern (Table 3.6-3). These species are not analyzed individually, but rather are grouped by taxonomic or behavioral similarities based on the stressor that is being analyzed.

Table 3.6-3: Migratory Bird Treaty Act Species and Birds of Conservation Concern within the Study Area

Family/Subfamily	Common Name	Scientific Name	Birds of Conservation Concern
Order PROCELLARIIFORMES			
Family DIOMEDEIDAE			
	Laysan albatross	*Phoebastria immutabilis*	X
	Black-footed albatross	*Phoebastria nigripes*	X
	Short-tailed albatross	*Phoebastria albatrus*	
Family PROCELLARIIDAE			
	Northern fulmar	*Fulmarus glacialis*	
	Kermadec petrel	*Pterodroma neglecta*	
	Murphy's petrel	*Pterodroma ultima*	
	Mottled petrel	*Pterodroma inexpectata*	
	Juan Fernandez petrel	*Pterodroma externa*	
	Hawaiian petrel	*Pterodroma sandwichensis*	
	White-necked petrel	*Pterodroma cervicalis*	
	Bonin petrel	*Pterodroma hypoleuca*	
	Black-winged petrel	*Pterodroma nigripennis*	
	Cook's petrel	*Pterodroma cookii*	
	Stejneger's petrel	*Pterodroma longirostris*	
	Phoenix petrel	*Pterodroma alba*	
	Tahiti petrel	*Pseudobulweria rostrata*	
	Bulwer's petrel	*Bulweria bulwerii*	
	Streaked shearwater	*Calonectris leucomelas*	
	Pink-footed shearwater	*Puffinus creatopus*	X
	Flesh-footed shearwater	*Puffinus carneipes*	
	Wedge-tailed shearwater	*Puffinus pacificus*	
	Buller's shearwater	*Puffinus bulleri*	
	Sooty shearwater	*Puffinus griseus*	
	Short-tailed shearwater	*Puffinus tenuirostris*	
	Christmas shearwater	*Puffinus nativitatis*	X
	Townsend's shearwater	*Puffinus auricularis*	
	Black-vented shearwater	*Puffinus opisthomelas*	X
Family HYDROBATIDAE			
	Wilson's storm-petrel	*Oceanites oceanicus*	
	Fork-tailed storm-petrel	*Oceanodroma furcata*	
	Leach's storm-petrel	*Oceanodroma leucorhoa*	
	Ashy storm-petrel	*Oceanodroma homochroa*	X
	Band-rumped storm-petrel	*Oceanodroma castro*	X
	Wedge-rumped storm-petrel	*Oceanodroma tethys*	
	Matsudaira's storm-petrel	*Oceanodroma matsudairae*	
	Black storm-petrel	*Oceanodroma melania*	
	Tristram's storm-petrel	*Oceanodroma tristrami*	X
	Least storm-petrel	*Oceanodroma microsoma*	

Table 3.6-3: Migratory Bird Treaty Act Species and Birds of Conservation Concern within the Study Area (continued)

Family/Subfamily	Common Name	Scientific Name	Birds of Conservation Concern
Order PELECANIFORMES			
Family PHAETHONTIDAE			
	Red-billed tropicbird	*Phaethon aethereus*	
	Red-tailed tropicbird	*Phaethon rubricauda*	
	White-tailed tropicbird	*Phaethon lepturus*	
Family SULIDAE			
	Masked booby	*Sula dactylatra*	
	Blue-footed booby	*Sula nebouxii*	
	Brown booby	*Sula leucogaster*	
	Red-footed booby	*Sula sula*	
Family PELECANIDAE			
	American white pelican	*Pelecanus erythrorhynchos*	
	California brown pelican	*Pelecanus occidentalis californicus*	
Family PHALACROCORACIDAE			
	Brandt's cormorant	*Phalacrocorax penicillatus*	
	Double-crested cormorant	*Phalacrocorax auritus*	
	Pelagic cormorant	*Phalacrocorax pelagicus*	
Family FREGATIDAE			
	Magnificent frigatebird	*Fregata magnificens*	
	Great frigatebird	*Fregata minor*	
Order CHARADRIIFORMES			
Family LARIDAE			
Subfamily LARINAE	Laughing gull	*Larus atricilla*	
	Franklin's gull	*Larus pipixcan*	
	Little gull	*Larus minutes*	
	Black-headed gull	*Larus ridibundus*	
	Bonaparte's gull	*Larus philadelphia*	
	Heermann's gull	*Larus heermanni*	
	Mew gull	*Larus canus*	
	Ring-billed gull	*Larus delawarensis*	
	California gull	*Larus californicus*	
	Herring gull	*Larus argentatus*	
Subfamily LARINAE	Thayer's gull	*Larus thayeri*	
	Slaty-backed gull	*Larus schistisagus*	
	Yellow-footed gull	*Larus livens*	
	Western gull	*Larus occidentalis*	
	Glaucous-winged gull	*Larus glaucescens*	
	Glaucous gull	*Larus hyperboreus*	
	Sabine's gull	*Xema sabini*	
	Black-legged kittiwake	*Rissa tridactyla*	
Subfamily STERNINAE	Blue noddy	*Procelsterna cerulea*	X
	Black noddy	*Anous minutus*	
	Brown noddy	*Anous stolidus*	

Table 3.6-3: Migratory Bird Treaty Act Species and Birds of Conservation Concern within the Study Area (continued)

Family/Subfamily	Common Name	Scientific Name	Birds of Conservation Concern
Subfamily STERNINAE	White tern	*Gygis alba*	
	Sooty tern	*Onychoprion fuscatus*	
	Gray-backed tern	*Onychoprion lunatus*	
	Little tern	*Sternula albifrons*	
	California Least tern	*Sternula antillarum browni*	
	Caspian tern	*Hydroprogne caspia*	
	Black tern	*Chlidonias niger*	
	Common tern	*Sterna hirundo*	
	Arctic tern	*Sterna paradisaea*	
	Forster's tern	*Sterna forsteri*	
	Black-naped tern	*Sterna sumatrana*	
	Royal tern	*Thalasseus maximus*	
	Great Crested tern	*Thalasseus bergii*	
	Elegant tern	*Thalasseus elegans*	
	Gull-billed tern	*Sterna nilotica*	X
Subfamily RYNCHOPINAE	Black skimmer	*Rynchops niger*	X
Family STERCORARIIDAE			
	South polar skua	*Stercorarius maccormicki*	
	Pomarine jaeger	*Stercorarius pomarinus*	
	Parasitic jaeger	*Stercorarius parasiticus*	
	Long-tailed jaeger	*Stercorarius longicaudus*	
Family ALCIDAE			
	Common murre	*Uria aalge*	
	Thick-billed murre	*Uria lomvia*	
	Pigeon guillemot	*Cepphus columba*	
	Long-billed murrelet	*Brachyramphus perdix*	
	Marbled murrelet	*Brachyramphus marmoratus*	
	Xantus's murrelet	*Synthliboramphus hypoleucus*	X
	Craveri's murrelet	*Synthliboramphus craveri*	
	Ancient murrelet	*Synthliboramphus antiquus*	
	Cassin's auklet	*Ptychoramphus aleuticus*	X
	Parakeet auklet	*Aethia psittacula*	
	Rhinoceros auklet	*Cerorhinca monocerata*	
	Horned puffin	*Fratercula corniculata*	
	Tufted puffin	*Fratercula cirrhata*	

3.6.2 AFFECTED ENVIRONMENT

Seabirds are a diverse group that are adapted to living in marine environments (Enticott and Tipling 1997) and use coastal (nearshore) waters, offshore waters (continental shelf), or open ocean areas (Harrison 1983). There are many biological, physical, and behavioral adaptations that are different for seabirds than for terrestrial birds. Seabirds typically live longer, breed later in life, and produce fewer young than other bird species (Onley and Scofield 2007). The feeding habits of seabirds are related to their individual physical characteristics, such as body mass, bill shape, and wing area (Hertel and

Ballance 1999; Spear and Ainley 1998). Some seabirds look for food (forage) on the sea surface, whereas others dive to variable depths to obtain prey (Burger 2001). Many seabirds spend most of their lives at sea and come to land only to breed, nest, and occasionally rest (Schreiber and Chovan 1986). Most species nest in groups (colonies) on the ground of coastal areas or oceanic islands, where breeding colonies number from a few individuals to thousands.

The Hawaiian Islands are important habitat for seabirds in the North Pacific Subtropical Gyre. The shoreline, estuarine, and open ocean environments support a variety and large population of seabird species by providing important nesting and feeding habitats. The Hawaiian Islands are in the warm North Pacific water mass (U.S. Fish and Wildlife Service 2005b). Despite low levels of localized production, recent research estimates that 15 million seabirds inhabit the Hawaiian Islands; 22 species of seabirds regularly nest in the Hawaiian Islands, and many more pass through during migration to and from their breeding grounds elsewhere in the Pacific (Birding Hawaii 2004).

The entire world populations of Hawaiian petrels and Newell's shearwaters and more than 95 percent of the world's Laysan and black-footed albatrosses nest in the northwest Hawaiian Islands. Most of the world's ashy storm-petrels, western gulls, and Brandt's cormorants nest along the west coast of the United States (U.S. Fish and Wildlife Service 2005b). In addition to breeding seabirds, millions of seabirds from more than 100 different species migrate to or through the Study Area. For example, an estimated abundance of 5.5 to 6 million seabirds off California are thought to occur based on at-sea surveys (U.S. Fish and Wildlife Service 2005b). Surveys around the Hawaiian Islands found 40 different species of seabirds, half of which were local breeders and the remainder were migrant species.

The Southern California Bight, within the California Current Large Marine Ecosystem, is important for both breeding and migratory bird species. More than 195 species of birds use coastal or offshore aquatic habitats in the Southern California Bight—the area of the Pacific Ocean lying between Point Conception on the Santa Barbara County coast to a point south of the U.S.-Mexico border (Anderson et al. 2007; Bearzi et al. 2009; Hunt and Butler 1980).

The following sections contain profiles for ESA-listed and ESA-candidate species and species groups that occur in the Study Area. The emphasis on species-specific information is placed on the ESA-protected species list because any threats or potential impacts on those species are subject to consultation with regulatory agencies. Additional information on the biology, life history, and conservation of seabird species, including species-specific profiles, can be found on the following organizations' websites: U.S. Fish and Wildlife Service Endangered Species Program (2010a), Birdlife International (2010), and the International Union for Conservation of Nature and Natural Resources (2010). Sections 3.6.3.5 to 3.6.3.9 describe the taxonomic groups of ESA-listed seabird species in the Study Area.

3.6.2.1 Group Size

A variety of group sizes and diversity may be encountered throughout the Study Area, ranging from solitary migration of an individual seabird to large concentrations of mixed-species flocks. Depending on season, location, and time of day, the number of seabirds observed (group size) will vary and will likely fluctuate from year to year. During spring and fall periods, diurnal and nocturnal migrants would likely occur in large groups as they migrate over open water. Most seabird species nest in groups (colonies) on the ground of coastal areas or oceanic islands, where breeding colonies number from a few individuals to thousands. This breeding strategy is believed to have evolved in response to the limited availability of relatively predator-free nesting habitats and distance to foraging sites from breeding grounds (Siegel-Causey and Kharitonov 1990). Outside of the breeding season, most Proceliid (birds within the Order

Procelliiformes) seabirds are solitary, though they may join mixed-species flocks while foraging and can be associated with whales and dolphins (Onley and Scofield 2007) or areas where prey density is high (U.S. Fish and Wildlife Service 2005c). During the breeding season, these seabirds usually form large nesting colonies. Similarly, Pelecaniform (birds within the Order Pelecaniformes) breeding, whether on the ground or in trees, is typically colonial. Foraging occurs either singly or in small groups. Foraging seabirds of the order Charadriiformes can range from singles or pairs (murrelets) (International Union for the Conservation of Nature 2010f; U.S. Fish and Wildlife Service 2005b) and can extend upward into larger groups (terns) where juveniles accompany adults to post-breeding foraging areas, where the water is calm and the food supply is good. There are post-season dispersal sites, where adults and fledglings congregate (U.S. Fish and Wildlife Service 2006). Large groups are occasionally observed foraging at great distances from colonies, including at inland water sources (Atwood and Minsky 1983).

3.6.2.2 Diving Information

Most of the seabird species found with the Study Area will dive, skim, or grasp prey at the water's surface or within the upper portion (1 to 2 m [3.3 to 6.6 ft.]) of the water column (Sibley 2007). Foraging strategies are species specific such as plunge-diving or pursuit diving. Plunge-diving, as utilized by terns and pelicans, is a foraging strategy in which the bird hovers over the water and dives into the water to pursue fish. Diving behavior in terns is limited to plunge-diving during foraging (U.S. Fish and Wildlife Service 1985) and in general, tern species do not usually dive deeper than 3 ft. (0.9 m). Pursuit divers, a common foraging strategy of seabirds of the Family Alcidae, usually float on the water and dive under to pursue fish and other prey. They most commonly eat fish, squid, and crustaceans (Burger 2004).

Petrels forage both night and day; they capture prey by resting on the water surface and dipping their bill and by aerial pursuit of flying fish (International Union for the Conservation of Nature 2010d). Hawaiian petrels eat mostly squid (50-75 percent of their diet), fish, and crustaceans (International Union for the Conservation of Nature 2010d).

More specific diving information in regard to taxonomic groups is provided in Sections 3.6.2.10 (Order Procellariiformes), 3.6.2.11 (Order Pelecaniformes) through 3.6.2.12 (Orders Charadriiformes).

3.6.2.3 Bird Hearing

The majority of the published literature on bird hearing focuses on terrestrial birds and their ability to hear in air as there is a paucity of data regarding underwater hearing abilities (Melvin and Parrish 1999). A review of 32 terrestrial and marine species indicates that birds generally have greatest hearing sensitivity between 1 and 4 kilohertz (kHz) (see Beason 2004). Very few can hear below 20 hertz (Hz), most have an upper frequency hearing limit of 10 kHz, and none exhibit hearing at frequencies higher than 20 kHz (Dooling et al. 2000). Thiessen (1958) reported the lower hearing threshold for the ring-billed gull (*Larus delawarensis*) of 2 kHz. Starlings (*Sturnus vulgais*) and house sparrows (*Passer domesticus*) have reported hearing ranges of 0.2-18 kHz (Brand and Kellogg, 1939) while the hearing range of pigeons (*Columba livia*) is 0.1 to 10 kHz (Necker, 1983). Hearing capabilities have been studied for only a few seabirds (Beason 2004; Beuter et al. 1986; Thiessen 1958; Wever et al. 1969); these studies show that seabird hearing ranges and sensitivity are consistent with what is known about bird hearing in general.

There is little published literature on the hearing abilities of birds underwater. In fact, there are no measurements of the underwater hearing of any diving birds (Therrien et al. 2011). There are some studies of bird behavior underwater when exposed to sounds, from which some hearing abilities of birds underwater could be inferred. Common murres (*Uria aalge*) were deterred from gillnets by acoustic pingers emitting 1.5 kHz pings at 120 decibels (dB) referenced (re) to 1 micro-Pascal (µPa); however, there was no significant reduction in rhinoceros auklet (*Cerorhinca monocerata*) bycatch in the same nets (Melvin et al. 1999).

3.6.2.4 General Threats

Threats to seabird populations in the Study Area include human-caused stressors such as incidental mortality from interactions with commercial and recreational fishing gear, predation by introduced species, disturbance and degradation of nesting areas by humans and domesticated animals, noise pollution from construction and other human activities, nocturnal collisions with power lines and artificial lights, collisions with aircraft, and pollution, such as that from oil spills and plastic debris (Anderson et al. 2007; Burkett et al. 2003; California Department of Fish and Game 2010; Carter and Kuletz 1995; Carter et al. 2005; Clavero et al. 2009; International Union for Conservation of Nature and Natural Resources 2010; North American Bird Conservation Initiative 2010; Piatt and Naslund 1995; U.S. Fish and Wildlife Service 2005b, 2008a, 2010a). Disease, volcanic eruptions, storms, and harmful algal blooms are also threats to seabirds (Anderson et al. 2007; Jessup et al. 2009; North American Bird Conservation Initiative 2010; U.S. Fish and Wildlife Service 2005b). In addition, seabird distribution, abundance, breeding, and other behaviors are affected by cyclical environmental events, such as the El Niño Southern Oscillation and Pacific Decadal Oscillation in the Pacific Ocean (Vandenbosch 2000).

In the long term, climate change could be the largest threat to seabirds (North American Bird Conservation Initiative 2010). Climate change effects include changes in air and sea temperatures, precipitation, the frequency and intensity of storms, pH level of sea water, and sea level. These changes could affect overall marine productivity, which could affect the food resources, distribution, and reproductive success of seabirds (Aebischer et al. 1990; Congdon et al. 2007). The projection for global sea levels rise from 2090-2099 is up to 1 ft. (0.3 m) relative to 1980-1999 levels (Church and White 2006; Solomon et al. 2007). As a result, seabird nesting colonies that occur along sections of coastlines undergoing sea level rise may experience a loss of nesting habitat (Congdon et al. 2007; Gilman and Ellison 2009; Gilman et al. 2008; Hitipeuw et al. 2007; Mullane and Suzuki 1997).

3.6.2.5 California Least Tern (*Sternula antillarum browni*)

3.6.2.5.1 Status and Management

The California least tern (*Sternula antillarum browni*) was federally listed as endangered in 1970 and is listed as endangered by the state of California (California Department of Fish and Game 2010). In 2006, the U.S. Fish and Wildlife Service completed the most recent 5-year status review for the species and recommended that the California least tern be downlisted to threatened under the ESA. The population increased from 600 pairs in 1973 to approximately 7,100 pairs in 2005, and least tern nesting sites have nearly doubled since the species was first listed (U.S. Fish and Wildlife Service 2006). In 2007, an estimated 6,744 to 6,989 California least tern breeding pairs established nests at 48 locations in California (Marschalek 2008); however, the species' population increase does not meet the requirements in the 1985 recovery plan to warrant delisting.

No critical habitat has been designated for the California least tern. Conservation for the California least tern is addressed in multiple memoranda of understanding and integrated natural resource management plans for military lands in the Southern California region, including Marine Corps Base Camp Pendleton, Naval Amphibious Base Coronado (U.S. Department of the Navy 2002), and Naval Base Ventura County Point Mugu.

3.6.2.5.2 Habitat and Geographic Range

The preferred nesting habitat consists of beaches, dunes, and sand bars on the ocean shore (U.S. Fish and Wildlife Service 1985). The California least tern nests in areas generally free of vegetation above the high tide mark. Colony sites are often near estuaries, lagoons, rivers, or the seacoast (U.S. Fish and Wildlife Service 1985). Atwood and Minsky (1983) noted that before the decline of the species, at least 82 percent of known nesting sites in California were within 1 mile (mi.) (1.6 kilometers [km]) of a river mouth or estuarine habitat.

California least terns spend the breeding season (April through August) in coastal waters along the central and Southern California coast, as well as along the west and southwestern coast of Mexico. Their distribution is from San Francisco to Baja California on the Pacific Coast of North America (U.S. Fish and Wildlife Service 2010b). The California least tern historically nested on coastal beaches of Monterey, California, to Cabo San Lucas, Baja California.

Foraging habitats include nearshore ocean waters, bays, river mouths, salt marshes, marinas, river channels, lakes, and ponds (Thompson et al. 1997). California least terns feed within 2 mi. (3.2 km) of the shoreline in ocean waters less than 60 ft. (18.3 m) deep, with most foraging within 1 mi. (1.6 km) of shore (Atwood and Minsky 1983). Atwood and Minsky (1983) also observed a tendency for foraging birds to be concentrated in coastal waters near major river mouths. Foraging habitat use varies within and between years, depending on the stage of breeding and prey availability (Atwood and Minsky 1983; BirdLife International 2009). Atwood and Minsky (1983) noted in their coastal colony study that, before terns disperse after breeding, they typically forage within 2 mi. (3.2 km) of nesting sites, although large groups were occasionally observed foraging at greater distances from colonies, including inland water sources. The presence of eelgrass is important because it is habitat for several prey species of the least tern such as topsmelt, one of the California least terns' preferred prey (BirdLife International 2009).

3.6.2.5.2.1 California Current Large Marine Ecosystem

California least terns occur in coastal waters throughout the Southern California portion of the Study Area during the breeding, non-breeding, and migration seasons. The current nesting range is from San Francisco Bay and south along the California coast to San Diego County which includes the Southern California portion of the Study Area in the California Current Large Marine Ecosystem and parts north of the Study Area (Massey and Fancher 1989). During migration, California least terns remain near the coast, although they have been observed foraging in multispecies feeding flocks 1 to 20 mi. (1.6 to 32.2 km) off the western coast of Baja California in late April and early May (U.S. Fish and Wildlife Service 2005b). The California least tern can be found in more offshore waters during the breeding season (courtship and incubation stages) when they forage farther from the nest site over open and deep water. Adults tend to travel farther when food availability is low, foraging in open ocean waters (BirdLife International 2009).

3.6.2.5.3 Population and Abundance

The California least tern population in California averaged about 4,300 pairs between 2000 and 2002, making up about 10 percent of the North American population (U.S. Fish and Wildlife Service 2005b). The California population has increased almost 12-fold from a low of 600 pairs in the early 1970s to roughly 7,100 pairs in 2005 (U.S. Fish and Wildlife Service 2001, 2005b).

3.6.2.5.4 Predator and Prey Interactions

California least terns forage by plunge-diving to catch prey in upper surface waters, usually within the first meter of water depth. In general, other tern species do not usually dive deeper than 3 ft. (0.9 m) (Eriksson 1985). No information exists on specific dive depths for California least terns. Prey species include anchovies, topsmelt, silverside smelt, opaleye, and gobies (BirdLife International 2009). Prey species composition varies throughout the year, depending on availability. Length of foraging and peak foraging behavior typically occur from the end of May through mid-July after chicks hatch.

California least terns are preyed upon by various species. These include gulls, ravens, crows, rodents, raccoons and coyotes prey on California least tern eggs, chicks, and adults (U.S. Fish and Wildlife Service 2006).

3.6.2.5.5 Species-Specific Threats

Threats to breeding least terns include the alteration of river habitat, flooding and development of coastal areas, disruptive recreation, an increase in aggressive gulls that compete for nesting sites, and predation by native and feral species, such as rats, great horned owls, black-crowned night herons, dogs, and cats (Sidle et al. 1992; United States Fish and Wildlife Service 1990). Oil pollution is also a concern within coastal and inland habitats.

3.6.2.6 Hawaiian Petrel (*Pterodroma sandwichensis*)

The Hawaiian petrel (*Pterodroma sandwichensis*) was recently split from the Galapagos petrel (*Pterodroma phaeopygia*) based on genetic and morphological evidence; before the split they were collectively known as the dark-rumped petrel (U.S. Fish and Wildlife Service 2005a).

3.6.2.6.1 Status and Management

The Hawaiian petrel is found only in Hawaii and is listed as endangered throughout its range under the ESA (U.S. Fish and Wildlife Service 2005a); there is no designated critical habitat. The greatest threat to adult survival and breeding success is predation by introduced animals, such as mongooses, cats, and rats. In some cases, predation has caused more than 70 percent nesting failure (U.S. Fish and Wildlife Service 2005a).

3.6.2.6.1.1 Habitat and Geographic Range

Hawaiian petrels nest only in Hawaii, specifically in the main Hawaiian Islands, though there are specimen records from Japan, Philippines, and Mollucas at the western edge of the distribution (International Union for the Conservation of Nature 2010d). Under pressure of predation, most nesting habitat is at the highest elevations available in the main Hawaiian Islands. Most sites (Haleakala National Park in Maui and Mauna Kea, Mauna Loa, and Kilauea in Hawaii) are characterized by high elevation (6,560 to 9,840 ft. [1,999.5 to 2,999.2 m]), dry climate, and sparse vegetation (less than 10 percent plant cover). Nesting habitat is poorly known on other islands. The Hawaiian petrel is present throughout the offshore waters of the Hawaiian Islands (International Union for the Conservation of Nature 2010d).

The Hawaiian petrel typically feeds well offshore but tends to feed closer to shore (0 to 45 mi. [0 to 72.4 km]) during spring than in the fall (most abundant at 170 to 230 mi. [273.6 to 370.1 km]) (Spear et al. 1999). The Hawaiian petrel favors open ocean water conditions, with an average sea surface temperature of 80 degrees (°) Fahrenheit (F) (27° Celsius [C]), sea surface salinity of 34 parts per thousand, wind speed of 19 mi. per hour (30.6 km per hour), and a wave height of 5 ft. (1.5 m). It also prefers an average depth from the warmer surface water to the point where cold water begins (the thermocline) of 35 ft. (10.7 m) (Spear et al. 1995).

The Hawaiian petrel is an open ocean species of the central tropical Pacific (U.S. Fish and Wildlife Service 2005a). They occur in open ocean waters throughout most of the Hawaii portion of the Study Area and the western portion of the Transit Corridor in the Insular Pacific-Hawaiian Large Marine Ecosystem. The Hawaiian petrel occurs largely in equatorial waters of the eastern tropical Pacific, generally from 10° South (S) to 20° North (N). Because of the difficulty in identification, the precise southeastern extent of the Hawaiian petrel and the northwestern extent of the similar Galapagos petrel remains uncertain (Spear et al. 1995).

3.6.2.6.1.2 Insular Pacific-Hawaiian Large Marine Ecosystem

Hawaiian petrels have important resting sites in coastal waters throughout the Hawaii portion of the Study Area in portions of the Insular Pacific-Hawaiian Large Marine Ecosystem. An area of the north shore of Kauai is widely known as a resting location for Hawaiian petrels (Birding Hawaii 2004). Based on known or suspected colony sites, gathering areas likely occur near shore on Lehua Rock, Kauai, Molokai, Lanai, Maui, and Hawaii (Day and Cooper 1995; Day et al. 2003; International Union for the Conservation of Nature 2010d; U.S. Fish and Wildlife Service 2005a) and perhaps around Kahoolawe (U.S. Fish and Wildlife Service 2005a). These areas provide resting habitat before the birds fly to inland nesting colonies. Hawaiian petrels move to and from nesting colonies during dusk and dawn (International Union for the Conservation of Nature 2010d).

3.6.2.6.2 Population and Abundance

The total population of Hawaiian petrels was estimated at 20,000, with a breeding population of 4,500 to 5,000 pairs (Spear et al. 1995; U.S. Fish and Wildlife Service 2005a); overall population trends on the Hawaiian islands are not known (U.S. Fish and Wildlife Service 2005a). Numbers of breeding Hawaiian petrels on Maui appear stable and have increased in areas of the Haleakala National Park, where predators are being managed (U.S. Fish and Wildlife Service 2005a). On Hawaii, numbers may be declining because of predation by introduced species (U.S. Fish and Wildlife Service 2005a).

3.6.2.6.3 Predator and Prey Interactions

Hawaiian petrels eat mostly squid (50 to 75 percent of their diet), fish, and crustaceans (International Union for the Conservation of Nature 2010d). They forage both night and day; they capture prey by resting on the water surface and dipping their bill and by aerial pursuit of flying fish (International Union for the Conservation of Nature 2010d). The foraging member of a pair may fly up to 930 mi. (1,496.7 km) from the nesting island (U.S. Fish and Wildlife Service 2005a).

Adult and young Hawaiian petrels are preyed on by introduced animals such as mongooses, cats, and rats.

3.6.2.6.4 Species-specific Threats

Threats to this endangered seabird include predation by introduced mammals, development, light attraction and collision, ocean pollution, and disturbance of its breeding grounds. The petrel does not have any natural defenses against predators such as rats, feral cats, and mongooses, and its burrows are very vulnerable. Collisions with artificial lights, utility poles, and fences kill Hawaiian petrels on some islands (International Union for the Conservation of Nature 2010d).

3.6.2.7 Short-tailed Albatross (*Phoebastria albatrus*)

The short-tailed albatross (*Phoebastria albatrus*) was formerly in the genus *Diomedea* and known as Steller's albatross; it is the largest of the North Pacific albatrosses.

3.6.2.7.1 Status and Management

The short-tailed albatross is widely regarded as one of the rarest species of albatrosses and one of the world's rarest birds (Harrison 1983; International Union for the Conservation of Nature 2010c). The short-tailed albatross is listed as endangered under the ESA throughout its range. Additionally, it is listed as endangered by the state of Hawaii (NatureServe 2004; U.S. Fish and Wildlife Service 2000, 2005b). No critical habitat has been designated for this species because little is known about its life in the open ocean (Piatt et al. 2006; U.S. Fish and Wildlife Service 2000).

Current threats to this species include ingestion of plastics mistaken for food items, volcanic eruption (at Torishima, Japan), typhoons, sunken longline fishing in Alaska and Russia, jig/troll fishery in Japan, invasive species at colonies (cats, rats, and plants), and researcher disturbance (U.S. Fish and Wildlife Service 2005c).

3.6.2.7.2 Habitat and Geographic Range

Short-tailed albatrosses are typically found in the open ocean and tend to concentrate along the edge of the continental shelf (NatureServe 2004). Upwelling zones are not only nutrient rich, but they also bring prey (for example, squid and fish) typically found only in deeper water to the surface, where they become available to albatrosses. Upwelling occurs when the wind moves warm, nutrient poor water away from the area, which allows colder, nutrient rich water to rise to the surface of the ocean. Short-tailed albatross nest on isolated, windswept, offshore islands with restricted human access (U.S. Fish and Wildlife Service 2000). Current and historical nesting habitat can be described as flat to steep slopes that are sparsely or fully vegetated. Short-tailed albatrosses disperse throughout the temperate and subarctic North Pacific approximately from May to October when they are not breeding, from Japan through California (U.S. Fish and Wildlife Service 2005b; 2008b?). Nonbreeders and failed breeders disperse from the colony months sooner. While many nonbreeders return to the colonies each year, the presence of immature birds far from the colony (such as the U.S. Pacific coast) during the breeding season suggests that some immature birds may spend years at sea before they return to the colony (U.S. Fish and Wildlife Service 2005c).

3.6.2.7.2.1 Open Ocean

The short-tailed albatross is an open ocean species that occurs throughout the Hawaii Range Complex (HRC), Transit Corridor, and Southern California (SOCAL) Range Complex portions of the Study Area. The range of the short-tailed albatross extends from Siberia south to the China coast, into the Bering Sea and Gulf of Alaska south to Baja California, Mexico, and throughout the North Pacific, including the Northwestern Hawaiian Islands (Committee on the Status of Endangered Wildlife in Canada 2003; Harrison 1983; Roberson 2000). Their at-sea distribution includes the entire North Pacific Ocean north of about 20° N latitude. Short-tailed albatrosses move seasonally around the North Pacific Ocean, with high densities observed during the breeding season (December through May) in Japan and throughout Alaska and along the west coast of North America during the non-breeding season (April through September) (International Union for the Conservation of Nature 2010c). Non-breeding subadults can be found in all areas throughout the year. They are seen regularly in the North Pacific Subtropical Gyre (U.S. Fish and Wildlife Service 2005c).

3.6.2.7.2.2 California Current Large Marine Ecosystem

Short-tailed albatross occasionally occur in SOCAL Range Complex portion of the California Current Large Marine Ecosystem, which is part of the Study Area. As the population began a gradual recovery after 1950, sporadic sightings have been recorded off California (International Union for the Conservation of Nature 2010c). Based on the number of sightings in the SOCAL Range Complex, the short-tailed albatross is considered rare in that portion of the Study Area, as well as off the entire California coast. Breeding does not occur in the SOCAL Bight, but because of the unique circulation and upwelling characteristics of this area, potential foraging habitat exists. Two documented sightings of the short-tailed albatross have occurred in SOCAL. Roberson (2000) reported a sighting in 1977 of an all-dark immature bird approximately 90 mi. (144.8 km) west of the San Diego area. McCaskie and Garrett (2002) reported a sighting in the vicinity of Santa Barbara Island in late February of 2002.

3.6.2.7.2.3 Insular Pacific-Hawaiian Large Marine Ecosystem

Short-tailed albatross occur in coastal waters throughout the Hawaii portion of the Study Area in the Insular Pacific-Hawaiian Large Marine Ecosystem. The short-tailed albatross regularly occurs on Midway Atoll and has been observed at other Northwestern Hawaiian Islands. Since the 1930s, short-tailed albatrosses have been occasionally reported during the breeding season at Midway Atoll. Some of these short-tailed albatrosses were recorded for several successive years. Although unconfirmed successful nesting was reported in 1961 and 1962 (Tickell 2000), the first confirmed nest site that produced an egg did not occur until 1993 (International Union for the Conservation of Nature 2010c). Nesting on the Northwestern Hawaiian Islands has been attempted, but successful nesting has not been confirmed (U.S. Fish and Wildlife Service 2005c). In the Hawaiian Islands, there was an unconfirmed sighting at Barking Sands on Kauai during March 2000 (Birding Hawaii 2004). Other known occurrences in Hawaii are of single birds (in 1976 and 1981) at French Frigate Shoals in the Northwestern Hawaiian Islands (U.S. Fish and Wildlife Service 2008b).

3.6.2.7.3 Population and Abundance

In 2005, the total population was estimated at 1,712, with 513 pairs at Torishima and 340 birds and 85 breeding pairs at Minami-Kojima (located northeast of Taiwan) (U.S. Fish and Wildlife Service 2005c). The Japan and Taiwan population is growing extremely rapidly at about 7.3 percent annually (International Union for the Conservation of Nature 2010c; U.S. Fish and Wildlife Service 2005c). Average population survival rate is 96 percent, and the current annual population growth is greater than 6 percent (U.S. Fish and Wildlife Service 2005c). Short-tailed albatross regularly visit the Hawaiian islands; although breeding attempts on Midway Atoll have been unsuccessful historically (U.S. Fish and Wildlife Service 2005c), a pair successfully bred in late 2010, hatching a chick in early 2011 which successfully fledged.

3.6.2.7.4 Predator and Prey Interactions

Short-tailed albatrosses are surface feeders and scavengers, feeding more inshore than other North Pacific albatrosses. In Japan, their diet consists of shrimp, squid, and fish (including bonita, flying fish, and sardines); diet information is not available for birds in the Study Area (U.S. Fish and Wildlife Service 2005c). Unlike other North Pacific albatrosses, short-tailed albatrosses frequently feed in sight of land.

Short-tailed albatross chicks are predated by other birds and introduced mammals such as cats and rats on nesting colonies (U.S. Fish and Wildlife Service 2005c).

3.6.2.7.5 Species-specific Threats

Short-tailed albatrosses have survived multiple threats to their existence. During the late 1800s and early 1900s, feather hunters clubbed to death an estimated five million of them, stopping only when the species was nearly extinct. In the 1930s, nesting habitat on the only active nesting island in Japan was damaged by volcanic eruptions, leaving fewer than 50 birds by the 1940s. Loss of nesting habitat to volcanic eruptions, severe storms, and competition with black-footed albatrosses for nesting habitat continue to be natural threats to short-tailed albatrosses today.

Human-induced threats include hooking and drowning on commercial longline gear, entanglement in derelict fishing gear, ingestion of plastic debris, contamination from oil spills, and potential predation by introduced mammals on breeding islands.

3.6.2.8 Marbled Murrelet (*Brachyramphus marmoratus*)

3.6.2.8.1 Status and Management

The marbled murrelet (*Brachyramphus marmoratus*) is listed as a threatened species in California, Oregon, and Washington under the ESA (U.S. Fish and Wildlife Service 1992) and is considered endangered by the state of California (California Department of Fish and Game 2010). Marbled murrelet populations have suffered significant declines in the Pacific Northwest, caused primarily by the removal of essential habitat by logging and coastal development (International Union for the Conservation of Nature 2010a). To stem these declines, critical habitat was designated in 1996 in mature and old-growth forest nesting habitat within 30 mi. (48.3 km) off the coast in Washington, Oregon, and California (U.S. Fish and Wildlife Service 1997). The entire critical habitat, as well as Primary Constituent Elements, are outside of the Study Area.

3.6.2.8.2 Habitat and Geographic Range

Marbled murrelets do not build a nest but use natural features, such as moss, clumps of mistletoe, or piles of needles as a nest site on tree limbs (International Union for the Conservation of Nature 2010a). Nests are in large conifers, such as coast redwood and western hemlock, in old-growth stands typically within 35 mi. (56.3 km) of marine waters. Important features in nesting habitat are stands of 500 acres (ac.) (202.3 hectares [ha]) or larger, multistoried canopy layers, and less than average canopy closures (Grenier and Nelson 1995; Hamer and Nelson 1995; Miller and Ralph 1995). In addition, habitat along major drainages (e.g., rivers and streams) is a key component (International Union for the Conservation of Nature 2010a), as murrelets tend to use these drainages as flight corridors to and from inland nest sites.

Marbled murrelets generally remain near breeding sites year-round in most areas (U.S. Fish and Wildlife Service 2005b). Foraging habitat is generally found within 3 mi. (4.8 km) from shore and in water less than 195 ft. (59.4 m) deep (Day and Nigro 2000; International Union for the Conservation of Nature 2010a). Birds occur closer to shore in exposed coastal areas and farther offshore in protected coastal areas (International Union for the Conservation of Nature 2010a). The highest concentrations are found in protected inshore waters (U.S. Fish and Wildlife Service 2005b). Physical and biological oceanographic processes that concentrate prey (such as upwelling and rip currents) have an important influence on the foraging distribution of marbled murrelets (Ainley et al. 1995; Burger 1995, 2002; Day and Nigro 2000; International Union for the Conservation of Nature 2010a; Strong et al. 1995). They are more commonly found inland during the summer breeding season but make daily trips to the ocean to gather food and have been detected in forests throughout the year. When not nesting, the birds live at sea, spending their days feeding close to shore and then moving several miles offshore at night.

3.6.2.8.2.1 California Current Large Marine Ecosystem

Marbled murrelets only occur in coastal waters of the California Current Large Marine Ecosystem within the northeast corner of the SOCAL Range Complex portion of the Study Area. Eight reported sightings of marbled murrelets have been documented within the Study Area off the California coast. Sightings have been reported at Marina del Rey, off Santa Barbara Island, at Mugu Lagoon in Ventura County, along the coast in San Diego County, and at the northern end of the Study Area near San Simeon Point (McCaskie and Garrett 2001). All of these documented sightings were recorded between November and March.

Foraging habitat in the Southern California Bight occurs usually within 3 mi. (4.8 km) of the coast in waters less than 195 ft. (59.4 m) deep (Day and Nigro 2000; International Union for the Conservation of Nature 2010a); however, because upwelling areas represent important foraging habitat for the marbled murrelet, the potential exists for individuals to be observed farther offshore in the Southern California Bight.

Winter distributions of marbled murrelets are poorly documented. In California, most birds appear to be year-round residents near breeding areas (Naslund 1993), although dispersal in the winter as far south as SOCAL and northern Mexico has been documented (Erickson et al. 1995). A single sighting has occurred at Enseñada Harbor (Erickson et al. 1995). The species is a rare fall/winter vagrant (occurring outside of its normal range) to SOCAL, and is “accidental” from the U.S.-Mexico border south along the Mexico coastline (International Union for the Conservation of Nature 2010a).

3.6.2.8.3 Population and Abundance

The largest number of marbled murrelets occurs in Alaska, where the population is estimated at 270,000, although the population has experienced a dramatic decline of approximately 70 percent over the last 25 years (Piatt et al. 2007). The population in British Columbia is estimated to be between 54,000 and 92,000 (Piatt et al. 2007). Current populations in Washington, Oregon, and California are small compared with the historical populations of British Columbia and Alaska, which at one time were believed to number in the hundreds of thousands (Piatt et al. 2007). A recent population estimate for Washington, Oregon, and California is a combined 20,200 (Raphael et al. 2007).

3.6.2.8.4 Predator and Prey Interactions

Marbled murrelets feed opportunistically on small fish, including sand lance, anchovy, herring, capelin, and smelt, and also on invertebrates (U.S. Fish and Wildlife Service 1997, 2005b). Feeding takes place in the nearshore marine environment, primarily in protected waters where both Pacific sand lance and surf smelt occur (Burger 2002; Whitworth et al. 2000). Individuals forage by diving, using their wings for underwater propulsion. The murrelet forages by pursuit diving in relatively shallow waters, usually between 20 and 80 m (6.1 and 24.4 ft.) in depth. The majority of birds are found as pairs or as singles in a band about 300 to 2,000 m (91.4 to 609.6 ft.) from shore. Foraging dive times averaged about 16 seconds. Murrelets generally forage during the day, and are most active in the morning and late afternoon hours. Some foraging occurs at night (Ralph et al 1995).

While at sea, marbled murrelets are preyed on by birds and mammals including peregrine falcons, bald eagles, western gulls, and northern fur seals. Birds such as common ravens, Steller’s jays, and sharp-shinned hawks are predators of marbled murrelet eggs, chicks, and adults during the nesting season (Nelson 1997).

3.6.2.8.5 Species-specific Threats

The principal factor threatening the persistence of marbled murrelet over the southern portions of its range is harvesting of old-growth and mature forests. In addition to habitat loss, interactions with fisheries, especially gill-net fisheries, and oil spills have also contributed to population declines (Ralph et al 1995). An estimated 3,500 murrelets are killed annually in Alaska by gill-net fisheries (Carter et al. 2005; Piatt and Naslund 1995). In addition, more than 1,000 oiled marbled murrelet carcasses were collected after the Exxon Valdez oil spill in Alaska (Carter and Kuletz 1995). Nest failure is caused by predation by raptors, ravens, and jays (Nelson 1997).

3.6.2.9 Newell's Shearwater (*Puffinus auricularis newelli*)

The classification of the Newell's shearwater (*Puffinus auricularis newelli*) is in flux. It was, until recently, regarded by some authorities as a distinct species, *Puffinus newelli* (International Union for the Conservation of Nature 2010a). Since 1982, most authorities have considered it a subspecies of Townsend's shearwater (*Puffinus auricularis*) (American Ornithologists' Union 1998). At least one author (Harrison 1983) regarded Newell's shearwater as a subspecies of Manx shearwater (*Puffinus puffinus newelli*). The U.S. Fish and Wildlife Service (2005b) identifies Newell's shearwater as a subspecies of Townsend's shearwater. Newell's shearwater is also known as Newell's dark-rumped shearwater.

3.6.2.9.1 Status and Management

Newell's shearwater is an ESA-listed threatened species, found only in the Hawaiian Islands. This species is also listed as threatened by the state of Hawaii (U.S. Fish and Wildlife Service 2005b). A federal recovery plan was finalized in 1983 (U.S. Fish and Wildlife Service 1983). Within the Hawaiian Islands Bird Conservation Region, Newell's shearwater is evaluated as highly imperiled, the most serious category, because of restricted breeding distribution and threats to breeding populations (U.S. Fish and Wildlife Service 2003). There is no critical habitat designation for the Newell's shearwater.

Newell's shearwater was thought to be extinct by 1908 as a consequence of subsistence hunting by Polynesians and predation by introduced rats, pigs, and dogs. However, they were rediscovered offshore in 1947. One was collected on Oahu in 1954 (Day et al. 2003) and Newell's shearwaters were confirmed as still breeding on Kauai in 1967 (U.S. Fish and Wildlife Service 2005b).

3.6.2.9.2 Habitat and Geographic Range

Newell's shearwater occurs in open ocean waters in the southern portion of the Hawaii portion of the Study Area and into the western portion of the Transit Corridor Study Area. They spend most of their time in the open ocean year-round (U.S. Fish and Wildlife Service 2005b) and come ashore only to nest. They avoid inshore waters except when gathering before they fly inland to breeding colonies at night (International Union for the Conservation of Nature 2010e).

Newell's shearwaters forage only over open ocean waters of depths reportedly much greater than 6,560 ft. (1,999.5 m) (Spear et al. 1995). Even when nesting, they feed over deep waters and are typically not within 15 mi. (24.1 km) of island shores (International Union for the Conservation of Nature 2010e). In particular, they find abundant food along oceanic fronts, such as the Equatorial Countercurrent (Spear et al. 1995). Preferred average ocean conditions are 80°F (26.7°C) sea surface temperature, 34.5 parts per thousand sea surface salinity, and 250 ft. (76.2 m) depth to cold water (Spear et al. 1995). The meteorological conditions favored by Newell's shearwaters are frequent clouds and rain squalls typical of intertropical convergence zones (Spear et al. 1995).

3.6.2.9.2.1 Insular Pacific-Hawaiian Large Marine Ecosystem

Newell's shearwater occurs in coastal waters throughout the Hawaii portion of the Study Area during the breeding season. Newell's shearwater nesting is entirely confined to the main Hawaiian Islands, from Lehua Rock east to Hawaii. Nesting is known on Lehua Rock, Kauai, Molokai, and Hawaii. No population estimates exist for the small nesting colonies that exist on Lehua Rock and Molokai (Day and Cooper 1995; International Union for the Conservation of Nature 2010e; U.S. Fish and Wildlife Service 2005b). About 20 breeding colonies of Newell's shearwaters are known in the main Hawaiian Islands, but others probably exist (International Union for the Conservation of Nature 2010e). In 1992, 11 colonies were known on Kauai. There is evidence but no confirmation of nesting on Oahu, Maui, and Lanai (U.S. Fish and Wildlife Service 2005b).

Newell's shearwaters nest on Kauai at high elevations (525 to 3,935 ft.) (160.02 to 1,199.4 m) on steep, densely vegetated mountain slopes and in burrows or deep rock crevices, although a substantial number also nest on dry sparsely vegetated cliffs on the Na Pali coast of Kauai and on Lehua Island (Reynolds and Ritchotte 1997; U.S. Fish and Wildlife Service 2005b). The use of steep slopes (mostly greater than 65°) for nesting is probably a consequence of predation pressure from introduced pigs, mongooses, and cats; they select sites where there is either an open canopy of trees and ground cover of uluhe ferns or a dense ground cover of tussock grasses (International Union for the Conservation of Nature 2010e).

On the Island of Hawaii, Newell's shearwaters fly over the entire island except the southwestern coast. Shearwaters are most numerous flying to and from the Kohala Mountains on the north coast (Day et al. 2003). During adult presence in the breeding season (April to September), Newell's shearwaters gather on the water close to shore before they fly inland around sunset (International Union for the Conservation of Nature 2010e). Based on known or suspected colony locations, Newell's shearwaters are expected to be found gathering in early evening at Niihau (north end around Lehua Rock), Kauai, Oahu, Maui, Molokai, Lanai, and Hawaii from April to September.

3.6.2.9.2.2 Open Ocean

During the breeding season, some birds forage west and north of the Hawaiian Islands so that the central part of their marine range moves northward in the Transit Corridor portion of the Study Area (International Union for the Conservation of Nature 2010e; U.S. Fish and Wildlife Service 2005b).

3.6.2.9.3 Population and Abundance

Population in the 1980s and early 1990s was estimated at about 84,000, but numbers in 2000 may have been only 21 percent of what they were in 1987 (U.S. Fish and Wildlife Service 2005b). The largest known population, found on Kauai, was devastated by two hurricanes in 1982 and 1992. Since that last storm, the species has been in steady decline on Kauai. The remaining adults and fledglings are suffering significant deaths from utility pole and line strikes (International Union for the Conservation of Nature 2010e). Continuing forest habitat destruction and predation from introduced mammals are also taking a toll on this species (International Union for the Conservation of Nature 2010e).

3.6.2.9.4 Predator and Prey Interactions

Although diet is not well known, evidence suggests that squid are a major dietary item. Newell's shearwaters capture food by pursuit-plunging (diving into water and swimming after prey, typically 10 to 30 m [32.8 to 98.4 ft.] deep), usually in company with multispecies feeding flocks associated with tuna (International Union for the Conservation of Nature 2010e). This species is not attracted to discarded fish byproducts and does not follow ships (Onley and Scofield 2007).

Newell's shearwaters are preyed on by introduced animals at their breeding sites, such as cats and birds such as barn owls (Ainley et al. 1997). Nocturnal activity and cavity-nesting behaviors are their only defense against mammal predators.

3.6.2.9.5 Species-specific Threats

Historical threats included subsistence hunting by Polynesians and predation by rats, dogs, and pigs. Current threats include artificial lights (e.g. street and resort lights) along the coast that blind and disorient fledglings. Once on the ground, these fledglings are unable to fly and thousands are killed each year by cars, cats, and dogs. In addition, adults can collide with power facilities and associated utility wires and associated lines are in the direct path of known Newell's flight corridors. Additional threats are the loss and degradation of forested habitat caused by introduced plants and herbivores.

Sections 3.6.2.10 to 3.6.2.12 describe the taxonomic groups of non ESA-listed seabird species in the Study Area.

3.6.2.10 Albatrosses, Petrels, Shearwaters, and Storm-petrels (order Procellariiformes)

The Procellariiformes is a large order of open ocean seabirds that are divided into four families: Diomedeidae (albatrosses), Procellariidae (petrels and shearwaters), Hydrobatidae (storm-petrels), and Pelecanoididae (diving-petrels) (Enticott and Tipling 1997; Onley and Scofield 2007). There are 39 species representing 3 families - albatrosses, petrels and shearwaters, and storm-petrels - that occur in the Study Area (Table 3.6-2 and Table 3.6-3). These species are generally long-lived, breed once a year, and lay only one egg. They have extremely broad distributions and include all marine birds that spend most of their lives at sea and exclusively feed in the open ocean, primarily on fish, crustaceans, and crabs. They can be found in high numbers resting on the water in flocks where prey is concentrated (Enticott and Tipling 1997). Some species feed around fishing boats or become injured from longline gear (Enticott and Tipling 1997; Onley and Scofield 2007). They nest in colonies on remote islands uninhabited by people. Some are ground nesters; others nest in cavities or burrows (Ramos et al. 1997). They return to their birth colonies. Most species of this order are monogamous and mate for life. Both parents participate in egg incubation and chick rearing (Elphick et al. 2001). Representative species include Laysan albatross, Northern fulmar, mottled petrel, pink-footed shearwater, and Wilson's storm-petrel.

3.6.2.11 Tropicbirds, Boobies, Pelicans, Cormorants, and Frigatebirds (order Pelecaniformes)

The Pelecaniformes order includes anhingas, pelicans, gannets and boobies, tropicbirds, cormorants, and frigatebirds. There are 14 species representing 5 families that occur in the Study Area: tropicbirds, boobies, pelicans, cormorants, and frigatebirds (Table 3.6-2 and Table 3.6-3). They all have webbed feet and eight toes, and all have a throat sac, called a gular sac (Brown and Harshman 2008). This sac is highly developed and visible in pelicans and frigatebirds but is also readily apparent in boobies and cormorants. Pelicans use the sac to trap fish, frigatebirds use it as a mating display and to feed on fish, squid, and similar marine life (Dearborn et al. 2001); and cormorants and boobies utilize the sac for heat regulation. These birds nest in colonies, but individual birds are monogamous (Brown and Harshman 2008). Representative species within the Study Area include white-tailed tropicbird, blue-footed booby, California brown pelican, pelagic cormorant, and magnificent frigatebird.

3.6.2.12 Phalaropes, Gulls, Noddies, Terns, Skua, Jaegers, and Alcids (order Charadriiformes)

There are 54 species representing three families from this diverse group that occur within the Study Area (Table 3.6-2 and Table 3.6-3). Gulls, noddies, and terns in the family Laridae are a diverse group of small to medium sized seabirds that inhabit coastal, nearshore, and open sea waters. Skuas and jaegers in the family Stercorariidae are stocky powerful birds with long pointed wings, long tails, strong hooked bills, and sharp talons known for robbing the food of smaller seabirds, teasing and harassing them until they drop their prey. Murres, murrelets, and auklets in the family Alcidae are good swimmers and divers and have short wings, which require them to flap their wings rapidly to fly.

Species in the order Charadriiformes occupy diverse habitats. Some species in this order spend most of their time at sea (e.g., jaegers, skuas, alcids), whereas others are more coastal or near shore (e.g., gulls). Many charadriiforms inhabit marine and freshwater wetlands; others spend most of their lives in or near the ocean. Many species breed in colonies, and some species lay more than one egg (Ericson et al. 2003; Fain and Houde 2007; Harrison 1983; Onley and Scofield 2007). Representative species within the Study Area include Sabine's gull, black-legged kittiwake, black noddy, sooty tern, South polar skua, pomerine jaeger, common murre, long-billed murrelet, rhinoceros auklet, and horned puffin.

3.6.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2, Description of Proposed Action and Alternatives, affect seabirds and seabird communities known to occur within the Study Area. For this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), seabirds are evaluated as groups of species characterized by distribution, body type, or behavior relevant to the stressor being evaluated. Activities are evaluated for their potential effect on all seabirds in general, on each taxonomic grouping, and on the five seabirds in the Study Area listed as endangered or threatened under the ESA. An impacts analysis for seabirds has been conducted for potential mortality, habitat destruction, or breeding and roosting disturbance. Migratory and breeding seabirds utilize portions of the Study Area to differing degrees depending on the foraging and breeding requirements of each species. As listed in the ESA-listed species descriptions, there is no critical habitat or primary constituent elements for listed species within the Study Area. Therefore, the analysis of stressors on critical habitat is not carried though this EIS document.

The alternatives for training and testing activities were examined to determine if the Proposed Action would produce one or more of the following impacts:

- A direct or indirect impact on seabirds or seabird populations from mortality attributed to military training and testing activities taking place within the Study Area.
- A direct or indirect impact on seabird populations from destruction or disturbance of foraging habitat attributed to military training and testing activities taking place within the Study Area.
- A direct or indirect impact on seabird populations from destruction or disturbance of seabird breeding colonies, foraging or roosting areas attributed to military training and testing activities taking place within the Study Area.

The consequences of the proposed military readiness activities on non-federally listed migratory seabirds or on modification of their habitat are evaluated based on the criteria described in the final rule authorizing DoD to incidentally take migratory seabirds during military readiness activities (50 C.F.R. Part 21, 28 February 2007) which states that military readiness activities are exempt from the take prohibitions of the Migratory Bird Treaty Act provided they do not result in a significant adverse effect on a population of a migratory seabird species. An activity has a significant adverse effect if, over a reasonable period of time, it diminishes the capacity of a population of migratory seabird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. A population is defined as "a group of distinct, coexisting, same species, whose breeding site fidelity, migration routes, and wintering areas are temporally and spatially stable, sufficiently distinct geographically (at some point of the year), and adequately described so that the population can be effectively monitored to discern changes in its status.” (U.S. Bureau of Land Management and U.S. Fish and Wildlife Service 2010).

Navy training and testing activities have the potential to contribute acoustic, energy, physical disturbance/strike, entanglement or ingestion stressors to seabird populations within the Study Area. These stressor types are induced by the training and testing activity types noted in Chapter 2, which vary in intensity, frequency, duration, and location within the Study Area; therefore, seabird species may be impacted by different proposed activities. Certain activities take place in specific locations or depth zones within the Study Area outside of the range or foraging abilities of seabirds. Therefore, seafloor device strike, cable and wire entanglement, parachute entanglement, and ingestion of munitions were not carried forward in this analysis for seabirds. Tables 2.8-1 through 2.8-5 present the baseline and proposed training and testing activity locations for each alternative (including number of events and ordnance expended). Based on the general threats to seabirds and shorebirds discussed in Section 3.6.2 (Affected Environment) the stressors applicable to ESA-listed species in the Study Area and analyzed below include the following:

- Acoustic stressors (tactical acoustic sonar and other acoustic devices, explosive detonations, pile driving, vessel noise, and aircraft noise)
- Energy stressors (electromagnetic)
- Physical disturbance and strike (aircraft, vessels and in-water devices, military expended materials non-explosive)
- Ingestion (military expended materials other than ordnance)
- Secondary stressors (air quality, water quality)

3.6.3.1 Acoustic Stressors

This section evaluates the potential for acoustic and explosive stressors to affect seabirds during training and testing activities in the Study Area. These stressors are associated with sonar and other underwater active acoustic sources, explosives, pile driving, aircraft noise, and vessel noise. Following the Conceptual Framework for Assessing Effects from Sound-Producing Activities (Section 3.0.5.7.1), categories of potential impacts from exposure to explosions and sound are direct trauma, hearing loss, auditory masking, behavioral reactions, and physiological stress. Potential negative nonphysiological consequences to seabirds from acoustic and explosive stressors include disturbance of foraging, roosting, or breeding; degradation of foraging habitat; and degradation of known seabird breeding colonies.

The types of seabirds exposed to sound-producing activities or explosive detonations depend on where training and testing activities occur relative to the coast. Seabirds can be divided into three groups based on breeding and foraging habitat: (1) those species such as albatrosses, petrels, frigatebirds, tropicbirds, boobies, and some terns that forage over the ocean and nest on oceanic islands; (2) species such as pelicans, cormorants, gulls, and some terns that nest along the coast and forage in nearshore areas; and (3) those few species such as marbled murrelet that nest in inland habitats and come to the coastal areas to forage.

The area from the beach to about 10 nautical miles (nm) offshore provides foraging areas for breeding terns, gulls, skimmers, and pelicans; a migration corridor and winter habitat for terns, gulls, skimmers, pelicans, loons, cormorants, and gannets; and supports nonbreeding and transient pelagic seabirds.

Offshore pelagic waters support nonbreeding and transient pelagic seabirds, loons, gannets, and several tern species (Davis et al. 2000; Hunter et al. 2006a). Pelagic seabirds are generally widely distributed, but they tend to congregate in areas of higher productivity and prey availability (Haney 1986a). Such areas include the Pacific Current, particularly areas of eddies and upwelling; areas with productive live/hard bottom habitats; and large algal mats.

Seabirds and migrating birds could be exposed to sounds from sources near the water surface or from airborne sources. While foraging seabirds will be present near the water surface, migrating birds may fly at various altitudes. Some species such as sea ducks and loons may be commonly seen flying just above the water's surface, but the same species can also be spotted flying so high that they are barely visible through binoculars (United States Geological Service 2006). While there is considerable variation, the favored altitude for most small birds appears to be between 500 ft. (152.4 m) and 1,000 ft. (304.8 m). Radar studies have demonstrated that 95 percent of the migratory movements occur at less than 10,000 ft. (3,048 m), the bulk of the movements occurring under 3,000 ft. (914.4 m) (United States Geological Service 2006).

Seabirds use a variety of foraging behaviors that could expose them to underwater sound. Most seabirds plunge-dive from the air into the water or perform aerial dipping (the act of taking food from the water surface in flight); others surface-dip (swimming and then dipping to pick up items below the surface) or jump-plunge (swimming, then jumping upward and diving under water). Birds that plunge-dive typically submerge for no more than a few seconds, and any exposure to underwater sound would be very brief. Other seabirds pursue prey under the surface, swimming deeper and staying underwater longer than other plunge-divers. Some of these seabirds may stay underwater for up to several minutes and reach depths between 50 ft. (15.2 m) and 550 ft. (167.6 m) (Jones 2001; Ronconi 2010). Sounds generated under water during training and testing would be more likely to impact seabirds that pursue prey, although as previously stated, little is known about seabird hearing ability underwater. Birds that forage in the open ocean often forage more actively at night, when prey species are more likely to be near the surface and naval training and testing is more limited.

If a seabird is close to an explosive detonation, the exposure to high pressure levels and sound impulse can cause barotrauma, physical injury due to a difference in pressure between an air space inside the body and the surrounding air or water. Damage could occur to the structure of the ear, resulting in hearing loss, or to internal organs, causing hemorrhage and rupture. If a seabird is close to an intense sound source, it could suffer hearing loss due to fatigue of the hair cells of the ear. Studies have examined hearing loss and recovery in only a few species of birds, and none studied hearing loss in seabirds (e.g., Hashino et al. 1988; Ryals et al. 1999; Ryals et al. 1995; Saunders and Dooling 1974). Unlike other species, birds have the ability to regenerate hair cells in the ear, usually resulting in considerable anatomical, physiological, and behavioral recovery within several weeks. Still, intense exposures are not always fully recoverable, even over periods up to a year after exposure, and damage and subsequent recovery vary significantly by species (Ryals et al. 1999). Birds may be able to protect themselves against damage from sustained sound exposures by regulating inner ear pressure, an ability that may protect ears while in flight (Ryals et al. 1999).

Numerous studies have documented that birds respond to anthropogenic noise, including aircraft overflights, weapons firing, and explosions (Larkin et al. 1996; National Park Service 1994; Plumpton 2006). Studies generally indicate that birds hear in-air sounds over a very limited range between 1 and 5 kHz but specific species hearing can extend to higher and lower frequencies (Beason 2004). The manner in which birds respond to noise depends on several factors, including life-history characteristics of the species, characteristics of the noise source, loudness, onset rate, distance from the noise source, presence or absence of associated visual stimuli, and previous exposure (Larkin et al. 1996; National Park Service 1994; Plumpton 2006). Researchers have documented a variety of behavioral responses of birds to noise, such as alert behavior, startle response, flying or swimming away, diving into the water, and increased vocalizations. While they are difficult to measure in the field, some of these behavioral responses are likely accompanied by physiological responses, such as increased heart rate, or stress (National Park Service 1994).

Chronic stress can compromise the general health of birds, but stress does not necessarily result in negative consequences to individual birds or to populations (Larkin et al. 1996; National Park Service 1994). For example, the reported behavioral and physiological responses of birds to noise exposure are within the range of normal adaptive responses to external stimuli, such as predation, that birds face on a regular basis. Unless they are repeatedly exposed to loud noises or simultaneously exposed to a combination of stressors, individuals may return to normal behavior and physiology almost immediately after exposure. Studies also have shown that birds can become habituated to noise following frequent exposure and cease to respond behaviorally to the noise (Larkin et al. 1996; National Park Service 1994; Plumpton 2006).

3.6.3.1.1 Sonar and Other Active Acoustic Sources

Sonar and other underwater active acoustic sources could be used throughout the Study Area. Information regarding the impacts from sonar on seabirds and the ability for seabirds to hear underwater is virtually unknown. The exposure to these sounds by seabirds, other than pursuit diving species, is likely to be very limited due to spending a very short time under water (plunge-diving or surface-dipping) or foraging only at the water surface. Pursuit divers may remain under water for minutes, increasing the chance of underwater sound exposure.

If the sound levels are sufficiently intense, even a short exposure could be problematic. Assuming that a seabird disturbed by an underwater sound would avoid the stressor by swimming to the surface, a physiological impact, such as hearing loss, would only occur if a seabird is close to an intense sound source. In general, birds are less susceptible to both temporary and permanent threshold shift than mammals (Saunders and Dooling 1974), so an underwater sound exposure would have to be intense and of a sufficient duration to cause temporary or permanent threshold shift. Avoiding the sound by returning to the surface would limit extended or multiple sound exposures underwater. There have been no studies documenting diving seabirds' reactions to sonar.

Seabirds that approach vessels while foraging would be most likely to be exposed to underwater active acoustic sources. If the presence of a ship attracts diving seabirds, the seabirds could be more likely to be exposed to an underwater sound if the ship is engaged in anti-submarine warfare or mine warfare with active acoustic sources. Some seabirds commonly follow vessels, including certain species of gulls, storm petrels, and albatrosses, for increased potential of foraging success as the prop wake brings prey to the surface (Hamilton III 1958; Hyrenbach 2001, 2006b; Melvin et al. 2001). However, most hull-mounted sonars do not project sound aft of ships (behind the ship, opposite the direction of travel), so most seabirds diving in ship wakes would not be exposed to sonar.

The possibility of an ESA-listed seabird species to be exposed to sonar and other active acoustic sources depends on whether it submerges during foraging and whether it forages in areas where these sound sources may be used. Although petrels and albatrosses forage in open ocean areas where sonar training and testing occurs, they would not be exposed to underwater sound because they forage at the surface.

Least terns forage in coastal shallow waters where they could be exposed to sonar and other active acoustic sources, notably near ports and shipyards where sonar maintenance and testing occur. However, their plunge dives are brief, so any chance of exposure would be minimal. Most other sonar use occurs farther offshore, however, so the chance for an exposure would be low.

3.6.3.1.1.1 No Action Alternative

Training Activities

Training activities under the No Action Alternative include activities that produce in-water noise from the use of sonar and other active non-impulsive acoustic sources include anti-submarine warfare, mine warfare, object detection and navigation, communication, and maintenance. These activities could occur throughout the Study Area, but would be concentrated in the SOCAL and HRC portions of the study area. The Pacific Current runs through the SOCAL Range Complex portion of the Study Area, and is an area of increased productivity that attracts foraging seabirds. Therefore, seabirds that forage in these open ocean areas would have a greater chance of underwater sound exposure than seabirds that forage in coastal areas.

Diving seabirds may not respond to an underwater sound, but if a diving seabird does react to an underwater sound source, it could result in a short-term behavioral response. Seabirds would avoid any additional exposures during a foraging dive when they surface. Due to the limited duration of training events and widespread availability of open ocean foraging habitat, any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population.

Least terns may briefly submerge while foraging, so there is a remote chance that a least tern could be briefly exposed to underwater sound sonar and other active acoustic sources. However, least terns forage in the nearshore waters, in areas where the acoustic sources used are minimal, further reducing the potential for exposure.

It is likely that few seabirds would be affected by sonar and other underwater active acoustic sources because:

- sources are used intermittently during a training event,
- training events are dispersed in space and time,
- most seabirds spend little time submerged, and
- exposures sufficiently intense (i.e., of a certain duration or within a close proximity) to cause physiological impacts are unlikely.

Sonar and other underwater acoustic sources used during training activities under the No Action Alternative may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of sonar and other underwater acoustic sources during training activities under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Testing activities under the No Action Alternative include activities that produce in-water noise from the use of sonar and other active non-impulsive acoustic sources could occur throughout the Study Area, but would be concentrated in the SOCAL and HRC portions of the study area. The Pacific Current runs through the SOCAL Range Complex portion of the Study Area, and is an area of increased productivity that attracts foraging seabirds. Therefore, seabirds that forage in these open ocean areas would have a greater chance of underwater sound exposure than seabirds that forage in coastal areas.

Diving seabirds may not respond to an underwater sound, but if a diving seabird does react to an underwater sound source, it could result in a short-term behavioral response. Seabirds would avoid any additional exposures during a foraging dive when they surface. Due to the limited duration of training events and widespread availability of open ocean foraging habitat, any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population.

It is likely that few seabirds would be affected by sonar and other underwater active acoustic sources because:

- sources are used intermittently during a training event,
- training events are dispersed in space and time,
- most seabirds spend little time submerged, and
- exposures sufficiently intense (i.e., of a certain duration or within a close proximity) to cause physiological impacts are unlikely.

Hawaiian petrels and short-tailed albatrosses do not submerge while foraging; therefore, they would not be exposed to underwater sound from sonar and other active acoustic sources. Least terns, marbled murrelet, and Newell's shearwater may briefly submerge while foraging, either during plunge-diving (terns) or pursuit diving (murrelet and shearwater), so there is a remote chance that these species could be exposed to underwater sound sonar and other active acoustic sources.

Sonar and other underwater acoustic sources used during testing activities under the No Action Alternative may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of sonar and other underwater acoustic sources during testing activities under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.1.2 Alternative 1

Training Activities

The number of annual training activities that produce in-water noise from the use of sonar and other active acoustic sources under Alternative 1 would approximately double from the No Action Alternative. This includes overall increases to anti-submarine warfare; mine warfare; object detection and navigation; communication; and maintenance. Training activities would occur in similar areas as under the No Action Alternative for similar activities. Based on the increased operations under Alternative 1 versus the No Action Alternative, more seabirds could be exposed to sonar and other active acoustic sources. Although the quantity of underwater acoustic stressors would increase, any impacts on seabirds would likely be limited to short-term behavioral reactions by diving seabirds as described under the No Action Alternative. Due to the limited duration of training events and widespread availability of open ocean foraging habitat, any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population.

Hawaiian petrels and short-tailed albatrosses do not submerge while foraging; therefore, they would not be exposed to underwater sound from sonar and other active acoustic sources. Least terns, marbled murrelet, and Newell's shearwater may briefly submerge while foraging, either during plunge-diving (terns) or pursuit diving (murrelet and shearwater), so there is a remote chance that these species could be exposed to underwater sound sonar and other active acoustic sources. However, any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population.

Sonar and other underwater acoustic sources used during training activities under the Alternative 1 may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of sonar and other underwater acoustic sources during training activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Section 3.0 and Table 3.0-8 describe the use of sonar and other underwater active acoustic sources during testing activities under Alternative 1. Use of sonar and other active acoustic sources would approximately double under Alternative 1 versus the No Action Alternative. Sonar and other active acoustic sources would be used in waters throughout the range complexes and testing ranges, and smaller amounts would be used in waters beyond the range complexes or in nearshore areas, including locations not used under the No Action Alternative. Although the quantity of underwater acoustic stressors would increase, any impacts on seabirds would likely be limited to short-term behavioral reactions by diving seabirds, as described under the No Action Alternative. Due to the limited duration of testing events and widespread availability of open ocean foraging habitat, any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population.

Hawaiian petrels and short-tailed albatrosses do not submerge while foraging; therefore, they would not be exposed to underwater sound from sonar and other active acoustic sources. Least terns, marbled murrelet, and Newell's shearwater may briefly submerge while foraging, either during plunge-diving (terns) or pursuit diving (murrelet and shearwater), so there is a remote chance that these species could be exposed to underwater sound sonar and other active acoustic sources. However, any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population.

Sonar and other underwater acoustic sources used during testing activities under Alternative 1 may affect, not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of sonar and other underwater acoustic sources during testing activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.1.3 Alternative 2

Training Activities

The number of annual training activities that produce in-water noise from the use of sonar and other active acoustic sources under Alternative 2 would increase over the No Action Alternative. This includes overall increases to anti-submarine warfare; mine warfare; object detection and navigation; communication; and maintenance. Training activities would occur in similar areas as under the No Action Alternative for similar activities. Based on the increased operations under Alternative 2 versus the No Action Alternative, more seabirds could be exposed to sonar and other active acoustic sources. Although the quantity of underwater acoustic stressors would increase, any impacts on seabirds would likely be limited to short-term behavioral reactions by diving seabirds, as described under the No Action Alternative. Due to the limited duration of training events and widespread availability of open ocean foraging habitat, any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population.

Hawaiian petrels and short-tailed albatrosses do not submerge while foraging; therefore, they would not be exposed to underwater sound from sonar and other active acoustic sources. Least terns, marbled murrelet, and Newell's shearwater may briefly submerge while foraging, either during plunge-diving (terns) or pursuit diving (murrelet and shearwater), so there is a remote chance that these species could be exposed to underwater sound sonar and other active acoustic sources.

Sonar and other underwater acoustic sources used during training activities under the Alternative 2 may affect, not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of sonar and other underwater acoustic sources during training activities under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Section 3.0.5.3.1.1 describes the use of sonar and other underwater active acoustic sources during testing activities under Alternative 2, including relative concentrations and locations within the Study Area. Use of sonar and other active acoustic sources would increase under Alternative 2 versus the No Action Alternative. The proposed testing activities would also increase over Alternative 1. Sonar and other active acoustic sources would be used in waters throughout the range complexes and testing ranges, and smaller amounts would be used in waters beyond the range complexes or in nearshore areas, including locations not used under the No Action Alternative. Although the quantity of underwater acoustic stressors would increase, any impacts on seabirds would likely be limited to short-term behavioral reactions by diving seabirds, as described under the No Action Alternative. Due to the limited duration of testing events and widespread availability of open ocean foraging habitat, any sound exposures would be minimal and are unlikely to have a long-term impact on an individual or a population.

Hawaiian petrels and short-tailed albatrosses do not submerge while foraging; therefore, they would not be exposed to underwater sound from sonar and other active acoustic sources. Least terns, marbled murrelet, and Newell's shearwater may briefly submerge while foraging, either during plunge-diving (terns) or pursuit diving (murrelet and shearwater), so there is a remote chance that these species could be exposed to underwater sound sonar and other active acoustic sources.

Sonar and other underwater acoustic sources used during testing activities under Alternative 2 may affect, not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of sonar and other underwater acoustic sources during testing activities under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.2 Explosive Detonations

The potential for seabirds to be exposed to explosive detonations from training or testing activities depends on several factors, including the presence of seabirds at, beneath, or above the water surface near the detonation; location of the detonation at, below, or above the water surface; size of the explosive; and distance from the detonation. Explosions are associated with detonations of high-explosive missiles and projectiles in air; high-explosive grenades, bombs, missiles, rockets, and projectiles at or immediately below the sea surface; mine neutralization charges on the bottom and in the water column; high-explosive torpedoes near the surface and in the water column; explosive sonobuoys in the water column; and other small charges used at various depths during testing. Section 3.0 describes the shock waves and acoustic waves imparted to a surrounding medium by an explosive detonation and how these waves propagate. Because airguns are an impulsive source, with the potential for similar non-traumatic impacts as explosives, they are considered in this section.

A seabird close to an explosive detonation could be killed or injured. Blast injuries are usually most evident in the gas-containing organs, such as those of the respiratory and gastrointestinal systems. Blasts can also damage pressure-sensitive components of the auditory system. In general, the impacts of explosions would be reduced with increasing distance of the seabird from the explosion, and would range from lethal injury in the immediate vicinity of an explosion to short-term behavioral impacts on the outer edges of the zone of influence.

Underwater detonations could affect diving seabirds and seabirds on the water surface. Studies have shown that birds are more susceptible to underwater explosions when they are submerged versus on the surface (Yelverton et al. 1973). Underwater detonations could have lethal impacts on seabirds in water if impulse exceeds 36 pounds per square inch (in.) (psi)– milliseconds (msec) (psi-msec) (248 Pascal [Pa]-second [sec]) for birds underwater and 100 psi-msec (690 Pa-sec) just below the water surface for birds at the water surface (Yelverton et al. 1973). These impulse levels correspond to onset mortality, or the level at which one percent of animals would not be expected to survive. Exposures to higher impulse levels would have greater likelihoods of mortality. No injuries would be expected for seabirds underwater at blast pressures below 6 psi-msec (41 Pa-sec) and for seabirds on the surface at blast pressures below 30 psi-msec (207 Pa-sec). Table 3.6-4 shows estimated ranges to onset mortality and to the safety range (no injury expected) for several classes of charges proposed to be used in the Study Area, assuming a diving seabird is exposed at 15 ft. (4.6 m) below the water surface, using the Yelverton method. Ranges to impacts are based on several factors including charge size, depth of the detonation, and how far the seabird is beneath the water surface. It should be cautioned that these are estimates, and actual ranges to impacts would depend on conditions at each detonation site.

Table 3.6-4: Estimated Ranges to Impacts for Diving Birds Exposed to Underwater Detonations

Source Class	Representative Munitions	Net Explosive Weight (lb.)	Depth of Charge	Distance to Onset Mortality	Safety Range
E6	Air-to-Surface missile	11-20	33 ft. (10 m)	220–330 ft. (70–100 m)	780–920 ft. (240–280 m)
E12	2,000-lb. bomb	601-1,000	10 ft. (3 m)	460-600 ft. (140–180 m)	1,000–1,200 ft. (330–370 m)
E17	40,000-lb. HBX charge	14,501–58,000	200 ft. (61 m)	2,700-3,900 ft. (800–1200 m)	7,300–9,700 ft. (2,200–3,000 m)

Note: ft. = feet; HBX = high blast explosive; lb. = pounds; m = meters

Detonations in air could also injure seabirds while either in flight or at the water surface. Experiments that exposed seabirds to blast waves in air provided a relationship between charge size, distance from detonation, and likelihood of seabird injury or mortality (Damon et al. 1974). Table 3.6-5 shows the safe distance from a detonation in air beyond which no injuries to seabirds would be expected.

Table 3.6-5: Safe Distance from Detonations in Air for Birds

Explosive Source Class	Sample Ordnance	Net Explosive Weight	Safe Distance (no Injury)[1]
E3	76-mm round	0.6–2 lb.	22 ft. (7 m)
E5	5-in. projectiles	6–10 lb.	22 ft. (10 m)
E7	Rolling Airframe Anti-Air Missile	21–60 lb.	70 ft. (21 m)

Note: ft. = feet; in. = inches; lb.= pound(s); m = meters; mm = millimeters
[1]Damon, 1974

The airborne noise associated with underwater explosions and airgun use is minimal. Because of the differences in acoustic transmission in water and in air, an effect called the Lloyd mirror reflects underwater sound at the water surface. Therefore, sound generated in the water will not pass over to the air (refer to the acoustic and explosives primer in Section 3.0). Sounds generated by most small underwater explosions, therefore, are unlikely to disturb seabirds above the water surface. If a detonation is sufficiently large or is near the water surface, however, pressure will be released at the air-water interface. Birds above this pressure release could be injured or killed.

Most high-explosive ordnance used in anti-surface warfare training and testing detonates at the water surface or a short distance below the water surface. The blast waves and acoustic waves would propagate through both water and air, although near the surface most pressure release would be into the air. Birds close to the detonation point would be injured or killed. Detonations in air during anti-air warfare training and testing would typically occur at much higher altitudes (greater than 3,000 ft. [914.4 m] above sea level) where seabirds and migrating birds are less likely to be present (U.S. Geological Survey 2006). Foraging seabirds will typically be at lower elevations where they are likely to be unaffected by in-air explosions. Therefore, seabirds are unlikely to be injured or killed by high-altitude in-air detonations.

At distances beyond those to injury, responses to noise from an explosive detonation would be limited to short-term behavioral or physiological responses (e.g., alert response, startle response, and temporary increase in heart rate). Startle or alert reactions to muzzle blasts are not likely to disrupt major behavior patterns, such as migrating, breeding, feeding, and sheltering, or to result in serious injury to any seabirds. Birds may be temporarily displaced and there may be temporary increases in stress levels; however, behavior and use of habitat would return shortly after the training is complete. (Beason 2004) notes that birds exposed to up to 146 A-weighted sound level (dBA) within 325 ft. (99.1 m) of the sound source flushed but then returned within minutes of the disturbance. The range of impacts could depend on the charge size, distance from the charge, and the seabird's life activity at the time of the exposure.

Fleeing response to an initial explosion may reduce seabird exposure to any additional explosions that occur within a short timeframe. Seabirds could also be attracted to an area to forage if an explosion resulted in a fish kill. This would only be a concern for events that involved multiple explosions in the same area within a single event, such as firing exercises, which involves firing multiple high-explosive 5-

in. rounds at a target area, and bombing exercises, which could involve multiple bomb drops separated by several minutes.

3.6.3.1.2.1 No Action Alternative

Training Activities

Explosive detonations are associated with training activities under the No Action Alternative that use high-explosive charges, including bombs, missiles, explosive munitions, explosive sonobuoys, grenades, munitions used in sinking exercises, and underwater detonations associated with mine neutralization training. The detonations would include explosive source classes up to E13 (1,000 – 1,740 lb. net explosive weight) (see Table 3.0-2). Training activities involving explosive detonations are spread throughout the Study Area, but would be concentrated in the SOCAL Range Complex portion of the Study Area, followed in descending order of numbers of activities by HRC, Silver Strand Training Complex (SSTC), and the Transit Corridor. Training activities using explosives generally do not occur within 1.6 nm of shore or within 3 nm of bays, rivers, or estuaries except those used in the San Diego Bay and boat training lanes of SSTC (E1 - E6 [less than 20 lb. net explosive weight]). A more detailed description of these training activities and their proposed locations are presented in Tables 2.9-2 and 2.9-3 of Chapter 2.

Nearshore waters are the primary foraging habitat for many seabird species. Any small detonations close to shore could have a short-term adverse impact on nesting and nearshore foraging species. Most larger detonations would occur near areas with the potential for relatively high concentrations of seabirds (upwelling areas associated with the Pacific Current; productive live/hard bottom habitats; and large algal mats); therefore, any impacts on seabirds are likely to be greater in these areas. While the impacts of explosive detonations on seabirds under the No Action Alternative cannot be quantified due to limited data on seabird density, lethal injury to some seabirds could occur. Lethal injuries would likely be associated with detonations of bombs with larger net explosive weights, although any event employing static targets may attract seabirds to the detonation site. Because explosive detonations occur at varying locations over a short time period and seabird presence changes seasonally and on a short-term basis, individual seabirds would not be expected to be repeatedly exposed to explosive detonations. Any impacts on migratory or breeding seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent and would not impact seabird or migratory bird populations.

Airborne detonations would occur during gunnery and air-to-air missile activities, although these would occur at relatively high altitudes. Any impacts would likely be limited to short-term startle reactions, as the detonations would occur far above typical seabird flight altitudes.

ESA-listed seabirds are known to be present in areas where detonations would occur during training under the No Action Alternative. While the information known about seabird distribution limits the ability to quantify the impacts of explosions, the likelihood of an injurious exposure seems remote based on the very low density of seabirds. An exposure resulting in a short-term behavioral response would be more likely to occur than an exposure that causes injury. Least terns could startle in the vicinity of explosive detonations from training at SSTC as they forage areas where detonations occur. However, the detonations used in these foraging areas are restricted to less than 20 lb. net explosive weight. If a detonation occurred in the vicinity of least terns, impacts would likely be limited to short-term startle reactions as the zone of impact around these smaller detonations are minimal. Protective measures, such as restricting underwater explosions if flocks of seabirds are rafting on the water’s surface inside a training area or if flocks of seabirds are migrating directly above the proposed training site minimize impacts on seabirds (Chapter 5, Mitigation). Further, at SSTC, the detonation area is monitored for 30 minutes prior to and 30 minutes after a detonation and that successive detonations be more than 30 minutes or less than 10 seconds apart, which further reduces the potential impact upon seabirds.

Explosive detonations used during training activities under the No Action Alternative may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of explosive detonations during training activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Explosive detonations are associated with testing activities under the No Action Alternative that use high-explosive charges, including bombs, missiles, explosive munitions, explosive sonobuoys, grenades, munitions used in sinking exercises, and underwater detonations associated with mine neutralization training. The detonations would include explosive source classes up to E11 (500 – 650 lb. net explosive weight) (see Table 3.0-9). Testing activities involving explosive detonations are spread throughout the Study Area, but would be concentrated in the SOCAL Range Complex portion of the Study Area, followed in descending order of numbers of activities by the HRC. Further, under the No Action Alternative, the vast majority (4,546) of explosive detonations are explosive source class E1 - E4 (less than 5 lb. net explosive weight). A more detailed description of these training activities and their proposed locations are presented in Tables 2.9-2 and 2.9-3 of Chapter 2.

Nearshore waters are the primary foraging habitat for many seabird species. Any small detonations close to shore could have a short-term adverse impact on nesting and nearshore foraging species. Most larger detonations would occur near areas with the potential for relatively high concentrations of seabirds (upwelling areas associated with the Pacific Current; productive live/hard bottom habitats; and large algal mats); therefore, any impacts on seabirds are likely to be greater in these areas. However, under the No Action Alternative, only 15 explosive detonations are of explosive class source E5 or greater (greater than 5 lb. net explosive weight) (Table 3.0-9). While the impacts of explosive detonations on seabirds under the No Action Alternative cannot be quantified due to limited data on seabird density, lethal injury to some seabirds could occur. Lethal injuries would likely be associated with detonations of bombs with larger net explosive weights, although any event employing static targets may attract seabirds to the detonation site. While some seabird mortality could occur, the mortality potential is very low, given the low number of large net explosive weight detonations and the dispersed nature of seabirds in the study area. Because explosive detonations occur at varying locations over a short time period and seabird presence changes seasonally and on a short-term basis, individual seabirds would not be expected to be repeatedly exposed to explosive detonations. Any impacts on migratory or breeding seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent and would not impact seabird or migratory bird populations.

ESA-listed seabirds are known to be present in areas where detonations would occur during training under the No Action Alternative. While the information known about seabird distribution limits the ability to quantify the impacts of explosions, the likelihood of an injurious exposure seems remote based on the very low density of seabirds and low net explosive weight used. An exposure resulting in a short-term behavioral response would be more likely to occur than an exposure that causes injury.

Explosive detonations used during testing activities under the No Action Alternative may affect, not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of explosive detonations during testing activities described under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.2.2 Alternative 1

Training Activities

The total number of explosive detonations throughout the Study Area would decrease by 15 percent under Alternative 1 (Table 3.0-9) as compared to the No Action Alternative. The detonations would include explosive source classes up to E13 (1,000 – 1,740 lb. net explosive weight). Training activities involving explosive detonations occur throughout the Study Area, but would be concentrated in the SOCAL Range Complex portion of the Study Area, followed in descending order of numbers of activities by HRC, SSTC, and the Transit Corridor. Training activities using explosives generally do not occur within 1.6 nm of shore or within 3 nm of bays, rivers, or estuaries except those used in the San Diego Bay and boat training lanes of SSTC (E1 - E7 [less than 60 lb. net explosive weight). Alternative 1 would introduce the use of high explosive rockets. The majority of these rockets would be used in the SOCAL Range Complex portions of the Study Area, with the remainder being used in the HRC portion of the Study Area, and none would be used in the SSTC portion of the Study Area. A more detailed description of these training activities and their proposed locations are presented in Tables 2.9-2 and 2.9-3 of Chapter 2.

Potential impacts on seabirds by explosive detonations are expected to be similar to those under the No Action Alternative, but the potential for exposure would decrease with lower number of explosive detonations. While some seabird mortalities could occur, only a small number of seabirds would be affected. Any impacts on seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term (behavioral) and infrequent and would not impact seabird or migratory bird populations. Repeated exposure of individual seabirds or groups of seabirds would be unlikely, based on the large operational area of the Study Area and the dispersed nature of the activities.

ESA-listed seabirds are known to be present in areas where detonations would occur during training under Alternative 1. While the information known about seabird distribution limits the ability to quantify the impacts of explosions, the likelihood of an injurious exposure seems remote based on the very low density of seabirds and smaller number of explosive detonations. An exposure resulting in a short-term behavioral response would be more likely to occur than an exposure that causes injury.

Explosive detonations used during training activities under Alternative 1 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of explosive detonations during training activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Explosive detonations associated with testing activities under Alternative 1 would nearly triple as compared to the No Action Alternative. The detonations would include explosive source classes up to E11 (500 – 650 lb. net explosive weight) (see Table 3.0-9). However, the vast majority (13,336 of 13,618) of explosive detonations are explosive source class E1 – E4 (less than 5 lb. net explosive weight).Testing activities involving explosive detonations are spread throughout the Study Area, but would be concentrated in the SOCAL Range Complex portion of the Study Area, followed in descending order of numbers of activities by the HRC. A more detailed description of these training activities and their proposed locations are presented in Tables 2.9-2 and 2.9-3 of Chapter 2.

Small detonations close to shore could have a short-term adverse impact on nesting and nearshore foraging species. Most larger detonations would occur near areas with the potential for relatively high concentrations of seabirds (upwelling areas associated with the Pacific Current; productive live/hard bottom habitats; and large algal mats); therefore, any impacts on seabirds are likely to be greater in these areas. However, under Alternative 1, only 282 explosive detonations are of explosive class source E5 or greater (greater than 5 lb. net explosive weight) (Table 3.0-9). While the impacts of explosive detonations on seabirds under Alternative 1 cannot be quantified due to limited data on seabird density, lethal injury to some seabirds could occur. Lethal injuries would likely be associated with explosive detonations with larger net explosive weights, although any event employing static targets may attract seabirds to the detonation site. While some seabird mortality could occur, the mortality potential is low, given the number of large net explosive weight detonations and the dispersed nature of seabirds in the study area. Because explosive detonations occur at varying locations over a short time period and seabird presence changes seasonally and on a short-term basis, individual seabirds would not be expected to be repeatedly exposed to explosive detonations. Similar to the No Action Alternative, any impacts on migratory or breeding seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent and would not impact seabird or migratory bird populations.

ESA-listed seabirds are known to be present in areas where detonations would occur during training under Alternative 1. While the information known about seabird distribution limits the ability to quantify the impacts of explosions, the likelihood of an injurious exposure seems remote based on the very low density of seabirds and net explosive weight used. An exposure resulting in a short-term behavioral response would be more likely to occur than an exposure that causes injury.

Explosive detonations used during testing activities under Alternative 1 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of explosive detonations during testing activities described under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.2.3 Alternative 2

Training Activities

The total number of explosive detonations throughout the Study Area would decrease by 15 percent under Alternative 2 (Table 3.0-9) as compared to the No Action Alternative. The detonations would include explosive source classes up to E13 (1,000 – 1,740 lb. net explosive weight). Training activities involving explosive detonations occur throughout the Study Area, but would be concentrated in the SOCAL Range Complex portion of the Study Area, followed in descending order of numbers of activities by HRC, SSTC, and the Transit Corridor. Training activities using explosives generally do not occur within 1.6 nm of shore or within 3 nm of bays, rivers, or estuaries except those used in the San Diego Bay and boat training lanes of SSTC (E1 - E7 [less than 60 lb. net explosive weight). Alternative 2 would introduce the use of high explosive rockets. The majority of these rockets would be used in the SOCAL Range Complex portions of the Study Area, with the remainder being used in the HRC portion of the Study Area, and none would be used in the SSTC portion of the Study Area. A more detailed description of these training activities and their proposed locations are presented in Tables 2.9-2 and 2.9-3 of Chapter 2.

Potential impacts on seabirds by explosive detonations are expected to be similar to those under the No Action Alternative, but the potential for exposure would decrease with lower number of explosive detonations. While some seabird mortalities could occur, only a small number of seabirds would be affected. Any impacts on seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term (behavioral) and infrequent and would not impact seabird or migratory bird populations. Repeated exposure of individual seabirds or groups of seabirds would be unlikely, based on the large operational area of the Study Area and the dispersed nature of the activities.

ESA-listed seabirds are known to be present in areas where detonations would occur during training under Alternative 2. While the information known about seabird distribution limits the ability to quantify the impacts of explosions, the likelihood of an injurious exposure seems remote based on the very low density of seabirds and smaller number of explosive detonations. An exposure resulting in a short-term behavioral response would be more likely to occur than an exposure that causes injury.

Explosive detonations used during training activities under Alternative 2 may affect, but are not likely to adversely affect ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of explosive detonations during training activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Explosive detonations associated with testing activities under Alternative 2 would approximately triple as compared to the No Action Alternative. The detonations would include explosive source classes up to E11 (500 – 650 lb. net explosive weight) (see Table 3.0-9). However, the vast majority (14,727 of 15,043) of explosive detonations are explosive source class E1 – E4 (less than 5 lb. net explosive weight).Testing activities involving explosive detonations occur throughout the Study Area, but would be concentrated in the SOCAL Range Complex portion of the Study Area, followed in descending order of numbers of activities by the HRC. A more detailed description of these training activities and their proposed locations are presented in Tables 2.9-2 and 2.9-3 of Chapter 2.

Small detonations close to shore could have a short-term adverse impact on nesting and nearshore foraging species. Most larger detonations would occur near areas with the potential for relatively high concentrations of seabirds (upwelling areas associated with the Pacific Current; productive live/hard bottom habitats; and large algal mats); therefore, any impacts on seabirds are likely to be greater in these areas. However, under Alternative 1, only 282 explosive detonations are of explosive class source E5 or greater (greater than 5 lb. net explosive weight) (Table 3.0-9). While the impacts of explosive detonations on seabirds under Alternative 1 cannot be quantified due to limited data on seabird density, lethal injury to some seabirds could occur. Lethal injuries would likely be associated with explosive detonations with larger net explosive weights, although any event employing static targets may attract seabirds to the detonation site. While some seabird mortality could occur, the mortality potential is low, given the number of large net explosive weight detonations and the dispersed nature of seabirds in the study area. Because explosive detonations occur at varying locations over a short time period and seabird presence changes seasonally and on a short-term basis, individual seabirds would not be expected to be repeatedly exposed to explosive detonations. Similar to the No Action Alternative, any impacts on migratory or breeding seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent and would not impact seabird or migratory bird populations.

ESA-listed seabirds are known to be present in areas where detonations would occur during training under the No Action Alternative. While the information known about seabird distribution limits the ability to quantify the impacts of explosions, the likelihood of an injurious exposure seems remote based on the very low density of seabirds and net explosive weight used. An exposure resulting in a short-term behavioral response would be more likely to occur than an exposure that causes injury.

Explosive detonations used during testing activities under Alternative 2 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the use of explosive detonations during testing activities described under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.3 Pile Driving

Acoustic sources from pile driving could occur within the SSTC portion of the Study Area during elevated causeway construction activities. During an elevated causeway event, a pier is constructed off of the beach. The pier is designed to allow for offload of materials and equipment from supply ships. Piles are driven into the sand with an impact hammer. Causeway platforms are then hoisted and secured onto the piles with hydraulic jacks and cranes. The elevated causeway pier, including associated piles, is removed at the conclusion of training. Noise associated with elevated causeway installation activities includes a loud impulsive sound derived from driving piles into the soft sandy substrate of the SSTC waters to temporarily support a causeway of linked pontoons.

Information regarding the impacts from acoustic sources on seabirds and the ability for seabirds to hear underwater is virtually unknown. The exposure to these sounds by seabirds, other than pursuit diving species, is likely to be very limited due to spending a very short time under water (plunge-diving or surface-dipping) or foraging only at the water surface. Pursuit divers may remain under water for minutes, increasing the chance of underwater sound exposure.

Responses to noise from pile driving would be limited to short-term behavioral or physiological responses (e.g., alert response, startle response, and temporary increase in heart rate). Startle or alert reactions to muzzle blasts are not likely to disrupt major behavior patterns, such as migrating, breeding, feeding, and sheltering, or to result in serious injury to any seabirds. Birds may be temporarily displaced and there may be temporary increases in stress levels; however, behavior and use of habitat would return shortly after the training is complete. Beason (2004) notes that birds exposed to up to 146 A-weighted sound level (dBA) within 325 ft. (99.1 m) of the sound source flushed but then returned within minutes of the disturbance. The range of impacts could depend on the charge size, distance from the charge, and the seabird's life activity at the time of the exposure.

3.6.3.1.3.1 No Action Alternative, Alternative 1, and Alternative 2

Training Activities

Pile driving is associated with four training activities annually under the No Action Alternative, Alternative 1, and Alternative 2. Training activities involving pile driving is limited to the SSTC portion of the Study Area.

Nearshore waters are the primary foraging habitat for many seabird species. Noise from pile driving close to shore could have a short-term adverse impact on nesting and nearshore foraging species. However, human activity such as vessel or boat movement, and equipment setting and movement, could cause seabirds to flee the activity area before the onset of pile driving. If seabirds were in the activity area, they would likely flee the area prior to the release of military expended materials or just after the initial strike of the pile. In-air pile driving noise could elicit short-term behavioral or physiological responses but are not likely to disrupt major behavior patterns, such as migrating, breeding, feeding, and sheltering, or to result in serious injury to any seabirds. Beason (2004) notes that birds exposed to up to 146 A-weighted sound level (dBA) within 325 ft. (99.1 m) of the sound source flushed but then returned within minutes of the disturbance. Pile driving noise is not expected to be at this sound level in air.

Information regarding the impacts from underwater pile driving noise on seabirds and the ability for seabirds to hear underwater is virtually unknown. The exposure to these sounds by seabirds, other than pursuit diving species, is likely to be very limited due to spending a very short time under water (plunge-diving or surface-dipping) or foraging only at the water surface. Pursuit divers may remain under water for minutes, increasing the chance of underwater sound exposure. Assuming that a seabird disturbed by an underwater sound would avoid the stressor by swimming to the surface, a physiological impact, such as hearing loss, would only occur if a seabird is close to an intense sound source. In general, birds are less susceptible to both temporary and permanent threshold shift than mammals (Saunders and Dooling 1974), so an underwater sound exposure would have to be intense and of a sufficient duration to cause temporary or permanent threshold shift. Avoiding the sound by returning to the surface would limit extended or multiple sound exposures underwater. Any impacts on migratory or breeding seabirds related to startle reactions, displacement from a preferred area, or reduced foraging success in offshore waters would likely be short-term and infrequent and would not impact seabird or migratory bird populations.

One ESA-listed seabird is known to be present in areas where pile driving would occur during training under the No Action Alternative, Alternative 1, or Alternative 2. California least terns could be exposed to intermittent pile driving noise during the approximate two week period of each elevated causeway event. However, during the elevated causeway activity, any impact based on displacement from the activity area would be minimized due to the availability of suitable foraging habitat in adjacent boat training lanes at SSTC. Further, an exposure resulting in a short-term behavioral response would only be expected if the seabirds did not leave the area prior to the start of the elevated causeway activity. Repeated exposure of individual seabirds is unlikely based on the seabird's capability to avoid or rapidly vacate an area of disturbance and availability of non-impacted foraging habitats.

Noise from pile driving events from training activities under all alternatives may affect, but is not likely to adversely affect, the ESA-listed California least tern. Noise from pile driving events from training activities under all alternatives would have no effect on the remaining ESA-listed seabirds in the Study Area.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from noise from pile driving events during training activities under any alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Under the No Action Alternative, Alternative 1, or Alternative 2, no pile driving events are planned during testing activities.

3.6.3.1.4 Vessel and Simulated Vessel Noise

The training and testing proposed in the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels). Birds could be exposed to noise from vessels throughout the Study Area, but few exposures would occur based on the infrequency of operations and the low density of vessels within the Study Area at any given time. However, if in the immediate area where vessels are operating, seabirds from any of the six taxonomic groups found within the Study Area (Table 3.6-2 and Table 3.6-3) could potentially be disturbed by vessel noise. Noise impacts on wildlife from recreational and commercial activities, vehicle traffic, and military training operations can include altering habitat use and activity patterns, increasing stress response, decreasing immune response, reducing reproductive success, increasing predation risk, degrading conspecific communication, and damaging hearing (Pater et al. 2009).

Birds respond to vessels in various ways. Some seabirds are commonly attracted to and follow vessels including certain species of gulls, storm petrels, and albatrosses (Hamilton 1958; Hyrenback 2001, 2006), while other species such as frigatebirds and sooty terns seem to avoid vessels (Borberg et al. 2005; Hyrenback 2006). Vessel noise could elicit short-term behavioral or physiological responses but are not likely to disrupt major behavior patterns, such as migrating, breeding, feeding, and sheltering, or to result in serious injury to any seabirds. Beason (2004) notes that birds exposed to up to 146 A-weighted sound level (dBA) within 325 ft. (99.1 m) of the sound source flushed but then returned within minutes of the disturbance. Vessel noise is not expected to be at this sound level. Harmful seabird/vessel interactions are commonly associated with commercial fishing vessels because birds are attracted to concentrated food sources around these vessels (Melvin and Parrish 1999); Dietrich and Melvin 2004). The concentrated food sources that attract seabirds to commercial fishing vessels are not present around Navy vessels.

Although loud sudden noises can startle and flush birds, Navy vessels are not expected to result in major acoustic disturbance of seabirds in the Study Area. Noises from Navy vessels are similar to or less than those of the general maritime environment. Birds respond to the physical presence of a vessel, regardless of the associated noise. The potential is very low for noise generated by Navy vessels to impact seabirds and would not result in major impacts on seabird populations; therefore, this issue is not addressed further in the analysis of impacts on this resource.

Noise from vessel or simulated vessel noise from training and testing activities under all alternatives would have no effect on ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from noise from vessels or simulated vessel noise during training or testing activities under any alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.5 Aircraft Noise

Fixed wing aircraft and helicopters are used for a variety of training and testing activities throughout the Study Area. Impacts of those activities on seabirds are applicable to everywhere in the Study Area that aircraft overflights occur, although some areas experience more aircraft activity than others. Various types of fixed-wing aircraft and helicopters are used in training and testing exercises throughout the Study Area (see Chapter 2, Description of Proposed Action and Alternatives). Seabirds and other migratory birds could be exposed to airborne noise associated with subsonic and supersonic fixed-wing aircraft overflights and helicopter operations while foraging or migrating in open water, near-shore, or coastal environments within the Pacific Ocean. If in an area where overflights are occurring, all taxonomic groups found within the Study Area (Table 3.6-2 and Table 3.6-3) could potentially be temporarily disturbed by aircraft noise.

Seabird exposure to fixed-wing aircraft noise would be brief (seconds) as an aircraft quickly passes overhead. Exposures would be infrequent based on the transitory and dispersed nature of the overflights; repeated exposure of individual seabirds over a short period of time (hours or days) is unlikely. If seabirds were to respond to an overflight, the responses would be limited to short-term behavioral or physiological reactions (e.g., alert response, startle response, temporary increase in heart rate), and the general health of individual seabirds would not be compromised. Birds repeatedly exposed to aircraft noise often become habituated to the noise and do not respond behaviorally (National Park Service 1994); (Larkin et al. 1996; Plumpton 2006). However, habituation seems unlikely in the Study Area given the widely dispersed nature of the operations and the relative infrequency of the operations.

Most fixed-wing aircraft flights occur at distances greater than 12 nautical miles (nm) offshore. Birds could be exposed to elevated noise levels while foraging or migrating in these open water environments, as well as in near-shore or coastal environments when aircraft flights occur in those areas. Most fixed-wing sorties would occur greater than 3,000 ft. (914.4 m) altitude and would be associated with air combat maneuver training and U.S. Navy Air Systems Command testing. Typical altitudes would range from 5,000 to 30,000 ft. (1,524 to 9,144km) and typical airspeeds would range from very low (less than 100 knots [kt]) to high subsonic (less than 600 kt). Sound exposure levels at the sea surface from most air combat maneuvers overflights are expected to be less than 85 dBA re 20 µPa, based on an F/A-18 aircraft flying at an altitude of 5,000 feet and at a subsonic airspeed of 400 knots (kt). Exceptions include sorties associated with air-to-surface ordnance delivery and sonobuoy drops from 500 to 5,000 ft. (152.4 to 1,524 m) altitude. Approximately 95 percent of bird flight during migrations occurs below 10,000 ft. (3,048 m) with the majority below 3,000 ft. (914.4 m) (U.S. Geological Survey 2006). While there is considerable variation, the favored altitude for most small birds appears to be between 500 and 1,000 ft. (152.4 and 304.8 m). Bird exposure to fixed-wing aircraft noise would be brief (seconds) as an aircraft quickly passes. Unlike the situation at a busy commercial airport or military landing field, repeated exposure of individual seabirds or groups of seabirds would be unlikely based on the dispersed nature of the overflights.

Some air combat maneuver training would involve high altitude, supersonic flight, which would produce sonic booms, but such airspeeds would be infrequent. Boom duration is generally less than 300 milliseconds. Sonic booms would cause seabirds to startle, but the exposure would be brief, and any reactions are expected to be short-term. Startle impacts range from altering behavior (e.g., stop feeding or preening), minor behavioral changes (e.g., head turning), or at worst, a flight response. Because most fixed-wing flights are not supersonic and both seabirds and aircraft are transient in any area, exposure of seabirds in the open ocean to sonic booms would be infrequent. It is unlikely that individual seabirds would be repeatedly exposed to sonic booms in the open ocean.

Unlike fixed-wing aircraft, helicopters typically operate below 1,000 ft. (304.8 m) altitude and often occur as low as 75–100 ft. (22.9–30.5 m) altitude. This low altitude increases the likelihood that seabirds would respond to noise from helicopter overflights. Helicopters travel at slower speeds (less than 100 kt) which increases durations of noise exposure compared to fixed-wing aircraft. In addition, some studies have suggested that birds respond more to noise from helicopters than from fixed-wing aircraft (Larkin et al. 1996; National Park Service 1994). Noise from low-altitude helicopter overflights would be expected to elicit short-term behavioral or physiological responses in exposed seabirds. Repeated exposure of individual seabirds or groups of seabirds is unlikely based on the dispersed nature of the overflights and seabird’s capability to avoid or rapidly vacate an area of disturbance. Therefore, the general health of individual seabirds would not be compromised.

3.6.3.1.5.1 No Action Alternative

Training Activities

Under the No Action Alternative, a variety of aircraft would be used throughout the Study Area, as described in Tables 2.8-1 through 2.8-5, Description of Proposed Action and Alternatives. Under the No Action Alternative, 10,896 fleet training activities utilize some type of aircraft ranging from fixed-wing aircraft to helicopters. The highest concentrations of aircraft noise would be associated with the greater number of flights in the SOCAL Range Complex compared to other portions of the Study Area, although training flights occur in each range complex and outside of the range complexes. These activities involve low-flying aircraft as part of training. Most of the helicopter training operations occur at low altitudes (75 to 100 ft. [22.9 to 30.5 m]), which increases the exposure of seabirds to their noise. Takeoffs and landings occur at established airfields and on vessels at sea at unspecified locations throughout the Study Area. Aircraft noise under the No Action Alternative could elicit short-term behavioral or physiological responses in some individual seabirds. Helicopter overflights are more likely to elicit responses than fixed-wing aircraft, but the general health of individual seabirds would not be compromised.

Navy aircraft training activities over the Pacific Ocean are concentrated near the continental shelfs and surrounding islands, removed from seabird nesting areas. Seabirds that forage in these areas may have greater presence in these productive areas, so aircraft overflights may cause more behavioral disturbances in these areas. A seabird in the open ocean would be exposed for a few seconds to fixed-wing aircraft noise as the aircraft quickly passes overhead. Seabirds foraging or migrating through a training area in the open ocean may respond by avoiding areas of concentrated aircraft noise. Exposures to seabirds would be infrequent, based on the brief duration and dispersed nature of the overflights. Repeated exposure to individual seabirds over hours or days is unlikely. Startle or alert reactions to aircraft are not likely to disrupt major behavior patterns, such as migrating, breeding, feeding, and sheltering, or to result in serious injury to any seabirds. While behavioral or physiological impacts of airborne activity on individual seabirds may occur, none of these impacts are long-lasting, and none are expected to have an adverse impact on seabirds at the population level.

Birds using wetlands, mud flats, beaches, and other shoreline habitats or shallow coastal foraging areas would be exposed to noise from near-shore helicopter training and aircraft in transit to off-shore training areas. The presence of dense aggregations of seabirds (terns) is a potential concern during low-attitude helicopter operations. Although seabirds may be more likely to react to helicopters than to fixed-wing aircraft, Navy helicopter pilots would avoid large flocks of seabirds to protect aircrews and equipment, thereby reducing disturbance to seabirds as well.

California least terns could be exposed to intermittent aircraft noise from aircraft originating from airfields located along the coast. If present in the open water areas where training activities involving aircraft overflights occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be temporarily disturbed while foraging or migrating. Short-term behavioral responses such as startle responses, head turning, or flight responses would be expected. Repeated exposures would be limited due to the transient nature of aircraft use and regular movement of seabirds. No long-term or population-level impacts are expected.

Noise from aircraft during training activities under the No Action Alternative may affect, but is not likely to adversely affect ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from noise from aircraft during training activities under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Under the No Action Alternative, approximately 840 testing activities involve the use of some type of aircraft ranging from fixed-wing aircraft to helicopters. Testing activities involving aircraft closely resemble training activities and would therefore have similar aircraft noise impacts.

California least terns could be exposed to intermittent aircraft noise from aircraft originating from airfields located along the coast. If present in the open water areas where testing activities involving aircraft overflights occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be temporarily disturbed while foraging or migrating. Short-term behavioral responses such as startle responses, head turning, or flight responses would be expected. Repeated exposures would be limited due to the transient nature of aircraft use and regular movement of seabirds. No long-term or population-level impacts are expected.

Noise from aircraft during testing activities under the No Action Alternative may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from noise from aircraft during testing activities under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.5.2 Alternative 1

Training Activities

Under Alternative 1, the total number of training activities involving aircraft throughout the Study Area would increase 13.2 percent over the No Action Alternative from 10,896 to 12,334 activities, with the highest increase in aircraft training events occurring in the SOCAL Range Complex portion of the Study Area (7,568 to 8,987 activities). The locations and types of aircraft would not differ from the No Action Alternative, as described in Tables 2.8-1 through 2.8-5, Description of Proposed Action and Alternatives.

The additional aircraft hours would increase noise overall but would not change the nature of the short-term reversible impacts described for the No Action Alternative.

Based on the increased training operations under Alternative 1, more seabirds could be exposed to noise; the number of times an individual seabird is exposed could also increase. Similar to the No Action Alternative, the responses would be limited to short-term behavioral or physiological reactions, and the general health of individual seabirds would not be compromised. While behavioral or physiological impacts of airborne activity on individual seabirds may occur, none of these impacts are long-lasting, and none are expected to have an adverse impact on migratory seabirds at the population level.

California least terns could be exposed to intermittent aircraft noise from aircraft originating from airfields located along the coast. If present in the open water areas where training activities involving aircraft overflights occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be temporarily disturbed while foraging or migrating. Short-term behavioral responses such as startle responses, head turning, or flight responses would be expected. Repeated exposures would be limited due to the transient nature of aircraft use and regular movement of seabirds. No long-term or population-level impacts are expected.

Noise from aircraft during training activities under Alternative 1 may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from noise from aircraft during training activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Under Alternative 1, the total number of testing activities involving aircraft throughout the Study Area would increase approximately 12 percent over the No Action Alternative from 840 to 941 annual events. The locations and types of aircraft would not differ from the No Action Alternative, as described in Tables 2.8-1 through 2.8-5, Description of Proposed Action and Alternatives. The additional aircraft activities would increase noise overall but would not change the nature of the short-term reversible impacts described for the No Action Alternative.

Based on the increased testing operations under Alternative 1, more seabirds could be exposed to noise; the number of times an individual seabird is exposed could also increase. Similar to the No Action Alternative, the responses would be limited to short-term behavioral or physiological reactions, and the general health of individual seabirds would not be compromised. While behavioral or physiological impacts of airborne activity on individual seabirds may occur, no long-term or population level impacts are expected.

California least terns could be exposed to intermittent aircraft noise from aircraft originating from airfields located along the coast. If present in the open water areas where testing activities involving aircraft overflights occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be temporarily disturbed while foraging or migrating. Short-term behavioral responses such as startle responses, head turning, or flight responses would be expected. Repeated exposures would be limited due to the transient nature of aircraft use and regular movement of seabirds. No long-term or population-level impacts are expected.

Noise from aircraft during testing activities under Alternative 1 may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from noise from aircraft during testing activities Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.5.3 Alternative 2

Training Activities

Under Alternative 2, the total number of training activities involving aircraft throughout the Study Area would increase 13.2 percent over the No Action Alternative from 10,896 to 12,334 activities, with the highest increase in aircraft training events occurring in the SOCAL Range Complex portion of the Study Area (1,568 to 8,987 activities). The locations and types of aircraft would not differ from the No Action Alternative, as described in Tables 2.8-1 through 2.8-5, Description of Proposed Action and Alternatives. The additional aircraft hours would increase noise overall but would not change the nature of the short-term reversible impacts described for the No Action Alternative.

Noise from aircraft during training activities under Alternative 2 may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from noise from aircraft during training activities under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Under Alternative 2, the total number of testing activities involving aircraft throughout the Study Area would increase over the No Action Alternative from 840 to 941 annual events. The locations and types of aircraft would not differ from the No Action Alternative, as described in Tables 2.8-1 through 2.8-5, Description of Proposed Action and Alternatives. The additional aircraft activities would increase noise overall but would not change the nature of the short-term reversible impacts described for the No Action Alternative.

Based on the increased testing operations under Alternative 2, more seabirds could be exposed to noise; the number of times an individual seabird is exposed could also increase. Similar to the No Action Alternative, the responses would be limited to short-term behavioral or physiological reactions, and the general health of individual seabirds would not be compromised. While behavioral or physiological impacts of airborne activity on individual seabirds may occur, no long-term population level.

Noise from aircraft activities during testing activities under Alternative 2 may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from noise from aircraft during testing activities Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.1.6 Summary of Impacts of Acoustic Stressors

Under the No Action Alternative, Alternative 1, or Alternative 2, noise from sonar, explosive detonations, pile driving, vessel noise, and aircraft noise would be expected to elicit brief behavioral or physiological responses in exposed seabirds. Repeated exposure of individual seabirds or groups of seabirds would be unlikely, based on the large operational area of the Study Area and the dispersed nature of the overflights, and the ability to easily avoid or rapidly vacate the action area. The general health of individual seabirds would not be compromised. Birds could be exposed to elevated noise levels while foraging or migrating, but would only be exposed to potentially disturbing levels of noise during low altitude helicopter or fixed wing exercises, especially in nearshore areas, or when in immediate proximity of an in-air explosion, firing event, or underwater detonation. Transiting seabirds or those resting on the water may be startled and also experience concussive injury from in-air explosions, firing events, or underwater detonations. However, protective measures, such as restricting activities to when seabirds are absent from the immediate vicinity of an underwater detonation training or testing activity, are implemented prior to and during these activities to minimize impacts on seabirds from these activities. Individual seabirds may be affected, but in-air explosions, firing events, or underwater detonations would have no impact on species or populations due to (1) the vast area over which training activities occur, (2) the implementation of Navy resource protection measures, (3) the ability of seabirds to flee disturbance.

3.6.3.2 Energy Stressors

This section analyzes the potential impacts of the various types of energy stressors that can occur during training and testing activities within the Study Area. This section includes analysis of the potential impacts from electromagnetic devices.

3.6.3.2.1 Impacts from Electromagnetic Devices

Several different types of electromagnetic devices are used during training and testing activities throughout the Study Area, as described in Chapter 2, Description of Proposed Action and Alternatives. Electromagnetic training and testing activities include an array of magnetic sensors used in mine countermeasure operations in the Study Area. Some electromagnetic devices such as a vessel radar and radio are devices that could impact seabirds above the water. Towed electromagnetic device impacts to seabirds would only occur underwater and would only impact diving species or species on the surface in the immediate area where the device is deployed. There is no information available on how birds react to electromagnetic fields underwater.

Electromagnetic devices are used primarily in towed-mine neutralization and port security training. Similar testing activities include the use of electromagnetic devices (e.g., mine detection/neutralization and electromagnetic activities [Littoral Combat Ship mission package testing, unmanned and autonomous surface/underwater vehicle testing, etc.]). The kinetic energy weapon is also included as an electromagnetic testing activity. In most cases, such as mine detection/neutralization, the device simply mimics the electromagnetic signature of a vessel passing through the water. None of the devices emit any type of electromagnetic “pulse.”

Potential impacts of those activities on seabirds are applicable to everywhere in the Study Area that electromagnetic devices are used. Electromagnetic devices used in Navy training and testing activities may potentially impact seabird navigation through disruption of electromagnetic fields. Birds use numerous other orientation cues to navigate in addition to magnetic fields. These include position of the sun, celestial cues, visual cues, wind direction, and scent (Fisher 1971, Haftorn et al. 1988, Wiltschko and Wiltschko 2005, Åkesson and Hedonström 2007). It is believed that by using a combination of these cues birds are able to successfully navigate long distances.

It has been demonstrated that some seabirds use the Earth's magnetic field as a navigational cue during seasonal migrations (Fisher 1971, Wiltschko and Wiltschko 2005, Åkesson and Hedonström 2007). A magnetite-based receptor mechanism in the upper bill of some birds provides information on position and compass direction (Wiltschko and Wiltschko 2005). Electromagnetic devices send out electromagnetic signals into the environment that seabirds could potentially detect and respond to.

Studies have been conducted on electromagnetic sensitivity in birds typically associated with land, though little information exists specifically on seabird response to electromagnetic changes at sea. Results from a study conducted by Larkin and Sutherland (1977) show that during nocturnal flights, birds are capable of sensing electromagnetic fields emitted from antenna in Wisconsin used for the Navy's Project Seafarer. A study conducted by Hanowski et al. (1993) on the effects of extremely low frequency electromagnetic fields on breeding and migrating birds around the Navy's extra low frequency communication system antenna in Wisconsin found no evidence that bird distribution or abundance was affected by electromagnetic fields produced by the antenna.

Possible effects on birds from disrupting electromagnetic fields include behavioral responses such as temporary disorientation and change in flight direction (Larkin and Sutherland 1977, Wiltschko and Wiltschko 2005). Many bird species return to the same stopover, wintering, and breeding areas every year and often follow the exact same or very similar migration routes (Åkesson 2003, Alerstam et al. 2006). However, ample evidence exists that displaced birds can successfully reorient and find their way when one or more cues are removed (Haftorn et al. 1988, Åkesson 2003). For example, Haftorn et al. (1988) found that after removal from their nests and release into a different area, snow petrels (*Pagodrama nivea*) were able to successfully navigate back to their nests even when their ability to smell was removed. Furthermore, Wiltschko and Wiltschko (2005) report that electromagnetic pulses administered to birds during an experimental study on orientation do not deactivate the magnetite-based receptor mechanism in the upper beak altogether, but instead cause the receptors to provide altered information, which in turn causes birds to head in different directions. However, these effects were temporary and the ability of the birds to correctly orient themselves returned after a few days.

3.6.3.2.1.1 No Action Alternative

<u>Training Activities</u>

Under the No Action Alternative, electromagnetic activities are planned as described in Tables 2.8-1, Description of Proposed Action and Alternatives. Training activities that include an electromagnetic component include anti-air warfare and electronic warfare.

The distribution of seabirds in the Study Area is patchy (Fauchald et al. 2002; Schneider and Duffy 1985). Exposure of seabirds would be limited to those foraging at or below the surface (e.g., cormorants, loons, petrels, grebes, etc.) because that is where the devices are used. Birds that forage inshore could be exposed to these electromagnetic stressors because their habitat overlaps with some of the activities that occur in the nearshore portions of SOCAL Range Complex and SSTC. However, the electromagnetic fields generated would be distributed over time and location, and any influence on the surrounding environment would be temporary and localized. More importantly, the electromagnetic devices used are typically towed by a helicopter and it is likely that any seabirds in the vicinity of the approaching helicopter would be dispersed by the sound and disturbance generated by the helicopter (see Section 3.6.3.1.5 [Aircraft Noise]) and move away from the device before any exposure could occur.

In the unlikely event that a seabird is temporarily disoriented by an electromagnetic device, it would still be able to re-orient using their internal magnetic compass to aid in navigation (Wiltschko et al. 2011).

California least terns could be exposed to intermittent electromagnetic stressors in nearshore areas where training activities occur. If present in the open water areas where training activities involving electromagnetic stressors occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be temporarily disturbed while foraging or migrating. Impacts on seabirds from potential exposure to electromagnetic fields would be temporary and inconsequential based on: (1) relatively low intensity of the magnetic fields generated (0.2 microtesla at 656 ft. [200 m] from the source), (2) very localized potential impact area, (3) temporary duration of the activities (hours), and (4) occurring only underwater. No long-term or population-level impacts are expected.

Electromagnetic devices used during training activities under the No Action Alternative may affect, but are not likely to adversely affect, ESA-listed seabirds.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from electromagnetic devises used during training activities under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Under the No Action Alternative, electromagnetic activities are planned as described in Tables 2.8-2 through 2.8-5, Description of Proposed Action and Alternatives.

For reasons stated in Section 3.6.3.2.1 (No Action Alternative), any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of seabird populations. California least terns could be exposed to intermittent electromagnetic stressors in nearshore areas where testing activities occur. If present in the open water areas where testing activities involving electromagnetic stressors occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be temporarily disturbed while foraging or migrating. Any temporary disorientation experienced by seabirds from electromagnetic changes caused by testing activities in the Study Area may be considered a short-term impact and would not hinder seabird navigation abilities. Repeated exposures would be limited due to the transient nature of the testing activities using electromagnetic devices and regular movement of seabirds. No long-term or population-level impacts are expected.

Electromagnetic devices used during testing activities under the No Action Alternative may affect, but are not likely to adversely affect, ESA-listed seabirds.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from electromagnetic devises used during testing activities under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.2.1.2 Alternative 1

Training Activities

The number of electromagnetic activities proposed for the Study Area under Alternative 1 each year does not increase from the No Action Alternative, as described in Tables 2.8-1 of Chapter 2, Description of Proposed Action and Alternatives. Therefore, the impacts on seabirds from activities performed during Alternative 1 would be the same as for the No Action Alternative.

Electromagnetic devices used during training activities under Alternative 1 may affect, but are not likely to adversely affect, ESA-listed seabirds.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from electromagnetic devises used during training activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

The number of electromagnetic activities proposed for the Study Area under Alternative 1 each year increases from the No Action Alternative by less than one percent, as described in Tables 2.8-1 of Chapter 2, Description of Proposed Action and Alternatives. Under Alternative 1, kinetic energy weapon testing would be introduced in the HRC portion of the Study Area, with 200 events per year. The electromagnetic kinetic energy weapon uses electrical energy to accelerate projectiles to supersonic velocities. The kinetic energy weapon would be operated from ships, firing projectiles toward land targets.

This unique weapons system charges for approximately two minutes and discharges in less than a second. The duration of the firing event is extremely short (about 8 milliseconds [ms]), which makes it quite unlikely that a seabird would fly over at the precise moment of firing. The short duration of each firing event also means that the likelihood of affecting any animal using magnetic fields for orientation is extremely small. Further, the high magnetic field levels experienced within 80 ft. (24.4 m) of the launcher quickly dissipate and return to background levels beyond 80 ft. (24.4 m) The magnetic field levels outside of the 80-ft. (24.4-m) buffer zone would be below the most stringent guidelines for humans (i.e., people with pacemakers or AIMD). Therefore, the electromagnetic impacts would be temporary in nature and not expected to result in impacts on organisms (U.S. Department of the Navy 2009).

The increase in activities and introduction of activities would not measurably increase the probability of seabirds being exposed to electromagnetic energy as compared to the No Action Alternative. The species and groups with potential to co-occur with these activities remain the same and potential impacts would be temporary and inconsequential, as discussed above for the No Action Alternative.

California least terns could be exposed to intermittent electromagnetic stressors in nearshore areas where testing activities occur. If present in the open water areas where testing activities involving electromagnetic stressors occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be temporarily disturbed while foraging or migrating. Any temporary disorientation experienced by seabirds from electromagnetic changes caused by testing activities in the Study Area may be considered a short-term impact and would not hinder seabird navigation abilities. Repeated exposures would be limited due to the transient nature of the testing activities using electromagnetic devices and regular movement of seabirds. For reasons stated in Section 3.6.3.2.1 (No Action Alternative, Testing Activities), any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of seabird populations. No long-term or population-level impacts are expected.

Electromagnetic devices used during testing activities under Alternative 1 may affect, but are not likely to adversely affect, ESA-listed seabirds.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from electromagnetic devises used during testing activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.2.1.3 Alternative 2

Training Activities

The number of electromagnetic activities proposed for the Study Area under Alternative 2 each year does not increase from the No Action Alternative, as described in Tables 2.8-1 of Chapter 2, Description of Proposed Action and Alternatives. Therefore, the impacts on seabirds from activities performed during Alternative 2 would be the same as for the No Action Alternative.

Electromagnetic devices used during training activities under Alternative 2 may affect, but are not likely to adversely affect, ESA-listed seabirds.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from electromagnetic devises used during training activities under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

The number of electromagnetic activities proposed for the Study Area under Alternative 2 each year increases less than one percent from the No Action Alternative, as described in Tables 2.8-1 of Chapter 2, Description of Proposed Action and Alternatives. Under Alternative 2, kinetic energy weapon testing would be introduced in the HRC portion of the Study Area, with 200 events per year. The electromagnetic kinetic energy weapon uses electrical energy to accelerate projectiles to supersonic velocities. The kinetic energy weapon would be operated from ships, firing projectiles toward land targets.

This unique weapons system charges for approximately two minutes and discharges in less than a second. The duration of the firing event is extremely short (about 8 ms), which makes it quite unlikely that a seabird would fly over at the precise moment of firing. The short duration of each firing event also means that the likelihood of affecting any animal using magnetic fields for orientation is extremely small. Further, the high magnetic field levels experienced within 80 ft. (24.4 m) of the launcher quickly dissipate and return to background levels beyond 80 ft. (24.4 m). The magnetic field levels outside of the 80-ft. (24.4-m) buffer zone would be below the most stringent guidelines for humans (i.e., people with pacemakers or AIMD). Therefore, the electromagnetic impacts would be temporary in nature and not expected to result in impacts on organisms (U.S. Department of the Navy 2009).

The increase in activities and introduction of activities would not measurably increase the probability of seabirds being exposed to electromagnetic energy as compared to the No Action Alternative. The species and groups with potential to co-occur with these activities remain the same and potential impacts would be temporary and inconsequential, as discussed above for the No Action Alternative.

California least terns could be exposed to intermittent electromagnetic stressors in nearshore areas where testing activities occur. If present in the open water areas where testing activities involving electromagnetic stressors occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be temporarily disturbed while foraging or migrating. Any temporary disorientation experienced by seabirds from electromagnetic changes caused by testing activities in the Study Area may be considered a short-term impact and would not hinder seabird navigation abilities. Repeated exposures would be limited due to the transient nature of the testing activities using electromagnetic devices and regular movement of seabirds. For reasons stated in Section 3.6.3.2.1 (No Action Alternative, Testing Activities), any behavioral changes are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of seabird populations. No long-term or population-level impacts are expected.

Electromagnetic devices used during testing activities under Alternative 2 may affect, but are not likely to adversely affect, ESA-listed seabirds.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from electromagnetic devises used during testing activities under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.2.2 Summary of Impacts of Energy Stressors

The impact of electromagnetic devices on seabirds is expected to be negligible based on (1) the limited geographic area in which they are used, (2) the rare chance that an individual seabird might encounter these devices in use, (3) the startle behavior of seabirds and the mobility of seabirds to temporarily leave the area when the devices are in use, and (4) the absence of physiological damage and the temporary nature of any impacts if an individual seabird encountered these devices.

The impacts of electromagnetic devices would be limited to individual cases where a seabird might become temporarily disoriented and change flight direction. Although individuals may be temporarily impacted, these behaviors would have no direct impact at the population level.

3.6.3.3 Physical Disturbance and Strike Stressors

This section describes the potential impacts to seabirds by aircraft and aerial target strikes, vessels (disturbance and strike), and military expended material strike. Aircraft include fixed-wing and rotary-wing aircraft; vessels include various sizes and classes of ships, submarines, and other boats, towed devices, unmanned surface vehicles, and unmanned underwater vehicles; military expended material includes non-explosive practice munitions, target fragments, parachutes, and other objects.

Physical disturbance and strike risks, primarily from aircraft, have the potential to impact all taxonomic groups found within the Study Area if seabirds are in the same area with aircraft, vessels, and military expended material. Impacts of physical disturbance include behavioral responses such as temporary disorientation, collision, change in flight direction, and avoidance response behavior. Physical disturbances may elicit short-term behavioral or physiological responses such as alert response, startle response, cessation of feeding, fleeing the immediate area, and a temporary increase in heart rate. These disturbances can also result in abnormal behavioral, growth, or reproductive impacts in nesting seabirds and can cause foraging and nesting seabirds to flush from or abandon their habitats and or nests. Aircraft strikes often result in bird mortalities or injuries.

Although seabirds likely hear and see approaching vessels and aircraft, they cannot avoid all collisions. Birds are known to be attracted to lights which can lead to collisions (Gehring et al. 2009; Poot et al. 2008). High-speed collisions with large objects can be fatal to birds. Training and testing activities around concentrated numbers of seabirds would cause greater disturbance and increase the potential for strikes.

3.6.3.3.1 Aircraft and Aerial Target Strikes

Wildlife aircraft strikes are a grave concern for the Navy because they can harm aircrews. Wildlife aircraft strikes can also damage equipment, and injure or kill wildlife (Bies et al 2006). The Naval

Aviation Safety Program Instruction, Chief of Naval Operations Instruction 3750.6R, identifies measures to evaluate and reduce or eliminate bird/aircraft strike hazards to aircraft, aircrews, and birds and requires the reporting of all strikes when damage or injuries occur as a result of a bird/aircraft strike. However, the numbers of bird deaths that occur annually from all Navy activities are insignificant from a bird population standpoint From 2000 to 2009, the Navy Bird Aircraft Strike Hazard program recorded 5,436 bird strikes with the majority occurring during the fall period from September to November. During the 10-year period, bird strikes were greatest in 2007 with 827 strikes and lowest in 2001 with 48. Bird strike potential is greatest in foraging or resting areas, in migration corridors, and at low altitudes. For example, birds can be attracted to airports because they often provide foraging and nesting resources.

While bird strikes can occur anywhere aircraft are operated, Navy data indicate that they occur most often over land or close to shore. The potential for bird strikes to occur in offshore areas is relatively low because Navy activities are widely dispersed and above 3,000 ft. (914.4 m) (for fixed-wing aircraft) where bird densities are low. The majority of bird flight is below 3,000 ft. (914.4 m) and approximately 95 percent of bird flight during migrations occurs below 10,000 ft. (3,048 m) (U.S. Geological Survey 2006). Bird and aircraft encounters are more likely to occur during aircraft takeoffs and landings than when the aircraft is engaged in level low-altitude flight. Approximately 97 percent of aircraft-wildlife collisions occur at or near airports when aircraft are operating at or below 2,000 ft. (609.6 m). In a study that examined 38,961 bird and aircraft collisions, Dobson (2010) found that the majority (74 percent) of collisions occurred below 500 ft. (152.4 m). However, collisions have been recorded at elevations as great as 12,139 ft. (3,699.9 m) (Dobson 2010).

3.6.3.3.1.1 No Action Alternative

Training Activities

Various types of fixed-wing aircraft and helicopters are used in training throughout the Study Area, (see Tables 2.8-1 through 2.8-5). Certain portions of the Study Area, such as areas near Navy airfields, installations, and ranges are used more heavily by Navy aircraft than other portions as described in further detail in Tables 2.8-2 to 2.8-3 in Chapter 2 (Description of Proposed Action and Alternatives). Under the No Action Alternative, approximately 10,896 activities involve the use of aircraft. Flight altitudes for all fixed-wing activities would be above 3,000 ft. (914.4 m) mean sea level with the exception of sorties associated with air-to-surface bombing exercises. Typical flight altitudes during air-to-surface bombing exercises are from 500 to 5,000 ft. (152.4 to 1,524 m) above mean sea level. Most fixed-wing aircraft flight hours (greater than 90 percent) occur at distances greater than 12 nm offshore. Most of the helicopter training operations occur at low altitudes (75 to 100 ft.) (22.9 to 30.5 m), which increases the exposure of seabirds.

In general, seabird populations consist of hundreds or thousands of individuals, ranging across a large geographical area. In this context, the loss of several or even dozens of birds due to physical strikes may not constitute a population-level impact, although some species gather in large flocks. Some bird strikes and associated bird mortalities or injuries could occur as a result of aircraft and aerial target use in the Study Area under the No Action Alternative; however, population-level impacts to seabirds would not likely result from aircraft strikes. If in the immediate area where aircraft are operating at low altitudes, ESA-listed species could be impacted by aircraft disturbance and strike during migration.

Bird exposure to strike potential would be relatively brief as an aircraft quickly passes. Birds actively avoid interaction with aircraft; however, disturbances or strike of various bird species may occur from aircraft on a site-specific basis. As a standard operating procedure, aircraft avoid large flocks of birds to minimize the personnel safety risk involved with a potential bird strike. Some seabird and aircraft strikes and associated seabird mortalities or injuries could occur in the Study Area under the No Action Alternative; however, no increased risk of impacts on seabird populations would result from aircraft strikes. No long-term or population-level impacts are expected.

California least terns could be exposed to intermittent aircraft overflights and strike potential in nearshore areas where training activities occur. If present in the open water areas where training activities involving aircraft occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be briefly exposed to strike potential. However, the data that Navy has collected on bird strikes reports that no ESA-listed species have been struck in the past, so it is not likely they would be struck by aircraft or aerial targets during training activities.

Aircraft used during training activities under the No Action Alternative may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from aircraft used during training activities under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Under the No Action Alternative, a total of approximately 1,019 testing activities are planned using fixed wing aircraft and helicopters. These aircraft would be used in all portions of the Study Area.

In general, seabird populations consist of hundreds or thousands of individuals, ranging across a large geographical area. In this context, the loss of several or even dozens of birds due to physical strikes may not constitute a population-level impact, although some species gather in large flocks. Strikes to species listed under the ESA may have more impact because the population size has already been reduced to near or below sustainable levels.

Seabird exposure to strike potential would be relatively brief as an aircraft quickly passes. Seabirds actively avoid interaction with aircraft; however, disturbances of various seabird species may occur from aviation operations on a site-specific basis. As a standard operating procedure, aircraft avoid large flocks of birds to minimize the safety risk involved with a potential bird strike. Some seabird and aircraft strikes and associated seabird mortalities or injuries could occur in the Study Area under the No Action Alternative; however, the potential impacts from aircraft testing activities would be the same as for Training activities, albeit at a lesser degree.

California least terns could be exposed to intermittent aircraft overflights and strike potential in nearshore areas where testing activities occur. If present in the open water areas where testing activities involving aircraft occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be briefly exposed to strike potential. However, the data that Navy has collected on bird strikes reports that no ESA-listed species have been struck in the past, so it is not likely they would be struck by aircraft or aerial targets during testing activities.

Aircraft used during testing activities under the No Action Alternative may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from aircraft used during testing activities under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.1.2 Alternative 1

Training Activities

Under Alternative 1, the number of training activities involving aircraft in the Study Area would increase by 1,438 activities as compared to the No Action Alternative, for a total of 12,334 activities involving aircraft, potentially leading to an increase in aircraft and aerial disturbance and strikes in some portions of the Study Area, as described in Table 2.8-1, Description of Proposed Action and Alternatives. While bird strikes can occur anywhere aircraft are operated, Navy data indicate that they occur most often over land or close to shore. The potential for seabird strikes to occur in offshore areas is relatively low because Navy activities are widely dispersed and above 3,000 ft. (914.4 m) (for fixed-wing aircraft) where seabird densities are low. Because seabird exposure to aircraft disturbance and strikes would be relatively brief and infrequent, no major impacts on seabirds would result from aircraft strikes. Furthermore, protective measures, such as avoiding large flocks of birds to minimize the safety risk involved with a potential bird strike, minimize impacts on seabirds (Chapter 5, Mitigation).

California least terns could be exposed to intermittent aircraft overflights and strike potential in nearshore areas where training activities occur. If present in the open water areas where training activities involving aircraft occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be briefly exposed to strike potential. However, the data that Navy has collected on bird strikes reports that no ESA-listed species have been struck in the past, so it is not likely they would be struck by aircraft or aerial targets during training activities.

Aircraft used during training activities under Alternative 1 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from aircraft used during training activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Under Alternative 1, the number of testing activities involving aircraft in the Study Area would increase by 373 activities as compared to the No Action Alternative, for a total of 1,392 activities involving aircraft, potentially leading to an increase in aircraft and aerial disturbance and strikes in some portions of the Study Area, as described in Tables 2.8-2 through 2.8-5, Description of Proposed Action and Alternatives. As described for the No Action Alternative, because seabird exposure to aircraft disturbance and strikes would be relatively brief and infrequent, no major impacts on seabirds would result from aircraft strikes. Furthermore, protective measures, such as avoiding large flocks of birds to minimize the safety risk involved with a potential seabird strike, minimize impacts on seabirds (Chapter 5, Mitigation).

California least terns could be exposed to intermittent aircraft overflights and strike potential in nearshore areas where testing activities occur. If present in the open water areas where testing activities involving aircraft occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be briefly exposed to strike potential. However, the data that Navy has collected on bird strikes reports that no ESA-listed species have been struck in the past, so it is not likely they would be struck by aircraft or aerial targets during testing activities.

Aircraft used during testing activities under Alternative 1 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from aircraft used during testing activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.1.3 Alternative 2

Training Activities

Under Alternative 2, the number of training activities involving aircraft in the Study Area would increase by 1,438 activities as compared to the No Action Alternative, for a total of 12,334 activities involving aircraft, potentially leading to an increase in aircraft and aerial disturbance and strikes in some portions of the Study Area, as described in Table 2.8-1, Description of Proposed Action and Alternatives. as described for the No Action Alternative, because seabird exposure to aircraft disturbance and strikes would be relatively brief and infrequent, no major impacts on seabirds would result from aircraft strikes. Furthermore, protective measures, such as avoiding large flocks of birds to minimize the safety risk involved with a potential seabird strike, minimize impacts on seabirds (Chapter 5, Mitigation).

California least terns could be exposed to intermittent aircraft overflights and strike potential in nearshore areas where testing activities occur. If present in the open water areas where testing activities involving aircraft occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be briefly exposed to strike potential. However, the data that Navy has collected on bird strikes reports that no ESA-listed species have been struck in the past, so it is not likely they would be struck by aircraft or aerial targets during testing activities.

Aircraft used during training activities under Alternative 2 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from aircraft used during training activities under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Under Alternative 2, the number of testing activities involving aircraft in the Study Area would increase by 519 activities as compared to the No Action Alternative, for a total of 1,538 activities involving aircraft, potentially leading to an increase in aircraft and aerial disturbance and strikes in some portions of the Study Area, as described in Tables 2.8-2 through 2.8-5, Description of Proposed Action and Alternatives. However, as described for the No Action Alternative, because seabird exposure to aircraft disturbance and strikes would be relatively brief and infrequent, no major impacts on seabirds would result from aircraft strikes. Furthermore, protective measures, such as avoiding large flocks of birds to minimize the safety risk involved with a potential seabird strike, minimize impacts on seabirds (Chapter 5, Mitigation).

California least terns could be exposed to intermittent aircraft overflights and strike potential in nearshore areas where testing activities occur. If present in the open water areas where testing activities involving aircraft occur, Hawaiian petrel, short-tailed albatross, marbled murrelet or Newell's shearwater could be briefly exposed to strike potential. However, the data that Navy has collected on bird strikes reports that no ESA-listed species have been struck in the past, so it is not likely they would be struck by aircraft or aerial targets during testing activities.

Aircraft used during testing activities under Alternative 2 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from aircraft used during testing activities under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.2 Vessel and In-water Device Strikes

Several different types of vessels (ships, submarines, boats) and in-water devices (towed devices, unmanned underwater vehicles) are used during training and testing activities throughout the Study Area, as described in Chapter 2, Description of Proposed Action and Alternatives. Potential impacts of those activities on seabirds are applicable to everywhere in the Study Area that vessels and in-water devices are used. Training and testing activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines. The number of Navy ships and smaller vessels in the Study Area varies based on training schedules. Activities involving vessel movements occur intermittently, ranging from a few hours to a few weeks. Events involving large vessels are widely spread over the open ocean, while smaller vessels are more active and more concentrated in nearshore areas.

Vessel transit speed of various types of Navy vessels ranges from 10 to 20 kt). During training, speeds generally range from 10 to 14 kt; however, vessels can and will on occasion operate within the entire spectrum of their specific operational capabilities. It is necessary for vessels to operate at higher speeds during specific events, such as pursuing and overtaking hostile vessels, taking evasive maneuvers, and performing maintenance and performance checks, such as in ship trials. During these events, vessels may often operate at the high end of the vessel's speed capability.

In addition to vessels, mine warfare devices that are towed through the water and remotely operated vehicles used during mine neutralization training could also strike seabirds. No documented instances of seabirds being struck by towed devices have occurred in the Study Area. Additionally, based on the low altitudes and relatively slow air speeds, seabirds would be able to detect and avoid the aircraft and cables that connect the aircraft to the towed device.

Impacts would be the physiological and behavioral disturbance from a vessel. Birds respond to moving vessels in various ways. Some species, such as gulls and albatross, commonly follow vessels (Hamilton 1958; Hyrenback 2001, 2006), while other species, such as plovers and curlews, seem to avoid vessels (Borberg et al. 2005; Hyrenback 2006). There could be a slightly increased risk of impacts during the winter, or fall/spring migrations when migratory birds are concentrated in coastal areas. However, despite this concentration, most birds would still be able to avoid collision with a vessel. Vessel movements could elicit brief behavioral or physiological responses, such as alert response, startle response, or fleeing the immediate area. Such responses typically conclude as rapidly as they occur. However, the general health of individual seabirds would not be compromised.

The possibility of collision with an aircraft carrier or surface combatant vessels (or a vessel's rigging, cables, poles, or masts) could increase at night, especially during inclement weather. Birds can become disoriented at night in the presence of artificial light (Black 2005), and lighting on vessels may attract some birds (Hunter et al. 2006b), increasing the potential for harmful encounters. Lighting on boats and vessels have also contributed to bird fatalities in open-ocean environments when birds are attracted to these lights (Merkel and Johansen 2011). This could be a scenario that Navy vessels could face, especially during the migration season when migrating birds are using celestial clues during night time flight. Many seabird species are attracted to artificial lighting, particularly Procrocellariiformes. In particular, Newell's shearwater and Hawaiian petrel fledglings are particularly susceptible to light attraction, which can cause exhaustion and increase potential for collision with land-based structures (Reed et al. 1985). Other harmful seabird-vessel interactions are commonly associated with commercial fishing vessels because seabirds are attracted to concentrated food sources around these vessels (Dietrich and Melvin 2004; Melvin and Parrish 2001). However, birds following vessels would not be the case for Navy vessels.

Navy aircraft carriers, surface combatant vessels, and amphibious warfare ships are minimally lighted for tactical purposes. For vessels of this type there are two white lights that shine forward and one that shines behind the boat, these lights must be visible for at least 6 nm. There is one red light the shines port and a green one that shines starboard, and these must be visible for at least 3 nm. Solid white lighting appears more problematic for birds, especially nocturnal migrants (Gehring et al. 2009; Poot et al. 2008). Navy vessel lights are mostly solid, but sometimes may not appear solid because of the constant movement of the vessel (wave action), making vessel lighting potentially less problematic for birds in some situations.

In addition to vessels, towed devices and unmanned vehicles are also used; however, no documented instances of birds being struck by in-water devices exist. It would be anticipated that most seabird species would move away from an unmanned vehicle or a towed device.

The other type of vessel movements in the Study Area with the potential to strike a seabird are those used during amphibious landings. These amphibious warfare vessels have the potential to impact shorebirds and seabirds by disturbing or striking individual animals as well as trampling nest sites. Amphibious vessel movements could elicit short-term behavioral or physiological responses such as alert response, startle response, cessation of feeding, fleeing the immediate area, nest abandonment, and a temporary increase in heart rate. Amphibious vessels have the potential to disturb nesting or foraging shorebirds such as the ESA-listed California least tern. However, the general health of individual seabirds would not be compromised, unless a direct strike occurred. However, it is highly unlikely that a seabird would be struck in this scenario because most foraging shorebirds in the vicinity of the approaching amphibious vessel would likely be dispersed by the sound of the approaching vessel before it could come close enough to strike a seabird.

3.6.3.3.2.1 No Action Alternative, Alternative 1 and Alternative 2

<u>Training Activities</u>

As indicated in 3.6.3.3.2, the majority of training activities utilize some type of vessel ranging from ships to submarines. Training involving vessel movements occurs intermittently and ranges in duration from a few hours up to a few weeks. These activities are widely dispersed throughout the Study Area. Training activities involving vessels occur throughout the Study Area, but would be concentrated in the SOCAL Range Complex portion of the Study Area, followed in descending order of numbers of activities by SSTC, HRC, and the Transit Corridor. Ship movements on the ocean surface have the potential to affect seabirds by disturbing or striking individual animals. The probability of ship and seabird interactions occurring in the Study Area depends on several factors, including the presence and density of seabirds;

numbers, types, and speeds of vessels; duration and spatial extent of activities; and protective measures implemented by the Navy. The number of Navy ships operating in the Study Area varies based on training schedules and can range up to 10 ships at any given time.

Vessel movements could result in short-term behavioral responses and low potential for injury/mortality from collisions, though based on the lower density of Navy vessels in pelagic waters, the generally intermittent and short duration of activities, and the high mobility of seabirds, the probability of seabird/vessel interaction is low. There would be a higher likelihood of vessel strikes over the higher productivity portions of the Study Area because of the concentration of seabirds is expected to be higher in those areas. However, even in areas of concentrated vessel use or seabird density, the probability of seabird/vessel interaction is low because of the high mobility of seabirds. Navy protective measures, which include avoidance of seabird colonies and habitats where seabirds may concentrate, would further reduce the probability of seabird/vessel collisions. The combination of these procedures, the relatively lower vessel density in pelagic waters in the Study Area, and the ability of seabirds to detect and avoid vessels reduce the probability that vessel strikes would impact seabird populations under the No Action Alternative.

Birds would not be exposed to unmanned underwater vehicles or remotely operated vehicles because they are typically used on or near the seafloor. The other in-water devices used are typically towed by a helicopter. As discussed for electromagnetic devices, it is likely that any seabirds in the vicinity of the approaching helicopter would be dispersed by the sound of the helicopter (see Section 3.6.3.1.3 [Aircraft Noise]) and move away from the in-water device before any exposure could occur.

Amphibious landings are the primary activity that could potentially impact ESA-listed seabird species, specifically California least tern. California least terns use the beaches of SSTC as a resting area and are typically found foraging in the waters near the beach. While they could be present, it is highly unlikely that a California least tern would be struck in this scenario because most foraging or resting seabirds in the vicinity of the approaching amphibious vessel would likely be dispersed by the sound of the approaching vessel before it could come close enough to strike a seabird. Therefore, amphibious assault activities would not cause any potential risk to California least tern in the Study Area. Furthermore, Naval Base Coronado has a specific Integrated Natural Resource Management Plan for addressing ESA-listed seabird species and those plans already include project avoidance and minimization actions that reduce threats from military activities to terns to a minimal level.

Vessel disturbance and strikes during training activities under the No Action Alternative, Alternative 1, or Alternative 2 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from vessel disturbance and strikes during training activities under the No Action Alternative, Alternative 1 or Alternative 2 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

As indicated in 3.6.3.3.2, the majority of testing activities utilize some type of vessel ranging from ships to submarines. Testing activities involving vessels occur throughout the Study Area, but would be concentrated in the SOCAL Range Complex portion of the Study Area, followed in descending order of numbers of activities by HRC, SSTC, and the Transit Corridor. All of the Naval Sea Systems Command testing activities utilize some type of vessel ranging from ships to submarines.

The potential for interaction is greater in coastal areas than pelagic areas where Navy vessel use is less concentrated. However, even in areas of concentrated vessel use, the probability of seabird/vessel interaction is low because of the high mobility of seabirds and intermittent and temporary vessel use. Certain portions of the Study Area, such as areas near ports, naval installations, or testing locations are used more heavily by vessels than other portions of the Study Area. Ship movements on the ocean surface have the potential to affect seabirds by disturbing or striking individual seabirds. The probability of ship and seabird interactions occurring in the Study Area depends on several factors, including the presence and density of seabirds; numbers, types, and speeds of vessels; duration and spatial extent of activities; and protective measures implemented by the Navy. The number of Navy ships operating in the Study Area varies based on the testing activity and can range up to 10 vessels at any given time.

The potential for interaction is greater in coastal areas than pelagic areas where Navy vessel use is less concentrated. However, even in areas of concentrated vessel use, the probability of seabird/vessel interaction is low because of the high mobility of seabirds that they could move away from an oncoming vessel. Flushing of seabirds is expected to be greatest with fast-moving, agile vessels. Impacts from Navy vessels would be limited to short-term behavioral responses and are not expected to have long-term effects. While such flushing or other effects of vessels on individual seabirds may occur, none of these temporary effects are expected to have an adverse effect on seabirds at the population level.

The relatively lower vessel density in pelagic waters in the Study Area, and the ability of seabirds to detect and avoid vessels reduce the probability that vessel strikes would impact seabird populations under the No Action Alternative. The impacts of vessel movements would be short-term, temporary, and localized disturbances of individual seabirds in the vicinity. No increased risk of impact to seabirds would result from physical disturbance and strikes with Navy vessels. If in the immediate area where vessels or in-water devices are operating, ESA-species could be disturbed, but this would not result in adverse impacts (impacts would be limited to short-term behavioral responses and are not expected to have long-term effects). No long-term or population-level impacts are expected.

Vessel disturbance and strikes during testing activities under the No Action Alternative, Alternative 1, or Alternative 2 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from vessel disturbance and strikes during testing activities under the No Action Alternative, Alternative 1, or Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.3 Military Expendable Materials

Many different types of military expended materials are left at sea during training and testing activities throughout the Study Area, as described in Chapter 2, Description of Proposed Action and Alternatives. During these training and testing events, various items may be introduced and expended into the marine environment and are referred to as military expended materials. Chapter 2 includes quantities of military expended materials used during training and testing activities in the Study Area.

Expended materials do have the potential to strike seabirds as they travel through the air. Statistical modeling to estimate the probability of seabird and military expended material strikes is not practical. The widely dispersed area in which bombs and missiles would be expended in the Study Area annually (see Chapter 2, Description of Proposed Action and Alternatives), coupled with the often patchy distribution of seabirds (Schneider and Duffy 1985, Haney 1986, Fauchald et al. 2002), suggest that the probability of these types of ordnance striking a seabird would be low. The number of small-caliber projectiles that would be expended annually during gunnery exercises is much higher than the number of large-caliber projectiles. However, the total number of rounds expended is not a good indicator of strike probability during gunnery exercises because multiple rounds are fired at individual targets.

Human activity such as vessel movement, aircraft overflights, and target setting, could cause seabirds to flee a target area before the onset of firing, thus avoiding harm. If seabirds were in the target area, they would likely flee the area prior to the release of military expended materials or just after the initial rounds strike the target area (assuming seabirds were not struck by the initial rounds). Additionally, the force of military expended material fragments dissipates quickly once the pieces hit the water, so direct strikes on seabirds foraging below the surface would not be likely. Also, munitions would not be used in shallow/nearshore areas. Individual seabirds may be impacted, but ordnance strikes would likely have no impact on seabird populations.

The potential for seabirds to experience strikes would remain quite low based on the large area over which ordnance is used, the relatively small size of the seabirds, and the ability of seabirds to readily flee. Individual seabirds may be impacted, but ordnance strikes would likely have no impact on seabird populations.

3.6.3.3.3.1 No Action Alternative

Training Activities

Current military training in the Study Area includes firing a variety of weapons employing a variety of non-explosive training rounds and explosive rounds including bombs, missiles, naval gunshells, cannon shells, and small-, medium-, and large-caliber projectiles, as well as sonobuoys released from aircraft. The majority of material expended in the Study Area consists of non-explosive training rounds (Table 3.0-63). While gunnery exercises are a common training activity, few Sinking Exercises per year are proposed under the No Action Alternative. During a sinking exercise, aircraft, ship, and submarine crews deliver ordnance on a seaborne target, usually a clean deactivated ship, which is deliberately sunk using multiple weapon systems. Sinking exercises occur in open-ocean areas and expend target fragments that could have the potential to strike seabirds. The potential impact of military expended material to seabirds in the Study Area is dependent on the ability of seabirds to detect and avoid foreign objects through their visual and auditory sensory systems and the relatively-fast flying speeds and good maneuverability of most seabird species.

The small number of bombs that would be expended in the Study Area annually, coupled with the often patchy distribution of seabirds suggest that the probability of this type of strike for a seabird would be extremely low. The number of small-caliber projectiles that would be expended annually during gunnery exercises is much higher. However, the total number of rounds expended is not a good indicator of strike probability during gunnery exercises because multiple rounds are fired at individual targets. Given the implementation of protective measures, and the lower density of seabirds away from nesting or roosting areas, non-explosive ordnance or sonobouys dropped from aircraft, under the No Action Alternative would have limited potential to affect seabirds.

Direct strikes from firing weapons or air-launched devices (e.g. sonobouys, torpedoes) are a potential stressor to seabirds. Seabirds in flight, resting on the water's surface, or foraging just below the water surface would be vulnerable to an direct strike. Strikes have the potential to injure or kill seabirds in the Study Area. However, there would not be long-term population level impacts. The vast area over which training activities occur combined with the ability of seabirds to flee disturbance, would make direct strikes unlikely. Individual seabirds may be affected, but strikes would have no impact on species or populations.

If in the immediate area where military expended materials are present, ESA-listed species could be impacted by military expended material strikes. It is highly unlikely that a seabird would be struck by military expended material because most seabirds in the vicinity of the approaching aircraft or vessel, from which the military expended material is released, would likely be dispersed by the sound of the approaching aircraft or vessel before it could come close enough to strike a seabird. Therefore, activities that release military expended materials would not cause any potential strike risk to ESA-listed seabirds in the Study Area.

Military expended material strikes from training activities under the No Action Alternative may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from military expended material strikes from training activities under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

Testing Activities

Under the No Action Alternative, testing activities would result in military expended material left in the Study Area, as described in Table 2.8-2, Description of Proposed Action and Alternatives. The potential impact of military expended material to seabirds in the Study Area is dependent on the ability of seabirds to detect and avoid foreign objects through their visual and auditory sensory systems and the relatively-fast flying speeds and good maneuverability of most seabird species.

Direct strikes from firing weapons and air-launched devices (e.g. sonobouys, torpedoes) are a potential stressor to seabirds. Seabirds in flight, resting on the water’s surface, or foraging just below the water surface would be vulnerable to an direct strike. Strikes have the potential to injure or kill seabirds in the Study Area. However, there would not be long-term population level impacts. The vast area over which testing activities occur combined with the ability of seabirds to flee disturbance, would make direct strikes unlikely. Individual seabirds may be affected, but strikes would have no impact on species or populations.

If in the immediate area where military expended materials are present, ESA-listed species could be impacted by military expended material strikes. It is highly unlikely that a seabird would be struck by military expended material because most seabirds in the vicinity of the approaching aircraft or vessel, from which the military expended material is released, would likely be dispersed by the sound of the approaching aircraft or vessel before it could come close enough to strike a seabird. Therefore, activities that release military expended materials would not cause any potential strike risk to ESA-listed seabirds in the Study Area.

Military expended material strikes from testing activities under the No Action Alternative may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from military expended material strikes from testing activities under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.3.2 Alternative 1

Training Activities

The total number of military expended materials throughout the Study Area would increase under Alternative 1. Under Alternative 1, the number of bombs increase by 350 high explosive bombs and 400 nonexplosive bombs as compared to the No Action Alternative, for a total of 884 high explosive bombs and 1,265 nonexplosive bombs. The number of small-caliber projectiles fired would increase by 2,201,400 as compared to the No Action Alternative, for a total of 2,409,000 small-caliber rounds. The number of medium-caliber rounds would increase by 6,900 as compared to the No Action Alternative for a total of 562,000 medium-caliber rounds. The number of nonexplosive large-caliber rounds would decrease by 2,078 as compared to the No Action Alternative, for a total of 25,280 nonexplosive large-caliber projectiles expended during training events and activities. The number of missiles utilized during training activities would increase by 184 as compared to the No Action Alternative for a total of 680 nonexplosive missiles expended. The number of sonobouys dropped would increase by 9,111 over the No Action Alternative, for a total of 51,391.

While the number of military expended materials increases under Alternative 1 as compared to the No Action Alternative, the potential for direct strikes remains low. The vast area over which training activities occur combined with the ability of seabirds to flee disturbance, would make direct strikes unlikely. Individual seabirds may be affected, but strikes would not be responsible for long-term population level impacts.

If in the immediate area where military expended materials are present, ESA-listed species could be impacted by military expended material strikes. It is highly unlikely that a seabird would be struck by military expended material because most seabirds in the vicinity of the approaching aircraft or vessel, from which the military expended material is released, would likely be dispersed by the sound of the approaching aircraft or vessel before it could come close enough to strike a seabird. Therefore, activities that release military expended materials would not cause any potential strike risk to ESA-listed seabirds in the Study Area.

Military expended material strikes from training activities under Alternative 1 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from military expended material strikes from training activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

The total number of military expended materials throughout the Study Area would increase under Alternative 1. Alternative 1 also introduces the use of 9,000 small-caliber projectiles. Under Alternative 1, the number of nonexplosive medium-caliber rounds would increase by 80,404 as compared to the No Action Alternative for a total of 87,404 medium-caliber rounds. Alternative 1 would also increase the use of high explosive medium-caliber projectiles by 12,500 as compared to the No Action Alternative, for a total of 15,000 high explosive medium-caliber projectiles. The number of nonexplosive large-caliber rounds would decrease by 5,792 as compared to the No Action Alternative, for a total of 8,343 nonexplosive large-caliber projectiles expended during testing events and activities. Alternative 1 would also introduce the usage of 1,469 high explosive projectiles. The number of high explosive missiles utilized during testing activities would increase by 60 as compared to the No Action Alternative for a total of 70 high explosive missiles expended. The number of sonobouys dropped would increase by

4,940 over the No Action Alternative, for a total of 12,079. Alternative 1 would also introduce the usage of 152 nonexplosive missiles. Alternative 1 would introduce the use of 270 high explosive rockets. The number of nonexplosive rockets utilized during testing activities would increase by 695 as compared to the No Action Alternative, for a total of 710 nonexplosive rockets.

These increases would result in increased strike potential from ordnance, however, the vast area over which testing activities occur, combined with the ability of seabirds to flee disturbance, would make direct strikes unlikely. Individual seabirds may be affected, but ordnance strikes would have no impact on species or community populations.

If in the immediate area where military expended materials are present, ESA-listed species could be impacted by military expended material strikes. It is highly unlikely that a seabird would be struck by military expended material because most seabirds in the vicinity of the approaching aircraft or vessel, from which the military expended material is released, would likely be dispersed by the sound of the approaching aircraft or vessel before it could come close enough to strike a seabird. Therefore, activities that release military expended materials would not cause any potential strike risk to ESA-listed seabirds in the Study Area.

Military expended material strikes from testing activities under Alternative1 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from military expended material strikes from testing activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.3.3 Alternative 2

Training Activities

The total number of military expended materials throughout the Study Area would increase under Alternative 2. Under Alternative 2, the number of bombs increase by 350 high explosive bombs and 400 nonexplosive bombs as compared to the No Action Alternative, for a total of 884 high explosive bombs and 1,265 nonexplosive bombs. The number of small-caliber projectiles fired would increase by 2,201,400 as compared to the No Action Alternative, for a total of 2,409,000 small-caliber rounds fired. The number of medium-caliber rounds (all nonexplosive practice munitions) would increase by 6,900 as compared to the No Action Alternative for a total of 562,000 medium-caliber rounds. The number of nonexplosive large-caliber rounds would decrease by 2,078 as compared to the No Action Alternative, for a total of 25,280 nonexplosive large-caliber projectiles expended during training events and activities. The number of missiles utilized during training activities would increase by 184 as compared to the No Action Alternative for a total of 680 nonexplosive missiles expended. The number of sonobouys dropped would increase by 9,111 over the No Action Alternative, for a total of 51,391. Alternative 2 would introduce the use of 4,180 high explosive rockets.

These increases would result in increased strike potential from ordnance, however, the vast area over which testing activities occur, combined with the ability of seabirds to flee disturbance, would make direct strikes unlikely. Individual seabirds may be affected, but ordnance strikes would have no impact on species or community populations.

If in the immediate area where military expended materials are present, ESA-listed species could be impacted by military expended material strikes. It is highly unlikely that a seabird would be struck by military expended material because most seabirds in the vicinity of the approaching aircraft or vessel, from which the military expended material is released, would likely be dispersed by the sound of the approaching aircraft or vessel before it could come close enough to strike a seabird. Therefore, activities that release military expended materials would not cause any potential strike risk to ESA-listed seabirds in the Study Area.

Military expended material strikes from training activities under Alternative 2 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from military expended material strikes from training activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

Testing Activities

The total number of military expended materials throughout the Study Area would increase under Alternative 2. Alternative 2 would introduce the use of 9,800 small-caliber projectiles. The number of nonexplosive medium-caliber rounds would increase by 80,404 as compared to the No Action Alternative for a total of 87,404 medium-caliber rounds. Alternative 2 would also increase the use of high explosive medium-caliber projectiles by 12,500 as compared to the No Action Alternative, for a total of 15,000 high explosive medium-caliber projectiles. The number of nonexplosive large-caliber rounds would decrease by 5,792 as compared to the No Action Alternative, for a total of 8,343 nonexplosive large-caliber projectiles expended during testing events and activities. The number of high explosive missiles utilized during testing activities would increase by 60 as compared to the No Action Alternative for a total of 70 high explosive missiles expended. The number of sonobouys dropped would increase by 6,100 over the No Action Alternative, for a total of 13,239. Alternative 2 would also introduce the usage of 152 nonexplosive missiles. Alternative 2 would introduce the use of 270 high explosive rockets and increase the number of nonexplosive rockets utilized during testing activities by 695 as compared to the No Action Alternative, for a total of 710 nonexplosive rockets.

There is the potential for individual seabirds to be injured or killed by direct strikes. However, there would not be long-term population level impacts. The vast area over which testing activities occur and implementation of Navy resource protection measures, combined with the small size and ability of seabirds to flee disturbance, would make direct strikes unlikely. Individual seabirds may be affected, but ordnance strikes would have no impact on species or community populations.

If in the immediate area where military expended materials are present, ESA-listed species could be impacted by military expended material strikes. It is highly unlikely that a seabird would be struck by military expended material because most seabirds in the vicinity of the approaching aircraft or vessel, from which the military expended material is released, would likely be dispersed by the sound of the approaching aircraft or vessel before it could come close enough to strike a seabird. Therefore, activities that release military expended materials would not cause any potential strike risk to ESA-listed seabirds in the Study Area.

Military expended material strikes from testing activities under Alternative 2 may affect, but are not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from military expended material strikes from testing activities under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.3.4 Summary of Impacts of Physical Stressors

Three physical disturbance or strike sub-stressors were identified and analyzed that have potential to affect seabirds: aircraft or aerial target strikes, vessel and in-water device strikes, and military expended materials. While bird strikes can occur anywhere aircraft are operated, Navy data indicate that they occur most often over land or close to shore. The potential for seabird strikes to occur in offshore areas is relatively low because (1) activities are widely dispersed, (2) seabird densities are low, (3) the seabirds are small and have the ability to flee disturbance, and (4) Navy protective measures include avoidance of seabird colonies and habitats where seabirds may concentrate.

Vessel movements could result in short-term behavioral responses and potential for injury/mortality from collisions. However, the probability of seabird/vessel collisions is extremely low based on (1) the low Navy vessel density, (2) the patchy distribution of seabirds throughout the Study Area, and (3) the implementation of Navy protective measures, which include avoidance of seabird colonies and habitats where seabirds may concentrate further reducing the probability of seabird/vessel collisions.

There is the potential for individual seabirds to be injured or killed by ordnance. However, there would not be long-term population level impacts. Individual seabirds may be affected, but ordnance strikes would have no impact on species or populations due to (1) the vast area over which training and testing activities occur, (2) implementation of Navy resource protection measures as described in Chapter 5, and (3) the small size of seabirds and their ability to flee disturbance.

3.6.3.4 Ingestion Stressors

This section analyzes the potential impacts of the various types of expended materials used by the Navy during training and testing activities within the Study Area. Birds could potentially ingest expended materials used by the Navy during training and testing activities within the Study Area. The Navy expends the following types of materials that could become ingestion stressors for seabirds during training and testing in the Study Area: chaff and flare endcaps/pistons. Ingestion of expended materials by seabirds could occur in all large marine ecosystems and open ocean areas and would occur either at the surface or just below the surface portion of the water column, depending on the size and buoyancy of the expended object and the feeding behavior of the seabirds. Floating material of ingestible size could be eaten by seabirds that feed at or near the water surface, while materials that sink pose a potential risk to diving seabirds that feed just below the water's surface. Some items, such as parachutes or sonobuoys are too large to be ingested and will not be discussed further. Also, parachutes sink rapidly to the seafloor.

Foraging depths of most diving seabirds are generally restricted to shallow depths, so it is highly unlikely that benthic, nearshore, or intertidal foraging would occur in areas of munitions use, and these seabirds would not encounter any type of munitions or fragments from munitions in nearshore or intertidal areas. Ingestion of military expended material from munitions is not expected to occur because the solid metal and heavy plastic objects from these ordnances sink rapidly to the seafloor, beyond the foraging depth range of most seabirds. Therefore, no impact of ingestion of military expended material from munitions would result for seabirds. As a result, the analysis in this section includes the potential ingestion of military expended materials other than munitions, all of which are expended away from nearshore habitats and close to the water surface.

A variety of ingestible materials may be released into the marine environment by Navy training and testing activities. Birds of all sizes and species are known to ingest a wide variety of items, which they might mistake for prey. For example, 21 of 38 seabird species (55 percent) collected off the coast of North Carolina from 1975 to 1989 contained plastic particles (Moser and Lee 1992). The mean particle sizes of ingested plastic were positively correlated with the birds' size though the mean mass of plastic found in the stomachs and gizzards of 21 species was below 3 grams (g) (0.11 ounce [oz.]).

Plastic is often mistaken for prey and the incidence of plastic ingestion appears to be related to a species' feeding mode and diet. Seabirds that feed by pursuit-diving, surface-seizing, and dipping tend to ingest plastic, while those that feed by plunging or piracy typically do not ingest plastic. Birds of the family Procellariidae, which include petrels and shearwaters, tend to accumulate more plastic than do other species. Some seabirds, including gulls and terns, regularly regurgitate indigestible parts of their food items such as shell and fish bones. However, most procellariiforms have small gizzards and an anatomical constriction between the gizzard and stomach that make it difficult to regurgitate solid material such as plastic (Azzarello and Van Vleet 1987; Pierce et al. 2004). Two species of albatross (Diomedeidae) have also been reported to ingest plastic while feeding at sea. While such studies have not conclusively shown that plastic ingestion is a significant source of direct mortality, it may be a contributing factor to other causes of albatross mortality (Naughton et al. 2007).

Moser and Lee (1992) found no evidence that seabird health was affected by the presence of plastic, but other studies have documented adverse consequences of plastic ingestion. As summarized by Pierce et al. (2004) and Azzarello and Van Vleet (1987), documented consequences of plastic ingestion by seabirds include blockage of the intestines and ulceration of the stomach, reduction in the functional volume of the gizzard leading to a reduction of digestive capability, and distention of the gizzard leading to a reduction in hunger. Studies have found negative correlations between body weight and plastic load, as well as body fat, a measure of energy reserves, and the number of pieces of plastic in a seabird's stomach (Auman et al. 1997; Ryan 1987; Sievert and Sileo 1993). Other possible concerns that have been identified include toxic plastic additives and toxic contaminants that could be adsorbed to the plastic from ambient seawater. Pierce et al. (2004) described a case where plastic ingestion caused seabird mortality from starvation of a member of family Procellariidae. Dissection of an adult greater shearwater gizzard revealed that a 1.5 in. (3.81 centimeters [cm]) by 0.5 in. (1.27 cm) fragment of plastic blocked the pylorus, obstructed the passage of food, and resulted in death from starvation.

Species such as storm-petrels, albatrosses, and shearwaters that forage by picking prey from the surface may have a greater potential to ingest any floating plastic debris. Although ingestion of plastic military expended material by any species from the taxonomic groups found within the Study Area (Table 3.6-2) has the potential to impact individual seabirds.

The distribution of floating expended items would be irregular in both space and time, as training activities do not occur in the same place each time. The random distribution of items across the large Study Area yields very low probabilities that seabirds will encounter a floating item. However, when a seabird does encounter a floating item of ingestible size, an ingestion risk may exist. Although most military expended materials components are expected to sink to the sea floor and spend limited periods within the water column, some items remain buoyant for an extended period. Expended training material, such as missile and target components that float, may be encountered by seabirds in the waters of the Study Area, increasing the potential for ingestion of smaller components.

3.6.3.4.1.1 Chaff

Based on the dispersion characteristics of chaff, large areas of air space and open water within the Study Area would be exposed to chaff, but the chaff concentrations would be very low. A general discussion of chaff as an ingestion stressor is presented in Section 3.0.4.6.5. It is unlikely that chaff would be selectively ingested (U. S. Department of the Air Force 1997). Ingestion of chaff fibers is not expected to cause physical damage to a bird's digestive tract based on the small size (ranging in lengths of 0.25 to 3 in. [0.6 4 to 7.6 cm] with a diameter of about 40 micrometers [µm] [0.001574 in.]) and flexible nature of the fibers and the small quantity that could reasonably be ingested. In addition, concentrations of chaff fibers that could reasonably be ingested are not expected to be toxic to seabirds. Scheuhammer (Scheuhammer 1987) reviewed the metabolism and toxicology of aluminum in birds and mammals and found that intestinal adsorption of orally ingested aluminum salts was very poor, and the small amount adsorbed was almost completely removed from the body by excretion. Dietary aluminum normally has small effects on healthy birds and mammals, and often high concentrations (greater than 0.016 oz./lb. [~1,000 mg/kg]) are needed to induce detrimental effects (Nybo 1996). It is highly unlikely that a seabird would ingest a toxic dose of chaff based on the anticipated environmental concentration of chaff for a worst-case scenario of 360 chaff cartridges simultaneously released at a single drop point (1.8 fibers/ft.^{2} [0.2 fibers/m^2]).

3.6.3.4.1.2 Flares

Ingestion of flare end caps 1.3 in. (3.3 cm) in diameter and 0.13 in. (0.33 cm) thick (U. S. Department of the Air Force 1997) by birds may result in gastrointestinal obstruction or reproductive complications. If a seabird were to ingest a plastic end cap or piston, the response would vary based on the species and individual seabird. The responses could range from none, to sublethal (reduced energy reserves), to lethal (digestive tract blockage leading to starvation). Ingestion of end caps and pistons by species that regularly regurgitate indigestible items would likely have no adverse impacts. However, end caps and pistons are similar in size to those plastic pieces described above that caused digestive tract blockages and eventual starvation. Therefore, ingestion of plastic end caps and pistons could be lethal to some individuals of some species of seabirds. Species with small gizzards and anatomical constrictions that make it difficult to regurgitate solid material would likely be most susceptible to blockage (such as Procellariiformes). Based on available information, it is not possible to accurately estimate actual ingestion rates or responses of individual seabirds.

3.6.3.4.2 No Action Alternative

3.6.3.4.2.1 Training Activities

Current Navy training activities in the Study Area include firing a variety of weapons. As listed in Chapter 2, these weapons employ a variety of nonexplosive and explosive training rounds, including bombs, missiles, naval gunshells, cannon shells, chaff or flares and small-caliber ammunition. These materials are used in the open ocean away from shore. These activities account for the majority of naval shells and rounds used in the Study Area. Expended materials resulting from ordnance use include remnants and shrapnel from explosive rounds and nonexplosive training rounds. These solid materials, many of which have a high metal content, quickly drop through the water column to the sea floor. Ingestion of expended ordnance does not occur in the water column because ordnance-related materials quickly sink.

Ordnance related materials would sink in relatively deep waters, would not present an ingestion risk to seabirds, and therefore, would likely have a negligible impact. However, seabirds could be exposed to some materials such as chaff fibers used during air combat maneuver, electronic warfare operations, or chaff exercises (Tables 2.8-1 through 2.8-5) in the air or at the sea surface through direct contact or inhalation. Seabirds could also ingest some types of expended materials if the materials float on the sea surface.

Other expended materials that could be ingested by seabirds include small plastic end caps and pistons associated with chaff and self-protection flares. The chaff end cap and piston are both round and are 1.3 in. (3.3 cm) in diameter and 0.13 in. (0.33 cm) thick (U.S. Department of the Navy 2011). This plastic expended material sinks in saltwater, which reduces the likelihood of ingestion.

Birds would have the potential to ingest military expended material. However, the concentration of military expended material in the Study Area is low and seabirds are patchily distributed (Schneider and Duffy 1985, Haney 1986, Fauchald et al. 2002). As discussed in Chapter 2, the highest density of chaff and flare end caps/pistons would be expended in the SOCAL Range Complex portion of the Study Area. Assuming that all end caps and pistons expended in the SOCAL Range Complex potion of the Study Area would be evenly distributed, the relative end-cap and piston concentration would be very low (0.24 pieces/nm^2/year, based on an area of 120,000 nm^2 and 29,065 end caps/pistons per year). The overall likelihood that seabirds would be impacted by ingestion of military expended material in the Study Area under the No Action Alternative is negligible.

Ingestion of military expended materials from training activities under the No Action Alternative may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from ingestion of military expended materials from training activities under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.4.2.2 Testing Activities

Current Navy testing activities in the Study Area include firing a variety of weapons. As listed in Chapter 2, these weapons employ a variety of nonexplosive and explosive rounds, including missiles, naval gunshells, cannon shells, and small-caliber ammunition. These materials are used in the open ocean away from shore. These activities account for the majority of naval shells and rounds used in the Study Area. Expended materials resulting from ordnance use include remnants and shrapnel from explosive rounds and nonexplosive rounds. These solid materials, many of which have a high metal content, quickly drop through the water column to the sea floor. Ingestion of expended ordnance does not occur in the water column because ordnance-related materials quickly sink. Under the No Action Alternative, ordnance related materials would sink in relatively deep waters, would not present a low ingestion risk to seabirds. However, seabirds could ingest some types of expended materials if the materials float on the sea surface. No flares (plastic end caps or pistons) or chaff is utilized under the No Action Alternative, therefore the ingestion risk of expended materials from testing activities is very low.

Ingestion of military expended materials from testing activities under the No Action Alternative may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from ingestion of military expended materials from testing activities under the No Action Alternative would not result in a significant adverse effect on migratory bird populations.

3.6.3.4.3 Alternative 1

3.6.3.4.3.1 Training Activities

Under Alternative 1, an overall increase of military expended material would be expended in the Study Area from the No Action Alternative, as described in Table 3.0-63 though 3.0-65, Description of Proposed Action and Alternatives. However, of the expended materials that could be ingested (chaff canisters, flares, and plastic end caps), there is no net increase from the No Action Alternative, therefore the ingestion risk is the same as for the No Action Alternative. As discussed in Chapter 2 and Section 3.6.3.4.2 (No Action Alternative), the highest density of chaff and flare end caps/pistons would be expended in the SOCAL Range Complex portion of the Study Area. The concentration of military expended material in the Study Area is low and seabirds are patchily distributed. The overall likelihood that seabirds would be impacted by ingestion of military expended material in the Study Area under Alternative 1 is negligible. If foraging in an area where military expended material are present seabirds could potentially be impacted by ingestion of military expended material, but this would not result in impacts on populations of these ESA-listed species.

Ingestion of military expended materials from training activities under Alternative 1 may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from ingestion of military expended materials from training activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.4.3.2 Testing Activities

Under Alternative 1, up to 221,794 additional military expended materials from testing activities would be expended in the Study Area from the No Action Alternative (24,372), as described in Table 3.0-65, Description of Proposed Action and Alternatives. However, of the expended materials that could be ingested (chaff canisters, flares, and plastic end caps), there is an increase of 604 from the No Action Alternative (where none were used). The chaff end cap and piston are both round and are 1.3 in. (3.3 cm) in diameter and 0.13 in. (0.33 cm) thick (U.S. Department of the Navy 2011). This plastic expended material sinks in saltwater, which reduces the likelihood of ingestion.

Birds would have the potential to ingest military expended material. However, the concentration of military expended material in the Study Area is low and seabirds are patchily distributed. The overall likelihood that seabirds would be impacted by ingestion of military expended material in the Study Area under Alternative 1 is low. Assuming that all end caps and pistons expended throughout the entire Study Area would be evenly distributed, the relative end-cap and piston concentration would be extremely low (0.002 pieces/nm^2/year, based on an area of 355,000 nm^2 and 604 end caps/pistons per year). The concentration of military expended material in the Study Area is low and seabirds are patchily distributed. The overall likelihood that seabirds would be impacted by ingestion of military expended material in the Study Area under Alternative 1 is negligible. If foraging in an area where military expended material are present seabirds could potentially be impacted by ingestion of military expended material, but this would not result in impacts on populations of these ESA-listed species.

Ingestion of military expended materials from testing activities under Alternative 1 may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from ingestion of military expended materials from testing activities under Alternative 1 would not result in a significant adverse effect on migratory bird populations.

3.6.3.4.4 Alternative 2

3.6.3.4.4.1 Training Activities

Under Alternative 2, an overall increase of military expended material would be expended in the Study Area from the No Action Alternative, as described in Table 3.0-65, Description of Proposed Action and Alternatives. However, of the expended materials that could be ingested (chaff canisters, flares, and plastic end caps), there is no net increase from the No Action Alternative, therefore the ingestion risk is the same as for the No Action Alternative. The concentration of military expended material in the Study Area is low and seabirds are patchily distributed. Therefore, the overall likelihood that seabirds would be impacted by ingestion of military expended material in the Study Area under Alternative 2 is negligible. If foraging in an area where military expended material are present seabirds could potentially be impacted by ingestion of military expended material, but this would not result in impacts on populations of these ESA-listed species.

Ingestion of military expended materials from training activities under Alternative 2 may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from ingestion of military expended materials from training activities under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.4.4.2 Testing Activities

Under Alternative 2, up to 236,348 additional military expended material from testing activities would be expended in the Study Area from the No Action Alternative (24,372), as described in Table 3.0-65, Description of Proposed Action and Alternatives. However, of the expended materials that could be ingested (chaff canisters, flares, and plastic end caps), there is an increase of 604 from the No Action Alternative (where none were used). The chaff end cap and piston are both round and are 1.3 in. (3.3 cm) in diameter and 0.13 in. (0.33 cm) thick (U.S. Department of the Navy 2011). This plastic expended material sinks in saltwater, which reduces the likelihood of ingestion.

Birds would have the potential to ingest military expended material. However, the concentration of military expended material in the Study Area is low and seabirds are patchily distributed. The overall likelihood that seabirds would be impacted by ingestion of military expended material in the Study Area under Alternative 1 is low. Assuming that all end caps and pistons expended throughout the entire Study Area would be evenly distributed, the relative end-cap and piston concentration would be extremely low (0.002 pieces/nm^2/year, based on an area of 355,000 nm^2 and 668 end caps/pistons per year). The concentration of military expended material in the Study Area is low and seabirds are patchily distributed. Therefore, the overall likelihood that seabirds would be impacted by ingestion of military expended material in the Study Area under Alternative 2 is negligible. If foraging in an area where military expended material are present seabirds could potentially be impacted by ingestion of military expended material, but this would not result in impacts on populations of these ESA-listed species.

Ingestion of military expended materials from testing activities under Alternative 2 may affect, but is not likely to adversely affect, ESA-listed seabird species.

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the impacts from ingestion of military expended materials from testing activities under Alternative 2 would not result in a significant adverse effect on migratory bird populations.

3.6.3.4.5 Summary of Impacts of Ingestion Stressors

It is possible that persistent expended materials could be accidentally ingested by seabirds while they were foraging for natural prey items, though the probability of this event is low as (1) foraging depths of diving seabirds is generally restricted to the surface of the water or shallow depths, (2) the material is unlikely to be mistaken for prey, and (3) the material remains at or near the sea surface for a short length of time.

Based on available information, it is not possible to accurately estimate actual ingestion rates or responses of individual seabirds. Nonetheless, the number of end caps or pistons ingested by seabirds is expected to be very low and only an extremely small percentage of the total would be potentially available to seabirds due to their relatively low concentration throughout the Study Area. Anatomical characteristics of species within family Procellariidae may elevate the risk of plastic ingestion relative to other species or families; however, exposure to species of family Procellariidae would still remain low. Plastic ingestion under the No Action Alternative, Alternative 1, or Alternative 2 would not result in a significant adverse impact on seabird populations. Sublethal and lethal impacts, if they occur, would be limited to a few individual seabirds.

3.6.3.5 Secondary Stressors

The potential of water and air quality stressors associated with training and testing activities to indirectly affect seabirds was analyzed. The assessment of potential water and air quality stressors refers to previous sections in this EIS/OEIS (Section 3.1 Sediments and Water Quality and Section 3.2 Air Quality), and addresses specific activities in local environments that may affect seabird habitats. At-sea activities that may impact water and air include general emissions.

As noted in Section 3.1.3, Sediments and Water Quality, Environmental Consequences, implementation of the No Action Alternative, Alternative 1, or Alternative 2 would not adversely affect water or sediment quality. Any physical impacts on seabird habitats would be temporary and local because training activities would occur infrequently. Impacts from activities would not be expected to adversely impact seabirds or seabird habitats.

Indirect impacts on water or air quality under the No Action Alternative, Alternative 1, or Alternative 2 would not affect ESA-listed seabird species due to: (1) the temporary nature of impacts on water or air quality, (2) the distribution of temporary water or air quality impacts, (3) the wide distribution of seabirds in the Study Area, and (4) the dispersed spatial and temporal nature of the training and testing activities that may have temporary water or air quality impacts. No long-term or population-level impacts are expected.

3.6.4 SUMMARY OF POTENTIAL IMPACTS (COMBINED IMPACTS OF ALL STRESSORS)ON SEABIRDS

This section evaluates the potential for combined impacts of all the stressors from the Proposed Action. The analysis and conclusions for the potential impacts from each of the individual stressors are discussed in the analyses of each stressor in the sections above. There are generally two ways that a seabird could be exposed to multiple stressors. The first would be if a seabird were exposed to multiple sources of stress from a single activity or activity (e.g., an amphibious landing activity may include an amphibious vessel that would introduce potential acoustic and physical strike stressors). The potential for a combination of these impacts from a single activity would depend on the range of effects to each of the stressors and the response or lack of response to that stressor. Most of the activities as described in the Proposed Action involve multiple stressors; therefore, it is likely that if a seabird were within the potential impact range of those activities, they may be impacted by multiple stressors simultaneously. This would be more likely to occur during large-scale exercises or activities that span a period of days or weeks (such as a sinking exercise or composite training unit exercise).

Secondly, an individual seabird could be exposed to a combination of stressors from multiple activities over the course of its life. This is most likely to occur in areas where testing and training activities are more concentrated (e.g., near ports, testing ranges, and routine activity locations) and in areas that individual seabirds frequent because it is within the animal's home range, migratory route, breeding area, or foraging area. Except for in the few concentrated areas mentioned above, combinations are unlikely to occur because training and testing activities are generally separated in space and time in such a way that it would be very unlikely that any individual seabirds would be exposed to stressors from multiple activities. However, animals with a small home range intersecting an area of concentrated Navy activity have elevated exposure risks relative to animals that simply transit the area through a migratory route. The majority of the proposed training and testing activities occur over a small spatial scale relative to the entire Study Area, have few participants, and are of a short duration (the order of a few hours or less).

Multiple stressors may also have synergistic effects. For example, seabirds that experience temporary hearing loss or injury from acoustic stressors could be more susceptible to physical strike and disturbance stressors via a decreased ability to detect and avoid threats. Birds that experience behavioral and physiological consequences of ingestion stressors could be more susceptible to physical strike stressors via malnourishment and disorientation. These interactions are speculative, and without data on the combination of multiple Navy stressors, the synergistic impacts from the combination of Navy stressors on seabirds are difficult to predict.

Although potential impacts to certain seabird species from the Proposed Action could include injury or mortality, impacts are not expected to decrease the overall fitness or result in long-term population-level impacts of any given population. In cases where potential impacts rise to the level that warrants mitigation, mitigation measures designed to reduce the potential impacts are discussed in Chapter 5. The potential impacts anticipated from the Proposed Action are summarized below in Endangered Species Act Determinations (3.6.5) and Migratory Bird Act Determinations (3.6.6) with respect to each regulation applicable to seabirds.

3.6.5 ENDANGERED SPECIES ACT DETERMINATIONS

Table 3.6-6 summarizes the ESA determinations for each substressor analyzed.

Table 3.6-6: Summary of Endangered Species Act Effects Determinations for Birds, for the Preferred Alternative

Navy Activities and Stressors		California least tern	Hawaiian petrel	Short-tailed albatross	Marbled murrelet	Newell's shearwater
Acoustic Stressors						
Sonar and other acoustic sources	Training Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Explosive Detonations	Training Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Pile Driving	Training Activities	May affect, not likely to adversely affect	No effect	No effect	No effect	No effect
	Testing Activities	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Vessel and simulated vessel noise	Training Activities	No effect	No effect	No effect	No effect	No effect
	Testing Activities	No effect	No effect	No effect	No effect	No effect
Aircraft Noise	Training Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Energy Stressors						
Electromagnetic devices	Training Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Physical Disturbance and Strike Stressors						
Aircraft and Aerial Target	Training Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect

Table 3.6 6: Summary of Endangered Species Act Effects Determinations for Birds, for the Preferred Alternative (continued)

Navy Activities and Stressors		California least tern	Hawaiian petrel	Short-tailed albatross	Marbled murrelet	Newell's shearwater
Physical Disturbance and Strike Stressors (continued)						
Vessels and in-water devices	Training Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Military expended materials	Training Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Ingestion Stressors						
Military expended materials	Training Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect	May affect, not likely to adversely affect

3.6.6 MIGRATORY BIRD ACT DETERMINATIONS

Under the Migratory Bird Treaty Act regulations applicable to military readiness activities (50 C.F.R. Part 21), the stressors introduced during training and testing activities would not result in a significant adverse effect on migratory bird populations.

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3.7 Marine Vegetation

MARINE VEGETATION SYNOPSIS

The United States Department of the Navy considered all potential stressors and the following have been analyzed for marine vegetation:

- Acoustic (explosions)
- Physical disturbance or strikes (vessel and in-water devices, military expended materials, and seafloor devices)

Preferred Alternative

- No Endangered Species Act listed marine vegetation species are found in the Hawaii-Southern California Training and Testing Study Area.
- Explosions and physical disturbance and strikes could affect marine vegetation by destroying individual plants or damaging parts of plants. The impacts of these stressors are not expected to result in detectable changes in growth, survival, or propagation, and are not expected to result in population-level impacts on marine plant species.
- Secondary stressors are not expected to result in detectable changes in growth, survival, propagation, or population-level impacts because changes in sediment and water quality or air quality are not likely to be detectable.
- These conclusions are based on the fact that the areas of impact are very small compared to the relative distribution and the locations where explosions or physical disturbance or strikes occur.

3.7.1 Introduction

This section analyzes potential impacts on marine vegetation found in the Hawaii-Southern California Training and Testing (HSTT) Study Area (Study Area). Marine vegetation, including marine algae and flowering plants, are found throughout the Study Area. Navy training and testing activities are evaluated for their potential impacts on species designated under the Endangered Species Act (ESA) and for their impacts on six major taxonomic groups of marine vegetation, as appropriate (Table 3.7-1). No ESA-listed species are found in the Study Area. Marine vegetation species regulated under the Magnuson-Stevens Fishery Conservation and Management Act are described in the Essential Fish Habitat Assessment.

The distribution and condition of offshore abiotic (non-living) substrates associated with attached macroalgae and the impact of stressors on those substrates are described in Section 3.3 (Marine Habitats). Additional information on the biology, life history, and conservation of marine vegetation can be found on the websites of the following agencies and groups:

- National Marine Fisheries Service (NMFS), Office of Protected Resources (including ESA-listed species distribution maps)
- Conservation International
- Algaebase
- National Resources Conservation Service
- National Museum of Natural History

To cover all marine vegetation types that are representative of the Study Area, the major taxonomic groups are discussed in Section 3.7.2. The major taxonomic groups consist of five groups of marine algae and one group of flowering plants (Table 3.7-1).

Table 3.7-1: Major Taxonomic Groups of Marine Vegetation in the Study Area

Marine Vegetation Groups[1]		Vertical Distribution in the Study Area[2]	
Common Name (Taxonomic Group)	**Description**	**Open Ocean**	**Coastal Waters**
Dinoflagellates (phylum Dinophyta)	Most are photosynthetic single-celled algae that have two whip-like appendages (flagella); Some live inside other organisms. Some produce toxins that can result in red tides or ciguatera poisoning.	Sea surface	Sea surface
Blue-green algae (phylum Cyanobacteria)	Many form mats that attach to reefs and produce nutrients for other marine species through nitrogen fixation.	Sea surface	Seafloor
Green algae (phylum Chlorophyta)	Marine species occur as unicellular algae, filaments, and large seaweeds.	None	Sea surface, seafloor
Diatoms, brown and golden-brown algae (phylum Heterokontophyta)	Single-celled algae that form the base of the marine food web; brown and golden-brown algae are large multi-celled seaweeds that form extensive canopies, providing habitat and food for many marine species.	Sea surface	Sea surface, seafloor
Red algae (phylum Rhodophyta)	Single-celled algae and multi-celled large seaweeds; some form calcium deposits.	Sea surface	Seafloor
Seagrass, cordgrass, and mangroves (phylum Spermatophyta)	Flowering plants are adapted to salty marine environments in mudflats and marshes, providing habitat and food for many marine species.	None	Seafloor

[1]Species groups are based on the Catalogue of Life (Bisby et al. 2010).
[2]Presence in the Study Area includes open ocean areas (North Pacific Subtropical Gyre and North Pacific Transition Zone) and coastal waters of two Large Marine Ecosystems (California Current and Insular Pacific-Hawaiian). "None" indicates absence of the taxonomic group within the Study Area portion (see map of the Study Area in Figure 3.0-2).

3.7.2 AFFECTED ENVIRONMENT

Factors that influence the distribution and abundance of vegetation in the large marine ecosystems and open ocean areas of the Study Area are the availability of light and nutrients, water quality, water clarity, salinity level, seafloor type (important for rooted or attached vegetation), currents, tidal schedule, and temperature (Green and Short 2003). Marine ecosystems in the Study Area depend almost entirely on the energy produced by photosynthesis of marine plants and algae (Castro and Huber 2000), which is the transformation of the sun's energy into chemical energy. In surface waters of the open ocean and coastal waters, as well as within the portion of the water column illuminated by sunlight, marine algae and flowering plants provide oxygen, food, and habitat for many organisms (Dawes 1998).

Marine vegetation along the California coast is represented by more than 700 varieties of seaweeds (such as corallines and other red algae, brown algae including kelp, and green algae), seagrasses (Leet et al. 2001; Wyllie-Echeverria and Ackerman 2003), and canopy-forming kelp species (Wilson 2002). Extensive mats of red algae provide habitat in areas of exposed sediment along the California coast (Adams et al. 2004; United States [U.S.] Department of the Navy (Navy) and San Diego Unified Port District 2011). Although historically important, large-scale harvesting of kelp beds no longer occurs along the California coast. Small-scale commercial operations, however, continue to harvest kelp, primarily for abalone feed (Wilson 2002). The canopy coverage of kelp beds varies under changing oceanographic conditions, and is also influenced by the level of harvesting and coastal pollution (Wilson 2002).

Red coralline algae and green calcareous (calcium-containing) algae (*Halimeda* species) secrete calcareous skeletons that bind sediments in coral reefs in Hawaii (Spalding et al. 2003). In the Northwestern Hawaiian Islands, beyond the coral reef habitat, algal meadows dominate the terraces and banks at depths of 98–131 feet (ft.) (30–40 meters [m]). There are approximately 1,740 square miles ($mi.^2$) (4,507 square kilometers [km^2]) of this type of substrate, an estimated 65 percent of which is covered by algal meadows (Parrish and Boland 2004). In Hawaii, there are two species of seagrasses and at least 204 species of red algae, 59 species of brown algae, and 92 species of green algae (Friedlander et al. 2005). Seaweeds are important in native Hawaiian culture, and are used in many foods (Preskitt 2002a). Coastal pollution, invasive species, and an increasing demand for fresh seaweed threaten native species (Friedlander et al. 2005).

Certain species of microscopic algae (dinoflagellates and diatoms, for example) can form algal blooms, which can pose serious threats to human health and wildlife species. Harmful algal blooms can deplete oxygen within the water column and block sunlight that other organisms need to live, and some algae within algal blooms release toxins that are dangerous to human and ecological health (Center for Disease Control and Prevention 2004). These algal blooms have a negative economic impact of hundreds of millions of dollars annually world-wide (National Centers for Coastal Ocean Science 2010).

The marine vegetation in the taxonomic groups of seagrass, cordgrass, and mangroves has more limited distributions; none of them occur in open ocean areas. The relative distribution of seagrass is influenced by the availability of suitable substrate in low-wave-energy areas at depths that allow sufficient light exposure. Cordgrasses form dense colonies in salt marshes that develop in temperate areas in protected, low-energy environments, along the intertidal portions of coastal lagoons, tidal creeks or rivers, or estuaries, wherever the sediment can support plant root development (Mitsch et al. 2009).

3.7.2.1 General Threats

Environmental stressors on marine vegetation are products of human activities (industrial, residential, and recreational) and natural occurrences. Species-specific information is discussed, where applicable, in Sections 3.7.3.2 and 3.7.3.3, and the cumulative impacts of these threats are analyzed in Chapter 4, Cumulative Impacts.

Human-made stressors that act on marine vegetation include excessive nutrient input (pollutants, such as fertilizers), siltation (the addition of fine particles to the ocean), pollution (oil, sewage, trash), climate change, overfishing (Mitsch et al. 2009; Steneck et al. 2002), shading from structures (National Marine Fisheries Service 2002), habitat degradation from construction and dredging (National Marine Fisheries Service 2002), and invasion by exotic species (Hemminga and Duarte 2000; Spalding et al. 2003). The seagrass, cordgrass, and mangrove taxonomic group is more sensitive to stressors than the algal taxonomic groups. The great diversity of algae makes generalization difficult but, overall, algae are resilient and colonize disturbed environments (Levinton 2009b).

Seagrasses, cordgrasses, and mangroves are all susceptible to the human-made stressors on marine vegetation, and their presence in the Study Area has decreased because of these stressors. Each of these types of vegetation is sensitive to additional unique stressors. Seagrasses are uprooted by dredging and scarred by boat propellers (Hemminga and Duarte 2000; Spalding et al. 2003). Seagrass that is scarred from boat propellers can take years to recover. Cordgrasses are damaged by sinking salt marsh habitat, a process known as marsh subsidence. Likewise, the global mangrove resource has decreased by 50 percent from aquaculture, changes in hydrology (water movement and distribution), and sea level rise (Feller et al. 2010).

Oil in runoff from land-based sources, natural seeps, and accidental spills (such as offshore drilling and oil tanker leaks) are some of the major sources of oil pollution in the marine environment (Levinton 2009a). The types and amounts of oil spilled, weather conditions, season, location, oceanographic conditions, and the method used to remove the oil (containment or chemical dispersants) are some of the factors that determine the severity of the effects. Sensitivity to oil varies among species and within species, depending on the life stage; generally, early-life stages are more sensitive than adult stages (Hayes et al. 1992).

Oil pollution can impact seagrasses directly by smothering the plants, or indirectly by lowering their ability to combat disease and other stressors (U.S. National Response Team 2010). Seagrasses that are totally submerged are less susceptible to oil spills because they largely escape direct contact with the pollutant. Depending on various factors, oil spills such as the Gulf War oil spill in 1991 (Kenworthy et al. 1993) can have no impact on seagrasses, or can have long-term impacts, such as the four-year decrease in eelgrass density caused by the *Exxon Valdez* oil spill in 1989 (Peterson 2001). Algae are relatively resilient to oil spills, while mangroves are highly sensitive to oil exposure. Contact with oil can cause death, leaf loss, and failure to germinate (Hoff et al. 2002). Salt marshes can also be severely impacted by oil spills, and the effects can be long term (Culbertson et al. 2008).

3.7.2.2 Taxonomic Groups

3.7.2.2.1 Dinoflagellates (Phylum Dinophyta)

Dinoflagellates are single-celled organisms with two flagella (whiplike structures used for locomotion) in the phylum Dinophyta (Bisby et al. 2010). Dinoflagellates are predominantly marine algae, with an estimated 1,200 species living in surface waters of the ocean worldwide (Castro and Huber 2000). Most dinoflagellates can use the sun’s energy to produce food through photosynthesis and also can ingest small food particles. Photosynthetic dinoflagellates are important primary producers in coastal waters (Waggoner and Speer 1998). Organisms such as zooplankton (microscopic animals that drift passively in the water column), feed on dinoflagellates.

Dinoflagellates are also valuable for their close relationship with reef-building corals. Some species of dinoflagellates live inside corals. This mutually beneficial relationship provides shelter and food (in the form of coral waste products) for the dinoflagellates; in turn, the corals receive essential nutrients produced by dinoflagellates (Spalding et al. 2001). Dinoflagellates cause some types of harmful algal blooms which result from sudden increases in nutrients (e.g., fertilizers) from land into the ocean or changes in temperature and sunlight (Levinton 2009c). Additional information on harmful algal blooms can be accessed on the Centers for Disease Control and the National Oceanic and Atmospheric Administration websites.

3.7.2.2.2 Blue-Green Algae (Phylum Cyanobacteria)

Blue-green algae are single-celled, photosynthetic bacteria that inhabit the lighted surface waters and seafloors of the world’s oceans (Bisby et al. 2010). Blue-green algae are key primary producers in the marine environment, and provide valuable ecosystem services such as producing oxygen and nitrogen. The blue-green algae *Prochlorococcus* is responsible for a large part of the oxygen produced globally by photosynthetic organisms. Other species of blue-green algae have specialized cells that convert nitrogen gas into a form that can be used by other marine plants and animals (nitrogen fixation) (Hayes et al. 2007; Sze 1998). In nutrient-poor waters of coral reef ecosystems in the Hawaiian archipelago in the Hawaiian portion of the Study Area, blue-green algae are an important source of food. Coral reefs in Hawaii exposed to physical and biological disturbance may be colonized by highly productive or invasive blue-green algae that may persist if animals that feed on them are not present (Cheroske et al. 2000).

3.7.2.2.3 Green Algae (Phylum Chlorophyta)

Green algae are single-celled organisms in the phylum Chlorophyta that may form large colonies of individual cells (Bisby et al. 2010). Green algae are predominately found in freshwater, with only 10 percent of the estimated 7,000 species living in the marine environment (Castro and Huber 2000). These species are important primary producers that play a key role at the base of the marine food web. Green algae are found in areas with a wide range of salinity, such as bays and estuaries, and are eaten by various organisms, including zooplankton and snails.

Green seaweeds harvested for human consumption in Hawaii's coastal waters include *Ulva fasciata, Enteromorpha prolifera,* and *Codium edule* (Preskitt 2002a). Invasive marine green algal species are found in coastal waters of the Study Area. *Caulerpa taxifolia* and *Codium fragile tomentosoide* are found in the Southern California portion of the Study Area (Global Invasive Species Database 2005). The invasive green algae *Avrainvillea amadelpha* has been recorded in the main Hawaiian Islands (Preskitt 2010). Native Hawaiian green algal species that may become invasive include *Cladophora sericea*, *Caulerpa taxifolia*, *Dictyosphaeria cavernosa*, *Ulva fasciata*, and *Enteromorpha flexuasa* (Preskitt 2010).

3.7.2.2.4 Brown Algae (Phylum Heterokontophyta)

Brown and golden-brown algae are single-celled (diatoms) and large multi-celled marine species with structures varying from fine filaments to thick leathery forms (Castro and Huber 2000). Most species are attached to the seafloor in coastal waters, although a free-floating type of brown algae (*Sargassum*) occurs in the Study Area.

3.7.2.2.4.1 Diatoms

Diatoms are single celled organisms with cell walls made of silicon dioxide. Two major groups of diatoms are generally recognized, centric diatoms and pinnate diatoms. Centric diatoms exhibit radial symmetry (symmetry about a point), while the pinnate diatoms are bilaterally symmetrical (symmetry about a line). Diatoms such as *Coscinodiscus* species (spp.) commonly occur in the Study Area. Some strains of another genus of diatoms, *Pseudo-nitzschia*, produce a toxic compound called domoic acid. Humans, marine mammals, and seabirds become sick or die when they eat organisms that feed on *Pseudo-nitzschia* strains that produce the toxic compound. The Southern California portion of the Study Area off the coasts of Los Angeles and Orange Counties had some of the highest concentrations of the toxic compound ever recorded in U.S. waters (Schnetzer et al. 2007). *Pseudo-nitzschia* blooms in the Southern California Bight during 2003 and 2004 were linked to over 1,400 marine mammal strandings (Schnetzer et al. 2007). Pollutants carried from land to the ocean by rainwater (Kudela and Cochlan 2000) and decreases in the movement of cool, nutrient-rich waters by the wind are believed to be the main causes of these harmful algal blooms in the Southern California portion of the Study Area (Kudela et al. 2004).

3.7.2.2.4.2 Kelp and *Sargassum*

Kelp is the most conspicuous brown algae occurring extensively along the coast in the Southern California portion of the Study Area. The giant kelp (*Macrocystis pyrifera*) can live up to eight years, and can reach lengths of 197 ft. (60 m). The leaf-like fronds can grow up to 24 inches (in.) (61 centimeters [cm]) per day (Leet et al. 2001). Bull kelp (*Nereocystis luetkeana*) can grow up to 5 in. (13 cm) per day.

Bull kelp attaches to rocky substrate, and can grow up to 164 ft. (50 m) in length in nearshore areas. In turbid waters, the offshore edge of kelp beds occurs at depths of 50–60 ft. (15–18 m), which can extend to a depth of 100 ft. (30 m) in the clear waters around the Channel Islands off the coast of Southern California (Wilson 2002). The kelp beds along the California coast and in waters off the Channel Islands are the most extensive and elaborate submarine forests in the world (Rodriguez et al. 2001).

Six species of canopy-forming kelp occur in the coastal waters of the California coast: the giant kelp (*Macrocystis pyrifera*), bull kelp (*Nereocystis luetkeana*), elk horn kelp (*Pelagophycus porra*), feather boa kelp (*Egregia menziesii*), chain bladder kelp (*Stephanocystis osmundacea*), and winged kelp (*Alaria marginata*) (Dayton 1985). The dominant kelp in the Southern California portion of the Study Area is giant kelp. Since the first statewide survey in 1967, the total area of kelp canopies has generally declined; the greatest decline occurred along the mainland coast of Southern California (Wilson 2002).

Kelp is managed by the California Department of Fish and Game, which issues exclusive leases to harvest designated beds for up to 20 years. Although they are not limited in the amount, harvesters cannot take kelp from deeper than 4 ft. (1.2 m) below the water's surface to protect the reproductive structures at the kelp's base (Wilson 2002). Edible brown seaweeds that are collected in Hawaii's coastal waters include *Sargassum echinocarpu*m and *Dictyopteris plagiograma* (Preskitt 2002a). Collection is regulated by the State of Hawaii Department of Land and Natural Resources.

Invasive marine brown algal species are found in coastal waters of the Southern California portion of the Study Area. *Undaria pinnatifida*, native to Japan, is found along the California coast (Global Invasive Species Database 2005). Two introduced species of *Sargassum* inhabit the Study Area. The brown alga *Sargassum muticum*, was introduced from the Sea of Japan, and now occupies portions of the California coast (Monterey Bay Aquarium Research Institute 2009). *Sargassum horneri,* which is native to western Japan and Korea, occurs in Long Beach Harbor and in Southern California waters off San Diego, Orange County, San Clemente Island, and Santa Catalina Island (Miller et al. 2007).

3.7.2.2.5 Red Algae (Phylum Rhodophyta)

Red algae are predominately marine, with approximately 4,000 species worldwide (Castro and Huber 2000). Red algal species exist in a range of forms, including single and multicellular forms (Bisby et al. 2010), from fine filaments to thick calcium carbonate crusts. Within the Study Area, they occur in coastal waters, primarily in reef environments and intertidal zones of Hawaii and California. Abbott (1999) identified 343 species of red algae in Hawaiian waters. Representative native species in Hawaii include *Laurencia* spp., *Gracilaria coronopifolia*, *Hypnea cervicornis*, and *Gracilaria parvispora*. Representative non-native species include *Acanthophora spicifera*, *Gracilaria salicornia*, *Hypnea musciformis*, *Kappaphycus alvarezii*, and *Gracilaria tikvahiaea*. Many Rhodophyta species support coral reefs by hardening the reef and by cementing coral fragments (Veron 2000), and are food for various sea urchins, fishes, and chitons. In California waters, common species include *Endocladia muricata*, *Mastocarpus papillatus*, and *Mazaella* spp.

3.7.2.2.6 Seagrasses, Cordgrasses, and Mangroves (Phylum Spermatophyta)

Seagrasses, cordgrasses, and mangroves are flowering marine plants in the phylum Spermatophyta (Bisby et al. 2010). These marine flowering plants create important habitat, and are a food source for many marine species.

3.7.2.2.6.1 Seagrasses

Seagrasses are unique among flowering plants because they grow submerged in shallow marine environments. Except for some species that inhabit the rocky intertidal zone, seagrasses grow in shallow, subtidal, or intertidal sediments, and can extend over a large area to form seagrass beds (Garrison 2004; Phillips and Meñez 1988). Seagrass beds provide important ecosystem services as a structure-forming keystone species (Harborne et al. 2006). They provide suitable nursery habitat for commercially important organisms (e.g., crustaceans, fish, and shellfish) and also is a food source for numerous species (e.g., turtles) (Heck et al. 2003; National Oceanic and Atmospheric Administration 2001). Seagrass beds combat coastal erosion, promote nutrient cycling through the breakdown of detritus (Dawes 1998), and improve water quality. Seagrasses also contribute a high level of primary production to the marine environment, which supports high species diversity and biomass (Spalding et al. 2003).

Seagrasses that occur in the coastal areas of the Southern California portion of the Study Area in the California Current Large Marine Ecosystem include eelgrass (*Zostera marina* and *Zostera asiatica*), surfgrass (*Phyllospadix scouleri* and *Phyllospadix torreyi*), widgeon grass (*Ruppia maritima*), and shoal grass (*Halodule wrightii*) (Spalding et al. 2003). The distribution of underwater vegetation is patchy along the California coast. In the Southern California portion of the Study Area, eelgrass and surfgrass are the dominant native seagrasses (Wyllie-Echeverria and Ackerman 2003).

In Hawaii, the most common seagrasses are Hawaiian seagrass (*Halophila hawaiiana*) and paddle grass (*Halophila decipiens*). Hawaiian seagrass is a native species found at 1.6 to 3.1 ft. (0.5 to 0.9 m) in subtidal, sandy areas surrounding reefs, in bays, or in fishponds. It occurs in coastal waters of Oahu near Mamala Bay (southern coast), in Maunalua Bay (southeastern coast), in Kaneohe Bay (northeast coast), in coastal waters of Maui, in the inner reef flats of southern Molokai, at Anini Beach on the northern shore of Kauai, and at Midway Atoll in the Northwestern Hawaiian Islands (Phillips and Meñez 1988). Paddle grass is possibly a nonnative species that occurs only on Oahu in waters to 115 ft. (35 m) deep; it is apparently restricted to the southern shore of Oahu (Maragos 2000; Preskitt 2001, 2002b).

3.7.2.2.6.2 Cordgrasses

Cordgrasses are temperate salt-tolerant land plants that inhabit salt marshes, mudflats, and other soft-bottom coastal habitats (Castro and Huber 2000). Salt marshes develop in intertidal, protected low-energy environments, usually in coastal lagoons, tidal creeks, rivers, or estuaries (Mitsch et al. 2009). The structure and composition of salt marshes provide important ecosystem services. Salt marshes support commercial fisheries by providing habitat for wildlife, protecting the coastline from erosion, filtering fresh water discharges into the open ocean, taking up nutrients, and breaking down or binding pollutants before they reach the ocean (Dreyer and Niering 1995; Mitsch et al. 2009). Salt marshes also are carbon sinks (carbon reservoirs) and facilitate nutrient cycling (Bouillon 2009; Chmura 2009). Carbon sinks are important in reducing the impact of climate change (Laffoley and Grimsditch 2009), and nutrient cycling facilitates the transformation of important nutrients through the environment. In salt marshes and mudflats along the California coast, native cordgrass species include California cordgrass (*Spartina foliosa*). Atlantic cordgrass (*Spartina alterniflora*) is a native cordgrass species from the Atlantic and Gulf coasts, and is considered an invasive species in California because it produces seeds at higher rates than the native cordgrass, and can quickly colonize mudflats (Howard 2008).

3.7.2.2.6.3 Mangroves

Mangroves are a group of woody plants that have adapted to brackish water environments in the tropics and subtropics (Ruwa 1996). Mangroves inhabit marshes and mudflats in tropical and subtropical areas. The red mangrove, *Rhizophora mangle*, and several other species of mangroves were introduced to Hawaii (Allen 1998). Since the introduction of this species, mangroves have invaded intertidal areas formerly devoid of trees. The red mangrove is now well-established in the main Hawaiian Islands. The red mangrove is considered to be an invasive species in the main Hawaiian Islands, and various resource agencies have eradication programs targeting the red mangrove and other mangrove infestations. No mangroves are found within California coastal environments.

3.7.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially impact marine vegetation. General characteristics of all Navy stressors were introduced in Section 3.0.5.3 (Identification of Stressors for Analysis), and living resources' general susceptibilities to stressors were introduced in Section 3.0.5.7 (Biological Resource Methods). Each marine vegetation stressor is introduced, analyzed by alternative, and analyzed for training activities and testing activities. Table H-3 in Appendix F shows the warfare areas and associated stressors that were considered for analysis of marine vegetation.

The stressors vary in intensity, frequency, duration, and location within the Study Area. Based on the general threats to marine vegetation discussed in Section 3.7.2 (Affected Environment) the stressors applicable to marine vegetation are:

- Acoustic (explosives)
- Physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices)
- Secondary stressors (sediments and water quality)

Because marine vegetation is not susceptible to energy, entanglement, or ingestion stressors, those stressors will not be assessed. Only the Navy training and testing activity stressors and their components that occur in the same geographic location as marine vegetation are analyzed in this section. Training and testing activities pose no direct threat to some types of marine vegetation habitats. Details of all training and testing activities, stressors, components that cause the stressor, and geographic occurrence within the Study Area, are summarized in Section 3.0.5.3 (Identification of Stressors for Analysis) and detailed in Appendix A (Navy Activities Descriptions).

3.7.3.1 Acoustic Stressors

This section analyzes the potential impacts of acoustic stressors that may occur during Navy training and testing activities on marine vegetation within the Study Area. The acoustic stressors that may impact marine vegetation include explosives that are detonated on or near the surface of the water, or underwater; therefore, only these types of explosions are discussed in this section.

3.7.3.1.1 Impacts of Explosives and Other Impulsive Sources

Various types of explosives are used during training and testing activities. The type, number, and location of activities that use explosives under each alternative are discussed in Section 3.0.5.3.1.2 (Explosions). Explosive sources are the only acoustic stressor applicable to this resource because explosives could physically damage marine vegetation.

The potential for an explosion to injure or destroy marine vegetation would depend on the amount of vegetation present, the number of munitions used, and their net explosive weight. In areas where marine vegetation and locations for explosions overlap, vegetation on the surface of the water, in the water column, or rooted in the seafloor may be impacted. Seafloor macroalgae and single-celled algae may overlap with underwater and sea surface explosion locations. If these vegetation types are near an explosion, only a small number of them are likely to be impacted relative to their total population level. The low number of explosions relative to the amount of seafloor macroalgae and single-celled algae in the Study Area also decreases the potential for impacts on these vegetation types. In addition, seafloor macroalgae are resilient to high levels of wave action (Mach et al. 2007), which may aid in their ability to withstand underwater explosions that occur near them. Underwater explosions also may temporarily increase the turbidity (sediment suspended in the water) of nearby waters, incrementally reducing the amount of light available to marine vegetation.

The potential for seagrass to overlap with underwater and surface explosions is limited to bayside areas of Silver Strand Training Complex (SSTC), as well as to protected areas along oceanside portions of SSTC. For instance, eelgrass is known to occur off Breakers Beach, but no explosives training occurs in known locations. Eelgrass primarily occurs in bayside areas, and may overlap with explosives training areas. Seagrasses could be uprooted or damaged by sea surface or underwater explosions. They are much less resilient to disturbance than *Sargassum* and other marine algae; regrowth after uprooting can take up to 10 years (Dawes et al. 1997). Explosions may also temporarily increase the turbidity (sediment suspended in the water) of nearby waters, but the sediment would settle to pre-explosion conditions within a number of days. Sustained high levels of turbidity may reduce the amount of light that reaches vegetation. This scenario is not likely because of the low number of explosions planned in areas with seagrass.

3.7.3.1.2 No Action Alternative

3.7.3.1.2.1 Training Activities

Under the No Action Alternative, training activities that use explosives do not generally occur near shorelines, bays, rivers, or estuaries. In addition, the majority of underwater explosions in the Study Area would likely occur over unvegetated seafloor because it is the predominant bottom-type in the areas proposed for these activities. However, areas of marine algae may overlap with underwater explosions. In the Southern California Range Complex (SOCAL), nearshore explosions occur within SSTC Boat Lanes and training areas surrounding San Clemente Island. An area off Breakers Beach supports eelgrass, however, no explosives training occurs in this area. Eelgrass and other seagrasses are found in portions of SSTC bayside areas where Navy training involves simulated explosives, but no actual detonations. Within the coastal waters of Hawaii, explosives training occurs at Puuloa Underwater Range, Barbers Point Underwater Range, Lima Landing area, and Ewa Training Minefield. These areas, all located on the underwater portion of the Ewa Plain, are characterized by benthic algae beds (primarily green algae) and uncolonized pavement (U.S. Department of the Navy 1998). MK-8 marine mammal training occurs within Hawaiian coastal waters; however, the training in Hawaii does not involve explosives.

Underwater and surface explosions conducted for training activities are not expected to cause any risk to kelp beds, other marine algae, or seagrass because: (1) the relative coverage of marine algae is low, (2) new growth may result from marine algae exposure to explosives, (3) the impact area of underwater explosions is very small relative to kelp beds and other marine algae distribution, and (4) seagrass does not overlap with areas where the stressor occurs. Based on these factors, potential impacts on Sargassum marine algae from underwater and surface explosions are not expected to result in detectable changes to its growth, survival, or propagation, and are not expected to result in population-level impacts; and there are no potential impacts on seagrass species.

3.7.3.1.2.2 Testing Activities

Under the No Action Alternative, testing activities that involve explosions are limited to open ocean portions of the Study Area, primarily within SOCAL. Therefore, seagrasses would not be impacted by explosions because the depth of water where testing activities occur is too deep to support benthic vegetation. Only marine algae floating at the surface or suspended near the surface would be impacted by explosions. As stated previously, this type of algae is capable of recovering quickly from wave action, and will likely demonstrate rapid recovery rates after explosions.

Underwater and surface explosions conducted for testing activities are not expected to pose a risk to marine algae or seagrass because: (1) the relative coverage of marine algae is low, (2) new growth may result from marine algae exposure to explosives, (3) the impact area of underwater explosions is very small relative to kelp beds and other marine algae distribution, and (4) seagrass does not overlap with areas where the stressor occurs. Based on these factors, potential impacts on marine algae from underwater and surface explosions are not expected to result in detectable changes to its growth, survival, or propagation, and are not expected to result in population-level impacts; and there are no potential impacts on seagrass species.

3.7.3.1.3 Alternative 1

3.7.3.1.3.1 Training Activities

Under Alternative 1, the total number of explosive training events would increase by approximately 12 percent relative to the No Action Alternative. Most of these increases would occur within SOCAL open ocean training areas. The number of explosions within SSTC Boat Lanes would increase slightly, from 408 under the No Action Alternative to 414 under Alternative 1.This increase would only occur as part of Mine Neutralization – Explosive Ordinance Disposal training activities. All other activities within SSTC involving explosions would not increase relative to the No Action Alternative. As stated previously, SSTC Boat Lanes where explosives occur do no overlap with eelgrass or other seagrass habitats.

The potential impacts on marine algae from exposure to underwater and surface explosions are as described in Section 3.7.3.1.2.1 (No Action Alternative). The impact of underwater explosions from mine neutralization activities on bottom habitats provides some perspective on the potential impact area. The impact footprint of underwater explosions on bottom habitats is 0.04 square nautical miles (nm^2), see Table 3.3-3, Section 3.3.3.1.1.1 (Training Activities). This impact footprint is small relative to the distribution of marine algae, such as kelp, in the Study Area.

In comparison to the No Action Alternative, the increase in activities presented in Alternative 1 may increase the risk to marine algae from exposure to underwater and surface explosions. The majority of the difference is because of the increase in medium-caliber projectiles, which are the smallest type of explosive described in Chapter 2. Despite the increase in underwater and surface explosions, the potential impacts on exposed marine algae are expected to be the same as under the No Action Alternative because the overlap with the resource is limited. Underwater and surface explosions conducted for training activities are not expected to pose a risk to seagrass because: (1) the impact area of underwater explosions is very small relative to seagrass distribution, (2) the low number of charges reduces the potential for impacts, and (3) disturbance would be temporary. For the same reasons as stated in Section 3.7.3.1.1.1 (No Action Alternative) for marine algae and here for seagrass, the use of surface and underwater explosions is not expected to result in detectable changes to their growth, survival, or propagation, and are not expected to result in population-level impacts.

3.7.3.1.3.2 Testing Activities

Under Alternative 1, underwater and surface explosions in the Study Area would increase by approximately 200 percent compared to the No Action Alternative (see Table 3.0-9). As under the No Action Alternative, testing activities would continue to occur in open ocean portions of SOCAL and Hawaii Range Complex (HRC). No explosives are used during testing activities within SSTC training areas, therefore, seagrasses in and around San Diego Bay would not be impacted.

The general conditions described for testing activities, the overlap with marine algae, lack of overlap with seagrass, and the potential impacts on marine algae from exposure to underwater and surface explosions are as described in Section 3.7.3.1.2 (No Action Alternative). The impact footprint of underwater explosions on bottom habitats is 0.06 nm^2, see Table 3.3-4, Section 3.3.3.1.2.1 (Training Activities). This impact footprint is small relative to the distribution of marine algae in the Study Area.

In comparison to the No Action Alternative, the increase in activities presented in Alternative 1 may increase the risk to marine algae from exposure to underwater and surface explosions. The majority of the difference is due to the increase in medium-caliber projectiles, which are the smallest type of explosive described in Table 3.0-8 (Explosives Detonated on or Near the Water Surface During Training and Testing Activities in the Study Area). Despite the increase in underwater and surface explosions, the potential impacts on exposed marine algae are expected to be the same as under the No Action Alternative because the overlap with the resource is limited. For the same reasons as stated in Section 3.7.3.1.2 (No Action Alternative), the use of surface and underwater explosions is not expected to result in detectable changes in marine algae growth, survival, or propagation, and are not expected to result in population-level impacts.

3.7.3.1.4 Alternative 2

3.7.3.1.4.1 Training Activities

Under Alternative 2, the same number of training activities and underwater detonations would occur as under Alternative 1. Therefore, underwater detonations under Alternative 2 would have the same impacts on marine vegetation as under Alternative 1.

In comparison to the No Action Alternative, the increase in activities presented in Alternative 2 may increase the risk of marine algae from exposure to underwater and surface explosions. It should be noted that the majority of the difference is because of the increase in medium-caliber projectiles, which are the smallest type of explosive described in Chapter 2. Despite the increase in underwater and surface explosions, the potential impacts on exposed marine algae are expected to be the same as under the No Action Alternative because the overlap with the resource is limited. Underwater and surface explosions conducted for training activities are not expected to pose a risk to seagrass because: (1) the impact area of underwater explosions is very small relative to seagrass distribution, (2) the low number of charges reduces the potential for impacts, and (3) disturbance would be temporary.

3.7.3.1.4.2 Testing Activities

Under Alternative 2, underwater and surface explosion use in the Study Area would increase by 11-fold compared to the No Action Alternative; see Table 3.0-9 (Explosives for Training and Testing Activities in the Study Area). As under the No Action Alternative, testing activities would continue to occur in open ocean portions of SOCAL and HRC. No explosives are used during testing activities within SSTC training areas, therefore, seagrasses in and around San Diego Bay would not be impacted.

The general conditions described for testing activities, the overlap with *Sargassum*, lack of overlap with seagrass, and the potential impacts on marine algae from exposure to underwater and surface explosions are as described in Section 3.7.3.1.1.1 (No Action Alternative). The impact footprint of underwater explosions on bottom habitats is 0.04 nm^2, see Table 3.3-6, Section 3.3.3.1.1 (Underwater Explosions). This impact footprint is small relative to the distribution of marine algae in the Study Area.

In comparison to the No Action Alternative, the 11-fold increase in activities presented in Alternative 1 may increase the risk to *Sargassum* from exposure to underwater and surface explosions. The majority of the difference is because of the increase in medium-caliber projectiles, which are the smallest type of explosive described in Table 3.0-8 (Explosives Detonated on or Near the Water Surface During Training and Testing Activities in the Study Area). Despite the increase in underwater and surface explosions, the potential impacts to exposed marine algae are expected to be the same as under the No Action Alternative because the overlap with the resource is limited. For the same reasons as stated in Section 3.7.3.1.1.1 (No Action Alternative), surface and underwater explosions are not expected to result in detectable changes in marine algae growth, survival, or propagation, and are not expected to result in population-level impacts.

3.7.3.2 Physical Disturbance and Strike Stressors

This section analyzes the potential impacts on marine vegetation of the various types of physical disturbance and strike stressors during training and testing activities within the Study Area. Three types of physical stressors are evaluated for their impacts on marine vegetation, including: (1) vessels, in-water devices, and towed in-water devices; (2) military expended materials; and (3) seafloor devices.

The evaluation of the impacts of physical strike and disturbance stressors on marine vegetation focuses on proposed activities that may cause vegetation to be damaged by an object that is moving through the water (e.g., vessels and in-water devices), dropped into the water (e.g., military expended materials), or deployed on the seafloor (e.g., mine shapes and anchors). Not all activities are proposed throughout the Study Area. Wherever appropriate, specific geographic areas of potential impact are identified.

Single-celled algae may overlap with physical disturbance or strike stressors, but the impact would be minimal relative to their total population level; therefore, they will not be discussed further. Seagrasses and macroalgae on the seafloor on the sea surface are the only types of marine vegetation that occur in locations where physical disturbance or strike stressors may be encountered. Therefore, only seagrasses, and macroalgae, are analyzed further for potential impacts of physical disturbance or strike stressors. Since the occurrence of marine algae is an indicator of marine mammal and sea turtle presence, some mitigation measures designed to reduce impacts on these resources may indirectly reduce impacts on marine algae; see Section 5.3.2.2 (Physical Strike and Disturbance).

3.7.3.2.1 Impacts of Vessel and In-Water Devices

Several different types of vessels (ships, submarines, boats, amphibious vehicles) and in-water devices (towed devices, unmanned underwater vehicles) are used during training and testing activities throughout the Study Area, as described in Chapter 2. Vessel movements occur intermittently, are variable in duration, ranging from a few hours to a few weeks, and are dispersed throughout the Study Area. Events involving large vessels are widely spread over offshore areas, while smaller vessels are more active in nearshore areas.

The potential impacts of Navy vessels and in-water devices used during training and testing activities on marine vegetation are based on the vertical distribution of the vegetation. Surface vessels include ships, boats, and amphibious vehicles; and seafloor vessels include unmanned underwater vehicles and autonomous underwater vehicles. Vessels may impact vegetation by striking or disturbing vegetation on the sea surface or seafloor (Spalding et al. 2003). In the open ocean, marine algae on the sea surface such as kelp paddies have a patchy distribution. Marine algae could be temporarily disturbed if struck by moving vessels or by the propeller action of transiting vessels. Fragmentation would be on a small spatial scale, and algal mats would be expected to re-form. These strikes could also injure the organisms that inhabit kelp paddies or other marine algal mat, such as sea turtles, seabirds, marine invertebrates, and fish (see Sections 3.5, 3.6, 3.8, and 3.9, respectively). In open-ocean areas, marine algae on the sea surface may be disturbed by vessels and in-water devices. Marine algae could be temporarily disturbed if struck by transiting vessels or by their propellers. It is resilient to winds, waves, and severe weather that could sink the mat or break it into pieces. If an algal mat mat is struck, broken pieces may grow into new algal mats because marine algae reproduces by vegetative fragmentation (i.e., new plants develop from pieces of the parent plant) (South Atlantic Fishery Management Council 1998). Impacts on marine algae by strikes may collapse the pneumatocysts (air sacs) that keep the mats afloat. Evidence suggests that some floating marine algae will continue to float even when up to 80 percent of the pneumatocysts are removed (Zaitsev 1971).

Vegetation on the seafloor such as seagrasses and macroalgae may be disturbed by amphibious combat vehicles. Seagrasses are resilient to the lower levels of wave action that occur in sheltered estuarine shorelines, but are susceptible to vessel propeller scarring (Sargent et al. 1995). Seagrasses could take up to 10 years to fully regrow and recover from propeller scars (Dawes et al. 1997). Seafloor macroalgae may be present in locations where these vessels and in-water devices occur, but the impacts would be minimal because of their resilience, distribution, and biomass. A literature search of at-risk marine macroalgae species in the Study Area (International Union for Conservation of Nature and Natural Resources 2011) did not indicate that this type of vegetation is more resilient to stressors than other marine vegetation. Because seafloor macroalgae in coastal areas are adapted to natural disturbances, such as storms and wave action that can exceed 33 ft. (10 m) per second (Mach et al. 2007), macroalgae will quickly recover from vessel and in-water device movements. Macroalgae that is floating in the area may be disturbed by amphibious combat vehicle activities, but the impact would not be detectable because of the low number of activities (see Table 2.8-1), and will not be considered further.

Towed in-water devices include towed targets that are used during activities such as Missile Exercises and Gun Exercises. These devices are operated at low speeds either on the sea surface or below it. The analysis of in-water devices will focus on towed surface targets because of the potential for impacts on marine algae. Unmanned underwater vehicles and autonomous underwater vehicles are used in training and testing activities in the Study Area. They are typically propeller-driven, and operate within the water column or crawl along the seafloor. The propellers of these devices are encased, eliminating the potential for seagrass propeller scarring. Algae on the seafloor could be disturbed by these devices although, for the same reasons given for vessel disturbance, unmanned underwater vehicles are not expected to compromise the health or condition of algae.

3.7.3.2.1.1 No Action Alternative, Alternative 1, and Alternative 2

<u>Training Activities</u>

Estimates of relative vessel use and location for each alternative are provided in Section 3.0.5.3.3.1 (Vessels). These estimates are based on the number of activities predicted for each alternative. While these estimates provide a prediction of use, actual Navy vessel use depends upon military training requirements, deployment schedules, annual budgets, and other unpredictable factors. Testing and training concentrations are most dependent upon locations of Navy shore installations and established testing and training areas. Under Alternatives 1 and 2, the Study Area would be expanded, but the concentration of use and the manner in which the Navy tests and trains would remain consistent with the range of variability observed over the last decade. Consequently, the Navy is not changing the rate of vessel use and, therefore, the level of expected strikes would not change either. The difference in events from the No Action Alternative to Alternative 1 and Alternative 2, shown in Table 3.0-30, is not likely to change the probability of a vessel strike in any meaningful way.

Under all alternatives, a variety of vessels, in-water devices, and towed in-water devices would be used throughout the Study Area during training activities, as described in Chapter 2. Most activities would involve one vessel, but activities may occasionally use two vessels. Most vessel traffic would occur in SSTC, in and near Pearl Harbor, off portions of Marine Corps Base Camp Pendleton, and on portions of San Clemente Island. Within SSTC, shallow-water vessel movements in defined boat lanes would continue to occur with minimal impacts on marine vegetation because these boat lanes overlie cobble and bare substrates.

Unlike most vessels used in offshore training activities that occur in deep water, amphibious vehicles are designed to move personnel and equipment from ship to shore in shallow water. In San Diego Bay, eelgrass beds are avoided to the maximum possible extent. Because of the dredging history of San Diego Bay near the Navy ship berths, impacts of vessel movements on marine vegetation are expected to be minimal (U.S. Department of the Navy and San Diego Unified Port District 2011). Because of the quantity of vessel traffic in Hawaiian nearshore waters since the 1940s (especially in waters off Oahu and within Pearl Harbor), the existing vegetation community profile is well-adapted to vessel disturbances.

On the open ocean, vessel strikes of marine vegetation would be limited to floating marine algae. Vessel movements may disperse or injure algal mats. Because algal distribution is patchy, mats may re-form, and events would be on a small spatial scale, Navy training activities involving vessel movement would not impact the general health of marine algae. Navy protective measures would ensure that vessels avoid large algal mats, eelgrass beds, or other sensitive vegetation that other marine life depend on for food or habitat; these measures would safeguard this vegetation type from vessel strikes. In addition, Navy protective measures would require helicopter crews that tow in-water devices for mine warfare exercises to monitor the water surface before and during exercises to identify and avoid marine algae.

Marine vegetation in the path of moving vessels or in-water devices may have a clearly detectable response (e.g., algal mats dispersing, rupture of individual plant cells), followed by a recovery period lasting weeks to months. Although marine vegetation growth near vessels or in-water devices used for training activities under the No Action Alternative would be inhibited during recovery, long-term survival, reproductive success, or lifetime reproductive success would not be impacted.

Under all Alternatives, the impacts of vessel, in-water device, and towed in-water device physical disturbances and strikes during training activities would be minimal disturbances of algal mats and seaweeds. Eelgrass bed damage is not likely but, if it occurs, the impacts would be minor, such as short-term turbidity increases.

The net impact of vessel, in-water device, and towed in-water device physical disturbances and strikes on marine vegetation is expected to be negligible under all alternatives, based on: (1) Navy protective measures; (2) the quick recovery of most vegetation types; (3) the short-term nature of most vessel movements and local disturbances of the surface water, with some temporary increase in suspended sediment in shallow areas; and (4) the deployment of in-water devices at depths where they would not likely come in contact with marine vegetation.

Testing Activities

Under all alternatives, the Navy would test a variety of vessels, vehicles, and in-water devices. Most of the testing activities involving vessel movements and in-water devices occur at sea within the SOCAL Range Complex and HRC, or within the transit corridor between the two range complexes. Some of the testing occurs pierside in San Diego Bay or Pearl Harbor.

On the sea surface, vessel and towed surface target strikes of marine vegetation would be limited to floating marine algal mats. Vessel movements may disperse or injure algal mats. However, algal mats may re-form, and testing events would be on a small spatial scale. Therefore, Navy testing activities involving vessel movement and towed surface targets are not expected to impact the general health of marine algae. No testing activities would occur near seagrasses, such as eelgrass beds in San Diego Bay.

The net impact of vessel, in-water device, and towed in-water device physical disturbances and strikes on marine vegetation during testing activities is expected to be negligible under all alternatives, based on: (1) Navy protective measures; (2) the quick recovery of most vegetation types; (3) the short-term nature of most vessel movements and local disturbances of the surface water, with some temporary increase in suspended sediment in shallow areas; and (4) the deployment of in-water devices at depths where they would not likely come in contact with marine vegetation.

3.7.3.2.2 Impacts of Military Expended Materials

This section analyzes the strike potential to marine fish of the following categories of military expended materials: (1) non-explosive practice munitions, (2) fragments of high-explosive munitions, and (3) expended materials other than ordnance, such as sonobuoys, vessel hulks, and expendable targets. For a discussion of the types of activities that use military expended materials, where they are used, and how many activities would occur under each Alternative, see Section 3.0.5.3.3.3 (Military Expended Materials Strikes).

Military expended materials can impact floating marine algae in the open ocean, and seagrass and other types of algae on the seafloor in coastal areas. Most types of military expended materials are deployed in the open ocean. In coastal water training areas, only projectiles (small and medium), target fragments, and countermeasures could be introduced into areas where shallow water vegetation such as seagrass and seafloor macroalgae may be impacted.

The following are descriptions of the types of military expended materials that could impact marine algae and seagrass. Marine algae could overlap with military expended materials anywhere in the Study Area. SSTC is the only location where these materials could overlap with seagrasses. Potential impacts on marine algae and seagrass are as discussed in Section 3.7.3.2.2. Tables 3.3-63 through 3.3-65 present the numbers and locations of activities that expend military materials during training and testing activities by location and alternative.

Small-, Medium-, and Large-Caliber Projectiles. Small-, medium-, and large-caliber non-explosive practice munitions, or fragments of high-explosive projectiles expended during training and testing activities rapidly sink to the seafloor. The majority of these projectiles would be expended in the open ocean areas of SOCAL and HRC. Because of the small sizes of the projectiles and of their casings, damage to marine vegetation is unlikely. Large-caliber projectiles are primarily used in offshore areas at depths greater than 26 m (83.3 ft.), while small- and medium-caliber projectiles would be expended in both offshore and coastal areas at depths less than 26 m (83.3 ft.). Marine algae could occur where these materials are expended, but seagrasses generally do not because these activities do not normally occur in water that is shallow enough for seagrass to grow (26 m [83.3 ft.]).

Bombs, Missiles, and Rockets. Bombs, missiles, and rockets, or their fragments (if high-explosive) are expended offshore (at depths greater than 26 m [83.3 ft.]) during training and testing activities, and rapidly sink to the seafloor. Marine algae could occur where these materials are expended, but seagrass generally does not because of water depth limitations for activities that expend these materials.

Parachutes. Parachutes of varying sizes are used during training and testing activities. The types of activities that use parachutes, the physical characteristics of these expended materials, where they are used, and the number of activities that would occur under each alternative are discussed in Section 3.0.5.3.4.3 (Parachutes). Marine algae could occur in any of the locations where these materials are expended.

Targets. Many training and testing activities use targets. Targets that are hit by munitions could break into fragments. Target fragments vary in size and type, but most fragments are expected to sink. Pieces of targets that are designed to float are recovered when possible. Target fragments would be spread out over large areas. Marine algae and seagrass could occur where these materials are expended.

Vessel Hulk. Vessel hulks is a notable type of military expended material because of its size. Vessel hulks are expended at sea during sinking exercises. Sinking exercises use a target (vessel hulk) against which live high-explosive or non-explosive munitions are fired; the sinking exercise is conducted in a manner that results in the sinking of the target. This activity would only be conducted in designated areas (SINKEX box) with bottom depths greater than 3,000 m (9,842.7 ft.), see Figure 3.0-2. Floating marine algal mats could occur where these materials are expended, but seagrass could not.

Countermeasures. Defensive countermeasures such as chaff and flares are used to protect against missile and torpedo attack. Chaff is made of aluminum-coated glass fibers and flares are pyrotechnic devices. Chaff, chaff canisters, and flare end caps are expendable materials. Chaff and flares are dispensed from aircraft or fired from ships. Seagrass may overlap with chaff and flares that are expended in the Gulf of Mexico Large Marine Ecosystem in the Key West Range Complex. Floating marine algal mats could occur in any of the locations that these materials are expended.

3.7.3.2.2.1 No Action Alternative

Training Activities

Tables 3.0-63 through 3.0-65 list the numbers and locations of military expended materials, most of which are small- and medium-caliber projectiles. The numbers and footprints of military expended materials are detailed in Table 3.3-5.

In HRC, projectiles would be expended in shallow-water habitats around Kaula Rock during air-to-ground gunnery exercises. Small-caliber projectiles would be expended over the course of 18 events per year, expending about 15,000 small- and medium-caliber projectiles per year. While most of these will remain on the small island, a small number could be expected to settle in the shallow water around Kaula Rock. Common algae found in rocky intertidal habitats include sea lettuce, coralline red algae, red fleshy algae, brown algae, and fleshy green algae (U.S. Department of the Navy 2005). Common plants that inhabit the sandy beach intertidal habitat include the beach morning glory (*Ipomoea* spp.), beach heliotrope

(*Tournefortia argentea*), milo (*Thespesia populnea*), and hau (*Hibiscus tiliaceus*) (Maragos 2000). The footprint of expended projectiles would be very small, and would have no impact on intertidal vegetation. No other activity would introduce projectiles or casings into shallow water in Hawaii.

Floating marine algal mats and other types of algae that occur on the sea surface in the open ocean may be temporarily disturbed if struck by military expended materials. This type of disturbance would not likely be different from conditions created by waves or rough weather. If enough military expended materials land on algal mats, the mats can sink, but sinking occurs as a natural part of the aging process of marine algae and would, therefore, not impact the population (Schoener and Rowe 1970). Strikes would have little impact and would not likely result in the mortality of marine algae or other algae, although these strikes may injure the organisms that inhabit marine algae, such as sea turtles, birds, marine invertebrates, and fish (see Sections 3.5, 3.6, 3.8 and 3.9, respectively).

Military expended materials used for training activities are not expected to pose a risk to marine algae or seagrass because: (1) the relative coverage of marine algae in the Study Area is low, (2) new growth may result from marine algae exposure to military expended materials, (3) the impact area of military expended materials is very small relative to marine algae distribution, and (4) seagrass overlap with areas where the stressor occurs is very limited. Based on these factors, potential impacts on marine algae and seagrass from military expended materials are not expected to result in detectable changes in their growth, survival, or propagation, and are not expected to result in population-level impacts.

<u>Testing Activities</u>

Tables 3.0-63 through 3.0-65 list the numbers and locations of military expended materials, most of which are small- and medium-caliber projectiles. The numbers and footprints of military expended materials are detailed in Tables 3.3-5 through 3.3-7. Under the No Action Alternative, testing activities would expend materials in shallow-water habitats. No testing activities would expend materials in shallow-water habitats of SSTC; however, some testing events would expend medium-caliber rounds in SOCAL testing areas as part of Naval Air Systems Command testing of the Airborne Projectile-based mine clearance system.

Under the No Action Alternative, military expended materials used for testing activities are not expected to pose a risk to marine algae or seagrass because: (1) the relative coverage of marine algae in the Study Area is low, (2) new growth may result from marine algae exposure to military expended materials, (3) the impact area of military expended materials is very small relative to marine algae distribution, and (4) seagrass does not overlap with areas where the stressor occurs. Based on these factors, potential impacts on marine algae from military expended materials are not expected to result in detectable changes in its growth, survival, or propagation, and are not expected to result in population-level impacts; and there are no potential impacts on seagrass.

3.7.3.2.2.2 Alternative 1

<u>Training Activities</u>

Tables 3.0-63 through 3.0-65 list the numbers and locations of military expended materials, most of which are small- and medium-caliber projectiles. The numbers and footprints of military expended materials are detailed in Table 3.3-6. As indicated in Section 3.0.5.3.3.3 (Military Expended Materials Strikes), under Alternative 1, the total amount of military expended materials is more than twice the amount expended in the No Action Alternative. The activities and type of military expended materials under Alternative 1 would be expended in the same geographic locations as the No Action Alternative.

Floating marine algal mats and other types of algae that occur on the sea surface in the open ocean may be temporarily disturbed if struck by military expended materials. This type of disturbance would not likely be different from conditions created by waves or rough weather. If enough military expended materials land on algal mats, the mats can sink, but sinking occurs as a natural part of the aging process of marine algae and would, therefore, not impact the population (Schoener and Rowe 1970). Strikes would have little impact, and would not likely result in the mortality of floating algal mats or other algae, although these strikes may injure the organisms that inhabit marine algal mats, such as sea turtles, birds, marine invertebrates, and fish (see Sections 3.5, 3.6, 3.8 and 3.9, respectively).

In comparison to the No Action Alternative, the increase in activities presented in Alternative 1 may increase the risk to marine algae and seagrass of exposure to military expended materials. Despite the increase in the number of military expended materials, the potential impacts on exposed algal mats and seagrass are expected to be the same as under the No Action Alternative because overlap with the resources are limited. For the same reasons as stated in Section 3.7.3.2.2.1 (No Action Alternative), the use of military expended materials is not expected to result in detectable changes in marine algae or seagrass growth, survival, or propagation, and are not expected to result in population-level impacts.

Testing Activities

Tables 3.0-63 through 3.0-65 list the numbers and locations of military expended materials, most of which are small- and medium-caliber projectiles. The numbers and footprints of military expended materials are detailed in Table 3.3-6. As indicated in Section 3.0.5.3.3.3 (Military Expended Materials Strikes), under Alternative 1, the total amount of military expended materials is nearly four-times the amount expended in the No Action Alternative. Testing activities under Alternative 1 would be in the same locations as under the No Action Alternative, and military materials would be expended in the same locations as under the No Action Alternative. Military expended materials would typically be of the same type listed under the No Action Alternative.

Under Alternative 1, increased deposition of military expended materials during testing activities would not increase the risk of physical disturbance or strike to seagrass. Under Alternative 1, increased deposition of military expended materials during testing activities could increase the risk of physical disturbance or strike to marine algae. Any damage from deposition of military expended materials would be followed by a recovery period lasting weeks to months. Marine algae could have a detectable response to physical disturbances or strikes by military expended materials, but would recover completely, with no impact on its growth, survival, reproductive success, or lifetime reproductive success.

3.7.3.2.2.3 Alternative 2

Training Activities

The numbers and locations of training activities under Alternative 2 are identical to those of training activities under Alternative 1. Therefore, impacts on and comparisons to the No Action Alternative also are identical, as described in Section 3.7.3.2.2.1 (No Action Alternative).

Testing Activities

The numbers and locations of testing activities under Alternative 2 are identical to those of training activities under Alternative 1. Therefore, impacts on and comparisons to the No Action Alternative also are identical, as described in Section 3.7.3.2.2.1 (No Action Alternative).

3.7.3.2.3 Impacts of Seafloor Devices

For a discussion of the types of activities that use seafloor devices, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.3.4 (Seafloor Devices). Six training and testing activities require the installation or removal of devices and infrastructure on the seafloor: (1) elevated causeway system and causeway pier insertion and retraction activities; (2) anti-terrorism/force protection underwater surveillance system training; (3) the installation of fixed intelligence, surveillance, and reconnaissance sensor systems; (4) precision anchoring training; (5) offshore petroleum discharge system training; and (6) salvage operations. Marine vegetation on the seafloor may be impacted by seafloor devices, while vegetation on the sea surface such as marine algal mats is not likely to be impacted; therefore, it will not be discussed further. Seagrasses and seafloor macroalgae in the Study Area may be impacted by the use of seafloor devices.

Seafloor device operation, installation, or removal could impact seagrass by physically removing vegetation (e.g., uprooting), crushing, temporarily increasing the turbidity (sediment suspended in the water) of waters nearby, or shading seagrass which may interfere with photosynthesis. If seagrass is not able to photosynthesize, its ability to produce energy is compromised. However, the intersection of seagrasses and seafloor devices is limited, and suspended sediments would settle in a few days. For seafloor devices, in particular, the potential for overlap with seagrass in the Study Area is limited to elevated causeway system and causeway pier insertion and retraction activities and offshore petroleum discharge system training activities. The bayside Bravo training area contains an estimated 1.13 ac. (0.45 ha) of eelgrass habitats; however, the designated Bravo Beach training lane (where the training activity would occur) is a previously disturbed and previously used zone within the Bay.

3.7.3.2.3.1 No Action Alternative

Training Activities

Under the No Action Alternative, elevated causeway systems training in Bravo may remove eelgrass within the footprint of the pile. Furthermore, the Navy is participating in mitigation programs for eelgrass restoration if this type of disturbance occurs within eelgrass habitats (U.S. Department of the Navy 2011).

Four anti-terrorism/force protection underwater surveillance training events would occur every year in San Diego Bay. Typical events last five days, and day operations may range from 8 to 24 hours per training day. These training activities would involve placing clump anchors around existing piers and ships. These areas are characterized as deep subtidal habitats greater than 20 ft. (6 m) in depth, subject to periodic dredging since the 1940s (U.S. Department of the Navy and San Diego Unified Port District 2011). These areas are too deep to support eelgrass.

Precision anchoring training events would occur 72 times per year within SSTC anchorages. Six offshore petroleum discharge system training events would occur every year. These training events would primarily occur in SSTC boat lanes, but may also occur in the Bravo Beach designated boat lane and waters outside of boat lanes in waters off SSTC.

Marine plant species found within the nearshore waters off San Diego and in waters around San Clemente Island are adapted to natural disturbance, and recover quickly from storms, as well as from wave and surge action. Bayside marine plant species, such as eelgrass, are found in areas where wave action is minimal. Pile driving and installation of seafloor devices may impact vegetation in benthic habitats, but the impacts would be temporary and would be followed by rapid (within a few weeks) recovery, particularly in oceanside boat lanes in nearshore waters off San Diego and in designated training areas adjoining San Clemente Island. In bayside areas, recovery of eelgrass from direct disturbance by pile driving would occur over longer timeframes (e.g., over a period of months). Eelgrass beds show signs of recovery after a cessation of physical disturbance; the rate of recovery is a function of the severity of the disturbance (Neckles et al. 2005). Eelgrass recovery in San Diego Bay is generally associated with improving water quality and a cessation of major disturbance activities in former eelgrass beds, such as dredging (Chavez 2009). Pile driving and installation of seafloor devices, in contrast to dredging, have a minor impact limited to the area of the actual pile and footprint of the mooring.

Seafloor device installation in shallow water habitats under the No Action Alternative training activities would pose a negligible risk to marine vegetation. Any impacts would be short-term, and devices would be installed in areas subject to other training activities or prior disturbance (e.g., SSTC boat lanes and Pearl Harbor training areas). Any damage from deposition of military expended materials would be followed by a recovery period lasting weeks to months. Although marine vegetation growth in the vicinity of seafloor devices installed during training activities under the No Action Alternative would be inhibited during recovery, long-term survival, reproductive success, and lifetime reproductive success would not be impacted.

<u>Testing Activities</u>

Testing activities under the No Action Alternative would install seafloor devices within the Study Area. Space and Naval Warfare Systems Command activities that may impact marine vegetation by installing seafloor devices include fixed system underwater communications testing (nine events in San Diego Bay, nine events at Point Loma and in Imperial Beach, and nine events in San Clemente Island Testing areas), fixed autonomous oceanographic research and meteorology and oceanography testing activities (45 events per year at Point Loma and Imperial Beach locations and 45 events in San Clemente Island Testing areas), and fixed intelligence, surveillance, and reconnaissance sensor system testing activities (nine events per year at Point Loma and Imperial Beach locations and 14 events in San Clemente Island Testing areas).

These testing activities would involve the temporary installation of several arrays on the seafloor, buried 2 to 6 in. (5 to 15 cm) in sandy seafloor substrates or suspended in the water column with a mooring structure. Typical tests last five days, and day operations occur over an eight-hour period. Arrays may stay in the water for several months.

Seafloor devices installed in shallow-water habitats under the No Action Alternative testing activities would pose a negligible risk to marine vegetation. Any impacts would be short-term, and devices would be installed in areas subject to other testing activities or prior disturbance (e.g., SSTC boat lanes and Pearl Harbor testing areas). Any damage from deposition of military expended materials would be followed by a recovery period lasting weeks to months. Although marine vegetation growth near seafloor devices installed during testing activities under the No Action Alternative would be inhibited during recovery, long-term survival, reproductive success, or lifetime reproductive success would not be impacted.

3.7.3.2.3.2 Alternative 1

<u>Training Activities</u>

Under Alternative 1, no additional elevated causeway system training events or any other new activity that involves pile driving are proposed. Precision anchoring events within SSTC anchorages would remain the same as under the No Action Alternative, at 72 events per year. Offshore petroleum discharge system training would also remain the same as under the No Action Alternative, at six events per year, as would salvage operations training (remaining steady at three events per year). The number of anti-terrorism/force protection underwater surveillance training would be increased by two events per year (for a total of six events per year) in San Diego Bay over the number of training events for this activity under the No Action Alternative.

Seafloor devices installed in shallow-water habitats under Alternative 1 training activities would pose a negligible risk to marine vegetation. Any damage from deposition of military expended materials would be followed by a recovery period lasting weeks to months. Although marine vegetation growth near seafloor devices installed during training activities under Alternative 1 would be inhibited during recovery, the long-term survival, reproductive success, and lifetime reproductive success would not be impacted.

Testing Activities

Alternative 1 testing events would increase relative to the No Action Alternative. Fixed-system, underwater communications testing would increase by one event per year in each testing area used for this testing activity (San Diego Bay, Point Loma and Imperial Beach, and San Clemente Island testing areas). Fixed autonomous oceanographic research and meteorology and oceanography testing activities would increase by 10 events per year to account for 50 events in Point Loma and Imperial Beach locations and 50 events in San Clemente Island testing areas. Fixed intelligence, surveillance, and reconnaissance sensor system testing activities would increase by one event per year at Point Loma and Imperial Beach locations, and would increase by two per year at San Clemente Island testing areas.

As noted previously, the Navy uses sandy substrates devoid of marine vegetation to the extent possible. Marine plant species found within San Diego Bay and in waters off San Clemente Island are adapted to natural disturbance, and recover quickly from storms, as well as to high-energy wave action and tidal surges in oceanside areas. As noted previously, eelgrass beds would require longer recovery periods in bayside areas.

Seafloor devices installed in shallow-water habitats during Alternative 1 testing activities would pose a negligible risk to marine vegetation. Any damage from deposition of military expended materials would be followed by a recovery period lasting weeks to months. Although marine vegetation growth in the vicinity of seafloor devices installed during testing activities under Alternative 1 would be inhibited during recovery, the long-term survival, reproductive success, and lifetime reproductive success would not be impacted.

3.7.3.2.3.3 Alternative 2

Training Activities

Under Alternative 2, no additional elevated causeway system training events or other new activities that involve pile driving are proposed. Precision anchoring events within SSTC anchorages would remain the same as under the No Action Alternative, at 72 events per year. Offshore petroleum discharge system training would also remain the same as under the No Action Alternative, at six events per year, as would salvage operations training (remaining at three events per year). Anti-terrorism/force protection underwater surveillance training would increase by two events per year (to six events per year) in San Diego Bay over the number of training events for this activity under the No Action Alternative.

Seafloor devices installed in shallow-water habitats during Alternative 2 training activities would pose a negligible risk to marine vegetation. Any damage from deposition of military expended materials would be followed by a recovery period lasting weeks to months. Although marine vegetation growth near seafloor devices installed during training activities under Alternative 2 would be inhibited during recovery, the long-term survival, reproductive success, or lifetime reproductive success would not be impacted.

Testing Activities

Alternative 2 testing events would increase relative to the No Action Alternative. Fixed-system underwater communications testing would increase by two events per year in each testing area used for this testing activity (San Diego Bay, Point Loma and Imperial Beach, and San Clemente Island testing areas). Fixed autonomous oceanographic research and meteorology and oceanography testing activities would increase by 20 events per year to account for 55 events in Point Loma and Imperial Beach locations and 55 events in San Clemente Island testing areas. Fixed intelligence, surveillance, and reconnaissance sensor system testing activities would increase by two events per year at Point Loma and Imperial Beach locations and increase by four per year at San Clemente Island testing areas.

The Navy uses sandy substrates devoid of marine vegetation to the extent possible. Marine plant species found within San Diego Bay and in waters off San Clemente Island are adapted to natural disturbance, and recover quickly from storms, as well as to high-energy wave action and tidal surges in oceanside areas. As noted previously, eelgrass beds in bayside areas would require longer recovery periods.

Seafloor devices installed in shallow-water habitats during Alternative 2 testing activities would pose a negligible risk to marine vegetation. Any damage from deposition of military expended materials would be followed by a recovery period lasting weeks to months. Although marine vegetation growth in the vicinity of seafloor devices installed during testing activities under Alternative 2 would be inhibited during recovery, the long-term survival, reproductive success, or lifetime reproductive success would not be impacted.

3.7.3.3 Secondary Stressors

This section analyzes potential impacts on marine vegetation exposed to stressors indirectly through changes in sediments and water quality. Section 3.1 (Sediments and Water Quality) considered the impacts on marine sediments and water quality from explosives and explosion by-products, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). The analysis determined that neither state or federal standards or guidelines for sediments nor water quality would be violated by the No Action Alternative, Alternative 1, or Alternative 2. Because of these conditions, population-level impacts on marine vegetation are likely to be inconsequential and not detectable. Therefore, because these standards and guidelines are structured to protect human health and the environment, and the proposed activities do not violate them, no indirect impacts are anticipated on marine vegetation from the training and testing activities proposed by the No Action Alternative, Alternative 1, or Alternative 2.

3.7.3.4 Summary of Potential Impacts (Combined Impacts of All Stressors) on Marine Vegetation

Activities described in this EIS/OEIS that have potential impacts on vegetation are widely dispersed, and not all stressors would occur simultaneously in a given location. The stressors that have potential impacts on marine vegetation include acoustic (underwater and surface explosions) and physical disturbances or strikes (vessel and in-water devices, military expended materials, and seafloor devices). Unlike mobile organisms, vegetation cannot flee from stressors once exposed. Marine algae are the vegetation most likely to be exposed to multiple stressors in combination because it occurs in large expanses. Discrete areas of the Study Area (mainly within offshore areas with depths greater than 26 m

(85.3 ft.) in portions of range complexes and testing ranges) could experience higher levels of activity involving multiple stressors, which could result in a higher potential risk for impacts on marine algae within those areas. The potential for exposure of seagrasses and attached macroalgae to multiple stressors would be less because activities are not concentrated in coastal (areas with depths less than 26 m) distributions of these species. The combined impacts of all stressors would not be expected to affect marine vegetation populations because: (1) activities involving more than one stressor are generally short in duration, (2) such activities are dispersed throughout the Study Area, and (3) activities are generally scheduled where previous activities have occurred. The aggregate effect on marine vegetation would not observably differ from existing conditions.

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3.8 Marine Invertebrates

MARINE INVERTEBRATES SYNOPSIS

The United States Department of the Navy considered all potential stressors and the following have been analyzed for marine invertebrates:

- Acoustic (sonar and other nonimpulsive acoustic sources, explosions and other impulsive acoustic sources)
- Energy (electromagnetic)
- Physical disturbance or strikes (vessels and in-water devices, military expended materials, and seafloor devices),
- Entanglement (cables, wires, and parachutes)
- Ingestion (military expended materials)
- Secondary stressors (metals and chemicals)

Preferred Alternative

- Per the Endangered Species Act (ESA), acoustic stressors may affect, but are not likely to adversely affect, ESA-listed black abalone (*Haliotis cracherodii*) or white abalone (*Haliotis sorenseni*) species. Acoustic stressors would have no effect on designated critical habitat.
- Per the ESA, energy stressors would have no effect on ESA-listed black abalone or white abalone species. Energy stressors would have no effect on designated critical habitat.
- Per the ESA, physical disturbance and strike stressors may affect, but are not likely to adversely affect, ESA-listed black abalone or white abalone species. Physical disturbance and strike stressors would have no effect on designated critical habitat.
- Per the ESA, entanglement stressors would have no effect on ESA-listed black abalone or white abalone species. Entanglement stressors would have no effect on designated critical habitat.
- Per the ESA, ingestion stressors would have no effect on ESA-listed black abalone or white abalone species. Ingestion stressors would have no effect on designated critical habitat.
- Per the ESA, secondary stressors would have no effect on ESA-listed black abalone or white abalone species. Secondary stressors would have no effect on designated critical habitat.

3.8.1 Introduction

In this Environmental Impact Statement/Overseas Environmental Impact Statement, marine invertebrates are evaluated based on their distribution and life history relative to the stressor or activity being considered. Activities are evaluated for their potential impact on marine invertebrates in general, and are evaluated by taxonomic and regulatory groupings as appropriate.

Invertebrates are animals without backbones, and marine invertebrates are a large, diverse group of at least 50,000 species (Brusca and Brusca 2003). Many of these species are important to humans ecologically and economically, providing essential ecosystem services (coastal protection) and income from tourism and commercial and recreational fisheries (Spalding et al. 2001). Because marine invertebrates occur in all habitats, activities that affect the water column or the seafloor could impact numerous zooplankton (invertebrates not generally visible to the naked eye), eggs, larvae, larger invertebrates living in the water column, and benthic invertebrates that live on or in the seafloor. The greatest densities of marine invertebrates are usually on the seafloor (Sanders 1968); therefore, activities that contact the seafloor have a greater potential for impact.

The following subsections briefly introduce the ESA-listed species, federally managed species, habitat types, and major taxonomic groups of marine invertebrates in the Study Area. Federally managed marine invertebrate species regulated under the Magnuson-Stevens Fishery Conservation and Management Act are described in the HSTT Essential Fish Habitat Assessment. The National Oceanic and Atmospheric Administration Fisheries Office of Protected Resources maintains a website that provides additional information on the biology, life history, species distribution (including maps), and conservation of invertebrates.

3.8.1.1 Endangered Species Act-Listed Species

Twelve invertebrate species in the Study Area are listed as endangered, species of concern, or candidates for listing (National Oceanic and Atmospheric Administration 2010b; National Oceanic and Atmospheric Administration and United States [U.S.] Department of Commerce 2010). The status and presence of these species in the Study Area are listed in Table 3.8-1. Profiles of the endangered abalone species and a group profile of the candidate species are provided in Sections 3.8.2.3, 3.8.2.4, and 3.8.2.5, respectively. Emphasis on species-specific information in the following species descriptions will be placed on the two ESA protected species because any threats to or potential impacts on those species are subject to consultation with regulatory agencies.

Table 3.8-1: Status of Endangered Species Act-Listed, Candidate, and Species of Concern Invertebrate Species in the Study Area

Species Name and Regulatory Status			Presence in Study Area		
Common Name	**Scientific Name**	**Endangered Species Act Status**	**Open Ocean Area / Transit Corridor**	**California Current**	**Insular Pacific-Hawaiian**
Black abalone	*Haliotis cracherodii*	Endangered	No	Yes	No
White abalone	*Haliotis sorenseni*	Endangered	No	Yes	No
Fuzzy table coral	*Acropora paniculata*	Candidate species	No	No	Yes
Irregular rice coral (Hawaiian reef coral)	*Montipora dilitata*	Candidate species/ Species of concern	No	No	Yes
Blue rice coral	*Montipora flabellate*	Candidate species	No	No	Yes
Sandpaper rice coral	*Montipora patula*	Candidate species	No	No	Yes
Swelling coral	*Leptoseris incrustans*	Candidate species	No	No	Yes
Puko's coral	*Porites pukoensis*	Candidate species	No	No	Yes
Agassiz's coral	*Cyphastrea agassizi*	Candidate species	No	No	Yes
Stellar coral	*Psammocora stellata*	Candidate species	No	No	Yes
Pink abalone	*Haliotis corrugate*	Species of concern	No	Yes	No
Green abalone	*Haliotis fulgens*	Species of concern	No	Yes	No

3.8.1.2 Federally Managed Species

Federally managed species of marine invertebrates are listed in Table 3.8-2. In the context of federally managed species, the term "fishery" applies to any biologically generated object extracted from the ocean (e.g., there is a lobster "fishery" even though the animals are not fish). Assessments in Section 3.8.3 (Environmental Consequences) combine federally managed species with the rest of their taxonomic group, unless impacts or differential effects warrant separate treatment. The analysis of impacts on commercial and recreational fisheries is provided in Section 3.11 (Socioeconomics).

Table 3.8-2: Federally Managed Marine Invertebrate Species with Essential Fish Habitat within the Study Area, Covered under Each Fishery Management Plan

Pacific Fishery Management Council	
Pacific Coast Coastal Pelagic Species Fishery Management Plan	
Common Name	**Species**
Market squid	*Loligo opalescens*
Western Pacific Fishery Management Council	
Fishery Ecosystem Plan for the Hawaii Archipelago	
Common Name	**Species**
Hawaiian spiny lobster	*Panulirus marginatus*
Spiny lobster	*Panulirus penicillatus*
Ridgeback slipper lobster	*Scyllarides haanii*
Chinese slipper lobster	*Parribacus antarcticus*
Kona crab	*Ranina ranina*
Deepwater shrimp	*Heterocarpus* spp.
Pink coral	*Corallium secundum, Corallium laauense*
Red coral	*Corallium regale*
Midway deepsea coral	*Corallium* sp nov.
Gold coral	*Gerardia* spp., *Callogorgia gilberti, Narella* spp., *Calyptrophora* spp.
Bamboo coral	*Lepidisis olapa, Acanella* spp.
Black coral	*Antipathes dichotoma, Antipathis granids, Antipathes ulex*

3.8.1.3 Taxonomic Groups

All marine invertebrate taxonomic groups are represented in the Study Area. Major invertebrate phyla (taxonomic range)—those with greater than 1,000 species (Appeltans et al. 2010)—and the general zones they inhabit in the Study Area are listed in Table 3.8-3. Throughout the marine invertebrate section, organisms may be referred to by their phylum name or, more generally, as marine invertebrates.

Table 3.8-3: Major Taxonomic Groups of Marine Invertebrates in the Hawaii-Southern California Training and Testing Study Area

Major Invertebrate Groups[1]		Presence in Study Area[2]	
Common Name (Species Group)	**Description**	**Open Ocean**	**Coastal Waters**
Foraminifera, radiolarians, ciliates (Phylum Foraminifera)	Benthic and pelagic single-celled organisms; shells typically made of calcium carbonate or silica.	Water column, seafloor	Water column, seafloor
Sponges (Phylum Porifera)	Benthic animals; large species have calcium carbonate or silica structures embedded in cells to provide structural support.	Seafloor	Seafloor
Corals, hydroids, jellyfish (Phylum Cnidaria)	Benthic and pelagic animals with stinging cells.	Water column, seafloor	Water column, seafloor
Flatworms (Phylum Platyhelminthes)	Mostly benthic; simplest form of marine worm with a flattened body.	Water column, seafloor	Water column, seafloor
Ribbon worms (Phylum Nemertea)	Benthic marine worms with a long extension from the mouth (proboscis) from the mouth that helps capture food.	Water column, seafloor	Seafloor
Round worms (Phylum Nematoda)	Small benthic marine worms; many live in close association with other animals (typically as parasites).	Water column, seafloor	Water column, seafloor
Segmented worms (Phylum Annelida)	Mostly benthic, highly mobile marine worms; many tube-dwelling species.	Seafloor	Seafloor
Bryozoans (Phylum Bryozoa)	Lace-like animals that exist as filter feeding colonies attached to the seafloor and other substrates.	Seafloor	Seafloor
Cephalopods, bivalves, sea snails, chitons (Phylum Molluska)	Mollusks are a diverse group of soft-bodied invertebrates with a specialized layer of tissue called a mantle. Mollusks such as squid are active swimmers and predators, while others such as sea snails are predators or grazers and clams are filter feeders.	Water column, seafloor	Water column, seafloor
Shrimp, crab, lobster, barnacles, copepods (Phylum Arthropoda - Crustacea)	Benthic or pelagic; some are immobile; with an external skeleton; all feeding modes from predator to filter feeder.	Water column, seafloor	Water column, seafloor
Sea stars, sea urchins, sea cucumbers (Phylum Echinodermata)	Benthic predators and filter feeders with tube feet.	Seafloor	Seafloor

Notes: Benthic = A bottom-dwelling organism, Pelagic = relating to, living, or occurring in the waters of the ocean or the open sea.
[1]Major species groups (those with more than 1,000 species) are based on the World Register of Marine Species (Appeltans et al. 2010) and Catalogue of Life (Bisby et al. 2010).
[2]Presence in the Study Area includes open ocean areas (North Pacific Gyre and North Pacific Transition Zone) and coastal waters of two Large Marine Ecosystems (California Current and Insular-Pacific Hawaiian).

3.8.2 AFFECTED ENVIRONMENT

Marine invertebrates live in all of the world's oceans, from warm shallow waters to cold deep waters. They inhabit the seafloor and water column in all of the large marine ecosystems and open-ocean areas in the Study Area. Marine invertebrate distribution in the Study Area is influenced by habitat, ocean currents, and water quality factors such as temperature, salinity, and nutrient content (Levinton 2009). The distribution of invertebrates is also influenced by their distance from the equator (latitude); in general, the number of marine invertebrate species increases toward the equator (Macpherson 2002). The higher number of species (diversity) and abundance of marine invertebrates in coastal habitats, compared with the open ocean, is a result of more nutrient availability from terrestrial environments and the variety of habitats and substrates found in coastal waters (Levinton 2009).

Marine invertebrates in the Hawaii Range Complex (HRC) portion of the Study Area inhabit coastal waters and seafloor habitats, including rocky intertidal zones, coral reefs, deep-water slopes, canyons, and seamounts. The intertidal zone is exposed to air at low tide and covered by water at high tide. Inhabitants of the rocky, wave-beaten intertidal zone include species such as helmet urchins (*Colobocentrotus atratus*) and limpets (Zabin 2003). At least 15 species of intertidal crab live in sandy beaches in the intertidal zone, feeding on algae and detritus (Waikiki Aquarium 2009a).

Corals are the primary living structural components of Hawaii's subtidal zone, with an average of about 20.3 percent coral coverage in the main Hawaiian Islands (Friedlander et al. 2005). Approximately 250 species of corals are found within the main Hawaiian Islands (Maragos et al. 2004). Six species of corals dominate Hawaiian waters: lobe coral (*Porites lobata*; 6.1 percent), finger coral (*Porites compressa*; 4.5 percent), rice coral (*Montipora capitata*; 3.9 percent), sandpaper rice coral (*Montipora patula*; 2.7 percent), cauliflower coral (*Pocillopora meandrina*; 2.4 percent), and blue rice coral (*Montipora flabellate*; 0.7 percent) (Friedlander et al. 2005). The Northwestern Hawaiian Islands have at least 57 species of stony coral, including seven genera of the table coral *Acropora*, which is rare in the main Hawaiian Islands but abundant and widespread in the French Frigate Shoals region (Maragos et al. 2004).

The coral reefs of the Northwestern Hawaiian Islands support diverse communities of bottom-dwelling invertebrates. Over 800 non-coral invertebrate species have been identified from the Northwestern Hawaiian Islands. Mollusks, echinoderms, and crustaceans dominate, representing 80 percent of the invertebrate species (Friedlander et al. 2005). Five species of lobster occur in Hawaii, primarily within the subtidal zone, although their range can extend slightly deeper. Four species occur throughout the tropical oceans of the world (Waikiki Aquarium 2009c), while the Hawaiian spiny lobster (*Panulirus marginatus*) is found only in Hawaii and Johnston Atoll (Polovina et al. 1999). Deepwater corals in the HRC portion of the Study Area include black corals, pink corals, red corals, gold coral, and bamboo coral. These species attach to relatively steep banks with strong currents that provide a steady stream of small algae and animals that drift in the water (plankton) to feed on, as well as minimal sedimentation that would inhibit colonization and growth of these slow-growing species (Grigg 1993).

Marine invertebrates in the Southern California portion of the Study Area inhabit coastal waters and benthic habitats, including salt marshes, kelp forests, soft sediments, canyons, and the continental shelf. Salt marsh invertebrates include oysters (such as the Olympia oyster [*Ostreola conchaphila*]), crabs, and worms that are important prey for birds and small mammals. Mudflats provide habitat for substantial amounts of crustaceans, bivalves, and worms. Representative species include various species of ghost shrimp and marine worms, California jackknife clams (*Ensis myrae*), and California horn snails (*Cerithidea californica*). Sand flats are dominated by bivalves such as heart cockle (*Corculum cardissa*), white-sand clam (*Macoma secta*), and bent-nosed clam (*Macoma nasuta*) (Proctor et al. 1980). The sandy intertidal area is dominated by species that are highly mobile and can burrow. The most common invertebrates are the common sand crab, isopods, talitrid amphipods, polychaetes, Pismo clam (*Tivela stultorum*), bean clam (*Donax gouldii*), and purple olive snail (*Olivella biplicata*) (Dugan et al. 2000).

More than 260 species of sponges, hydroids, sea fans, mollusks, echinoderms, and ascidians (sea squirts) have been identified in the subtidal rocky reefs of central and Southern California (Chess and Hobson 1997). Rock oysters and mussels dominate the tops of rocky reefs. The orange cup coral (*Balanophyllia elegans*) is a common stony coral in hard-bottom habitats of the shallow subtidal zones of the Study Area (Bythell 1986; Kushner et al. 1999). At greater depths, there are calcareous bryozoans, sea fans, stony corals, purple sea urchins, rock scallops, and red abalone (Chess and Hobson 1997).

The Channel Islands, located off the coast of Southern California, are situated in a transitional location between cold and warm water (National Oceanic and Atmospheric Administration 2007). Four of the southern Channel Islands (Santa Barbara, Santa Catalina, San Nicolas, and San Clemente islands) are within the Southern California portion of the Study Area. This area is diverse in invertebrates, supporting over 5,000 species. The dominant taxa include sea lilies, crabs, lobsters, basket stars, brittle stars, brachiopods, sea urchins, anemones, and salps (Tissot et al. 2006). This diversity is supported by a number of structure-forming invertebrates, including black corals, sea whips, and sponges. Diversity among marine invertebrate species appears greatest for black corals (Tissot et al. 2006). The 17 known species of stony corals include two species that are endemic to the area, flower coral (*Nomlandia californica*) and tree coral (*Dendrophyllia californica*) (Cairns 1994).

The soft-bottom sediments of California's estuarine communities are highly productive, with a high diversity of invertebrates. Representative organisms in the soft-bottom communities of California estuaries, such San Diego Bay, include crustaceans (e.g., caridean or bay shrimps, Pacific razor clams, gaper clams, Washington clams, littleneck clams, and blue mussels) (Emmett et al. 1991; Kalvass 2001). Marine worms, crustaceans, and mollusks are the dominant invertebrates living on and in the soft-bottom sediment and the submerged aquatic vegetation of San Diego Bay (U.S. Department of the Navy (Navy) and San Diego Unified Port District 2000).

3.8.2.1 Invertebrate Hearing and Vocalization

Very little is known about sound detection and use of sound by aquatic invertebrates (Budelmann 2010; Montgomery et al. 2006; Popper et al. 2001). Organisms may detect sound by sensing either the particle motion or pressure component of sound, or both. Aquatic invertebrates probably do not detect pressure since many are generally the same density as water and few, if any, have air cavities that would function like the fish swim bladder in responding to pressure (Budelmann 2010; Popper et al. 2001). Many aquatic invertebrates, however, have ciliated "hair" cells that may be sensitive to water movements, such as those caused by currents or water particle motion very close to a sound source (Budelmann 2010; Mackie and Singla 2003). These cilia may allow invertebrates to sense nearby prey or predators or help with local navigation.

Aquatic invertebrates that can sense local water movements with ciliated cells include cnidarians, flatworms, segmented worms, urochordates (tunicates), mollusks, and arthropods (Budelmann 2010; Popper et al. 2001). The sensory capabilities of corals are largely limited to detecting water movement using receptors on their tentacles (Gochfeld 2004), and the exterior cilia of coral larvae likely help them detect nearby water movements (Vermeij et al. 2010). Some aquatic invertebrates have specialized organs called statocysts for the determination of equilibrium and, in some cases, linear or angular acceleration. Statocysts allow an animal to sense movement, and may enable some species, such as cephalopods and crustaceans, to be sensitive to water particle movements associated with sound (Hu et al. 2009; Kaifu et al. 2008; Montgomery et al. 2006; Popper et al. 2001). Because any acoustic sensory capabilities, if present at all, are limited to detecting water motion, and water particle motion near a sound source falls off rapidly with distance, aquatic invertebrates are probably limited to detecting nearby sound sources rather than sound caused by pressure waves from distant sources.

Both behavioral and auditory brainstem response studies suggest that crustaceans may sense sounds up to three kilohertz (kHz), but best sensitivity is likely below 200 Hertz (Hz) (Lovell et al. 2005; Lovell et al. 2006; Goodall et al. 1990). Most cephalopods (e.g., octopus and squid) likely sense low-frequency sound below 1,000 Hz, with best sensitivities at lower frequencies (Budelmann 2010; Mooney et al. 2010; Packard et al. 1990). A few cephalopods may sense higher frequencies up to 1,500 Hz (Hu et al. 2009). Squid did not respond to toothed whale ultrasonic echolocation clicks at sound pressure levels ranging from 199 to 226 decibels (dB) referenced to (re) 1 µ (micro) Pascal (Pa) peak-to-peak, likely because these clicks were outside of squid hearing range (Wilson et al. 2007). However, squid exhibited alarm responses when exposed to broadband sound from an approaching seismic airgun with received levels exceeding 145 to 150 dB re 1 µPa root mean square (McCauley et al. 2000b).

Aquatic invertebrates may produce and use sound in territorial behavior, to deter predators, to find a mate, and to pursue courtship (Popper et al. 2001). Some crustaceans produce sound by rubbing or closing hard body parts together, such as lobsters and snapping shrimp (Latha et al. 2005; Patek and Caldwell 2006). The snapping shrimp chorus makes up a significant portion of the ambient noise budget in many locales (Cato and Bell 1992). Each click is up to 215 dB re 1 µPa, with a peak around 2 to 5 kHz (Heberholz and Schmitz 2001). Other crustaceans, such as the California spiny lobster, make low-frequency rasping or rumbling noises, perhaps used in defense or territorial display, that are often obscured by ambient noise (Patek and Caldwell 2006; Patek et al. 2009).

Reef noises, such as fish pops and grunts, sea urchin grazing (around 1.0 kHz to 1.2 kHz), and snapping shrimp noises (around 5 kHz) (Radford et al. 2010), may be used as a cue by some aquatic invertebrates. Nearby reef noises were observed to affect movements and settlement behavior of coral and crab larvae (Jeffs et al. 2003; Radford et al. 2007; Stanley et al. 2010; Vermeij et al. 2010). Larvae of other crustacean species, including pelagic and nocturnally emergent species that benefit from avoiding coral reef predators, appear to avoid reef noises (Simpson et al. 2011). Detection of reef noises is likely limited to short distances (less than 330 ft. [100 m]) (Vermeij et al. 2010).

3.8.2.2 General Threats

General threats to marine invertebrates include overexploitation and destructive fishing practices (Jackson et al. 2001; Miloslavich et al. 2011; Pandolfi et al. 2003), habitat degradation from pollution and coastal development (Cortes and Risk 1985; Downs et al. 2009), disease, and invasive species (Bryant et al. 1998; Galloway et al. 2009; National Marine Fisheries Service 2010b; Wilkinson 2002). These threats are compounded by global threats to marine life, including the increasing temperature and decreasing pH of the ocean from pollution linked to global climate change (Cohen et al. 2009; Miloslavich et al. 2011).

In the Study Area, marine invertebrates that are managed to ensure their sustainability have delineated essential fish habitat, which is designated by National Marine Fisheries Service (NMFS) and regional fishery management councils. The sustainability and abundance of these organisms are vital to the marine ecosystem and to the sustainability of the world’s commercial fisheries (Pauly et al. 2002).

Marine invertebrates are harvested for food and for the aquarium trade. Economically important invertebrate groups that are fished, commercially and recreationally, for food in the United States are crustaceans (e.g., shrimps, lobsters, and crabs), bivalves (e.g., scallops, clams, and oysters), and cephalopods (e.g., squid and octopuses) (Morgan and Chuenpagdee 2003; Pauly et al. 2002). These fisheries are a key part of the commercial fisheries industry in the United States (Food and Agriculture Organization of the United Nations 2005). Global threats to crustaceans, bivalves, and cephalopods are largely the result of overfishing, destructive fishing techniques (e.g., trawling) and habitat modification (Morgan and Chuenpagdee 2003; Pauly et al. 2002). A relatively new threat to invertebrates is bioprospecting, the collection of organisms in pursuit of new compounds for pharmaceutical products.

Additional information on the biology, life history, and conservation of marine invertebrates can be found on the websites maintained by the following organizations:

- NMFS, particularly for ESA-listed species, species of concern, and candidate species
- U.S. Coral Reef Task Force
- MarineBio Conservation Society
- Waikiki Aquarium
- Monterey Bay Aquarium

The discussion above represents general threats to marine invertebrates. Additional threats to individual species within the Study Area are described below in the accounts of those species. The following sections include descriptions of ESA-listed species, a group description of species considered candidates for ESA listing, and descriptions of the major marine invertebrate taxonomic groups in the Study Area. The species-specific information emphasizes the ESA-listed and candidate species because any threats to or potential impacts on those species are subject to consultation with regulatory agencies. These taxonomic group descriptions include descriptions of key habitat-forming invertebrates, including reef-forming sponges, shallow-water corals, two groups of key deep-water corals that form essential fish habitat, corals and other organisms that define live hardbottom, reef-building worms, and reef-building mollusks (e.g., oysters).

3.8.2.3 Black Abalone (*Haliotis cracherodii*)

3.8.2.3.1 Status and Management

The black abalone (*Haliotis cracherodii*) was listed as endangered under the ESA on February 13, 2009 (National Marine Fisheries Service 2009). A dramatic decline in abundance, likely caused by a disease known as withering syndrome (explained in more detail below), prompted closure of both the commercial and recreational fisheries in California. The State of California imposed a moratorium on all abalone harvesting in central and Southern California in 1997 (Butler et al. 2009). A system of California Marine Protected Areas aids in enforcing these regulations. An *Abalone Recovery Management Plan* was adopted by the State of California in 2005.

NMFS has prepared a status review for this species (National Marine Fisheries Service 2009). Critical habitat was designated for black abalone by NMFS on 27 October 2011 (76 Federal Register 66806-66844). Most of the designated critical habitat lies along the California coast north of the Study Area. Designated critical habitat includes rocky intertidal and subtidal habitats from the mean higher high water line to a depth of approximately 20 feet (ft.) (6 meters [m]), as well as the waters encompassed by these areas. Designated critical habitat extends from Del Mar Landing Ecological Reserve to the Palos Verdes Peninsula. Within the Study Area, critical habitat occurs on Santa Catalina and Santa Barbara

Islands. The specific areas proposed for designation off San Nicolas and San Clemente Islands were determined to be ineligible for designation because the Navy's Integrated Natural Resources Management Plans provide benefits to black abalone in those areas. The critical habitat designation also identifies primary constituent elements, which are habitat elements essential for the conservation of the species. The primary constituent elements for black abalone are rocky substrate, food resources, juvenile settlement habitat, suitable water quality, and suitable nearshore circulation patterns.

Various projects are in place to monitor the status of the species, to understand and address withering disease, to improve reproduction, and to minimize illegal harvest. For instance, the Navy monitors black abalone populations on San Clemente and San Nicolas Islands, and the species is managed under both the *San Clemente Island Integrated Natural Resources Management Plan* and *San Nicolas Island Integrated Natural Resources Management Plan*.

3.8.2.3.2 Habitat and Geographic Range

The distribution of the black abalone ranges approximately from Point Arena in northern California to Bahia Tortugas and Isla Guadalupe, Mexico (National Marine Fisheries Service 2009). Although the geographic range of black abalone extends to northern California, most abalone populations historically have occurred in the Channel Islands (Butler et al. 2009). A map of the black abalone range can be accessed at http://www.nmfs.noaa.gov/pr/species/invertebrates/blackabalone.htm.

Black abalone live on rocky substrates in the middle intertidal zone within the Southern California portion of the Study Area. They occur among other invertebrate species, including California mussels (*Mytilus californianus*), gooseneck barnacles (*Pollicipes polymerus*), and anemones. Of the seven species of abalone in the waters of California, the black abalone inhabits the shallowest areas. It is rarely found deeper than 20 ft. (6.1 m), and smaller individuals generally inhabit the higher intertidal zones. Complex surfaces with cracks and crevices may be crucial habitat for juveniles, and appear to be important for adult survival as well (National Marine Fisheries Service 2009).

3.8.2.3.3 Population and Abundance

Black abalones were abundant before 1985 in the coastal waters from Point Arena in northern California to Bahia Tortugas and Isla Guadalupe, Mexico. Substantial populations also occurred in the coastal waters of the Channel Islands of Southern California. In the early 1970s, the black abalone constituted the largest abalone fishery in California (Smith et al. 2003). Because of withering syndrome disease, the black abalone has experienced 95 percent or greater declines in abundance since the mid 1980s. Withering syndrome is caused by the bacteria species *Candidatus Xenohaliotis californiensis*, which attacks the lining of the abalone's digestive tract, inhibiting the production of digestive enzymes. To prevent starvation, the abalone consumes its own body mass, causing its characteristic muscular "foot" to wither and atrophy. This impairs the abalone's ability to adhere to rocks, making it far more vulnerable to predation or starvation (National Marine Fisheries Service 2009).

Major declines in abundance in the Channel Islands, the primary fishing grounds for this species before closure, have severely reduced the population as a whole (National Marine Fisheries Service 2009). The Black Abalone Status Review Team estimates that, unless effective measures are put in place to counter the population decline caused by withering syndrome and overfishing, the species will be extinct within 30 years (Butler et al. 2009). San Nicolas Island is one of the only locations in Southern California where black abalone have been increasing and where multiple recruitment events have occurred since 2005 (National Marine Fisheries Service 2009).

3.8.2.3.4 Predator-Prey Interactions

The black abalone diet varies with life history stage. As larvae, black abalones receive nourishment from an egg yolk and do not actively feed. Settled abalone clamp tightly to rocky substrates and feed on algal matter that they scrape from the rocks. Juveniles feed on bottom-dwelling diatoms, bacterial films, and algae. As they increase in size and become less vulnerable to predation, abalones leave their sheltered habitat to search for food. Adult abalone feed primarily on fragments of drift kelp (Smith et al. 2003) and red algae (Butler et al. 2009). The primary predators of abalone are humans, fish, otters (Smith et al. 2003), sea stars, and striped crabs (National Oceanic and Atmospheric Administration 2010a).

3.8.2.3.5 Species-Specific Threats

The black abalone population is declining because of withering syndrome and overharvesting, as described above. An additional factor in the population decline is the black abalone's reproductive process. The black abalone is a sedentary marine mollusk that requires a critical population size and the proximity of other spawning abalone to successfully reproduce. The reduction in black abalone populations has isolated many individuals, preventing them from reproducing successfully.

3.8.2.4 White Abalone (*Haliotis sorenseni*)

3.8.2.4.1 Status and Management

The white abalone (*Haliotis sorenseni*) was listed as endangered under the ESA in June 2001 (National Marine Fisheries Service 2001), and is recognized as one stock (Hobday and Tegner 2000). Overfishing in the 1970s reduced the population to such low densities that successful reproduction was severely restricted. White abalone survival and recovery continue to be negatively affected by reproductive failure (Hobday et al. 2001), as well as by rising sea surface temperatures (Vilchis et al. 2005) and diseases, such as withering syndrome (Friedman et al. 2003).

The State of California suspended all forms of harvesting of the white abalone in 1996 and, in 1997, imposed an indefinite moratorium on the harvesting of all abalone in central and Southern California (National Marine Fisheries Service 2008). Critical habitat is not designated for white abalone. NMFS determined that informing the public of the locations of critical habitat, which includes areas where white abalone still exist, would increase the risk of illegal harvesting of white abalone (National Marine Fisheries Service 2001, 2008). Potential habitat may exist between Point Conception, California, and the California/Mexico border, with much of it occurring in the isolated, deep waters off the Channel Islands. In reaction to concerns over the status of white abalone, the White Abalone Restoration Consortium was formed to propagate a captive-reared stock to enhance the depleted wild stock (National Marine Fisheries Service 2008). There are now three captive breeding programs at the Channel Islands Marine Resource Institute, the Bodega Bay Marine Laboratory, and the National Oceanic and Atmospheric Administration Southwest Fisheries Science Center.

3.8.2.4.2 Habitat and Geographic Range

The white abalone is a well-concealed, attached, bottom-dwelling species that prefers reefs and rock piles with low relief areas surrounded by sandy areas (Hobday and Tegner 2000). White abalone in the Southern California Bight typically inhabit depths ranging from 60 to 195 ft. (18 to 59 m), with the highest densities occurring between 130 and 165 ft. (40 and 50 m) (Butler et al. 2006). White abalones are found in waters deeper than other west coast abalone species. Overall, habitat associations of white abalone depend on its main food source, attached or drifting brown algae (National Marine Fisheries Service 2001). Thus, depth distribution is limited by water clarity and light penetration as well as by the availability of hard substrate or anchoring points on seafloor (Butler et al. 2006). Evidence suggests that white abalone prefer the sand and rock interface at the reef's edge, rather than the middle sections of reefs (National Marine Fisheries Service 2008).

White abalone were historically found between Point Conception, California, and Punta Abreojos, Baja California, Mexico, at depths as shallow as 16 ft. (5 m) (National Marine Fisheries Service 2008). White abalone was once abundant throughout its range, but was more common and abundant along the coast in the northern and southern extents of its range. This area includes the Channel Islands of San Clemente (Navy owned) and Santa Catalina islands in the northeastern corner of the Southern California portion of the California Current Large Marine Ecosystem (Figure 3.8-1); Butler et al. 2006; National Marine Fisheries Service 2008). On the southern end of the range, the species was also common around a number of islands, including Isla Cedros and Isla Natividad, Mexico (Hobday and Tegner 2000). Although it occurs in extremely low numbers, its current range appears similar to that of its historical range (National Marine Fisheries Service 2008).

Except for some isolated survivors, the species is distributed only around the Channel Islands and along various banks within the Study Area (Hobday and Tegner 2000; Rogers-Bennett et al. 2002). Since 1996, various researchers (Butler et al. 2006; Davis et al. 1996, 1998; Hobday and Tegner 2000) have conducted submersible surveys off Tanner and Cortes Banks (approximately 50 mi. [80 kilometers {km}] southwest of San Clemente Island) to map abalone habitat structure, examine distributions, and estimate the population size. They recorded 258 animals, with 168 recorded on Tanner Bank in 2002, at depths ranging from 105 to 180 ft. (32 to 55 m). In 2004, 35 individuals were recorded at Tanner Bank, 12 at Cortez Bank, and five off San Clemente Island. One study (Butler et al. 2006) documented five square miles ($mi.^2$) (1,359 hectares [ha]) of available white abalone habitat at Tanner Bank, 4 $mi.^2$ (1,139 ha) at Cortez Bank, and 3 $mi.^2$ (889 ha) on the western side of San Clemente Island. Both of these banks are underwater mountains that occur off the coast of Southern California.

3.8.2.4.3 Population and Abundance

Since the 1970's, the white abalone population has experienced a 99 percent reduction in density (National Marine Fisheries Service 2008). In 2000, the NMFS white abalone "Status Review" estimated that 1,600 white abalone existed in the wild and predicted that, without intervention, they would disappear by 2010 (Hobday and Tegner 2000). Sound navigation and ranging (sonar) surveys in 2002 and 2003 by Butler et al. revealed that the total abundance throughout its range may be larger. They estimated white abalone total abundances at 12,818 for Tanner Bank and 7,365 for Cortes Bank.

3.8.2.4.4 Predator-Prey Interactions

Similar to black abalone, the white abalone diet varies with life history stage. As larvae, white abalones do not actively feed. Settled abalone clamp tightly to rocky substrates and feed on algal matter scraped from the rocks or trapped under their shells. Juveniles feed on bottom-dwelling diatoms, bacterial films, and algae. As they increase in size and become less vulnerable to predation, abalones leave their sheltered habitat to search for food. Adult white abalone feed primarily on fragments of attached or drifting brown algae (National Oceanic and Atmospheric Administration 2010c). Predators of white abalone include sea otters, fish, sea stars, crabs, and octopuses, as well as humans through illegal harvesting (Hobday and Tegner 2000).

3.8.2.4.5 Species-specific Threats

White abalone faces similar threats (overharvesting and withering syndrome) to those of black abalone. Because of the small population of white abalone, impacts on the remaining population are magnified.

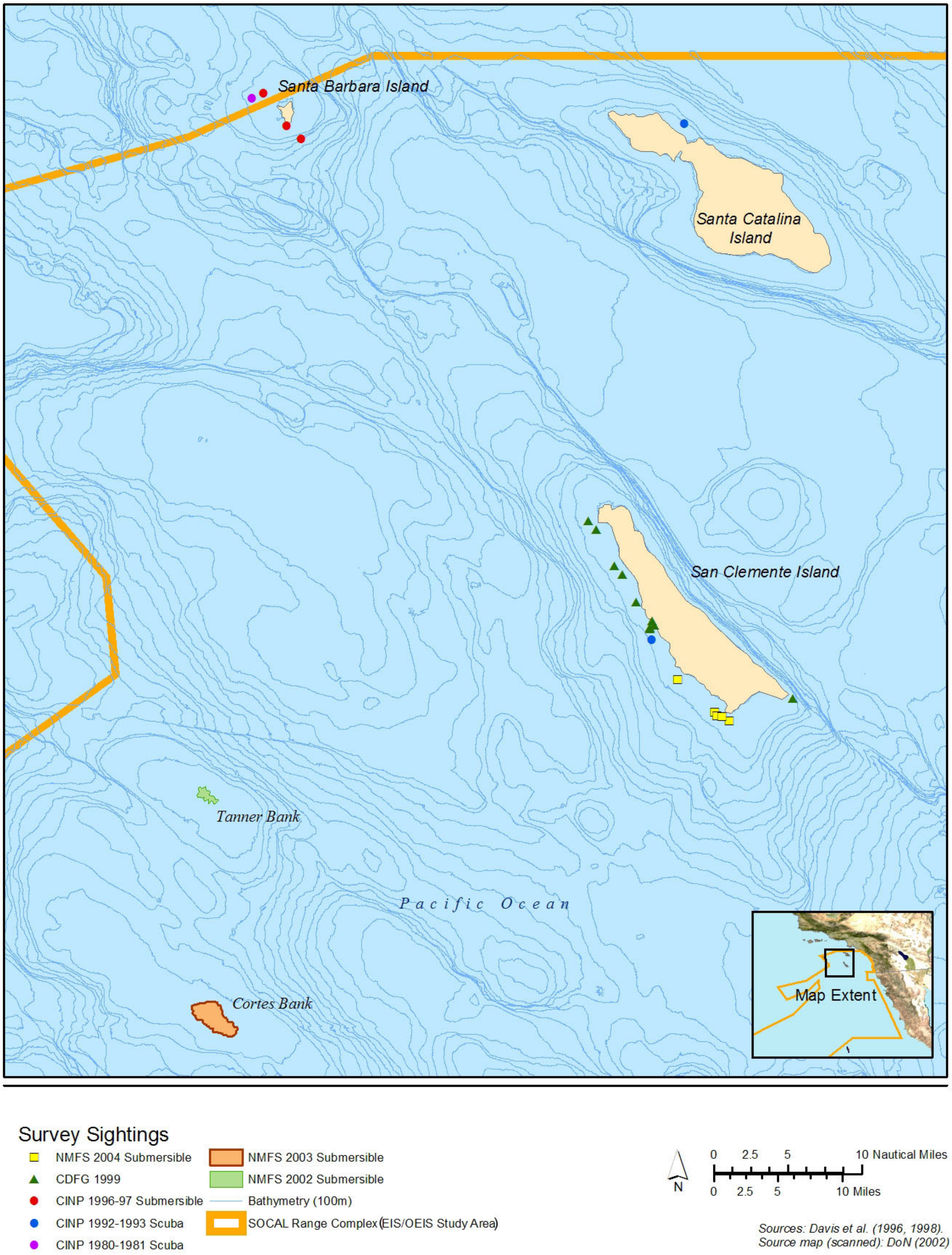

Figure 3.8-1: Locations of Sightings of White Abalone in the Hawaii-Southern California Training and Testing Study Area

3.8.2.5 Coral Candidate Species for Endangered Species Act Listing

3.8.2.5.1 Status and Management

In February 2010, NMFS issued *Notice of 90-Day Finding on a Petition to List 83 Species of Corals as Threatened or Endangered Under the ESA* (National Marine Fisheries Service 2010). Nine species of the candidate species listed in the notice occur in the Study Area (within Hawaiian waters, not within waters off Southern California) (see Table 3.8-1). Five families of coral represent the candidate species in the Study Area: Acroporidae, Agaricidae, Poritidae, Faviidae, and Siderastreidae. The *ESA*-candidate species in the Acroporidae family are fuzzy table coral (*Acropora paniculata*), irregular rice coral (*Montipora dilatata)*, blue rice coral (*Montipora flabellata*), and sandpaper rice coral (*Montipora patula*) (National Marine Fisheries Service 2010). Prior to its classification as a candidate species, the irregular rice coral was identified by NMFS as an ESA species of concern in 2004, based on the geographic limit of its distribution, its susceptibility to bleaching, and other environmental threats (National Marine Fisheries Service 2007). Fenner (2005) categorizes fuzzy table coral and irregular rice coral as rare, blue rice coral as common, and sandpaper rice coral as dominant.

The Agaricidae, Poritidae, and Siderastreidae families are represented by one ESA-candidate species each, swelling coral (*Leptoseris incrustans*), Puko's coral (*Porites pukoensis*), and stellar coral (*Psammocora stellata*), respectively. Swelling coral and stellar coral are considered to be uncommon, and Puko's coral is considered rare in the Hawaiian archipelago (Fenner 2005). The ESA-candidate species in the Faviidae family are Agassiz's coral (*Cyphastrea agassizi*) and ocellated coral (*Cyphastrea ocellina*). Ocellated coral is considered common and Agassiz's coral is considered uncommon in the Hawaii archipelago (Fenner 2005).

3.8.2.5.2 Habitat and Geographic Range

The candidate coral species occur throughout the coastal areas of the Insular Pacific-Hawaiian Large Marine Ecosystem in the Hawaii portion of the Study Area. Of the four Acroporidae corals in the Study Area, three are found only in the Hawaiian Islands, including irregular rice coral, blue rice coral, and sandpaper rice coral. Sandpaper rice coral may also occur on Johnston Atoll, approximately 750 nautical miles (nm) (1,400 km) southwest of the Hawaiian Islands chain. Fuzzy table coral is a widely distributed species, occurring throughout the central Indo-Pacific region and elsewhere. Within the Study Area, it occurs in the main and Northwestern Hawaiian Islands. Although this species is widely distributed, habitat degradation has caused fuzzy table coral to lose 35 percent of its available habitat within its range. Irregular rice coral is known from only seven locations within the Hawaiian Island chain, with a total area less than 193 $mi.^2$ (500 square kilometers [km^2]). Its primary site is in Kaneohe Bay, where there are only 10 colonies. It also occurs at Midway Atoll, Pearl and Hermes Atoll, Lisianski Island, Maro Reef, and French Frigate Shoals in the Northwestern Hawaiian Islands (National Marine Fisheries Service 2007). Blue rice coral is more widespread than irregular rice coral, occurring throughout the Hawaiian Islands archipelago, but it is generally uncommon throughout its range. Sandpaper rice coral is the most abundant of the three Hawaiian corals but, like irregular rice coral, it has a limited range, known only from five locations (Brown and Wolf 2009).

Swelling coral is a widespread species, occurring throughout the Red Sea and the East Indian Ocean as far as Hawaii and French Polynesia (Brown and Wolf 2009). Puko's coral is found only in Hawaii, and is known to occur only in shallow sheltered bays of Molokai (Sheppard et al. 2008). Stellar coral is widely distributed across the Indo-Pacific region, from the Seychelles in the western Indian Ocean to areas on the Pacific coasts of North, Central, and South America (Cortes et al. 2008). Agassiz's coral and ocellated coral are uncommon in the Hawaiian archipelago (Fenner 2005). They are also found on Johnston Atoll, south of the Hawaiian Islands.

Acroporid corals, the largest group of stony corals, are typically found in shallow, warm, nutrient-poor waters that allow sufficient sunlight penetration to support the zooxanthellae (i.e., single-cell algae embedded in coal polyp tissue) that they host. They primarily inhabit areas that face the seaward margins of islands, where waves and currents provide optimal mixing and flushing of seawater, support the propagation of gametes (germ cells) and coral fragments, and transport essential minerals and nutrients to the corals (Colin and Arneson 1995a).

Fuzzy table coral occurs in shallow tropical reefs on upper reef slopes, just subtidal to reef edges, and in sheltered lagoons at depths of 30 to 115 ft. (9 to 35 m) (Brown and Wolf 2009). Irregular rice coral occurs in subtidal environments with calm waters at depths of 3 to 35 ft. (1 to 10 m) (National Marine Fisheries Service 2007). Blue rice coral thrives in shallow-reef environments with high wave energy, where it does not have to compete with branching corals (Brown and Wolf 2009). Sandpaper rice coral is also a shallow reef species that occurs at a maximum depth of 32 ft. (10 m) (Brown and Wolf 2009). Swelling coral occurs at depths of 32 to 64 ft. (10 to 20 m) on reef slopes (Brown and Wolf 2009). Puko's coral occurs in protected environments such as lagoons. Stellar coral occurs in shallow, wave-washed rock habitat or on coarse sandy bottoms at depths of 50 to 65 ft. (15 to 20 m) (Brown and Wolf 2009). Agassiz's coral and ocellated coral occur in tropical, shallow reef environments to at least 65 ft. (20 m), and are found on the back slope and the outer edge of reefs, in lagoons, and in the outer reef channel (DeVantier et al. 2008a).

3.8.2.5.3 Population and Abundance

Many corals can reproduce both sexually or asexually. Some are hermaphrodites, meaning that they possess both male and female reproductive organs. Some species reproduce sexually by releasing eggs and sperm into the water where fertilization occurs and larvae begin to develop. After larvae settle on an appropriate surface, the colony begins to grow (Boulon et al. 2005). Fragmentation is a common form of asexual reproduction in species with thin branches. During a storm, thin branches typically break off from a colony and form new colonies by attaching to a suitable surface (Richmond 1997). Although fragmentation helps maintain high growth rates, it reduces the reproductive potential of some coral species by delaying the production of eggs and sperm for years following the damage (Lirman 2000).

Irregular rice coral colonies break easily in storms or through bioerosion, and the resulting fragments readily form new colonies (National Marine Fisheries Service 2007). This species is sensitive to thermal stress, as are all *Montipora* species, and recovers slowly after a bleaching event.

Stellar corals grow slowly but are also among the most opportunistic of corals because they can rapidly recolonize areas left vacant by disturbances (Brown and Wolf 2009). Sexual reproduction is important, but asexual reproduction and fragmentation are more effective strategies for colonizing free areas within the reef. Stellar coral is a widespread but rare species, occurring from the Seychelles in the western Indian Ocean to the Pacific coast of the Americas. The population trend for the species is unknown, although it has lost an estimated 32 percent of the habitat within its range (Brown and Wolf 2009). It occurs in the Hawaiian and Marianas archipelagos, as well as in Indonesia and other countries in the central Indo-Pacific region. It is rare to uncommon in the Indo-West Pacific region, but it can be locally abundant in the eastern tropical Pacific Ocean (Brown and Wolf 2009).

Species-specific information for fuzzy table coral (Richards et al. 2008), irregular rice coral (DeVantier et al. 2008b), blue rice coral (DeVantier et al. 2008c), and sandpaper rice coral (DeVantier et al. 2008d) are not available, but overall declines in coral reef habitat suggest decreasing population trends for these species.

Swelling coral is found throughout the Hawaiian archipelago. No estimates of its population or abundance are available, either in the Study Area or globally, although the population of this species is believed to be decreasing (Brown and Wolf 2009).

The population trend for Puko's coral is unknown (Sheppard et al. 2008). This species is very rare, with likely fewer than 50 colonies occurring at a single site on Molokai (Sheppard et al. 2008).

The populations of Agassiz's coral and ocellated coral are declining (International Union for Conservation of Nature and Natural Resources 2010). Agassiz's coral and ocellated coral are both widespread species, found in the Andaman Sea, the central Indo-Pacific, Southeast Asia, Japan, the east China Sea, eastern Australia, the oceanic west Pacific, Fiji, and the Hawaiian Islands and Johnston Atoll (DeVantier et al. 2008a). No abundance information is available for either species.

3.8.2.5.4 Predator-Prey Interactions

Corals feed on plankton, the majority of which are small marine organisms. Corals use stinging cells on tentacles surrounding their mouths to capture prey (Brusca and Brusca 2003). In addition to actively capturing prey, reef-building corals have another method of acquiring nutrients through their symbiotic relationship with zooxanthellae. The waste products of the coral host provide nitrogen to the zooxanthellae, and the zooxanthellae provide organic compounds (e.g., carbohydrates) produced by photosynthesis to its host (Brusca and Brusca 2003; Schuhmacher and Zibrowius 1985). The photosynthetic pigments in zooxanthellae also provide corals with their characteristic color. Predators of corals include sea stars, snails, and fish (e.g., parrotfish and butterfly fish).

3.8.2.5.5 Species-specific Threats

NMFS evaluates species-specific threats to coral species considered as candidates for ESA listing (National Marine Fisheries Service 2009). These species are susceptible to the same suite of stressors that threaten corals generally, although disease and pollution (e.g., nutrients and pesticides) are the most important stressors (Hughes et al. 2003; Pandolfi et al. 2003; Porter et al. 2001). Other threats being investigated by NMFS include ocean warming and acidification, dredging, predation, reef fishing, bioprospecting, physical damage from boats and anchors, and invasive species (National Marine Fisheries Service 2009).

3.8.2.6 Forminiferans, Radiolarians, Ciliates (Phylum Protozoa)

Foraminiferans, radiolarians, and ciliates are minute singled-celled organisms, sometimes forming colonies of cells, belonging to the Phylum Protozoa (Castro and Huber 2000). They are found in the water column and seafloor of the world's oceans. Foraminifera in the genus *Globergerina* occur in the waters around the California Current and Insular Pacific-Hawaiian Large Marine Ecosystems (Field et al. 2006). Forminifera form diverse and intricate shells out of calcium carbonate (Wetmore 2006). The shells of formanifera that live in the water column eventually sink to the deep seafloor, forming sediments known as formaminiferan ooze (Wetmore 2006). Formaninfera feed on diatoms and other small organisms. Their predators include copepods and other zooplankton. Radiolarians are microscopic organisms that form glass-like shells made of silica. Radiolarian ooze covers large areas of the ocean floor (Castro and Huber 2000; Wetmore 2006). Ciliates are protozoans with small hairs (cilia) that are used to feed and move around.

3.8.2.7 Sponges (Phylum Porifera)

Sponges include over 8,000 marine species worldwide, and are classified in the Phylum Porifera (Appeltans et al. 2010). Sponges are bottom-dwelling, multi-cellular animals that can be best described as an aggregation of cells that perform different functions. Sponges are largely sessile (not mobile), except for their larval stages, and are common throughout the Study Area at all depths. Sponges reproduce both sexually and asexually. Water flowing through the sponge provides food and oxygen and removes wastes (Castro and Huber 2000; Collins and Waggoner 2006). Many sponges form calcium carbonate or silica spicules or bodies embedded in cells to provide structural support (Castro and Huber 2000). Sponges provide homes for a variety of animals, including shrimp, crabs, barnacles, worms, brittle stars, sea cucumbers, and other sponges (Colin and Arneson 1995d). Sponges in the genera *Grantiidae* and *Clathria* occur in the waters around the California Current Large Marine Ecosystems. Common species in the Insular Pacific-Hawaiian Large Marine Ecosystem include grey encrusting sponge (*Gelliodes fibrosa*) and *blue Caribbean sponge* (*Haliclona caerulea*) (Quanzi and Wang 2009).

3.8.2.8 Corals, Hydroids, Jellyfish (Phylum Cnidaria)

There are over 10,000 marine species of corals, hydroids, and jellyfish worldwide (Appeltans et al. 2010). Members of this group are found throughout the Study Area at all depths. Hydroids are colonial animals similar in form to corals. Hydroids have both flexible and rigid skeletons, but are not considered to be habitat-forming (Colin and Arneson 1995a; Gulko 1998). Jellyfish are motile as larvae, sessile as an intermediate colonial polyp stage, and motile as adults (Brusca and Brusca 2003). They are predatory at all stages and, like all Cnidaria, use tentacles equipped with stinging cells to capture prey (Castro and Huber 2000; University of California at Berkeley 2010a). Jellyfish are an important prey species for a range of organisms, including some sea turtles and ocean sunfish (*Mola mola*) (Heithaus et al. 2002; James and Herman 2001).

Corals are in a class of animals that also includes anemones and soft corals. The individual unit is referred to as a polyp, and most species occur as colonies of polyps. Reef-building corals in the photic zone, shallower than approximately 650 ft. (200 m), usually host zooxanthellae that provide extra energy to the corals (Castro and Huber 2000). All corals feed on small planktonic organisms or dissolved organic matter, although some shallow-water corals derive most of their energy from their symbiotic algae (Dubinsky and Berman-Frank 2001). Most hard corals and some soft corals are habitat-forming (i.e., they form coral reefs) (Freiwald et al. 2004; Spalding et al. 2001), and some soft corals define particular habitat types (e.g., hard bottom is typically characterized by sponges and soft corals) (South Atlantic Fishery Management Council 1998).

Apart from a few exceptions in the Pacific Ocean, coral reefs are confined to the warm tropical and subtropical waters between 30 degrees (°) North (N) and 30° South (S). The dominant species of corals in the Insular Pacific-Hawaiian Large Marine Ecosystem are in the genera Porites, Montipora, and Pavona (National Marine Fisheries Service 2007, 2009). Deep-sea coral communities are prevalent throughout the Hawaiian archipelago, and often form offshore reefs that surround all of the Main Hawaiian Islands at depths between 27 and 109 fathoms (Maragos 1998). Much like shallow-water corals, deep-sea corals are fragile, slow growing, and can survive for hundreds of years (Roberts and Hirshfield, 2003). In the Hawaiian Islands, gorgonians are the most common group of deep-sea corals. Of the gorgonians, primnoids are the most abundant group in the Hawaiian archipelago and are dominant off Molokai (Chave and Malahoff, 1998).

While there are no coral reefs in the eastern Pacific Ocean, there are cold-water coral species that would occur within the California Current Large Marine Ecosystem. Corals of the in the California portion of the Study Area include anthozoans and hydrozoans (or hydrocorals); anthozoans include hexacorals and octocorals. Hexacorals are represented by scleractinians (stony corals), antipatharians (black corals), and corallimorpharians (coral-like organisms lacking a calcium carbonate skeleton); octocorals include soft corals and gorgonians (e.g., sea fans). Most of the habitat-forming deep-sea corals are anthozoans and hydrozoans (Etnoyer and Morgan 2003, 2005). The majorities of stony corals within the California Current Large Marine Ecosystem are, however, azooxanthellate and obtain energy from detritus, zooplankton, and nekton they capture from the surrounding water (Cairns 1994; Roberts and Hirshfield 2003). Since azooxanthellate corals do not depend on sunlight or a symbiotic existence with zooxanthellae, they can be found in water depths exceeding 20,000 ft (6,000 m) (Etnoyer and Morgan 2005).

3.8.2.9 Flatworms (Phylum Platyhelminthes)

Flatworms include between 8,000 and 20,000 marine species worldwide (Appeltans et al. 2010; Castro and Huber 2000), and are the simplest form of marine worm (Castro and Huber 2000). The largest single group of flatworms is parasites commonly found in fishes, seabirds, and whales (Castro and Huber 2000; University of California Berkeley 2010b). The life history of parasitic flatworms plays a role in the regulation of populations for the marine vertebrates they inhabit. Ingestion by the host organism is the primary dispersal method for parasitic flatworms. As parasites, they are not typically found in the water column, outside of a host organism. The remaining groups are non-parasitic carnivores, living without a host. Flatworms are found throughout the Study Area living on rocks in tide pools and reefs, or within the top layer of sandy areas. Flatworms in the genera *Waminoa* and *Freemania* occur in the waters around the California Current Large Marine Ecosystems. Dominant genera of flatworms in the Insular Pacific-Hawaiian Large Marine Ecosystem include *Pseudobiceros* and *Pseudoceros* (Appeltans et al. 2010; Castro and Huber 2000).

3.8.2.10 Ribbon Worms (Phylum Nemertea)

Ribbon worms include approximately 1,000 marine species worldwide (Appeltans et al. 2010). Ribbon worms, with their distinct gut and mouth parts, are more complex than flatworms (Castro and Huber 2000). Organisms in this phylum are bottom-dwelling, predatory marine worms that are equipped with a long extension from the mouth (proboscis) that helps them capture food (Castro and Huber 2000). Some species are also equipped with a sharp needle-like structure that delivers poison to kill prey. Ribbon worms occupy an important place in the marine food web as prey for a variety of fish and invertebrates and as a predator of other bottom-dwelling organisms, such as worms and crustaceans (Castro and Huber 2000). Some ribbon worms are parasitic and occupy the inside of the mantle of mollusks, where they feed on the waste products of their host (Castro and Huber 2000). Ribbon worms are found throughout the Study Area in soft-bottom habitat. *Emplectonema gracile* is a common species of ribbon worm that occurs in the waters around the California Current Large Marine Ecosystems. Several species of ribbon worms in the genus *Baseodiscus* are endemic to the Insular Pacific-Hawaiian Large Marine Ecosystem (Castro and Huber 2000).

3.8.2.11 Round Worms (Phylum Nematoda)

Round worms include over 5,000 marine species, though this number may be a gross underestimate (Appeltans et al. 2010). Common genera include *Anisakis* and *Thynnascaris* (Castro and Huber 2000). Round worms are small and cylindrical, and are abundant in sediments and in host organisms as parasites (Castro and Huber 2000). Round worms are one of the most widespread marine invertebrates, with population densities of one million organisms per 11 square feet ($ft.^2$) (1 square meter [m^2]) of mud (Levinton 2009). This group has a variety of food preferences, including algae, small invertebrates, annelid worms, and organic material from sediment. Like free-living flatworms, parasitic nematodes provide important ecosystem services by regulating populations of other marine organisms by causing illness or mortality in less viable organisms. Round worms are found throughout the Study Area. Species in the family Anisakidae infect marine fish, and may cause illness in humans if fish are consumed raw without proper precautions (Castro and Huber 2000).

3.8.2.12 Segmented Worms (Phylum Annelida)

Segmented worms include approximately 12,000 marine species worldwide in the phylum Annelida, although most marine forms are in the class Polychaeta (Appeltans et al. 2010). Segmented worms are the most complex group of marine worms, with a well-developed respiratory and gastrointestinal system (Castro and Huber 2000). Different species of segmented worms may be highly mobile or burrow in the seafloor (Castro and Huber 2000). Most segmented worms are predators; others are scavengers, deposit feeders, filter feeders, or suspension feeders of sand, sediment, and water (Hoover 1998c). The variety of feeding strategies and close connection to the seafloor make Annelids an integral part of the marine food web (Levinton 2009). Burrowing in the seafloor and agitating the sediment increases the oxygen content of the seafloor and makes important buried nutrients available to other organisms. This ecosystem service allows bacteria and other organisms, which are also an important part of the food web, to flourish on the seafloor. Segmented worms are found throughout the Study Area inhabiting rocky, sandy, and muddy areas of the seafloor. Common genera of segmented worms in the California Current Large Marine Ecosystem are *Nereis* and *Phragmatapoma*. Common species in the Insular Pacific-Hawaiian Large Marine Ecosystem are *Loimia medusa* and *Spirobranchus giganteus*. These worms also colonize corals, vessel hulls, docks, and floating debris (Castro and Huber 2000).

3.8.2.13 Bryozoans (Phylum Bryozoa)

Bryozoans are small lace-like, colony-forming animals. Classified in the Phylum Bryozoa, there are approximately 5,000 marine species worldwide (Appeltans et al. 2010). Bryozoans attach to a variety of surfaces, including rocks, shells, wood, and algae, and feed on particles suspended in the water (Hoover 1998a). Bryozoans are found throughout the Study Area. Genera that occur in the California Current Large Marine Ecosystem are *Bugula* and *Schizporella*. Common species in the Insular Pacific-Hawaiian Large Marine Ecosystem are *Disporella violacea* and *Reteporellina denticulate*. Bryozoans are of economic importance for bioprospecting (the search for organisms for potential commercial use in pharmaceuticals). Bryozoans also interfere with boat operations and clog industrial water intakes and conduits (Hoover 1998a).

3.8.2.14 Squid, Bivalves, Sea Snails, Chitons (Phylum Molluska)

Approximately 27,000 marine species are classified in the Phylum Molluska worldwide (Appeltans et al. 2010). Octopus and squid (cephalopods), sea snails and slugs (gastropods), clams and mussels (bivalves), and chitons (polyplacophorans) are mollusks with a muscular organ called a foot, which is used for mobility (Castro and Huber 2000). Sea snails and slugs eat fleshy algae and a variety of invertebrates, including hydroids, sponges, sea urchins, worms, and small crustaceans, as well as detritus (Castro and Huber 2000; Colin and Arneson 1995c). Clams, mussels, and other bivalves feed on plankton and other suspended food particles (Castro and Huber 2000). Chitons use rasping tongues, known as radula, to scrape food (algae) off rocks (Castro and Huber 2000; Colin and Arneson 1995c). Squid and octopus are active swimmers at all depths, and use a beak to prey on a variety of organisms, including fish, shrimp, and other squids (Castro and Huber 2000; Hoover 1998c; Western Pacific Regional Fishery Management Council 2001). Octopuses mostly prey on fish, shrimp, eels, and crabs (Wood and Day 2005).

Important commercial, ecological, and recreational species of Molluska in the California Current Large Marine Ecosystem include all abalone species (black abalone, white abalone, green abalone, red abalone, pink abalone, threaded abalone, and flat abalone) found within the Study Area and the California market squid (*Loligo opalescens*) (Clark et al. 2005). Important commercial, ecological, and recreational species of Molluska in the Insular Pacific-Hawaiian Large Marine Ecosystem include various species of squid, the endemic cuttlefish (*Euprymna scolopes),* and limpets (*Cellana exarata* and *Cellana sandwicensis*), also called opihi (Western Pacific Regional Fishery Management Council 2001).

3.8.2.15 Shrimp, Crab, Lobster, Barnacles, Copepods (Phylum Arthropoda)

Shrimp, crab, lobster, barnacles, and copepods are animals with skeletons on the outside of their body (Castro and Huber 2000). Classified in the Phylum Arthropoda, over 50,000 species belong to the subphylum Crustacea within Phylum Arthropoda (Appeltans et al. 2010). Shrimp, crabs, and lobsters are typically carnivorous or omnivorous predators or scavengers, preying on mollusks (primarily gastropods, such as limpets, sea snails and slugs), other crustaceans, echinoderms (such as starfish, urchins, and sea cucumbers), small fish, algae, and sea grass (Waikiki Aquarium 2009a, b, c; Western Pacific Regional Fishery Management Council 2009). Barnacles and copepods feed by filtering algae and small organisms from the water (Levinton 2009).

Important commercial, ecological, and recreational species of Crustacea in the California Current Large Marine Ecosystem include the spot shrimp (*Pandalus platyceros*), ridgeback rock shrimp (*Sicyonia ingentis*), rock crab (*Cancer* species), sheep crab (*Loxorhynchus grandis*) and California spiny lobster (*Panulirus interruptus*) (Clark et al. 2005). The Hawaiian spiny lobster is an important commercial, ecological, and recreational species of Crustacea in the Insular Pacific-Hawaiian Large Marine Ecosystem.

3.8.2.16 Sea Stars, Sea Urchins, Sea Cucumbers (Phylum Echinodermata)

Phylum Echinodermata has over 6,000 marine species, such as sea stars, sea urchins, and sea cucumbers (Appeltans et al. 2010). Sea stars (asteroids), sea urchins (echinoids), sea cucumbers (holothuriods), brittle stars and basket stars (ophuiroids), and feather stars and sea lilies (crinoids) are symmetrical around the center axis of the body (Castro and Huber 2000). Most echinoderms have separate sexes, but unisexual forms occur among the sea stars, sea cucumbers, and brittle stars. Many species have external fertilization, producing planktonic larvae, but some brood their eggs, never releasing free-swimming larvae (Colin and Arneson 1995b). Many echinoderms are either scavengers or predators on organisms that do not move, such as algae, stony corals, sponges, clams, and oysters (Hoover 1998b). Some species filter food particles from sand, mud, or water.

Important commercial, ecological, and recreational species of echinoderms in the California Current Large Marine Ecosystem include California sea cucumbers (*Parastichopus californicus*), sea stars (*Pisaster* species), red sea urchin (*Strongylocentrotus franciscanus*), and purple sea urchin (*Strongylocentrotus purpuratus*) (Clark et al. 2005). Important commercial, ecological, and recreational species of echinoderm in the Insular Pacific-Hawaiian Large Marine Ecosystem include helmet urchins, the burrowing sea urchin (*Echinometra mathaei*), sea cucumbers, and sea stars. The crown-of-thorns sea star (*Acanthaster planci*) is a carnivorous predator that feeds on coal polyps and can devastate coral reefs because of its voracious appetite (Pawson 1995). In 1969, crown-of-thorns sea stars infested reefs off southern Molokai but did not cause extensive damage to living coral polyps of cauliflower coral (Gulko 1998; Hoover 1998b).

3.8.3 Environmental Consequences

This section analyzes the potential impacts on marine invertebrates from implementing the project alternatives, including the No Action Alternative, Alternative 1, and Alternative 2. Navy training and testing activities are evaluated for their potential impact on marine invertebrates in general, by taxonomic groups, and in detail for species listed under the ESA, species proposed for listing, and federally managed species or groups such as coral Habitat Areas of Particular Concern (Section 3.8.2, Affected Environment).

General characteristics of all Navy stressors were introduced in Section 3.0.5.3 (Identification of Stressors for Analysis) and living resources' general susceptibilities to stressors were introduced in Section 3.0.5.7 (Biological Resource Methods). Stressors vary in intensity, frequency, duration, and location within the Study Area. Based on the general threats to marine invertebrates discussed in Section 3.8.2, Affected Environment, stressors applicable to marine invertebrates in the Study Area and analyzed below include the following:

- Acoustic (sonar and other active acoustic sources and explosions and other impulsive acoustic sources)
- Energy (electromagnetic)
- Physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices)
- Entanglement (cables, wires, and parachutes)
- Ingestion (military expended materials)
- Secondary stressors (metals and chemicals)

These components are analyzed for potential impacts on marine invertebrates within the stressor categories contained in this section. The specific analyses of the training and testing activities consider these components, within the context of geographic location and overlap of marine invertebrates resources. In addition to the analysis here, the details of all training and testing activities, stressors, and geographic occurrence within the Study Area are summarized in Section 3.0.5.3 (Identification of Stressors for Analysis) and detailed in Appendix A (Navy Activities Descriptions).

3.8.3.1 Acoustic Stressors (non-impulsive and impulsive sources)

Assessing whether sounds may disturb or injure an animal involves understanding the characteristics of the acoustic sources, the animals that may be near the sound, and the effects that sound may have on the physiology and behavior of those animals. The methods used to predict acoustic effects on invertebrates build upon the Conceptual Framework for Assessing Effects from Sound-Producing Activities (Section 3.0.5.7.1). Categories of potential impacts are direct trauma, hearing loss, auditory masking, behavioral reactions, and physiological stress. Little information is available on the potential impacts on marine invertebrates of exposure to sonar, explosions, and other sound-producing activities. Most studies focused on squid or crustaceans, and the consequences of exposures to broadband impulsive air guns typically used for seismic exploration, rather than on sonar or explosions.

Direct trauma and mortality may occur due to the rapid pressure changes associated with an explosion. Most marine invertebrates lack air cavities that could make them vulnerable to trauma due to rapid pressure changes. Marine invertebrates could also be displaced by a shock wave, which could cause injury.

To experience hearing impacts, masking, behavioral reactions, or physiological stress, a marine invertebrate must be able to sense sound. Marine invertebrates are likely only sensitive to water particle motion caused by nearby low-frequency sources, and likely do not sense distant or mid- and high-frequency sounds (Section 3.8.2.1, Hearing and Vocalization]). Andre et al. (2011) found progressive damage to statocyst hair cells in squid after exposure to two hours of 50- to 100-Hz sweeps at sound pressure levels of 157 to 175 dB re 1 µPa; however, it is impossible to determine whether damage was because of the sound exposure or some other aspect of capture or captivity because inappropriate and incorrect controls were used. No damage to statocysts and no impacts on crustacean balance (another function of the statocyst) were observed in crustaceans repeatedly exposed to high-intensity airgun firings (Christian et al. 2003; Payne et al. 2007). This limited information suggests that marine invertebrate statocysts may be resistant to impulsive sound impacts, but that the impact of long-term or non-impulsive sound exposures is undetermined.

Masking occurs when a sound interferes with an animal's ability to detect other biologically relevant sounds in its environment. Little is known about how marine invertebrates use sound in their environment. Some studies have shown that crab and coral larvae and post-larvae may use nearby reef sounds when in their settlement phase (Jeffs et al. 2003; Radford et al. 2007; Stanley et al. 2010; Vermeij et al. 2010), although it is unknown what component of reef noise is used. Larvae likely sense particle motion of nearby sounds, limiting their reef noise detection range (less than 328 ft. [100 m]) (Vermeij et al. 2010). Anthropogenic sounds could mask important acoustic cues, affecting detection of settlement cues or predators, potentially affecting larval settlement patterns or survivability in highly modified acoustic environments (Simpson et al. 2011). Low-frequency sounds could interfere with perception of low-frequency rasps or rumbles among crustaceans, although these are often already obscured by ambient noise (Patek et al. 2009).

Studies of invertebrate behavioral responses to sound have focused on responses to impulsive sound. Some captive squid showed strong startle responses, including inking, when exposed to the first shot of broadband sound from a nearby seismic airgun (sound exposure level of 163 dB re 1 μPa^2-s), but strong startle responses were not seen when sounds were gradually increased (McCauley et al. 2000a,b). Slight increases in behavioral responses, such as jetting away or changes in swim speed, were observed at receive levels exceeding 145 dB re 1 μPa^2-s (McCauley et al. 2000a,b). Other studies have shown no observable response by marine invertebrates to sounds. Snow crabs did not react to repeated firings of a seismic airgun (peak received sound level was 201 dB re 1 µPa) (Christian et al. 2003), while squid did not respond to killer whale echolocation clicks (higher frequency signals ranging from 199 to 226 dB re 1 µPa) (Wilson et al. 2007). Krill did not respond to a research vessel approaching at 2.7 knots (source level below 150 dB re 1 µPa) (Brierley et al. 2003). Distraction may be a consequence of some sound exposures. Hermit crabs were shown to delay reaction to an approaching visual threat when exposed to continuous noise, putting them at increased risk of predation (Chan et al. 2010).

There is some evidence of possible stress effects on invertebrates from long-term or intense sound exposure. Captive sand shrimp exposed to low-frequency noise (30 to 40 dB above ambient) continuously for three months demonstrated decreases in both growth rate and reproductive rate (Lagardère 1982). Sand shrimp showed lower rates of metabolism when kept in quiet, soundproofed tanks than when kept in tanks with typical ambient noise (Lagardère and Régnault 1980). Repeated intense airgun exposures caused no changes in biochemical stress markers in snow crabs (Christian et al. 2003), but some biochemical stress markers were observed in lobsters (Payne et al. 2007). The study indicated that this may have been because of captivity rather than noise exposure. The effect of long-term (multiple years), intermittent sound exposure was examined in a statistical analysis of recorded catch rate of rock lobster and seismic airgun activity (Parry and Gason 2006). No correlation was found between catch rate and seismic airgun activity, implying no long-term population impacts from intermittent anthropogenic sound exposure over long periods.

Because research on the consequences of exposing marine invertebrates to anthropogenic sounds is limited, qualitative analyses were conducted to determine the effects of the following acoustic stressors on marine invertebrates within the Study Area: non-impulsive sources (including sonar, vessel noise, aircraft overflights, and other active acoustic sources) and impulsive acoustic sources (including explosives, pile driving, airguns, and weapons firing).

3.8.3.1.1 Impacts from Sonar and Other Non-impulsive Sources

Sources of non-impulsive underwater sound during testing and training events include broadband vessel noise (including surface ships, boats, and submarines), aircraft overflight noise (fixed-wing and rotary-wing aircraft), sonar, and other active non-impulsive sources. Non-impulsive sounds associated with testing and training are described in Section 3.0.5.3.1 (Acoustic Stressors).

Surface combatant ships and submarines are designed to be quiet to evade enemy detection, whereas other Navy ships and small craft have higher source levels, similar to equivalently sized commercial ships and private vessels (see Section 3.0.5.3.1.6, Vessel Noise). Ship noise tends to be low-frequency and broadband. Broadband noise from aircraft would depend on the platform, speed, and altitude (see Section 3.0.5.3.1.7, Aircraft Overflight Noise). Any sound transmitted through the air-water interface. Underwater sounds from aircraft are strongest just below the surface and directly under the aircraft. Sonar and other active acoustic sound sources emit sound waves into the water to detect objects, safely navigate, and communicate. These sources may emit low-, mid-, high-, or very-high-frequency sounds at various sound pressure levels.

Most marine invertebrates do not have the capability to sense sound; however, some may be sensitive to nearby low-frequency and possibly lower-mid-frequency sounds, such as some active acoustic sources or vessel noise (see Section 3.8.2.1, Invertebrate Hearing and Vocalization). Because marine invertebrates lack the adaptations that would allow them to sense sound pressure at long distances, the distance at which they may detect a sound is probably limited.

The relatively low sound pressure level beneath the water surface due to aircraft is likely not detectable by most marine invertebrates. For example, the sound pressure level from an H-60 helicopter hovering at 50 ft. is estimated to be about 125 dB re 1 µPa at 1 m below the surface, a sound pressure lower than other sounds to which marine invertebrates have shown no reaction (see Section 3.8.3.1, Acoustic Stressors). Therefore, impacts due to aircraft overflight noise are not expected.

3.8.3.1.1.1 No Action Alternative

<u>Training Activities</u>

Under the No Action Alternative, training activities using sonar and other active acoustic sources could occur throughout the Study Area, but would typically occur in the Southern California Range Complex (SOCAL) and HRC. Certain portions of the Study Area, such as areas near Navy ports, airfields, and range complexes are used more heavily by vessels and aircraft than other portions of the Study Area. Navy vessel noise and aircraft overflight noise associated with training could occur in all of the range complexes and throughout the Study Area while in transit. The locations and number of activities proposed for training under the No Action Alternative are shown in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Sounds produced during training are described in Section

3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

As discussed above, most marine invertebrates would not sense mid- or high-frequency sounds, distant sounds, or aircraft noise transmitted through the air-water interface (see Section 3.8.2.1, Invertebrate Hearing and Vocalization). Most marine invertebrates would not be close enough to intense sound sources, such as some sonars, to potentially experience impacts to sensory structures. Any marine invertebrate capable of sensing sound may alter its behavior if exposed to non-impulsive sound, although it is unknown if responses to non-impulsive sounds occur. Continuous noise, such as from vessels, may contribute to masking of relevant environmental sounds, such as reef noise. Because the distance over which most marine invertebrates are expected to detect any sounds is limited and vessels would be in transit, any sound exposures with the potential to cause masking or behavioral responses would be brief. Without prolonged proximate exposures, long-term impacts are not expected. Although non-impulsive underwater sounds produced during training activities may briefly impact individuals, intermittent exposures to non-impulsive sounds are not expected to impact survival, growth, recruitment, or reproduction of widespread marine invertebrate populations.

Under the No Action Alternative, ESA-listed black and white abalone would not be expected to be able to hear any sonar or any other active acoustic sources. Training activities using sonar and other active acoustic sources are not proposed in ESA-listed black and white abalone critical habitat designated in shallow waters within SOCAL. Any noise produced by transiting vessels would not result in the destruction or impairment of any hard substrate that could be ESA-listed black and white abalone habitat, nor would it be close enough to interfere cause noise masking.

Under the ESA, underwater non-impulsive sound generated during training activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under the ESA, underwater non-impulsive sound generated during training activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Under the No Action Alternative, testing activities using sonar and other active acoustic sources could occur throughout the Study Area, but would typically occur in SOCAL and HRC. Certain portions of the Study Area, such as areas near Navy ports and airfields, installations, and training and testing ranges are used more heavily by vessels and aircraft than other portions of the Study Area. Underwater noise from vessels and aircraft overflights associated with testing could occur in all the range complexes, the training ranges, and throughout the Study Area while in transit. The locations and number of activities proposed for testing under the No Action Alternative are shown in Table 2.8-2 through 2.8-5 of Chapter 2 (Description of Proposed Action and Alternatives). Sounds produced during testing are described in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

As discussed above, most marine invertebrates would not sense mid- or high-frequency sounds, distant sounds, or aircraft noise transmitted through the air-water interface (see Section 3.8.2.1, Invertebrate Hearing and Vocalization). Most marine invertebrates would not be close enough to intense sound sources, such as some sonars, to potentially experience impacts to sensory structures. Any marine invertebrate capable of sensing sound may alter its behavior if exposed to non-impulsive sound, although it is unknown if responses to non-impulsive sounds occur. Continuous noise, such as from vessels, may contribute to masking of relevant environmental sounds, such as reef noise. Because the distance over which most marine invertebrates are expected to detect any sounds is limited and vessels would be in transit, any sound exposures with the potential to cause masking or behavioral responses would be brief. Without prolonged proximate exposures, long-term impacts are not expected. Although non-impulsive underwater sounds produced during training activities may briefly impact individuals, intermittent exposures to non-impulsive sounds are not expected to impact survival, growth, recruitment, or reproduction of widespread marine invertebrate populations.

Under the No Action Alternative, ESA-listed black and white abalone would not be expected to be able to hear any sonar or any other active acoustic sources. Training activities using sonar and other active acoustic sources are not proposed in ESA-listed black and white abalone critical habitat designated in shallow waters within SOCAL. Any noise produced by transiting vessels would not result in the destruction or impairment of any hard substrate that could be ESA-listed black and white abalone habitat, nor would it be close enough to interfere cause noise masking.

Under the ESA, underwater non-impulsive sound generated during testing activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under the ESA, underwater non-impulsive sound generated during testing activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

3.8.3.1.1.2 Alternative 1

Training Activities

Under Alternative 1, marine invertebrates would be exposed to increased amounts of non-impulsive noise compared to the No Action alternative due to increased use of sonars and other active acoustic sources, vessels, and aircraft overflights. Non-impulsive sound sources used during training would be similar to those under the No Action Alternative, with the addition of new active acoustic sources associated with the introduction of the Littoral Combat Ship. The locations of training using vessels, aircraft, and sonars would be similar to those under the No Action Alternative. The locations and number of activities proposed for training under Alternative 1 are shown in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). Sounds produced during training are described in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

In comparison to the No Action Alternative, the increased use of sonars, vessels, and aircraft associated with training under Alternative 1 would increase the likelihood of exposure of marine invertebrates to non-impulsive underwater sounds. The expected impacts to any individual marine invertebrates capable of detecting the sound, however, would remain the same. For the same reasons as stated in Section 3.8.3.1.1.1 (No Action Alternative), non-impulsive sounds associated with training are not expected to impact most marine invertebrates or cause more than a short-term behavioral disturbance to some marine invertebrates capable of detecting nearby sound. No long-term impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected. Similarly, non-impulsive underwater sound during training would not impact ESA-listed black and white abalone or critical habitat.

Under the ESA, underwater non-impulsive sound generated during training activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under the ESA, underwater non-impulsive sound generated during training activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Under Alternative 1, marine invertebrates would be exposed to increased amounts of sonars and active acoustic sources (including sources not analyzed under the No Action Alternative), vessel noise, and aircraft overflight noise during testing activities compared to the No Action Alternative. The locations of testing activities using vessels, aircraft, and sonars and other active acoustic sources would be similar to those under the No Action Alternative. The locations and number of activities proposed for testing under Alternative 1 are shown in Tables 2.8-2 through 2.8-5 of Chapter 2 (Description of Proposed Action and Alternatives). Sounds produced during testing are described in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

In comparison to the No Action Alternative, the increased use of sonars, vessels, and aircraft associated with testing under Alternative 1 would increase the likelihood of exposure of marine invertebrates to non-impulsive underwater sounds. The expected impacts to any individual marine invertebrates capable of detecting the sound, however, would remain the same. For the same reasons as stated in Section 3.8.3.1.1.1 (No Action Alternative), non-impulsive sounds associated with testing are not expected to impact most marine invertebrates or cause more than a short-term behavioral disturbance to some marine invertebrates capable of detecting nearby sound. No long-term impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected. Similarly, non-impulsive underwater sound during training would not impact ESA-listed black and white abalone or critical habitat.

Under the ESA, underwater non-impulsive sound generated during testing activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under the ESA, underwater non-impulsive sound generated during testing activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.1.1.3 Alternative 2

Training Activities

Under Alternative 2, the number of training activities with non-impulsive sound would be the same as under Alternative 1. Therefore, Alternative 2 would have the same effects as under Alternative 1.

Under the ESA, underwater non-impulsive sound generated during training activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under the ESA, underwater non-impulsive sound generated during training activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Under Alternative 2, marine invertebrates would be exposed to increased amounts of sonars and active acoustic sources, vessel noise, and aircraft overflight noise during testing activities compared to the No Action Alternative. The locations of testing activities using vessels, aircraft, and sonars and other active acoustic sources would be similar to those under the No Action Alternative. The locations and number of activities proposed for testing under Alternative 2 are shown in Tables 2.8-2 through 2.8-5 of Chapter 2

(Description of Proposed Action and Alternatives). Sounds produced during testing are described in Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), Section 3.0.5.3.1.6 (Vessel Noise), and Section 3.0.5.3.1.7 (Aircraft Overflight Noise).

In comparison to the No Action Alternative, the increased use of sonars, vessels, and aircraft associated with testing under Alternative 2 would increase the likelihood of exposure of marine invertebrates to non-impulsive underwater sounds. The expected impacts to any individual marine invertebrates capable of detecting the sound, however, would remain the same. For the same reasons as stated in Section 3.8.3.1.1.2 (Alternative 1), non-impulsive sounds associated with testing are not expected to impact most marine invertebrates or cause more than a short-term behavioral disturbance to some marine invertebrates capable of detecting nearby sound. No long-term impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected. Similar to Alternative 2, non-impulsive underwater sound during training would not affect ESA-listed black or white abalone or their critical habitats.

Under the ESA, underwater non-impulsive sound generated during testing activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under the ESA, underwater non-impulsive sound generated during testing activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.1.2 Impacts from Explosions and Other Impulsive Sources

Explosions; impact pile driving; weapons firing, launch, and impact of ordnance on the water surface; and airguns introduce loud, impulsive, broadband sounds into the marine environment. Impulsive sources are characterized by rapid pressure rise times and high peak pressures. Explosions produce high-pressure shock waves that could cause injury or physical disturbance due to rapid pressure changes. Some other impulsive sources, such as airguns and impact pile driving, also produce shock waves, but of lower intensity. Impulsive sounds are usually brief, but the associated rapid pressure changes can injure or startle marine invertebrates.

Limited studies of crustaceans have examined mortality rates at various distances from detonations in shallow water (Aplin 1947; Chesapeake Biological Laboratory 1948; Gaspin et al. 1976). Similar studies of mollusks have shown them to be more resistant than crustaceans to explosive impacts (Chesapeake Biological Laboratory 1948; Gaspin et al. 1976). Other invertebrates found in association with mollusks, such as sea anemones, polychaete worms, isopods, and amphipods, were observed to be undamaged in areas near detonations (Gaspin et al. 1976). Using data from these experiments, Young (1991) developed curves that estimate the distance from an explosion beyond which at least 90 percent of certain marine invertebrates would survive, depending on the weight of the explosive (Figure 3.8-2).

In deeper waters where most detonations would occur near the water surface, most benthic marine invertebrates would be beyond the 90 percent survivability ranges shown above, even for larger quantities of explosives. In addition, most detonations would occur near the water surface, releasing a portion of the explosive energy into the air rather than the water and reducing impacts to marine invertebrates throughout the water column. The number of organisms affected would depend on the size of the explosive, the distance from the explosion, and the presence of groups of pelagic invertebrates. In addition to trauma caused by a shock wave, organisms could be killed in an area of cavitation that forms near the surface above large underwater detonations. Cavitation is where the reflected shock wave creates a region of negative pressure followed by a collapse, or water hammer (see Section 3.0.4, Acoustic and Explosives Primer).

Some charges are detonated in shallow water or near the seafloor, including explosive ordnance demolition charges and some explosions associated with mine warfare. In addition to injuring nearby organisms, a blast near the bottom could potentially disturb hard substrate suitable for colonization (see Section 3.3.3.1, Acoustic Stressors). An explosion in the near vicinity of hard corals could cause fragmentation and siltation of the corals. Shallow coral reefs and live hardbottom are avoided during activities involving explosives (see Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring).

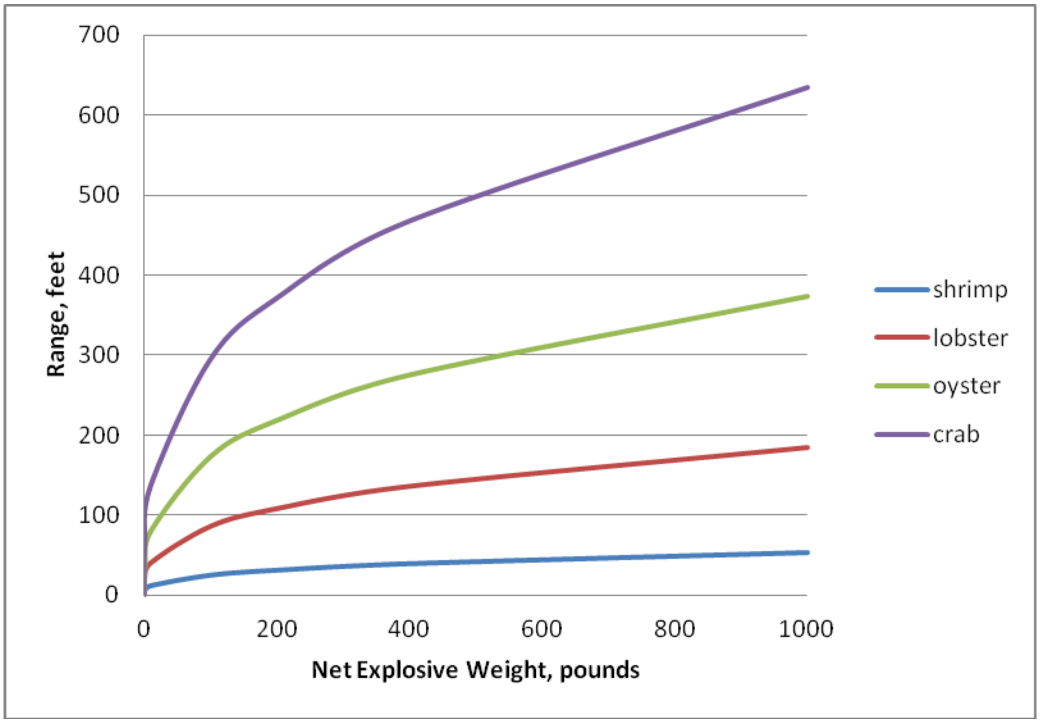

Figure 3.8-2: Prediction of Distance to 90 Percent Survivability of Marine Invertebrates Exposed to an Underwater Explosion (Young 1991)

Impulses from pile driving and removal are broadband and carry most of their energy in the lower frequencies (see Section 3.0.5.3.1.3, Pile Driving, for a discussion of sounds produced during impact pile driving and vibratory pile removal). Impact pile driving can produce a shock wave that is transmitted to the sediment and water column (Reinhall and Dahl 2011). Nearby marine invertebrates could be killed or injured by the physical placement of the pile or by the impulses. Marine invertebrates in the area around a pile driving and vibratory removal site would be exposed to multiple impulsive sounds over an estimated 13 days. Repeated exposures to impulsive noise, such as pile driving, could damage structures used by some marine invertebrates to sense water motion, although studies have shown crustaceans may withstand repeated impulsive exposures without sensory damage.

Air guns have slower rise times and lower peak pressures than many explosives. Studies of airgun impacts on marine invertebrates have used seismic airguns, which are more powerful than any airguns proposed for use during Navy testing. Studies of crustaceans have shown that adult crustaceans were not noticeably physically affected by exposures to intense seismic airgun use (Christian et al. 2003;

Payne et al. 2007). Snow crab eggs repeatedly exposed to airgun firings had slightly increased mortality and apparent delayed development (Christian et al. 2003), but Dungeness crab (*Metacarcinus magister*) zoeae were not affected by repeated exposures (Pearson et al. 1993). Some squid showed strong startle responses, including inking, when exposed to the first shot of broadband sound from a nearby seismic airgun (sound exposure level of 163 dB re 1 µPa^2-s), but strong startle responses were not seen when sounds were gradually increased (McCauley et al. 2000a; McCauley et al. 2000b). Seismic airguns were implicated in giant squid strandings in unpublished reports (Guerra and Gonzales 2006; Guerra et al. 2004). Although analyses of the damage to the stranded squid were inconclusive and proximity to the airguns was unknown, the report hypothesized that the squid may have become disoriented due to statolith damage or may have been close enough to experience shock wave impacts. Airguns used during testing of swimmer defense systems are intended to be nonlethal swimmer deterrents, and are substantially less powerful than those used in seismic studies. It is unlikely that they would injure marine invertebrates. Some pelagic invertebrates such as squid within a short distance may startle and swim away from these airguns.

Firing weapons on a ship generates sound by firing the gun (muzzle blast), the shell flying through the air, and vibration from the blast propagating through the ship's hull (see Section 3.0.5.3.1.5, Weapons Firing, Launch, and Impact Noise). In addition, larger non-explosive munitions and targets could produce loud impulsive noise when hitting the water, depending on the size, weight, and speed of the object at impact (McLennan 1997). Small- and medium-caliber munitions are not expected to produce substantial impact noise.

Based on studies with airguns, some marine invertebrates exposed to impulsive sounds from airguns and weapons firing may exhibit startle reactions, such as inking by a squid or changes in swim speed. Similarly, marine invertebrates beyond the range to any injurious effects from exposure to explosions or pile driving may also exhibit startle reactions. Repetitive impulses during pile driving or multiple explosions, such as during a firing exercise, may be more likely to have injurious effects or cause avoidance reactions. However, impulsive sounds produced in water during testing and training are single impulses or multiple impulses over a limited duration (e.g., gun firing or driving a pile). Any auditory masking, in which the sound of an impulse could prevent detection of other biologically relevant sounds, would be very brief.

At a distance, impulses lose their high pressure peak and take on characteristics of non-impulsive acoustic waves. Similar to the impacts expected for non-impulsive sounds discussed previously, it is expected these exposures would cause no more than brief startle reactions in some marine invertebrates.

3.8.3.1.2.1 No Action Alternative

Training Activities

Under the No Action Alternative, marine invertebrates would be exposed to explosions at or beneath the water surface and underwater impulsive noise from weapons firing, launches, impacts of non-explosive munitions, and pile driving during training activities. Noise could be produced by explosions, weapons firing, launches, and impacts of non-explosive munitions throughout the Study Area, including HRC, SOCAL, and Silver Strand Training Complex (SSTC). The number of training events using explosives, weapons firing, launches, and non-explosive munitions and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). A discussion of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosions). The largest source class proposed for training under the No Action Alternative is E12 (651-1,000 pounds [lb.]

net explosive weight), used during bombing exercises (air-to-surface) and sinking exercises. The types of noise produced during weapons firing, launches, and non-explosive munitions impact are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). Pile driving noise is discussed in Section 3.0.5.3.1.3 (Pile Driving).

In general, explosive events would consist of a single explosion or a few smaller explosions over a short period. Some marine invertebrates close to a detonation would likely be killed, injured, broken, or displaced. Most detonations would occur greater than 3 nm from shore. As water depth increases away from shore, benthic invertebrates would be less likely to be impacted by detonations at or near the surface. In addition, detonations near the surface would release a portion of their explosive energy into the air, reducing the explosive impacts in the water.

Many corals and hardbottom invertebrates are sessile, fragile, and particularly vulnerable to shock wave impacts. Many of these organisms are slow-growing and could require decades to recover (Precht et al. 2001). Explosive impacts on benthic invertebrates are more likely when an explosive is large compared to the water depth or when an explosive is detonated at or near the bottom; however, most explosions would occur at or near the water surface, reducing the likelihood of bottom impacts.

Explosions from underwater detonations during mine warfare activities could create show waves that may affect ESA-listed black and white abalone. Underwater detonations, however, would typically occur over soft-bottom substrate, which is not considered black or white abalone habitat. There is no designated critical habitat for ESA-listed black or white abalone on San Clemente Island, and other underwater explosions would not overlap with critical habitat.

Pile driving could cause additional injury, mortality, displacement, or disturbance of marine invertebrates in the vicinity of the construction area; however, impacts at the proposed sandy beach and San Diego Bay locations would be recoverable. Because impulsive exposures are brief, limited in number, spread over a large area, no long-term impacts due to startle reactions or short-term behavioral changes would be expected.

Noise produced by weapons firing, launches, and impacts of non-explosive munitions would consist of a single or several impulses over a short period and would likely not be injurious.

Some marine invertebrates may be sensitive to the low-frequency component of impulsive sound, and they may exhibit startle reactions or temporary changes in swim speed in response to an impulsive exposure. Because exposures are brief, limited in number, and spread over a large area, no long-term impacts due to startle reactions or short-term behavioral changes are expected. Although individual marine invertebrates may be injured or killed during an explosion, no long-term impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected.

Under ESA, explosions and underwater impulsive sound generated during training activities under the No Action Alternative may affect, but would not likely adversely affect, ESA-listed abalone species.

Under ESA, explosions and underwater impulsive sound generated during training activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Under the No Action Alternative, marine invertebrates would be exposed to explosions at or beneath the water surface and underwater impulsive sounds from airguns, weapons firing, launches, and impacts of non-explosive munitions during testing activities. Testing activities under the No Action Alternative would not include pile driving. Noise could be produced by explosions, weapons firing, launches, and impacts of non-explosive munitions throughout the Study Area, including HRC, SOCAL, and SSTC. The number of testing events using explosives, airguns, weapons firing, launches, and non-explosive munitions and their proposed locations are presented in Tables 2.8-2 through 2.8-5 of Chapter 2 (Description of Proposed Action and Alternatives). A discussion of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosions). The types of noise produced during weapons firing, launches, and non-explosive munitions impact are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). Noise produced by the firing of airguns is discussed in Section 3.0.5.3.1.4 (Swimmer Defense Airguns). The largest source class proposed for testing under the No Action Alternative is E12 (651-1,000 lb. net explosive weight).

Many corals and hardbottom invertebrates are sessile, fragile, and particularly vulnerable to shock wave impacts. Many of these organisms are slow-growing and could require decades to recover (Precht et al. 2001). Explosive impacts on benthic invertebrates are more likely when an explosive is large compared to the water depth or when an explosive is detonated at or near the bottom; however, most explosions would occur at or near the water surface, reducing the likelihood of bottom impacts.

Explosions from underwater detonations during mine warfare activities could create show waves that may affect ESA-listed black and white abalone. Underwater detonations, however, would typically occur over soft-bottom substrate, which is not considered black or white abalone habitat. There is no designated critical habitat for ESA-listed black or white abalone on San Clemente Island, and other underwater explosions would not overlap with critical habitat.

Noise produced by swimmer defense airguns, weapons firing, launches, and impacts of non-explosive munitions would consist of a single or several impulses over a short period and would likely not be injurious.

Some marine invertebrates may be sensitive to the low-frequency component of impulsive sound, and they may exhibit startle reactions or temporary changes in swim speed in response to an impulsive exposure. Because impulsive exposures are brief, limited in number, and spread over a large area, no long-term impacts due to startle reactions or short-term behavioral changes are expected. Although individual marine invertebrates may be injured or killed during an explosion, no long-term impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected.

Under ESA, explosions and underwater impulsive sound generated during testing activities under the No Action Alternative may affect, but would not likely adversely affect, ESA-listed abalone species.

Under ESA, explosions and underwater impulsive sound generated during testing activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitat

3.8.3.1.2.2 Alternative 1

Training Activities

Under Alternative 1, marine invertebrates would be exposed to explosions at or beneath the water surface and underwater impulsive noise from weapons firing, launches, impacts of non-explosive munitions, and pile driving during training activities. Although training would increase, it would generally occur in the same areas as under the No Action Alternative, with the addition of explosives used during mine neutralization- explosive ordnance demolition. The largest source class proposed for training under Alternative 1 is E12 (651-1,000 lb. net explosive weight), used during bombing exercises (air-to-surface) and sinking exercises. The number of training events using explosives, weapons firing, launches, and non-explosive munitions and their proposed locations are presented in Table 2.8-1 of Chapter 2 (Description of Proposed Action and Alternatives). A discussion of explosives and the number of detonations in each source class are provided in Section 3.0.5.3.1.2 (Explosions). The types of noise produced during weapons firing, launches, and non-explosive munitions impact are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). Pile driving noise is discussed in Section 3.0.5.3.1.3 (Pile Driving).

Although more marine invertebrates could be exposed to explosions at or near the water surface and underwater impulsive noise due to weapons firing, launches, and non-explosive munitions impacts, the type of impacts to individual marine invertebrates are expected to remain the same as those described under the No Action Alternative (Section 3.8.3.1.2.1, No Action Alternative). Although individual marine invertebrates may be injured or killed during an explosion or during pile driving, no long-term impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected.

Explosions from underwater detonations during mine warfare activities could create show waves that may affect ESA-listed black and white abalone. Underwater detonations, however, would typically occur over soft-bottom substrate, which is not considered black or white abalone habitat. There is no designated critical habitat for ESA-listed black or white abalone on San Clemente Island, and other underwater explosions would not overlap with critical habitat.

Under ESA, explosions and underwater impulsive sound generated during training activities under Alternative 1 may affect, but would not likely adversely affect, ESA-listed abalone species.

Under ESA, explosions and underwater impulsive sound generated during training activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Under Alternative 1, marine invertebrates would be exposed to additional explosions at or beneath the water surface and increased amounts of underwater impulsive sounds due to airguns, weapons firing, launch, and impacts of non-explosive munitions during testing activities. Testing activities under Alternative 1 would not include pile driving. The description, number, and proposed locations of testing activities are presented in Tables 2.8-2 through 2.8-5 of Chapter 2 (Description of Proposed Action and Alternatives).

Testing activities under Alternative 1 that produce in-water noise from weapons firing, launch, and impacts of non-explosive munitions with the water's surface would increase compared to the No Action Alternative. The types of noise produced during weapons firing, launches, and non-explosive munitions impact are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise).

Although more marine invertebrates could be exposed to explosions and impulsive noise due to airguns, weapons firing, launches, and non-explosive munitions impacts, the type of impacts to individual marine invertebrates are expected to remain the same as those described under the No Action Alternative (Section 3.8.3.1.2.1, No Action Alternative). Because impulsive exposures are brief, limited in number, and spread over a large area, no long-term impacts due to startle reactions or short-term behavioral changes are expected. Although individual marine invertebrates may be injured or killed during an explosion, no long-term impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected.

Explosions from underwater detonations during mine warfare activities could create show waves that may affect ESA-listed black and white abalone. Underwater detonations, however, would typically occur over soft-bottom substrate, which is not considered black or white abalone habitat. There is no designated critical habitat for ESA-listed black or white abalone on San Clemente Island, and other underwater explosions would not overlap with critical habitat.

Under ESA, explosions and underwater impulsive sound generated during testing activities under Alternative 1 may affect, but would not likely adversely affect, ESA-listed abalone species.

Under ESA, explosions and underwater impulsive sound generated during testing activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.1.2.3 Alternative 2

Training Activities

Under Alternative 2, the number of training activities and number of underwater explosions would be the same as under Alternative 1. Therefore, Alternative 2 would have the same effects as under Alternative 1.

Under ESA, explosions and underwater impulsive sound generated during training activities under Alternative 2 may affect, but would not likely adversely affect, ESA-listed abalone species.

Under ESA, explosions and underwater impulsive sound generated during training activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Under Alternative 2, marine invertebrates would be exposed to additional explosions at or beneath the water surface and increased amounts of underwater impulsive sounds due to airguns, weapons firing, launch, and impacts of non-explosive munitions during testing activities. Testing activities under Alternative 2 would not include pile driving. The description, number, and proposed locations of testing activities are presented in Tables 2.8-2 through 2.8-5 of Chapter 2 (Description of Proposed Action and Alternatives).

Testing activities under Alternative 2 that produce in-water noise from weapons firing, launch, and impacts of non-explosive munitions with the water's surface would increase compared to the No Action Alternative. The types of noise produced during weapons firing, launches, and non-explosive munitions impact are discussed in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise).

Although more marine invertebrates could be exposed to explosions and impulsive noise due to airguns, weapons firing, launches, and non-explosive munitions impacts, the type of impacts to individual marine invertebrates are expected to remain the same as those described under the No Action Alternative (Section 3.8.3.1.2.1, No Action Alternative). Because impulsive exposures are brief, limited in number, and spread over a large area, no long-term impacts due to startle reactions or short-term behavioral changes are expected. Although individual marine invertebrates may be injured or killed during an explosion, no long-term impacts on the survival, growth, recruitment, or reproduction of marine invertebrate populations are expected.

Explosions from underwater detonations during mine warfare activities could create show waves that may affect ESA-listed black and white abalone. Underwater detonations, however, would typically occur over soft-bottom substrate, which is not considered black or white abalone habitat. There is no designated critical habitat for ESA-listed black or white abalone on San Clemente Island, and other underwater explosions would not overlap with critical habitat.

Under ESA, explosions and underwater impulsive sound generated during testing activities under Alternative 2 may affect, but would not likely adversely affect, ESA-listed abalone species.

Under ESA, explosions and underwater impulsive sound generated during testing activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.1.3 Summation of Effects from Acoustic Stressors

Under the No Action Alternative, Alternative 1, or Alternative 2, exposures to sound-producing and explosive stressors would occur primarily within the range complexes and testing ranges. The Navy identified and analyzed the following acoustic and explosive stressors that could impact marine invertebrates: sonar, other active acoustic sources, vessels, aircraft, explosions, pile driving, airguns, weapons firing, weapons launches, and non-explosive water surface impacts. Both pelagic and benthic marine invertebrates could be impacted by these stressors. In most cases, marine invertebrates would not respond to impulsive and non-impulsive sounds, although they may detect and briefly respond to nearby low-frequency sounds. These short-term responses would likely be inconsequential. Explosions and pile driving would likely kill or injure nearby marine invertebrates. Explosions near the seafloor and very large explosions in the water column may impact shallow water corals, hardbottom habitat and associated marine invertebrates, and deep-water corals from physical disturbance, fragmentation, or mortality. Most explosions at the water surface would not injure benthic marine invertebrates because the explosive weights would be small compared to the water depth.

3.8.3.2 Energy Stressors

This section analyzes the potential impacts of the various types of energy stressors that can occur during training and testing activities within the Study Area. This section includes analysis of the potential impacts from electromagnetic devices.

3.8.3.2.1 Impacts from Electromagnetic Devices

Several different types of electromagnetic devices are used during training and testing activities. For a discussion of the types of activities that use electromagnetic devices, where they are used, and how many activities would occur under each alternative, please see Section 3.0.5.3.2.1 (Electromagnetic). Aspects of electromagnetic stressors that are applicable to marine organisms in general are presented in Section 3.0.5.7.2 (Conceptual Framework for Assessing Effects from Energy-Producing Activities).

Little information exists about marine invertebrates’ susceptibility to electromagnetic fields. Most corals are thought to use water temperature, day length, lunar cycles, and tidal fluctuations as cues for spawning. Magnetic fields are not known to control coral spawning release or larval settlement. Some arthropods (e.g., spiny lobster and American lobster) can sense magnetic fields, and this ability is thought to assist the animal with navigation and orientation (Lohmann et al. 1995, Normandeau et al.

2011). These animals travel relatively long distances during their lives, and magnetic field sensation may exist in other invertebrates that travel long distances. Marine invertebrates, including several commercially important species and federally managed species, could use magnetic cues (Normandeau et al. 2011). Susceptibility experiments have focused on arthropods, but several mollusks and echinoderms are also susceptible. However, because susceptibility is variable within taxonomic groups it is not possible to make generalized predictions for groups of marine invertebrates. Sensitivity thresholds vary by species ranging from 0.3–30 milliteslas, and responses included non-lethal physiological and behavioral changes (Normandeau et al. 2011). The primary use of magnetic cues seems to be navigation and orientation. Human-introduced electromagnetic fields could disrupt these cues and interfere with navigation, orientation, or migration. Because electromagnetic fields weaken exponentially with increasing distance from their source, large and sustained magnetic fields present greater exposure risks than small and transient fields, even if the small field is many times stronger than the earth's magnetic field (Normandeau et al. 2011). Transient or moving electromagnetic fields may cause temporary disturbance to susceptible organisms' navigation and orientation.

Important physical and biological characteristics of designated critical habitat for ESA-listed black and white abalone are defined in Sections 3.8.2.3.2 and 3.8.2.4.2 (Habitat and Geographic Range), respectively. There is no established mechanism for energy stressors to affect important characteristics of this critical habitat. Therefore; it is not probable that energy stressors could degrade the quality or quantity of black and white abalone critical habitat.

3.8.3.2.1.1 No Action Alternative

Training Activities

Table 3.0-18 lists the number and location of training activities that use electromagnetic devices. As indicated in Section 3.0.5.3.2.1 (Electromagnetic), under the No Action Alternative, training activities involving electromagnetic devices occur during magnetic influence mine sweeping activities as part of mine warfare. No training activities involving electromagnetic devices would occur in HRC under the No Action Alternative.

Species that do not occur within these specified areas—including ESA-listed black and white abalone and ESA-candidate coral species—would not be exposed to the electromagnetic fields. Species that do occur within the areas listed above would have the potential to be exposed to the electromagnetic fields. There is no overlap of electromagnetic devices used during training activities with designated critical habitat for black and white abalone. Therefore, electromagnetic devices would not affect black and white abalone critical habitat.

The impact of electromagnetic fields on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the number of activities involving the stressor is low, (3) exposures would be localized, temporary, and would cease with the conclusion of the activity, and (4) even for susceptible organisms invertebrates (e.g., some species of arthropods, mollusks, and echinoderms) the consequences of exposure are limited to temporary disruptions to navigation and orientation.

Under ESA, electromagnetic devices used during training activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under ESA, electromagnetic devices used during training activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Table 3.0-18 lists the number and location of testing activities that use electromagnetic devices. As indicated in Section 3.0.5.3.2.1 (Electromagnetic), under the No Action Alternative, training activities involving electromagnetic devices occur during airborne towed minesweeping systems testing activities in SOCAL; no testing activities involving electromagnetic devices would occur in HRC under the No Action Alternative.

Species that do not occur within these specified areas—including ESA-listed black and white abalone and ESA-candidate coral species—would not be exposed to the electromagnetic fields. Species that do occur within the areas listed above would have the potential to be exposed to the electromagnetic fields. There is no overlap of electromagnetic devices used during training activities with designated critical habitat for black and white abalone. Therefore, electromagnetic devices would not affect black and white abalone critical habitat.

The impact of electromagnetic fields on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the number of activities involving the stressor is low, (3) exposures would be localized, temporary, and would cease with the conclusion of the activity, and (4) even for susceptible organisms invertebrates (e.g., some species of arthropods, mollusks, and echinoderms) the consequences of exposure are limited to temporary disruptions to navigation and orientation.

Under ESA, electromagnetic devices used during testing activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under ESA, electromagnetic devices used during testing activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

3.8.3.2.1.2 Alternative 1

Training Activities

Table 3.0-18 lists the number and location of training activities that use electromagnetic devices. As indicated in Section 3.0.5.3.2.1 (Electromagnetic), under Alternative 1, training activities involving electromagnetic devices occur during magnetic influence mine sweeping activities as part of mine warfare. The number of mine countermeasures activities in SOCAL would remain the same. No training activities involving electromagnetic devices would occur in HRC under the Alternative 1.

Species that do not occur within these specified areas—including ESA-listed black and white abalone and ESA-candidate coral species—would not be exposed to the electromagnetic fields. Species that do occur within the areas listed above would have the potential to be exposed to the electromagnetic fields. There is no overlap of electromagnetic devices used during training activities with designated critical habitat for black and white abalone. Therefore, electromagnetic devices would not affect black and white abalone critical habitat.

As with the No Action Alternative, these training events would occur in open waters where the depth to the seafloor allows for the dissipation of electromagnetic waves. Therefore, since electromagnetic devices would used less often under Alternative 1, effects of electromagnetic stressors would have less of an impact compared to the No Action Alternative.

Under ESA, electromagnetic devices used during training activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under ESA, electromagnetic devices used during training activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Table 3.0-18 lists the number and location of testing activities that use electromagnetic devices. As indicated in Section 3.0.5.3.2.1 (Electromagnetic), under Alternative 1, testing activities involving electromagnetic devices occur during airborne towed minesweeping systems testing activities in SOCAL; no testing activities involving electromagnetic devices would occur in HRC under Alternative 1. The number of testing activities that use electromagnetic devices under Alternative 1 would the same as under the No Action Alternative.

Species that do not occur within these specified areas—including ESA-listed black and white abalone and ESA-candidate coral species—would not be exposed to the electromagnetic fields. Species that do occur within the areas listed above would have the potential to be exposed to the electromagnetic fields. There is no overlap of electromagnetic devices used during training activities with designated critical habitat for black and white abalone. Therefore, electromagnetic devices would not affect black and white abalone critical habitat.

As with the No Action Alternative, testing activities under Alternative 1 would occur in open waters, where depth to the seafloor allows for the dissipation of electromagnetic waves. Therefore, since electromagnetic devices would used in the same number of testing activities, effects of electromagnetic stressors under Alternative 1 would the same impact as under the No Action Alternative.

Under ESA, electromagnetic devices used during testing activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under ESA, electromagnetic devices used during testing activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.2.1.3 Alternative 2

Training Activities

Under Alternative 2, training activities would be consistent with Alternative 1. Therefore, Alternative 2 would have the same effects as under Alternative 1.

Under ESA, electromagnetic devices used during training activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under ESA, electromagnetic devices used during training activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Table 3.0-18 lists the number and location of testing activities that use electromagnetic devices. As indicated in Section 3.0.5.3.2.1 (Electromagnetic). Under Alternative 2, the number of testing activities using electromagnetic devices would be consistent with Alternative 1. Therefore, Alternative 2 would have the same effects as under Alternative 1.

Under ESA, electromagnetic devices used during testing activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under ESA, electromagnetic devices used during testing activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.2.2 Summation of Effects from Energy Stressors

Exposures to energy stressors are limited spatially and temporally. Available evidence suggests that many marine invertebrates, including ESA-listed abalone and ESA-candidate corals, are not susceptible to electromagnetic fields. If susceptible invertebrates are near an electromagnetic source and if they sense the electromagnetic field, it could interfere with navigation and orientation. Because exposures would be temporary and cease with the conclusion of the activity, electromagnetic sources would not impede or disrupt the overall ability of marine invertebrates to navigate, orient, or migrate.

3.8.3.3 Physical Disturbance and Strike

This section analyzes the potential impacts of the various types of physical disturbance and strike stressors used by Navy during training and testing activities within the Study Area. For a list of locations and numbers of activities that may cause physical disturbance and strikes refer to Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors). The physical disturbance and strike stressors that may impact marine invertebrates include (1) vessels and in-water devices, (2) military expended materials, and (3) seafloor devices.

Most marine invertebrate populations extend across wide areas containing hundreds or thousands of discrete patches of suitable habitat. Sessile (attached to the seafloor) invertebrate populations may be maintained by complex currents that carry adults and young from place to place. Such widespread populations are difficult to evaluate in terms of Navy training and testing activities that occur in relatively small areas of the Study Area. In this context, a physical strike or disturbance would impact individual organisms directly or indirectly, but not to the extent that the viability of populations or species would be impacted.

With few exceptions, activities involving vessels and in-water devices are not intended to contact the seafloor. Except for amphibious activities and bottom-crawling unmanned underwater vehicles, there is no potential strike impact and limited potential disturbance impact on benthic or habitat-forming marine invertebrates.

With the exception of corals and other sessile benthic invertebrates, most invertebrate populations recover quickly from disturbance. Many large invertebrates, such as crabs, shrimps, and clams, undergo massive disturbance during commercial and recreational harvests. Other invertebrates, such as the small soft-bodied organisms that live in the bottom sediment, are thought to be well-adapted to natural physical disturbances, although recovery from human-induced disturbance is delayed by decades or more (Lindholm et al. 2011). These populations would recover from a strike or other disturbance on scales of weeks to years. Biotic habitats, such as coral reefs, deep-sea coral, and sponge communities, may take decades to re-grow following a strike or disturbance (Precht et al. 2001).

3.8.3.3.1 Vessel and In-Water Devices

The majority of the training activities under all the alternatives involve vessels, and a few of the activities involve the use of in-water devices. For a discussion of the types of activities that use vessels and in-water devices, where they are used, and how many events would occur under each alternative, see Tables 3.0-30 and 3.0-38. See Table 3.0-19 for a representative list of Navy vessel sizes and speeds and Table 3.0-31 for the types, sizes, and speeds of Navy in-water devices used in the Study Area.

Vessels and in-water devices could impact marine invertebrates by disturbing the water column or sediments, or directly striking organisms (Bishop 2008). The propeller wash (water displaced by propellers used for propulsion) from vessel movement and water displaced from vessel hulls could disturb marine invertebrates in the water column, and is a likely cause of zooplankton mortality (Bickel et al. 2011). This local and short-term exposure to vessel and propeller movements could displace, injure, or kill zooplankton, invertebrate eggs or larvae, and macro-invertebrates in the upper portions of the water column.

Few sources of information are available on the impact of non lethal chronic disturbance on marine invertebrates. One study of seagrass-associated marine invertebrates, such as amphipods and polychaetes, found that chronic disturbance from vessel wakes resulted in the long-term displacement of some marine invertebrates from the impacted area (Bishop 2008). Impacts of this type resulting from repeated exposure in shallow water are not likely to result from Navy training and testing activities because (1) most vessel movements occur in relatively deep water, and (2) vessel movements are concentrated in well-established port facilities and associated channels (Mintz and Parker 2006).

Vessels and towed in-water devices do not normally collide with invertebrates that inhabit the seafloor because Navy vessels are operated in relatively deep waters and have navigational capabilities to avoid contact with these habitats. A consequence of vessel operation in shallow water is increased turbidity from stirring-up bottom sediments. Turbidity can impact corals and invertebrate communities on hardbottom areas by reducing the amount of light that reaches these organisms and by clogging siphons for filter feeding organisms. Reef-building corals are sensitive to water clarity because they host symbiotic algae that require sunlight to live. Encrusting organisms residing on hardbottom can be impacted by persistent silting from increased turbidity. In addition, propeller wash and physical contact with coral and hardbottom areas can cause structural damage to the substrate as well as mortality to encrusting organisms. While information on the frequency of vessel operations in shallow water is not adequate to support a specific risk assessment, typical navigational procedures minimize the likelihood of contacting the seafloor, and most Navy vessel movements in nearshore waters are confined to established channels and ports, or predictable transit lanes within the Hawaiian Islands or between San Diego Bay and San Clemente Island.

Amphibious vessels would contact the seafloor in the surf zone during Amphibious Assault and Amphibious Raid operations. Benthic invertebrates within the disturbed area, such as crabs, clams, and polychaete worms, could be displaced, injured, or killed during amphibious operations. Benthic invertebrates inhabiting these areas are adapted to a highly variable environment and are expected to rapidly re-colonize disturbed areas by immigration and larval recruitment. Studies indicate that benthic communities of high energy, sandy beaches recover relatively quickly (typically within two to seven months) following beach nourishment (U. S. Army Corps of Engineers 2001). Schoeman et al. (2000) found that the macrobenthic (visible organisms on the seafloor) community required between 7 and 16 days to recover following excavation and removal of sand from a 2,150 $ft.^2$ (200 m^2) quadrant in the mid-intertidal zone of a sandy beach. The impacts of amphibious vehicle operations on benthic communities would be relatively minor, short-term, and local.

Unmanned underwater vehicles travel at relatively low speeds, and are smaller than most vessels, making the risk of strike or physical disturbance to marine invertebrates very low. Zooplankton, invertebrate eggs or larvae, and macro-invertebrates in the water column could be displaced, injured, or killed by unmanned underwater vehicle movements.

3.8.3.3.1.1 No Action Alternative

Training Activities

As indicated in Sections 3.0.5.3.3.1 (Vessel Strikes) and 3.0.5.3.3.2 (In-Water Devices), the majority of the training activities include vessels, and a few of the activities involve the use of in-water devices. These activities could be widely dispersed throughout the Study Area, but would be more concentrated near naval ports, piers and ranges. Amphibious landings could occur in SSTC, SOCAL, and HRC.

Species that do not occur near the surface within the Study Area—including ESA-listed black and white abalone—would not be exposed to vessel strikes. In addition, these species would not be affected by amphibious landings since ESA-listed black and white abalone inhabit rocky shores and hardbottom, which are not used for amphibious landings. There is no designated critical habitat on San Clemente Island, where the majority of amphibious landings would occur, and the majority of vessel movements would occur in the open ocean.

Species that do occur near the surface within the Study Area would have the potential to be exposed to vessel strikes. Large, slow vessels would pose little risk to marine invertebrates in the open ocean although, in coastal waters, currents from large vessels may cause resuspension and settlement of sediment onto sensitive invertebrate communities. Vessels travelling at high speeds would generally pose more of a risk through propeller action in shallow waters. Under the No Action Alternative, these shallow-water vessels would continue to operate in defined boat lanes with sufficient depths to avoid propeller or hull strikes of benthic invertebrates.

There would be a higher likelihood of vessel strikes over the continental shelf portions of the Study Area because of the concentration of vessel movements in those areas. Exposure of marine invertebrates to vessel disturbance and strikes is limited to organisms in the uppermost portions of the water column. Pelagic marine invertebrates are generally disturbed, rather than struck, as the water flows around the vessel or in-water device. Invertebrates that occur on the seafloor, including shallow-water corals, hardbottom, and deep-water corals, are not likely to be exposed to this stressor because they typically occur at depths greater than that potentially impacted by vessels.

The impact of vessels and in-water devices on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges, (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event, and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Under ESA, vessel, towed in-water device, or unmanned vehicle strikes or physical disturbance from training activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under ESA, vessel, towed in-water device, or unmanned vehicle strikes or physical disturbance from training activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

As indicated in Sections 3.0.5.3.3.1 (Vessels) and 3.0.5.3.3.2 (In-Water Devices), Navy vessel movements and in-water devices would occur throughout the Study Area during testing activities. Vessel movements and in-water devices during testing activities would be similar to those described previously under training activities for the No Action Alternative.

Species that do not occur near the surface within the Study Area—including ESA-listed black and white abalone—would not be exposed to vessel strikes. In addition, these species would not be affected by amphibious landings since ESA-listed black and white abalone inhabit rocky shores and hardbottom, which are not used for amphibious landings. There is no designated critical habitat on San Clemente Island, where the majority of amphibious landings would occur, and the majority of vessel movements would occur in the open ocean.

The impact of vessels and in-water devices on marine invertebrates would be inconsequential because: (1) the area exposed to the stressor amounts to a small portion of each vessel's and in-water device's footprint, and is extremely small relative to most marine invertebrates' ranges, (2) the frequency of activities involving the stressor is low such that few individuals could be exposed to more than one event, and (3) exposures would be localized, temporary, and would cease with the conclusion of the activity. Activities involving vessels and in-water devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Under ESA, vessel, towed in-water device, or unmanned vehicle strikes or physical disturbance from testing activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under ESA, vessel, towed in-water device, or unmanned vehicle strikes or physical disturbance from testing activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

3.8.3.3.1.2 Alternative 1

Training Activities

As indicated in Sections 3.0.5.3.3.1 (Vessel Strikes) and 3.0.5.3.3.2 (In-Water Devices), the majority of the training activities include vessels, and a few of the activities involve the use of in-water devices. These activities could be widely dispersed throughout the Study Area, but would be more concentrated near naval ports, piers and ranges. Amphibious landings could occur in SSTC, SOCAL, and HRC.

The vessels and in-water devices used during training activities under Alternative 1 would be similar to those described under the No Action Alternative. Therefore, effects under Alternative 1 from vessel strikes and in-water devices would be similar to No Action Alternative.

Under ESA, vessel, towed in-water device, or unmanned vehicle strikes or physical disturbance from training activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under ESA, vessel, towed in-water device, or unmanned vehicle strikes or physical disturbance from training activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

As indicated in Sections 3.0.5.3.3.1 (Vessel Strikes) and 3.0.5.3.3.2 (In-Water Devices), the majority of the testing activities include vessels, and a few of the activities involve the use of in-water devices. These activities could be widely dispersed throughout the Study Area, but would be more concentrated near naval ports, piers and ranges. Amphibious landings could occur in SSTC, SOCAL, and HRC.

The vessels and in-water devices used during training activities under Alternative 1 would be similar to those described under the No Action Alternative. Therefore, effects under Alternative 1 from vessel strikes and in-water devices would be similar to No Action Alternative.

Under ESA, vessel, towed in-water device, or unmanned vehicle strikes or physical disturbance from testing activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under ESA, vessel, towed in-water device, or unmanned vehicle strikes or physical disturbance from testing activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.3.1.3 Alternative 2

Training

Under Alternative 2, training activities would be consistent with Alternative 1. Therefore, Alternative 2 would have the same effects as under Alternative 1.

Under ESA, vessel, towed in-water device, or unmanned vehicle strikes or physical disturbance from training activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under ESA, vessel, towed in-water device, or unmanned vehicle strikes or physical disturbance from training activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

Testing

As indicated in Sections 3.0.5.3.3.1 (Vessel Strikes) and 3.0.5.3.3.2 (In-Water Devices), the majority of the testing activities include vessels, and a few of the activities involve the use of in-water devices. These activities could be widely dispersed throughout the Study Area, but would be more concentrated near naval ports, piers and ranges. Amphibious landings could occur in SSTC, SOCAL, and HRC.

The vessels and in-water devices used during training activities under Alternative 2 would be similar to those described under the No Action Alternative. Therefore, effects under Alternative 2 from vessel strikes and in-water devices would be similar to No Action Alternative.

Under ESA, vessel, towed in-water device, or unmanned vehicle strikes or physical disturbance from testing activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under ESA, vessel, towed in-water device, or unmanned vehicle strikes or physical disturbance from testing activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.3.2 Military Expended Materials

This section analyzes the strike potential to invertebrates from the following categories of military expended materials: (1) non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expended materials other than ordnance, such as sonobuoys, vessel hulks, and expendable targets. For a discussion of the types of activities that use military expended materials, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.3.3 (Military Expended Materials Strikes).

Military expended materials are deposited throughout the Study Area. However, the majority of military expended materials are deposited within the confines of established gunnery ranges and weapons testing areas. These areas of higher military expended materials deposition are generally away from the coastline but on the continental shelf and slope.

Chaff and flares include canisters, end-caps, and aluminum coated glass fibers. Chaff, in particular, may be transported great distances by the wind, beyond the areas where they are deployed before contacting the sea surface. These materials contact the sea surface and seafloor with very little kinetic energy, and their low buoyant weight makes them an inconsequential strike and abrasion risk. Aerial countermeasures, therefore, will not be addressed as potential strike and disturbance stressors.

Physical disturbances or strikes by military expended materials on marine invertebrates are possible at the water's surface, through the water column, and on the seafloor. Disturbance or strike impacts on marine invertebrates by military expended materials falling through the water column are possible, but not very likely because military expended materials do not generally sink rapidly enough to cause strike injury (i.e., as opposed to fragments propelled by high explosives); and exposed invertebrates would likely experience only temporary displacement as the object passes by. Therefore, the discussion of military expended materials disturbance and strikes will focus on military expended materials at the water's surface and on the seafloor. While marine invertebrates on the seafloor may be impacted by military expended materials propelled by high explosives, this event is not very likely except for mine warfare detonations, which typically occur at or near the seafloor.

Sessile marine invertebrates and infauna are particularly susceptible to military expended material strikes, including shallow-water corals, hardbottom, and deep-water corals. Most shallow-water coral reefs in the Study Area are within or adjacent HRC, where expended materials are primarily lightweight flares and chaff that have inconsequential strike potential.

3.8.3.3.2.1 Munitions

Small-, Medium-, and Large-Caliber Projectiles

Various types of projectiles could cause a temporary local impact when they strike the surface of the water. Navy training and testing in the Study Area, such as gunnery exercises, include firing a variety of weapons and using a variety of non-explosive training and testing rounds, including torpedoes and small-, medium-, and large-caliber projectiles. Large-caliber projectiles are primarily used in the open ocean beyond 20 nm.

Direct ordnance strikes from firing weapons are potential strike stressors to marine invertebrates. Military expended materials could impact the water with great force and produce a large impulse.

Physical disruption of the water column is a local, temporary impact, and would be limited to a small area (within a radius of tens of meters) around the impact point, persisting for a few minutes. Physical and chemical properties of the surrounding water would be temporarily altered (e.g., slight heating or cooling and increased oxygen concentrations due to turbulent mixing with the atmosphere), but there would be no lasting change resulting in long-term impacts on marine invertebrates. Although the sea surface is rich with invertebrates, most are zooplankton and relatively few are large pelagic invertebrates (e.g., some jellyfish and some swimming crabs). Zooplankton, eggs and larvae, and larger pelagic organisms in the upper portions of the water column could be displaced, injured, or killed by military expended materials impacting the sea surface. Individual organisms would be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted, primarily because the number of organisms exposed to these devices is extremely small relative to population sizes.

Marine invertebrates on the seafloor could be displaced, injured, or killed by military expended materials contacting the seafloor. While all marine invertebrates living on or in the seafloor are susceptible to disturbance, strikes, and burial by military expended materials, only sessile (attached to the seafloor) marine invertebrates are susceptible to impact by abrasion. Parachutes are the principal source of abrasion stressors to marine invertebrates, and these are addressed separately because the nature of their potential impacts is materially different than other military expended materials.

Potential impacts of projectiles on marine invertebrates, including shallow-water, hardbottom, or deep-water corals, present the greatest risk of long-term damage compared with other seafloor communities because (1) many corals and hardbottom invertebrates are sessile, fragile, and particularly vulnerable; (2) many of these organisms grow slowly, and could require decades to recover (Precht et al. 2001); and (3) military expended materials are likely to remain mobile for a longer period because natural encrusting and burial processes are much slower on these habitats than on hardbottom habitats.

Bombs, Missiles, and Rockets

Bombs, missiles, and rockets are potential strike stressors to marine invertebrates. The nature of their potential impacts is the same as projectiles. However, they are addressed separately because they are larger than most projectiles, and because high-explosive bombs, missiles, and rockets are likely to produce a greater number of small fragments than projectiles. Propelled fragments are produced by high explosives. Close to the explosion, invertebrates could be injured by propelled fragments. However, studies of underwater bomb blasts have shown that fragments are larger than those produced during air blasts and decelerate much more rapidly (O'Keefe and Young 1984; Swisdak Jr. and Montaro 1992), reducing the risk to marine organisms. Bombs, missiles, and rockets are designed to explode within 3 ft. (1 m) of the sea surface where marine invertebrates are relatively infrequent. The fitness of individual organisms would be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted, primarily because the number of organisms exposed to these devices would be extremely small relative to population sizes.

3.8.3.3.2.2 Military Expended Materials other than Munitions

Vessel Hulk

During a sinking exercise, aircraft, ship, and submarine crews deliver ordnance on a surface target, which is a clean (Section 3.1 [Sediments and Water Quality]), deactivated ship deliberately sunk using multiple weapon systems. Sinking exercises occur in specific open ocean areas, outside of the coastal range complexes. Ordnance strikes by the various weapons used in these exercises are a potential source of impacts. However, these impacts are discussed for each of those weapons categories in this section and are not repeated here. Therefore, the analysis of sinking exercises as a strike potential for benthic invertebrates is discussed in terms of the vessel hulk landing on the seafloor. The primary difference between a vessel hulk and other military expended materials as a strike potential for marine invertebrates is a difference in scale. As the vessel hulk settles on the seafloor, all marine invertebrates within the footprint of the hulk would be impacted by strike or burial, and invertebrates a short distance beyond the footprint of the hulk would be disturbed. A vessel hulk may also change ocean flow patterns, sediment transport, and benthic communities. Habitat-forming invertebrates (i.e., corals) are likely absent where sinking exercises are planned because this activity occurs in depths greater than the range of corals and most other habitat-forming invertebrates (approximately 10,000 ft. [3,050 m]) and away from hydrothermal vent communities.

Parachutes

Parachutes of varying sizes are used during training and testing activities. For a discussion of the types of activities that use parachutes, physical characteristics of these expended materials, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.4.2 (Parachutes). See Table 3.0-82 for information regarding the number and location of activities involving parachutes. Activities that expend sonobuoy and air-launched torpedo parachutes generally occur in water deeper than 183 m. Because they are in the air and water column for a time span of minutes (see Section 3.0.5.3.4.2, Parachutes), it is improbable that such a parachute deployed over water deeper than 183 m could travel far enough to affect shallow-water corals. Parachutes may impact marine invertebrates by disturbance, strikes, burial, smothering, or abrasion. Movement of parachutes in the water may break more fragile invertebrates such as deep-water corals.

3.8.3.3.2.3 No Action Alternative

Training Activities

The number of military expended materials and their impact footprints are detailed in Table 3.3-5. As indicated in Section 3.0.5.3.3.3, Military Expended Materials Strikes, under the No Action Alternative, nearly all military expended materials would be expected in HRC and SOCAL.

The majority of military expended materials would be used in the open ocean. Some military expended materials may be expended in the nearshore waters of San Clemente Island during use of impact areas. The majority of fired ordnance would impact on land and would not be expected to affect ESA-listed black and white abalone. Military expended materials would not be expected to affect black and white abalone because of the limited amount of military expended materials in nearshore waters. There is no designated critical habitat on San Clemente Island. The majority of military expended material in nearshore waters is chaff and flares, which pose a negligible risk to critical habitat.

Military expended materials that are ordnance (e.g., bombs, missiles, rockets, projectiles, and associated fragments may strike marine invertebrates at the sea surface or on the seafloor. Consequences of strike or disturbance may include injury or mortality, particularly within the footprint of the object as it contacts the seafloor. Secondary impacts are possible if military expended materials are mobilized by currents or waves, and would cease when the military expended materials are incorporated into the seafloor by natural encrustation or burial processes. The fitness of individual organisms would be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted primarily because the number of organisms exposed to these devices would be extremely small relative to population sizes.

During sinking exercises, pelagic invertebrates present near the water's surface in the immediate vicinity of the exercise have the potential to be injured or killed. Sinking exercise vessel hulks contacting the seafloor would result in mortality of marine invertebrates within the footprint of the hulk and disturbance of marine invertebrates near the footprint of the hulk. Sinking exercises may result in injury or mortality of marine invertebrates near the footprint of the hulk. Though the footprint of a sinking exercise is large relative to other military expended materials, the impacted area is extremely small relative to the spatial distribution of marine invertebrate populations. Sinking exercises would impact the fitness of individual organisms directly or indirectly, but not to the extent that the viability of populations or species would be impacted.

Activities occurring at depths less than 2,600 ft. (800 m) may impact deep-water corals and other marine invertebrate assemblages. Consequences from impacts of military expended materials on marine invertebrate assemblages may include breakage, injury, or mortality. Parachutes and cables may cause abrasion injury or mortality, or breakage. The fitness of individual organisms would be impacted directly or indirectly, to the extent that the viability of populations or species would be impacted.

The impact of military expended materials on marine invertebrates is likely to cause injury or mortality to individuals, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, and (3) exposures would be localized and would cease when the military expended material stops moving. Activities involving military expended material are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all military expended materials could degrade habitat quality.

Under ESA, strikes by military expended material from training activities under the No Action Alternative may affect, but is not likely to adversely affect, ESA-listed abalone species.

Under ESA, strikes by military expended material from training activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

The number of military expended materials and their impact footprints are detailed in Table 3.3-5. As indicated in Section 3.0.5.3.3.3, Military Expended Materials Strikes, under the No Action Alternative, nearly all of the military expended materials are expected in HRC and SOCAL.

The majority of military expended materials would be used in the open ocean. Some military expended materials may be expended in the nearshore waters of San Clemente Island during use of impact areas. The majority of fired ordnance would impact on land and would not be expected to affect ESA-listed black and white abalone. Military expended materials would not be expected to affect black and white abalone because of the limited amount of military expended materials in nearshore waters. There is no designated critical habitat on San Clemente Island. The majority of military expended material in nearshore waters is chaff and flares, which pose a negligible risk to critical habitat.

Bombs, missiles, rockets, projectiles, and associated fragments may strike marine invertebrates at the sea surface or on the seafloor. Consequences of strikes or disturbances may include injury or mortality, particularly within the footprint of the object as it contacts the seafloor. Individual organisms would be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted primarily, because the number of organisms exposed to these devices would be extremely small relative to population sizes.

Activities occurring at depths less than 2,600 ft. (800 m) may impact deep-water corals and other marine invertebrate assemblages. Consequences may include breakage, injury, or mortality for each projectile or munitions (see Section 3.3, Marine Habitats). Parachutes and cables may cause abrasion injury or mortality and breakage. The fitness of individual organisms would be impacted directly or indirectly to the extent that the viability of populations or species would be impacted.

The impact of military expended materials on marine invertebrates is likely to cause injury or mortality to individuals, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, and (3) exposures would be localized and would cease when the military expended material stops moving. Activities involving military expended materials are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all military expended materials could degrade habitat quality.

Under ESA, strikes by military expended material from testing activities under the No Action Alternative may affect, but is not likely to adversely affect, ESA-listed abalone species.

Under ESA, strikes by military expended material from testing activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

3.8.3.3.2.4 Alternative 1

Training Activities

The number of military expended materials and their impact footprints are detailed in Table 3.3-6. As indicated in Section 3.0.5.3.3.3, Military Expended Materials Strikes, under Alternative 1, nearly all of the military expended materials are expected in HRC and SOCAL. Alternative 1 would include substantial increases in the use of small- and medium-caliber projectiles. The use of bombs, missiles, rockets, projectiles, and associated fragments would also increase incrementally.

The majority of military expended materials would be used in the open ocean. Some military expended materials may be expended in the nearshore waters of San Clemente Island during use of impact areas. The majority of fired ordnance would impact on land and would not be expected to affect ESA-listed black and white abalone. Military expended materials would not be expected to affect black and white abalone because of the limited amount of military expended materials in nearshore waters. There is no designated critical habitat on San Clemente Island. The majority of military expended material in nearshore waters is chaff and flares, which pose a negligible risk to critical habitat.

Although the number of military expended materials would increase under Alternative 1 compared to the No Action Alternative, the effects would be similar to those described under the No Action Alternative. The probability of military expended material strikes on marine invertebrates, however, would increase because of the increase in the number of military expended materials. Activities involving military expended materials are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all military expended materials could degrade habitat quality.

Under ESA, strikes by military expended material from training activities under Alternative 1 may affect, but is not likely to adversely affect, ESA-listed abalone species.

Under ESA, strikes by military expended material from training activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

The number of military expended materials and their impact footprints are detailed in Table 3.3-6. As indicated in Section 3.0.5.3.3.3, Military Expended Materials Strikes, under Alternative 1, nearly all of the military expended materials are expected in HRC and SOCAL. Alternative 1 would include substantial increases in the use of small- and medium-caliber projectiles, bombs, missiles, rockets, projectiles, and associated fragments because of the introduction of new testing activities.

The majority of military expended materials would be used in the open ocean. Some military expended materials may be expended in the nearshore waters of San Clemente Island during use of impact areas. The majority of fired ordnance would impact on land and would not be expected to affect ESA-listed black and white abalone. Military expended materials would not be expected to affect black and white abalone because of the limited amount of military expended materials in nearshore waters. There is no designated critical habitat on San Clemente Island. The majority of military expended material in nearshore waters is chaff and flares, which pose a negligible risk to critical habitat.

Although the number of military expended materials would increase under Alternative 1 compared to the No Action Alternative, the effects would be similar to those described under the No Action Alternative. The probability of military expended material strikes on marine invertebrates, however, would increase because of the increase in the number of military expended materials. Activities involving military expended materials are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all military expended materials could degrade habitat quality.

Under ESA, strikes by military expended material from testing activities under Alternative 1 may affect, but is not likely to adversely affect, ESA-listed abalone species.

Under ESA, strikes by military expended material from testing activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.3.2.5 Alternative 2

Training Activities

Under Alternative 2, the Navy proposes the same numbers and types of military expended materials as described in Alternative 1. Therefore, the impacts of Alternative 2 training activities on marine invertebrates would be the same as for Alternative 1.

Under ESA, strikes by military expended material from training activities under Alternative 2 may affect, but is not likely to adversely affect, ESA-listed abalone species.

Under ESA, strikes by military expended material from training activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

The number of military expended materials and their impact footprints are detailed in Table 3.3-7. As indicated in Section 3.0.5.3.3.3, Military Expended Materials Strikes, under Alternative 2, nearly all of the military expended materials are expected in HRC and SOCAL. Alternative 2 would include substantial increases in the use of small- and medium-caliber projectiles, bombs, missiles, rockets, projectiles, and associated fragments because of the introduction of new testing activities.

The majority of military expended materials would be used in the open ocean. Some military expended materials may be expended in the nearshore waters of San Clemente Island during use of impact areas. The majority of fired ordnance would impact on land and would not be expected to affect ESA-listed black and white abalone. Military expended materials would not be expected to affect black and white abalone because of the limited amount of military expended materials in nearshore waters. There is no designated critical habitat on San Clemente Island. The majority of military expended material in nearshore waters is chaff and flares, which pose a negligible risk to critical habitat.

Although the number of military expended materials would increase under Alternative 2 compared to the No Action Alternative, the effects would be similar to those described under the No Action Alternative. The probability of military expended material strikes on marine invertebrates, however, would increase because of the increase in the number of military expended materials. Activities involving military expended materials are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level. However, the combined consequences of all military expended materials could degrade habitat quality.

Under ESA, strikes by military expended material from testing activities under Alternative 2 may affect, but is not likely to adversely affect, ESA-listed abalone species.

Under ESA, strikes by military expended material from testing activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.3.3 Seafloor Devices

For a discussion of the types of activities that use seafloor devices, where they are used, and how many activities would occur under each alternative, see Sections 3.0.5.3.3.4 (Seafloor Devices). Seafloor devices include items that are placed on, dropped on, or moved along the seafloor, such as mine shapes, anchor blocks, surface vessel anchors, bottom-placed instruments, bottom-crawling unmanned underwater vehicles, and bottom-placed targets that are recovered (not expended).

Deployment of seafloor devices would cause disturbance, injury, or mortality within the footprint of the device, may disturb marine invertebrates outside the footprint of the device, and would cause temporary local increases in turbidity near the ocean bottom. Objects placed on the seafloor may attract invertebrates, or provide temporary attachment points for invertebrates. Some invertebrates attached to the devices would be removed from the habitat when the devices are recovered. A shallow depression may remain in the soft bottom sediment where an anchor was dropped. This analysis assumes a 1:1 relationship between high-explosive mines and their moorings; and a 1:1 relationship between high-explosive mine neutralizers and moorings for their targets.

3.8.3.3.3.1 No Action Alternative

<u>Training Activities</u>

Table 3.0-68 lists the number and location where seafloor devices are used. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under the No Action Alternative, seafloor devices used during training activities would occur in HRC, SOCAL, and SSTC.

Seafloor devices could occur within potential ESA-listed black and white abalone habitat off San Clemente Island, but would not be expected to affect either species because seafloor devices are typically placed in soft-bottom areas. There is no designated critical habitat for ESA-listed black and white abalone off San Clement Island and seafloor devices would not occur in areas of designated critical habitat within the Study Area.

Under the No Action Alternative, four elevated causeway systems training events would occur every year, primarily in SSTC oceanside Boat Lanes 1 through 10, but also periodically in the bayside Bravo training area (see Figure 2.1-10).Boat Lanes 1 through 10 have sand (5,300 acres [ac.; 22 km^2]) or cobble (510 ac. [2.5 km^2]) substrates, with a small amount of understory algae (3.26 ac. [0.013 km^2]) (U.S. Department of the Navy 2006). The bayside Bravo training area contains an estimated 1.13 ac. (0.5 ha) of sandy substrates that support benthic invertebrate communities. Elevated causeway systems training in Bravo would remove surface substrate within the footprint of the pile, but the effects are expected to be short in duration.

Potential impacts of precision anchoring are qualitatively different than other seafloor devices because the activity involves repeated disturbance to the same area of seafloor. Precision anchoring occurs in long-established soft-bottom areas that have a history of disturbance by anchors, and continued exposure is likely to be inconsequential and not detectable.

Salvage operations under the No Action Alternative would occur three times per year in Puuloa Underwater Range, Naval Defensive Sea Area, Keehi Lagoon, or training areas in Pearl Harbor. Training activities would consist of lowering and raising a vessel from the seafloor. The infrastructure to keep the vessel in place was implemented after in 2009. Potential impacts to marine invertebrates would be limited to area directly below the vessel, but this area would experience repeated impacts from raising and lower the vessel during each training activity.

The impact of seafloor devices on marine invertebrates is likely to cause injury or mortality to individuals, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, and (3) exposures would be localized. Activities involving seafloor devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Under ESA, physical disturbance and physical strikes by seafloor devices used during training activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under ESA, physical disturbance and physical strikes by seafloor devices used during training activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Table 3.0-68 lists the number and location where seafloor devices are used. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under the No Action Alternative, seafloor devices used during testing activities would occur in HRC, SOCAL, and SSTC.

Under the No Action Alternative, nine anti-terrorism/force protection underwater surveillance testing events would occur every year in San Diego Bay. Events typically last five days, and day operations could range from 8 to 24 hours per testing day. These testing activities would involve placing clump anchors around existing piers and ships. These areas are characterized as deep subtidal habitats greater than 20 ft. (6 m) in depth, subject to periodic dredging since the 1940s (U.S. Department of the Navy 2006). These areas may support various hard-shelled marine invertebrates.

Under the No Action Alternative, the Navy would conduct nine testing events per year in waters off Point Loma and 12 events per year in training areas around San Clemente Island using the fixed intelligence, surveillance, and reconnaissance sensor system. Fixed intelligence, surveillance, and reconnaissance sensor system testing involves the temporary installation of several arrays on the seafloor in sandy seafloor substrates or suspended in the water column with a mooring structure. Arrays may stay in the water for several months.

Seafloor devices could occur within potential ESA-listed black and white abalone habitat off San Clemente Island, but would not be expected to affect either species because seafloor devices are typically placed in soft-bottom areas. There is no designated critical habitat for ESA-listed black and white abalone off San Clement Island and seafloor devices would not occur in areas of designated critical habitat within the Study Area.

The impact of seafloor devices on marine invertebrates is likely to cause injury or mortality to individuals, but impacts to populations would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, and (3) exposures would be localized. Activities involving seafloor devices are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at the population level.

Under ESA, physical disturbance and physical strikes by seafloor devices used during testing activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under ESA, physical disturbance and physical strikes by seafloor devices used during testing activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

3.8.3.3.3.2 Alternative 1

Training Activities

Table 3.0-68 lists the number and location where seafloor devices are used. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 1, seafloor devices used during training activities would occur in HRC, SOCAL, and SSTC. Under Alternative 1, the number of training activities that use seafloor devices would remain the same as under the No Action Alternative. Because there would be no changes in the seafloor devices used for training activities under Alternative 1 relative to the No Action Alternative, the effects of Alternative 1 training activities would be the same as for the No Action Alternative.

Under ESA, physical disturbance and physical strikes by seafloor devices used during training activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under ESA, physical disturbance and physical strikes by seafloor devices used during training activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Table 3.0-68 lists the number and location where seafloor devices are used. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 1, seafloor devices used during testing activities would occur in HRC, SOCAL, and SSTC. Under Alternative 1, the Navy would increase the number of anti-terrorism/force protection underwater surveillance testing to 10 events per year) in San Diego Bay, compared to four events per year under the No Action Alternative. The Navy would increase fixed intelligence, surveillance, and reconnaissance sensor system testing in waters off Point Loma by one event per year (for a total of 10 per year) and two events per year (for a total of 14 per year) in testing areas off San Clemente Island. The Navy would not increase testing for this activity in waters off Camp Pendleton.

The total increase of three fixed intelligence, surveillance, and reconnaissance sensor testing activities in waters off Point Loma and San Clemente Island would increase the number of installed devices on the seafloor, and therefore could directly impact benthic invertebrates or remove portions of the seafloor from available habitat for benthic invertebrate species. Although the Navy would increase the number of testing activities involving the installation or removal of seafloor devices, the Navy would continue to minimize impacts on the marine invertebrate community by using previously disturbed areas. Impacts from seafloor devices under Alternative 1 would be similar to those described under the No Action Alternative because the same seafloor devices would be used. There would be an increased likelihood of strikes from seafloor devices, however, because of the increased number of testing activities.

Under ESA, physical disturbance and physical strikes by seafloor devices used during testing activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under ESA, physical disturbance and physical strikes by seafloor devices used during testing activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.3.3.3 Alternative 2

Training Activities

Under Alternative 2, training activities would be consistent with Alternative 1. Therefore, Alternative 2 would have the same effects as under Alternative 1.

Under ESA, physical disturbance and physical strikes by seafloor devices used during training activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under ESA, physical disturbance and physical strikes by seafloor devices used during training activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Table 3.0-68 lists the number and location where seafloor devices are used. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 2, seafloor devices used during testing activities would occur in HRC, SOCAL, and SSTC. Under Alternative 2, three additional fixed intelligence, surveillance, and reconnaissance sensor testing activities in waters off Point Loma and San Clemente Island would increase the number of installed devices on the seafloor. Because there would be no changes in seafloor devices used for training activities under Alternative 1 relative to the No Action Alternative, the effects of Alternative 2 training activities would be similar to the No Action Alternative.

Under ESA, physical disturbance and physical strikes by seafloor devices used during testing activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under ESA, physical disturbance and physical strikes by seafloor devices used during testing activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.3.4 Summation of Effects from Physical Disturbance and Strike Stressors

Exposures to physical disturbance and strike stressors occur primarily on the range complexes and testing ranges within the Study Area. The Navy identified and analyzed three physical disturbance or strike substressors that could impact marine invertebrates: vessel and in-water devices, military expended materials, and seafloor devices. Vessel and in-water device strikes are unlikely to impact invertebrates other than plankton, while military expended materials and seafloor device strikes could impact resident benthic (seafloor) invertebrates.

3.8.3.4 Entanglement Stressors

This section analyzes the potential entanglement impacts of the various types of expended materials used by the Navy during training and testing activities within the Study Area. Included are potential impacts from two types of military expended materials: (1) cables and wires, and (2) parachutes. Aspects of entanglement stressors that are applicable to marine organisms in general are presented in Section 3.0.5.3.4, Entanglement Stressors.

Most marine invertebrates are less susceptible to entanglement than fishes, sea turtles, and marine mammals due to their size, behavior, and morphology. Because even fishing nets which are designed to take marine invertebrates operate by enclosing rather than entangling, marine invertebrates seem to be somewhat less susceptible than vertebrates to entanglement (Chuenpagdee et al. 2003). A survey of marine debris entanglements found that marine invertebrates composed 16 percent of all animal entanglements (Ocean Conservancy 2010). The same survey cites potential entanglement in military items only in the context of waste-handling aboard ships, and not for military expended materials. Nevertheless, it is conceivable that marine invertebrates, particularly arthropods and echinoderms with rigid appendages, might become entangled in cables and guidance wires, and in parachutes.

3.8.3.4.1 Impacts from Cables and Wires

Fiber optic cables are only expended during airborne mine neutralization testing activities and torpedo guidance wires are used in training and testing activities. For a discussion of the types of activities that use guidance wires and fiber-optic cables, physical characteristics of these expended materials, where they are used, and how many activities would occur under each alternative, please see Sections 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires). Abrasion and shading-related impacts on sessile benthic (attached to the seafloor) marine invertebrates that may result from entanglement stressors are discussed with physical impacts in Section 3.8.3.3 (Physical Disturbance or Strike).

A marine invertebrate that might become entangled could be only temporarily confused and escape unharmed, it could be held tightly enough that it could be injured during its struggle to escape, it could be preyed upon while entangled, or it could starve while entangled. The likelihood of these outcomes cannot be predicted with any certainty because interactions between invertebrate species and entanglement hazards are not well known. The potential entanglement scenarios are based on observations of how marine invertebrates are entangled in marine debris, which is far more prone to tangling than guidance wire or fiber-optic cable (Environmental Sciences Group 2005; Ocean

Conservancy 2010). The small number of guidance wires and fiber-optic cables expended across the Study Area results in an extremely low rate of potential encounter for marine invertebrates.

Tube-launched, optically tracked, wire- guided missiles would expend wires in the nearshore or offshore waters of HRC and SOCAL during training only, and their potential impacts would be similar to those described for torpedo guidance wires.

3.8.3.4.1.1 No Action Alternative

Training Activities

Tables 3.0-76, 3.0-78, and 3.0-79 list the number and locations of activities that expend fiber optic cables and guidance wires under the No Action Alternative. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative, airborne mine neutralization activities, with HE neutralizers, that expend fiber optic cables could occur in the SOCAL Range Complex. Torpedoes expending guidance wire would occur in HRC and SOCAL Range Complex.

ESA-listed black and white abalone do not occur in areas offshore where torpedo launches would occur, and would not be exposed to cables and guidance wires. Airborne mine neutralization activities and fiber-optic cables expended during training activities could occur in the nearshore areas of SOCAL, where ESA-listed abalone species are present. ESA-listed abalone species, however, would not be affected by fiber-optic cables because fiber-optic cables would not be expected to entangle ESA-listed abalone species since they are sessile marine invertebrates. No effect would be expected on critical habitat from entanglement; potential physical disturbance on critical habitat by fiber-optic cables and guidance wires are discussed as a physical impact in Section 3.8.3.3.2 (Military Expended Materials).

Given the low numbers used, most marine invertebrates would never be exposed to a cable or guidance wire. The impact of cables and guidance wires on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors, most would avoid entanglement and simply be temporarily disturbed. Activities involving cables and guidance wires are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Under the ESA, entanglement in cables or guidance wires expended during training activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under the ESA, entanglement in cables or guidance wires expended during training activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Tables 3.0-77, 3.0-78, and 3.0-80 list the number and locations of activities that expend fiber optic cables and guidance wires under the No Action Alternative. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative, airborne mine neutralization activities (with HE neutralizers) that expend fiber optic cables would occur in HRC and SOCAL Range Complex, and torpedoes expending guidance wire would occur in HRC and the SOCAL Range Complex.

ESA-listed black and white abalone do not occur in areas offshore where torpedo launches would occur, and would not be exposed to cables and guidance wires. Airborne mine neutralization activities and fiber-optic cables expended during testing activities could occur in the nearshore areas of SOCAL, where ESA-listed abalone species are present. ESA-listed abalone species, however, would not be affected by fiber-optic cables because fiber-optic cables would not be expected to entangle ESA-listed abalone species since they are sessile marine invertebrates. No effect would be expected on critical habitat from entanglement; potential physical disturbance on critical habitat by fiber-optic cables and guidance wires are discussed as a physical impact in Section 3.8.3.3.2 (Military Expended Materials).

Fiber optic cables and guidance wires expended during testing activities would be the same or similar types to those expended during training activities. Therefore, fiber cables and wires expended during testing activities would have the same effects on marine invertebrates as those described for training activities under the No Action Alternative.

Under the ESA, entanglement in cables or guidance wires expended during testing activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under the ESA, entanglement in cables or guidance wires expended during testing activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

3.8.3.4.1.2 Alternative 1

Training Activities

Tables 3.0-76, 3.0-78, and 3.0-79 list the number and locations of activities that expend fiber optic cables and guidance wires under Alternative 1. The activities using fiber optic cables under Alternative 1 would occur in the same geographic locations as the No Action Alternative. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 1, the number of training activities that expend fiber optic cables would be greater than that of the No Action Alternative. Under Alternative 1, the number of torpedo training activities that expend guidance wire is expected to increase 15 percent compared to the No Action Alternative. The torpedo activities using guidance wire under Alternative 1 would occur in the same geographic locations as the No Action Alternative.

As stated in Section 3.8.3.4.1.1 (No Action Alternative), cables and guidance wires would not be expected to cause injury or mortality to marine invertebrate individuals. Cables and guidance wires would not have an effect on ESA-listed species, and use of cables and guidance wires would not reduce the conservation value of critical habitat because overlap between the stressor and resource would not be anticipated. In comparison to the No Action Alternative, the increase in activities would not substantially increase the risk of exposure to cables and guidance wires.

Under the ESA, entanglement in cables or guidance wires expended during training activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under the ESA, entanglement in cables or guidance wires expended during training activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Tables 3.0-77, 3.0-78, and 3.0-80 list the number and locations of activities that expend fiber optic cables and guidance wires under Alternative 1. The activities that expend fiber optic cables and guidance wires under Alternative 1 would occur in the same geographic locations as the No Action Alternative. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 1, the number of airborne mine neutralization activities (with HE neutralizers) would increase to 16 testing activities per year, compared to 15 testing activities under the No Action Alternative. The number of torpedo activities that expend guidance wire would also increase to more than two-times that of the No Action Alternative. The torpedo activities using guidance wire under Alternative 1 would occur in the same geographic locations as the No Action Alternative.

As stated in Section 3.8.3.4.1.1 (No Action Alternative), cables and guidance wires would not be expected to cause injury to or mortality of marine invertebrate individuals. Cables and guidance wires would not affect ESA-listed species, and use of cables and guidance wires would not reduce the conservation value of critical habitat because overlap between the stressor and resource is not anticipated.. In comparison to the No Action Alternative, the increase in activities would not substantially increase the risk of exposure to cables and guidance wires.

Under the ESA, entanglement in cables or guidance wires expended during testing activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under the ESA, entanglement in cables or guidance wires expended during testing activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.4.1.3 Alternative 2

Training Activities

Under Alternative 2, the Navy proposes the same numbers and types of military expended materials as described in Alternative 1. Therefore, the impacts of Alternative 2 training activities on marine invertebrates would be the same as for Alternative 1.

Under the ESA, entanglement in cables or guidance wires expended during training activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under the ESA, entanglement in cables or guidance wires expended during training activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Tables 3.0-77, 3.0-78, and 3.0-80 list the number and locations of activities that expend fiber optic cables and guidance wires under Alternative 2. The activities that expend fiber optic cables and guidance wires under Alternative 2 would occur in the same geographic locations as the No Action Alternative. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 2, the number of airborne mine neutralization activities (with HE neutralizers) would increase to 17 testing activities per year, compared to 15 testing activities under the No Action Alternative. The number of torpedo activities that expend guidance wire under Alternative 2 would increase to nearly three-times that of the No Action Alternative. The torpedo activities using guidance wire under Alternative 2 would occur in the same geographic locations as the No Action Alternative.

As stated in Section 3.8.3.4.1.1 (No Action Alternative), cables and guidance wires would not be expected to cause injury or mortality marine invertebrate individuals. Cables and guidance wires would not affect ESA-listed species, and use of cables and guidance wires would not reduce the conservation value of critical habitat because overlap between the stressor and resource is not anticipated.. In comparison to the No Action Alternative, the increase in activities would not substantially increase the risk of exposure to cables and guidance wires.

Under the ESA, entanglement in cables or guidance wires expended during testing activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under the ESA, entanglement in cables or guidance wires expended during testing activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.4.2 Impacts from Parachutes

Parachutes of varying sizes are used during training and testing activities. For a discussion of the types of activities that use parachutes, physical characteristics of these expended materials, where they are used, and how many activities would occur under each alternative, please see Section 3.0.5.3.4.2 (Parachutes). Parachutes pose a potential, though unlikely, entanglement risk to susceptible marine invertebrates. The most likely method of entanglement would be a marine invertebrate crawling through the fabric or cord that would then tighten around it.

Abrasion and shading-related impacts on sessile benthic (attached to the seafloor) marine invertebrates that may result from entanglement stressors are discussed with physical impacts in Section 3.8.3.3 (Physical Disturbance and Strike). Potential indirect effects of the parachute being transported laterally along the seafloor are discussed in Section 3.8.3.6 (Secondary Stressors).

A marine invertebrate that might become entangled could be temporarily confused and escape unharmed, held tightly enough that it could be injured during its struggle to escape, preyed upon while entangled, or starved while entangled. The likelihood of these outcomes cannot be predicted with any certainty because interactions between invertebrate species and entanglement hazards are not well known. The potential entanglement scenarios are based on observations of how marine invertebrates are entangled in marine debris (Environmental Sciences Group 2005; Ocean Conservancy 2010). The number of parachutes expended across the Study Area is extremely small relative to the number of marine invertebrates, resulting in a low rate of potential encounter for marine invertebrates.

3.8.3.4.2.1 No Action Alternative

<u>Training Activities</u>

Table 3.0-82 lists the number and locations of expended parachutes. As indicated in Section 3.0.5.3.4.3 (Parachutes), under the No Action Alternative, activities involving parachute use would occur in HRC and SOCAL.

ESA-listed abalone species are not susceptible to entanglement in parachutes since they are sessile marine invertebrates. Similarly, entanglement cannot affect critical habitat; potential consequences of physical disturbance and strike stressors associated with these objects, however, is addressed in Section 3.8.3.3.2 (Military Expended Materials).

Most marine invertebrates would never encounter a parachute. The impact of parachutes on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors, most would avoid entanglement and simply be temporarily disturbed. Activities involving parachutes are not expected to yield any behavioral changes or lasting effects on the survival, growth, recruitment, or reproduction of invertebrate species at individual or population levels.

Under the ESA, entanglement in parachutes expended during training activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under the ESA, entanglement in parachutes expended during training activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Table 3.0-82 lists the number and locations of expended parachutes. As indicated in Section 3.0.5.3.4.3 (Parachutes), under the No Action Alternative, activities involving parachute use would occur in HRC and SOCAL.

ESA-listed abalone species are not susceptible to entanglement in parachutes since they are sessile marine invertebrates. Similarly entanglement cannot affect critical habitat; potential consequences of physical disturbance and strike stressors associated with these objects, however, is addressed in Section 3.8.3.3.2 (Military Expended Materials).

Most marine invertebrates would never encounter a parachute. Some individual marine invertebrates could be injured or killed in the unlikely event of exposure and entanglement, but most mobile marine invertebrates would avoid entanglement and simply be temporarily disturbed and would recover completely soon after exposure. The growth, survival, annual reproductive success, or lifetime reproductive success of populations would not be impacted directly or indirectly.

Under the ESA, entanglement in parachutes expended during testing activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under the ESA, entanglement in parachutes expended during testing activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

3.8.3.4.2.2 Alternative 1

Training Activities

Table 3.0-82 lists the number and locations of expended parachutes. As indicated in Section 3.0.5.3.4.3 (Parachutes), under Alternative 1, activities involving parachute use would occur in HRC and SOCAL. ESA-listed abalone species are not susceptible to entanglement in parachutes since they are sessile marine invertebrates. Despite the increase in number of expended parachutes, parachutes used under Alternative 1 would be the same as those used under the No Action Alternative, and would have the same effects as described under the No Action Alternative.

Most marine invertebrates would never encounter a parachute. Some individual marine invertebrates could be injured or killed in the unlikely event of exposure and entanglement, but most mobile marine invertebrates would avoid entanglement and simply be temporarily disturbed and would recover completely soon after exposure. The growth, survival, annual reproductive success, or lifetime reproductive success of populations would not be impacted directly or indirectly.

Under the ESA, entanglement in parachutes expended during training activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under the ESA, entanglement in parachutes expended during training activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Table 3.0-82 lists the number and locations of expended parachutes. As indicated in Section 3.0.5.3.4.3 (Parachutes), under Alternative 1, activities involving parachute use would occur in HRC and SOCAL. ESA-listed abalone species are not susceptible to entanglement in parachutes since they are sessile marine invertebrates. Despite the increase in number of expended parachutes, parachutes used under Alternative 1 would be the same as those used under the No Action Alternative, and would have the same effects as described under the No Action Alternative.

Under the ESA, entanglement in parachutes expended during testing activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under the ESA, entanglement in parachutes expended during testing activities under Alternative 1 would have no effect on ESA-listed abalone species and would have no effect on designated critical habitats.

3.8.3.4.2.3 Alternative 2

Training Activities

Under Alternative 2, the Navy proposes the same numbers and types of parachutes as described in Alternative 1. Therefore, the impacts of Alternative 2 training activities on marine invertebrates would be the same as for Alternative 1.

Under the ESA, entanglement in parachutes expended during training activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under the ESA, entanglement in parachutes expended during training activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

Testing Activities

Table 3.0-82 lists the number and locations of expended parachutes. As indicated in Section 3.0.5.3.4.3 (Parachutes), under Alternative 2, activities involving parachute use would occur in HRC and SOCAL. ESA-listed abalone species are not susceptible to entanglement in parachutes since they are sessile marine invertebrates. Despite the increase in number of expended parachutes, parachutes used under Alternative 2 would be the same as those used under the No Action Alternative, and would have the same effects as described under the No Action Alternative.

Under the ESA, entanglement in parachutes expended during testing activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under the ESA, entanglement in parachutes expended during testing activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.4.3 Summation of Effects from Entanglement Stressors

The impact entanglement on marine invertebrates is not likely to cause injury or mortality to individuals, and impacts would be inconsequential because: (1) the area exposed to the stressor is extremely small relative to most marine invertebrates' ranges, (2) the activities are dispersed such that few individuals could conceivably be exposed to more than one event, (3) exposures would be localized, and (4) marine invertebrates are not particularly susceptible to entanglement stressors, most would avoid entanglement and simply be temporarily disturbed.

3.8.3.5 Ingestion Stressors

This section analyzes the potential ingestion impacts of the various types of military expended materials used by the Navy during training and testing activities within the Study Area. Expended materials could be ingested by marine invertebrates in all large marine ecosystems and open ocean areas. Ingestion could occur at the surface, in the water column, or on the seafloor, depending on the size and buoyancy of the expended object and the feeding behavior of the animal. Floating material is more likely to be eaten by animals that feed at or near the water surface, while materials that sink to the seafloor present a higher risk to bottom-feeding animals. Marine invertebrates are universally present in the water and the seafloor, but the majority of individuals are smaller than a few millimeters (e.g., zooplankton, most roundworms, and most arthropods). Most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrades into smaller fragments.

If expended material is ingested by marine invertebrates, the primary risk is from a blocked digestive tract. Most military expended materials are relatively inert in the marine environment, and are not likely to cause injury or mortality via chemical effects (see Section 3.8.3.5 [Secondary Stressors] for more information on the chemical properties of these materials).

The most abundant military expended material of ingestible size is chaff. The materials in chaff are generally nontoxic in the marine environment except in quantities substantially larger than those any marine invertebrate could reasonably be exposed to from normal usage. Chaff is similar in form to fine human hair, and somewhat analogous to the spicules of sponges or the siliceous cases of diatoms (Spargo 1999). Many invertebrates ingest sponges, including the spicules, without suffering harm (Spargo 1999). Marine invertebrates may occasionally encounter chaff fibers in the marine environment and may incidentally ingest chaff when they ingest prey or water. Literature reviews and controlled experiments suggest that chaff poses little environmental risk to marine organisms at concentrations that could reasonably occur from military training and testing (Arfsten et al. 2002, Spargo 1999). Studies were conducted to determine likely effects on marine invertebrates from ingesting chaff involving a laboratory investigation of crabs that were fed radiofrequency chaff. Blue crabs were force-fed a chaff-and-food mixture daily for a few weeks at concentrations 10 to 100 times predicted real-world exposure levels without a notable increase in mortality (Arfsten et al. 2002).

As described in Section 3.8.2 (Affected Environment), tens of thousands of marine invertebrate species inhabit the Study Area. There is little literature about the effects of debris ingestion on marine invertebrates; consequently, there is little basis for an evidence-based assessment of risks. It is not feasible to speculate on which invertebrates in which locations might ingest specific types of military expended materials. However, invertebrates that actively forage (e.g., worms, octopus, shrimp, and sea cucumbers) are at much greater risk of ingesting military expended materials than invertebrates that filter-feed (e.g., sponges, corals, oysters, and barnacles). Though ingestion is possible in some circumstances, based on the little scientific information available, it seems that negative impacts on individuals are unlikely and impacts on populations would be inconsequential and not detectable. Adverse consequences of marine invertebrates ingesting military expended materials are possible but not probable.

3.8.3.5.1 No Action Alternative

3.8.3.5.1.1 Training Activities

Under the No Action Alternative, a variety of potentially ingestible military expended materials, such as chaff, would be released to the marine environment by Navy training activities. Ingestion is not likely in the majority of cases because most military expended materials are too large to be ingested by most marine invertebrates. The fractions of military expended materials that are of ingestible size, or become ingestible after degradation, are unlikely to impact individuals.

Under the ESA, ingestion of military expended materials from training activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under the ESA, ingestion of military expended materials from training activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

3.8.3.5.1.2 Testing Activities

Under the No Action Alternative, a variety of potentially ingestible military expended materials would be released to the marine environment by Navy testing activities. No chaff canisters would be released during testing activities under the No Action Alternative. Ingestion is not likely in the majority of cases because most military expended materials are too large to be ingested by most marine invertebrates. The fractions of military expended materials that are of ingestible size, or become ingestible after degradation, are unlikely to impact individuals.

Under the ESA, ingestion of military expended materials from testing activities under the No Action Alternative would have no effect on ESA-listed abalone species.

Under the ESA, ingestion of military expended materials from testing activities under the No Action Alternative would have no effect on ESA-listed abalone species critical habitats.

3.8.3.5.2 Alternative 1

3.8.3.5.2.1 Training Activities

Under Alternative 1, a variety of potentially ingestible military expended materials, such as chaff, would be released to the marine environment by Navy training activities. Under Alternative 1, the expended chaff would increase to 228 canisters per year within HRC and 32 per year within SOCAL (260 canisters per year throughout the Study Area) compared with the No Action Alternative. As with the No Action Alternative, ingestion is not likely because most military expended materials are too large to be ingested by most marine invertebrates. The fraction of military expended materials that are of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to have impacts on populations or sub-populations.

Under the ESA, ingestion of military expended materials from training activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under the ESA, ingestion of military expended materials from training activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.5.2.2 Testing Activities

Testing activities under Alternative 1 would introduce 504 canisters of chaff per year in the Study Area, compared to no use of chaff under the No Action Alternative. Within HRC, 300 canisters would be released from ships or planes. Within SOCAL, 204 canisters would be released. As with the No Action Alternative, ingestion is not likely because most military expended materials are too large to be ingested by most marine invertebrates. The fractions of military expended materials that are of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to have impacts on populations or sub-populations.

Under the ESA, ingestion of military expended materials from testing activities under Alternative 1 would have no effect on ESA-listed abalone species.

Under the ESA, ingestion of military expended materials from testing activities under Alternative 1 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.5.3 Alternative 2

3.8.3.5.3.1 Training Activities

Under Alternative 2, the Navy proposes the same numbers and types of chaff as described in Alternative 1. Therefore, the impacts of Alternative 2 training activities on marine invertebrates would be the same as for Alternative 1.

Under the ESA, ingestion of military expended materials from training activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under the ESA, ingestion of military expended materials from training activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.5.3.2 Testing Activities

Testing activities under Alternative 2 would introduce 554 canisters of chaff in the Study Area, compared to no use of chaff under the No Action Alternative. Within HRC, 300 canisters would be released from ships or planes. Within SOCAL, 254 canisters would be released. As with the No Action Alternative, ingestion is not likely because most military expended materials are too large to be ingested by most marine invertebrates. The fractions of military expended materials that are of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to have impacts on populations or sub-populations.

Under the ESA, ingestion of military expended materials from testing activities under Alternative 2 would have no effect on ESA-listed abalone species.

Under the ESA, ingestion of military expended materials from testing activities under Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.5.4 Summary of Effects from Ingestion Stressors

Most military expended materials and fragments of military expended materials are too large to be ingested by marine invertebrates. The potential for marine invertebrates to encounter fragments of ingestible size increases as the military expended materials degrade into smaller fragments. The fractions of military expended materials of ingestible size, or that become ingestible after degradation, may impact individual marine invertebrates, but are unlikely to impact populations.

3.8.3.6 Secondary Stressors

This section analyzes potential impacts on marine invertebrates exposed to stressors indirectly through sediment and water. These two ecosystem constituents, sediment and water, are also primary constituents of marine invertebrate habitat and clear distinctions between indirect impacts and habitat impacts are difficult to maintain. For this analysis, indirect impacts on marine invertebrates via sediment or water that do not require trophic transfers (e.g., bioaccumulation) to be observed are considered here. The terms "indirect" and "secondary" do not imply reduced severity of environmental consequences, but instead describe how the impact may occur in an organism or its ecosystem.

Stressors from Navy training and testing activities could pose secondary or indirect impacts on marine invertebrates via habitat, sediment, or water quality. These include: (1) explosives and by-products; (2) metals; (3) chemicals; and (4) other materials such as targets, chaff, and plastics.

3.8.3.6.1 Explosives, Explosion By-Products, and Unexploded Ordnance

High-order explosions consume most of the explosive material, creating typical combustion products. In the case of royal demolition explosive, 98 percent of the combustion products are common seawater constituents, with the remainder rapidly diluted by ocean currents and circulation (Table 3.1-9 in Section 3.1, Sediments and Water Quality). Explosion by-products from high order detonations present no indirect stressors to marine invertebrates through sediment or water. Low-order detonations and unexploded ordnance present an elevated likelihood of effects on marine invertebrates, and the potential impacts of these on marine invertebrates will be analyzed. Explosive material not completely consumed during a detonation from ordnance disposal and mine clearance training are collected after training is complete; therefore, potential impacts are assumed to be inconsequential and not detectable for these training and testing activities. Marine invertebrates may be exposed by contact with the explosive, contact with contaminants in the sediment or water, and ingestion of contaminated sediments. Most marine invertebrates are very small relative to ordnance or fragments, and direct ingestion of unexploded ordnance is unlikely.

Indirect impacts of explosives and unexploded ordnance on marine invertebrates via sediment are possible near the ordnance. Degradation of explosives proceeds via several pathways discussed in Section 3.1.3.1, Explosives and Explosion By-Products. Degradation products of royal demolition explosive are not toxic to marine organisms at realistic exposure levels (Rosen and Lotufo 2010). Trinitrotoluene and its degradation products impact developmental processes in marine invertebrates and are acutely toxic to adults at concentrations similar to real-world exposures (Rosen and Lotufo 2007b, 2010). The relatively low solubility of most explosives and their degradation products indicate that concentrations of these contaminants in the marine environment are relatively low and readily diluted. Furthermore, while explosives and their degradation products were detectable in marine sediment approximately 6 to 12 inches (15 to 30 centimeters) from degrading ordnance, the concentrations of these compounds were not statistically distinguishable from background beyond 3 to 6 ft. (1 to 2 m) from the degrading ordnance (Durrach et al. 1998; Section 3.1.3.1, Explosives and

Explosion By-Products). Taken together, marine invertebrates, eggs, and larvae probably would be adversely impacted by the indirect effects of degrading explosives within a very small radius of the explosive (1 to 6 ft. [0.3 to 2 m]).

Indirect impacts of explosives and unexploded ordnance on marine invertebrates via water are likely to be inconsequential and not detectable for two reasons. First, most explosives and explosive degradation products have very low solubility in sea water (Table 3.1-13 in Section 3.1, Sediments and Water Quality). This means that dissolution occurs extremely slowly, and harmful concentrations of explosives and degradation are not likely to accumulate except within confined spaces. Second, a low concentration of contaminants, slowly delivered into the water column, is readily diluted to non-harmful concentrations. While marine invertebrates may be adversely impacted by the indirect effects of degrading explosives via water (Rosen and Lotufo 2007a, 2010), this is extremely unlikely in realistic scenarios.

Impacts on marine invertebrates, including zooplankton, eggs, and larvae, are likely within a very small radius of the ordnance (1 to 6 ft. [0.3 to 2 m]). These impacts may continue as the ordnance degrades over months to decades. Because most ordnance is deployed as projectiles, multiple unexploded or low-order detonations would not accumulate on spatial scales of 1 to 6 ft. (0.3 to 2 m); therefore, potential impacts are likely to remain local and widely separated. Given these conditions, the possibility of population-level impacts on marine invertebrates is inconsequential.

3.8.3.6.2 Metals

Certain metals are harmful to marine invertebrates at concentrations above background levels (e.g., cadmium, chromium, lead, mercury, zinc, copper, manganese, and many others) (Negri et al. 2002; Wang and Rainbow 2008). Metals are introduced into seawater and sediments as a result of training and testing activities involving vessel hulks, targets, ordnance, munitions, and other military expended materials (Section 3.1.3.2, Metals). Many metals bioaccumulate, and physiological impacts begin to occur only after several trophic transfers concentrate the toxic metals. Indirect impacts of metals on marine invertebrates via sediment and water involve concentrations several orders of magnitude lower than concentrations achieved via bioaccumulation. Marine invertebrates may be exposed by contact with the metal, contact with contaminants in the sediment or water, and ingestion of contaminated sediments. Most marine invertebrates are very small relative to Navy military expended materials, and ingestion would be unlikely.

Because metals often concentrate in sediments, potential adverse indirect impacts are much more likely via sediment than via water. Despite the acute toxicity of some metals (e.g., hexavalent chromium or tributyltin) (Negri et al. 2002) concentrations above safe limits are rarely encountered even in live-fire areas of Vieques where deposition of metals from Navy activities is very high (see Section 3.1.3.2, Metals). Pait (2010) and others sampled in areas in which live ammunition and weapons were used. Other studies described in Section 3.1.3.2 (Metals) find no harmful concentrations of metals from deposition of military metals into the marine environment. Marine invertebrates, eggs, or larvae could be indirectly impacted by metals via sediment within a few inches of the object.

Concentrations of metals in sea water are orders of magnitude lower than concentrations in marine sediments. Marine invertebrates probably would not be indirectly impacted by toxic metals via the water, or via sediment near the object (e.g., within a few inches); such impacts would be local and widely separated. Concentrations of metals in water are not likely to be high enough to cause injury or mortality to marine invertebrates. Therefore, indirect impacts of metals via water are likely to be inconsequential and not detectable. Given these conditions, population-level impacts on marine invertebrates are likely to be inconsequential and not detectable.

3.8.3.6.3 Chemicals

Several Navy training and testing activities introduce potentially harmful chemicals into the marine environment; principally, flares and propellants from rockets, missiles, and torpedoes. Properly functioning flares, missiles, rockets, and torpedoes combust most of their propellants, leaving benign or readily diluted soluble combustion by-products (e.g., hydrogen cyanide). Operational failures allow propellants and their degradation products to be released into the marine environment. The greatest risk to marine invertebrates from flares, missiles, and rocket propellants is perchlorate, which is highly soluble in water, persistent, and impacts metabolic processes in many plants and animals. Torpedo propellant poses little risk to marine invertebrates because the chemicals have relatively low toxicity (Section 3.1.3.3). Marine invertebrates may be exposed by contact with the chemical, contact with chemical contaminants in the sediment or water, and ingestion of contaminated sediments. Most marine invertebrates are very small relative to Navy military expended materials or fragments of military expended materials, and ingestion of military expended materials would be unlikely.

The principal toxic component of missiles and rockets is perchlorate, which is highly soluble and does not readily adsorb to sediments. Therefore, missile and rocket fuel poses inconsequential risks of indirect impacts on marine invertebrates via sediment. In contrast, the principal toxic components of torpedo fuel, propylene glycol dinitrate and nitrodiphenylamine, adsorb to sediments, have relatively low toxicity, and are readily degraded by biological processes (Section 3.1.3.3, Chemicals). Marine invertebrates, eggs, or larvae could be indirectly impacted by propellants via sediment near the object (e.g., within a few inches), but these potential impacts would diminish rapidly as the propellant degrades (see discussion in Section 3.1.3.3 [Chemicals Other than Explosives]).

In seawater, however, perchlorate, the principal ingredient of solid missile and rocket propellant, is highly soluble, persistent, and impacts metabolic processes in many plants and animals. Perchlorate contamination rapidly disperses throughout the water column and water within sediments. While it impacts biological processes at low concentrations (e.g., less than 10 parts per billion), toxic concentrations are unlikely to be encountered in seawater. The principal mode of perchlorate toxicity in the environment is bioaccumulation.

Torpedo propellants have relatively low toxicity and pose an inconsequential risk to marine invertebrates. Marine invertebrates, zooplankton, eggs, or larvae could be indirectly impacted by hydrogen cyanide produced by torpedo fuel combustion, but these impacts would diminish rapidly as the chemical becomes diluted below toxic levels. Chemicals are rapidly diluted and readily biodegraded, and concentrations high enough to be acutely toxic are unlikely in the marine environment (see Section 3.1.3.3 [Chemicals Other than Explosives] for a discussion of these mechanisms). Concentrations of chemicals in sediment and water are not likely to cause injury or mortality to marine invertebrates; therefore; indirect impacts of chemicals via sediment and water are likely to be inconsequential and not detectable. Based on negligible impacts on individuals, population-level impacts on marine invertebrates are likely to be inconsequential and not detectable.

In the past, polychlorinated biphenyls (PCBs) were a concern because they were present in certain materials (e.g., insulation, sires, felts, and gaskets) on vessels used as targets during sinking exercises. PCBs have a variety of deleterious effects on marine organisms. PCBs persist in the tissues of organisms at the bottom of the food chain. Consumers of those species may accumulate PCBs at concentrations many times higher than the PCB concentration in the surrounding water or sediments. Vessels now used for sinking exercises are selected from a list of U.S. Navy-approved vessels that were cleaned in accordance with U.S. Environmental Protection Agency (USEPA) guidelines, but may contain PCBs that could not be removed during cleaning.

3.8.3.6.4 Other Materials

Military expended materials that are re-mobilized after their initial contact with the seafloor (e.g., by waves or currents) may continue to strike or abrade marine invertebrates. Secondary physical strike and disturbances are relatively unlikely because most expended materials are more dense than the surrounding sediments (i.e., metal), and are likely to remain in place as the surrounding sediment moves. The principal exception is likely to be parachutes, which are moved easily relative to projectiles and fragments. Potential secondary physical strike and disturbance impacts may cease only: (1) when the military expended materials is too massive to be mobilized by typical oceanographic processes, (2) when the military expended material becomes encrusted by natural processes and incorporated into the seafloor, or (3) when the military expended materials becomes permanently buried. The fitness of individual organisms would be impacted directly or indirectly, but not to the extent that the viability of populations or species would be impacted.

All military expended material, including targets and vessel hulks used for sinking exercises that contain materials other than metals, explosives, or chemicals, is evaluated for potential indirect impacts on marine invertebrates via sediment and water. Principal components of these military expended materials include: aluminized fiberglass (chaff); carbon or Kevlar fiber (missiles); and plastics (canisters, targets, sonobuoy components, parachutes, etc). Potential effects of these materials are discussed in Section 3.1.3.4, Other Materials. Chaff has been extensively studied, and no indirect toxic effects are known to occur at realistic concentrations in the marine environment (Arfsten et al. 2002). Plastics contain chemicals, including persistent organic pollutants, which could indirectly affect marine invertebrates (Derraik 2002; Mato et al. 2001; Teuten et al. 2007). Marine invertebrates may be exposed by contact with the plastic, contact with associated plastic chemical contaminants in the sediment or water, or ingestion of contaminated sediments. Most marine invertebrates are very small relative to Navy military expended materials or fragments of military expended materials, and direct ingestion of military expended materials is unlikely.

The only material that could impact marine invertebrates via sediment is plastics. Harmful chemicals in plastics interfere with metabolic and endocrine processes in many plants and animals (Derraik 2002). Potentially harmful chemicals in plastics are not readily adsorbed to marine sediments; instead, marine invertebrates are most at risk via ingestion or bioaccumulation (Sections 3.8.3.4 [Ingestion Stressors] and 3.3 Marine Habitats). Because plastics retain much of their chemical properties as they are physically degraded into microplastic particles (Singh and Sharma 2008), the exposure risks to marine invertebrates are dispersed over time. Marine invertebrates could be indirectly impacted by chemicals from plastics expended during training and testing activities but, these effects would be limited to direct contact with the material. Because of these conditions, population-level impacts on marine invertebrates are likely to be inconsequential and not detectable.

Under the ESA, secondary stressors from training and testing activities under the No Action Alternative, Alternative 1, and Alternative 2 would have no effect on ESA-listed abalone species.

Under the ESA, secondary stressors from training and testing activities under the No Action Alternative, Alternative 1, and Alternative 2 would have no effect on ESA-listed abalone species critical habitats.

3.8.3.7 Summary of Potential Impacts (Combined Impacts of All Stressors) on Marine Invertebrates

As described in Section 3.0.5.5 (Resource-Specific Impacts Analysis for Multiple Stressors), this section evaluates the potential for combined impacts of all the stressors from the proposed action. The analysis and conclusions for the potential impacts from each of the individual stressors are discussed in the sections above and summarized in Sections 3.8.3.7.2 (Endangered Species Act Determinations). Stressors associated with Navy training and testing activities do not typically occur in isolation but rather occur in some combination. For example, mine neutralization activities include elements of acoustic, physical disturbance and strike, entanglement, ingestion, and secondary stressors that are all coincident in space and time. An analysis of the combined impacts of all stressors considers the potential consequences of aggregate exposure to all stressors and the repetitive or additive consequences of exposure over multiple years. This analysis makes the reasonable assumption that the majority of exposures to stressors are non-lethal, and instead focuses on consequences potentially impacting the organism's fitness (e.g., physiology, behavior, reproductive potential).

It is unlikely that mobile or migratory marine invertebrates that occur within the water column would be exposed to multiple activities during their lifespan because they are relatively short-lived, and most Navy training and testing activities impact small widely-dispersed areas. It is much more likely that stationary organisms or those that only move over a small range (e.g., corals, worms, and sea urchins) would be exposed to multiple activities because many Navy activities recur in the same location (e.g., gunnery and mine warfare).

Multiple stressors can co-occur with marine invertebrates in two general ways. The first would be if a marine invertebrate were exposed to multiple sources of stress from a single event or activity. The second is exposure to a combination of stressors over the course of the organism's life. Both general scenarios are more likely to occur where training and testing activities are concentrated. The key difference between the two scenarios is the amount of time between exposures to stressors. Time is an important factor because some stressors develop over a long period while others occur and pass quickly (e.g., dissolution of secondary stressors into the sediment versus physical disturbance). Similarly, time is an important factor for the organism because subsequent disturbances or injuries often increase the time needed for the organism to recover to baseline behavior/physiology, extending the time that the organism's fitness is impacted.

Marine invertebrates are susceptible to multiple stressors (see Section 3.8.2 [General Threats]), and susceptibilities of many species are enhanced by additive or synergistic effects of multiple stressors (Section 3.8.2.8 [Phylum Cnidaria]). The global decline of corals, for example, is driven primarily by synergistic impacts of pollution, ecological consequences of overfishing, and climate change. As discussed in the analyses above, marine invertebrates are not particularly susceptible to energy, entanglement, or ingestion stressors resulting from Navy activities (Section 3.8.3.2 [Energy Stressors]; Section 3.8.3.4 [Entanglement Stressors]; and Section 3.8.3.5 [Ingestion Stressors]; therefore, the opportunity for Navy stressors to result in additive or synergistic consequences is most likely limited to acoustic, physical strike and disturbance, and secondary stressors.

Despite uncertainty in the nature of consequences resulting from combined impacts, the location of potential combined impacts can be predicted with more certainty because combinations are much more likely in locations that training and testing activities are concentrated. However, analyses of the nature of potential consequences of combined impacts of all stressors on marine invertebrates remain largely qualitative and speculative. Where multiple stressors coincide with marine invertebrates, the likelihood of a negative consequence is elevated but it is not feasible to predict the nature of the consequence or its likelihood because not enough is known about potential additive or synergistic interactions. Even for shallow-water coral reefs, an exceptionally well-studied resource, predictions of the consequences of multiple stressors are semi-quantitative and generalized predictions remain qualitative (Hughes and Connell 1999; Jackson 2008; Norström et al. 2009). It is also possible that Navy stressors will combine with non-Navy stressors, and this is qualitatively discussed in Chapter 4.0, Cumulative Impacts.

3.8.3.7.1 Endangered Species Act Determinations

Table 3.8-4 summarizes the Navy's determination of effect on ESA-listed marine invertebrates for each stressor based on the previous analysis sections. Accordingly, the Navy is including black abalone and white abalone in the Section 7 ESA consultation with NMFS. No other ESA-listed invertebrate species occur within the Study Area.

Table 3.8-4: Summary of Endangered Species Act Determinations for Marine Invertebrates for the Preferred Alternative

Stressor		Black Abalone	White Abalone
Acoustic Stressors			
Sonar and Other Non-impulsive Acoustic Sources	Training Activities	No effect	No effect
	Testing Activities	No effect	No effect
Explosives and Other Impulsive Acoustic Sources	Training Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Energy Stressors			
Electromagnetic Devices	Training Activities	No effect	No effect
	Testing Activities	No effect	No effect
Physical Disturbance and Strike Stressors			
Vessels and In-water Devices	Training Activities	No effect	No effect
	Testing Activities	No effect	No effect
Military Expended Materials	Training Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect	May affect, not likely to adversely affect
Seafloor devices	Training Activities	No effect	No effect
	Testing Activities	No effect	No effect
Entanglement Stressors			
Cables and Wires	Training Activities	No effect	No effect
	Testing Activities	No effect	No effect
Parachutes	Training Activities	No effect	No effect
	Testing Activities	No effect	No effect
Ingestion Stressors			
Military Expended Materials	Training Activities	No effect	No effect
	Testing Activities	No effect	No effect
Secondary Stressors			
Explosives, Explosion By-Products, Unexploded Ordnance, Metals, Chemicals, and Other Materials	Training Activities	No effect	No effect
	Testing Activities	No effect	No effect

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3.9 FISH

FISH SYNOPSIS

The United States Department of the Navy considered all potential stressors and the following have been analyzed for fish:

- Acoustic (sonar and other non-impulsive acoustic sources, explosions and other impulsive acoustic sources)
- Energy (electromagnetic)
- Physical disturbance and strike (vessels and in-water devices, military expended materials, seafloor devices)
- Entanglement (cables and wires, parachutes)
- Ingestion (munitions and military expended materials other than munitions)
- Secondary (indirect impacts associated with habitat quality)

Preferred Alternative

- Per Endangered Species Act (ESA) standards, acoustic sources may affect but are not likely to adversely affect ESA-listed steelhead trout. Acoustic sources would not affect critical habitat.
- Per ESA standards, energy sources used during training and testing activities may affect but are not likely to adversely affect ESA-listed steelhead trout. Energy sources would not affect critical habitat.
- Per ESA standards, physical disturbance and strike sources used during training and testing activities would have no effect on ESA-listed steelhead trout. Physical disturbance and strikes would not affect critical habitat.
- Per ESA standards, entanglement sources from cables, wires, and parachutes used during training and testing activities would have no effect on ESA-listed steelhead trout. Entanglement sources would not affect critical habitat.
- Per ESA standards, ingestion sources from military expended materials (munitions and non-munitions) used during training and testing activities would have no effect on ESA-listed steelhead trout. Ingestion sources would not affect critical habitat.
- Per ESA standards, secondary stressors from training and testing activities would have no effect on ESA-listed steelhead trout. Ingestion sources would not affect critical habitat.

3.9.1 INTRODUCTION AND METHODS

This section analyzes the potential impacts of the Proposed Action on fishes found in the Hawaii-Southern California Training and Testing (HSTT) Study Area (Study Area). Section 3.9 provides a synopsis of the United States (U.S.) Department of the Navy's (Navy) determinations of the impacts of the Proposed Action on fish. Section 3.9.1 (Introduction) introduces the species and taxonomic groups that occur in the Study Area. Section 3.9.2 (Affected Environment) discusses the baseline affected environment. The complete analysis of environmental consequences is in Section 3.9.3 (Environmental Consequences), and the potential impacts of the Proposed Action on fishes are summarized in Section 3.9.4 (Summary of Potential Impacts on Fish).

For this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS), marine fishes are evaluated as groups of species characterized by distribution, body type, or behavior relevant to the stressor being evaluated. Activities are evaluated for their potential impact on all fishes in general, by taxonomic groupings, and the one marine fish in the Study Area listed under the Endangered Species Act (ESA).

Fish species listed under the ESA, along with major taxonomic groups in the Study Area, are described in this section. Marine fish species that are regulated under the Magnuson-Stevens Fishery Conservation and Management Act are discussed in Section 3.9.1.3. Additional general information on the biology, life history, distribution, and conservation of marine fishes can be found on the websites of the following agencies and organizations, as well as many others:

- National Marine Fisheries Service (NMFS), Office of Protected Resources (including ESA-listed species distribution maps)
- Regional Fishery Management Councils
- International Union for Conservation of Nature
- Essential Fish Habitat Text Descriptions

Fishes are not distributed uniformly throughout the Study Area but are closely associated with a variety of habitats. Some species, such as large sharks, tuna, and billfishes range across thousands of square miles; others, such as gobies and reef fishes have small home ranges and restricted distributions (Helfman et al. 2009a). The movements of some open-ocean species may never overlap with coastal fishes that spend their lives within several hundred feet (a few hundred meters) of the shore. Even within a single fish species, the distribution and specific habitats in which individuals occur may be influenced by its developmental stage, size, sex, reproductive condition, and other factors.

3.9.1.1 Endangered Species Act Species

There is only one marine fish, steelhead trout (*Oncorhynchus mykiss*) in the Study Area that is listed as endangered under the ESA (Table 3.9-1 and Section 3.9.2.3).

One species (scalloped hammerhead shark [*Sphyrna lewini*]) is a candidate for listing as threatened or endangered in the future, and there are three species of concern (basking shark [*Cetorhinus maximus*], bocaccio [*Sebastes paucispinis*], and cowcod [*Sebastes levis*]), defined as a species about which NMFS has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the ESA. The emphasis on species-specific information in the following profiles will be on the one ESA protected species because any threats or potential impacts on that species are subject to consultation with regulatory agencies. Consideration is also given to the broad taxonomic groups to cover the non-regulated fishes within the marine ecosystem of the Study Area.

Table 3.9-1: Status and Presence of Endangered Species Act-Listed Fish Species, Candidate Species, and Species of Concern Found in the Hawaii-Southern California Training and Testing Study Area

Species Name and Regulatory Status			Presence in Study Area	
Common Name	**Scientific Name**	**Endangered Species Act Listing**	**Open Ocean Area**	**Coastal Waters**
Steelhead trout	*Oncorhynchus mykiss*	Endangered (Southern California distinct population segment[1])	Santa Maria River, California to U.S.-Mexico Border	California Current
Scalloped Hammerhead Shark	*Sphyrna lewini*	Candidate under petition	Southern California and waters off of Hawaii	Southern California and waters off of Hawaii
Basking shark	*Cetorhinus maximus*	Species of Concern (Eastern North Pacific population)	Canada to Southern California	California Current
Bocaccio	*Sebastes paucispinis*	Species of Concern (Southern California distinct population segment[1])	Oregon to Central Baja California	California Current
Cowcod	*Sebastes levis*	Species of Concern (Central Oregon to central Baja California and Guadalupe Island, Mexico evolutionarily significant unit[2])	Central Oregon to Central Baja California	California Current

[1] A species with more than one distinct population segment can have more than one ESA listing status, as individual distinct population segments can be either not listed under the ESA or can be listed as endangered, threatened, or a candidate species.
[2] Evolutionarily significant unit is a population of organisms that is considered distinct for purposes of conservation.

3.9.1.2 Taxonomic Groups

Taxonomic groupings of marine fishes are listed in Table 3.9-2 and are described further in Section 3.9.2 (Affected Environment). In order to capture all marine fishes representative of the Study Area, these taxonomic groups are presented to supplement the approach used for the ESA-protected species in this document.

Table 3.9-2: Major Taxonomic Groups of Marine Fishes within the Hawaii-Southern California Training and Testing Study Area

Major Marine Fish Groups[1]		Vertical Distribution Within Study Area[2]	
Common Name (Taxonomic Group)	**Description**	**Open Ocean**	**Coastal Waters**
Jawless fishes (order Myxiniformes and order Petromyzontiformes)	Primitive fishes with an eel-like body shape that feed on dead fishes or are parasitic on other fishes	Water column, seafloor	Seafloor
Sharks, rays, and chimaeras (class Chondrichthyes)	Cartilaginous (non-bony) fishes, many of which are open ocean predators	Surface, water column, seafloor	Surface, water column, seafloor
Eels and bonefishes (order Anguilliformes, order Elopiformes)	Undergo a unique larval stage with a small head and elongated body; very different from other fishes	Surface, water column, seafloor	Surface, water column, seafloor
Smelt and salmonids (orders Argentiniformes, Osmeriformes, and Salmoniformes)	Most salmon and smelt are migratory between marine and estuarine/freshwater habitats; Argentiniformes occur in deep waters	Seafloor (Argentiniformes only), surface, water column	Surface, water column
Dragonfishes and lanternfishes (orders Stomiiformes and Myctophiformes)	Largest group of deepwater fishes, most possess adaptations for low-light conditions	Water column, seafloor	Water column, seafloor
Greeneyes, lizardfishes, lancetfishes, and telescopefishes (order Aulopiformes)	Possess both primitive and advanced features of marine fishes	Seafloor	Water column, seafloor
Cods (orders Gadiformes and Ophidiiformes)	Important commercial fishery resources (cods), associated with bottom habitats, also includes some deepwater groups	Water column, seafloor	Water column, seafloor
Toadfishes and anglerfishes (orders Batrachoidiformes and Lophiiformes)	Includes the toadfishes and the anglerfishes, a lie-in-wait predator	Seafloor	Seafloor
Mullets, silversides, needlefishes, and killifish (orders Mugiliformes, Atheriniformes, Beloniformes, and Cyprinodontiformes)	Small-sized nearshore/coastal fishes, primarily feed on organic debris; also includes the surface-oriented flyingfishes	Surface	Surface, water column, seafloor
Oarfishes, squirrelfishes, dories (orders Lampridiformes, Beryciformes, Zeiformes)	Primarily open ocean or deepwater fishes, except for squirrelfishes (reef-associated)	Surface, water column, seafloor	Surface, water column, seafloor
Pipefishes and seahorses (order Gasterosteiformes)	Small mouth with tubular snout and armor like scales; gives birth to live young and shows a high level of parental care	None	Surface, water column, seafloor
Scorpionfishes (order Scorpaeniformes)	Bottom dwelling with modified pectoral fins to rest on the bottom	Seafloor	Seafloor

Table 3.9-2: Major Taxonomic Groups of Marine Fishes within the Hawaii-Southern California Training and Testing Study Area (continued)

Major Marine Fish Groups[1]		Vertical Distribution Within Study Area[2]	
Common Name (Taxonomic Group)	**Description**	**Open Ocean**	**Coastal Waters**
Snappers, drums, and croakers (families Sciaenidae and Lutjanidae)	Important game fishes and common predators of all marine waters; sciaenids produce sounds with their swim bladders	Surface, water column, seafloor	Surface, water column, seafloor
Groupers and seabasses (family Serranidae)	Important game fishes with vulnerable conservation status; some have a hermaphroditic strategy in which females become males as they mature	Water column, seafloor	Surface, water column, seafloor
Wrasses, damselfishes (family Pomacentridae), and parrotfishes (families Labridae and Scaridae)	Primarily reef-associated fishes with a hermaphroditic strategy in which females become males as they mature	Water column, seafloor	Surface, water column, seafloor
Gobies and blennies (families Gobiidae and Blennidae)	Gobies are the largest and most diverse family of marine fishes, mostly found in bottom habitats of coastal areas	Surface, water column, seafloor	Surface, water column, seafloor
Jacks, tunas, mackerels, and billfishes (families Carangidae, Scombridae, Xiphiidae, Istiophoridae)	Highly migratory predators found near the surface; they make up a major component of fisheries	Surface	Surface, water column
Flounders (order Pleuronectiformes)	Flatfishes that occur in bottom habitats throughout the world where they are well camouflaged	Seafloor	Seafloor
Triggerfishes, puffers, and molas (order Tetraodontiformes)	Unique body shapes and characteristics to avoid predators (e.g., spines); includes ocean sunfish, the largest bony fish	Surface, water column, seafloor	Surface, water column, seafloor

[1]Taxonomic groups are based on the following commonly accepted references (Helfman et al. 1997; Moyle and Cech 1996; Nelson 2006).
[2] Presence in the Study Area includes open ocean areas (portions of the North Pacific Subtropical Gyre and North Pacific Transition Zone) and coastal waters of two Large Marine Ecosystems-California Current and Insular Pacific-Hawaiian.

3.9.1.3 Federally Managed Species

The fisheries of the United States are managed within a framework of overlapping international, federal, state, interstate, and tribal authorities. Individual states and territories generally have jurisdiction over fisheries in marine waters within 3 nm of their coast. Federal jurisdiction includes fisheries in marine waters inside the U.S. Exclusive Economic Zone, which encompasses the area from 3 nm to 200 nm offshore of any U.S. coastline (National Oceanic and Atmospheric Administration 1996).

The Magnuson-Stevens Fishery Conservation and Management Act and Sustainable Fisheries Act (see Section 3.0.1.1 [Federal Statutes] for details) led to the formation of eight fishery management councils that share authority with the NMFS to manage and conserve the fisheries in federal waters. Essential Fish Habitat is also identified and managed under this act. For analyses of impacts on those habitats included as Essential Fish Habitat within the Study Area, refer to Sections 3.3 (Marine Habitats), 3.7 (Marine Vegetation), and 3.8 (Invertebrates). Together with NMFS, the councils maintain fishery management plans for specific species or species groups to regulate commercial and recreational fishing within their geographic regions. There are two regional fishery management councils including the Western Pacific Regional Fishery Management Council and the Pacific Regional Fishery Management Council within the HSTT Study Area.

Federally managed species of marine fishes are listed in Table 3.9-3 and Table 3.9-4. These species are considered, along with ESA-listed species and other taxonomic groupings, in the analysis of impacts in Section 3.9.3 (Environmental Consequences). The analysis of impacts on commercial and recreational fisheries is provided in Section 3.11 (Socioeconomic Resources).

Table 3.9-3: Federally Managed Fish Species Within the Hawaii-Southern California Training and Testing Study Area, Western Pacific Regional Fishery Management Council

Western Pacific Regional Fishery Management Council		
Common Name	**Local Name**	**Scientific Name**
Hawaii Archipelago Bottomfish Management Unit Species (BMUS)		
Amberjack	kahala	*Seriola dumerili*
Black jack	ulua la'uli	*Caranx lugubris*
Blue stripe snapper	ta'ape	*Lutjanus kasmira*
Giant trevally	white papio/ulua au kea	*Caranx ignobilis*
Gray jobfish	uku	*Aprion virescens*
Longtail snapper	onaga or 'ula'ula koa'e	*Etelis coruscans*
Pink snapper	'opakapaka	*Pristipomoides filamentosus*
Pink snapper	kalekale	*Pristipomoides seiboldii*
Red snapper	ehu	*Etelis carbunculus*
Sea bass	hapu'upu'u	*Epinephelus quernus*
Silver jaw jobfish	lehi	*Aphareus rutilans*
Snapper	gindai	*Pristipomoides zonatus*
Thicklip trevally	pig ulua, butaguchi	*Pseudocaranx dentex*
Yellowtail snapper	kalekale	*Pristipomoides auricilla*
Hawaii Archipelago Bottomfish Management Unit Species - Seamount Groundfish		
Alfonsin	NA	*Beryx splendens*
Armorhead	NA	*Pseudopentaceros wheeleri*
Raftfish	NA	*Hyperoglyphe japonica*
Hawaii Archipelago Coral Reef Ecosystem Management Units Species, Currently Harvested Coral Reef Taxa (CHCRT)		
Anchovies	nehu	Engraulidae
Anemones	NA	Actinaria
Angelfishes	NA	Pomacanthidae
Banded goatfish	kumu or moano	*Parupeneus* spp.
Bandtail goatfish	weke pueo	*Upeneus arge*
Barracudas	kaku	Sphyraenidae

Table 3.9-3: Federally Managed Fish Species Within the Hawaii-Southern California Training and Testing Study Area, Western Pacific Regional Fishery Management Council (continued)

Western Pacific Regional Fishery Management Council		
Common Name	**Local Name**	**Scientific Name**
Hawaii Archipelago Coral Reef Ecosystem Management Units Species, Currently Harvested Coral Reef Taxa (CHCRT)		
Bigeye	‘aweoweo	*Priacanthus hamrur*
Bigeye scad	akule or hahalu	*Selar crumenophthalmus*
Bigscale soldierfish	menpachi or ‘u‘u	*Myripristis berndti*
Black tongue unicornfish	kala holo	*Naso hexacanthus*
Black triggerfish	humuhumu ‘ele‘ele	*Melichthys niger*
Blacktip reef shark	manō	*Carcharhinus melanopterus*
Blennies	pa o‘o	Blenniidae
Blue-lined squirrelfish	‘ala‘ihi	*Sargocentron tiere*
Blue-lined surgeon	maiko	*Acanthurus nigroris*
Bluespine unicornfish	kala	*Naso unicornus*
Brick soldierfish	menpachi or ‘u‘u	*Myripristis amaena*
Bridled triggerfish	NA	*Sufflamen fraenatum*
Brown surgeonfish	mai‘i‘i	*Acanthurus nigrofuscus*
Butterflyfish	kikakapu	*Chaetodon auriga*
Butterflyfishes	kikakapu	Chaetodontidae
Cardinalfishes	‘upapalu	Apogonidae
Cigar wrasse	kupoupou	*Cheilio inermis*
Convict tang	manini	*Acanthurus triostegus*
Coral crouchers	NA	Caracanthidae
Cornetfish	nunu peke	Fistularia commersoni
Crown squirrelfish	‘ala‘ihi	*Sargocentron diadema*
Damselfishes	mamo	Pomacentridae
Doublebar goatfish	munu	*Parupeneus bifasciatus*
Dragon eel	puhi	*Enchelycore pardalis*
Eels (Those species not listed as CHCRT)	puhi	Muraenidae
		Congridae
		Ophichthidae
Eller’s barracuda	kawele‘a or kaku	*Sphyraena helleri*
Eye-striped surgeonfish	palani	*Acanthurus dussumieri*
False mullet	uouoa	*Neomyxus leuciscus*
File-lined squirrelfish	‘ala‘ihi	*Sargocentron microstoma*
Flounders and soles	paki‘i	Bothidae
Flounders and soles	paki‘i	Soleidae
Flounders and soles	paki‘i	Pleuronectidae

Table 3.9-3: Federally Managed Fish Species Within the Hawaii-Southern California Training and Testing Study Area, Western Pacific Regional Fishery Management Council (continued)

Western Pacific Regional Fishery Management Council		
Common Name	**Local Name**	**Scientific Name**
Hawaii Archipelago Coral Reef Ecosystem Management Units Species, Currently Harvested Coral Reef Taxa (CHCRT)		
Frogfishes	NA	Antennariidae
Galapagos shark	manō	*Carcharhinus galapagensis*
Giant moray eel	puhi	*Gymnothorax javanicus*
Glasseye	‘aweoweo	*Heteropriacanthus cruentatus*
Goatfishes	weke, moano, kumu	Mullidae
Gobies	‘o‘opu	Gobiidae
Gray unicornfish	NA	*Naso caesius*
Great barracuda	kaku	*Sphyraena barracuda*
Grey reef shark	manō	*Carcharhinus amblyrhynchos*
Groupers, seabass (Those species not listed as CHCRT or in BMUS)	roi, hapu‘upu‘u	Serrandiae
Hawaiian flag-tail	‘aholehole	*Kuhlia sandvicensis*
Hawaiian squirrelfish	‘ala‘ihi	*Sargocentron xantherythrum*
Hawkfishes (Those species not listed as CHCRT)	po‘opa‘a	Cirrhitidae
Herrings	NA	Clupeidae
Jacks and scads (Those species not listed as CHCRT or in BMUS)	dobe, kagami, pa‘opa‘o, papa, omaka, ulua	Carangidae
Labridae wrasses (Those species not listed as CHCRT)	hinalea	Labridae wrasses
Mackerel scad	‘opelu or ‘opelu mama	*Decapterus macarellus*
Moorish idol	kihikihi	*Zanclus cornutus*
Moorish Idols	kihikihi	Zanclidae
Multi-barred goatfish	moano	*Parupeneus multifaciatus*
Orange goatfish	weke nono	*Mulloidichthys pfleugeri*
Orangespine unicornfish	kalalei or umaumalei	*Naso lituratus*
Orange-spot surgeonfish	na‘ena‘e	*Acanthurus olivaceus*
Parrotfish	uhu or palukaluka	*Scarus* spp.
Pearly soldierfish	menpachi or ‘u‘u	*Myripristis kuntee*
Peppered squirrelfish	‘ala‘ihi	*Sargocentron punctatissimum*
Picassofish	humuhumu nukunuku apua‘a	*Rhinecanthus aculeatus*
Pinktail triggerfish	humuhumu hi‘ukole	*Melichthys vidua*
Pipefishes and seahorses	NA	Syngnathidae
Puffer fishes and porcupine fishes	‘o‘opu hue or fugu	Tetraodontidae

Table 3.9-3: Federally Managed Fish Species Within the Hawaii-Southern California Training and Testing Study Area, Western Pacific Regional Fishery Management Council (continued)

Western Pacific Regional Fishery Management Council		
Common Name	**Local Name**	**Scientific Name**
Hawaii Archipelago Coral Reef Ecosystem Management Units Species, Currently Harvested Coral Reef Taxa (CHCRT)		
Raccoon butterflyfish	kikakapu	*Chaetodon lunula*
Razor wrasse	laenihi or nabeta	*Xyrichtys pavo*
Rays and skates	hihimanu	Dasyatididae
		Myliobatidae
Red ribbon wrasse	NA	*Thalassoma quinquevittatum*
Remoras	NA	Echeneidae
Ringtail surgeonfish	Pualu	*Acanthurus blochii*
Ring-tailed wrasse	po‘ou	*Oxycheilinus unifasciatus*
Rockmover wrasse	NA	*Novaculichthys taeniourus*
Rudderfish	nenue	*Kyphosus biggibus*
Rudderfish	nenue	*Kyphosus cinerascens*
Rudderfish	nenue	*Kyphosus vaigiensis*
Rudderfishes (Those species not listed as CHCRT)	nenue	Kyphosidae
Saber or long jaw squirrelfish	‘ala‘ihi	*Sargocentron spiniferum*
Saddleback butterflyfish	kikakapu	*Chaetodon ephippium*
Saddleback hogfish	‘a‘awa	*Bodianus bilunulatus*
Sandperches	NA	Pinguipedidae
Scorpionfishes, lionfishes	nohu, okoze	Scorpaenidae
Sharks	manō	Carcharhinidae
		Sphyrnidae
Side-spot goatfish	malu	*Parupeneus pleurostigma*
Snappers (Those species not listed as CHCRT or in BMUS)	to‘au	Lutjanidae
Trumpetfish	nunu	Aulostomus chinensis
Solderfishes and squirrelfishes	‘u‘u	Holocentridae
Sponges	NA	Porifera
Spotfin squirrelfish	‘ala‘ihi	*Neoniphon* spp.
Spotted unicornfish	kala lolo	*Naso brevirostris*
Stareye parrotfish	panuhunuhu	*Calotomus carolinus*
Surgeonfishes	na‘ena‘e, maikoiko	Acanthuridae
Striped bristletooth	NA	*Ctenochaetus striatus*
Stripped mullet	‘ama‘ama	*Mugil cephalus*
Sunset wrasse	NA	*Thalassoma lutescens*
Surge wrasse	ho‘u	*Thalassoma purpureum*
Threadfin	moi	*Polydactylus sexfilis*
Tilefishes	NA	Malacanthidae

Table 3.9-3: Federally Managed Fish Species Within the Hawaii-Southern California Training and Testing Study Area, Western Pacific Regional Fishery Management Council (continued)

Western Pacific Regional Fishery Management Council		
Common Name	**Local Name**	**Scientific Name**
Hawaii Archipelago Coral Reef Ecosystem Management Units Species, Currently Harvested Coral Reef Taxa (CHCRT)		
	humu humu	Balistidae
Trunkfishes	makukana	Ostraciidae
Undulated moray eel	puhi laumilo	*Gymnothorax undulatus*
Whitebar surgeonfish	maiko or maikoiko	*Acanthurus leucopareius*
Whitecheek surgeonfish	NA	*Acanthurus nigricans*
Whitemargin unicornfish	kala	*Naso annulatus*
White-spotted surgeonfish	‘api	*Acanthurus guttatus*
Whitetip reef shark	manō lalakea	*Triaenodon obesus*
Yellow goatfish	weke	*Mulloidichthys spp.*
Yellow tang	lau‘ipala	*Zebrasoma flavescens*
Yellow-eyed surgeonfish	kole	*Ctenochaetus strigosus*
Yellowfin goatfish	weke‘ula	*Mulloidichthys vanicolensis*
Yellowfin soldierfish	menpachi or ‘u‘u	*Myripristis chryseres*
Yellowfin surgeonfish	pualu	*Acanthurus xanthopterus*
Yellowmargin moray eel	puhi paka	*Gymnothorax flavimarginatus*
Yellowsaddle goatfish	moano kea or moano kale	*Parupeneus cyclostomas*
Yellowstripe goatfish	weke‘a or weke a‘a	*Mulloidichthys flavolineatus*

Notes: All other coral reef ecosystem management unit species that are marine plants, invertebrates, and fishes that are not listed in the preceding tables or are not bottomfish management unit species, crustacean management unit species, Pacific pelagic management unit species, precious coral or seamount groundfish.
Source: (Western Pacific Regional Fishery Management Council 2009).
NA=Not Applicable

Table 3.9-4: Federally Managed Fish Species within the Hawaii-Southern California Training and Testing Study Area, Pacific Regional Fishery Management Council

Pacific Regional Fishery Management Council	
Common Name	**Scientific Name**
Groundfish Management Unit Species	
Sharks and Skates	
Big skate	*Raja binoculata*
California skate	*Raja inornata*
Leopard shark	*Triakis semifasciata*
Longnose skate	*Raja rhina*
Soupfin shark	*Galeorhinus zyopterus*
Spiny dogfish	*Squalus acanthias*
Ratfish	

Table 3.9-4: Federally Managed Fish Species within the Hawaii-Southern California Training and Testing Study Area, Pacific Regional Fishery Management Council (continued)

Pacific Regional Fishery Management Council	
Common Name	**Scientific Name**
Ratfish	*Hydrolagus colliei*
Morids	
Finescale codling	*Antimora microlepis*
Grenadiers	
Pacific rattail	*Coryphaenoides acrolepis*
Roundfish	
Cabezon	*Scorpaenichthys marmoratus*
Kelp greenling	*Hexagrammos decagrammus*
Lingcod	*Ophiodon elongatus*
Pacific cod	*Gadus macrocephalus*
Pacific Regional Fishery Management Council	
Groundfish Management Unit Species	
Roundfish	
Pacific whiting (hake)	*Merluccius productus*
Sablefish	*Anoplopoma fimbria*
Rockfish[1]	
Aurora rockfish	*Sebastes aurora*
Bank rockfish	*Sebastes rufus*
Black rockfish	*Sebastes melanops*
Black and yellow rockfish	*Sebastes chrysomelas*
Blackgill rockfish	*Sebastes melanostomus*
Blue rockfish	*Sebastes mystinus*
Bocaccio	*Sebastes paucispinis*
Bronzespotted rockfish	*Sebastes gilli*
Brown rockfish	*Sebastes auriculatus*
Calico rockfish	*Sebastes dallii*
California scorpionfish	*Scorpaena gutatta*
Canary rockfish	*Sebastes pinniger*
Chameleon rockfish	*Sebastes phillipsi*
China rockfish	*Sebastes nebulosus*
Chilipepper	*Sebastes goodei*
Copper rockfish	*Sebastes caurinus*
Cowcod	*Sebastes levis*
Darkblotched rockfish	*Sebastes crameri*
Dusky rockfish	*Sebastes ciliatus*
Dwarf-red rockfish	*Sebastes rufinanus*

Table 3.9-4: Federally Managed Fish Species within the Hawaii-Southern California Training and Testing Study Area, Pacific Regional Fishery Management Council (continued)

Pacific Regional Fishery Management Council	
Common Name	**Scientific Name**
Groundfish Management Unit Species	
Flag rockfish	*Sebastes rubrivinctus*
Freckled rockfish	*Sebastes lentiginosus*
Gopher rockfish	*Sebastes carnatus*
Grass rockfish	*Sebastes rastrelliger*
Greenblotched rockfish	*Sebastes rosenblatti*
Greenspotted rockfish	*Sebastes chlorostictus*
Greenstriped rockfish	*Sebastes elongatus*
Halfbanded rockfish	*Sebastes semicinctus*
Harlequin rockfish	*Sebastes variegatus*
Honeycomb rockfish	*Sebastes umbrosus*
Kelp rockfish	*Sebastes atrovirens*
Longspine thornyhead	*Sebastolobus altivelis*
Mexican rockfish	*Sebastes macdonaldi*
Rockfish[1]	
Olive rockfish	*Sebastes serranoides*
Pink rockfish	*Sebastes eos*
Pinkrose rockfish	*Sebastes simulator*
Pygmy rockfish	*Sebastes wilsoni*
Pacific ocean perch	*Sebastes alutus*
Quillback rockfish	*Sebastes maliger*
Redbanded rockfish	*Sebastes babcocki*
Redstripe rockfish	*Sebastes proriger*
Rosethorn rockfish	*Sebastes helvomaculatus*
Rosy rockfish	*Sebastes rosaceus*
Rougheye rockfish	*Sebastes aleutianus*
Sharpchin rockfish	*Sebastes zacentrus*
Shortbelly rockfish	*Sebastes jordani*
Shortraker rockfish	*Sebastes borealis*
Shortspine thornyhead	*Sebastolobus alascanus*
Silvergray rockfish	*Sebastes brevispinis*
Speckled rockfish	*Sebastes ovalis*
Splitnose rockfish	*Sebastes diploproa*
Squarespot rockfish	*Sebastes hopkinsi*
Starry rockfish	*Sebastes constellatus*
Stripetail rockfish	*Sebastes saxicola*
Swordspine rockfish	*Sebastes ensifer*
Tiger rockfish	*Sebastes nigrocinctus*

Table 3.9-4: Federally Managed Fish Species within the Hawaii-Southern California Training and Testing Study Area, Pacific Regional Fishery Management Council (continued)

Pacific Regional Fishery Management Council	
Common Name	**Scientific Name**
Groundfish Management Unit Species	
Treefish	*Sebastes serriceps*
Vermilion rockfish	*Sebastes miniatus*
Widow rockfish	*Sebastes entomelas*
Yelloweye rockfish	*Sebastes ruberimus*
Yellowmouth rockfish	*Sebastes reedi*
Yellowtail rockfish	*Sebastes flavidus*
Flatfish	
Arrowtooth flounder (turbot)	*Atheresthes stomias*
Butter sole	*Isopsetta isolepis*
Curlfin sole	*Pleuronichthys decurrens*
Dover sole	*Microstomus pacificus*
English sole	*Parophrys vetulus*
Flathead sole	*Hippoglossoides elassodon*
Pacific sanddab	*Citharichthys sordidus*
Petrale sole	*Eopsetta jordani*
Rex sole	*Glyptocephalus zachirus*
Rock sole	*Lepidopsetta bilineata*
Sand sole	*Psettichthys melanostictus*
Starry flounder	*Platichthys stellatus*
Coastal Pelagic Management Unit Species	
Pacific sardine	*Sardinops sagax*
Pacific (chub) mackerel	*Scomber japonicus*
Northern anchovy, central and northern subpopulations	*Engraulis mordax*
Market squid	*Doryteuthis opalescens*
Jack mackerel	*Trachurus symmetricus*
Highly Migratory Species Management Unit Species	
Tunas	
North Pacific albacore	*Thunnus alalunga*
Yellowfin tuna	*Thunnus albacares*
Bigeye tuna	*Thunnus obesus*
Skipjack tuna	*Katsuwonus pelamis*
Pacific bluefin tuna	*Thunnus orientalis*

Table 3.9-4: Federally Managed Fish Species within the Hawaii-Southern California Training and Testing Study Area, Pacific Regional Fishery Management Council (continued)

Pacific Regional Fishery Management Council	
Common Name	**Scientific Name**
Sharks	
Common thresher shark	*Alopias vulpinus*
Pelagic thresher shark	*Alopias pelagicus*
Bigeye thresher shark	*Alopias superciliosus*
Shortfin mako or bonito shark	*Isurus oxyrinchus*
Blue shark	*Prionace glauca*
Billfish and Swordfish	
Striped marlin	*Tetrapturus audax*
Swordfish	*Xiphias gladius*
Other	
Dorado or dolphinfish	*Coryphaena hippurus*

Source: (Pacific Fishery Management Council 2008).
[1]The category “rockfish” includes all genera and species of the family Scopaenidae, even if not listed, that occur in the Washington, Oregon, and California area. The Scopaenidae genera are *Sebastes*, *Scorpaena*, *Sebastolobus*, and *Scorpaenodes*.

3.9.2 AFFECTED ENVIRONMENT

The distribution and abundance of fishes depends greatly on the physical and biological factors of the marine ecosystem, such as salinity, temperature, dissolved oxygen, population dynamics, predator and prey interaction oscillations, seasonal movements, reproduction and life cycles, and recruitment success (Helfman et al. 1997). A single factor is rarely responsible for the distribution of fish species; more often, a combination of factors is accountable. For example, open ocean species optimize their growth, reproduction, and survival by tracking gradients of temperature, oxygen, or salinity (Helfman et al. 1997). Another major component in understanding species distribution is the location of highly productive regions, such as frontal zones. These areas concentrate various prey species and their predators, such as tuna, and provide visual cues for the location of target species for commercial fisheries (National Marine Fisheries Service 2001). These types of open ocean predatory fishes occupy the transit lane portion of the Study Area, located mostly within the North Pacific Subtropical Gyre.

Environmental variations, such as the Pacific decadal oscillation events (e.g., El Niño or La Niña), change the normal water temperatures in an area which affects the distribution, habitat range, and movement of open ocean species (Adams et al. 2002; Bakun et al. 2010; Sabarros et al. 2009) within the transit lane and the Study Area. Pacific decadal oscillation events have caused the distribution of fisheries, such as that of the skipjack tuna (*Katsuwonus pelamis*), to shift by more than 620 miles (mi) (997.8 kilometers [km]) (National Marine Fisheries Service 2001; Stenseth et al. 2002).

Currently 566 species of reef and shore fishes are known to occur around the Insular Pacific-Hawaiian Large Marine Ecosystem within the Study Area. The high number of species that are found only in Hawaii can be explained by its geographical and hydrographical isolation; 24 percent of fishes that occur in Hawaii are found only in the Hawaiian Islands (Randall 1998). Migratory open ocean fishes, such as the larger tunas, the billfishes, and some sharks, are able to move across the great distance that separates the Hawaiian Islands from other islands or continents in the Pacific. Coral reef fish communities in the Hawaiian Islands (excluding Nihoa) show a consistent pattern of species throughout the year. Exceptions include the seasonal distributions of migratory, open ocean species. Several of the reef fish species (bigeye scad [*Selar crumenophthalmus*], mackerel scad [*Decapterus macarellus*], goatfishes [Mullidae], and squirrelfishes [Holocentridae]) in the Study Area also show seasonal fluctuations which are usually related to movements of juveniles into new areas or spawning activity (U. S. Navy Office of Naval Research 2001).

The Southern California portion of the Study Area is in a region of highly productive fisheries (Leet et al. 2001) within the California Current Large Marine Ecosystem. The portion of the California Bight in the Study Area is a transitional zone between cold and warm water masses, geographically separated by Point Conception. The California Bight refers to the coastal area between Point Conception to just past San Diego, including much of the Southern California portion of the Study Area. The cold-water California Current Large Marine Ecosystem is rich in microscopic plankton (diatoms, krill, and other organisms), which form the base of the food chain in the Southern California portion of the Study Area. Small coastal pelagic fishes depend on this plankton and in turn are fed on by larger species (such as highly migratory species). Approximately 480 species of marine fish inhabit the southern California Bight, and numerous fish species utilize spawning, nursery, feeding, and seasonal grounds in nearshore, inshore (including bays and estuaries), and offshore waters of southern California (Cross and Allen 1993). The high fish diversity found in the Study Area occurs for several reasons: (1) the ranges of many temperate and tropical species extend into Southern California; (2) the area has complex bottom features and physical oceanographic features that include several water masses and a changeable marine climate (Allen et al. 2006; Horn and Allen 1978); and (3) the islands and coastal areas provide a diversity of habitats that include soft bottom, rocky reefs, kelp beds, and estuaries, bays, and lagoons.

3.9.2.1 Hearing and Vocalization

All fish have two sensory systems to detect sound in the water: the inner ear, which functions very much like the inner ear in other vertebrates, and the lateral line, which consists of a series of receptors along the fish's body (Popper 2008). The inner ear generally detects relatively higher-frequency sounds, while the lateral line detects water motion at low frequencies (below a few hundred Hertz [Hz]) (Hastings and Popper 2005a).

Many researchers have investigated hearing and vocalizations in fish species (e.g.,Astrup 1999; Astrup and Mohl 1993; Casper et al. 2003a; Casper and Mann 2006a; Coombs and Popper 1979a; Dunning et al. 1992; Egner and Mann 2005a; Gregory and Clabburn 2003; Hawkins and Johnstone 1978a; Higgs et al. 2004; Iversen 1967, 1969; Jorgensen et al. 2005; Kenyon 1996a; Mann et al. 2001a; Mann et al. 2005a; Mann and Lobel 1997; Meyer et al. 2010 ; Myrberg 2001; Nestler et al. 2002; Popper 2008; Popper and Carlson 1998; Popper and Tavolga 1981; Ramcharitar et al. 2006a; Ramcharitar et al. 2001; Ramcharitar and Popper 2004a; Ramcharitar and Popper 2004b; Remage-Healey et al. 2006b; Ross 1996; Sisneros and Bass 2003b; Song et al. 2006; Wright, Soto, et al. 2007; Wright et al. 2005a).

Although hearing capability data only exist for fewer than 100 of the 32,000 fish species, current data suggest that most species of fish detect sounds from 50 to 1,000 Hz, with few fish hearing sounds above 4 kilohertz (kHz) (Popper 2008). It is believed that most fish have their best hearing sensitivity from 100 to 400 Hz (Popper 2003b). Additionally, some clupeids (shad in the subfamily Alosinae) possess ultrasonic hearing (i.e., able to detect sounds above 100,000 Hz) (Astrup 1999).

The inner ears of fish are directly sensitive to acoustic particle motion rather than acoustic pressure (for a more detailed discussion of particle motion versus pressure, see Section 3.0.4, Acoustic and Explosives

Primer). Although a propagating sound wave contains both pressure and particle motion components, particle motion is most significant at low frequencies (less than a few hundred Hz) and closer to the sound source. However, a fish's gas-filled swim bladder can enhance sound detection by converting acoustic pressure into localized particle motion, which may then be detected by the inner ear. Fish with swim bladders generally have better sensitivity and better high-frequency hearing than fish without swim bladders (Popper and Fay 2010). Some fish also have specialized structures such as small gas bubbles or gas-filled projections that terminate near the inner ear. These fish have been called "hearing specialists," while fish that do not possess specialized structures have been referred to as "generalists" (Popper et al. 2003). In reality many fish species possess a continuum of anatomical specializations that may enhance their sensitivity to pressure (versus particle motion), and thus higher frequencies and lower intensities (Popper and Fay 2010).

Past studies indicated that hearing specializations in marine fish were quite rare (Amoser and Ladich 2005; Popper 2003b). However, more recent studies have shown that there are more fish species than originally investigated by researchers, such as deep sea fish, that may have evolved structural adaptations to enhance hearing capabilities (Buran et al. 2005; Deng et al. 2011). Marine fish families Holocentridae (squirrelfish and soldierfish), Pomacentridae (damselfish), Gadidae (cod, hakes, and grenadiers), and Sciaenidae (drums, weakfish, and croakers) have some members that can potentially hear sound up to a few kHz. There is also evidence, based on the structure of the ear and the relationship between the ear and the swim bladder, that at least some deep-sea species, including myctophids, may have hearing specializations and thus be able to hear higher frequencies (Deng et al. 2011; Popper 1977; Popper 1980), although it has not been possible to do actual measures of hearing on these fish from great depths.

Several species of reef fish tested have shown sensitivity to higher frequencies (i.e., over 1000 Hz). The hearing of the shoulderbar soldierfish (*Myripristis kuntee*) has a high-frequency auditory range extending toward 3 kHz (Coombs and Popper 1979b), while other species tested in this family have been demonstrated to lack this high frequency hearing ability (e.g., Hawaiian squirrelfish [*Adioryx xantherythrus*] and saber squirrelfish [*Sargocentron spiniferum*]). Some damselfish can hear frequencies of up to 2 kHz, but with best sensitivity well below 1 kHz (Egner and Mann 2005b; Kenyon 1996b; Wright et al. 2005b; Wright, Higgs, et al. 2007).

Sciaenid research by Ramcharitar et al. (2006b) investigated the hearing sensitivity of weakfish (*Cynoscion regalis*). Weakfish were found to detect frequencies up to 2 kHz. The sciaenid with the greatest hearing sensitivity discovered thus far is the silver perch (*Bairdiella chrysoura*), which has responded to sounds up to 4 kHz (Ramcharitar et al. 2004). Other species tested in the family Sciaenidae have been demonstrated to lack this higher frequency sensitivity.

It is possible that the Atlantic cod (*Gadus morhua,* Family: Gadidae) is also able to detect high-frequency sounds (Astrup and Mohl 1993). However, in Astrup and Mohl's (1993) study it is feasible that the cod was detecting the stimulus using touch receptors that were over driven by very intense fish-finding sonar emissions (Astrup 1999)Ladich, 2004. Nevertheless, Astrup and Mohl (1993) indicated that cod have high frequency thresholds of up to 38 kHz at 185 to 200 decibels (dB) relative to (re) 1 micropascal (µPa), which likely only allows for detection of odontocete's clicks at distances no greater than 33 to 98 feet (ft.) (10.1 to 29.9 meters [m]) (Astrup 1999).Experiments on several species of the Clupeidae (i.e., herrings, shads, and menhadens) have obtained responses to frequencies between 40 kHz and 180 kHz(Astrup 1999); however, not all clupeid species tested have demonstrated this very high-frequency hearing. Mann et al. (1998) reported that the American shad can detect sounds from 0.1 to 180 kHz with two regions of best sensitivity: one from 0.2 to 0.8 kHz, and the other from 25 kHz to 150 kHz. This shad species has relatively high thresholds (about 145 dB re 1µPa), which should enable the fish to detect odontocete clicks at distances up to about 656 ft. (200 m) (Mann et al. 1997). Likewise, other members of the subfamily Alosinae, including Alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), and Gulf menhaden (*Brevoortia patronus*), have upper hearing thresholds exceeding 100 to 120 kHz. In contrast, the Clupeidae bay anchovy (*Anchoa mitchilli*), scaled sardine (*Harengula jaguana*), and Spanish sardine (*Sardinella aurita*) did not respond to frequencies over 4 kHz (Gregory and Clabburn 2003; Mann et al. 2001b). Mann et al. (2005b) found hearing thresholds of 0.1 kHz to 5 kHz for Pacific herring (*Clupyea pallasii*).

Two other groups to consider are the jawless fish (Superclass: Agnatha – lamprey) and the cartilaginous fish (Class: Chondrichthyes – the sharks, rays, and chimeras). While there are some lampreys in the marine environment, virtually nothing is known about their hearing capability. They do have ears, but these are relatively primitive compared to the ears of other vertebrates, and it is unknown whether they can detect sound (Popper and Hoxter 1987). While there have been some studies on the hearing of cartilaginous fish, these have not been extensive. However, available data suggest detection of sounds from 20 to 1000 Hz, with best sensitivity at lower ranges (Casper et al. 2003b; Casper and Mann 2006b; Casper and Mann 2009; Myrberg 2001). It is likely that elasmobranchs only detect low-frequency sounds because they lack a swim bladder or other pressure detector.

Most other marine species investigated to date lack higher-frequency hearing (i.e., greater than 1000 Hz). This notably includes sturgeon species tested to date that could detect sound up to 400 or 500 Hz (Lovell et al. 2005; Meyer et al. 2010)and Atlantic salmon that could detect sound up to about 500 Hz (Hawkins and Johnstone 1978b; Kane et al. 2010). Both of these groups of fish have members within the Study Area listed or proposed for listing under the ESA.

Bony fish can produce sounds in a number of ways and use them for a number of behavioral functions (Ladich 2008). Over 30 families of fish are known to use vocalizations in aggressive interactions, whereas over 20 families known to use vocalizations in mating (Ladich 2008). Sound generated by fish as a means of communication is generally below 500 Hz (Slabbekoorn et al. 2010a). The air in the swim bladder is vibrated by the sound producing structures (often muscles that are integral to the swim bladder wall) and radiates sound into the water (Zelick et al. 1999). Sprague and Luczkovich (2004) calculated that silver perch can produce drumming sounds ranging from 128 to 135 dB re 1µPa. Female midshipman fish apparently use the auditory sense to detect and locate vocalizing males during the breeding season (Sisneros and Bass 2003a).

3.9.2.2 General Threats

This section covers the existing condition of marine fishes as a resource and presents some of the major threats within the Study Area. Species-specific threats are addressed for each of the ESA-listed species. Human-made impacts are widespread throughout the world's oceans, such that very few habitats remain unaffected by human influence (Halpern et al. 2008). These stressors have shaped the condition of marine fish populations, particularly those species with large body sizes and late maturity ages, making these species especially vulnerable to habitat losses and fishing pressure (Reynolds et al. 2005). This trend is evidenced by the world's shark species, which make up 60 percent of the marine fishes of conservation concern (International Union for Conservation of Nature and Natural Resources 2009). Furthermore, the conservation status of only 3 percent of the world's marine fish species has been evaluated, so the threats to the remaining species are largely unknown at this point (Reynolds et al. 2005).

Overfishing is the most serious threat that has led to the listing of ESA-protected marine species (Crain et al. 2009; Kappel 2005), with habitat loss also contributing to extinction risk (Cheung et al. 2007; Dulvy et al. 2003; Jonsson et al. 1999; Limburg and Waldman 2009; Musick et al. 2000). Approximately 30 percent of the United States-managed fishery stocks are overfished (National Marine Fisheries Service 2009). Overfishing occurs when fishes are harvested in quantities above a sustainable level. Overfishing impacts targeted species, and non-targeted species (or “bycatch” species) that often are prey for other fishes and marine organisms. Bycatch may also include seabirds, turtles, and marine mammals. Additionally, in recent decades the marine fishes being targeted have changed such that when higher-level predators become scarce, different organisms on the food chain are subsequently targeted; this has negative implications for entire marine food webs (Crain et al. 2009; Pauly and Palomares 2005). Other factors, such as fisheries-induced evolution and intrinsic vulnerability to overfishing, have been shown to reduce the abundance of some populations (Kauparinen and Merila 2007). Fisheries-induced evolution describes a change in genetic composition of the population that results from intense fishing pressure, such as a reduction in the overall size and growth rates of fish in a population. Intrinsic vulnerability describes certain life history traits (e.g., large body size, late maturity age, low growth rate) that result in a species being more susceptible to overfishing than others (Cheung et al. 2007).

Pollution primarily impacts coastal fishes that occur near the sources of pollution. However, global oceanic circulation patterns result in a considerable amount of marine pollutants and debris scattered throughout the open ocean (Crain et al. 2009). Pollutants in the marine environment that may impact marine fishes include organic pollutants (e.g., pesticides, herbicides, polycyclic aromatic hydrocarbons, flame retardants, and oil), inorganic pollutants (e.g., heavy metals), and debris (e.g., plastics and wastes from dumping at sea) (Pews Oceans Commission 2003). High chemical pollutant levels in marine fishes may cause behavioral changes, physiological changes, or genetic damage in some species (Goncalves et al. 2008; Moore 2008; Pews Oceans Commission 2003; van der Oost et al. 2003). Bioaccumulation of pollutants (e.g., metals and organic pollutants) is also a concern, particularly in terms of human health, because people consume top predators with high pollutant loads. Bioaccumulation is the net buildup of substances (e.g., chemicals or metals) in an organism directly from contaminated water or sediment through the gills or skin, from ingesting food containing the substance (Newman 1998), or from ingestion of the substance itself (Moore 2008). Entanglement in abandoned commercial and recreational fishing gear has also caused pollution-related declines for some marine fishes; some species are more susceptible to entanglement by marine debris than others (Musick et al. 2000).

Other human-caused stressors on marine fishes are the introduction of nonnative species, climate change, aquaculture, energy production, vessel movement, and underwater noise:

- Non-native fishes pose threats to native fishes when they are introduced into an environment lacking natural predators and then compete with, and prey upon, native marine fishes for resources (Crain et al. 2009).
- Global climate change is contributing to a shift in fish distribution from lower to higher latitudes (Brander 2010; Brander 2007; Dufour et al. 2010; Glover and Smith 2003; Limburg and Waldman 2009; Wilson et al. 2010).
- The threats of aquaculture operations on wild fish populations are reduced water quality, competition for food, predation by escaped or released farmed fishes, spread of disease, and reduced genetic diversity (Kappel 2005). These threats become apparent when escapees enter the natural ecosystem (Hansen and Windsor 2006; Ormerod 2003). The National Oceanic and

Atmospheric Administration is developing an aquaculture policy aimed at promoting sustainable marine aquaculture (National Oceanic and Atmospheric Administration 2011).

- Energy production and offshore activities associated with power-generating facilities results in direct and indirect fish injury or mortality from two primary sources; including cooling water withdrawal that results in entrainment mortality of eggs and larvae and impingement mortality of juveniles and adults (U.S. Environmental Protection Agency 2004), and offshore wind energy development that results in acoustic impacts (Madsen et al. 2006).
- Vessel strikes pose threats to some large, slow-moving fishes at the surface. Whale sharks, basking sharks, ocean sunfish, and manta rays are also vulnerable to ship strikes, and numerous collisions have been recorded (National Marine Fisheries Service 2010; Rowat et al. 2007b; Stevens 2007; The Hawaii Association for Marine Education and Research Inc. 2005).
- Underwater noise is a threat to marine fishes. However, the physiological and behavioral responses of marine fishes to underwater noise (Codarin et al. 2009; Popper 2003a)(Slabbekoorn et al. 2010b; Wright et al. 2010) have been investigated for only a limited number of species (Popper and Hastings 2009a, b). In addition to vessels, other sources of underwater noise include pile-driving activity (California Department of Transportation 2001; Carlson and Hastings 2007; Feist et al. 1992; Mueller-Blenkle et al. 2010a; Nedwell et al. 2003a; Popper et al. 2006) and seismic activity (Popper and Hastings 2009a). Information on fish hearing is provided in Section 3.9.2.1 (Hearing and Vocalization), with further discussion in Section 3.9.3.1 (Acoustic Stressors).

3.9.2.3 Steelhead Trout (*Oncorhynchus mykiss*)

3.9.2.3.1 Life History

Steelhead are born in freshwater streams, where they spend their first one to three years. They later move into the ocean, where most of their growth occurs. After spending between one and four years in the ocean, steelhead return to their home freshwater stream to spawn. Unlike other species of Pacific salmon, steelhead do not necessarily die after spawning and are able to spawn more than once. Steelhead may exhibit either an anadromous lifestyle or they may spend their entire life in freshwater (McEwan and Jackson 1996). The name steelhead trout is used primarily for the anadromous form of this species.

There is considerable variation in this life history pattern within the population, partly due to Southern California’s variable seasonal and annual climatic conditions. Some winters produce heavy rainfall and flooding, which allow juvenile steelhead easier access to the ocean, while dry seasons may close the mouths of coastal streams, limiting juvenile steelheads’ access to marine waters (National Marine Fisheries Service 1997).

3.9.2.3.2 Status and Management

Steelhead trout are an anadromous form of rainbow trout and are federally protected by the designation of distinct population segments, which is defined as a population or group of populations that is discrete or separate from other populations of the same species and are equivalent to evolutionarily significant units. Distinct population segments are also the smallest division of a taxonomic species permitted to be protected under the ESA (West Coast Salmon Biological Review Team et al. 2003). NMFS has jurisdiction over the marine life form, while the U.S. Fish and Wildlife Service and respective state resource agencies have jurisdiction over the freshwater resident life forms.

Of the 15 steelhead trout distinct population segments, 2 are listed as endangered, 9 are listed as threatened, and 1 is an ESA species of concern (National Marine Fisheries Service 2010). NMFS listed the Southern California distinct population segment of steelhead as endangered in 1997 (National Marine Fisheries Service 1997). Critical habitat for 10 west coast steelhead distinct population segments has been designated and the Southern California critical habitat, relative to the Study Area is shown in Figure 3.9-1 and includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.2.3.3 Habitat and Geographic Range

The present distribution of steelhead extends from the Kamchatka Peninsula in Asia, east to Alaska, and south to Southern California, although the species' historical range extended at least to Mexico (Good et al. 2005). Steelhead trout are found along the entire Pacific Coast of the United States. Worldwide, steelhead are also naturally found in the western Pacific as far as the Kamchatka Peninsula (Russia). This species has also been introduced (by stocking) in other locations throughout the world, including freshwater streams in Hawaii (Kokee State Park on the island of Kauai) (National Marine Fisheries Service 2010), although this particular population does not migrate into the ocean.

Since spawning occurs exclusively in freshwater systems outside of the Study Area, spawning habitats are not described here. However, information on freshwater habitats and spawning areas can be found in Pacific Fishery Management Council (2000), Beauchamp et al. (1983) and Emmett et al. (1991).

Of the six species of Pacific salmon that have evolutionarily significant units or distinct population segments along the West Coast, only the steelhead occurs within the Southern California portion of the Study Area (National Marine Fisheries Service 2005). The Southern California distinct population segment range for steelhead extends from Santa Maria River south to San Mateo Creek (National Marine Fisheries Service 2002), within the California Current Large Marine Ecosystem. It was expanded in 2002 to include streams south of Malibu Creek, specifically Topanga and San Mateo Creeks (National Marine Fisheries Service 2002). The lower portion of San Mateo Creek flows through Marine Corps Base Camp Pendleton and into the Southern California portion of the Study Area. Except for this possible small population in San Mateo Creek, the species is considered completely extinct from the Santa Monica Mountains in California to the U.S.-Mexico border.

Steelhead tend to move immediately offshore on entering the marine environment although, in general, steelhead tend to remain closer to shore than other Pacific salmon species (Beamish et al. 2005). They generally remain within the coastal waters of the California Current (Beamish et al. 2005; Quinn and Myers 2004).

3.9.2.3.4 Population and Abundance

Most of the distinct population segments have a low abundance relative to historical levels, and there is widespread occurrence of hatchery fish in naturally spawning populations (Good et al. 2005; National Marine Fisheries Service 2010). NMFS has reported population sizes from individual distinct population segments, but because all of these units occur together while at sea, it is difficult to estimate the marine population numbers. Specific population numbers, based on freshwater returns, within each of the distinct population segments is found in Good et al. (2005).

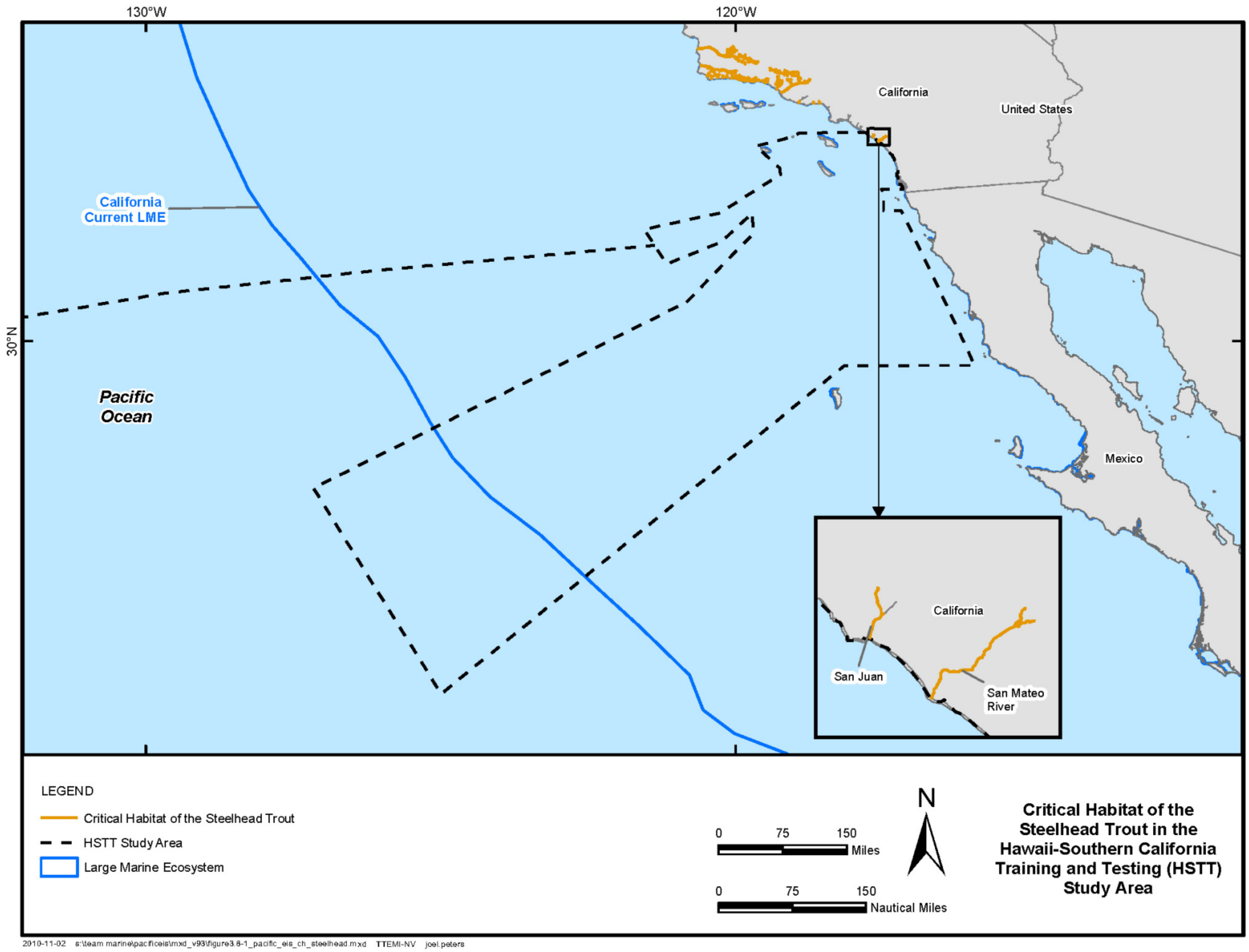

Figure 3.9-1: Critical Habitat of the Steelhead Trout within and adjacent to the Southern California Study Area

3.9.2.3.5 Predator/Prey Interactions

Predators of steelhead include fish-eating birds, such as terns and cormorants, and pinnipeds, such as sea lions and harbor seals, especially within coastal areas (National Marine Fisheries Service 2010). Juveniles in freshwater feed mostly on zooplankton (small animals that drift in the water), while adults feed on aquatic and terrestrial insects, molluscs, crustaceans, fish eggs, minnows, and other small fishes, including other trout and salmon depending on whether they are inhabiting streams or the ocean (National Marine Fisheries Service 2010).

3.9.2.3.6 Migration

Adult steelhead can migrate up to 930 mi. (1,496.7 km) from their ocean habitats to reach their freshwater spawning grounds in high elevation tributaries. In the Southern California portion of the Study Area, the primary rivers that steelhead migrate into are the Santa Maria, Santa Ynez, Ventura, and Santa Clara Rivers (Good et al. 2005), although some of these rivers contain considerable migration barriers such as dams.

3.9.2.3.7 Species-Specific Threats

There are many threats to the survival of the Southern California steelhead distinct population segment. Principle threats include, but are not limited to, alteration of stream flow patterns and habitat degradation, barriers to fish passages, channel alterations, water quality problems, non-native exotic fish and plants and climate change. These threats pose a serious challenge to the persistence of Southern California steelhead, and most threats are increasing in magnitude as human population grows in Southern California.

3.9.2.4 Jawless Fishes (Orders Myxiniformes and Petromyzontiformes)

Hagfishes (Myxiniformes) occur exclusively in marine habitats and are represented by 70 species worldwide within temperate marine locations. This group feeds on dead or dying fishes and has very limited external features often associated with fishes, such as fins and scales (Helfman et al. 1997). The members of this group are important scavengers that recycle nutrients back through the ecosystem. Lampreys (Petromyzontiformes) are represented by approximately 11 marine or saltwater/freshwater species distributed primarily throughout the temperate regions of the Northern Hemisphere. Lampreys typically are parasitic, feeding on other live fishes. The most striking feature of the lampreys is the oral disc mouth, which they use to attach to other fishes and feed on their blood (Moyle and Cech 1996; Nelson 2006).

Hagfishes and lampreys occur in the seafloor habitats of open ocean waters in the transit lane and California Current Large Marine Ecosystem portions of the Study Area, but not in the Hawaii portion of the Study Area (Paxton and Eshmeyer 1994). Hagfishes are typically found at depths greater than 80 ft. (24.4 m) and temperatures below 55°F (13°C).

3.9.2.5 Sharks, Rays, and Chimaeras (Class Chondrichthyes)

The cartilaginous (non-bony) marine fishes of the class Chondrichthyes are distributed throughout the world’s oceans, occupying all areas of the water column. This group is mainly predatory and contains many of the apex predators found in the ocean (e.g., great white shark, mako shark, and tiger shark) (Helfman et al. 1997). The whale shark and basking shark are notable exceptions as filter-feeders. Sharks and rays have some unique features among marine fishes; no swim bladder; protective toothlike scales; unique sensory systems (electroreception, mechanoreception); and some species bear live young in a variety of life history strategies (Moyle and Cech 1996). The subclass Elasmobranchii contains more than

850 marine species, including sharks, rays and skates, spread across nine orders (Nelson 2006). Very little is known about the subclass Holocephali, which contains 58 marine species of chimaeras (Nelson 2006).

Sharks and rays occupy relatively shallow temperate and tropical waters throughout the world. More than half of these species occur in less than 655 ft. (199.6 m) of water, and nearly all are found at depths less than 6,560 ft. (1,999.4 m) (Nelson 2006). Sharks and rays are found in all open ocean areas and coastal waters of the Study Area (Paxton and Eshmeyer 1994) and throughout the North Pacific Subtropical Gyre, the Insular Pacific-Hawaiian Large Marine Ecosystem, and the California Current Large Marine Ecosystem that encompass the Study Area. While most sharks occur in the water column, many rays occur on or near the seafloor. Chimaeras are cool-water marine fishes that are found at depths between 260 and 8,500 ft. (79.2 and 2,590.8 m) (Nelson 2006). They occur in the open ocean of the transit lane and Hawaii portions of the Study Area, up to the lower continental shelf (Paxton and Eshmeyer 1994).

3.9.2.6 Eels and Bonefishes (Orders Anguilliformes and Elopiformes)

These fishes have a unique larval stage, called leptocephalus, in which leptocephali grow to much larger sizes during an extended larval period as compared to most other fishes. The eels (Anguilliformes) have an elongated snakelike body; most of the 780 eel species do not inhabit the deep ocean. Eels generally feed on other fishes or small bottom-dwelling invertebrates, but they also feed on larger organisms (Helfman et al. 1997). Moray eels, snake eels, and conger eels are well represented by many species that occur in the Study Area (Paxton and Eshmeyer 1994). The fishes in the order Elopiformes include two distinct groups that exhibit very different forms: the bonefishes, predators of shallow tropical waters; and the little-known spiny eels, elongated seafloor feeders of decaying organic matter in deep ocean areas (Paxton and Eshmeyer 1994).

Eels are found in all marine habitat types, although most inhabit shallow subtropical or tropical marine habitats (Paxton and Eshmeyer 1994) within the Insular Pacific-Hawaiian and California Current Large Marine Ecosystems in the water column and seafloor. The bonefishes and spiny eels occur in deep ocean waters, ranging from 400 to 16,000 ft. (121.9 to 4,876.8 m) within the open ocean area of the Study Area and throughout the North Pacific Subtropical Gyre on the seafloor and water column (Paxton and Eshmeyer 1994).

3.9.2.7 Smelt and Salmonids (Orders Argentiniformes, Osmeriformes, and Salmoniformes)

A distinguishing feature of this group of fishes is an adipose fin composed of fatty tissue on their backs. The deepwater smelts of the order Argentiniformes differ from the true smelts of the order Osmeriformes, mostly by their preferred habitat (deepwater versus coastal). The true smelts are found in large abundances within coastal areas throughout the Northern Hemisphere, while the deepwater smelts are limited mainly to deepwater regions of the world’s oceans. Smelts are an important forage fish for other marine organisms, including other fishes, birds, and marine mammals.

The native distribution of Salmoniformes is restricted to the cold waters of the Northern Hemisphere. Most species of salmon spawn in freshwater and live in the sea; they are among the most thoroughly studied fish groups in the world.

3.9.2.8 Dragonfishes and Lanternfishes (Orders Stomiiformes and Myctophiformes)

The orders Stomiiformes and Myctophiformes comprise one of the largest groups of the world's deepwater fishes—more than 500 total species, many of which are not very well described in the scientific literature (Nelson 2006). The ecological role of many of these species is also not well understood (Helfman et al. 1997). These fishes are known for their unique body forms (e.g., slender bodies, or disc-like bodies, often possessing light-producing capabilities) and adaptations that likely present some advantages within the deepwater habitats in which they occur (e.g., large mouths, sharp teeth, and sensitive lateral line (sensory) systems) (Haedrich 1996; Koslow 1996; Marshall 1996; Rex and Etter 1998; Warrant and Locket 2004).

Overall the dragonfishes and lanternfishes occur in deep ocean waters, ranging from 3,280 to 16,000 ft. (999.7 to 4,876.8 m), making diurnal migrations within the open ocean area of the Study Area and throughout the North Pacific Subtropical Gyre (Froese and Pauly 2010; Paxton and Eshmeyer 1994).

3.9.2.9 Greeneyes, Lizardfishes, Lancetfishes, and Telescopefishes (Order Aulopiformes)

Fishes of the order Aulopiformes are a diverse group that possess both primitive (adipose [fatty] fin, rounded scales) and advanced (unique swim bladder and jawbone) features of marine fishes (Paxton and Eshmeyer 1994). They are common in estuarine and coastal waters as well as deep ocean waters. The lizardfishes (Synodontidae), Bombay ducks (Harpadontidae), and greeneyes (Chlorophthalmidae) primarily occur in coastal waters to the outer shelf, where they rest on the bottom and are well camouflaged with the substrate (Paxton and Eshmeyer 1994). Lancetfishes (Alepisauridae) are primarily mid-water column fishes, but can be found ranging from the surface to deep-waters. Telescopefishes are primarily found in deep waters 1,640 to 3,280 ft. (499.9 to 999.7 m), but can also be found at shallower depths and may approach the surface at night (Paxton and Eshmeyer 1994).

In general greeneyes, lizardfishes, and lancetfishes occur in the coastal waters of the Study Area, including all of the Insular Pacific-Hawaiian and California Current Large Marine Ecosystems. Telescopefishes occur primarily in the deeper waters associated with the open ocean areas of the Study Area (Paxton and Eshmeyer 1994).

3.9.2.10 Cods and Cusk-eels (Orders Gadiformes and Ophidiiformes)

The cods and cusk-eels include over 900 species, some of which are target species of commercial fisheries. The cods, or groundfish, account for approximately half of the world's commercial fishery landings (Food and Agriculture Organization of the United Nations 2005). Gadiforms, such as cods, are almost exclusively marine fishes, and occupy seafloor habitats in temperate, arctic, and Antarctic regions.

The order Ophidiiformes includes cusk-eels and brotulas, which have long eel-like tapering bodies and are distributed in deepwater areas throughout tropical and temperate oceans. The characteristics of ophidiiforms are similar to those of the other deepwater groups. Other fishes of this order are also found in shallow waters on coral reefs. In addition, there are several cusk-eel species which are pelagic or found on the continental shelves and slopes.

Cods are generally found near the seafloor and feed on bottom-dwelling organisms. They do not occur in the Study Area (Paxton and Eshmeyer 1994). Cusk-eels occur near the seafloor of the coastal waters and in the open ocean areas of the HSTT Study Area (Paxton and Eshmeyer 1994).

3.9.2.11 Toadfishes and Anglerfishes (Orders Batrachoidiformes and Lophiiformes)

The toadfishes and anglerfishes include nearly 400 species. The order Batrachoidiformes includes only the toadfish family. Some species of toadfishes produce and detect sounds by vibrating the swimbladder. They spawn in and around bottom structures and invest a substantial amount of parental care by defending their nests, Moyle and Cech 1996; Paxton and Eshmeyer 1994). The order Lophiiformes includes all of the world's anglerfishes, goosefishes, frogfishes, batfishes, and deepwater anglerfishes—most of which occur in seafloor habitats of all oceans. Some deepwater anglerfish use highly modified "lures" to attract prey (Helfman et al. 1997; Koslow 1996). These fishes are also an important predator among the deepwater, seafloor habitats of the Study Area (Nelson 2006). The anglerfishes can be broken into two groups: (1) those that dwell in the deep water (10 families); and (2) those that live on the bottom or attached to drifting seaweed in shallow water (5 families).

The primary distribution of the toadfishes in the Study Area is limited to seafloor habitats of the California Current Large Marine Ecosystem. Anglerfishes are also found in seafloor habitats, but with a wider distribution covering all waters of the Study Area (Froese and Pauly 2010; Moyle and Cech 1996; Paxton and Eshmeyer 1994).

3.9.2.12 Mullets, Silversides, Needlefish, and Killifish (Orders Mugiliformes, Atheriniformes, Beloniformes, and Cyprinodontiformes)

Mugiliformes (mullets) contain 71 marine species that occupy coastal marine and estuarine waters of all tropical and temperate oceans. There has been disagreement in the taxonomic classification of this group; some have included this group within the superorder Athinerimorpha (Nelson 2006), while others have placed it as a suborder within the Perciformes (Moyle and Cech 1996). Mullets feed on decaying organic matter in estuaries and possess a filter feeding mechanism with a gizzard like digestive tract. They feed on the bottom by scooping up food that is retained by their very small gill rakers (Moyle and Cech 1996). Most species within these groups are important prey for predators in all estuarine habitats within the Study Area.

Most of these fishes are found in tropical or temperate marine waters and occupy shallow habitats near the water surface. An exception to this nearshore distribution includes the flyingfishes and halfbeaks, which occur within oceanic or shallow seacoast regions where light penetrates, in tropical to warm-temperate regions. The silversides are a small inshore species often found in intertidal habitats. The Cyprinodontiformes include the killifishes that are often associated with intertidal coastal zones and salt marsh habitats and are highly tolerant of pollution. These fishes are found in all coastal waters and open ocean areas of the Study Area (Froese and Pauly 2010; Paxton and Eshmeyer 1994).

3.9.2.13 Oarfishes, Squirrelfishes, and Dories (Orders Lampridiformes, Beryciformes, and Zeiformes)

There are only 19 species in the order Lampridiformes—the oarfishes. They exhibit diverse body shapes, and some have a protruding mouth, which allows for a suction feeding technique while feeding on plankton. Other species, including the crestfish, posses grasping teeth used to catch prey. They occur only in the mid-water column of the open ocean, but are rarely observed (Nelson 2006). Fishes in the order Beryciformes are primarily deepwater or nocturnal species, many of which are poorly described. There are a few shallow water exceptions, including squirrelfishes, which are distributed throughout reef systems in tropical and subtropical marine regions (Nelson 2006). Squirrelfishes are an important food source relied upon by some communities who catch their own food (Froese and Pauly 2010). They possess specialized eyes and large mouths and primarily feed on bottom-dwelling crustaceans (Goatley and Bellwood 2009). Very little is known about the order Zeiformes, or dories, which include some very rare families, many containing only a single species (Paxton and Eshmeyer 1994). Even general information on their biology, ecology, and behavior is limited.

Squirrelfishes are common in coral reef systems in the Study Area within the Insular Pacific-Hawaiian Large Marine Ecosystem. Most of the Lampridiformes and Zeiformes are confined to seafloor regions in all coastal waters of the Study Area, as well as the open ocean areas at depths of 130 to 330 ft. (39.6 to 100.6 m) (Moyle and Cech 1996; Paxton and Eshmeyer 1994).

3.9.2.14 Pipefishes and Seahorses (Order Gasterosteiformes)

Gasterosteiformes include sticklebacks, pipefishes, and seahorses, many of which are common within the Study Area. Most of these species are found in brackish water (a mixture of seawater and freshwater) throughout the world (Nelson 2006) and occur in surface, water column, and seafloor habitats. Small mouths on a long snout and armorlike scales are characteristic of this group. Most of these species exhibit a high level of parental care, either through nest building (sticklebacks) or brooding pouches (male seahorses have a pouch where eggs develop), which results in relatively few young being produced (Helfman et al. 1997). This group also includes the trumpetfishes and cornetfishes, ambush predators, with a large mouth used to capture smaller lifestages of fishes.

This group is associated with tropical and temperate reef systems. They are found in the coastal waters of the Study Area within the Insular Pacific-Hawaiian and California Current Large Marine Ecosystems, but not in the open ocean (Froese and Pauly 2010; Moyle and Cech 1996; Paxton and Eshmeyer 1994).

3.9.2.15 Scorpionfishes (Order Scorpaeniformes)

The order Scorpaeniformes is a diverse group of more than 1,400 marine species, all with bony plates or spines near the head. This group contains the scorpionfishes, waspfishes, rockfishes, velvetfishes, pigfishes, sea robins, gurnards, sculpins, snailfishes, and lumpfishes (Froese and Pauly 2010; Moyle and Cech 1996; Paxton and Eshmeyer 1994). Many of these fishes are adapted for inhabiting the seafloor of the marine environment (e.g., modified pectoral fins or suction discs), where they feed on smaller crustaceans and fishes. Sea robins are capable of generating sounds with their swimbladders (Moyle and Cech 1996).

Scorpionfishes are widely distributed in open ocean and coastal habitats, at all depths, throughout the world. They occur in all waters of the Study Area. Most occur in depths less than 330 ft. (100.6 m), but others are found in deepwater habitat, down to 7,000 ft. (2,133.6 m) (Paxton and Eshmeyer 1994).

3.9.2.16 Croakers, Drums, and Snappers (Families Sciaenidae and Lutjanidae)

The families Sciaenidae and Lutjanidae include mainly predatory coastal marine fishes, including the recreationally important snappers, drums, and croakers. These fishes are sometimes distributed in schools as juveniles, and then become more solitary as they grow larger. They feed on fishes and crustaceans. Drums and croakers (Sciaenidae) produce sounds via their swimbladders, which generate a drumming sound. The snappers (Lutjanidae) are generally associated with seafloor habitats and tend to congregate near structured habitats, including natural/artificial reefs and oil platforms (Moyle and Cech 1996). Other representative groups include the brightly colored and diverse forms of reef-associated cardinalfishes, butterflyfishes, angelfishes, dottybacks, and goatfishes (Paxton and Eshmeyer 1994).

Like the scorpionfishes, this group is widely distributed in open ocean and coastal habitats throughout the world. They occur in all waters of the Study Area, but are particularly concentrated, and exhibit the most varieties, in depths less than 330 ft. (100 m), often associated with reef systems within the Insular

Pacific-Hawaiian and California Current Large Marine Ecosystems portion of the Study Area (Froese and Pauly 2010; Paxton and Eshmeyer 1994).

3.9.2.17 Groupers and Seabasses (Family Serranidae)

The Serranidae are primarily nearshore marine fishes that support recreational and commercial fisheries. Most seabasses and groupers are nocturnal predators found primarily within reef systems. They generally possess large mouths and feed mostly on bottom-dwelling fishes and crustaceans (Goatley and Bellwood 2009). Some groupers and seabasses take advantage of feeding opportunities in the low-light conditions of twilight when countershaded fishes become conspicuous and easier for these predators to locate (Rickel and Genin 2005). Other groupers are active during the daytime and exhibit a variety of opportunistic predatory strategies, such as ambush (Wainwright and Richard 1995) to benefit from mistakes made by prey species. Many of the serranids begin life as females and then become male as they grow larger (Moyle and Cech 1996). Their slow maturation has resulted in many of the grouper species within the Study Area to be designated with vulnerable to critically endangered conservation status (International Union for Conservation of Nature and Natural Resources 2010). This group occurs in all coastal waters of the Study Area, but are mostly concentrated, in depths less than 100 ft. (30.5 m), within the Insular Pacific-Hawaiian and California Current Large Marine Ecosystems portion of the Study Area (Froese and Pauly 2010; Moyle and Cech 1996; Paxton and Eshmeyer 1994).

3.9.2.18 Wrasses, Parrotfish, and Damselfishes (Families Labridae, Scaridae, and Pomacentridae)

The suborder Labroidei contains many nearshore marine reef or structure-associated fishes, including the diverse wrasses (Labridae), parrotfishes (Scaridae), and damselfishes (Pomacentridae). Most of the wrasses are conspicuous, brightly colored, coral reef fishes, but others are found in temperate waters. Most are active during the daytime and exhibit a variety of opportunistic predatory strategies, such as ambush (Wainwright and Richard 1995) to capitalize on mistakes made by prey species. Parrotfishes provide important ecological functions to the reef system by grazing on coral and processing sediments (Goatley and Bellwood 2009). Similar to the Serranidae, many wrasses and parrotfishes begin life as females but change into males as they grow larger and exhibit with a variety of reproductive strategies found among the species and between populations (Moyle and Cech 1996). Damselfishes are noted for their territoriality and are brightly colored. This group occurs in all coastal waters of the Study Area, but are mostly concentrated in depths less than 100 ft. (30.5 m) within the Insular Pacific-Hawaiian and California Current Large Marine Ecosystems portion of the Study Area (Froese and Pauly 2010; Moyle and Cech 1996; Paxton and Eshmeyer 1994).

3.9.2.19 Gobies, Blennies, and Surgeonfishes (Suborders Gobioidei, Blennioidei, and Acanthuroidei)

The seafloor-dwelling gobies (Gobioidei) include Gobiidae, the largest family of marine fishes (Nelson 2006); they exhibit modified pelvic fins that allow them to adhere to varying bottom surfaces (Helfman et al. 1997). Fishes of the suborder Blennioidei primarily occupy the intertidal zones throughout the world, including the clinid blennies and the combtooth blennies of the family Blenniidae (Mahon et al. 1998; Moyle and Cech 1996; Nelson 2006). The blennies and gobies primarily feed on detritus on the seafloor. The suborder Acanthuroidei contains the surgeonfishes, moorish idols, and rabbitfishes of tropical reef systems. They have elongated small mouths used to scrape algae from coral. These grazers provide an important function to the reef system by controlling the growth of algae on the reef (Goatley and Bellwood 2009). Some of these species are adapted to target particular prey species; for example, the elongated snouts of butterflyfishes allow for biting off exposed parts of invertebrates (Leysen et al. 2010).

These fishes occur in all coastal waters of the Study Area, but are mostly concentrated, and exhibit the most varieties, in depths less than 100 ft. (30.5 m), within the Insular Pacific-Hawaiian and California Current Large Marine Ecosystems portion of the Study Area (Froese and Pauly 2010; Moyle and Cech 1996; Paxton and Eshmeyer 1994).

3.9.2.20 Jacks, Tunas, Mackerels, and Billfishes (Families Carangidae, Scombridae, Xiphiidae, and Istiophoridae)

The suborder Scombroidei contain some of the most voracious open ocean predators: the jacks, mackerels, barracudas, billfishes, and tunas (Estrada et al. 2003; Sibert et al. 2006). Many jacks are known to feed nocturnally (Goatley and Bellwood 2009) and in the low-light conditions of twilight (Rickel and Genin 2005), by ambushing their prey (Sancho 2000). The open ocean, highly migratory tunas, mackerels, and billfishes are extremely important to fisheries; they together account for approximately one-third of total annual worldwide catch, by weight, with tunas, and swordfish as the most important species (Food and Agriculture Organization of the United Nations 2005, 2009). There are two Hawaii-based longline fisheries that target bigeye tuna and swordfish, with fishing grounds occurring in the Study Area. One unique adaptation found in these fishes is ram ventilation (Wegner et al. 2006). Ram ventilation uses the motion of the fish through the water to increase respiratory efficiency in large, fast-swimming open ocean fishes (Wegner et al. 2006). Many fishes in this group have large-scale migrations that allow for feeding in highly productive areas, which vary by season (Pitcher 1995).

These fishes occupy the open ocean areas that comprise the largest area of ocean but make up only about 5 percent of the total marine fishes (Froese and Pauly 2010; Helfman et al. 1997). They are mostly found near the surface, or the upper portion of the water column, located within all coastal waters and open ocean areas of the Study Area, including all of the Insular Pacific-Hawaiian and California Current Large Marine Ecosystems (Froese and Pauly 2010; Paxton and Eshmeyer 1994).

3.9.2.21 Flounders (Order Pleuronectiformes)

The order Pleuronectiformes includes flatfishes (flounders, dabs, soles, and tonguefishes) that are found in all marine seafloor habitats throughout the world (Nelson 2006). Fishes in this group have eyes on either the left side or the right side of the head as larvae mature and are not symmetrical like other fishes (Saele et al. 2004). All flounder species are ambush predators, feeding mostly on other fishes and bottom-dwelling invertebrates (Drazen and Seibel 2007; Froese and Pauly 2010).

This group is widely distributed on the seafloor of open ocean and coastal habitats throughout the world. They occur in all waters of the Study Area, but are particularly concentrated, and exhibit the most varieties, in depths less than 330 ft. (100.6 m), often associated with sand bottoms within the Insular Pacific-Hawaiian and California Current Large Marine Ecosystems and open ocean portions of the Study Area (Froese and Pauly 2010; Paxton and Eshmeyer 1994).

3.9.2.22 Triggerfish, Puffers, and Molas (Order Tetraodontiformes)

The fishes in the order Tetraodontiformes are the most advanced group of modern bony fishes. This order includes the triggerfishes, filefishes, puffers, and ocean sunfishes. Like the flounders, this group exhibits body shapes unique among marine fishes, including modified spines or other structures advantageous in predator avoidance. The unique body shapes also require the use of a tail swimming style because some species lack the muscle structure and body shape of other fishes. Most of these fishes are active during the daytime and exhibit a variety of strategies for catching prey, such as ambushing their prey (Wainwright and Richard 1995). The ocean sunfishes (*Mola* species) are the largest bony fish and the most prolific vertebrate species, with females producing more than 300 million eggs in a breeding season (Moyle and Cech 1996). The ocean sunfishes occur very close to the surface. They are slow swimming and feed on a variety of plankton, like jellyfish, crustaceans, and fishes (Froese and Pauly 2010). Their only natural predators are sharks, orcas, and sea lions (Helfman et al. 1997).

Most species within this group are associated with reef systems. This group is widely distributed in tropical and temperate bottom or mid-water column habitats (open ocean and coastal) throughout the world. They occur in all waters of the Study Area, but are particularly concentrated, and exhibit the most varieties, in depths less than 330 ft. (100.6 m), often associated with reefs or structured seafloor habitats within the Insular Pacific-Hawaiian and California Current Large Marine Ecosystems and open ocean portions of the Study Area (Froese and Pauly 2010; Paxton and Eshmeyer 1994). One major exception is for the molas (ocean sunfishes), which occur at the surface in all open ocean areas (Helfman et al. 1997).

3.9.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) potentially impact marine fishes known to occur within the Study Area. Tables 2.8-1 through 2.8-5 present the baseline and proposed training and testing activity locations for each alternative (including number of activities and ordnance expended). The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to marine fish in the Study Area and analyzed below include the following:

- Acoustic (sonar and other non-impulsive acoustic sources, explosions and other impulsive acoustic sources)
- Energy (electromagnetic)
- Physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices)
- Entanglement (cables and wires, parachutes)
- Ingestion (military expended materials—munitions and non-munitions)
- Secondary stressors

Each of these components was carefully analyzed for potential impacts on fishes within the stressor categories contained in this section. The specific analysis of the training and testing activities considers these components within the context of geographic location and overlap of marine fish resources. In addition to the analysis here, the details of all training and testing activities, stressors, components that cause the stressor, and geographic overlap within the Study Area are included in Chapter 2.

3.9.3.1 Acoustic Stressors

The following sections analyze potential impacts on fish from proposed activities that involve acoustic stressors (non-impulsive and impulsive).

3.9.3.1.1 Analysis Background and Framework

This section is largely based on a technical report prepared for the Navy: *Effects of Mid- and High-Frequency Sonars on Fish* (Popper 2008). Additionally, Popper and Hastings (2009) provide a critical overview of some of the most recent research regarding potential effects of anthropogenic sound on fish.

Studies of the effects of human-generated sound on fish have been reviewed in numerous places (e.g., National Research Council 1994, 2003; Popper 2003; Popper et al. 2004; Hastings and Popper 2005a; Popper 2008; Popper and Hastings 2009). Most investigations, however, have been in the gray literature (non-peer-reviewed reports—see Hastings and Popper 2005a; Popper 2008; and Popper and Hastings 2009 for extensive critical reviews of this material).

Fish have been exposed to short-duration, high-intensity signals such as might be found near high-intensity sonar, pile driving, or a seismic air gun survey. The investigators in such studies examined short-term effects that could result in death to the exposed fish, as well as hearing loss and long-term consequences. Recent experimental studies have provided additional insight into the issues (e.g., Doksæter et al. 2009; Govoni et al. 2003; McCauley et al. 2003; Popper et al. 2005, 2007).

3.9.3.1.1.1 Direct Injury

Non-Impulsive Sound Sources

Potential direct injuries from non-impulsive sound sources, such as sonar, are unlikely because of to the relatively lower peak pressures and slower rise times than potentially injurious sources such as explosives. Non-impulsive sources also lack the strong shock wave such as that associated with an explosion. Therefore, direct injury is not likely to occur from exposure to non-impulsive sources such as sonar, vessel noise, or subsonic aircraft noise. The theories of sonar induced acoustic resonance, bubble formation, neurotrauma, and lateral line system injury are discussed below, although these phenomena are difficult to recreate under real-world conditions and are therefore unlikely to occur.

Two unpublished reports examined the effects of mid-frequency sonar-like signals (1.5 to 6.5 kHz) on larval and juvenile fish of several species (Jørgensen et al. 2005; Kvadsheim and Sevaldsen 2005). In the first study, Jørgensen et al. (2005) exposed larval and juvenile fish to various sounds in order to investigate potential effects on survival, development, and behavior. The study used herring (*Clupea harengus*) (standard lengths 2 to 5 centimeters [cm]), Atlantic cod (*Gadus morhua*) (standard length 2 and 6 cm), saithe (*Pollachius virens*) (4 cm), and spotted wolffish (*Anarhichas minor*) (4 cm) at different developmental stages. The researchers placed the fish in plastic bags 10 ft. (3 m) from the sound source and exposed them to between four and 100 pulses of one-second duration of pure tones at 1.5, 4, and 6.5 kHz. The fish in only two groups out of the 82 tested exhibited any adverse effects. These two groups were both composed of herring, a hearing specialist, and were tested with sound pressure levels of 189 dB re 1 µPa, which resulted in a post-exposure mortality of 20 to 30 percent. In the remaining 80 tests, there were no observed effects on behavior, growth (length and weight), or the survival of fish that were kept as long as 34 days post exposure. While statistically significant losses were documented in the two groups impacted, the researchers only tested that particular sound level once, so it is not known if this increased mortality was due to the level of the test signal or to other unknown factors.

High sound pressure levels may cause bubbles to form from micronuclei in the blood stream or other tissues of animals, possibly causing embolism damage (Ketten 1998). Fish have small capillaries where these bubbles could be caught and lead to the rupturing of the capillaries and internal bleeding. It has also been speculated that this phenomena could also take place in the eyes of fish due to potentially high gas saturation within the fish’s eye tissues (Popper and Hastings 2009).

As reviewed in Popper and Hastings (2009), Hastings (1990, 1995) found ‘acoustic stunning’ (loss of consciousness) in blue gouramis (*Trichogaster trichopterus*) following an 8-minute exposure to a 150 Hz pure tone with a peak sound pressure level (SPL) of 198 dB re 1 µPa. This species of fish has an air bubble in the mouth cavity directly adjacent to the animal’s braincase that may have caused this injury.

Hastings (1990, 1995) also found that goldfish exposed to two hours of continuous wave sound at 250 Hz with peak pressures of 204 dB re 1 µPa, and fathead minnows exposed to 0.5 hours of 150 Hz continuous wave sound at a peak level of 198 dB re 1 µPa did not survive.

The only study on the effect of exposure of the lateral line system to continuous wave sound (conducted on one freshwater species) suggests no effect on these sensory cells by intense pure tone signals (Hastings et al. 1996).

Explosions and Other Impulsive Sound Sources

The greatest potential for direct, non-auditory tissue effects is primary blast injury and barotrauma following exposure to explosions. Primary blast injury refers to those injuries that result from the initial compression of a body exposed to a blast wave. Primary blast injury is usually limited to gas-containing structures (e.g., swim bladder) and the auditory system. Barotrauma refers to injuries caused when the swim bladder or other gas-filled structures vibrate in response to the signal, particularly if there is a relatively sharp rise-time and the walls of the structure strike near-by tissues and damage them.

An underwater explosion generates a shock wave that produces a sudden, intense change in local pressure as it passes through the water (U.S. Department of the Navy 1998, 2001). Pressure waves extend to a greater distance than other forms of energy produced by the explosion (i.e., heat and light) and are therefore the most likely source of negative effects to marine life from underwater explosions (Craig 2001; Scripps Institution of Oceanography 2005; U.S. Department of the Navy 2006).

The shock wave from an underwater explosion is lethal to fish at close range (see Section 3.0.5.3.1.2 [Explosions] for a discussion of ranges for mortality dependent on charge size), causing massive organ and tissue damage and internal bleeding (Keevin and Hempen 1997). At greater distance from the detonation point, the extent of mortality or injury depends on a number of factors including fish size, body shape, orientation, and species (Keevin and Hempen 1997; Wright 1982). At the same distance from the source, larger fish are generally less susceptible to death or injury, elongated forms that are round in cross-section are less at risk than deep-bodied forms, and fish oriented sideways to the blast suffer the greatest impact (Edds-Walton and Finneran 2006; O'Keeffe 1984; O'Keeffe and Young 1984; Wiley et al. 1981; Yelverton et al. 1975). Species with gas-filled organs have higher mortality than those without them (Continental Shelf Associates Inc. 2004; Goertner et al. 1994).

Two aspects of the shock wave appear most responsible for injury and death to fish: the received peak pressure and the time required for the pressure to rise and decay (Dzwilewski and Fenton 2002). Higher peak pressure and abrupt rise and decay times are more likely to cause acute pathological effects (Wright and Hopky 1998). Rapidly oscillating pressure waves might rupture the kidney, liver, spleen, and sinus and cause venous hemorrhaging (Keevin and Hempen 1997). They can also generate bubbles in blood and other tissues, possibly causing embolism damage (Ketten 1998). Oscillating pressure waves might also burst gas-containing organs. The swim bladder, the gas-filled organ used by most fish to control buoyancy, is the primary site of damage from explosives (Wright 1982; Yelverton et al. 1975). Gas-filled swim bladders resonate at different frequencies than surrounding tissue and can be torn by rapid oscillation between high- and low-pressure waves. Swim bladders are a characteristic of many bony fish but are not present in sharks and rays.

Studies that have documented fish killed during planned underwater explosions indicate that most fish that die do so within one to four hours, and almost all die within a day (Hubbs and Rechnizer 1952; Yelverton et al. 1975). Fitch and Young (1948) found that the type of fish killed changed when blasting was repeated at the same marine location within 24 hours of previous blasting. They observed that most fish killed on the second day were scavengers, presumably attracted by the victims of the previous day's blasts. However, fishes collected during these types of studies have mostly been recovered floating on the water's surface. Gitschlag et al. (2001) collected both floating fish and those that were sinking or lying on the bottom after explosive removal of nine oil platforms in the northern Gulf of Mexico. They found that 3 to 87 percent (46 percent average) of the specimens killed during a blast might float to the surface. Other impediments to accurately characterizing the magnitude of fish mortality included currents and winds that transported floating fishes out of the sampling area and predation by seabirds or other fishes.

There have been few studies of the impact of underwater explosions on early life stages of fishes (eggs, larvae, juveniles). Fitch and Young (1948) reported the demise of larval anchovies exposed to underwater blasts off California, and Nix and Chapman (1985) found that anchovy and smelt larvae died following the detonation of buried charges. It has been suggested that impulsive sounds, such as that produced by seismic airguns, may cause damage to the cells of the lateral line in fish larvae and fry when in close proximity (15 ft. [5 m]) to the sound source (Booman et al. 1996).Similar to adult fishes, the presence of a swim bladder contributes to shock wave-induced internal damage in larval and juvenile fishes (Settle et al. 2002). Shock wave trauma to internal organs of larval pinfish and spot from shock waves was documented by Govoni et al. (2003). These were laboratory studies, however, and have not been verified in the field.

It has been suggested that impulsive sounds, such as those produced by seismic airguns, may cause damage to the cells of the lateral line in fish larvae and juveniles when in proximity (16 ft. [4.9 m]) to the sound source (Booman et al. 1996).

There have been a number of studies that suggest that the sounds from pile driving, and particularly from driving of larger piles, kill fish that are very close to the source. The source levels in such cases often exceed a peak sound pressure level of 230 dB re 1 µPa and there is some evidence of tissue damage accompanying exposure (e.g., Abbott and Reyff 2004; Caltrans 2001) reviewed in (Hastings and Popper 2005b). However, there is reason for concern in analysis of such data since, in many cases the only dead fish that were observed were those that came to the surface. It is not clear whether fish that did not come to the surface survived the exposure to the sounds, or died and were carried away by currents.

There are also a number of non-peer reviewed experimental studies that placed fish in cages at different distances from the pile driving operations and attempted to measure mortality and tissue damage as a result of sound exposure. However, in most cases the studies' (e.g. Abbott et al. 2002; Abbott and Reyff 2004; Abbott et al. 2005; Caltrans 2001; Nedwell et al. 2003b) work was done with few or no controls, and the behavioral and histopathological observations done very crudely (the exception being Abbott et al. 2005). As a consequence of these limited and unpublished data, it is not possible to know the real effects of pile driving on fish.

Interim criteria for injury of fish were discussed in Stadler and Woodbury (2009). The onset of physical injury would be expected if either the peak sound pressure level exceeds 206 dB re 1 µPa, or the cumulative sound exposure level, accumulated over all pile strikes generally occurring within a single day, exceeds 187 dB re 1 μPa^2-s for fish 2 grams or larger, or 183 dB re 1 μPa^2-s for smaller fish (Stadler and Woodbury 2009). A more recent study by Halvorsen et al., (2011) used carefully controlled laboratory conditions to determine the level of pile driving sound that may cause a direct injury to the fish tissues (barotrauma). The investigators found that juvenile Chinook salmon (*Oncorhynchus tshawytscha*) received less than a single strike sound exposure level of 179 to 181 dB re 1µPa^2-s and cumulative sound exposure level of less than 211 dB re 1µPa^2-s over the duration of the pile driving activity would sustain no more than mild, non-life-threatening injuries.

3.9.3.1.1.2 Hearing Loss

Exposure to high intensity sound can cause hearing loss, also known as a noise-induced threshold shift, or simply a threshold shift (Miller 1974). A temporary threshold shift (TTS) is a temporary, recoverable loss of hearing sensitivity. A TTS may last several minutes to several weeks and the duration may be related to the intensity of the sound source and the duration of the sound (including multiple exposures). A permanent threshold shift is non-recoverable, results from the destruction of tissues within the auditory system, and can occur over a small range of frequencies related to the sound exposure. As with temporary threshold shift, the animal does not become deaf but requires a louder sound stimulus (relative to the amount of PTS) to detect a sound within the affected frequencies; however, in this case, the effect is permanent.

Permanent hearing loss, or permanent threshold shift has not been documented in fish. The sensory hair cells of the inner ear in fish can regenerate after they are damaged, unlike in mammals where sensory hair cells loss is permanent (Lombarte et al. 1993; Smith et al. 2006). As a consequence, any hearing loss in fish may be as temporary as the timeframe required to repair or replace the sensory cells that were damaged or destroyed (e.g., Smith et al. 2006).

Non-Impulsive Sound Sources

Studies of the effects of long-duration sounds with sound pressure levels below 170–180 dB re 1 µPa indicate that there is little to no effect of long-term exposure on species that lack notable anatomical hearing specialization (Amoser and Ladich 2003; Scholik and Yan 2001; Smith et al. 2004a, b; Wysocki et al. 2007). The longest of these studies exposed young rainbow trout (*Onorhynchus mykiss*), to a level of noise equivalent to one that fish would experience in an aquaculture facility (e.g., on the order of 150 dB re 1 µPa) for about nine months. The investigators found no effect on hearing (i.e., TTS) as compared to fish raised at 110 dB re 1 µPa.

In contrast, studies on fish with hearing specializations (i.e., greater sensitivity to lower sound pressures and higher frequencies) have shown that there is some hearing loss after several days or weeks of exposure to increased background sounds, although the hearing loss seems to recover (e.g., (Scholik and Yan 2002; Smith et al. 2006; Smith et al. 2004a). Smith et al. (2006; 2004b) exposed goldfish to noise at 170 dB re 1 µPa and found a clear relationship between the amount of hearing loss (TTS) and the duration of exposure until maximum hearing loss occurred after 24 hours of exposure. A ten-minute exposure resulted in a 5 dB TTS, whereas a three-week exposure resulted in a 28 dB TTS that took over two weeks to return to pre-exposure baseline levels (Smith et al. 2004a)(Note: recovery time not measured by investigators for shorter exposure durations).

Similarly, Wysocki and Ladich (2005) investigated the influence of noise exposure on the auditory sensitivity of two freshwater fish with notable hearing specializations, the goldfish and the lined Raphael catfish (*Platydoras costatus*), and on a freshwater fish without notable specilizations, the pumpkinseed sunfish (*Lepomis gibbosus*). Baseline thresholds showed greatest hearing sensitivity around 0.5 kHz in the goldfish and catfish and at 0.1 kHz in the sunfish. For the goldfish and catfish, continuous white noise of approximately 130 dB re 1 µPa at 1 m resulted in a significant TTS of 23 to 44 dB. In contrast, the auditory thresholds in the sunfish declined by 7 to 11 dB. The duration of exposure and time to recovery was not addressed in this study. Scholik and Yan (2001) demonstrated TTS in fathead minnows (*Pimephales promelas*) after a 24-hour exposure to white noise (0.3–2.0 kHz) at 142 dB re 1 µPa, that did not recover as long as 14 days post-exposure.

Studies have also examined the effects of the sound exposures from Surveillance Towed Array Sensor System Low-Frequency Active sonar on fish hearing (Kane et al. 2010; Popper et al. 2007). Hearing was measured both immediately post exposure and for several days thereafter. Maximum received sound pressure levels were 193 dB re 1 µPa for 324 or 628 seconds. Catfish and some specimens of rainbow trout showed 10-20 dB of hearing loss immediately after exposure to the low-frequency active sonar when compared to baseline and control animals; however, another group of rainbow trout showed no hearing loss. Recovery in trout took at least 48 hours, but studies were not completed. The different results between rainbow trout groups is difficult to understand, but may be due to developmental or genetic differences in the various groups of fish. Catfish hearing returned to, or close to, normal within about 24 hours after exposure to low-frequency active sonar. Furthermore, examination of the inner ears of the fish during necropsy (note: maximum time fish were held post exposure before sacrifice was 96 hours) revealed no differences from the control groups in cilliary bundles or other features indicative of hearing loss (Kane et al. 2010).

The study of mid-frequency active sonar by the same investigators also examined potential effects on fish hearing and the inner ear (Halvorsen et al. 2012; Kane et al. 2010). Out of the four species tested (rainbow trout, channel catfish, largemouth bass, and yellow perch) only one group of channel catfish, tested in December, showed any hearing loss after exposure to mid-frequency active sonar. The signal consisted of a 2 second (s) long, 2.8–3.8 kHz frequency sweep followed by a 3.3 kHz tone of 1 s duration. The stimulus was repeated five times with a 25 second interval. The maximum received sound pressure level was 210 dB re 1 µPa. These animals, which have the widest hearing range of any of the species tested, experienced approximately 10 dB of threshold shift that recovered within 24 hours. Channel catfish tested in October did not show any hearing loss. The investigators speculated that the difference in hearing loss between catfish groups might have been due to the difference in water temperature of the lake where all of the testing took place (Seneca Lake, New York) between October and December. Alternatively, the observed hearing loss differences between the two catfish groups might have been due to differences between the two stocks of fish (Halvorsen et al. 2012). Any effects on hearing in channel catfish due to sound exposure appear to be transient (Halvorsen et al. 2012; Kane et al. 2010). Investigators observed no damage to cilliary bundles or other features indicative of hearing loss in any of the other fish tested including the catfish tested in October (Kane et al. 2010).

Some studies have suggested that there may be some loss of sensory hair cells due to high intensity sources; however, none of these studies concurrently investigated effects on hearing. Enger (1981) found loss of cilliary bundles of the sensory cells in the inner ears of Atlantic cod (*Gadus morhua*) following 1-5 hours of exposure to pure tone sounds between 50 and 400 Hz with a sound pressure level of 180 dB re 1 µPa. Hastings (1995) found auditory hair-cell damage in a species with notable anatomical hearing specializations, the goldfish (*Carassius auratus*) exposed to 250 Hz and 500 Hz continuous tones with maximum peak levels of 204 dB re 1 µPa and 197 dB re 1 µPa, respectively, for about two hours. Similarly, Hastings et al. (1996) demonstrated damage to some sensory hair cells in oscars (*Astronotus ocellatus*) following a one hour exposure to a pure tone at 300 Hz with a peak pressure level of 180 dB re 1 µPa. In none of the studies was the hair cell loss more than a relatively small percent (less than a maximum of 15 percent) of the total sensory hair cells in the hearing organs.

Explosions and Other Impulsive Sound Sources

Popper et al. (2005) examined the effects of a seismic airgun array on a fish with hearing specializations, the lake chub (*Couesius plumbeus*), and two species that lack notable specializations, the northern pike (*Esox lucius*) and the broad whitefish (*Coregonus nasus*) (a salmonid). In this study the average received exposure levels were a mean peak pressure level of 207 dB re 1 µPa; sound pressure level of 197 dB re 1 µPa; and single-shot sound exposure level of 177 dB re 1 μPa^2-s. The results showed temporary hearing loss for both lake chub and northern pike to both 5 and 20 airgun shots, but not for the broad whitefish. Hearing loss was approximately 20 to 25 dB at some frequencies for both the northern pike and lake chub, and full recovery of hearing took place within 18 hours after sound exposure. Examination of the sensory surfaces of the ears by an expert on fish inner ear structure showed no damage to sensory hair cells in any of the fish from these exposures (Song et al. 2008).

McCauley et al. (2003) showed loss of a small percent of sensory hair cells in the inner ear of the pink snapper (*Pagrus auratus*) exposed to a moving airgun array for 1.5 hours. Maximum received levels exceeded 180 dB re 1 μPa^2s for a few shots. The loss of sensory hair cells continued to increase for up to at least 58 days post exposure to 2.7 percent of the total cells. It is not known if this hair cell loss would result in hearing loss since fish have tens or even hundreds of thousands of sensory hair cells in the inner ear Popper and Hoxter 1984; Lombarte and Popper 1994) and only a small portion were affected by the sound. The question remains as to why McCauley et al. (2003) found damage to sensory hair cells while Popper et al. (2005) did not. There are many differences between the studies, including species, precise sound source, and spectrum of the sound that it is hard to speculate.

Hastings et al. (2008) exposed the pinecone soldierfish (*Myripristis murdjan*), a fish with anatomical specializations to enhance their hearing; and three species without notable specializations: the blue green damselfish (*Chromis viridis*), the saber squirrelfish (*Sargocentron spiniferum*), and the bluestripe seaperch (*Lutjanus kasmira*) to an airgun array. Fish in cages in 16 ft. (4.9 m) of water were exposed to multiple airgun shots with a cumulative sound exposure level of 190 dB re 1 μPa^2s. The authors found no hearing loss in any fish following exposures.

As with other impulsive sound sources, it is assumed that sound from pile driving may cause hearing loss in fish located near the site (Popper and Hastings 2009c), however research definitively demonstrating this is lacking.

3.9.3.1.1.3 Auditory Masking

Auditory masking refers to the presence of a noise that interferes with a fish's ability to hear biologically relevant sounds. Fish use sounds to detect predators and prey, and for schooling, mating, and navigating, among other uses (Myrberg 1980; Popper et al. 2003). Masking of sounds associated with these behaviors could have impacts to fish by reducing their ability to perform these biological functions.

Any noise (i.e., unwanted or irrelevant sound, often of an anthropogenic nature) detectable by a fish can prevent the fish from hearing biologically important sounds including those produced by prey or predators (Myrberg 1980; Popper et al. 2003). Auditory masking may take place whenever the noise level heard by a fish exceeds ambient noise levels, the animal's hearing threshold, and the level of a biologically relevant sound. Masking is found among all vertebrate groups, and the auditory system in all vertebrates, including fish, is capable of limiting the effects of masking noise, especially when the frequency range of the noise and biologically relevant signal differ (Fay 1988; Fay and Megela-Simmons 1999).

The frequency of the sound is an important consideration for fish because many marine fish are limited to detection of the particle motion component of low frequency sounds at relatively high sound intensities (Amoser and Ladich 2005). The frequency of the acoustic stimuli must first be compared to the animal's known or suspected hearing sensitivity to establish if the animal can potentially detect the sound.

One of the problems with existing fish auditory masking data is that the bulk of the studies have been done with goldfish, a freshwater fish with well-developed anatomical specializations that enhance hearing abilities. The data on other species are much less extensive. As a result, less is known about masking in marine species, many of which lack the notable anatomical hearing specializations. However, Wysocki and Ladich (2005) suggest that ambient sound regimes may limit acoustic communication and orientation, especially in animals with notable hearing specializations.

Tavolga (1974a, b) studied the effects of noise on pure-tone detection in two species without notable anatomical hearing specializations, the pin fish (*Lagodon rhomboids*) and the African mouth-Breeder (*Tilapia macrocephala*), and found that the masking effect was generally a linear function of masking level, independent of frequency. In addition, Buerkle (1968, 1969) studied five frequency bandwidths for Atlantic cod in the 20 to 340 Hz region and showed masking across all hearing ranges. Chapman and Hawkins (1973b) found that ambient noise at higher sea states in the ocean has masking effects in cod, *Gadus morhua (*L.), haddock, *Melanogrammus aeglefinus(* L.), and pollock, *Pollochinus pollachinus* (L.), and similar results were suggested for several sciaenid species by Ramcharitar and Popper (2004c).Thus, based on limited data, it appears that for fish, as for mammals, masking may be most problematic in the frequency region near the signal.

There have been a few field studies that may suggest masking could have an impact on wild fish. Gannon et al. (2005) showed that bottlenose dolphins (*Tursiops truncatus*) move toward acoustic playbacks of the vocalization of Gulf toadfish (*Opsanus beta*). Bottlenose dolphins employ a variety of vocalizations during social communication including low-frequency pops. Toadfish may be able to best detect the low-frequency pops since their hearing is best below 1 kHz, and there is some indication that toadfish have reduced levels of calling when bottlenose dolphins approach (Remage-Healey et al. 2006a). Silver perch have also been shown to decrease calls when exposed to playbacks of dolphin whistles mixed with other biological sounds (Luczkovich et al. 2000). Results of the Luczkovich et al. (2000) study, however, must be viewed with caution because it is not clear what sound may have elicited the silver perch response (Ramcharitar et al. 2006b). Astrup (1999) and Mann et al. (1998) hypothesized that high frequency detecting species (e.g., clupeids) may have developed sensitivity to high frequency sounds to avoid predation by odontocetes. Therefore, the presence of masking noise may hinder a fish's ability to detect predators and therefore increase predation.

Of considerable concern is that human-generated sounds could mask the ability of fish to use communication sounds, especially when the fish are communicating over some distance. In effect, the masking sound may limit the distance over which fish can communicate, thereby having an impact on important components of their behavior. For example, the sciaenids, which are primarily inshore species, are one of the most active sound producers among fish, and the sounds produced by males are used to "call" females to breeding sights (Ramcharitar et al. 2001) reviewed in (2006b). If the females are not able to hear the reproductive sounds of the males, there could be a significant impact on the reproductive success of a population of sciaenids. Since most sound production in fish used for communication is generally below 500 Hz (Slabbekoorn et al. 2010a), sources with significant low-frequency acoustic energy could affect communication in fish.

Also potentially vulnerable to masking is navigation by larval fish, although the data to support such an idea are still exceedingly limited. There is indication that larvae of some reef fish (species not identified in study) may have the potential to navigate to juvenile and adult habitat by listening for sounds emitted from a reef (either due to animal sounds or non-biological sources such as surf action) (e.g., Higgs 2005). In a study of an Australian reef system, the sound signature emitted from fish choruses was between 0.8 and 1.6 kHz (Cato 1978) and could be detected by hydrophones 3 to 4 nm (5.6 to 7.4 km) from the reef (McCauley and Cato 2000). This bandwidth is within the detectable bandwidth of adults and larvae of the few species of reef fish, such as the dameslefish, *Pomacentrus partitus,* and bicolor damselfish, *Eupomacentrus partitus,* that have been studied (Kenyon 1996b; Myrberg 1980). At the same time, it has not been demonstrated conclusively that sound, or sound alone, is an attractant of larval fish to a reef, and the number of species tested has been very limited. Moreover, there is also evidence that larval fish may be using other kinds of sensory cues, such as chemical signals, instead of, or alongside of, sound (Atema et al. 2002).

3.9.3.1.1.4 Physiological Stress and Behavioral Reactions

As with masking, a fish must first be able to detect a sound above its hearing threshold for that particular frequency and the ambient noise before a behavioral reaction or physiological stress can occur. There are little data available on the behavioral reactions of fish, and almost no research conducted on any long-term behavioral effects or the potential cumulative effects from repeated exposures to loud sounds (Popper and Hastings 2009c).

Stress refers to biochemical and physiological responses to increases in background sound. The initial response to an acute stimulus is a rapid release of stress hormones into the circulatory system, which may cause other responses such as elevated heart rate and blood chemistry changes. Although an increase in background sound has been shown to cause stress in humans, only a limited number of studies have measured biochemical responses by fish to acoustic stress (Remage-Healey et al. 2006a; (e.g., Smith et al. 2004b; Wysocki et al. 2007; Wysocki et al. 2006) and the results have varied. There is evidence that a sudden increase in sound pressure level or an increase in background noise levels can increase stress levels in fish (Popper and Hastings 2009). Exposure to acoustic energy has been shown to cause a change in hormone levels (physiological stress) and altered behavior in some species such as the goldfish (*Carassius auratus*) (Pickering 1981; Smith et al. 2004a, b), but not all species tested to date, such as the rainbow trout (*Oncorhynchus mykiss*) (Wysocki et al. 2007).

Behavioral effects to fish could include disruption or alteration of natural activities such as swimming, schooling, feeding, breeding, and migrating. Sudden changes in sound level can cause fish to dive, rise, or change swimming direction. There is a lack of studies that have investigated the behavioral reactions of unrestrained fish to anthropogenic sound. Studies of caged fish have identified three basic behavioral reactions to sound: startle, alarm, and avoidance (McCauley et al. 2000; Pearson et al. 1992; Scripps Institution of Oceanography and Foundation. 2008). Changes in sound intensity may be more important to a fish's behavior than the maximum sound level. Sounds that fluctuate in level tend to elicit stronger responses from fish than even stronger sounds with a continuous level (Schwartz 1985).

Non-Impulsive Sound Sources

Remage-Healey et al. (2006a) found elevated cortisol levels, a stress hormone, in Gulf toadfish (*Opsanus beta*) exposed to low frequency bottlenose dolphin sounds. Additionally, the toadfish' call rates dropped by about 50 percent, presumably because the calls of the toadfish, a primary prey for bottlenose dolphins, give away the fish's location to the dolphin. The researchers observed none of these effects in toadfish exposed to an ambient control sound (i.e., low-frequency snapping shrimp 'pops').

Smith et al. (2004b) found no increase in corticosteroid, a stress hormone, in goldfish (*Carassius auratus*) exposed to a continuous, band-limited noise (0.1 to 10 kHz) with a sound pressure level of 170 dB re 1 µPa for one month. Wysocki et al. (2007) exposed rainbow trout (*Onorhynchus mykiss*) to continuous band-limited noise with a sound pressure level of about 150 dB re 1 µPa for nine months with no observed stress effects. Growth rates and effects on the trout's immune system were not significantly different from control animals held at sound pressure level of 110 dB re 1 µPa.

Gearin et al. (2000) studied responses of adult sockeye salmon (*Oncorhynchus nerka*) and sturgeon (*Acipenser* sp.) to pinger sounds produced by acoustic devices designed to deter marine mammals from gillnet fisheries. The pingers produced sounds with broadband energy with peaks at 2 kHz or 20 kHz. They found that fish did not exhibit any reaction or behavior change to the pingers, which demonstrated that the alarm was either inaudible to the salmon and sturgeon, or that neither species was disturbed by the mid-frequency sound (Gearin et al. 2000). Based on hearing threshold data, it is highly likely that the salmonids did not hear the sounds.

Culik et al. (2001) did a very limited number of experiments to determine the catch rate of herring (*Clupea harengus*) in the presence of pingers producing sounds that overlapped with the frequency range of hearing for herring (2.7 kHz to over 160 kHz). They found no change in catch rates in gill nets with or without the higher frequency (greater than 20 kHz) sounds present, although there was an increase in the catch rate with the signals from 2.7 kHz to 19 kHz (a different source than the higher frequency source). The results could mean that the fish did not "pay attention" to the higher frequency sound or that they did not hear it, but that lower frequency sounds may be attractive to fish. At the same time, it should be noted that there were no behavioral observations on the fish, and so how the fish actually responded when they detected the sound is not known.

Doksæter et al (2009) studied the reactions of wild, overwintering herring to Royal Netherlands Navy experimental mid-frequency active sonar and killer whale feeding sounds. The behavior of the fish was monitored using upward looking echosounders. The received levels from the 1-2 kHz and 6-7 kHz sonar signals ranged from 127-197 dB re 1 µPa and 139-209 dB re 1 µPa, respectively. Escape reactions were not observed upon the presentation of the mid-frequency active sonar signals; however, the playback of the killer whale sounds elicited an avoidance reaction. The authors concluded that these mid-frequency sonars could be used in areas of overwintering herring without substantially affecting the fish.

There is evidence that elasmobranchs respond to human-generated sounds. Myrberg and colleagues did experiments in which they played back sounds and attracted a number of different shark species to the sound source (e.g., Myrberg et al. 1969; Myrberg et al. 1976; Myrberg et al. 1972; Nelson and Johnson 1972). The results of these studies showed that sharks were attracted to low-frequency sounds (below several hundred Hz), in the same frequency range of sounds that might be produced by struggling prey. However, sharks are not known to be attracted by continuous signals or higher frequencies (which they presumably cannot hear).

Studies documenting behavioral responses of fish to vessels show that Barents Sea capelin (*Mallotus villosus*) may exhibit avoidance responses to engine noise, sonar, depth finders, and fish finders (Jørgensen et al. 2004). Avoidance reactions are quite variable depending on the type of fish, its life history stage, behavior, time of day, and the sound propagation characteristics of the water (Schwartz 1985). Misund (1997a) found that fish ahead of a ship, that showed avoidance reactions, did so at ranges of 160 to 490 ft. (48.8–149.4 m). When the vessel passed over them, some species of fish responded with sudden escape responses that included lateral avoidance or downward compression of the school.

In a study by Chapman and Hawkins (1973b) the low-frequency sounds of large vessels or accelerating small vessels caused avoidance responses by herring. Avoidance ended within 10 seconds after the vessel departed. Twenty-five percent of the fish groups habituated to the sound of the large vessel and 75 percent of the responsive fish groups habituated to the sound of small boats.

Explosions and Other Impulsive Sound Sources

Pearson et al. (1992) exposed several species of rockfish (*Sebastes spp.*) to a seismic airgun. The investigators placed the rockfish in field enclosures and observed the fish's behavior while firing the airgun at various distances for 10 minute trials. Dependent upon the species, rockfish exhibited startle or alarm reactions between peak to peak sound pressure level of 180 dB re 1 µPa and 205 dB re 1 µPa. The authors reported the general sound level where behavioral alterations became evident was at about 161 dB re 1 µPa for all species. During all of the observations, the initial behavioral responses only lasted for a few minutes, ceasing before the end of the 10-minute trial.

Similarly, Skalski et al. (1992) showed a 52 percent decrease in rockfish (*Sebastes* sp.) caught with hook-and-line (as part of the study – fisheries independent) when the area of catch was exposed to a single airgun emission at 186-191 dB re 1 µPa (mean peak level) (See also Pearson et al. 1987, 1992). They also demonstrated that fish would show a startle response to sounds as low as 160 dB re 1 µPa, but this level of sound did not appear to elicit decline in catch. Wright (1982) also observed changes in fish behavior as a result of the sound produced by an explosion, with effects intensified in areas of hard substrate.

Wardle et al. (2001) used a video system to examine the behaviors of fish and invertebrates on reefs in response to emissions from seismic airguns. The researchers carefully calibrated the airguns to have a peak level of 210 dB re 1 µPa at 16 m and 195 dB re 1 µPa at 109 m from the source. There was no indication of any observed damage to the marine organisms. They found no substantial or permanent changes in the behavior of the fish or invertebrates on the reef throughout the course of the study, and no marine organisms appeared to leave the reef.

Engås et al. (1996) and Engås and Løkkeborg (2002) examined movement of fish during and after a seismic airgun study by measuring catch rates of haddock (*Melanogrammus aeglefinus*) and Atlantic cod (*Gadus morhua*) as an indicator of fish behavior using both trawls and long-lines as part of the experiment. These investigators found a significant decline in catch of both species that lasted for several days after termination of airgun use. Catch rate subsequently returned to normal. The conclusion reached by the investigators was that the decline in catch rate resulted from the fish moving away from the airgun sounds at the fishing site. However, the investigators did not actually observe behavior, and it is possible that the fish just changed depth.

The same research group showed, more recently, parallel results for several additional pelagic species including blue whiting and Norwegian spring spawning herring (Slotte et al. 2004). However, unlike earlier studies from this group, the researchers used fishing sonar to observe behavior of the local fish schools. They reported that fish in the area of the airguns appeared to go to greater depths after the airgun exposure compared to their vertical position prior to the airgun usage. Moreover, the abundance of animals 18 to 31 mi. (30 to 50 km) away from the ensonification increased, suggesting that migrating fish would not enter the zone of seismic activity.

Alteration in natural behavior patterns due to exposure to pile driving noise has not been well studied. However, one study (Mueller-Blenkle et al. 2010b) demonstrated behavioral reactions of cod (*Gadus morhua*) and Dover sole (*Solea solea*) to pile driving sounds. Sole showed a significant increase in swimming speed. Cod reacted, but not significantly, and both species showed directed movement away from the sources with signs of habituation after multiple exposures. For sole, reactions were seen with peak sound pressure levels of 144 – 156 dB re 1µPa; and cod showed altered behavior at peak sound pressure levels of 140 – 161 dB re 1 µPa. For both species, this corresponds to a peak particle motion between 6.51×10^{-3} and 8.62×10^{-4} m/s^2.

3.9.3.1.2 Impacts from Non-Impulsive Sources

Non-impulsive sources from the Proposed Action include sonar and other active acoustic sources, vessel noise, and subsonic aircraft noise. Potential acoustic effects to fish from non-impulsive sources may be considered in four categories, as detailed in Section 3.9.3.1.1, Analysis Background and Framework: (1) direct injury; (2) hearing loss; (3) auditory masking; and (4) physiological stress and behavioral reactions.

As discussed in Section 3.9.3.1.1.1 (Direct Injury), direct injury to fish as a result of exposure to non-impulsive sounds is highly unlikely to occur. Therefore, direct injury as a result of exposure to non-impulsive sound sources is not discussed further in this analysis.

Research discussed in Section 3.9.3.1.1.2 (Hearing Loss), indicates that exposure of fish to transient, non-impulsive sources is unlikely to result in any hearing loss. Most sonar sources are outside of the hearing and sensitivity range of most marine fish, and noise sources such as vessel movement and aircraft overflight lack the duration and intensity to cause hearing loss. Furthermore, permanent threshold shift has not been demonstrated in fish as they have been shown to regenerate lost sensory hair cells. Therefore, hearing loss as a result of exposure to non-impulsive sound sources is not discussed further in this analysis.

3.9.3.1.2.1 No Action Alternative – Training Activities

<u>Sonar and Other Active Acoustic Sources</u>

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), training activities under the No Action Alternative include activities that produce in-water noise from the use of sonar and other active acoustic sources, and could occur throughout the Study Area. Sonar and other active acoustic sources proposed for use are transient in most locations as active sonar activities pass through the Study Area. A few activities involving sonar and other active acoustic sources occur in inshore water (within bays and estuaries), specifically at pierside locations. Sonar maintenance activities that would occur at pierside locations occur infrequently and typically emit only a few pings per activity.

Only a few species of shad within the Clupeidae family (herrings) are known to be able to detect high-frequency sonar and other active acoustic sources (greater than 10,000 Hz). Other marine fish would not detect these sounds and would therefore experience no stress, behavioral disturbance, or auditory masking. Shad species, especially in nearshore and inland areas where mine warfare activities take place that often employ high-frequency sonar systems, could have behavioral reactions and experience auditory masking during these activities. However, mine warfare activities are typically limited in duration and geographic extent. Furthermore, sound from high-frequency systems may only be detectable above ambient noise regimes in these coastal habitats from within a few kilometers. Behavioral reactions and auditory masking if they occurred for some shad species are expected to be transient. Long-term consequences for the population would not be expected.

Most marine fish species are not expected to be able to detect sounds in the mid-frequency range of the operational sonars. The fish species that are known to detect mid-frequencies (some sciaenids [drum], most clupeids [herring], and potentially deep-water fish such as myctophids [lanternfish]) do not have their best sensitivities in the range of the operational sonars. Thus, these fish may only detect the most powerful systems, such as hull mounted sonar within a few kilometers; and most other, less powerful mid-frequency sonar systems, for a kilometer or less. Due to the limited time of exposure due to the moving sound sources, most mid-frequency active sonar used in the Study Area would not have the potential to substantially mask key environmental sounds or produce sustained physiological stress or behavioral reactions. Furthermore, although some species may be able to produce sound at higher frequencies (greater than 1 kHz), vocal marine fish, such as sciaenids, largely communicate below the range of mid-frequency levels used by most sonars. Other marine species probably cannot detect mid-frequency sonar (1,000 – 10,000 Hz) and therefore impacts are not expected for these fish. However, any such effects would be temporary and infrequent as a vessel operating mid-frequency sonar transits an area. As such, sonar use is unlikely to impact fish species. Long-term consequences for fish populations due to exposure to mid-frequency sonar and other active acoustic sources are not expected.

A large number of marine fish species may be able to detect low-frequency sonars and other active acoustic sources. However, low-frequency active usage is rare and most low-frequency active operations are conducted in deeper waters, usually beyond the continental shelf break. The majority of fish species, including those that are the most highly vocal, exist on the continental shelf and within nearshore, estuarine areas. Fish within a few tens of kilometers around a low-frequency active sonar could experience brief periods of masking, physiological stress, and behavioral disturbance while the system is used, with effects most pronounced closer to the source. However, overall effects would be localized and infrequent. Based on the low level and short duration of potential exposure to low-frequency sonar and other active acoustic sources, long-term consequences for fish populations are not expected.

Vessel Noise

As discussed in Section 3.0.5.3.1.6 (Vessel Noise), training activities under the No Action Alternative include vessel movement. Navy vessel traffic could occur anywhere within the Study Area; however, it would be concentrated near ports or naval installations and training ranges (e.g., San Diego, Silver Strand Training Complex (SSTC), San Clemente Island, Pearl Harbor). Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to two weeks. Additionally, a variety of smaller craft would be operated within the Study Area. Small craft types, sizes and speeds vary. These activities would be spread across the coastal and open ocean areas designated within the Study Area. Vessel movements involve transit to and from ports to various locations within the Study Area, and many ongoing and proposed training and testing activities within the Study Area involve maneuvers by various types of surface ships, boats, and submarines (collectively referred to as vessels).

A detailed description of vessel noise associated with the Proposed Action is provided in Section 3.0.5.3.1.6 (Vessel Noise). Vessel noise has the potential to expose fish to sound and general disturbance, which could result in short-term behavioral or physiological responses (e.g., avoidance, stress, increased heart rate). Training and testing activities involving vessel movements occur intermittently and range in duration from a few hours up to a few weeks. These activities are widely dispersed throughout the Study Area. While vessel movements have the potential to expose fish occupying the water column to sound and general disturbance, potentially resulting in short-term behavioral or physiological responses, such responses would not be expected to compromise the general health or condition of individual fish. In addition, most activities involving vessel movements are infrequent and widely dispersed throughout the Study Area. The exception is for pierside activities, although these areas are located inshore, these are industrialized areas that are already exposed to high levels of anthropogenic noise due to numerous waterfront users (e.g., industrial and marinas). Therefore, impacts from vessel noise would be temporary and localized. Long-term consequences for the population are not expected.

Aircraft Noise

As described in Section 3.0.5.3.1.7 (Aircraft Overflight Noise), training activities under the No Action Alternative include fixed and rotary wing aircraft overflights. Certain portions of the Study Area, such as areas near Navy airfields, installations, and ranges are used more heavily by Navy aircraft than other portions. These activities would be spread across the coastal and open ocean areas designated within the Study Area. A detailed description of aircraft noise as a stressor is provided in Section 3.0.5.3.1.7 (Aircraft Overflight Noise). Aircraft produce extensive airborne noise from either turbofan or turbojet engines. A severe but infrequent type of aircraft noise is the sonic boom, produced when the aircraft exceeds the speed of sound. Rotary wing aircraft (helicopters) produce low-frequency sound and vibration (Pepper et al. 2003).

Fish may be exposed to aircraft-generated noise wherever aircraft overflights occur, however, sound is primarily transferred into the water from air in a narrow cone under the aircraft. Most of these sounds would occur near airbases and fixed ranges within each range complex. Some species of fish could respond to noise associated with low-altitude aircraft overflights or to the surface disturbance created by downdrafts from helicopters. Aircraft overflights have the potential to affect surface waters and, therefore, to expose fish occupying those upper portions of the water column to sound and general disturbance potentially resulting in short-term behavioral or physiological responses. If fish were to respond to aircraft overflights, only short-term behavioral or physiological reactions (e.g., swimming away and increased heart rate) would be expected. Therefore, long-term consequences for individuals would be unlikely and long-term consequences for the populations are not expected.

3.9.3.1.2.2 Conclusions - Impacts on Fish from Non-impulsive Sound Sources

The majority of fish species exposed to non-impulsive sources would likely have no reaction or mild behavioral reactions. Overall, long-term consequences for individual fish are unlikely in most cases because acoustic exposures are intermittent and unlikely to repeat over short periods. Since long-term consequences for most individuals are unlikely, long-term consequences for populations are not expected.

Steelhead trout, as summarized in Section 3.9.2.3, are anadromous and spend a portion of their lives in both the marine environment as well as in the riverine and estuarine systems from the Kamchatka Peninsula in Asia, east to Alaska, and south to Southern California. Steelhead trout have the potential to be exposed to non-impulsive sound associated with training activities under the No Action Alternative in the coastal areas of the Southern California (SOCAL) Range Complex and SSTC.

It is believed that steelhead trout, which are anatomically similar to Atlantic salmon, are unable to detect the sound produced by mid- or high-frequency sonar and other active acoustic sources (Section 3.9.2.1, Hearing and Vocalization). Therefore acoustic impacts from these sources are not expected.

Low-frequency active sonar and other active acoustic sources are not typically operated in coastal or nearshore waters. If low frequency sources are used in coastal waters, then adult steelhead trout could be exposed to sound within their hearing range within these areas. If this did occur, steelhead trout could experience behavioral reactions, physiological stress, and auditory masking, although these impacts would be expected to be short-term and infrequent based on the low probability of co-occurrence between the activity and species. Long-term consequences for the populations would not be expected.

The primary exposure to vessel and aircraft noise would occur around the Navy ranges, ports, and air bases. Vessel and aircraft overflight noise have the potential to expose steelhead trout to sound and general disturbance, potentially resulting in short-term behavioral responses. However, as discussed above, any short-term behavioral reactions, physiological stress, or auditory masking are unlikely to lead to long-term consequences for individuals. Therefore, long-term consequences for populations are not expected.

Under the ESA, the use of non-impulsive sound sources for training activities under the No Action Alternative may affect, but are not likely to adversely affect ESA-listed steelhead trout.

The use of non-impulsive sound sources under the No Action Alternative during training activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.1.2.3 No Action Alternative – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-3, and in Section 3.0.5.3.1 (Acoustic Stressors), testing activities under the No Action Alternative include activities that use sonar and other active acoustic sources that produce underwater sound, and could occur throughout the Study Area. Proposed testing activities under the No Action Alternative that involve sonar and other active acoustic sources differ in number and location from training activities under the No Action Alternative, however the types and severity of impacts would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

As discussed in Section 3.0.5.3.1.6 (Vessel Noise), testing activities under the No Action Alternative include vessel movement in many events. Navy vessel traffic could occur anywhere within the Study Area; however, it would be concentrated near ports or naval installations and training ranges (e.g., San Diego, Silver Strand Training Complex [SSTC], San Clemente Island, Pearl Harbor). Activities involving vessel movements occur intermittently and are variable in duration, ranging from a few hours up to two weeks. Additionally, a variety of smaller craft would be operated within the Study Area. Small craft types, sizes, and speeds vary. During testing, speeds generally range from 10 to 14 knots; however, vessels can and will, on occasion, operate within the entire spectrum of their specific operational capabilities. In all cases, the vessels would be operated in a safe manner consistent with the local conditions. These events would occur throughout the entire Study Area. Proposed testing activities under the No Action Alternative that involve vessel movement differ in number and location from training activities under the No Action Alternative, however the types and severity of impacts would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

As discussed in Section 3.0.5.3.1.7 (Aircraft Overflight Noise), testing activities under the No Action Alternative include fixed and rotary wing aircraft overflights. Certain portions of the Study Area, such as areas near Navy airfields, installations, and ranges are used more heavily by Navy aircraft than other portions. These events would occur throughout the entire Study Area. Proposed testing activities under the No Action Alternative that involve aircraft overflights differ in number and location from training activities under the No Action Alternative, however, the types and severity of impacts would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

Impacts to fish due to non-impulsive sound are expected to be limited to short-term, minor behavioral reactions. Long-term consequences for populations would not be expected. Predicted impacts to ESA-listed steelhead trout and any designated critical habitat would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

Under the ESA, the use of non-impulsive sound sources for testing activities as described in the No Action Alternative may affect, but are not likely to adversely affect ESA-listed steelhead trout.

The use of non-impulsive sound sources under the No Action Alternative during testing activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.1.2.4 Alternative 1 Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1 and Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), the number of annual training activities that produce in-water noise from the use of sonar and other active acoustic sources under Alternative 1 would increase, however the locations, types, and severity of impacts would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.6 (Vessel Noise), training activities, under Alternative 1 include an increase in the numbers of activities that involve vessels compared to the No Action Alternative, however, the locations and predicted impacts would not differ. Proposed training activities under Alternative 1 that involve vessel movement differ in number from training activities proposed under the No Action Alternative, however, the locations, types, and severity of impacts would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

As discussed in Chapter 2 (Description of Proposed Action And Alternatives), Table 2.8-1, and Section 3.0.5.3.1.7 (Aircraft Overflight Noise), training activities under Alternative 1 include an increase in the number of activities that involve aircraft as compared to the No Action Alternative, however, the training locations, types of aircraft, and types of activities would not differ. The number of individual predicted impacts associated with Alternative 1 aircraft overflight noise may increase, however, the locations, types, and severity of impacts would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

Despite the increase in activity, the potential effects of training activities involving sonar and other active acoustic sources under Alternative 1 on fish species would be similar to those described above for training activities under the No Action Alternative, and are expected to be limited to short-term, minor behavioral reactions. Effects to fish populations would not occur as a result of non-impulsive sounds associated with training activities under Alternative 1. Predicted impacts to ESA-listed steelhead trout and designated critical habitat would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

Under the ESA, the use of non-impulsive sound sources for training activities under Alternative 1 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

The use of non-impulsive sound sources under Alternative 1 during training activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.1.2.5 Alternative 1 - Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-3, and Section 3.0.5.3.1 (Acoustic Stressors), the number of annual testing activities that produce in-water sound from the use of sonar and other active acoustic sources analyzed under Alternative 1 would increase over what was analyzed for the No Action Alternative. These activities would happen in the same general locations under Alternative 1 as described under the No Action Alternative in Section 3.9.3.1.2.1, No Action Alternative – Testing Activities.

Despite the increase in activity, the potential effects of testing activities involving sonar and other active acoustic sources under Alternative 1 on fish species would be similar to those described above for training activities under the No Action Alternative, and are expected to be limited to short-term, minor behavioral reactions. Effects to fish populations would not occur as a result of non-impulsive sounds associated with testing activities under Alternative 1. Predicted impacts to ESA-listed steelhead trout and designated critical habitat would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

Under the ESA, the use of non-impulsive sound sources for testing activities under Alternative 1 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

The use of non-impulsive sound sources under Alternative 1 during testing activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.1.2.6 Alternative 2 – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1 and Section 3.0.5.3.1.1 (Sonar and Other Active Acoustic Sources), the number of annual training activities that produce in-water noise from the use of sonar and other active acoustic sources under Alternative 2 would increase, however the locations, types, and severity of impacts would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

As discussed in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.6 (Vessel Noise), training activities, under Alternative 2 include an increase in the numbers of activities that involve vessels compared to the No Action Alternative, however, the locations and predicted impacts would not differ. Proposed training activities under Alternative 2 that involve vessel movement differ in number from training activities proposed under the No Action Alternative, however, the locations, types, and severity of impacts would not be discernable from those described in 3.9.3.1.2.1, No Action Alternative – Training Activities.

As discussed in Chapter 2 (Description of Proposed Action And Alternatives), Table 2.8-1, and Section 3.0.5.3.1.7 (Aircraft Overflight Noise), training activities under Alternative 2 include an increase in the number of activities that involve aircraft as compared to the No Action Alternative, however, the training locations, types of aircraft, and types of activities would not differ. The number of individual predicted impacts associated with Alternative 2 aircraft overflight noise may increase, however, the locations, types, and severity of impacts would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

Despite the increase in activity, the potential effects of training activities involving sonar and other active acoustic sources under Alternative 2 on fish species would be similar to those described above for training activities under the No Action Alternative, and are expected to be limited to short-term, minor behavioral reactions. Effects to fish populations would not occur as a result of non-impulsive sounds associated with training activities under Alternative 2. Predicted impacts to ESA-listed steelhead trout and designated critical habitat would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

Under the ESA, the use of non-impulsive sound sources for training activities under Alternative 2 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

The use of non-impulsive sound sources under Alternative 2 *during training activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.*

3.9.3.1.2.7 Alternative 2 - Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-3, and Section 3.0.5.3.1 (Acoustic Stressors), the number of annual testing activities that produce in-water sound from the use of sonar and other active acoustic sources analyzed under Alternative 2 would increase over what was analyzed for the No Action Alternative. These activities would happen in the same general locations under Alternative 2 as described under the No Action Alternative in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

Despite the increase in activity, the potential effects of testing activities involving sonar and other active acoustic sources under Alternative 2 on fish species would be similar to those described above for training activities under the No Action Alternative, and are expected to be limited to short-term, minor behavioral reactions. Effects to fish populations would not occur as a result of non-impulsive sounds associated with testing activities under Alternative 2. Predicted impacts to ESA-listed steelhead trout and designated critical habitat would not be discernable from those described in Section 3.9.3.1.2.1, No Action Alternative – Training Activities.

Under the ESA, the use of non-impulsive sound sources for testing activities under Alternative 2 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

The use of non-impulsive sound sources under Alternative 2 during testing activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.1.3 Impacts from Explosions and Other Impulsive Sound Sources

Explosions and other impulsive sound sources include explosions from underwater detonations and explosive ordnance, swimmer defense airguns, pile driving, and noise from weapons firing, launch, and impact with the water's surface. Potential acoustic effects to fish from impulsive sound sources may be considered in four categories, as detailed in Section 3.9.3.1 (Acoustic Stressors) (1) direct injury; (2) hearing loss; (3) auditory masking; and (4) physiological stress and behavioral reactions.

3.9.3.1.2.8 No Action Alternative – Training Activities

Training activities do not include the use of swimmer defense airguns.

Explosions

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.2 (Explosions), training activities under the No Action Alternative would use underwater detonations and explosive ordnance. Training activities involving explosions could be conducted throughout the Study Area, although activities do not normally occur within 3 nm of shore except at designated underwater detonation areas (e.g., Puuloa Underwater Range, Barbers Point Underwater Range, NISMF, Lima Landing, Ewa Training Minefield, Pyramid cove, NW Harbor, Imperial Beach, SSTC).

Concern about potential fish mortality associated with the use of at-sea explosives led military researchers to develop mathematical and computer models that predict safe ranges for fish and other animals from explosions of various sizes (e.g., Yelverton et al. 1975, Goertner 1982, Goertner et al. 1994). Young (1991) provides equations that allow estimation of the potential effect of underwater explosions on fish possessing swim bladders using a damage prediction method developed by Goertner (1982). Young's parameters include the size of the fish and its location relative to the explosive source, but are independent of environmental conditions (e.g., depth of fish and explosive shot frequency). An example of such model predictions is shown in Table 3.9-5, which lists estimated explosive-effects ranges using Young's (1991) method for fish possessing swim bladders exposed to explosions that would typically occur during training exercises. The 10 percent mortality range is the distance beyond which 90 percent of the fish present would be expected to survive. It is difficult to predict the range of more subtle effects causing injury but not mortality (CSA 2004).

Table 3.9-5: Estimated Explosive Effects Ranges for Fish with Swim Bladders

Training Operation and Type of Ordnance	Net Explosive Weight (lb.)	Depth of Explosion (ft.)	10% Mortality Range (ft.)		
			1-oz Fish	1-lb Fish	30-lb Fish
Mine Neutralization					
MK 103 Charge	0.002	10	40	28	18
AMNS Charge	3.24	20	366	255	164
20-lb NEW UNDET Charge	20	30	666	464	299
Missile Exercise					
Hellfire	8	3.3	317	221	142
Maverick	100	3.3	643	449	288
Firing Exercise with IMPASS					
HE Naval Gun Shell, 5-inch	8	1	244	170	109
Bombing Exercise					
MK 20	109.7	3.3	660	460	296
MK 82	192.2	3.3	772	539	346
MK 83	415.8	3.3	959	668	430
MK 84	945	3.3	1,206	841	541

Notes: AMNS = airborne mine neutralization system, HE = high-explosive, IMPASS = integrated marine portable acoustic scoring system, NEW = Net Explosive Weight, lb. = pound, ft. = foot/feet, oz. = ounce, UNDET = underwater detonation

Fish not killed or driven from a location by an explosion might change their behavior, feeding pattern, or distribution. Changes in behavior of fish have been observed as a result of sound produced by explosives, with effect intensified in areas of hard substrate (Wright 1982). Stunning from pressure waves could also temporarily immobilize fish, making them more susceptible to predation.

The number of fish killed by an underwater explosion would depend on the population density in the vicinity of the blast, as well as factors discussed above such as net explosive weight, depth of the explosion, and fish size. For example, if an explosion occurred in the middle of a dense school of menhaden, herring, or other schooling fish, a large number of fish could be killed. Furthermore, the probability of this occurring is low based on the patchy distribution of dense schooling fish.

Sounds from explosions could cause hearing loss in nearby fish (dependent upon charge size). Permanent hearing loss has not been demonstrated in fish, as lost sensory hair cells can be replaced unlike in mammals. Fish that experience hearing loss could miss opportunities to detect predators or prey, or reduce interspecific communication. If an individual fish were repeatedly exposed to sounds from underwater explosions that caused alterations in natural behavioral patterns or physiological stress, these impacts could lead to long-term consequences for the individual such as reduced survival, growth, or reproductive capacity. However, the time scale of individual explosions is very limited, and training exercises involving explosions are dispersed in space and time. Consequently, repeated exposure of individual fish to sounds from underwater explosions is not likely and most acoustic effects are expected to be short-term and localized. Long-term consequences for populations would not be expected.

Weapons Firing, Launch, and Impact Noise

As described in Chapter 2 (Description of Proposed Action and Alternatives), and Table 2.8-1, training activities under the No Action Alternative include activities that produce in water noise from weapons firing, launch, and non-explosive ordnance impact with the water's surface. Activities are spread throughout the Study Area, and could take place within coastal or open ocean areas. Most activities involving large caliber naval gunfire or the launching of targets, missiles, bombs, or other ordnance are conducted greater than 12 nm from shore.

A detailed description of weapons firing, launch, and impact noise is provided in Section 3.0.5.3.1.5 (Weapons Firing, Launch, and Impact Noise). Noise under the muzzle blast of a 5-inch gun and directly under the flight path of the shell (assuming the shell is a few meters above the water's surface) would produce a peak sound pressure level of approximately 200 dB re 1 µPa near the surface of the water (1–2 m depth). Sound due to missile and target launches is typically at a maximum during initiation of the booster rocket and rapidly fades as the missile or target travels downrange. Many missiles and targets are launched from aircraft, which would produce minimal noise in the water due to the altitude of the aircraft at launch. Mines, non-explosive bombs, and intact missiles and targets could impact the water with great force and produce a large impulse and loud noise of up to approximately 270 dB re 1 µPa at 1 m, but with very short pulse durations, depending on the size, weight, and speed of the object at impact (McLennan 1997). This corresponds to sound exposure levels of around 200 dB re 1 μPa^2-s at 1 m. These sounds from weapons firing launch, and impact noise would be transient and of short duration, lasting no more than a few seconds at any given location.

Fish that are exposed to noise from weapons firing, launch, and non-explosive ordnance impact with the water's surface may exhibit brief behavioral reactions, however due to the short term, transient nature of weapons firing, launch, and non-explosive impact noise, animals are unlikely to be exposed multiple times within a short period. Behavioral reactions would likely be short term (minutes) and substantive costs or long-term consequences for individuals or populations would not be expected.

Pile Driving

Pile driving would occur during the construction and removal phases of the elevated causeway training activities at the SSTC. The training involves the use of an impact hammer to dive the piles into the sediment and a vibratory hammer to later remove the piles. The pile driving locations are adjacent to Navy pier side locations in industrialized waterways that carry a high volume of vessel traffic in addition to Navy vessels using the pier. These coastal areas tend to have high ambient noise levels due to natural and anthropogenic sources present.

The results to date show only the most limited mortality, and then only when fish are very close to an intense sound source. Whereas there is evidence that fish within a few meters of a pile driving operation would potentially be killed, very limited data suggest that fish further from the source are not killed, and may not be harmed. As a consequence of these limited and unpublished data, it is not possible to know the quantitative effects of pile driving on fish.

As elevated causeway system pile installation and removal within the project area would result in temporary increased underwater noise levels. Underwater sound levels likely to result from unattenuated impact pile driving would be 190 dB re 1 µPa (root mean square), 210 dB re 1 µPa (peak), and 177 dB re 1 μPa^2-sec (sound exposure level) at 10 meters. Underwater sound levels likely to result from vibratory pile driving would be 170 dB re 1 µPa (root mean square) at 10 meters. Since many fish use their swim bladders for buoyancy, they are susceptible to rapid expansion/decompression due to peak pressure waves from underwater noises (Hastings and Popper 2005a). At a sufficient level this exposure can be fatal. Recently, underwater noise effects criteria for fish were revised and accepted for in-water projects following a multi-agency agreement that included concurrence from National Marine Fisheries Service and the U.S. Fish and Wildlife Service (Fisheries Hydroacoustic Working Group 2008). The underwater noise thresholds for fish for behavioral disturbance and the onset of injury are presented in Table 3.9-6. The Navy evaluated the distance at which pile driving noise would meet or exceed these thresholds, resulting in zones within the water column where behavioral or injurious effects could occur. However, due to the absence of any data from which the density of fish species could be determined, the Navy was unable to calculate the number or percent of the fish population that may be exposed to these effects within each zone. As a result, the remaining analysis presents the distance(s) from the pile at which these criteria or effects would be experience by fish and a qualitative assessment of the impacts that these sounds would have on the behavior and physiology of these animals.

For impact pile driving, the underwater noise threshold criteria for fish injury from a single pile strike occurs at a peak sound pressure level of 206 dB re 1 µPa. This sound level may be exceeded during impact pile driving within a circle centered at the location of the driven pile, out to a distance of approximately 60 ft. (18.3 m).

Alternatively, fish can also be affected by the cumulative effects of underwater noise from impact pile driving, and the extent of effects is evaluated by calculating the accumulated sound exposure level, based on the number of strikes per day. An impact hammer could be used for up to 200 to 300 impact strikes per pile, with a speed of 30 to 50 strikes per minute. It is expected that any pile driven using an impact hammer would probably require more than one strike. The results of the cumulative noise analysis for this proposed action indicate that the 187 dB and 183 dB accumulated sound exposure level threshold could be exceeded within a circle centered at the location of the driven pile out to a distance of approximately 6.6 ft. (2.01 m), and 13.2 ft. (4.02 m), respectively. The accumulated sound exposure level distance is shorter than the distance to the peak pressure of 206 dB re 1 µPa, therefore the fish are likely to be injured from peak pressure before accumulating enough energy to cause injury. During impact pile driving, the associated underwater noise levels would result in behavioral responses, including avoidance of the pile driving location, and would have the potential to cause injury.

Table 3.9-6: Range of Effects for Fish from Pile Driving

Criteria/ Predicted Effect	Size of Fish	Criteria	Distance of Effect for Impact Hammer (meters)	Distance of Effect for Vibratory Pile Driving (meters)
Onset of Injury	All Fish	206 dB re 1 µPa (peak)	18	N/A
	Fish two grams or greater	187 dB re 1 μPa^2-s (SEL)	2	N/A
	Fish less than two grams	183 dB re 1 μPa^2-s (SEL)	4	N/A
Behavioral impacts[1]	All Fish	150 dB re 1 µPa (rms)	4642	215

Source: Fisheries Hydroacoustic Working Group, 2008

SEL=sound exposure level; rms=root mean square

[1]Behaviorial criteria was not set forth by the Fisheries Hydroacoustic Working Group, so as a conservative measure, National Oceanic and Atmospheric Administration Fisheries and U.S. Fish and Wildlife Service generally use 150 dB root mean square as the threshold for behavioral effects to ESA-listed fish species (salmon and bull trout) for most biological opinions evaluating pile driving, however there are currently no research or data to support this threshold.

A vibratory hammer would be used to remove all piles during elevated causeway system training. When using the vibratory driver method, the distances at which the underwater noise thresholds occur (150 dB root mean square) would be reduced to 710 ft. (216.4 m) for behavioral disruption. There are currently no criteria or expected occurrences of injury to fish from vibratory pile driving (Table 3.9-6).

Fish near the pile driving location may display a startle response during initial stages of pile driving, and would likely avoid the immediate area during pile driving activities. However, field investigations in Puget Sound in the state of Washington on salmonid behavior, when occurring near pile driving projects (Feist 1991; Feist et al. 1992), found little evidence that normally nearshore migrating salmonids move further offshore to avoid the general project area. In fact, some studies indicate that construction site behavioral responses, including site avoidance, may be as strongly tied to visual stimuli as well as underwater sound (Feist 1991; Feist et al. 1992; Ruggerone et al. 2008). Any fish which are behaviorally disturbed may change their normal behavior patterns (i.e., swimming speed or direction, foraging habits, etc.) or be temporarily displaced from the area of construction.

The number of fish affected by pile driving would depend on the population density in the vicinity of the location of the activity, as well as factors discussed above such as pile driving method used and fish size. The number of fish potentially killed would not, however, represent significant mortality in terms of the total population of such fish in the Study Area. Furthermore, the probability of this occurring is low based on the patchy distribution of dense schooling fish. Fish density in a given area is inherently dynamic and varies seasonally, daily, and over shorter time frames. Consequently, fish density data are not available for the Study Area and the number of fish affected by pile driving cannot be accurately quantified.

To summarize, a limited number of fish would be killed in the immediate proximity of the pile driving locations. Additional fish would be injured and could subsequently die or suffer greater rates of predation. Beyond the range of injurious effects, there could be short-term effects such as masking, stress, behavioral changes, and hearing threshold shifts. However, given the relatively small area that would be affected, and the abundance and distribution of the species concerned, no population-level effects would be expected. When training and testing activities are completed, any fish species disrupted by the exercise should repopulate the area over time. The regional abundance and diversity of fish are unlikely to measurably decrease.

Conclusion

Potential impacts on fish from explosions and impulsive sound sources can range from no effect, brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin et al. 1997). Occasional behavioral reactions to intermittent explosions and impulsive sound sources are unlikely to cause long-term consequences for individual fish or populations.

Animals that experience hearing loss (permanent or temporary threshold shift) as a result of exposure to explosions and impulsive sound sources may have a reduced ability to detect relevant sounds such as predators, prey, or social vocalizations. It is uncertain whether some permanent hearing loss over a part of a fish's hearing range would have long-term consequences for that individual. If this did affect the fitness of a few individuals, it is unlikely to have long-term consequences for the population.

It is possible for fish to be injured or killed by an explosion; however, long-term consequences for a loss of a few individuals is unlikely to have measureable effects on overall stocks or populations. Therefore, long-term consequences to fish populations would not be expected.

Steelhead trout, as summarized in Section 3.9.2.3, are anadromous and spend a portion of their lives in both the marine environment as well as in the riverine and estuarine systems from the Kamchatka Peninsula in Asia, east to Alaska, and south to Southern California. Steelhead trout have the potential to be exposed to explosive energy and sound associated with training activities under the No Action Alternative in the coastal areas of the SOCAL Range Complex and SSTC. Since steelhead trout spawn in rivers and the early lifestages of the fish occur in riverine and estuarine environments, eggs and larvae would not be exposed to impulsive sounds produced from explosions, weapons firing, launch, and non-explosive ordnance impact with the water's surface during training activities.

Training activities involving impulsive sound sources in the SOCAL Range Complex and SSTC have the possibility to impact steelhead trout, potentially resulting in short-term behavioral or physiological responses, hearing loss, injury, or mortality. However, given the infrequent nature of training activities involving impulsive sound sources in the SOCAL Range Complex and SSTC and the rarity of the species, the likelihood of steelhead trout encountering an explosive activity taking place anywhere within the range complex is remote. Impacts to designated steelhead trout critical habitat would not occur as activities do not overlap.

Under the ESA, the use of impulsive sound sources for training activities under the No Action Alternative may affect, but are not likely to adversely affect ESA-listed steelhead trout.

The use of impulsive sound sources under the No Action Alternative during training activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.1.2.9 No Action Alternative – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-2 and Table 2.8-3, and Section 3.0.5.3.1.2 (Explosions), testing activities under the No Action Alternative would involve underwater detonations and explosive ordnance. No explosive bombs, Improved Extended Echo Ranging sonobuoys, or pile driving are proposed under the No Action Alternative.

Testing activities involving explosions could be conducted throughout the Study Area, although activities do not normally occur within 3 nm of shore except at designated underwater detonation areas (e.g., Puuloa Underwater Range, Barbers Point Underwater Range, Lima Landing, Ewa Training Minefield, Pyramid cove, NW Harbor, Imperial Beach, SSTC). Proposed testing activities under the No Action Alternative that involve explosives and other impulsive sources differ in number and location from training activities under the No Action Alternative, however the types and severity of impacts would not be discernable from those described in Section 3.9.3.1.3.1, No Action Alternative – Training Activities.

As described in Tables 2.8-2 to 2.8-3, testing activities under the No Action Alternative include activities that produce in water noise from weapons firing, launch, and non-explosive ordnance impact with the water's surface. Activities are spread throughout the Study Area and could take place within coastal or open ocean area. Proposed testing activities under the No Action Alternative that produce in-water noise from weapons firing, launch, and non-explosive ordnance impact with the water's surface differ in number and location from training activities under the No Action Alternative, however the types and severity of impacts would not be discernable from those described in Section 3.9.3.1.3.1, No Action Alternative – Training Activities.

Swimmer Defense Airguns

Testing activities under the No Action Alternative would include the use of swimmer defense airguns up to five times per year pierside in San Diego Bay, California as described in Table 2.8-3. See the discussion in Section 3.0.5.3.1.4 (Swimmer Defense Airguns) for details on swimmer defense airguns. Source levels are estimated to be 185 to 195 dB re 1µPa^2-s at 1m. For 100 shots, the cumulative sound exposure level would be approximately 215 to 225 dB re 1µPa^2-s at 1m.

Single, small airguns (60 in^3) are unlikely to cause direct trauma to marine fish. Impulses from airguns lack the strong shock wave and rapid pressure increase, as would be expected from explosive sources that can cause primary blast injury or barotrauma. As discussed in Section 3.9.3.1.1.1 (Direct Injury), there is little evidence that airguns can cause direct injury to adult fish, with the possible exception of injuring small juvenile or larval fish nearby (approximately 16 ft. [4.9 m]). Therefore, larval and small juvenile fish within a few meters of the airgun may be injured or killed. Considering the small footprint of this hypothesized injury zone, and the isolated and infrequent use of the swimmer defense airgun, population consequences would not be expected.

As discussed in Section 3.9.3.1.1.2 (Hearing Loss), temporary hearing loss in fish could occur if fish were exposed to impulses from swimmer defense airguns, although some studies have shown no hearing loss from exposure to airguns within 16 ft. (4.9 m). Therefore, fish within a few meters of the airgun may receive temporary hearing loss. However, due to the relatively small size of the airgun, and their limited use in pierside areas, impacts would be minor, and may only impact a few individual fish. Population consequences would not be expected.

Airguns do produce broadband sounds, however the duration of an individual impulse is about 1/10th of a second. Airguns could be fired up to 100 times per activity, but would generally be used less based on the actual testing requirements. The pierside areas where these activities are proposed are inshore, with high levels of use, and therefore have high levels of ambient noise, see Section 3.0.4.5 (Ambient Noise). Auditory masking is discussed in Section 3.9.3.1.1.3 (Auditory Masking), and only occurs when the interfering signal is present. Due to the limited duration of individual shots and the limited number of shots proposed for the swimmer defense airgun, only brief, isolated auditory masking to marine fish would be expected. Population consequences would not be expected.

In addition, fish that are able to detect the airgun impulses may exhibit alterations in natural behavior. As discussed in Section 3.9.3.1.1.4 (Physiological Stress and Behavioral Reactions), some fish species with site fidelity such as reef fish may show initial startle reactions, returning to normal behavioral patterns within a matter of a few minutes. Pelagic and schooling fish that typically show less site fidelity may avoid the immediate area for the duration of the activities. Due to the limited use and relatively small footprint of swimmer defense airguns, impacts to fish are expected to be minor. Population consequences would not be expected.

Conclusion

As discussed for training activities, potential impacts on fish from explosions and impulsive sound sources can range from no effect, brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin et al. 1997). Occasional behavioral reactions to intermittent explosions and impulsive sound sources are unlikely to cause long-term consequences for individual fish or populations.

Animals that experience hearing loss (permanent or temporary threshold shift) as a result of exposure to explosions and impulsive sound sources may have a reduced ability to detect relevant sounds such as predators, prey, or social vocalizations. It is uncertain whether some permanent hearing loss over a part of a fish's hearing range would have long-term consequences for that individual. If this did affect the fitness of a few individuals, it is unlikely to have long-term consequences for the population.

It is possible for fish to be injured or killed by an explosion; however, long-term consequences for a loss of a few individuals is unlikely to have measureable effects on overall stocks or populations. Therefore, long-term consequences to fish populations would not be expected.

Underwater explosions, particularly those associated with mine warfare testing that occur in shallow water areas in the SOCAL Range Complex and SSTC have the possibility to impact steelhead trout. Exposures may result in behavioral responses, hearing loss, physical injury, or death to fish near the activities. However, given the infrequent nature of activities involving underwater explosions in the SOCAL Range Complex and SSTC and the rarity of the species, the likelihood of steelhead trout encountering an explosive activity taking place anywhere within the range complex is remote. Impacts to designated steelhead trout critical habitat would not be discernable from those described in Section 3.9.3.1.3.1 No Action Alternative – Training Activities.

Under the ESA, the use of impulsive sound sources for testing activities under the No Action Alternative may affect, but are not likely to adversely affect ESA-listed steelhead trout.

The use of impulsive sound sources under the No Action Alternative during testing activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.1.2.10 Alternative 1- Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.2 (Explosions), the number of annual training activities that use explosions under Alternative 1 would increase.

Proposed training activities under Alternative 1 that involve underwater explosions differ in number from training activities proposed under the No Action Alternative; however the locations, types, and severity of impacts would not be discernable from those described in Section 3.9.3.1.3.1, No Action Alternative – Training Activities.

As discussed for the No Action Alternative, potential impacts on fish from explosions and impulsive sound sources can range from no effect, brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin et al. 1997). Occasional behavioral reactions to intermittent explosions and impulsive sound sources are unlikely to cause long-term consequences for individual fish or populations. While serious injury or mortality to individual fish would be expected if they were present in the immediate vicinity of explosive ordnance use, despite the increase in activities under Alternative 1, impacts from at-sea explosion from training activities would be temporary and localized since the activities are infrequent and widely dispersed throughout the Study Area, and the distribution of potentially affected fishes also varies.

Underwater explosions, particularly those associated with mine warfare testing that occur in shallow water areas in the SOCAL Range Complex and SSTC have the possibility to impact steelhead trout. Exposures may result in behavioral responses, hearing loss, physical injury, or death to fish near the activities. However, given the infrequent nature of activities involving underwater explosions in the SOCAL Range Complex and SSTC and the rarity of the species, the likelihood of steelhead trout encountering an explosive activity taking place anywhere within the range complex is remote. Impacts to designated steelhead trout critical habitat would not be discernable from those described in Section 3.9.3.1.3.1 No Action Alternative – Training Activities.

Under the ESA, the use of impulsive sound sources for training activities under Alternative 1 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

The use of impulsive sound sources under Alternative 1 during training activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.1.2.11 Alternative 1 – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-3, and in Section 3.0.5.3.1.2 (Explosions), the number of annual testing activities that use explosions under Alternative 1 would increase over the No Action Alternative. No explosive bombs, Improved Extended Echo Ranging sonobuoys, or pile driving are proposed under the Alternative 1. These activities would happen in the same general locations under Alternative 1 as under the No Action Alternative.

Testing activities involving explosions could be conducted throughout the Study Area, although activities do not normally occur within 3 nm of shore except at designated underwater detonation areas (e.g., Puuloa Underwater Range, Barbers Point Underwater Range, Lima Landing, Ewa Training Minefield, Pyramid cove, NW Harbor, Imperial Beach, SSTC). Proposed testing activities under Alternative 1 that involve explosives and other impulsive sources differ in number and location from training activities under the No Action Alternative, however the types and severity of impacts would not be discernable from those described in Section 3.9.3.1.3.1, No Action Alternative – Training Activities.

As described in Tables 2.8-2 to 2.8-3, testing activities under Alternative 1 include activities that produce in water noise from weapons firing, launch, and non-explosive ordnance impact with the water's surface. Activities are spread throughout the Study Area and could take place within coastal or open ocean area. Proposed testing activities under Alternative 1 that produce in-water noise from weapons firing, launch, and non-explosive ordnance impact with the water's surface differ in number and location from training activities under the No Action Alternative, however the types and severity of impacts would not be discernable from those described in Section 3.9.3.1.3.1, No Action Alternative – Training Activities.

As discussed for training activities, potential impacts on fish from explosions and impulsive sound sources can range from no effect, brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin et al. 1997). Occasional behavioral reactions to intermittent explosions and impulsive sound sources are unlikely to cause long-term consequences for individual fish or populations. While serious injury or mortality to individual fish would be expected if they were present in the immediate vicinity of explosive ordnance use, impacts from at-sea explosion from testing activities would be temporary and localized since activities are infrequent and widely dispersed throughout the Study Area.

Underwater explosions, particularly those associated with mine warfare testing that occur in shallow water areas in the SOCAL Range Complex and SSTC have the possibility to impact steelhead trout. Exposures may result in behavioral responses, hearing loss, physical injury, or death to fish near the activities. However, given the infrequent nature of activities involving underwater explosions in the SOCAL Range Complex and SSTC and the rarity of the species, the likelihood of steelhead trout encountering an explosive activity taking place anywhere within the range complex is remote. Impacts to designated steelhead trout critical habitat would not be discernable from those described in Section 3.9.3.1.3.1 No Action Alternative – Training Activities.

Under the ESA, the use of impulsive sound sources for testing activities under Alternative 1 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

The use of impulsive sound sources under Alternative 1 during testing activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.1.2.12 Alternative 2 – Training Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Table 2.8-1, and Section 3.0.5.3.1.2 (Explosions), under Alternative 2, the total number of explosive bombs, missiles, rockets, gun rounds, underwater explosives, and Improved Extended Echo Ranging sonobuoys proposed to be expended during training activities in the Study Area would be the same as Alternative 1.

As discussed for the No Action Alternative, potential impacts on fish from explosions and impulsive sound sources can range from no effect, brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin et al. 1997). Occasional behavioral reactions to intermittent explosions and impulsive sound sources are unlikely to cause long-term consequences for individual fish or populations. While serious injury or mortality to individual fish would be expected if they were present in the immediate vicinity of explosive ordnance use, impacts from at-sea explosion from training activities would be temporary and localized since the activities are infrequent and widely dispersed throughout the Study Area, and the distribution of potentially affected fishes also varies.

Underwater explosions, particularly those associated with mine warfare testing that occur in shallow water areas in the SOCAL Range Complex and SSTC have the possibility to impact steelhead trout. Exposures may result in behavioral responses, hearing loss, physical injury, or death to fish near the activities. However, given the infrequent nature of activities involving underwater explosions in the SOCAL Range Complex and SSTC and the rarity of the species, the likelihood of steelhead trout encountering an explosive activity taking place anywhere within the range complex is remote. Impacts to designated steelhead trout critical habitat would not be discernable from those described in Section 3.9.3.1.3.1 No Action Alternative – Training Activities.

Under the ESA, the use of impulsive sound sources for training activities under Alternative 2 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

The use of impulsive sound sources under Alternative 2 during training activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.1.2.13 Alternative 2 – Testing Activities

As described in Chapter 2 (Description of Proposed Action and Alternatives), Tables 2.8-2 to 2.8-3, and in Section 3.0.5.3.1.2 (Explosions), the number of annual testing activities that use explosions under Alternative 2 would increase over the No Action Alternative. These activities would happen in the same general locations under Alternative 2 as under the No Action Alternative.

Testing activities involving explosions could be conducted throughout the Study Area, although activities do not normally occur within 3 nm of shore except at designated underwater detonation areas (e.g., Puuloa Underwater Range, Barbers Point Underwater Range, Lima Landing, Ewa Training Minefield, Pyramid cove, NW Harbor, Imperial Beach, SSTC). Proposed testing activities under Alternative 2 that involve explosives and other impulsive sources differ in number and location from training activities under the No Action Alternative, however the types and severity of impacts would not be discernable from those described in Section 3.9.3.1.3.1, No Action Alternative – Training Activities.

As described in Tables 2.8-2 to 2.8-3, testing activities under Alternative 2 include activities that produce in water noise from weapons firing, launch, and non-explosive ordnance impact with the water's surface. Activities are spread throughout the Study Area and could take place within coastal or open ocean area. Proposed testing activities under Alternative 2 that produce in-water noise from weapons firing, launch, and non-explosive ordnance impact with the water's surface differ in number and location from training activities under the No Action Alternative, however the types and severity of impacts would not be discernable from those described in Section 3.9.3.1.3.1, No Action Alternative – Training Activities.

As discussed for training activities, potential impacts on fish from explosions and impulsive sound sources can range from no effect, brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin et al. 1997). Occasional behavioral reactions to intermittent explosions and impulsive sound sources are unlikely to cause long-term consequences for individual fish or populations. While serious injury or mortality to individual fish would be expected if they were present in the immediate vicinity of explosive ordnance use, impacts from at-sea explosion from testing activities would be temporary and localized since activities are infrequent and widely dispersed throughout the Study Area, and the distribution of potentially affected fishes also varies

Underwater explosions, particularly those associated with mine warfare testing that occur in shallow water areas in the SOCAL Range Complex and SSTC have the possibility to impact steelhead trout. Exposures may result in behavioral responses, hearing loss, physical injury, or death to fish near the activities. However, given the infrequent nature of activities involving underwater explosions in the SOCAL Range Complex and SSTC and the rarity of the species, the likelihood of steelhead trout encountering an explosive activity taking place anywhere within the range complex is remote. Impacts to designated steelhead trout critical habitat would not be discernible from those described in Section 3.9.3.1.3.1 No Action Alternative – Training Activities.

Under the ESA, the use of impulsive sound sources for testing activities under Alternative 2 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

The use of impulsive sound sources under Alternative 2 during testing activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.1.2.14 Summary of Effects to Marine Fish from Acoustic and Explosive Stressors

Under the No Action Alternative, Alternative 1 or Alternative 2, potential impacts on fish from acoustic and explosive stressors can range from no impact brief acoustic effects, tactile perception, and physical discomfort, to slight injury to internal organs and the auditory system, to death of the animal (Keevin et al. 1997). Occasional behavioral reactions to intermittent explosions and impulsive sound sources are unlikely to cause long-term consequences for individual fish or populations. While serious injury or mortality to individual fish would be expected if they were present in the immediate vicinity of explosive ordnance use, impacts from acoustic and explosive stressors would be temporary and localized since the activities are infrequent and widely dispersed throughout the Study Area, and the distribution of potentially affected fishes also varies.

Under the ESA, acoustic and explosive stressors occurring off the California coast under the No Action Alternative, Alternative 1, or Alternative 2 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

Acoustic and explosive stressors under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.2 Energy Stressors

This section analyzes the potential impacts of energy stressors that can occur during training and testing activities within the Study Area, and for HSTT only includes potential impacts from electromagnetic devices.

3.9.3.2.1 Impacts from Electromagnetic Devices

Several different electromagnetic devices are used during training and testing activities. A discussion of the type, number, and location of activities using these devices under each alternative is presented in Section 3.0.5.3.2.1 (Electromagnetic).

A comprehensive review of information regarding the sensitivity of marine organisms to electric and magnetic impulses, including fishes comprising the subclass elasmobranchii (sharks, skates, and rays; hereafter referred to as elasmobranchs), as well as other bony fishes, is presented in Normandeau (2011). The synthesis of available data and information contained in this report suggests that while many fish species (particularly elasmobranchs) are sensitive to electromagnetic fields, further investigation is necessary to understand the physiological response and magnitude of the potential effects. Most examinations of electromagnetic fields on marine fishes have focused on buried undersea cables associated with offshore wind farms in European waters (Boehlert and Gill 2010; Gill 2005; Ohman et al. 2007).

Many fish groups including lamprey, elasmobranchs, eels, salmonids, stargazers, and others, have an acute sensitivity to electrical fields, known as electroreception (Bullock et al. 1983; Helfman et al. 2009b). Electroreceptors are thought to aid in navigation, orientation, and migration of sharks and rays (Kalmijn 2000). In elasmobranchs, behavioral and physiological response to electromagnetic stimulus varies by species and age, and appears to be related to foraging behavior (Rigg et al. 2009). Many elasmobranchs respond physiologically to electric fields of 10 nanovolts (nV) per cm and behaviorally at 5 nV per cm (Collin and Whitehead 2004). Electroreceptive marine fishes with ampullary (pouch) organs can detect considerably higher frequencies of 50 hertz (Hz) to more than 2 kilohertz (kHz) (Helfman et al. 2009b). The distribution of electroreceptors on the head of these fishes, especially around the mouth suggests that these sensory organs may be used in foraging. Additionally, some researchers hypothesize that the electroreceptors aid in social communication (Collin and Whitehead 2004). The ampullae of some fishes are sensitive to low frequencies (< 0.1–25 Hz) of electrical energy (Helfman et al. 2009b), which may be of physical or biological origin, such as muscle contractions. For example, the ampullae of the shovelnose sturgeon (*Scaphirhynchus platorynchus*), were shown to respond to electromagnetic stimuli in a way comparable to the well-studied elasmobranchs, which are sensitive to electric fields as low as 1 microvolt (µV) per cm with a magnetic field of 100 gauss (Bleckmann and Zelick 2009).

While elasmobranchs and other fishes can sense the level of the earth's electromagnetic field, the potential effects on fish resulting from changes in the strength or orientation of the background field are not well understood. When the electromagnetic field is enhanced or altered, sensitive fishes may experience an interruption or disturbance in normal sensory perception. Research on the electrosensitivity of sharks indicates that some species respond to electrical impulses with an apparent avoidance reaction (Helfman et al. 2009b; Kalmijn 2000). This avoidance response has been exploited as a shark deterrent, to repel sharks from areas of overlap with human activity (Marcotte and Lowe 2008).

Experiments with electromagnetic pulses can provide indirect evidence of the range of sensitivity of fishes to similar stimuli. Two studies reported that exposure to electromagnetic pulses do not have any effect on fishes (Hartwell et al. 1991; Nemeth and Hocutt 1990). The observed 48-hour mortality of small estuarine fishes (sheepshead minnow, mummichog, Atlantic menhaden, striped bass, Atlantic silverside, fourspine stickleback, and rainwater killifish) exposed to electromagnetic pulses of 100 to 200 kilovolts (kV) per m (10 nanoseconds per pulse) from distances greater than 164 ft. (50 m) was not statistically different than the control group (Hartwell et al. 1991; Nemeth and Hocutt 1990). During a study of Atlantic menhaden, there were no statistical differences in swimming speed and direction (toward or away from the electromagnetic pulse source), between a group of individuals exposed to electromagnetic pulses and the control group (Hartwell et al. 1991; Nemeth and Hocutt 1990).

Both laboratory and field studies confirm that elasmobranchs (and some teleost [bony] fishes) are sensitive to electromagnetic fields, but the long-term impacts are not well-known. Electromagnetic sensitivity in some marine fishes (e.g., salmonids) is already well-developed at early life stages (Ohman et al. 2007), with sensitivities reported as low as 0.6 millivolt per centimeter (mV/cm) in Atlantic salmon (Formicki et al. 2004); however, most of the limited research that has occurred focuses on adults. Some species appear to be attracted to undersea cables, while others show avoidance (Ohman et al. 2007). Under controlled laboratory conditions, the scalloped hammerhead (*Sphyrna lewini*) and sandbar shark (*Carcharhinus plumbeus*) exhibited altered swimming and feeding behaviors in response to very weak electric fields (less than 1 nV per cm) (Kajiura and Holland 2002). In a test of sensitivity to fixed magnets, five Pacific sharks were shown to react to magnetic field strengths of 25 to 234 gauss at distances ranging between 0.85 and 1.90 ft. (0.26 and 0.58 m) and avoid the area (Rigg et al. 2009). A field trial in the Florida Keys demonstrated that southern stingray (*Dasyatis americana*) and nurse shark (*Ginglymostoma cirratum*) detected and avoided a fixed magnetic field producing a flux of 950 gauss (O'Connell et al. 2010).

Potential impacts of electromagnetic activity on adult fishes may not be relevant to early life stages (eggs, larvae, juveniles) due to ontogenic (lifestage-based) shifts in habitat utilization (Botsford et al. 2009; Sabates et al. 2007). Some skates and rays produce egg cases that occur on the bottom, while many neonate and adult sharks occur in the water column or near the water surface. Other species may have an opposite life history, with egg and larval stages occurring near the water surface, while adults may be demersal.

Based on current literature, only the fish groups identified above as capable of detecting electromagnetic fields (primarily elasmobranchs, salmonids, tuna, eels, and stargazers) will be carried forward in this analysis and the remaining taxonomic groups (from Table 3.9-2) will not be discussed further.

3.9.3.2.1.1 No Action Alternative, Alternative 1, and Alternative 2 – Training Activities

Table 3.0-18 lists the number and location of electromagnetic energy activities, which are similar under all Alternatives, with discountable increases under Alternatives 1 and 2. As indicated in Section 3.0.5.3.2.1 (Electromagnetic), training activities involving electromagnetic devices occur in the Hawaii and SOCAL Range Complexes, and SSTC. Exposure of fishes to electromagnetic stressors is limited to those fish groups identified in Section 3.9.2.4 to 3.9.2.22 (Marine Fish Groups) that are able to detect the electromagnetic properties in the water column (Bullock et al. 1983; Helfman et al. 2009b). Fish species that do not occur within these specified areas would not be exposed to the electromagnetic fields. Species that do occur within the areas listed above, including the ESA-listed steelhead trout would have the potential to be exposed to the electromagnetic fields.

Electromagnetic devices are used primarily during mine detection/neutralization activities, and in most cases, the devices simply mimics the electromagnetic signature of a vessel passing through the water. None of the devices include any type of electromagnetic “pulse.” The towed body used for mine sweeping is designed to simulate a ship’s electromagnetic signal in the water, and so would not be experienced by fishes as anything unusual. The static magnetic field generated by the electromagnetic systems is of relatively minute strength, typically 23 gauss at the cable surface and 0.002 gauss at a radius of 656 ft. (199.9 m). The strength of the electromagnetic field decreases quickly away from the cable down to the level of earth's magnetic field (0.5 gauss) at less than 13 ft. (3.9 m) from the source (Department of Navy 2005a). In addition, training activities generally occur offshore in the water column, where fishes with high mobility predominate and fish densities are relatively low, compared with nearshore benthic habitat. Because the towed body is continuously moving, most fishes are expected to move away from it or follow behind it, in ways similar to responses to a vessel.

For any electromagnetically sensitive fishes in close proximity to the source, the generation of electromagnetic fields during training activities has the potential to interfere with prey detection and navigation. They may also experience temporary disturbance of normal sensory perception or could experience avoidance reactions (Kalmijn 2000), resulting in alterations of behavior and avoidance of normal foraging areas or migration routes. Mortality from electromagnetic devices is not expected.

Therefore, the electromagnetic devices used would not cause any potential risk to fishes because (1) the range of impact (i.e., greater than earth's magnetic field) is small (i.e., 13 ft. [3.9 m] from the source); (2) the electromagnetic components of these activities are limited to simulating the electromagnetic signature of a vessel as it passes through the water; and (3) the electromagnetic signal is temporally variable and would cover only a small spatial range during each activity in the Study Area. Some fishes could have a detectable response to electromagnetic exposure, but any impacts would be temporary with no anticipated impact on an individual's growth, survival, annual reproductive success, or lifetime reproductive success (i.e., fitness). Fitness refers to changes in an individual's growth, survival, annual reproductive success, or lifetime reproductive success. Electromagnetic exposure of eggs and larvae of sensitive bony fishes would be low relative to their total ichthyoplankton biomass (Able and Fahay 1998) and; therefore, potential impacts on recruitment would not be expected.

The only ESA-listed fish species capable of detecting electromagnetic energy occurring in the area where electromagnetic training activities are planned is the steelhead trout. Steelhead trout generally occur in shallow nearshore and coastal waters, and therefore could encounter electromagnetic devices used in training activities in the SOCAL Range Complex and SSTC. Other locations of electromagnetic training activities include offshore areas that do not overlap with the normal distribution of this species. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, none of the electromagnetic stressors would affect steelhead trout critical habitat. If located in the immediate area where electromagnetic devices are being used, steelhead trout could experience temporary disturbance in normal sensory perception during migratory or foraging movements, or avoidance reactions (Kalmijn 2000), but any disturbance would be inconsequential.

Under the ESA, electromagnetic training activities occurring off the California coast under the No Action Alternative, Alternative 1, and Alternative 2 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

Electromagnetic activities under the No Action Alternative, Alternative 1, and Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.2.1.2 No Action Alternative– Testing Activities

Table 3.0-18 lists the number and location of electromagnetic energy activities. As indicated in Section 3.0.5.3.2.1 (Electromagnetic), testing activities involving electromagnetic devices occur only in the SOCAL Range Complex.

The electromagnetic devices used in testing activities would not cause any potential risk to fishes for the same reasons stated for training activities above.

Under the ESA, electromagnetic testing activities occurring off the California coast under the No Action Alternative may affect, but are not likely to adversely affect ESA-listed steelhead trout.

Electromagnetic activities under the No Action Alternative would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.2.1.3 No Action Alternative and Alternative 1 – Testing Activities

Table 3.0-18 lists the number and location of electromagnetic energy activities. As indicated in Section 3.0.5.3.2.1 (Electromagnetic), testing activities involving electromagnetic devices occur only in the SOCAL Range Complex.

Under Alternative 1, a total of 27 electromagnetic testing activities are planned (an increase of 12 activities per year over the No Action Alternative). The increase in number of testing activities under Alternative 1 would not increase the potential for impact on fishes within the Study Area, for reasons described in Section 3.9.3.2.1.1 No Action Alternative – Training Activities.

Under the ESA, electromagnetic testing activities occurring off the California coast under Alternative 1 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

Electromagnetic activities under Alternative 1 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.2.1.4 Alternative 2 - Testing Activities

Table 3.0-18 lists the number and location of electromagnetic energy activities. As indicated in Section 3.0.5.3.2.1 (Electromagnetic), under Alternative 2, testing activities involving electromagnetic devices occur only in the SOCAL Range Complex.

Under Alternative 2, a total of 31 electromagnetic testing activities are planned (an increase of 16 activities per year over the No Action Alternative). The increase in number of testing activities under Alternative 2 would not increase the potential for impact on fishes within the Study Area, for reasons described in Section 3.9.3.2.1.1 No Action Alternative – Training Activities.

Under the ESA, electromagnetic testing activities occurring off the California coast under Alternative 2 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

Electromagnetic activities under Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.2.2 Summary and Conclusions of Energy Impacts

Under the No Action Alternative, Alternative 1 or Alternative 2, disturbance from activities using electromagnetic energy could be expected to elicit brief behavioral or physiological responses only in those exposed fishes with sensitivities/detection abilities (primarily sharks and rays) within the corresponding portion of the electromagnetic spectrum that these activities use. For electromagnetic devices, the typical reaction would be for the fish to avoid (move away from) the signal upon detection. The impact of electromagnetic signals are expected to be inconsequential on fishes or fish populations because signals are similar to regular vessel traffic, and the electromagnetic signal would be continuously moving and cover only a small spatial area during use.

Under the ESA, energy stressors occurring off the California coast under the No Action Alternative, Alternative 1, or Alternative 2 may affect, but are not likely to adversely affect ESA-listed steelhead trout.

Energy stressors under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.3 Physical Disturbance and Strike Stressors

This section evaluates the potential effects of various types of physical disturbance and strike stressors used by Navy during training and testing activities within the Study Area. A list of these activities is presented in Table 3.0-7.

Physical disturbance and strike stressors from vessels and in-water devices, military expended materials, and seafloor devices have the potential to affect all marine fish groups found within the Study Area (Tables 3.9-1 and 3.9-2), although some fish groups are more susceptible to strike potential than others. The potential responses to physical strikes are varied, but include behavioral changes such as avoidance, altered swimming speed and direction, physiological stress, and physical injury or mortality. Despite their ability to detect approaching vessels using a combination of sensory cues (sight, hearing, lateral line), larger slow-moving fishes (e.g., ocean sunfish, basking sharks, manta rays) cannot avoid all collisions, with some collisions resulting in mortality (Speed et al. 2008).

How a physical strike impacts a fish depends on the relative size of the object potentially striking the fish and the location of the fish in the water column. Before being struck by an object, Atlantic salmon for example, would sense a pressure wave through the water (Hawkins and Johnstone 1978a) and have the ability to swim away from the oncoming object. The movement generated by a large object moving through the water would simply displace small fishes in open water, such as Atlantic herring. Some fish might have time to detect the approaching object and swim away; others could be struck before they become aware of the object. An open-ocean fish that is displaced a small distance by movements from an object falling into the water nearby would likely continue on its original path as if nothing had happened. However, a bottom-dwelling fish near a sinking object would likely be disturbed, and may exhibit a general stress response, as described in Section 3.0.5.7 (Biological Resource Methods). As in all vertebrates, the function of the stress response in fishes is to rapidly raise the blood sugar level to prepare the fish to flee or fight (Helfman et al. 2009b). This generally adaptive physiological response can become a liability to the fish if the stressor persists and the fish is not able to return to its baseline physiological state. When stressors are chronic, the fish may experience reduced growth, health, or survival (Wedemeyer et al. 1990). If the object hits the fish, direct injury (in addition to stress) or death may result.

Many fishes respond to a sudden physical approach or contact by darting quickly away from the stimulus. Some other species may respond by freezing in place and adopting cryptic coloration. Some other species may respond in an unpredictable manner. Regardless of the response, the individual must stop its current activity and divert its physiological and cognitive attention to responding to the stressor

(Helfman et al. 2009b). The energy costs of reacting to a stressor depend on the specific situation, but in all cases the caloric requirements of stress reactions reduce the amount of energy available to the fish for other functions, such as predator avoidance, reproduction, growth, and maintenance (Wedemeyer et al. 1990).

The ability of a fish to return to its previous activity following a physical strike (or near-miss resulting in a stress response) is a function of a variety of factors. Some fish species are more tolerant of stressors than others and become re-acclimated more easily. Experiments with species for use in aquaculture have revealed the immense variability among species in their tolerance to physical stressors. Within a species, the rate at which an individual recovers from a physical strike may be influenced by its age, sex, reproductive state, and general condition. A fish that has reacted to a sudden disturbance by swimming at burst speed would tire after only a few minutes; its blood hormone and sugar levels (cortisol and glucose) may not return to normal for up to, or longer than, 24 hours. During its recovery period, the fish would not be able to attain burst speeds and would be more vulnerable to predators (Wardle 1986). If the individual were not able to regain a steady state following exposure to a physical stressor, it may suffer reduced immune function and even death (Wedemeyer et al. 1990).

Potential impacts of physical disturbance or strike to adults may be different than for other life stages (eggs, larvae, juveniles) because these life stages do not necessarily occur together in the same location (Botsford et al. 2009; Sabates et al. 2007), and because they have different response capabilities. The numbers of eggs and larvae exposed to vessel movements would be low relative to total ichthyoplankton biomass (Able and Fahay 1998); therefore, measurable effects on fish recruitment would not be expected. Also, the early life stages of most marine fishes (excluding sharks and other livebearers) already have extremely high natural mortality rates (10 to 85 percent per day) from predation on these life stages (Helfman et al. 2009b), and therefore, most eggs and larvae are not expected to survive to the next life stage, as demonstrated by equivalent adult modeling (Horst 1977).

3.9.3.3.1 Impacts from Vessel and In-Water Device Strikes

The majority of the activities under all alternatives involve vessels, and a few of the activities involve the use of in-water devices. For a discussion of the types of activities that use vessels and in-water devices, where they are used, and how many activities would occur under each Alternative, see Section 3.0.5.3.3 (Physical Disturbance and Strike Stressors). See Table 3.0-19 for a representative list of Navy vessel sizes and speeds and Table 3.0-31 for the types, sizes, and speeds of Navy in-water devices used in the Study Area. Vessels and in-water devices are covered together in this section because they both present similar potential impacts to fishes.

Vessels and in-water devices do not normally collide with adult fish, most of which can detect and avoid them. One study on fishes' behavioral responses to vessels showed that most adults exhibit avoidance responses to engine noise, sonar, depth finders, and fish finders (Jørgensen et al. 2004), reducing the potential for vessel strikes. Misund (1997b) found that fishes ahead of a ship that showed avoidance reactions did so at ranges of 160 to 490 ft. (48.8 to 149.4 m). When the vessel passed over them, some fishes responded with sudden escape responses that included lateral avoidance or downward compression of the school. Conversely, Rostad (2006) observed that some fishes are attracted to different types of vessels (e.g., research vessels, commercial vessels) of varying sizes, noise levels, and habitat locations. Fish behavior in the vicinity of a vessel is therefore quite variable, depending on the type of fish, its life history stage, behavior, time of day, and the sound propagation characteristics of the water (Schwarz 1985). Early life stages of most fishes could be displaced by vessels and not struck in the same manner as adults of larger species. However, a vessel's propeller movement or propeller wash could entrain early life stages. The low-frequency sounds of large vessels or accelerating small vessels caused avoidance responses among herring (Chapman and Hawkins 1973a), but avoidance ended within 10 seconds (s) after the vessel departed. Because a towed in-water device is continuously moving, most fishes are expected to move away from it or to follow behind it, in a manner similar to their responses to a vessel. When the device is removed, most fishes would simply move to another area.

There are a few notable exceptions to this assessment of potential vessel strike impacts on marine fish groups. Large slow-moving fish such as ocean sunfish, whale sharks, basking sharks, and manta rays occur near the surface in open-ocean and coastal areas, and are more susceptible to ship strikes, causing blunt trauma, lacerations, fin damage, or mortality. Speed et al. (2008) evaluated this specifically for whale sharks, but these other large slow-moving fishes are also likely to be susceptible because of their similar behavior and location in the water column. Increases in the numbers and sizes of shipping vessels in the modern cargo fleets make it difficult to gather mortality data because personnel on large ships are often unaware of whale shark collisions (Stevens 2007), therefore, the occurrence of whale shark strikes is likely much higher than has been documented by the few studies that have been conducted. The results of a whale shark study outside of the Study Area in the Gulf of Tadjoura, Djibouti, revealed that of the 23 whale sharks observed during a five-day period, 65 percent had scarring from boat and propeller strikes (Rowat et al. 2007a). Based on the typical physiological responses described in Section 3.9.3.3, vessel movements are not expected to compromise the general health or condition of individual fishes, except for whale sharks, basking sharks, manta rays, and ocean sunfish.

3.9.3.3.1.1 No Action Alternative, Alternative 1 and Alternative 2

Training Activities

As indicated in Sections 3.0.5.3.3.1 (Vessels) and 3.0.5.3.3.2 (In-Water Devices), training activities involving in-water devices can occur anywhere in the Study Area. Navy vessel activity primarily occurs within the U.S. Exclusive Economic Zone, and certain portions of the Study Area, such as areas near ports or naval installations and training ranges (e.g., San Diego, SSTC, San Clemente Island, Pearl Harbor) are used more heavily by vessels than other portions of the Study Area. These activities do not differ seasonally and could be widely dispersed throughout the Study Area. The differences in the number of in-water device activities between alternatives increases by less than 2 percent under Alternative 1 and Alternative 2 compared to the No Action Alternative. Species that do not occur near the surface within the Study Area would not be exposed to in-water device strike potential. Species that occur near the surface within the Study Area—including the ESA-listed steelhead trout—would have the potential to be exposed to in-water device strikes.

Exposure of fishes to vessel strike stressors is limited to those fish groups identified in Section 3.9.2.13 to 3.9.2.33 (Marine Fish Groups) that are large, slow-moving, and may occur near the surface, such as ocean sunfish, whale sharks, basking sharks, and manta rays. These species are distributed widely in offshore and nearshore portions of the Study Area. Any isolated cases of a Navy vessel striking an individual could injure that individual, impacting the fitness of an individual fish, but not to the extent that the viability of populations would be impacted. Vessel strikes would not pose a risk to most of the other marine fish groups, because many fish can detect and avoid vessel movements, making strikes rare and allowing the fish to return to their normal behavior after the ship or device passes. As a vessel approaches a fish, they could have a detectable behavioral or physiological response (e.g., swimming away and increased heart rate) as the passing vessel displaces them. However, such reactions are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of these marine fish groups at the population level.

Operational features of in-water devices and their use substantially limit the exposure of fish to potential strikes. First, in-water devices would not pose any strike risk to benthic fishes because the towed equipment is designed to stay off the bottom. Prior to deploying a towed in-water device, there is a standard operating procedure to search the intended path of the device for any floating debris (i.e., driftwood) or other potential obstructions, since they have the potential to cause damage to the device.

The likelihood of strikes by towed mine warfare devices on adult fish, which could result in injury or mortality, would be extremely low because these life stages are highly mobile. The use of in-water devices may result in short-term and local displacement of fishes in the water column. However, these behavioral reactions are not expected to result in substantial changes to an individual's fitness, or species recruitment, and are not expected to result in population-level impacts. Ichthyoplankton (fish eggs and larvae) in the water column could be displaced, injured, or killed by towed mine warfare devices. The numbers of eggs and larvae exposed to vessels or in-water devices would be extremely low relative to total ichthyoplankton biomass (Able and Fahay 1998); therefore, measurable changes on fish recruitment would not occur.

The risk of a strike from vessels and in-water devices used in training activities would be extremely low because: (1) standard operating procedures reduce potential strikes from in-water device strikes, (2) most fish can detect and avoid vessel and in-water device movements, and (3) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts. Since impacts from strikes would be rare, and although any increase in vessel and in-water device use proposed under Alternatives 1 and 2 could potentially increase the probability of a strike, for the reasons stated above for the No Action Alternative, impacts on fish or fish populations would be negligible.

Based on the primarily nearshore distribution of steelhead trout and overlap of vessel and in-water device use, potential strike risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. Similar to other salmon species, steelhead trout can sense pressure changes in the water column and swim quickly (Baum 1997; Popper and Hastings 2009a), and are likely to escape collision with vessels and in-water devices. Therefore, while vessels and in-water devices could overlap with steelhead trout, the likelihood of a strike would be extremely low, with discountable effects. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, vessel and in-water device use would not affect steelhead trout critical habitat.

Under the ESA, the use of vessels and in-water devices during training activities occurring off the California coast under the No Action Alternative, Alternative 1, and Alternative 2 would have no effect on ESA-listed steelhead trout.

The use of vessels and in-water devices under the No Action Alternative, Alternative 1, and Alternative 2 during training activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

As indicated in Sections 3.0.5.3.3.1 (Vessel Strikes) and 3.0.5.3.3.2 (In-Water Devices), testing activities involving in-water devices can occur anywhere in the Study Area.

As discussed for training activities and similarly, the risk of a strike from vessels and in-water devices used in testing activities would be extremely low because: (1) standard operating procedures reduce potential strikes from in-water device strikes, (2) most fish can detect and avoid vessel and in-water device movements, and (3) the types of fish that are likely to be exposed to vessel and in-water device strike are limited and occur in low concentrations where vessels and in-water devices are used. Potential impacts of exposure to vessels and in-water devices are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts. Since impacts from strikes would be rare, and although any increase in vessel and in-water device use proposed under Alternatives 1 and 2 could potentially increase the probability of a strike, for the reasons stated above for the No Action Alternative, impacts on fish or fish populations would be negligible.

Based on the primarily nearshore distribution of steelhead trout and overlap of vessel and in-water device use, potential strike risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. Similar to other salmon species, steelhead trout can sense pressure changes in the water column and swim quickly (Baum 1997; Popper and Hastings 2009a), and are likely to escape collision with vessels and in-water devices. Therefore, while vessels and in-water devices could overlap with steelhead trout, the likelihood of a strike would be extremely low, with discountable effects. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, vessel and in-water device use would not affect steelhead trout critical habitat.

Under the ESA, the use of vessels and in-water devices during testing activities occurring off the California coast under the No Action Alternative, Alternative 1, and Alternative 2 would have no effect on ESA-listed steelhead trout.

The use of vessels and in-water devices under the No Action Alternative, Alternative 1, and Alternative 2 during testing activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.3.2 Impacts from Military Expended Material Strikes

Navy training and testing activities in the Study Area include firing a variety of weapons and employing a variety of explosive and non-explosive rounds including bombs, and small-, medium-, and large-caliber projectiles, or even entire ship hulks during a sinking exercise. During these training and testing activities, various items may be introduced and expended into the marine environment and are referred to as military expended materials.

This section analyzes the strike potential to marine fish of the following categories of military expended materials: (1) non-explosive practice munitions, (2) fragments from high-explosive munitions, and (3) expended materials other than ordnance, such as sonobuoys, vessel hulks, and expendable targets. For a discussion of the types of activities that use military expended materials, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.3.3 (Military Expended Materials Strikes).

While disturbance or strike from any of these objects as they sink through the water column is possible, it is not very likely for most expended materials because the objects generally sink through the water slowly and can be avoided by most fishes. Therefore, with the exception of sinking exercises, the discussion of military expended materials strikes focuses on strikes at the surface or in the upper water column from fragments (of high-explosives) and projectiles because those items have a greater potential for a fish strike as they hit the water, before slowing down as they move through the water column.

Vessel Hulk. During a sinking exercise, aircraft, ship, and submarine crews deliver ordnance on a seaborne target, usually a clean deactivated ship (Section 3.1 [Water and Sediment Quality]), which is deliberately sunk using multiple weapon systems. Sinking exercises occur in specific open ocean areas, outside of the coastal range complexes, in waters exceeding 6,000 ft. (1,830 m) in depth. Direct ordnance strikes from the various weapons used in these exercises are a source of potential impact. However, these impacts are discussed for each of those weapons categories in this section and are not repeated here. Therefore, the analysis of sinking exercises as a strike potential for benthic fishes is discussed in terms of the ship hulk landing on the seafloor.

Small-, Medium-, and Large-Caliber Projectiles. Various types of projectiles could cause a temporary (seconds), localized impact when they strike the surface of the water. Current Navy training and testing in the Study Area, such as gunnery exercises, include firing a variety of weapons and using a variety of non-explosive training and testing rounds, including 5 in. (12.7 centimeters [cm]) naval gun shells, torpedoes, and small-, medium-, and large-caliber projectiles. See Table 3.0-63 for information regarding the number and location of activities involving small- and medium-caliber non-explosive practice munitions. The larger-caliber projectiles are primarily used in the open ocean beyond 20 nm. Direct ordnance strikes from firing weapons are potential stressors to fishes. There is a remote possibility that an individual fish at or near the surface may be struck directly if it is at the point of impact at the time of non-explosive ordnance delivery. Expended rounds may strike the water surface with sufficient force to cause injury or mortality. However, limited fish species swim right at, or near, the surface of the water (e.g., with the exception of pelagic sharks, herring, salmonids, flying fishes, jacks, tuna, mackerels, billfishes, ocean sunfishes, and other similar species.

Various projectiles would fall on soft or hard bottom habitats, where they could either become buried immediately in the sediments, or sit on the bottom for an extended time period (See Figures 3.3-1 through 3.3-6). Except for the 5 in. (12.7 cm) and the 30 mm rounds, which are fired from a helicopter, all projectiles would be aimed at surface targets. These targets would absorb most of the projectiles' energy before they strike the surface of the water and sink. This factor would limit the possibility of high-velocity impacts with fish from the rounds entering the water. Furthermore, fish can quickly and easily leave an area temporarily when vessels or helicopters approach. It is reasonable to assume, therefore, that fish would leave an area prior to, or just after the onset of, projectile firing and would return once tests are completed.

Most ordnance would sink through the water column and come to rest on the seafloor, stirring up sediment and possibly inducing a startle response, displacing, or injuring nearby fishes in extremely rare cases. Particular impacts on a given fish species would depend on the size and speed of the ordnance, the water depth, the number of rounds delivered, the frequency of training and testing, and the sensitivity of the fish.

Bombs, Missiles, and Rockets. Direct ordnance strikes from bombs, missiles, and rockets are potential stressors to fishes. Some individual fish at or near the surface may be struck directly if they are at the point of impact at the time of non-explosive ordnance delivery. However, most missiles hit their target or are disabled before hitting the water. Thus, most of these missiles and aerial targets hit the water as fragments, which quickly dissipates their kinetic energy within a short distance of the surface. A limited number of fishes swim right at, or near, the surface of the water, as described for small-, medium-, and large-caliber projectiles.

As discussed in Appendix I, statistical modeling conducted for the Study Area indicates that the probability of military expended materials striking marine mammals is extremely low. Statistical modeling could not be conducted to estimate the probability of military expended material strikes on fish, because fish density data are not available at the scale of an OPAREA or testing range.

In lieu of strike probability modeling, the number, size, and area of potential impact (or "footprints") of each type of military expended material is presented in Tables 3.3-5 through 3.3-7. The application of this type of footprint analysis to fish follows the notion that a fish occupying the impact area could be susceptible to potential impacts, either at the water surface (e.g., pelagic sharks, salmonids, flying fishes, jacks, tuna, mackerels, billfishes, and ocean sunfishes [Table 3.9-2]) or as military expended material falls through the water column and settles to the bottom (e.g., flounders, skates, and other benthic fishes listed in Table 3.9-2). Furthermore, most of the projectiles fired during training and testing activities are fired at targets, and most projectiles hit those targets, so only a very small portion of those would hit the water with their maximum velocity and force. Of that small portion, a small number of fish at or near the surface (pelagic fishes) or near the bottom (benthic fishes) may be directly impacted if they are in the target area and near the expended item that hits the water surface (or bottom), but population-level effects would not occur.

Propelled fragments are produced by an exploding bomb. Close to the explosion, fishes could potentially sustain injury or death from propelled fragments (Stuhmiller et al. 1990). However, studies of underwater bomb blasts have shown that fragments are larger than those produced during air blasts and decelerate much more rapidly (O'Keefe and Young 1984; Swisdak Jr. and Montaro 1992), reducing the risk to marine organisms.

Fish disturbance or strike could result from bomb fragments (after explosion) falling through the water column in very small areas compared to the vast expanse of the testing ranges, OPAREAs, range complexes, or the Study Area. The expected reaction of fishes exposed to this stressor would be to immediately leave the area where bombing is occurring, thereby reducing the probability of a fish strike after the initial expended materials hit the water surface. When a disturbance of this type concludes, the area would be repopulated and the fish stock would rebound with inconsequential impacts on the resource (Lundquist et al. 2010).

3.9.3.3.2.1 No Action Alternative

Training Activities

Tables 3.0-63 to 3.0-65 list the number and location of military expended materials, most of which are small- and medium caliber projectiles. As indicated in Section 3.0.5.3.3.3 (Military Expended Materials Strikes), under the No Action Alternative, military expended material use can occur throughout the Study Area.

Marine fish groups identified in Section 3.9.2.13 to 3.9.2.33 (Marine Fish Groups) that are particularly susceptible to military expended material strikes are those occurring at the surface, within the offshore and continental shelf portions of the range complexes (where the strike would occur). Those groups include pelagic sharks, salmonids, flying fishes, jacks, tuna, mackerels, billfishes, ocean sunfishes, and other similar species (Table 3.9-2). Additionally, certain deep-sea fishes would be exposed to strike risk as a ship hulk, expended during a sinking exercise, settles to the seafloor. These groups include hagfishes, dragonfishes, lanternfishes, anglerfishes, and oarfishes.

Projectiles, bombs, missiles, rockets, projectiles and associated fragments have the potential to directly strike fish as they hit the water surface and below the surface to the point where the projectile loses its forward momentum. Fish at and just below the surface would be most susceptible to injury from strikes because velocity of these materials would rapidly decrease upon contact with the water and as it travels through the water column. Consequently, most water column fishes would have ample time to detect and avoid approaching munitions or fragments as they fall through the water column. The probability of strike based on the “footprint” analysis included in Table 3.3-5 indicates that even for an extreme case of expending all small-caliber projectiles within a single gunnery box, the probability of any of these items striking a fish (even as large as bluefin tuna or whale sharks) is extremely low. Therefore, since most fishes are smaller than bluefin tuna or whale sharks, and most military expended materials are less abundant than small-caliber projectiles, the risk of strike by these items is exceedingly low for fish overall. A possibility exists that a small number of fish at or near the surface may be directly impacted if they are in the target area and near the point of physical impact at the time of military expended material strike, but population-level impacts would not occur.

Sinking exercises occur in open-ocean areas, outside of the coastal range complexes. While serious injury or mortality to individual fish would be expected if they were present within range of high explosive activities (analyzed in Section 3.9.3.1 [Acoustic Stressors]), sinking exercises under the No Action Alternative would not result in impacts on pelagic fish populations at the surface based on the low number of fish in the immediate area and the placement of these activities in deep, ocean areas where fish abundance is low or widely dispersed. Disturbances to benthic fishes from sinking exercises would be highly localized. Any deep sea fishes located on the bottom where a ship hulk would settle could experience displacement, injury, or death. However, population level impacts on the deep sea fish community would not occur because of the limited spatial extent of the impact and the wide dispersal of fishes in deep ocean areas.

The impact of military expended material strikes would be inconsequential due to the (1) limited number of species found directly at the surface where military expended material strikes could occur; (2), the rare chance that a fish might be directly struck at the surface by military expended materials, and; (3) the ability of most fish to detect and avoid an object falling through the water below the surface. The potential impacts of military expended material strikes would be short term and localized disturbances of the water column (and seafloor areas within sinking exercise locations).

Based on the primarily nearshore distribution of steelhead trout and overlap of military expended materials use, potential strike risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While military expended materials use could overlap with steelhead trout, the likelihood of a strike would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, military expended materials use would not affect steelhead trout critical habitat.

Under the ESA, military expended material strikes during training activities occurring off the California coast under the No Action Alternative would have no effect on ESA-listed steelhead trout.

Military expended material strikes during training activities under the No Action Alternative would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Tables 3.0-63 to 3.0-65 list the number and location of military expended materials, most of which are small- and medium-caliber projectiles. As indicated in Section 3.0.5.3.3.3 (Military Expended Materials Strikes), under the No Action Alternative, military expended material use can occur throughout the Study Area.

The potential impacts of military expended material strikes would be short term and localized disturbances of the water surface (and seafloor areas within sinking exercise locations) and would be inconsequential for the same reasons stated under the analysis under the No Action Alternative for training activities.

Based on the primarily nearshore distribution of steelhead trout and overlap of military expended materials use, potential strike risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While military expended materials use could overlap with steelhead trout, the likelihood of a strike would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, military expended materials use would not affect steelhead trout critical habitat.

Under the ESA, military expended material strikes during testing activities occurring off the California coast under the No Action Alternative would have no effect on ESA-listed steelhead trout.

Military expended material strikes during testing activities under the No Action Alternative would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.3.2.2 Alternative 1

Training Activities

Tables 3.0-63 to 3.0-65 list the number and location of military expended materials, most of which are small- and medium-caliber projectiles. As indicated in Section 3.0.5.3.3.3 (Military Expended Materials Strikes), under Alternative 1, military expended material use can occur throughout the Study Area.

Compared to the No Action Alternative, the overall increase in military expended materials used under Alternative 1 is due primarily to a large increase in small-caliber projectiles, and a relatively smaller increase in the number of medium-caliber projectiles. These changes would result in increased exposure of fish to military expended materials; however, the probability of strike based on the "footprint" analysis included in Table 3.3-6 indicates that even for an extreme case of expending all small-caliber projectiles within a single gunnery box, the probability of any of these items striking a fish (even as large as bluefin tuna or whale sharks) is extremely low. The potential impacts of military expended material strikes would be short term and localized disturbances of the water surface (and seafloor areas within sinking exercise locations) and would be inconsequential for the same reasons stated under the analysis under the No Action Alternative for training activities.

Based on the primarily nearshore distribution of steelhead trout and overlap of military expended materials use, potential strike risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While military expended materials use could overlap with steelhead trout, the likelihood of a strike would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, military expended materials use would not affect steelhead trout critical habitat.

Under the ESA, military expended material strikes during training activities occurring off the California coast under Alternative 1 would have no effect on ESA-listed steelhead trout.

Military expended material strikes during training activities under Alternative 1 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Tables 3.0-63 to 3.0-65 list the number and location of military expended materials, most of which are small- and medium-caliber projectiles. As indicated in Section 3.0.5.3.3.3 (Military Expended Materials Strikes), under Alternative 1, military expended material use can occur throughout the Study Area.

Compared to the No Action Alternative, the overall increase in military expended materials used under Alternative 1 is due primarily to a large increase in small-caliber projectiles, and a relatively smaller increase in the number of medium-caliber projectiles. These changes would result in increased exposure of fish to military expended materials; however, the probability of strike based on the "footprint" analysis included in Table 3.3-6 indicates that even for an extreme case of expending all small-caliber projectiles within a single gunnery box, the probability of any of these items striking a fish (even as large as bluefin tuna or whale sharks) is extremely low. The potential impacts of military expended material strikes would be short term and localized disturbances of the water surface (and seafloor areas within sinking exercise locations) and would be inconsequential for the same reasons stated under the analysis under the No Action Alternative for training activities.

Based on the primarily nearshore distribution of steelhead trout and overlap of military expended materials use, potential strike risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While military expended materials use could overlap with steelhead trout, the likelihood of a strike would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, military expended materials use would not affect steelhead trout critical habitat.

Under the ESA, military expended material strikes during testing activities occurring off the California coast under Alternative 1 would have no effect on ESA-listed steelhead trout.

Military expended material strikes during training activities under Alternative 1 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.3.2.3 Alternative 2

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative would also be identical as described in Section 3.9.3.3.2.2, Alternative 1.

Under the ESA, military expended material strikes during training activities occurring off the California coast under Alternative 2 would have no effect on ESA-listed steelhead trout.

Military expended material strikes during training activities under Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Tables 3.0-63 to 3.0-65 list the number and location of military expended materials, most of which are small- and medium-caliber projectiles. As indicated in Section 3.0.5.3.3.3 (Military Expended Materials Strikes), under Alternative 2, military expended material use can occur throughout the Study Area.

Compared to the No Action Alternative, the overall increase in military expended materials used under Alternative 2 is due primarily to a large increase in small-caliber projectiles, and a relatively smaller increase in the number of medium-caliber projectiles. These changes would result in increased exposure of fish to military expended materials; however, the probability of strike based on the "footprint" analysis included in Table 3.3-7 indicates that even for an extreme case of expending all small-caliber projectiles within a single gunnery box, the probability of any of these items striking a fish (even as large as bluefin tuna or whale sharks) is extremely low. The potential impacts of military expended material strikes would be short term and localized disturbances of the water surface (and seafloor areas within sinking exercise locations) and would be inconsequential for the same reasons stated under the analysis under the No Action Alternative for training activities.

Based on the primarily nearshore distribution of steelhead trout and overlap of military expended materials use, potential strike risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While military expended materials use could overlap with steelhead trout, the likelihood of a strike would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, military expended materials use would not affect steelhead trout critical habitat.

Under the ESA, military expended material strikes during testing activities occurring off the California coast under Alternative 2 would have no effect on ESA-listed steelhead trout.

Military expended material strikes during training activities under Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.3.3 Impacts from Seafloor Devices

For a discussion of the types of activities that use seafloor devices, where they are used, and how many activities would occur under each alternative, see Section 3.0.5.3.3.4 (Seafloor Devices). Seafloor devices include items that are placed on, dropped on, or moved along the seafloor such as mine shapes, anchor blocks, anchors, bottom-placed instruments, bottom-crawling unmanned undersea vehicles, and bottom-placed targets that are not expended. As discussed in the military expended materials strike section, objects falling through the water column would slow in velocity as they sink toward the bottom and could be avoided by most fish.

Seafloor devices with a strike potential for fish include those items temporarily deployed on the seafloor. The potential strike impacts of unmanned underwater vehicles, including bottom crawling types, are also included here. Entanglement in seafloor cables is discussed in Section 3.9.3.4 (Entanglement Stressors). Some fishes are attracted to virtually any tethered object in the water column (Dempster and Taquet 2004) and could be attracted to an inert mine assembly. However, while a fish might be attracted to the object, their sensory abilities allow them to avoid colliding with fixed tethered objects in the water column (Bleckmann and Zelick 2009), so the likelihood of a fish striking one of these objects is implausible. Therefore, strike hazards associated with collision into other seafloor devices such as deployed mine shapes or anchored devices are highly unlikely to pose any strike hazard to fishes and are not discussed further.

3.9.3.3.3.1 No Action Alternative

Training Activities

Table 3.0-68 lists the number and location of activities that use seafloor devices. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under the No Action Alternative, activities that use seafloor devices occur in the SSTC, Hawaii, and SOCAL Range Complexes.

Seafloor devices have the potential to directly strike fish as they hit the water surface and below the surface to the point where the projectile strikes the bottom. Fish at and just below the surface, as well as those on the bottom would be most susceptible to injury from strikes because velocity of these materials would rapidly decrease upon contact with the water and as it travels through the water column. Consequently, most water column fishes would have ample time to detect and avoid approaching devices as they fall through the water column. A possibility exists that a small number of fish at or near the surface or resting on the bottom may be directly impacted if they are in the target area and near the point of physical impact at the time of seafloor device strike, but the likelihood of one of these objects striking a fish is implausible and in the rare event that a strike occurred, population-level impacts would not occur.

Based on the primarily nearshore distribution of steelhead trout and overlap of seafloor device use, potential strike risk would be greatest in the coastal areas of the SOCAL Range Complex. While seafloor device use could overlap with steelhead trout, the likelihood of a strike would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, seafloor device use would not affect steelhead trout critical habitat.

Under the ESA, the use of seafloor devices during training activities occurring off the California coast under the No Action Alternative would have no effect on ESA-listed steelhead trout.

The use of seafloor devices during training activities under the No Action Alternative would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Table 3.0-68 lists the number and location of activities that use seafloor devices. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under the No Action Alternative, testing activities that use seafloor devices occur only in the SOCAL Range Complex.

Seafloor devices have the potential to directly strike fish as they hit the water surface and below the surface to the point where the projectile strikes the bottom. Fish at and just below the surface, as well as those on the bottom would be most susceptible to injury from strikes because velocity of these materials would rapidly decrease upon contact with the water and as it travels through the water column. Consequently, most water column fishes would have ample time to detect and avoid approaching devices as they fall through the water column. A possibility exists that a small number of fish at or near the surface or resting on the bottom may be directly impacted if they are in the target area and near the point of physical impact at the time of seafloor device strike, but the likelihood of one of these objects striking a fish is implausible and in the rare event that a strike occurred, population-level impacts would not occur.

Based on the primarily nearshore distribution of steelhead trout and overlap of seafloor device use, potential strike risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While seafloor device use could overlap with steelhead trout, the likelihood of a strike would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, seafloor device use would not affect steelhead trout critical habitat.

Under the ESA, the use of seafloor devices during testing activities occurring off the California coast under the No Action Alternative would have no effect on ESA-listed steelhead trout.

The use of seafloor devices during testing activities under the No Action Alternative would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.3.3.2 Alternative 1

Training Activities

Training activities that deploy seafloor devices under Alternative 1 would occur in the same geographic areas as under the No Action Alternative, Section 3.9.3.3.3.1 (No Action Alternative), and are expected to decrease by approximately 7 percent.

Similar to the No Action Alternative, a possibility exists that a small number of fish at or near the surface or resting on the bottom may be directly impacted if they are in the target area and near the point of physical impact at the time of seafloor device strike, but the likelihood of one of these objects striking a fish is implausible and in the rare event that a strike occurred, population-level impacts would not occur.

Based on the primarily nearshore distribution of steelhead trout and overlap of seafloor device use, potential strike risk would be greatest in the coastal areas of the SOCAL Range Complex. While seafloor device use could overlap with steelhead trout, the likelihood of a strike would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, seafloor device use would not affect steelhead trout critical habitat.

Under the ESA, the use of seafloor devices during training activities occurring off the California coast under Alternative 1 would have no effect on ESA-listed steelhead trout.

The use of seafloor devices during training activities under Alternative 1 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Table 3.0-68 lists the number and location of activities that use seafloor devices. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 1, the number of activities using seafloor devices is approximately twice that of the No Action Alternative. The activities using seafloor devices under Alternative 1 would occur in the same geographic location as the No Action Alternative. In addition, seafloor devices would be used in the Hawaii Range Complex. As discussed in Section 3.9.3.3.2 (Impacts from Military Expended Materials Strike), and similar to the No Action Alternative, a possibility exists that a small number of fish at or near the surface or resting on the bottom may be directly impacted if they are in the target area and near the point of physical impact at the time of seafloor device strike, but the likelihood of one of these objects striking a fish is implausible and in the rare event that a strike occurred, population-level impacts would not occur.

Based on the primarily nearshore distribution of steelhead trout and overlap of seafloor device use, potential strike risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While seafloor device use could overlap with steelhead trout, the likelihood of a strike would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, seafloor device use would not affect steelhead trout critical habitat.

Under the ESA, the use of seafloor devices during testing activities occurring off the California coast under Alternative 1 would have no effect on ESA-listed steelhead trout.

The use of seafloor devices during testing activities under Alternative 1 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.3.3.3 Alternative 2

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative would also be identical as described in Section 3.9.3.3.3.2, Alternative 1.

Under the ESA, the use of seafloor devices during training activities occurring off the California coast under Alternative 2 would have no effect on ESA-listed steelhead trout.

The use of seafloor devices during training activities under Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Table 3.0-68 lists the number and location where seafloor devices are used. As indicated in Section 3.0.5.3.3.4 (Seafloor Devices), under Alternative 2, the number of activities using seafloor devices is approximately twice that of the No Action Alternative. The activities using seafloor devices under Alternative 2 would occur in the same geographic location as the No Action Alternative. In addition, seafloor devices would be used in the Hawaii Range Complex. As discussed in Section 3.9.3.3.2 (Impacts from Military Expended Materials Strike), and similar to the No Action Alternative and Alternative 1, a possibility exists that a small number of fish at or near the surface or resting on the bottom may be directly impacted if they are in the target area and near the point of physical impact at the time of seafloor device strike, but the likelihood of one of these objects striking a fish is implausible and in the rare event that a strike occurred, population-level impacts would not occur.

Based on the primarily nearshore distribution of steelhead trout and overlap of seafloor device use, potential strike risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While seafloor device use could overlap with steelhead trout, the likelihood of a strike would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, seafloor device use would not affect steelhead trout critical habitat.

Under the ESA, the use of seafloor devices during testing activities occurring off the California coast under Alternative 2 would have no effect on ESA-listed steelhead trout.

The use of seafloor devices during testing activities under Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.3.4 Summary and Conclusions of Physical Disturbance and Strike Impacts

3.9.3.3.4.1 Combined Physical Disturbance and Strike Stressors

The greatest potential for combined impacts of physical disturbance and strike stressors under the Proposed Action, would occur for sinking exercises because of multiple opportunities for potential strike by vessel, ordnance, or other military expended material. Under the Proposed Action, no more than eight sinking exercises would occur per year. Sinking exercises were specifically chosen to evaluate impacts on military expended material strike because sinking exercises represent the activity with the greatest amount of military expended materials by weight. During each sinking exercise, approximately 725 objects would be expended, including large bombs, missiles, large projectiles, torpedoes, and one target vessel. Therefore, during each sinking exercise, approximately 105 objects per km^2 would sink to the ocean floor. These items, combined with the mass and size of the ship hulk itself, are representative of an extreme case for military expended materials of all types striking benthic fishes. However, the overlap of these activities would only occur during a limited number of activities and only within the open ocean areas where the sinking exercises areas are located.

A less intensive example of potential impacts of combined strike stressors would be for cases where a fish could be displaced by a vessel in the water column during any number of activities utilizing bombs, missiles, rockets, or projectiles. As the vessel maneuvers during the exercise, any fishes displaced by that vessel movement could potentially be struck by munitions expended by that vessel during that same exercise. This would be more likely to occur in concentrated areas of this type of activity (e.g., a gunnery exercise inside a gunnery box). However, the likelihood of this occurring is probably quite low anywhere else, because most activities do not expend their munitions towards, or in proximity to, a training or testing vessel for safety reasons. While small-caliber projectiles are expended away from but often close to the vessel from which the projectiles are fired, this does not necessarily increase the risk of strike. During the initial displacement of the fish from vessel activity, or after the first several projectiles are fired, most fishes would disperse widely and the probability of strike may actually be reduced in most cases. Also, the combination of these stressors would cease immediately when the activity ends; therefore, combination is possible but not reasonably foreseeable.

3.9.3.3.4.2 Summary of Physical Disturbance and Strike Stressors and General Conclusions

Exposures to physical disturbance and strike stressors occur primarily within the range complexes and operating areas associated with the Study Area. Research suggests that only a limited number of marine fish species are susceptible to being struck by a vessel. Most fishes would not respond to vessel disturbance beyond a temporary displacement from their normal activity, which would be inconsequential and not detectable. The Navy identified and analyzed three physical disturbance or strike substressors that have potential to impact fishes: vessel and in-water device strikes, military expended material strikes, and seafloor device strikes. While the potential for vessel strikes on fish can occur anywhere vessels are operated, most fishes are highly mobile and capable of avoiding vessels, expended materials, or objects in the water column. For the larger slower-moving species (e.g., basking shark, manta ray, and ocean sunfish) the potential for a vessel or military expended material strike increases, as discussed in the analysis. The potential for a seafloor device striking a fish is very low because the sensory capabilities of most fishes allow them to detect and avoid underwater objects.

Under the ESA, physical disturbance and strikes occurring off the California coast under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on ESA-listed steelhead trout.

Physical disturbance and strikes under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.4 Entanglement Stressors

This section evaluates potential entanglement impacts of various types of expended materials used by the Navy during training and testing activities within the Study Area. The likelihood of fish being affected by an entanglement stressor is a function of the physical properties, location, and buoyancy of the object and the behavior of the fish as described in Section 3.0.5.7.4, Conceptual Framework for Assessing Effects from Entanglement. Two types of military expended materials are considered here: (1) cables and wires, and (2) parachutes.

Most entanglement observations involve abandoned or discarded nets, lines, and other materials that form loops or incorporate rings (Derraik 2002; Keller et al. 2010; Laist 1987; Macfadyen et al. 2009). A 25-year dataset assembled by the Ocean Conservancy reported that fishing line, rope, and fishing nets accounted for approximately 68 percent of fish entanglements, with the remainder due to encounters with various items such as bottles, cans, and plastic bags (Ocean Conservancy 2010). No occurrences involving military expended materials were documented.

Fish entanglement occurs most frequently at or just below the surface or in the water column where objects are suspended. A smaller number involve objects on the seafloor, particularly abandoned fishing gear designed to catch bottom fish or invertebrates (Ocean Conservancy 2010). More fish species are entangled in coastal waters and the continental shelf than elsewhere in the marine environment because of higher concentrations of human activity (e.g., fishing, sources of entangling debris), higher fish abundances, and greater species diversity (Helfman et al. 2009b; Macfadyen et al. 2009). The consequences of entanglement range from temporary and inconsequential to major physiological stress or mortality.

Some fish are more susceptible to entanglement in derelict fishing gear and other marine debris, compared to other fish groups. Physical features, such as rigid or protruding snouts of some elasmobranchs (e.g., the wide heads of hammerhead sharks), increase the risk of entanglement compared to fish with smoother, more streamlined bodies (e.g., lamprey and eels). Most other fish, except for jawless fish and eels that are too smooth and slippery to become entangled, are susceptible to entanglement gear specifically designed for that purpose (e.g., gillnets); however, the Navy does not expend any items that are designed to function as entanglement objects.

The overall effects of entanglement are highly variable, ranging from temporary disorientation to mortality due to predation or physical injury. The evaluation of a species’ entanglement potential should consider the size, location, and buoyancy of an object as well as the behavior of the fish species.

The following sections seek to identify entanglement potential due to military expended material. Where appropriate, specific geographic areas (open ocean areas, range complexes, testing ranges, and bays and inland waters) of potential impact are identified.

3.9.3.4.1 Impacts from Cables and Wires

Fiber optic cables and guidance wires are used during training and testing activities. A discussion of the types of activities, physical characteristics, location of use, and the number of items expended under each alternative is presented in Section 3.0.5.3.4.1, Fiber Optic Cables and Guidance Wires.

Marine fish groups identified in Sections 3.9.2 (Affected Environment), that could be susceptible to entanglement in expended cables and wires are those with elongated snouts lined with tooth-like structures that easily snag on other similar marine debris, such as derelict fishing gear (Macfadyen et al. 2009). Some elasmobranchs (hammerhead sharks) and billfish occurring within the offshore and continental shelf portions of the range complexes (where the potential for entanglement would occur) could be susceptible to entanglement in cables and wires. Species occurring outside the specified areas within these range complexes would not be exposed to fiber optic cables or guidance wires.

Once a guidance wire is released, it is likely to sink immediately and remain on the seafloor. In some cases, the wire may snag on a hard structure near the bottom and remain partially or completely suspended. The types of fish that encounter any given wire would depend, in part, on its geographic location and vertical location in the water column. In any situation, the most likely mechanism for entanglement would involve fish swimming through loops in the wire that tighten around it; however, loops are unlikely to form in guidance wire (Environmental Sciences Group 2005).

Because of their physical characteristics, guidance wires and fiber optic cables pose a potential, though unlikely, entanglement risk to susceptible fish. Potential entanglement scenarios are based on fish behavior in abandoned monofilament, nylon, and polypropylene lines used in commercial nets. Such derelict fishing gear is abundant in the ocean (Macfadyen et al. 2009) and pose a greater hazard to fish than the very thin wire expended by the Navy. Fishing gear materials often have breaking strengths that can be up to orders of magnitude greater than that of guidance wire and fiber optic cables (Environmental Sciences Group 2005), and are far more prone to tangling, as discussed in 3.0.5.3.4.1, Fiber Optic Cables and Guidance Wires. Fiber optic cables do not easily form loops, are brittle, and break easily if bent, so they pose a negligible entanglement risk. Additionally, the encounter rate and probability of impact from guidance wires and fiber optic cables are low, as few are expended and therefore, have limited overlap with sawfish or sturgeon.

Tube-launched optically tracked wire- guided missiles would expend wires in the nearshore or offshore waters of the Navy Cherry Point Range Complex, during training only and are discussed together with torpedo guidance wires because their potential impacts would be similar to those described here for torpedo guidance wires, which are also expended in the Navy Cherry Point Range Complex.

3.9.3.4.1.1 No Action Alternative

Training Activities

Tables 3.0-78 and 3.0-81 list the number and locations of activities that expend fiber optic cables and guidance wires. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative, activities that expend fiber optic cables occur in the SOCAL Range Complex and the SSTC, while expended guidance wires would occur in the Hawaii and SOCAL Range Complexes. While individual fish susceptible to entanglement could encounter guidance wires and cables, the long-term consequences of entanglement are unlikely for either individuals or populations because: (1) the encounter rate is low given the low number of items expended, (2) the types of fish that are susceptible to these items is limited, (3) the restricted overlap with susceptible fish, and (4) the properties of guidance wires and fiber optic cables reduce entanglement risk to fish. Potential impacts of exposure to guidance wires and fiber optic cables are not expected to result in substantial changes to an individual's behavior, fitness, or species recruitment, and are not expected to result in population-level impacts.

Expended torpedo guidance wire would not co-occur with the distribution and habitat of steelhead trout. The sink rates of these guidance wires would rule out the possibility of it drifting great distances into nearshore and coastal areas where steelhead trout are found, or into designated river or estuarine critical habitat.

Under the ESA, the use of cables and wires for training activities occurring off the California coast under the No Action Alternative would have no effect on ESA-listed steelhead trout.

The use of cables and wires for training activities under the No Action Alternative would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Tables 3.0-78 and 3.0-81 list the number and locations of activities that expend fiber optic cables and guidance wires. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under the No Action Alternative, activities that expend fiber optic cables occur only in the SOCAL Range Complex, while expended guidance wires would occur in the Hawaii and SOCAL Range Complexes. Risk of entanglement resulting from proposed testing activities would be low as described in the analysis for the No Action Alternative – Training Activities.

Under the ESA, the use of cables and wires for testing activities occurring off the California coast under the No Action Alternative would have no effect on ESA-listed steelhead trout.

The use of cables and wires for testing activities under the No Action Alternative would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.4.1.2 Alternative 1

Training Activities

Tables 3.0-78 and 3.0-81 list the number and locations of activities that expend fiber optic cables and guidance wires. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 1, activities that expend fiber optic cables occur in the SOCAL Range Complex and the SSTC, while expended guidance wires would occur in the Hawaii and SOCAL Range Complexes. Despite the slight increase from the No Action Alternative, the risk of entanglement resulting from proposed training activities would be low as described in the analysis for the No Action Alternative – Training Activities.

Under the ESA, the use of cables and wires for training activities occurring off the California coast under Alternative 1 would have no effect on ESA-listed steelhead trout.

The use of cables and wires for training activities under Alternative 1 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Tables 3.0-78 and 3.0-81 list the number and locations of activities that expend fiber optic cables and guidance wires. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 1, activities that expend fiber optic cables occur only in the SOCAL Range Complex, while expended guidance wires would occur in the Hawaii and SOCAL Range Complexes. Despite the approximately 20 percent increase from the No Action Alternative, the risk of entanglement resulting from proposed testing activities would be low as described in the analysis for the No Action Alternative – Training Activities.

Under the ESA, the use of cables and wires for testing activities occurring off the California coast under Alternative 1 would have no effect on ESA-listed steelhead trout.

The use of cables and wires for testing activities under Alternative 1 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.4.1.3 Alternative 2

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative would also be identical as described in Section 3.9.3.4.1.2, Alternative 1 – Training. Despite the slight increase from the

No Action Alternative, the risk of entanglement resulting from proposed training activities would be low as described in the analysis for the No Action Alternative – Training Activities.

Under the ESA, the use of cables and wires for training activities occurring off the California coast under Alternative 2 would have no effect on ESA-listed steelhead trout.

The use of cables and wires for training activities under Alternative2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Tables 3.0-78 and 3.0-81 list the number and locations of activities that expend fiber optic cables and guidance wires. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires), under Alternative 2, activities that expend fiber optic cables occur only in the SOCAL Range Complex, while expended guidance wires would occur in the Hawaii and SOCAL Range Complexes. As indicated in Section 3.0.5.3.4.1 (Fiber Optic Cables and Guidance Wires) under Alternative 2, the number of activities that expend fiber optic cables is nearly the same as that of the No Action Alternative. The activities using fiber optic cables under Alternative 2 would occur in the same geographic locations as the No Action Alternative. The number of torpedo activities that expend guidance wire is nearly two times that of the No Action Alternative. These activities under Alternative 2 would occur in the same geographic locations as the No Action Alternative. Despite the increase from the No Action Alternative, the risk of entanglement resulting from proposed testing activities would be low as described in the analysis for the No Action Alternative – Training Activities.

Under the ESA, the use of cables and wires for testing activities occurring off the California coast under Alternative 2 would have no effect on ESA-listed steelhead trout.

The use of cables and wires for testing activities under Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.4.2 Impacts from Parachutes

Parachutes of varying sizes are used during training and testing activities. The types of activities that use parachutes, physical characteristics and size of parachutes, locations where parachutes are used, and the number of parachute activities proposed under each alternative are presented in Section 3.0.5.3.4.2 (Parachutes).

Fish face many potential entanglement scenarios in abandoned monofilament, nylon, polypropylene line, and other derelict fishing gear in the nearshore and offshore marine habitats of the Study Area (Macfadyen et al. 2009; Ocean Conservancy 2010). Abandoned fishing gear is dangerous to fish because it is abundant, essentially invisible, strong, and easily tangled. In contrast, parachutes are rare, highly visible, and not designed to capture fish. The combination of low encounter rates and weak entangling features reduce the risk that steelhead trout would be adversely impacted by parachutes.

Once a parachute has been released to the water, it poses a potential entanglement risk to fish. The Naval Ocean Systems Center identified the potential impacts of torpedo air launch accessories, including parachutes, on fish (U. S. Department of the Navy 1996). Unlike other materials in which fish become entangled (such as gill nets and nylon fishing line), the parachute is relatively large and visible, reducing the chance that visually oriented fish would accidentally become entangled in it. No cases of fish entanglement have been reported for parachutes (Ocean Conservancy 2010; U. S. Department of the Navy 2001a). Entanglement in a newly-expended parachute while it is in the water column is unlikely because fish generally react to sound and motion at the surface with a behavioral reaction by swimming away from the source (see Section 3.9.3.3.2, Impacts from Military Expended Material Strikes) and would detect the oncoming parachute in time to avoid contact. While the parachute is sinking, fish would have ample opportunity to swim away from the large moving object. Even if the parachute landed directly on a fish, it would likely be able to swim away faster than the parachute would sink because the resistance of the water would slow the parachute's downward motion.

Once the parachute is on the bottom, however, it is feasible that a fish could become entangled in the parachute or its suspension lines while diving and feeding, especially in deeper waters where it is dark. If the parachute dropped in an area of strong bottom currents, it could billow open and pose a short-term entanglement threat to large fish feeding on the bottom. Benthic fish with elongated spines could become caught on the parachute or lines. Most sharks and other smooth-bodied fish are not expected to become entangled because their soft, streamlined bodies can more easily slip through potential snares. A fish with spines or protrusions (e.g., some sharks, billfish, sturgeon, or sawfish) on its body that swam into the parachute or a loop in the lines, and then struggled, could become bound tightly enough to prevent escape. Although this scenario is possible based on the structure of the materials and the shape and behavior of fish, it is not considered a likely event.

Aerial-launched sonobuoys are deployed with a parachute. The sonobuoy itself is not considered an entanglement hazard for upon deployment (Environmental Sciences Group 2005), but their components may pose an entanglement hazard once released into the ocean. Sonobuoys contain cords, electronic components, and plastic mesh that may entangle fish (Environmental Sciences Group 2005). Open-ocean filter feeding species, such as basking sharks, whale sharks, and manta rays could become entangled in these items, whereas smaller species could become entangled in the plastic mesh in the same manner as a small gillnet. Since most sonobuoys are expended in offshore areas, many coastal fish would not encounter or have any opportunity to become entangled in materials associated with sonobuoys, apart from the risk of entanglement in parachutes described above.

3.9.3.4.2.1 No Action Alternative

Training Activities

Table 3.0-82 lists the number and locations of activities that expend parachutes. The number and footprint of parachutes are detailed in Table 3.3-5. As indicated in Section 3.0.5.3.4.2 (Parachutes) under the No Action Alternative, activities involving parachute use would occur in the open ocean portions of the Study Area. Given the size of the range complexes and the resulting widely scattered parachutes (0.12 per nm^2), it would be very unlikely that fishes would encounter and become entangled in any parachutes or sonobuoy accessories. If a fish were to encounter and become entangled in any of these items, the growth, survival, annual reproductive success, or lifetime reproductive success of populations would not be impacted directly or indirectly.

Expended parachutes generally would not co-occur with the distribution and critical habitat of steelhead trout. However, if an expended parachute were encountered, the steelhead trout, like all salmonids, is a strong swimmer with a streamlined body that is unlikely to become entangled in parachutes or lines. The impacts of entanglement with parachutes are discountable because of the low density of parachutes expended, the offshore location of activities and the body shape of steelhead trout, which makes it unlikely to become entangled.

Under the ESA, the use of parachutes for training activities occurring off the California coast under the No Action Alternative would have no effect on ESA-listed steelhead trout.

The use of parachutes for training activities under the No Action Alternative would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Table 3.0-82 lists the number and locations of activities that expend parachutes. The number and footprint of parachutes are detailed in Table 3.3-5. As indicated in Section 3.0.5.3.4.2 (Parachutes) under the No Action Alternative, activities involving parachute use would occur in the open ocean portions of the Hawaii and SOCAL Range Complexes. Given the size of the range complexes and the resulting widely scattered parachutes (0.02 per nm^2), it would be very unlikely that fishes would encounter and become entangled in any parachutes or sonobuoy accessories. If a fish were to encounter and become entangled in any of these items, the growth, survival, annual reproductive success, or lifetime reproductive success of populations would not be impacted directly or indirectly.

Expended parachutes generally would not co-occur with the distribution and critical habitat of steelhead trout. However, if an expended parachute were encountered, the steelhead trout, like all salmonids, is a strong swimmer with a streamlined body that is unlikely to become entangled in parachutes or lines. The impacts of entanglement with parachutes are discountable because of the low density of parachutes expended, the offshore location of activities and the body shape of steelhead trout, which makes it unlikely to become entangled.

Under the ESA, the use of parachutes for testing activities occurring off the California coast under the No Action Alternative would have no effect on ESA-listed steelhead trout.

The use of parachutes for testing activities under the No Action Alternative would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.4.2.2 Alternative 1

Training Activities

Table 3.0-82 lists the number and locations of activities that expend parachutes. The number and footprint of parachutes are detailed in Table 3.3-6. As indicated in Section 3.0.5.3.4.2 (Parachutes) under Alternative 1, activities involving parachute use would occur in the open ocean portions of the Study Area. Given the size of the range complexes and the resulting widely scattered parachutes (0.14 per nm^2), it would be very unlikely that fishes would encounter and become entangled in any parachutes or sonobuoy accessories. If a fish were to encounter and become entangled in any of these items, the growth, survival, annual reproductive success, or lifetime reproductive success of populations would not be impacted directly or indirectly.

Expended parachutes generally would not co-occur with the distribution and critical habitat of steelhead trout. However, if an expended parachute were encountered, the steelhead trout, like all salmonids, is a strong swimmer with a streamlined body that is unlikely to become entangled in parachutes or lines. The impacts of entanglement with parachutes are discountable because of the low density of parachutes expended, the offshore location of activities and the body shape of steelhead trout, which makes it unlikely to become entangled.

Under the ESA, the use of parachutes for training activities occurring off the California coast under Alternative 1 would have no effect on ESA-listed steelhead trout.

The use of parachutes for training activities under Alternative 1 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Table 3.0-82 lists the number and locations of activities that expend parachutes. The number and footprint of parachutes are detailed in Table 3.3-6. As indicated in Section 3.0.5.3.4.2, (Parachutes) under Alternative 1, activities involving parachute use would occur in the open ocean portions of the Hawaii and SOCAL Range Complexes, with the number of activities involving the use of parachutes being approximately two times that of the No Action Alternative. The activities using parachutes under Alternative 1 would occur in the same geographic locations as the No Action Alternative. Given the size of the range complexes and the resulting widely scattered parachutes (0.03 per nm^2), it would be very unlikely that fishes would encounter and become entangled in any parachutes or sonobuoy accessories. If a fish were to encounter and become entangled in any of these items, the growth, survival, annual reproductive success, or lifetime reproductive success of populations would not be impacted directly or indirectly.

Expended parachutes generally would not co-occur with the distribution and critical habitat of steelhead trout. However, if an expended parachute were encountered, the steelhead trout, like all salmonids, is a strong swimmer with a streamlined body that is unlikely to become entangled in parachutes or lines. The impacts of entanglement with parachutes are discountable because of the low density of parachutes expended, the offshore location of activities and the body shape of steelhead trout, which makes it unlikely to become entangled.

Under the ESA, the use of parachutes for testing activities occurring off the California coast under Alternative 1 would have no effect on ESA-listed steelhead trout.

The use of parachutes for testing activities under Alternative 1 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.4.2.3 Alternative 2

Training Activities

The number and location of training activities under Alternative 2 are identical to training activities under Alternative 1. Therefore, impacts and comparisons to the No Action Alternative would also be identical as described in Section 3.9.3.4.2.2, Alternative 1.

Under the ESA, the use of parachutes for training activities occurring off the California coast under Alternative 2 would have no effect on ESA-listed steelhead trout.

The use of parachutes for training activities under Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Table 3.0-82 lists the number and locations of activities that expend parachutes. The number and footprint of parachutes are detailed in Table 3.3-7. As indicated in Section 3.0.5.3.4.2 (Parachutes) under Alternative 2, activities involving parachute use would occur in the open ocean portions of the Hawaii and SOCAL Range Complexes, with the number of activities involving the use of parachutes being approximately two times that of the No Action Alternative. The activities using parachutes under Alternative 2 would occur in the same geographic locations as the No Action Alternative. Given the size of the range complexes and the resulting widely scattered parachutes (0.03 per nm^2), it would be very unlikely that fishes would encounter and become entangled in any parachutes or sonobuoy accessories. If a fish were to encounter and become entangled in any of these items, the growth, survival, annual reproductive success, or lifetime reproductive success of populations would not be impacted directly or indirectly.

Expended parachutes generally would not co-occur with the distribution and critical habitat of steelhead trout. However, if an expended parachute were encountered, the steelhead trout, like all salmonids, is a strong swimmer with a streamlined body that is unlikely to become entangled in parachutes or lines. The impacts of entanglement with parachutes are discountable because of the low density of parachutes expended, the offshore location of activities and the body shape of steelhead trout, which makes it unlikely to become entangled.

Under the ESA, the use of parachutes for testing activities occurring off the California coast under Alternative 2 would have no effect on ESA-listed steelhead trout.

The use of parachutes for testing activities under Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.4.3 Summary and Conclusions of Entanglement Impacts

While most fish species are susceptible to entanglement in fishing gear that is designed to entangle a fish by trapping a fish by its gills or spines (e.g., gill nets), only a limited number of fish species that possess certain features such as an irregular shaped or rigid rostrum (snout) (e.g., billfish) are susceptible to entanglement by military expended materials. A survey of marine debris entanglements found no fish entanglements in military expended materials in a 25 year dataset (Ocean Conservancy 2010).

Combined Entanglement Stressors

An individual fish could experience the following consequences of entanglement stressors: displacement, stress, avoidance response, behavioral changes, entanglement causing injury, and entanglement causing mortality. If entanglement results in mortality, it cannot act in combination because mortal injuries occur with the first instance. Therefore, there is no possibility for the occurrence of this consequence to increase if sub-stressors are combined.

Sub-lethal consequences may result in delayed mortality because they cause irrecoverable injury or alter the individual's ability to feed or detect and avoid predation. Sub-lethal effects resulting in mortality could be more likely if the activities occurred in essentially the same location and occurred within the individual's recovery time from the first disturbance. This circumstance is only likely to arise during training and testing activities that cause frequent and recurring entanglement stressors to essentially the same location (e.g., torpedoes expended at the same location as sonobuoys). In these specific circumstances the potential consequences to fishes from combinations of entanglement stressors may be greater than the sum of their individual consequences.

These specific circumstances that could multiply the consequences of entanglement stressors are highly unlikely to occur for two reasons. First, it is highly unlikely that torpedo guidance wires and sonobuoy parachutes would impact essentially the same space because most of these sub-stressors are widely dispersed in time and space. Because the risk of injury or mortality is extremely low for each sub-stressor independently, the combined impact of these sub-stressors does not increase the risk in a meaningful way. Furthermore, while it is conceivable that interaction between sub-stressors could magnify their combined risks, the necessary circumstances are highly unlikely to overlap.

Interaction between entanglement sub-stressors is likely to have neutral consequences for fishes. There is no potential for these entangling objects to combine in a way that would multiply their impact, as is the case with derelict (abandoned or discarded) fishing nets that commonly occur in the Study Area (Macfadyen et al. 2009) and entangle fish by design. Fish entangled in derelict nets attract scavengers and predators that may themselves become entangled in an ongoing cycle (Morgan and Chuenpagdee 2003). Guidance wires and parachutes are used relatively infrequently over a wide area, and are mobile for only a short time. Therefore, unlike discarded fishing gear, it is extremely unlikely that guidance wires and parachutes could interact.

Summary of Entanglement Stressors

The Navy identified and analyzed two military expended materials types that have potential to entangle fishes: torpedo guidance wires and parachutes. Other military expended materials types such as bomb or missile fragments do not have the physical characteristics to entangle fishes in the marine environment and were not analyzed. Even for fishes that might encounter and become entangled in an expended torpedo wire, the breaking strength of that wire is low enough that the impact would be only temporary and not likely to cause harm to the individual.

Under the ESA, entanglement stressors used off the California coast under the No Action Alternative, Alternative 1, and Alternative 2 would have no effect on ESA-listed steelhead trout.

Entanglement stressors used under the No Action Alternative, Alternative 1, and Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.5 Ingestion Stressors

This section analyzes the potential ingestion impacts of the various types of munitions and military expended materials other than munitions used by the Navy during training and testing activities within the Study Area. Aspects of ingestion stressors that are applicable to marine organisms in general are presented in Section 3.0.5.7.5, Conceptual Framework for Assessing Effects from Ingestion. Ingestion of expended materials by fishes could occur in coastal and open ocean areas, and can occur at the surface, in the water column, or at the seafloor depending on the size and buoyancy of the expended object and the feeding behavior of the fish. Floating material is more likely to be eaten by fishes that feed at or near the water surface (e.g., ocean sunfishes, basking sharks, manta rays, etc.), while materials that sink to the seafloor present a higher risk to bottom-feeding fishes (e.g., rockfish, hammerhead sharks, skates/rays, flounders).

It is reasonable to assume that any item of a size that can be swallowed by a fish could be eaten at some time; this analysis focuses on ingestion of materials in two locations: (1) at the surface or water column, and (2) at the seafloor. Open-ocean predators and open-ocean planktivores are most likely to ingest materials in the water column. Coastal bottom-dwelling predators and estuarine bottom-dwelling predators could ingest materials from the seafloor. The potential for fish, including the ESA-listed fish species, to encounter and ingest expended materials is evaluated with respect to their feeding group and geographic range, which influence the probability that they would eat military expended materials.

The Navy expends the following types of materials during training and testing in the Study Area that could become ingestion stressors: non-explosive practice munitions (small- and medium-caliber), fragments from high-explosives, fragments from targets, chaff, flare casings (including plastic end caps and pistons), and small parachutes. The activities that expend these items and their general distribution are detailed in Section 3.0.5.3.5, Ingestion Stressors. Metal items eaten by marine fish are generally small (such as fishhooks, bottle caps, and metal springs), suggesting that small- and medium-caliber projectiles, pistons, or end caps (from chaff canisters or flares) are more likely to be ingested. Both physical and toxicological impacts could occur as a result of consuming metal or plastic materials. Items of concern are those of ingestible size that either drift at or just below the surface (or in the water column) for a time or sink immediately to the seafloor. The likelihood that expended items would cause a potential impact on a given fish species depends on the size and feeding habits of the fish and the rate at which the fish encounters the item and the composition of the item. In this analysis only small- and medium-caliber munitions (or small fragments from larger munitions), chaff, small parachutes, and end caps and pistons from flares and chaff cartridges are considered to be of ingestible size for a fish.

The analysis of ingestion impacts on fish is structured around the following feeding strategies:

Feeding at or Just Below the Surface or Within the Water Column

- **Open-Ocean Predators.** Large, migratory, open-ocean fishes, such as tuna, dorado, sharks, and billfishes, feed on fast-swimming prey in the water column of the Study Area. These fishes range widely in search of unevenly distributed food patches. Smaller military expended materials could be mistaken for prey items and ingested purposefully or incidentally as the fish is swimming. Prey fishes sometimes dive deeper to avoid an approaching predator (Pitcher 1986). A few of these predatory fishes (e.g., tiger sharks) are known to ingest any type of marine debris that fit into its mouth, even items such as tires.

- **Open-Ocean Planktivores.** Plankton eating fish in the open-ocean portion of the Study Area include anchovies, sardines, flying fishes, ocean sunfish, manta rays, whale sharks, and basking sharks. These fishes feed by either filtering plankton from the water column or by selectively ingesting larger zooplankton. These planktivores could encounter, and incidentally feed on smaller types of military expended materials (e.g., chaff, end caps, pistons) at the surface or in the water column. None of the species listed under the ESA in the Study Area are open ocean planktivores, but some species in this group of fishes (e.g., anchovies) constitute a major prey base for many important predators.

Military expended materials that could potentially impact these types of fish at or just below the surface or in the water column include those items that float or are suspended in the water column for some period of time (e.g., parachutes and end caps and pistons from chaff cartridges or flares).

Fishes Feeding at the Seafloor

- **Coastal Bottom Dwelling Predators/Scavengers.** Large predatory fishes near the seafloor are represented by rockfishes, groupers, and jacks, which are typical seafloor predators in coastal and deeper nearshore waters of the Study Area (See Table 3.9-7). These species feed opportunistically on or near the bottom, taking fish and invertebrates from the water column and from the bottom (e.g., crabs, octopus). Bottom-dwelling fishes in the nearshore coasts (See Table 3.9-7) may feed by seeking prey and by scavenging on dead fishes and invertebrates (e.g., skates, rays, flatfish, rat fish).

Military expended materials that could be ingested by fish at the seafloor include items that sink (e.g., small-caliber projectiles and casings, fragments from high-explosive munitions).

Table 3.9-7: Summary of Ingestion Stressors on Fishes Based on Location

Feeding Guild	Representative Species	ESA-Protected Species	Overall Potential for Impact
Open-ocean Predators	Dorado, most shark species, tuna, billfish	None	These fishes may eat floating or sinking expended materials, but the encounter rate would be extremely low.
Open-ocean plankton eaters	Basking shark	None	These fishes may ingest floating expended materials incidentally as they feed in the water column, but the encounter rate would be extremely low.
Coastal bottom-dwelling predators	Rockfishes, groupers, jacks	None	These fishes may eat expended materials on the seafloor, but the encounter rate would be extremely low.
Coastal/estuarine bottom-dwelling predators and scavengers	Skates and rays, flounders	None	These fishes could incidentally eat some expended materials while foraging, especially in muddy waters with limited visibility. However, encounter frequency would be extremely low.

Note: ESA=Endangered Species Act.

Potential impacts of ingestion to adults are different than for other lifestages (eggs, larvae, juveniles) because early lifestages are too small to ingest any military expended materials except for chaff, which has been shown to have no impact on fishes. Therefore, no ingestion potential impacts on early lifestages would occur with the exception of later stage larvae and juveniles.

Within the context of fish location in the water column and feeding strategies, the analysis is divided into (1) munitions (small- and medium-caliber projectiles, and small fragments from larger munitions); and (2) military expended material other than munitions (chaff, chaff end caps, pistons, parachutes, flares, and target fragments).

3.9.3.5.1 Impacts from Ingestion of Munitions and Military Expended Materials other than Munitions

The potential impacts of ingesting foreign objects on a given fish depend on the species and size of the fish. Fish that normally eat spiny, hard-bodied invertebrates could be expected to have tougher mouths and digestive systems than fish that normally feed on softer prey. Materials that are similar to the normal diet of a fish would be more likely to be ingested and more easily handled once ingested—for example, by fish that feed on invertebrates with sharp appendages. These items could include fragments from high-explosives that a fish could encounter on the seafloor. Relatively small or smooth objects, such as small caliber projectiles or their casings, might pass through the digestive tract without causing harm. A small sharp-edged item could cause a fish immediate physical distress by tearing or cutting the mouth, throat, or stomach. If the object is rigid and large (relative to the fish's mouth and throat), it may block the throat or obstruct the flow of waste through the digestive system. An object may be enclosed by a cyst in the gut lining (Danner et al. 2009; Hoss and Settle 1990). Ingestion of large foreign objects could lead to disruption of a fish's normal feeding behavior, which could be sublethal or lethal.

Munitions are heavy and would sink immediately to the seafloor, so exposure would be limited to those fish identified as bottom-dwelling predators and scavengers. It is possible that expended small caliber projectiles on the seafloor could be colonized by seafloor organisms and mistaken for prey or that expended small caliber projectiles could be accidentally or intentionally eaten during foraging. Over time, the metal may corrode or become covered by sediment in some habitats, reducing the likelihood of a fish encountering the small caliber, non-explosive practice munitions.

Fish feeding on the seafloor in the offshore locations where these items are expended (e.g., gunnery boxes) would be more likely to encounter and ingest them than fish in other locations. A particularly large item (relative to the fish ingesting it) could become permanently encapsulated by the stomach lining, with the rare chance that this could impede the fish's ability to feed or take in nutrients. However, in most cases, a fish would pass a round, smooth item through its digestive tract and expel it, with no long-term measurable reduction in the individual's fitness.

If high-explosive ordnance does not explode, it would sink to the bottom. In the unlikely event that explosive material, high-melting-point explosive (known as HMX) or royal demolition explosive (known as RDX), is exposed on the ocean floor it would break down in a few hours (U. S. Department of the Navy 2001b). HMX or RDX would not accumulate in the tissues of fish (Lotufo et al. 2010; Price et al. 1998). Fish may take up trinitrotoluene (TNT) from the water when it is present at high concentrations but not from sediments (Lotufo et al. 2010). The rapid dispersal and dilution of TNT expected in the marine water column reduces the likelihood of a fish encountering high concentrations of TNT to near zero.

3.9.3.5.1.1 No Action Alternative

<u>Training Activities</u>

Projectiles

Table 3.0-63 lists the number and location of small- and medium-caliber projectiles. As indicated in Section 3.0.5.3.5.1 (Non-explosive Practice Munitions) under the No Action Alternative, small- and medium-caliber projectile use would occur in the Hawaii and SOCAL Range Complexes. Species that occur in these areas would have the potential to be exposed to small- and medium-caliber projectiles.

Table 3.0-64 lists the number and location of activities that expend fragments from high-explosive ordnance and munitions (e.g., demolition charges, grenades, bombs, missiles, and rockets). The number and footprint of high-explosive ordnance and munitions are detailed in Table 3.3-5; however, the fragment size cannot be quantified. As indicated in Section 3.0.5.3.5.2 (Fragments from High-explosive Munitions), under the No Action Alternative, high-explosive ordnance and munitions use would occur in the Hawaii and SOCAL Range Complexes. Species that occur in these areas would have the potential to be exposed to fragments from high explosive ordnance and munitions. These items are heavy and would sink immediately to the seafloor, so exposure to fishes would be limited to those groups identified as bottom-dwelling predators and scavengers. It is possible that expended small-caliber projectiles on the seafloor could be colonized by seafloor organisms and mistaken for prey or that expended small-caliber projectiles could be accidentally or intentionally eaten during foraging. Over time, the metal corrodes slowly or may become covered by sediment in some habitats, reducing the likelihood of a fish encountering the small-caliber non explosive practice munitions. High explosive munitions are typically fused to detonate within 5 ft. (1.5 m) of the water surface, with steel fragments breaking off in all directions and rapidly decelerating in the water and settling to the seafloor. The analysis generally assumes that most explosive expended materials sink to the seafloor and become incorporated into the seafloor, with no substantial accumulations in any particular area (see Section 3.1 [Sediments and Water Quality]).

Encounter rates in locations with concentrated small-caliber projectiles would be assumed to be greater than in less concentrated areas. Fishes feeding on the seafloor in the offshore locations where these items are expended (e.g., focused in gunnery boxes) would be more likely to encounter these items and at risk for potential ingestion impacts than in other locations. If ingested, and swallowed, these items could potentially disrupt an individual's feeding behavior or digestive processes. If the item is particularly large for the fish ingesting it, the projectile could become permanently encapsulated by the stomach lining, with the rare chance that this could impede the fish's ability to feed or take in nutrients. However, in most cases a fish would pass the round and smooth item through their digestive tract and expel the item with full recovery expected without impacting the individual's growth, survival, annual reproductive success, or lifetime reproductive success. There are no ESA-listed species that occur at the offshore locations where small-caliber projectile use is concentrated.

Unexploded high-explosive munitions would sink to the bottom. The residual explosive material would not be exposed to the marine environment, as it is encased in a non-buoyant cylindrical package. Should the High Melting point Explosive or Royal Demolition Explosive be exposed on the ocean floor, they would break down within a few hours (Department of the Navy 2001b) and would not accumulate in the tissues of fishes (Lotufo, Gibson, et al. 2010; Price et al. 1998). Tri-Nitro Toluene (TNT) would bioaccumulate in fish tissues if present at high concentrations in the water, but not from fish exposure to TNT in sediments (Lotufo, Blackburn, et al. 2010). Given the rapid dispersal and dilution expected in the marine water column, the likelihood of a fish encountering high concentrations of TNT is very low. Over time, Royal Demolition Explosive residue would be covered by ocean sediments in most habitats or diluted by ocean water.

It is not possible to predict the size or shape of fragments resulting from high explosives. High explosives used in the Study Area range in size from medium-caliber projectiles to large bombs, rockets, and missiles. When these items explode, they partially break apart or remain largely intact with irregular shaped pieces—some of which may be small enough for a fish to ingest. Fishes would not be expected to ingest most fragments from high explosives because most pieces would be too large to ingest. Also, since fragment size cannot be quantified, it is assumed that fragments from larger munitions are similarly sized as larger munitions, but more fragments would result from larger munitions than smaller munitions. Small-caliber projectiles far outnumber the larger-caliber high explosive projectiles/bombs/missiles/rockets expended as fragments in the Study Area. Although it is possible that the number of fragments resulting from a high explosive could exceed this number, this cannot be quantified. Therefore, small-caliber projectiles would be more prevalent throughout the Study Area, and more likely to be encountered by bottom-dwelling fishes, and potentially ingested than fragments from any type of high explosive munitions.

Chaff and Flares

Tables 3.0-83 and 3.0-84 lists the number and location of expended chaff and flares. As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions) under the No Action Alternative, activities that expend chaff and flares occur in the open ocean areas of the Hawaii and SOCAL Range Complexes. Species that occur in these areas would have the potential to be exposed to chaff and flares. Under all Alternatives, a total of 20,950 chaff cartridges would be expended from aircraft during training activities. No potential impacts would occur from the chaff itself, as discussed in Section 3.0.5.3.5.3, but there is some potential for the end caps or pistons associated with the chaff cartridges to be ingested. Under all Alternatives, a total of 10,050 flares would be expended during training flare exercises. The flare device consists of a cylindrical cartridge approximately 1.4 in (3.6 cm) in diameter and 5.8 in (14.7 cm) in length. Items that could be potentially ingested from flares include plastic end caps and pistons. An extensive literature review and controlled experiments conducted by the U.S. Air Force revealed that self-protection flare use poses little risk to the environment (U.S. Air Force 1997). The light generated by flares in the air (designed to burn out completely prior to entering the water) would have no impact on fish based on short burn time, relatively high altitudes where they are used, and the wide-spread and infrequent use. The potential exists for large, open-ocean predators (e.g., tunas, billfishes, pelagic sharks) to ingest self-protection flare end caps or pistons as they float on the water column for some time. A variety of plastic and other solid materials have been recovered from the stomachs of billfishes, dorado (South Atlantic Fishery Management Council 2011) and tuna (Hoss and Settle 1990).

End caps and pistons sink in saltwater (Spargo 1999), which reduces the likelihood of ingestion by surface-feeding fishes. However, some of the material could remain at or near the surface, and predatory fishes may incidentally ingest these items. The highest density of chaff and flare end caps/pistons would be expended in the SOCAL Range Complex. Assuming that all end-caps and pistons would be evenly dispersed in the SOCAL Range Complex, the annual relative end-cap and piston concentration would be very low (0.07 nm^2).

Based on the low environmental concentration (Table 3.3-5), it is unlikely that a larger number of fish would ingest an end cap or piston, much less a harmful quantity. Furthermore, a fish might expel the item before swallowing it. The number of fish potentially impacted by ingestion of end caps or pistons would be low based on the low environmental concentration and population-level impacts are not expected to occur.

Summary of Training Activities

Overall, the potential impacts of ingesting small-caliber projectiles, high explosive fragments, parachutes, or end caps/pistons would be limited to individual cases where a fish might suffer a negative response, for example, ingesting an item too large to be digested. While ingestion of ordnance-related materials, or the other military expended materials identified here, could result in sublethal or lethal impacts, the likelihood of ingestion is low based on the dispersed nature of the materials and the limited exposure of those items at the surface/water column or seafloor where certain fishes could be at risk of ingesting those items. Furthermore, a fish might taste an item then expel it before swallowing it (Felix et al. 1995), in the same manner that fish would temporarily take a lure into its mouth, then spit it out. Based on these factors, the number of fish potentially impacted by ingestion of ordnance-related materials would be low and population-level impacts are not likely to occur.

Based on the primarily nearshore distribution of steelhead trout and overlap of munitions use, potential ingestion risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While munitions use could overlap with steelhead trout, the likelihood of ingestion would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, munitions use would not affect steelhead trout critical habitat.

Under the ESA, ingestion of munitions or military expended material other than munitions for training activities occurring off the California coast under the No Action Alternative would have no effect on ESA-listed steelhead trout.

Ingestion of munitions or military expended material other than munitions for training activities under the No Action Alternative would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Table 3.0-63 lists the number and location of small- and medium-caliber projectiles. As indicated in Section 3.0.5.3.5.1 (Non-explosive Practice Munitions) under the No Action Alternative, only medium caliber projectile use would occur in the SOCAL Range Complex. Species that occur in these areas would have the potential to be exposed to small- and medium-caliber projectiles.

Table 3.0-64 lists the number and location of activities that expend fragments from high-explosive ordnance and munitions (e.g., demolition charges, grenades, bombs, missiles, and rockets). The number and footprint of high-explosive ordnance and munitions are detailed in Table 3.3-5; however, the fragment size cannot be quantified. As indicated in Section 3.0.5.3.5.2 (Fragments from High-explosive Munitions), under the No Action Alternative, high-explosive ordnance and munitions use would occur in the Hawaii and SOCAL Range Complexes. Species that occur in these areas would have the potential to be exposed to fragments from high explosive ordnance and munitions.

Under the No Action Alternative, no testing activities use chaff or flares (Tables 3.0-83 and 3.0-84).

Overall, the potential impacts of ingesting small-caliber projectiles, high-explosive fragments, parachutes, or flare end caps/pistons would be limited to individual cases where a fish might suffer a negative response, for example, ingesting an item too large to be digested. While ingestion of ordnance-related materials, or the other military expended materials identified here, could result in sublethal or lethal impacts, the likelihood of ingestion is low based on the dispersed nature of the materials and the limited exposure of those items at the surface/water column or seafloor where certain fishes could be at risk of ingesting those items. Furthermore, a fish might expel the item before swallowing it. Based on these factors, the number of fish potentially impacted by ingestion of ordnance-related materials would be low and population-level impacts are not likely to occur.

Based on the primarily nearshore distribution of steelhead trout and overlap of munitions use, potential ingestion risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While munitions use could overlap with steelhead trout, the likelihood of ingestion would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, munitions use would not affect steelhead trout critical habitat.

Under the ESA, ingestion of munitions or military expended material other than munitions for testing activities occurring off the California coast under the No Action Alternative would have no effect on ESA-listed steelhead trout.

Ingestion of munitions or military expended material other than munitions for testing activities under the No Action Alternative would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.5.1.2 Alternative 1

Training Activities

Projectiles

Table 3.0-63 lists the number and location of small- and medium- caliber projectiles. As indicated in Section 3.0.5.3.5.1 (Non-explosive Practice Munitions) under Alternative 1, small- and medium-caliber projectile use would occur in the open ocean portions of the Study Area. Species that occur in these areas would have the potential to be exposed to small- and medium-caliber projectiles.

Table 3.0-64 lists the number and location of activities that expend fragments from high-explosive ordnance and munitions (e.g., demolition charges, grenades, bombs, missiles, and rockets). The number and footprint of high-explosive ordnance and munitions are detailed in Table 3.3-6; however, the fragment size cannot be quantified. As indicated in Section 3.0.5.3.5.2 (Fragments from High-explosive Munitions), under Alternative 1, high-explosive ordnance and munitions use would occur in the open ocean portions of the Study Area. Species that occur in these areas would have the potential to be exposed to fragments from high explosive ordnance and munitions.

Chaff and Flares

Tables 3.0-83 and 3.0-84 lists the number and location of expended chaff and flares. As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions) under Alternative 1, activities that expend chaff and flares occur in the open ocean areas of the Hawaii and SOCAL Range Complexes. Species that occur in these areas would have the potential to be exposed to chaff and flares. The number and location of training activities under Alternative 1 are identical to training activities under the No Action Alternative. Therefore, impacts and comparisons to the No Action Alternative would also be identical as described in Section 3.9.3.5.1.1, No Action Alternative. Summary of Training Activities.

The increase in expended materials under Alternative 1 would increase the probability of ingestion risk; however, as discussed under the No Action Alternative, the likelihood of ingestion would still be low based on the dispersed nature of the materials and the limited exposure of those items at the surface/water column or seafloor where certain fishes could be at risk of ingesting those items. Therefore, the number of fish potentially impacted by ingestion of expended materials would be low and population-level impacts are not likely to occur.

Based on the primarily nearshore distribution of steelhead trout and overlap of munitions use, potential ingestion risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While munitions use could overlap with steelhead trout, the likelihood of ingestion would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, munitions use would not affect steelhead trout critical habitat.

Testing Activities

Table 3.0-63 lists the number and location of small- and medium-caliber projectiles. As indicated in Section 3.0.5.3.5.1 (Non-explosive Practice Munitions) under Alternative 1, small- and medium-caliber projectile use would occur in the entre Study Area. Species that occur in these areas would have the potential to be exposed to small- and medium-caliber projectiles.

Table 3.0-64 lists the number and location of activities that expend fragments from high-explosive ordnance and munitions (e.g., demolition charges, grenades, bombs, missiles, and rockets). The number and footprint of high-explosive ordnance and munitions are detailed in Table 3.3-6; however, the fragment size cannot be quantified. As indicated in Section 3.0.5.3.5.2 (Fragments from High-explosive Munitions), under Alternative 1, high-explosive ordnance and munitions use would occur open ocean portions of the Study Area. Species that occur in these areas would have the potential to be exposed to fragments from high explosive ordnance and munitions.

Tables 3.0-83 and 3.0-84 lists the number and location of expended chaff and flares. As indicated in Section 3.0.5.3.5.3 (Military Expended Materials Other Than Munitions) under Alternative 1, activities that expend chaff and flares occur in the open ocean areas of the Hawaii and SOCAL Range Complexes. Species that occur in these areas would have the potential to be exposed to chaff and flares. The number and location of training activities under Alternative 1 are identical to training activities under the No Action Alternative. Therefore, impacts and comparisons to the No Action Alternative would also be identical as described in Section 3.9.3.5.1.1, No Action Alternative.

Given the reasons stated under the training activities, the number of fish potentially impacted by ingestion of ordnance-related materials would be low and population-level impacts are not likely to occur.

Based on the primarily nearshore distribution of steelhead trout and overlap of munitions use, potential ingestion risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While munitions use could overlap with steelhead trout, the likelihood of ingestion would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, munitions use would not affect steelhead trout critical habitat.

Under the ESA, ingestion of munitions or military expended material other than munitions for testing activities occurring off the California coast under Alternative 1 would have no effect on ESA-listed steelhead trout.

Ingestion of munitions or military expended material other than munitions for testing activities under Alternative 1 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.5.1.3 Alternative 2

Training Activities

Under Alternative 2, the number of military expended materials would be the same as under Alternative 1 (Tables 3.0-63 and 3.0-64). Therefore, the impact of military expended materials would be the same as under Alternative 1.

Based on the primarily nearshore distribution of steelhead trout and overlap of munitions use, potential ingestion risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While munitions use could overlap with steelhead trout, the likelihood of ingestion would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, munitions use would not affect steelhead trout critical habitat.

Under the ESA, ingestion of munitions or military expended material other than munitions for training activities occurring off the California coast under Alternative 2 would have no effect on ESA-listed steelhead trout.

Ingestion of munitions or military expended material other than munitions for training activities under Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Testing Activities

Under Alternative 2, the number of military expended materials would increase slightly compared to the No Action Alternative (Tables 3.0-63 and 3.0-64). Given the reasons stated under the training activities under Alternative 1, the number of fish potentially impacted by ingestion of ordnance-related materials would be low and population-level impacts are not likely to occur.

Based on the primarily nearshore distribution of steelhead trout and overlap of munitions use, potential ingestion risk would be greatest in the coastal areas of the SOCAL Range Complex and SSTC. While munitions use could overlap with steelhead trout, the likelihood of ingestion would be extremely low given the low abundance of steelhead trout in the Study Area and the dispersed nature of the activity. The majority of the primary constituent elements required by steelhead trout are applicable to freshwater and estuaries (i.e., spawning sites, rearing sites, and migration corridors), and are outside the Study Area. Therefore, munitions use would not affect steelhead trout critical habitat.

Under the ESA, ingestion of munitions or military expended material other than munitions for testing activities occurring off the California coast under Alternative 2 would have no effect on ESA-listed steelhead trout.

Ingestion of munitions or military expended material other than munitions for testing activities under Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.5.2 Summary and Conclusions of Ingestion Impacts

3.9.3.5.2.1 Combined Ingestion Stressors

An individual fish could experience the following consequences of ingestion stressors: stress, behavioral changes, ingestion causing injury, and ingestion causing mortality. Ingestion causing mortality cannot act in combination because mortal injuries occur with the first instance. Therefore, there is no possibility for the occurrence of this consequence to increase if sub-stressors are combined.

Sub-lethal consequences may result in delayed mortality because they cause irrecoverable injury or alter the individual's ability to feed or detect and avoid predation. Normally, for fish large enough to ingest it, most small-caliber projectiles would pass through a fish's digestive system without injury. However, in this scenario it is possible that a fish's digestive system could already be compromised or blocked in such a manner that the small-caliber projectiles can no longer easily pass through without harm. It is conceivable that a fish could first ingest a small bomb fragment that might damage or block its digestive tract, then ingest a small-caliber projectile, with magnified combined impacts. Sub-lethal effects resulting in mortality could be more likely if the activities occurred in essentially the same location and occurred within the individual's recovery time from the first disturbance. This circumstance is likely to arise only during training and testing activities that cause frequent and recurring ingestion stressors to essentially the same location (e.g., chaff cartridge end caps/flares expended at the same location as small-caliber projectiles). In these specific circumstances the potential consequences to fishes from combinations of ingestion stressors may be greater than the sum of their individual consequences.

These specific circumstances that could magnify the consequences of ingestion stressors are highly unlikely to occur because, with the exception of a sinking exercise, it is highly unlikely that chaff cartridge end caps/flares and small-caliber projectiles would impact essentially the same location because most of these sub-stressors are widely dispersed in time and space.

The combined impact of these sub-stressors does not increase the risk in a meaningful way because the risk of injury or mortality is extremely low for each sub-stressor independently. While it is conceivable that interaction between sub-stressors could magnify their combined risks, the necessary circumstances are highly unlikely to overlap. Interaction between ingestion sub-stressors is likely to have neutral consequences for fishes.

Under the ESA, ingestion of munitions or military expended material other than munitions for training activities occurring off the California coast under Alternative 1 would have no effect on ESA-listed steelhead trout.

Ingestion of munitions or military expended material other than munitions for training activities under Alternative 1 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.5.2.2 Summary and Conclusions of Ingestion Impacts

The Navy identified and analyzed three military expended materials types that have ingestion potential for fishes: non-explosive practice munitions, military expended materials from high explosives, and military expended materials from non-ordnance items (e.g., end caps, canisters, chaff, and accessory materials). The probability of fishes ingesting military expended materials depends on factors such as the size, location, composition, and the buoyancy of the expended material. These factors, combined with the location and feeding behavior of fishes were used to analyze the likelihood the expended material would be mistaken for prey and what the potential impacts would be if ingested. Most expended materials, such as large- and medium-caliber ordnance, would be too large to be ingested by a fish, but other materials, such as small-caliber munitions or some fragments of larger items, may be small enough to be swallowed by some fishes. During normal feeding behavior, many fishes ingest nonfood items and often reject (spit out) nonfood items prior to swallowing. Other fishes may ingest and swallow both food and nonfood items indiscriminately. There are concentrated areas where bombing, missile, and gunnery activities that generate materials that could be ingested. However, even within those areas, the overall impact on fishes would be inconsequential.

The potential impacts of military expended material ingestion would be limited to individual cases where a fish might suffer a negative response, for example, ingesting an item too large, sharp, or pointed to pass through the digestive tract without causing damage. Based on available information, it is not possible to accurately estimate actual ingestion rates or responses of individual fishes. Nonetheless, the number of military expended materials ingested by fishes is expected to be very low and only an extremely small percentage of the total would be potentially encountered by fishes. Certain feeding behavior such as "suction feeding" along the seafloor exhibited by sturgeon may increase the probability of ingesting military expended materials relative to other fishes; however, encounter rates would still remain low.

Under the ESA, ingestion of munitions or military expended material other than munitions occurring off the California coast under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on ESA-listed steelhead trout.

Ingestion of munitions or military expended material other than munitions under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.3.6 Secondary Stressors

This section analyzes potential impacts on fishes exposed to stressors indirectly through impacts on habitat, sediment, or water quality. These are also primary elements of marine fish habitat and firm distinctions between indirect impacts and habitat impacts are difficult to maintain. For the purposes of this analysis, indirect impacts on fishes via sediment or water which do not require trophic transfer (e.g., bioaccumulation) in order to be observed are considered here. It is important to note that the terms "indirect" and "secondary" do not imply reduced severity of environmental consequences, but instead describe how the impact may occur in an organism or its ecosystem.

Stressors from Navy training and testing activities could pose secondary or indirect impacts on fishes via habitat, sediment, and water quality. These include: (1) explosives and by-products; (2) metals; (3) chemicals; (4) other materials such as targets, chaff, and plastics, and (5) impacts on fish habitat. Activities associated with these stressors are detailed in Tables 2.8-1 to 2.9-5, 2.9-2, and 2.9-3 and analyses of their potential impacts are discussed in Section 3.1 (Sediments and Water Quality) and Section 3.3 (Marine Habitats).

3.9.3.6.1 Explosives

In addition to directly impacting fish and fish habitat, underwater explosions could impact other species in the food web including plankton and other prey species that fish feed upon. The impacts of underwater explosions would differ depending upon the type of prey species in the area of the blast. As discussed in Section 3.9.4.1, fish with swim bladders are more susceptible to blast injuries than fish without swim bladders.

In addition to physical impacts of an underwater blast, prey might have behavioral reactions to underwater sound. For instance, prey species might exhibit a strong startle reaction to detonations that might include swimming to the surface or scattering away from the source. This startle and flight response is the most common secondary defense among animals (Hanlon and Messenger 1996). The sound from underwater explosions might induce startle reactions and temporary dispersal of schooling fishes if they are within close proximity. The abundances of fish and invertebrate prey species near the detonation point could be diminished for a short period of time before being repopulated by animals from adjacent waters. Alternatively, any prey species that would be directly injured or killed by the blast could draw in scavengers from the surrounding waters that would feed on those organisms, and in turn could be susceptible to becoming directly injured or killed by subsequent explosions. Any of these scenarios would be temporary, only occurring during activities involving explosives, and no lasting impact on prey availability or the pelagic food web would be expected. Indirect impacts of underwater detonations and high explosive ordnance use under the Proposed Action would not result in a decrease in the quantity or quality of fish populations or fish habitats in the Study Area.

3.9.3.6.2 Explosion By-Products, and Unexploded Ordnance

Deposition of undetonated explosive materials into the marine environment can be reasonably well estimated by the known failure and low-order detonation rates of high explosives. Undetonated explosives associated with mine neutralization activities are collected after training is complete; therefore, potential impacts are assumed to be inconsequential for these training and testing activities, but other activities could result in unexploded ordnance and unconsumed explosives on the seafloor. Fishes may be exposed by contact with the explosive, contact with contaminants in the sediment or water, and ingestion of contaminated sediments.

High-order explosions consume most of the explosive material, creating typical combustion products. In the case of Royal Demolition Explosive, 98 percent of the products are common seawater constituents and the remainder are rapidly diluted below threshold impact level. Explosion by-products associated with high order detonations present no indirect stressors to fishes through sediment or water. However, low order detonations and unexploded ordnance present elevated likelihood of impacts on fishes.

Indirect impacts of explosives and unexploded ordnance to fishes via sediment is possible in the immediate vicinity of the ordnance. Degradation of explosives proceeds via several pathways discussed in Section 3.1. Degradation products of Royal Demolition Explosive are not toxic to marine organisms at realistic exposure levels (Rosen and Lotufo 2010). TNT and its degradation products impact developmental processes in fishes and are acutely toxic to adults at concentrations similar to real-world exposures (Halpern et al. 2008; Rosen and Lotufo 2010). Relatively low solubility of most explosives and their degradation products means that concentrations of these contaminants in the marine environment are relatively low and readily diluted. Furthermore, while explosives and their degradation products were detectable in marine sediment approximately 6 to 12 in (15.2 to 30.5 m) away from degrading ordnance, the concentrations of these compounds were not statistically distinguishable from background beyond 3 to 6 ft. (0.9 to 1.8 m) from the degrading ordnance (Section 3.1). Taken together, it is likely that various lifestages of fishes could be impacted by the indirect impacts of degrading explosives within a very small radius of the explosive 1 to 6 ft. (0.3 to 1.8 m).

3.9.3.6.3 Metals

Certain metals are harmful to fishes at concentrations above background levels (e.g., cadmium, chromium, lead, mercury, zinc, copper, manganese, and many others) (Wang and Rainbow 2008). Metals are introduced into seawater and sediments as a result of Navy training and testing activities involving vessel hulks, targets, ordnance, munitions, and other military expended materials (Section 3.1.3.2). Some metals bioaccumulate and physiological impacts begin to occur only after bioaccumulation concentrate the metals (see Section 3.3 [Marine Habitats] and Chapter 4 [Cumulative Impacts]). Indirect impacts of metals to fishes via sediment and water involve concentrations several orders of magnitude lower than concentrations achieved via bioaccumulation. Fishes may be exposed by contact with the metal, contact with contaminants in the sediment or water, and ingestion of contaminated sediments. Concentrations of metals in sea water are orders of magnitude lower than concentrations in marine sediments. It is extremely unlikely that fishes would be indirectly impacted by toxic metals via the water.

3.9.3.6.4 Chemicals

Several Navy training and testing activities introduce potentially harmful chemicals into the marine environment; principally, flares and propellants for rockets, missiles, and torpedoes. Polychlorinated biphenyls (PCBs) are discussed in Section 3.1. Properly functioning flares missiles, rockets, and torpedoes combust most of their propellants; leaving benign or readily diluted soluble combustion by-products (e.g., hydrogen cyanide). Operational failures allow propellants and their degradation products to be released into the marine environment.

The greatest risk to fishes from flares, missile, and rocket propellants is perchlorate which is highly soluble in water, persistent, and impacts metabolic processes in many plants and animals. Fishes may be exposed by contact with contaminated water or ingestion of contaminated sediments. Since perchlorate is highly soluble, it does not readily absorb to sediments. Therefore, missile and rocket fuel poses no risk of indirect impact on fishes via sediment. In contrast, the principal toxic components of torpedo fuel, propylene glycol dinitrate and nitrodiphenylamine, adsorbs to sediments, has relatively low toxicity, and is readily degraded by biological processes (Section 3.1). It is conceivable that various lifestages of fishes could be indirectly impacted by propellants via sediment in the immediate vicinity of the object (e.g., within a few inches), but these potential impacts would diminish rapidly as the propellant degrades.

3.9.3.6.5 Other Materials

Some military expended materials (e.g., parachutes) could become remobilized after their initial contact with the sea floor (e.g., by waves or currents) and could be reintroduced as an entanglement or ingestion hazard for fishes. In some bottom types (without strong currents, hard-packed sediments, and low biological productivity), items such as projectiles might remain intact for some time before becoming degraded or broken down by natural processes. While these items remain intact sitting on the bottom, they could potentially remain ingestion hazards. These potential impacts may cease only (1) when the military expended materials are too massive to be mobilized by typical oceanographic processes, (2) if the military expended materials become encrusted by natural processes and incorporated into the seafloor, or (3) when the military expended materials become permanently buried. In this scenario, a parachute could initially sink to the seafloor, but then be transported laterally through the water column or along the seafloor, increasing the opportunity for entanglement. In the unlikely event that a fish would become entangled, injury or mortality could result. The entanglement stressor would eventually cease to pose an entanglement risk as it becomes encrusted or buried.

3.9.3.6.6 Impacts on Fish Habitat

The Proposed Action could result in localized and temporary changes to the benthic community during activities that impact fish habitat. Fish habitat could become degraded during activities that would strike the seafloor or introduce military expended materials, bombs, projectiles, missiles, rockets, or fragments to the seafloor. During, or following activities that impact benthic habitats, fish species may experience loss of available benthic prey at locations in the Study Area where these items might be expended on essential fish habitat or habitat areas of particular concern. Additionally, plankton and zooplankton that are eaten by fish may also be negatively impacted by these same expended materials. The spatial area of Essential Fish Habitat and habitat areas of particular concern impacted by the Proposed Action would be relatively small compared to the available habitat in the HSTT Study Area. Potentially a maximum area of 0.3 nm^2 of essential fish habitat and habitat areas of particular concern may have decreased habitat value resulting from the Proposed Action, based on the footprint of expended materials. However, there would still be vast expanses of essential fish habitat and habitat areas of particular concern adjacent to the areas of habitat impact that would remain undisturbed by the Proposed Action.

Impacts of physical disturbance and strikes by small, medium, and large projectiles would be concentrated within designated gunnery box areas, resulting in localized disturbances of hard bottom areas, but could occur anywhere in the range complexes or the Study Area. Hard bottom is important habitat for many different species of fish, including those fishes managed by various fishery management plans.

When a projectile hits a biogenic habitat, the substrate immediately below the projectile is not available at that habitat type on a long-term basis, until the material corrodes. The substrate surrounding the projectile would be disturbed, possibly resulting in short-term localized increased turbidity. Given the large spatial area of the range complexes compared to the small percentage covered by biogenic habitat, it is unlikely that most of the small, medium, and large projectiles expended in the Study Area would fall onto this habitat type. Furthermore, these activities are distributed within discrete locations within the Study Area, and the overall footprint of these areas is quite small with respect to the spatial extent of this biogenic habitat within the Study Area.

Sinking exercises could also provide secondary impacts on deep sea populations. These activities occur in open-ocean areas, outside of the coastal range complexes, with potential direct disturbance or strike impacts on deep sea fishes, covered in Section 3.9.4.4. Secondary impacts on these fishes could occur after the ship hulks sink to the seafloor. Over time, the ship hulk would be colonized by marine organisms that attach to hard surfaces. For fishes that feed on these types of organisms, or whose abundances are limited by available hard structural habitat, the ships that are sunk during sinking exercises could provide an incidental beneficial impact on the fish community (Love and York 2005).

Designated critical habitat of steelhead trout includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek, and is outside the Study Area. Therefore, would be no impacts associated with secondary stressors.

Under the ESA, secondary stressors resulting occurring off the California coast under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on ESA-listed steelhead trout.

Secondary stressors under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.4 SUMMARY OF POTENTIAL IMPACTS ON FISH

3.9.4.1 Combined Impacts of All Stressors

As described in Section 3.0.5.5 (Resource-Specific Impacts Analysis for Multiple Stressors), this section evaluates the potential for combined impacts of all the stressors from the Proposed Action. The analysis and conclusions for the potential impacts from each individual stressor are discussed in the analyses of each stressor in the sections above and summarized in Sections 3.9.4.2, Endangered Species Act Determinations.

There are generally two ways that a fish could be exposed to multiple stressors. The first would be if a fish were exposed to multiple sources of stress from a single activity (e.g., a mine warfare activity may include the use of a sound source and a vessel). The potential for a combination of these impacts from a single activity would depend on the range of effects of each stressor and the response or lack of response to that stressor. Most of the activities as described in the Proposed Action involve multiple stressors; therefore, it is likely that if a fish were within the potential impact range of those activities, they may be impacted by multiple stressors simultaneously. This would be even more likely to occur during large-scale exercises or activities that span a period of days or weeks (such as a sinking exercises or composite training unit exercise).

Fish could be exposed to a combination of stressors from multiple activities over the course of its life. This is most likely to occur in areas where training and testing activities are more concentrated (e.g., near naval ports, testing ranges, and routine activity locations outlined in Table 3.0-3 and in areas that individual fish frequent because it is within the animal's home range, migratory corridor, spawning or feeding area. Except for in the few concentration areas mentioned above, combinations are unlikely to occur because training and testing activities are generally separated in space and time in such a way that it would be very unlikely that any individual fish would be exposed to stressors from multiple activities. However, animals with a home range intersecting an area of concentrated Navy activity have elevated exposure risks relative to animals that simply transit the area through a migratory corridor. The majority of the proposed training and testing activities occur over a small spatial scale relative to the entire Study Area, have few participants, and are of a short duration (the order of a few hours or less).

Multiple stressors may also have synergistic effects. For example, fish that experience temporary hearing loss or injury from acoustic stressors could be more susceptible to physical strike and disturbance stressors via a decreased ability to detect and avoid threats. Fish that experience behavioral and physiological consequences of ingestion stressors could be more susceptible to entanglement and physical strike stressors via malnourishment and disorientation. These interactions are speculative, and without data on the combination of multiple Navy stressors, the synergistic impacts from the combination of Navy stressors are difficult to predict in any meaningful way. Navy research and monitoring efforts include data collection through conducting long-term studies in areas of Navy activity, occurrence surveys over large geographic areas, biopsy of animals occurring in areas of Navy activity, and tagging studies where animals are exposed to Navy stressors. These efforts are intended to contribute to the overall understanding of what impacts may be occurring overall to animals in these areas.

Although potential impacts to certain fish species from the Proposed Action may include injury or mortality, impacts are not expected to decrease the overall fitness of any given population. Mitigation measures designed to reduce the potential impacts are discussed in Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring. The potential impacts anticipated from the Proposed Action are summarized in Sections 3.9.4.2, Endangered Species Act Determinations, with respect to each regulation applicable to fish.

Under the ESA, secondary stressors resulting occurring off the California coast under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on ESA-listed steelhead trout.

Secondary stressors under the No Action Alternative, Alternative 1, or Alternative 2 would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

3.9.4.2 Endangered Species Act Determinations

Table 3.9-8 summarizes the ESA determinations for each substressor analyzed. For all substressors, training and testing activities would have no effect on steelhead trout critical habitat, which includes the estuarine and freshwater habitat of San Juan Creek, Trabuco Creek, and San Mateo Creek.

Table 3.9-8: Summary of Endangered Species Act Determinations for Training and Testing Activities for the Preferred Alternative

Stressor		Steelhead Trout
Acoustic Stressors		
Non-Impulsive Sources	Training Activities	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect
Explosives and other non-impulsive sources	Training Activities	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect
Energy Stressors		
Electromagnetic devices	Training Activities	May affect, not likely to adversely affect
	Testing Activities	May affect, not likely to adversely affect
Physical Disturbance and Strike Stressors		
Vessels and in-water devices	Training Activities	No effect
	Testing Activities	No effect
Military expended materials	Training Activities	No effect
	Testing Activities	No effect
Seafloor devices	Training Activities	No effect
	Testing Activities	No effect
Entanglement Stressors		
Cables and wires	Training Activities	No effect
	Testing Activities	No effect
Parachutes	Training Activities	No effect
	Testing Activities	No effect
Ingestion Stressors		
Munitions	Training Activities	No effect
	Testing Activities	No effect
Military expended materials other than munitions	Training Activities	No effect
	Testing Activities	No effect

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3.10 Cultural Resources

CULTURAL RESOURCES SYNOPSIS

The United States Department of the Navy considered all potential stressors and the following have been analyzed for submerged cultural resources:

- Acoustic (underwater explosions at depth, cratering from underwater detonations at depth, aircraft and sonic booms, and pile-driving)
- Physical disturbance (use of towed-in-water devices, deposition of military expended materials, and use of sea floor devices)

Preferred Alternative

Acoustic and physical stressors, as indicated above, could adversely affect submerged prehistoric sites and unrecorded submerged historic resources in accordance with Section 106 of the National Historic Preservation Act.

3.10.1 Introduction and Methods

3.10.1.1 Introduction

Cultural resources are found throughout the Hawaii-Southern California Training and Testing (HSTT) Study Area (Study Area). The approach to assessing cultural resources includes defining the resource; presenting the regulatory requirements for identifying, evaluating, and treating the resource within established jurisdictional parameters; establishing the specific resource subtypes in the Study Area; identifying the data used to define the current conditions; and describing the method of impact analysis.

Cultural resources are defined as districts, landscapes, sites, structures, objects, and ethnographic resources, as well as other physical evidence of human activity, that are considered to be important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Cultural resources include archaeological resources, historic architectural resources, and traditional cultural properties related to pre-contact (prior to European contact) and post-contact periods.

Archaeological resources include prehistoric and historic sites and artifacts. Archaeological resources can have a surface component, a subsurface component, or both. Prehistoric resources are physical properties resulting from human activities that predate written records, and include village sites, temporary camps, lithic scatters, roasting pits, hearths, milling features, petroglyphs, rock features, and burials. Historic resources postdate the advent of written records in a region, and include building foundations, refuse scatters, wells, cisterns, and privies. Submerged cultural resources include historic shipwrecks and other submerged historic materials, such as sunken airplanes and prehistoric cultural remains. Architectural resources are elements of the built environment consisting of standing buildings or structures from the historic period. These resources include existing buildings, dams, bridges, lighthouses, and forts. Traditional cultural resources are resources associated with beliefs or cultural practices of a living culture, subculture, or community. These beliefs and practices must be rooted in the group’s history and must be important in maintaining the cultural identity of the group. Prehistoric archaeological sites and artifacts, historic and contemporary locations of traditional events, sacred places, landscapes, and resource collection areas, including fishing, hunting and gathering areas, may be traditional cultural resources.

3.10.1.2 Identification, Evaluation, and Treatment of Cultural Resources

Procedures for identifying, evaluating, and treating cultural resources within state territorial waters (within 3 nautical miles [nm] of the coast) and United States (U.S.) territorial waters (within 12 nm of the coast) are contained in a series of federal and state laws and regulations, and agency guidelines. Archaeological, architectural, and Native American resources are protected by a variety of laws and their implementing regulations: the National Historic Preservation Act of 1966 as amended in 2006, the Archeological and Historic Preservation Act of 1974, the Archaeological Resources Protection Act of 1979, the American Indian Religious Freedom Act of 1978, the Native American Graves Protection and Repatriation Act of 1990, the Submerged Lands Act of 1953, the Abandoned Shipwreck Act of 1987, and the Sunken Military Craft Act of 2004. The Advisory Council on Historic Preservation (Advisory Council) further guides treatment of archaeological and architectural resources through the regulations, *Protection of Historic Properties* (36 Code of Federal Regulations [C.F.R.] Part 800). The category of "historic properties" is a subset of cultural resources that is defined in the National Historic Preservation Act (16 United States Code [U.S.C.] § 470w(5)) as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (National Register), including artifacts, records, and material remains related to such a property or resource.

Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of their actions on cultural resources listed in or eligible for inclusion in the National Register. The regulations implementing Section 106 (36 C.F.R. Part 800) specify a consultation process to assist in satisfying this requirement. Consultation with the appropriate State Historic Preservation Offices, the Advisory Council, Native American tribes and Native Hawaiian organizations, the public, and state and federal agencies is required by Section 106 of the National Historic Preservation Act. Government-to-government consultation required by Executive Order (EO) 13007 will be accomplished concurrently with the preparation of this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) for the portion of the Proposed Action within state territorial waters (within 3 nm). Scoping letters for this EIS/OEIS were sent to appropriate State Historic Preservation Offices and federally-recognized Native American tribes. No other formal consultation is anticipated with State Historic Preservation Offices, tribes, or Native Hawaiians.

Additional regulations and guidelines for submerged historic resources include 10 U.S.C. 113, note for the Sunken Military Craft Act; the *Abandoned Shipwreck Guidelines* prepared by the National Park Service (National Park Service 2007) and, for the purposes of conducting research or recovering Navy ship and aircraft wrecks, the *Guidelines for Archaeological Research Permit Applications on Ship and Aircraft Wreck*s *under the Jurisdiction of the Department of the Navy* (36 C.F.R. Part 767) overseen by the Naval History and Heritage Command. The Sunken Military Craft Act does not apply to actions taken by, or at the direction of, the United States. In addition, the federal archaeological program developed by the National Park Service pursuant to a Presidential Order, includes a collection of historical and archaeological resource protection laws to which federal managers adhere.

No specific procedures for identifying and protecting cultural resources in the open ocean have been defined by the international community (Zander and Varmer 1996). No treaty offering comprehensive protection of submerged cultural resources has been developed. A few international conventions prepared by the United Nations Educational, Scientific, and Cultural Organization apply to submerged cultural resources, including the 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property, the 1972 Convention Concerning the Protection of the World Cultural and Natural Heritage, the 1982 Convention on the Law of the Sea, and the 2001 Convention on the Protection of the Underwater Cultural Heritage. Only the 1970 and 1972 conventions have been fully ratified by the United States.

3.10.1.3 Methods

3.10.1.3.1 Approach

Within the Pacific region, the approach for establishing current conditions is based on different regulatory parameters defined by geographical location. Within state territorial waters (within 3 nm), the National Historic Preservation Act is the guiding mandate; within U.S. territorial waters (12 nm), the National Environmental Policy Act (NEPA) is the primary mandate. Areas beyond 12 nm in the open ocean will not be analyzed, as those areas are beyond the jurisdiction of the National Historic Preservation Act and NEPA.

The implementing regulations of Section 106 of the National Historic Preservation Act require federal agencies to take into account the effects that a proposed action would have on cultural resources included in or eligible for inclusion in the National Register. “Historic properties” is synonymous with National Register-eligible or -listed archaeological, architectural, or traditional resources. Cultural resources that have not been formally evaluated (i.e., a Consensus Determination in consultation with the State Historic Preservation Office) may be considered potentially eligible, and thus are afforded the same regulatory consideration as resources listed in the National Register. Evaluations and determinations of historic properties within the Study Area are the responsibility of the federal agency, in consultation with either the State Historic Preservation Office (California) or the Hawaii Historic Preservation Division (Hawaii).

Properties are evaluated for nomination to the National Register and for National Register eligibility using the following criteria (36 C.F.R. § 60.4(a)-(d)):

- Criterion A: Be associated with events that have made a significant contribution to the broad patterns of American history
- Criterion B: Be associated with the lives of persons significant in the American past
- Criterion C: Embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction
- Criterion D: Yield, or may be likely to yield, information important in prehistory or history

A historic property also must possess the following aspects of integrity: location, design, setting, materials, workmanship, feeling, and association to convey its significance and to qualify for the National Register. These seven aspects, in various combinations, define integrity. To retain integrity, a property will always possess several, and usually most, of these aspects.

Cultural resources in U.S. territorial waters (within 12 nm of the coastline) are as follows:

- Resources listed on or eligible for listing on the National Register (Section 106 of the National Historic Preservation Act)
- Entitled to sovereign immunity (e.g., British cargo vessels) under the Sunken Military Craft Act
- Submerged war graves protected by the Sunken Military Craft Act

- Submerged nonmilitary burials and human remains

3.10.1.3.2 Data Sources

Cultural resources information relevant to this EIS/OEIS was derived from a variety of sources, including previous environmental documents, national and international shipwreck databases, the National Register Information System (managed by the National Park Service), information repositories associated with State Historic Preservation Offices, on-line maps and data, and published sources, as cited. Previous environmental documents used for general information include the *Hawaii Range Complex EIS/OEIS* (U.S. Department of the Navy 2008a), *Southern California Range Complex EIS/OEIS* (U.S. Department of the Navy 2008b), and *Silver Strand Training Complex EIS* (U.S. Department of the Navy 2011).

The national and international shipwreck databases researched included the National Oceanic and Atmospheric Administration's Office of Coast Survey Advanced Wreck and Obstruction Information System, National Oceanic and Atmospheric Administration Aids to Navigation, California State Lands Commission Shipwrecks database, and the General Dynamics Global Maritime Wrecks Database, as well as secondary sources of shipwreck information. Many of the shipwreck databases and secondary sources overlap, generating repetitiveness in data. Many federal agencies "share" data as well as secondary sources. The intent of this analysis is not to provide a definitive number of shipwrecks, obstructions, or hazards within a defined area, however, but rather to provide an overview of the potential resources in an area.

The online National Register Information System was reviewed to identify National Register-listed properties, historic districts, and National Historic Landmarks. Appropriate information repositories associated with the State Historic Preservation Offices were contacted or their online databases were reviewed for information on shipwreck locations, types, and eligibility for listing on the state registers and National Register of Historic Places.

3.10.1.3.3 Cultural Context

Several types of historic properties may be present in the Study Area, including: submerged prehistoric occupation sites along the continental shelf; wrecks of ships, submarines, aircraft, and barges; sunken navigational equipment, such as buoys; man-made obstructions; and Indian tribe and Native Hawaiian marine resource gathering areas (e.g., traditional fishing, seaweed, mussel, abalone, clam-gathering grounds, and whaling areas). Research suggests that the sea level rose steadily from about 18,000 years ago to about 7,500 years ago, whereupon it reached present-day levels. PaleoIndian and Archaic period sites thus were submerged by the rising ocean. Many of these sites would not have been preserved as the encroaching ocean inundated, reworked, and redeposited sediments. In California, locations where PaleoIndian and Archaic period sites may have been preserved include: back barrier deposits or mainland shore deposits located behind large, nearshore islands, estuaries, and portions of coastal floodplains.

3.10.1.3.3.1 Hawaii

Human colonization of the Hawaiian Islands occurred after sea levels stabilized, so no sites are known to exist beyond the current coast lines. Traditional Hawaiian cultural resources may be located below the water surface, however, because of intentional placement or environmental factors such as erosion (Minerals Management Service 1990).

Archaeological evidence suggests that the first permanent settlements appeared in the Hawaiian Islands around approximately Anno Domini (A.D.) 300. Because the sea level had already stabilized by the time the Hawaiian Islands were first settled, no pre-contact submerged archaeological sites are found in Hawaii. Any submerged cultural resources are the result of natural erosion or modern/historical development.

European contact with the Hawaiian Islands occurred when Captain James Cook landed in Waimea Harbor in 1778. Kamehameha I united the Hawaiian Islands in 1818. Hawaii assumed importance in the east-west fur trade during this period, and later became the focal point for the Pacific whaling industry. Honolulu and Lahaina became the principal ports for the whaling fleet in Hawaii. By the 1840s, approximately 600 whaling vessels were arriving in Hawaii each year (Kelley 2006). Sunken vessels from this period may be located near the coasts of the Hawaiian Islands. Pearl Harbor became an import harbor in the late 19th century and, in 1887, the U.S. Senate allowed the Navy to lease Pearl Harbor. The harbor was dredged in the early 20th century to accommodate large vessels and, in 1908, Pearl Harbor Naval Shipyard was established. Unknown, sunken vessels associated with early 20th century Pearl Harbor may be present in the harbor.

3.10.1.3.3.2 Southern California

The Late Prehistoric Period along the coast of Southern California was characterized by elaborate artifact inventories and distinctive local cultural complexes that lasted until contact with Europeans (Sutton 2010). Artifacts from this period include circular fishhooks, whalebone markers, asphalt skirt weights, steatite ollas, shell beads, bone gorges, composite fishhooks, Cottonwood series projectile points, and spear points (Noah 1998, Sutton 2010). Evidence from numerous archaeological sites along the coast suggests an exploitation of bay and estuary kelp beds, rocky areas, and offshore environments. Bones from numerous species of fish and marine mammals have been recovered from middens. Coastal Late Prehistoric settlements were located near estuaries, along mouths of sloughs and rivers, and around bays, such as Mission Bay in San Diego. Prehistoric habitation sites are not commonly found outside of the inner continental shelf. During the Late Prehistoric Period, cultural traits associated with Kumeyaay, Luiseño, Cupeño, and Cahuilla peoples of the ethnographic period are found.

The maritime history along the west coast of the United States is a history of exploration, imperial competition, and commercial adventurism. The period of exploration began at least as early as the first Spanish voyages northward from Mexico in the 1530s, and by 1578 the British were encroaching on the Spanish monopoly along the coast of California. Undiscovered sunken vessels from early Spanish and British exploration, colonization, and trade may be present in coastal Southern California.

Prior to World War I, the Navy did not have strong presence in San Diego. By 1921, the Navy acquired a site for the U.S. Destroyer Base, San Diego facility. During the 1930s, San Diego harbor was dredged as a result of Public Works Administration projects, and San Clemente Island was purchased by the Navy as a firing range. The Navy base expanded considerably during World War II, with over 5,100 ships being serviced as a result of the war in the Pacific. Because of the importance of Naval Base San Diego and San Clemente Island Naval Auxiliary Landing Field, the region could contain sunken vessels that were associated with these facilities (Naval Base San Diego 2012).

3.10.2 Affected Environment

The Study Area is divided into three distinct regions for cultural resources evaluation: Southern California, Hawaii, and the open ocean Transit Corridor between them (see Figure 2.1-1). The Study Area covers 335,000 square nm (nm^2); however, only the regions that are located in the offshore waters of

Hawaii and Southern California are being evaluated. In the Hawaii Operating Area (OPAREA) (235,000 nm^2), a component of the Hawaii Range Complex, thousands of known wrecks, obstructions, occurrences, or sites marked as “unknown” have been recorded. In the Southern California (SOCAL) Range Complex, within the SOCAL OPAREA (120,000 nm^2) a few hundred such sites have been recorded. The Study Area could contain submerged prehistoric sites on the continental shelf.

3.10.2.1 Hawaii

3.10.2.1.1 Submerged Prehistoric Resources

A few submerged prehistoric resources are located in the waters surrounding the Hawaiian Islands. These resources primarily consist of old shoreline features, such as fishponds. Only a few of the approximately 100 fishponds remain that once existed along the shoreline surrounding Oahu.

3.10.2.1.2 Known Wrecks, Obstructions, Occurrences, or “Unknowns”

Thousands of submerged cultural resources lie in the open, deep waters surrounding the Hawaiian Islands. Typical among these resources are wrecks of World War II submarines and ships, commercial fishing vessels and tankers, and aircraft. Accurate counts of the number of shipwrecks surrounding the Hawaiian Islands are difficult, because Pacific Ocean currents are quick to destroy wrecks. The most likely types of shipwrecks to occur around the Hawaiian Islands are 19th century cargo ships, submarines, old whaling and merchant ships, fishing boats, 20th century U.S. Warships, and recreational craft. The *Automated Wreck and Obstruction Information System*, Region 16 (2010) records the approximate locations of some deep-water submerged shipwrecks.

A variety of submerged resources are located in the waters surrounding the Hawaiian Islands (U.S. Department of the Navy 2008a). The most common of these submerged resources are shipwrecks. However, junked motor vehicles, harbor features, and old shoreline features are also present. Figure 3.10-1 through Figure 3.10-3 illustrate offshore shipwrecks near the Hawaiian Islands. Shipwrecks located near the Island of Hawaii are concentrated along the northwestern coastline and within Hilo Bay. The numerous known wrecks in the waters surrounding Oahu include: the largely intact Sea Tiger, a World War II-era Japanese midget submarine; the *Mahi* a Navy minesweeper/cable layer intentionally sunk off the Waianae Coast to create an artificial reef; and the YO-257, a Navy yard oiler built in the 1940s, intentionally sunk off Waikiki to create an artificial reef. Because offshore shipwrecks are in relatively deep water and their locations are not precisely known, a figure illustrating offshore Hawaii shipwrecks is not presented in this document. Submerged resources in Pearl Harbor are discussed in Section 3.10.2.1.3.

3.10.2.1.3 Cultural Resources Eligible for Listing or Listed in the National Register

The data indicate that no shipwrecks in the State of Hawaii are listed in the National Register, excluding those at Naval Station Pearl Harbor. At Pearl Harbor, an abundance of submerged cultural resources are associated with World War II. Major shipwrecks include the *USS Arizona* and the *USS Utah*, both of which are listed in the National Register.

3.10.2.1.4 Cultural Resources Eligible for or Listed on the Hawaii Register

The Study Area contains no National Register-listed or -eligible sites.

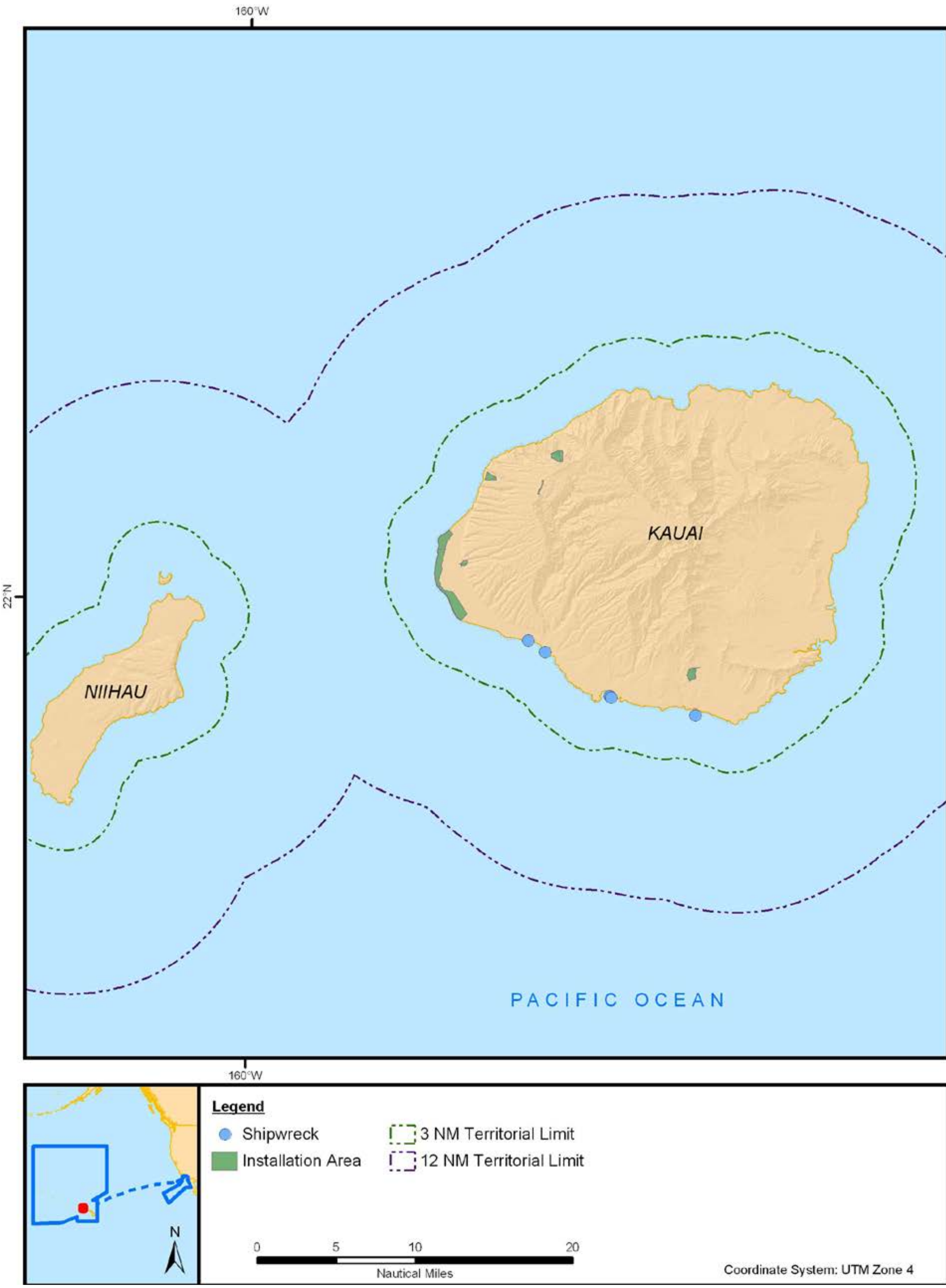

Figure 3.10-1: Kauai Submerged Shipwrecks

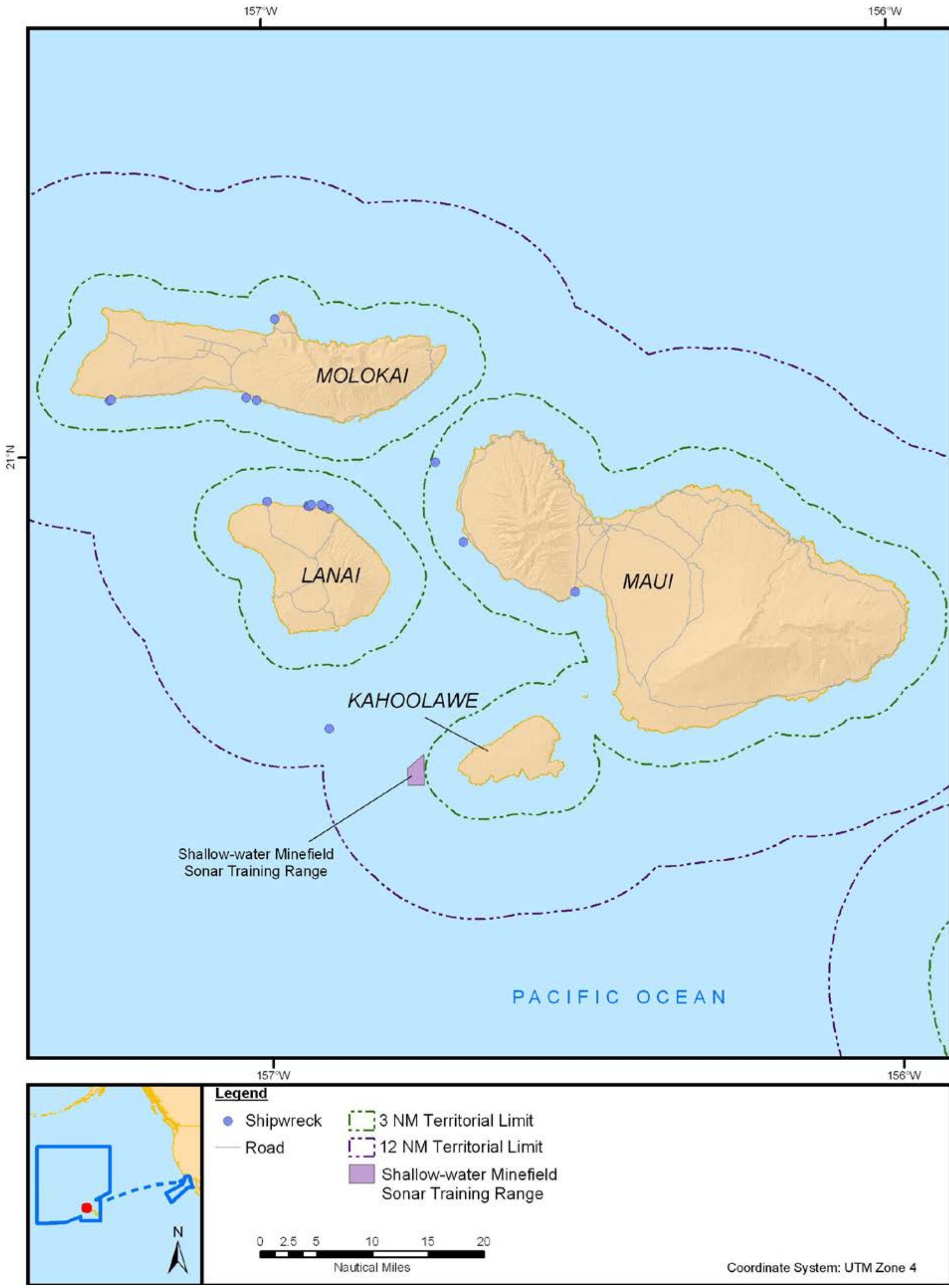

Figure 3.10-2: Molokai, Lanai, Maui, and Kahoolawe Submerged Shipwrecks

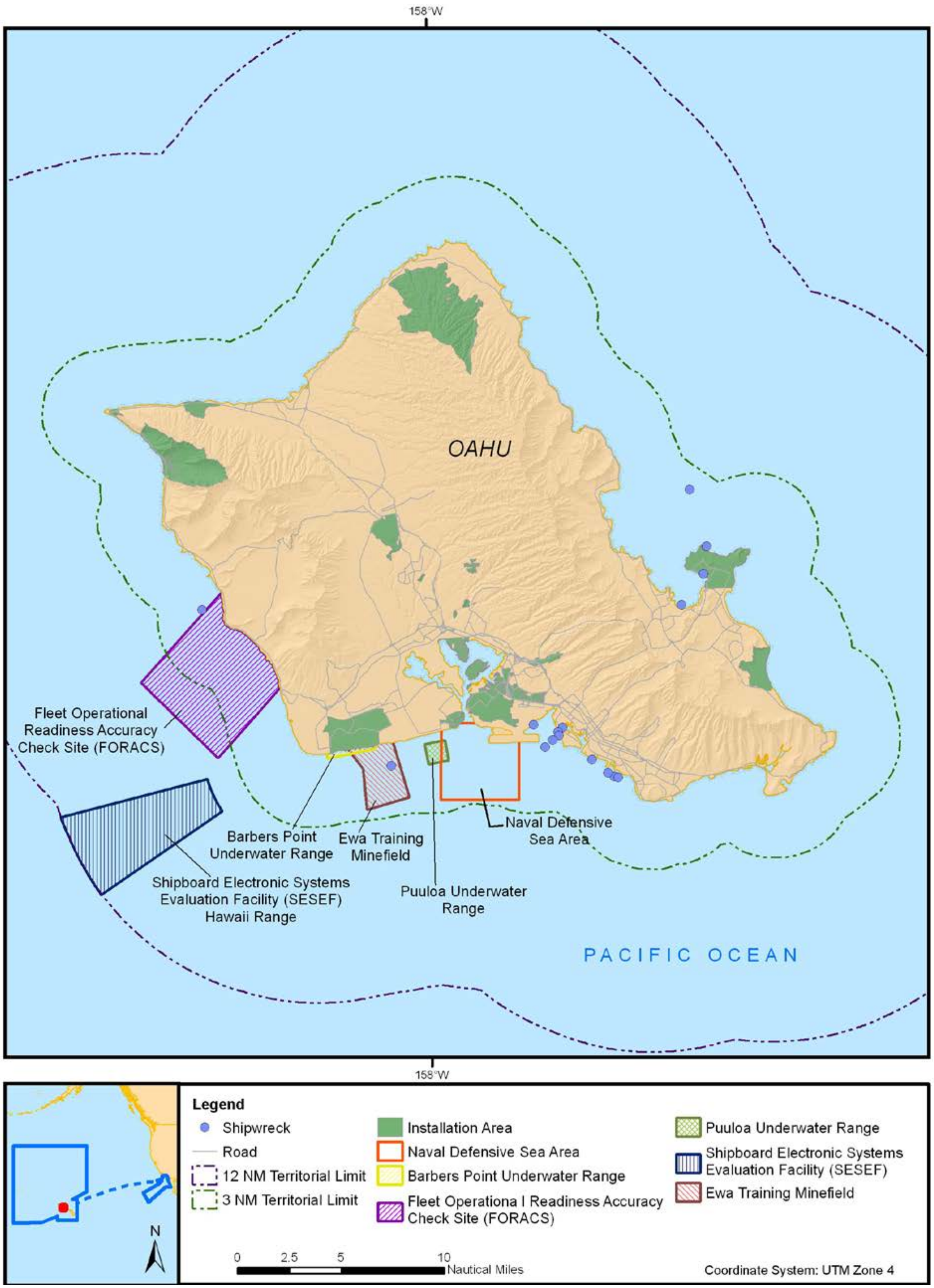

Figure 3.10-3: Oahu Submerged Shipwrecks

3.10.2.1.5 World Heritage Sites

The Hawaii region of the Study Area contains no World Heritage Sites. However, Papahanaumokuakea, a World Heritage Site, is adjacent to the Study Area and no activities related to the HSTT would occur near it.

3.10.2.1.6 Submerged Burial Sites and War Graves

Other than the *USS Arizona*, the Study Area contains no burial sites or war graves.

3.10.2.2 Southern California

3.10.2.2.1 Submerged Prehistoric Resources

PaleoIndian and Archaic period sites occur on the continental shelf off the coast of California. Approximately 110 submerged artifacts and sites from the Archaic period have been identified in Southern California (Masters 2003). However, they are located outside of Navy training and testing areas. Prehistoric cultural materials, such as stone bowls and mortars, are also common off the coast of San Diego County (Masters and Schneider 2000; Masters 2003). A concentration of this cultural material is located off La Jolla and Point Loma (Masters 2003).

3.10.2.2.2 Known Wrecks, Obstructions, Occurrences, or "Unknowns"

3.10.2.2.2.1 Offshore

From the early period of Spanish exploration to the intense commercialization of the 19th and 20th centuries, there has been a great variety of shipwrecks in the Pacific Ocean. The earliest known shipwreck was the Manila galleon *San Agustin* that sank off the northern coast of California in 1595. Since that time, thousands of vessels of varying types and descriptions have sunk off the coast of California. Various databases of these shipwrecks have been compiled, including the *Automated Wreck and Obstruction Information System* database (Automated Wreck and Obstruction Information System Database 2010). As part of a Minerals Management Service study (Minerals Management Service 1990), a database was compiled that documents 4,676 shipwrecks off the coast of California, with 876 wrecks in Southern California. The *Automated Wreck and Obstruction Information System* database (Automated Wreck and Obstruction Information System Database 2010) documents 292 wrecks just in San Diego, Orange, Los Angeles, and Ventura Counties.

Submerged cultural resources in the waters around San Clemente Island include pleasure craft, sport and commercial fishers, and cargo and military vessels (Department of the Navy 2008b). Of these 68 submerged cultural resources, 22 are within 12 nm of San Clemente Island and seven are beyond the territorial limit. Submerged aircraft are also reported off San Clemente Island. Figure 3.10-4 illustrates known submerged cultural resources near San Clemente Island.

The potential for long-term preservation of historic properties in the waters surrounding San Clemente Island is considered low, because the intertidal waters in the area create a high-energy environment that accelerates the decay of archaeological resources. Submerged cultural resources identified include 35 shipwrecks, 14 unknown or unidentified vessels, 17 aircraft, an anchor, and the abandoned Sea Lab.

3.10.2.2.2.2 Silver Strand Training Complex

On the bay side of Silver Strand peninsula, three shipwrecks are in or near the training beaches. Unnamed wrecks are recorded in shallow water at the northern end of Delta South beach, in the middle of San Diego Bay, and at the mouth of Fiddler's Cove. The ages and cultural value of these wrecks are not known (Department of the Navy 2008b).

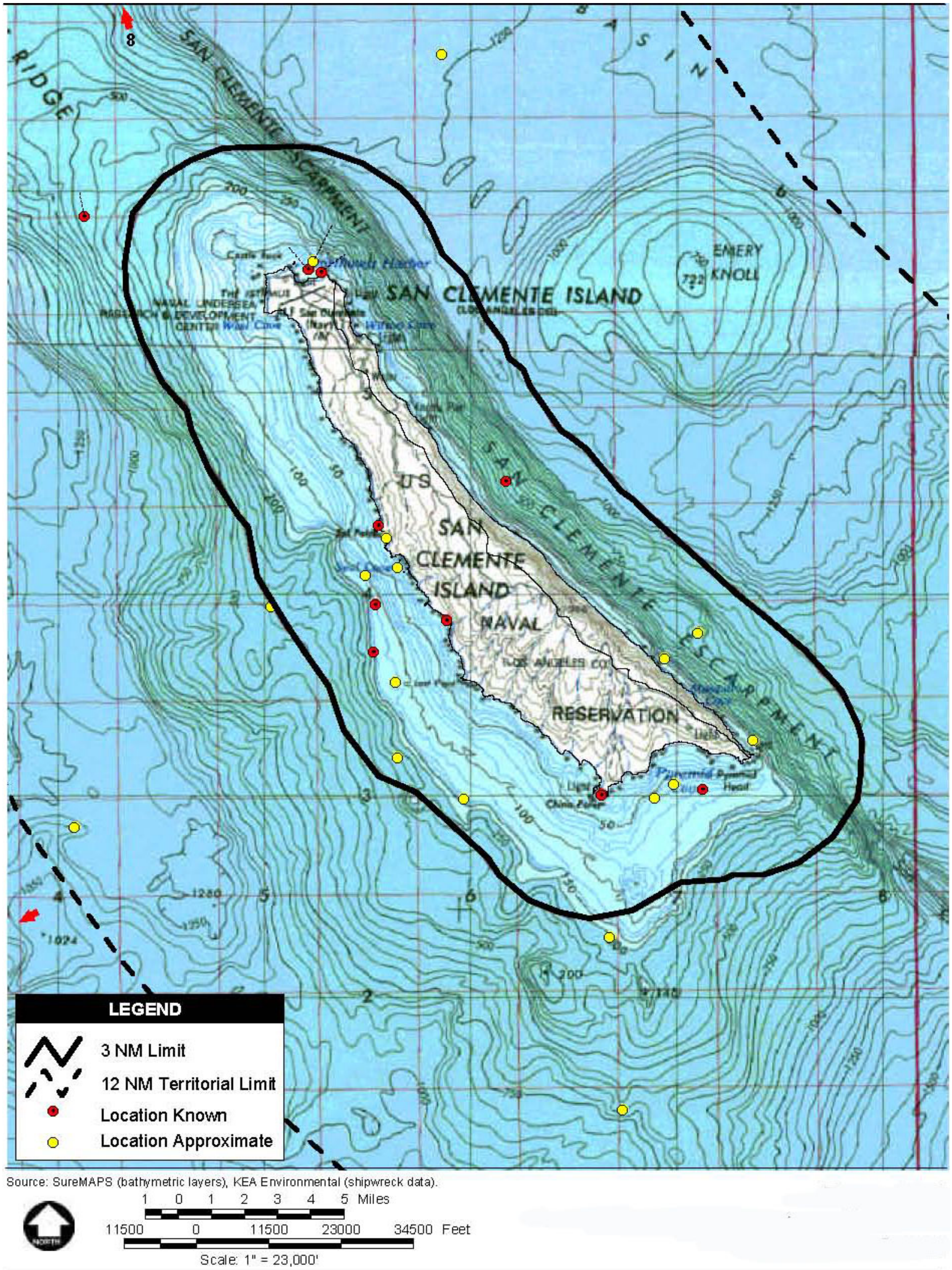

Figure 3.10-4: San Clemente Island Submerged Shipwrecks

On the ocean side of the peninsula, three shipwrecks are located near Silver Strand Training Complex (SSTC) training areas: the bark Narwhale (sank in 1934); the submarine S-142: and the Subchaser YC689 (sank in 1943). The destroyer *USS Hogan* (DD178), a military aircraft (S2F Tracker), and a sunken sailboat are located offshore, south of SSTC and west of the City of Imperial Beach (Figure 3.10-5) (Department of the Navy 2008b).

3.10.2.2.2.3 San Diego Bay

Known cultural resources in San Diego Bay have not been inventoried. However, cultural resources were reviewed for the San Diego Deepening at Tenth Avenue Marine Terminal project (EDAW 2005). This review identified three known submerged cultural features: a shipwreck (the *Della*), an 1887 marine utility cable, and a sunken Ford Model T. The EDAW study identified 24 cultural resources with unknown location, but known to be lost in the San Diego area, including schooners, barges, a submarine, clippers, gas and oil screws, a yacht, a bark, a ferry, a ship, and a steamer. Figure 3.10-5 illustrates known submerged cultural resources in San Diego Bay.

3.10.2.2.3 Cultural Resources Eligible for or Listed on the National Register

The Study Area contains no National Register-listed or -eligible sites.

3.10.2.2.4 Cultural Resources Eligible for or Listed on the California Register

The Study Area contains no California Register-listed or -eligible sites.

3.10.2.2.5 World Heritage Sites

The Study Area contains no World Heritage Sites.

3.10.2.2.6 Submerged Burial Sites and War Graves

The Study Area contains no burial sites or war graves.

3.10.2.3 Hawaii-Southern California Training and Testing Transit Corridor

The literature was not reviewed to identify cultural resources within the HSTT transit corridor. Waters along the HSTT transit corridor are deep, sometimes over 18,000 feet (ft.) (5,486.4 meters [m]); thus, identifying cultural resources on the ocean floor in the corridor is difficult. The HSTT transit corridor lies within Regions 12 and 16 of the *Automated Wreck and Obstruction Information System* database (Automated Wreck and Obstruction Information System Database 2010). Hundreds of shipwreck locations in this database were obtained from coordinates of the last known surface position of a vessel. An accurate shipwreck location on the ocean’s floor in this corridor would be difficult to verify within the database, because ocean currents would have influenced the initial resting places and subsequent movements of the vessels on the ocean’s floor.

3.10.2.4 Current Practices

The Navy routinely abides by standard operating procedures for avoiding submerged obstructions, including possible historic shipwrecks. Within waters of California and Hawaii, in the unlikely event that a previously unidentified shipwreck is encountered during a training or testing activity, the Navy ceases all activity near the shipwreck and notifies the State Historic Preservation Office or Hawaii State Historic Preservation Division of its location.

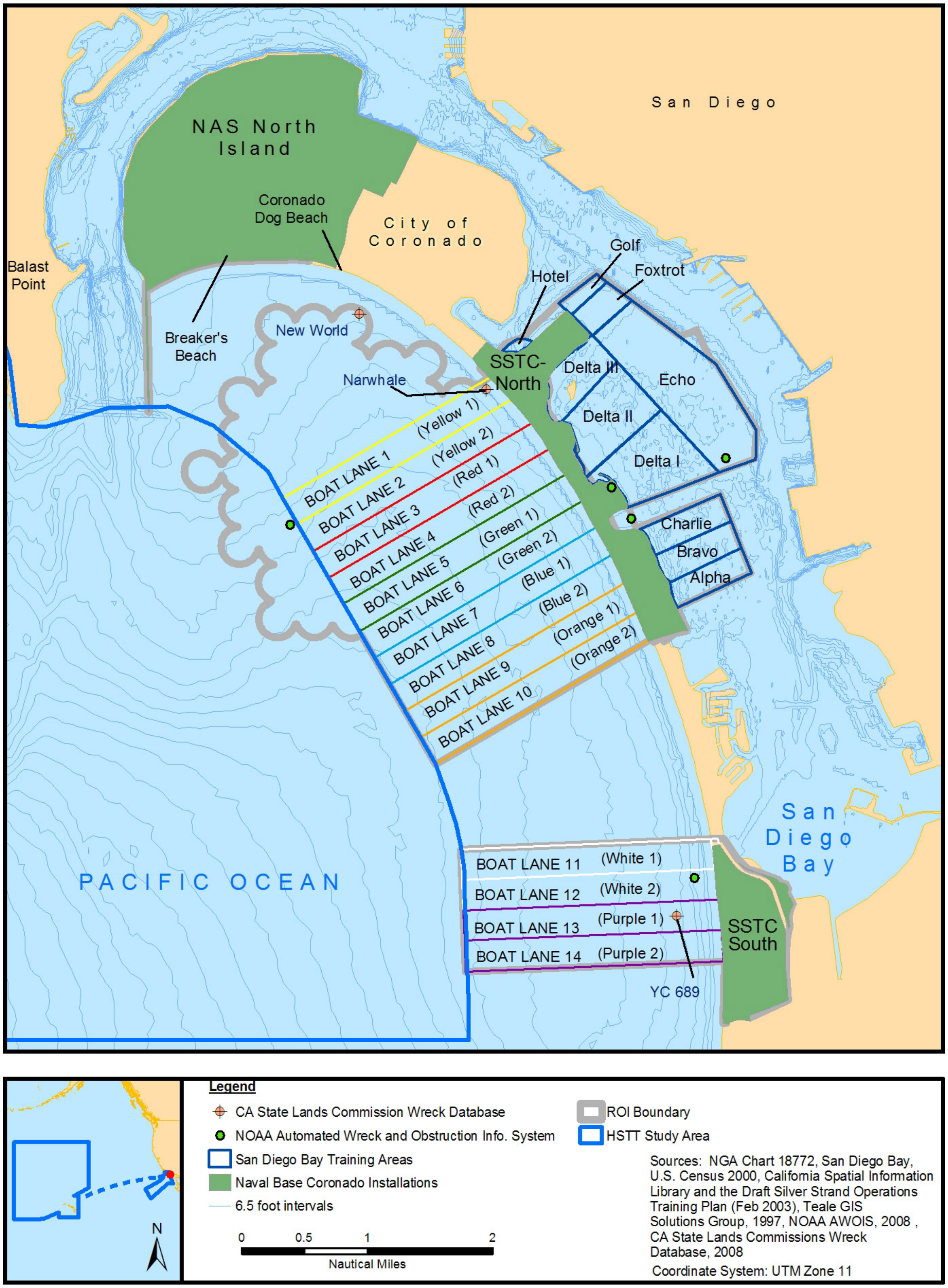

Figure 3.10-5: San Diego Bay and Silver Strand Training Complex Submerged Cultural Resources

The Programmatic Agreement among the Commander, Navy Region Hawaii, the Advisory Council, and the Hawaii State Historic Preservation Division (2003) includes protective measures to ensure that previously unidentified submerged cultural resources are adequately protected. The Programmatic Agreement stipulates, "If during the performance of an undertaking, historic properties, including submerged archaeological sites and traditional cultural properties, are discovered or unanticipated effects are found, or a previously unidentified property which may be eligible for listing on the National Register is discovered, Commander, Navy Region Hawaii would take all reasonable measures to avoid or minimize harm to the property until it concludes consultation with the State Historic Preservation Office and any Native Hawaiian organization, including Oahu Council of Hawaiian Civic Clubs, which has made known to Commander, Navy Region Hawaii that it attaches religious and cultural significance to the historic property."

Within the SOCAL Range Complex, a Programmatic Agreement was established to address only impacts on cultural resources on San Clemente Island. On the open ocean beyond San Clemente Island, the Navy abides by its standard operating procedures, as stated above.

3.10.3 ENVIRONMENTAL CONSEQUENCES

This section evaluates how and to what degree the activities described in Chapter 2 could impact cultural resources of the Study Area. Tables 2.8-1 through 2.8-5 present the baseline and proposed training and testing activity locations for each alternative (including numbers of events and ordnance expended). Appendix H describes the warfare areas and associated stressors that were considered for analysis of cultural resources. The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to cultural resources in the Study Area that are analyzed include:

- Acoustic Stressors
    - Impacts from explosives- shock (pressure) waves from underwater explosions
    - Impacts from explosives-cratering
    - Impacts from aircraft vibration from sonic booms
    - Impacts from pile-driving

- Physical Stressors
    - Impacts from vessels and in-water devices use of towed-in-water devices
    - Impacts from deposition of military expended materials
    - Impacts from seafloor devices

Sonar and other non impulsive sources do not affect the structural elements of historic shipwrecks and, therefore, an in-depth analysis of sonar impacts will not be included in this section. Archaeologists regularly use multi-beam sonar and side-scan sonar to explore shipwrecks without disturbing them. Based on the physics of underwater sound, the shipwreck would need to be very close (<22 ft. [<6.7 m]) to the sonar sound source for the shipwreck to experience any slight oscillations from the induced pressure waves. Any oscillations experienced at a depth of less than 22 ft. (6.7 m) would be negligible up to within a few yards from the sonar source. This distance is smaller than the typical safe navigation and operating depth for most sonar sources, and therefore is not expected to impact historic shipwrecks.

3.10.3.1 Acoustic Stressors

Acoustic stressors that could impact cultural resources are vibration and shock waves from underwater explosions. A shock wave and oscillating bubble pulses resulting from any kind of underwater explosion, such as explosive torpedoes, missiles, bombs, projectiles, mines, and certain sonobuoys and explosive sonobuoys, could impact the exposed portions of nearby submerged historic resources. Shock waves (pressure) generated by underwater explosions would be periodic rather than continuous, and could create overall structural instability and eventual collapse of architectural features of submerged historic resources. The amount of damage would depend on factors such as the size of the charge, the distance from the historic shipwreck, the water depth, and the topography of the ocean floor.

3.10.3.1.1 Impacts of Explosive Shock (pressure) Waves from Underwater Explosions

Anti-surface missiles and projectiles explode at or immediately below the ocean surface (within one meter). Shock waves (pressure) from these types of explosions within the water column would not reach historic resources on the ocean floor. Underwater detonations of improved extended echo ranging sonobuoys and high explosives would occur well below the surface and on or near the ocean bottom. Shock waves from nearby underwater detonations may affect the exposed portions of historic shipwrecks. These activities could damage nearby historic shipwrecks because of the properties that allow water to rapidly transmit shock waves. The amount of damage from an underwater explosion would depend on a number of factors, such as the size of the explosive charge, the distance from the historic shipwreck, and the topography of the seafloor.

Underwater explosions generating vibration and shock waves within the Study Area would have little impacts on known cultural resources because (1) known historic shipwrecks, obstructions, and archaeological sites are routinely avoided during training and testing and (2) most shipwrecks are located at substantial depths and they are distributed over large areas of the sea floor.

3.10.3.1.1.1 No Action Alternative

<u>Training</u>

Under the No Action Alternative, training activities would continue at current levels within existing designated areas within the OPAREAs in the offshore waters of Hawaii and Southern California. Consequently, no impacts on cultural resources are expected by underwater detonations at depth. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to Programmatic Agreements (PAs) that are already in place for existing training areas.

<u>Testing</u>

Under the No Action Alternative, testing activities would continue within existing designated areas within the OPAREA along the offshore waters of Hawaii and Southern California. Consequently, no impacts on cultural resources are expected by underwater detonations at depth. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing testing areas.

3.10.3.1.1.2 Alternative 1

Training

Under Alternative 1, the number of explosive round detonations (high explosions) would remain the same as the No Action Alternative. Training would continue in the same localities specified in current Hawaii Range Complex (HRC), SSTC, and SOCAL EIS documents. As a result, no impacts on cultural resources by underwater detonations at depth are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

Testing

Under Alternative 1, the number of high-explosive rounds detonated during testing activities would increase within the OPAREAs in the offshore waters of Hawaii and Southern California. Testing would continue in the same localities specified in current HRC, SSTC, and SOCAL EIS documents. As a result, no impacts on cultural resources by underwater detonations at depth are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing testing areas.

3.10.3.1.1.3 Alternative 2

Training

Under Alternative 2, the number of high-explosive rounds detonated would remain the same as under the No Action Alternative. Training would continue in the same localities specified in current HRC, SSTC, and SOCAL EIS documents. As a result, no impacts on cultural resources by underwater detonations at depth are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

Testing

Under Alternative 2, the numbers of high-explosive rounds detonated during testing activities would increase within the OPAREA along the offshore waters of Hawaii and Southern California. Testing would continue in the same localities specified in current HRC, SSTC, and SOCAL EIS documents. As a result, no impacts on cultural resources by underwater detonations at depth are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing testing areas.

3.10.3.1.2 Impacts from Explosives – Cratering

Underwater explosions at depth or on or near the ocean bottom could displace sediment and leave a crater. Cratering could affect submerged prehistoric sites and previously unidentified historic resources (e.g., shipwrecks) located at or near the point of detonation. Cratering of unconsolidated, soft-bottom habitats would result from Mine Neutralization charges set on or near the bottom. These relatively small (less than 60 pounds) charges are set on the sea floor by Navy divers in shallow waters. Cratering could disrupt the horizontal patterning and vertical stratigraphy of submerged prehistoric sites. Cratering could disrupt or destroy features of unidentified historic shipwrecks and unrecorded historic resources, and could subsequently destroy those characteristics that would make them eligible for listing on the National Register of Historic Places.

3.10.3.1.2.1 No Action Alternative

Training

Under the No Action Alternative, training activities would continue at current levels within existing designated areas. In Southern California, cratering would be associated with underwater detonations at San Clemente Island (Northwest Harbor, Horse Beach Cove, Kingfisher), Southern California Anti-Submarine Warfare Range, Shallow Water Training Range, Shallow Water Minefield, Camp Pendleton Amphibious Assault Area, and at SSTC (Boat Lanes 1-14, Breakers Beach, and Delta and Echo training areas). In Hawaii, cratering would be associated with underwater detonations at Puuloa Underwater Range, Marine Corps Base Hawaii, Marine Corps Training Area Bellows, Barbers Point Underwater Range, Naval Inactive Ship Maintenance Facility, Lima Landing, Kingfisher, Shallow Water Minefield, Sonar Training Area, and Ewa Training Minefield. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

Testing

Under the No Action Alternative, testing activities would continue at current levels within existing designated areas within the OPAREAs in the offshore waters of Hawaii and Southern California. Because submerged prehistoric sites have not been effectively identified on the continental shelf, cratering created by deep underwater explosions could disturb or damage previously unidentified artifacts on the sea floor and archaeological deposits buried in the ocean sediments. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing testing areas.

3.10.3.1.2.2 Alternative 1

Training

Under Alternative 1, the number of high explosive rounds associated with mine warfare training activities would increase within the OPAREA in the offshore waters of Hawaii and Southern California. Because submerged prehistoric sites have not been effectively identified on the continental shelf, cratering created by deep underwater explosions could disturb or damage previously unidentified artifacts on the sea floor and archaeological deposits buried in the ocean sediments. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

Testing

Under Alternative 1, the number of high explosive rounds associated with mine warfare activities would increase within the OPAREAs in the offshore waters of Hawaii and Southern California. Because submerged prehistoric sites have not been effectively identified on the continental shelf, cratering created by deep underwater explosions could disturb or damage previously unidentified artifacts on the sea floor and archaeological deposits buried in the ocean sediments. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing testing areas.

3.10.3.1.2.3 Alternative 2

Training

Under Alternative 2, the number of high explosive rounds associated with mine warfare activities would increase within the OPAREA along the offshore waters of Hawaii and Southern California. Because submerged prehistoric sites have not been effectively identified on the continental shelf, cratering created by deep underwater explosions could disturb or damage previously unidentified artifacts on the sea floor and archaeological deposits buried in the ocean sediments. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

Testing

Under Alternative 2, the number of high explosive rounds associated with mine warfare activities would increase within the OPAREA in the offshore waters of Hawaii and Southern California. Because submerged prehistoric sites have not been effectively identified on the continental shelf, cratering created by deep underwater explosions could disturb or damage previously unidentified artifacts on the sea floor and archaeological deposits buried in the ocean sediments. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing testing areas..

3.10.3.1.3 Impacts of Pile-Driving

3.10.3.1.3.1 No Action Alternative

Training

Under the No Action Alternative, training activities would continue at current levels within existing designated areas. In Southern California pile-driving for Elevated Causeway training at SSTC, would subject nearshore sediments to vibration, disruption, and compaction. Pile-driving would not occur in Hawaii. Elevated Causeway training at SSTC would occur only in the Oceanside Boat Lanes 1-10 and in the bayside Bravo training area. A bark (a three- or four-masted sailing vessel) built in 1883, the Narwhal, lies in Boat Lane 1, but the Navy would routinely avoid training near known submerged cultural resources. On the bayside of SSTC, sediments have been periodically dredged and the potential for encountering submerged historic resources that retain their integrity is low. Submerged historic resources at SSTC have not been comprehensively surveyed or evaluated; however, so unrecorded historic resources could be disturbed by pile-driving. Elevated Causeway training would occur up to four times per year in areas previously disturbed by pile-driving, so no substantial effects on undiscovered submerged historic resources are anticipated.

Testing

Pile-driving is not associated with any testing activities under the No Action Alternative.

3.10.3.1.3.2 Alternative 1

Training

Under Alternative 1, the number of Elevated Causeway training events would not increase relative to the No Action Alternative. Therefore, the potential for affecting undiscovered submerged historic resources would be the same as described under the No Action Alternative.

Testing

Pile-driving is not associated with any testing activities under Alternative 1.

3.10.3.1.3.3 Alternative 2

Training

Under Alternative 2, the number of Elevated Causeway training events would not increase relative to the No Action Alternative. Therefore, the potential for affecting undiscovered submerged historic resources would be the same as described under the No Action Alternative.

Testing

Pile-driving is not associated with any testing activities under Alternative 2.

3.10.3.1.4 Regulatory Conclusions for Acoustic Stressors

In accordance with Section 106 of the National Historic Preservation Act, acoustic stressors resulting from underwater explosions at depth during training and testing activities may affect previously unidentified submerged historic resources in U.S. territorial waters and in areas containing submerged resources protected by the Sunken Military Craft Act from under the No Action Alternative, Alternative 1, and Alternative 2. Both Alternative 1 and 2 would increase the annual number of underwater detonations. Depending on their locations, an increase in the number of activities could increase the probability of disturbing submerged cultural resources. Pile-driving for Elevated Causeway training at SSTC is not expected to affect submerged cultural resources.

3.10.3.2 Physical Disturbance and Strike Stressors

Any physical disturbance on the continental shelf and seafloor, such as ship anchoring, targets or mines resting on the seafloor, moored mines, bottom-mounted tripods, unmanned underwater vehicles, or bottom crawlers, could inadvertently damage or destroy submerged prehistoric sites and historic resources. A towed system and attachment cable or vessel strike could inadvertently encounter, snag, damage, or destroy submerged historic resources in shallow water. Expended materials such as chaff, flares, projectiles, casings, target or missile fragments, non-explosive practice munitions, rocket fragments, ballast weights, sonobuoys, torpedo launcher accessories, or mine shapes could be deposited on the ocean bottom on or near submerged prehistoric sites or historic resources. Heavier expended materials could damage intact fragile shipwreck features if they landed with velocity on a resource.

3.10.3.2.1 Impacts from Vessels and In-Water Devices

Use of a towed system and attachment cable could inadvertently encounter, snag, damage, or destroy historic shipwrecks, particularly those situated in relatively shallow water, and especially during low tide. Prior to deploying a towed device, the standard operating procedure is to search the intended path of the device for any floating debris (i.e., driftwood) or other potential surface obstructions, since they could damage the device.

3.10.3.2.1.1 No Action Alternative

Training

Under the No Action Alternative, training operations and major range events would continue at current levels within designated areas of the OPAREAs in the offshore waters of Hawaii and Southern California. No significant impacts on known cultural resources are expected from towed-in-water devices snagging and damaging historic shipwrecks within the Study Area because known obstructions, including historic shipwrecks and archaeological sites, are routinely avoided during training. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

Testing

Under the No Action Alternative, testing activities using towed-in-water devices would continue within existing designated areas of the OPAREAs in the offshore waters of Hawaii and Southern California. Because testing would continue in existing localities, as specified in the HCR, SSTC, and SOCAL EISs, no impacts on cultural resources are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing testing areas.

3.10.3.2.1.2 Alternative 1

Training

Under Alternative 1, the number of training activities using towed-in-water devices would increase in the OPAREAs in offshore waters of Hawaii and Southern California. Because training would continue in existing localities, as specified in the HCR, SSTC, and SOCAL EISs, no impacts on cultural resources are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

Testing

Under Alternative 1, the number of testing activities using towed-in-water devices would increase in the OPAREAs in the offshore waters of Hawaii and Southern California. Because training would continue in existing localities, as specified in the HCR, SSTC, and SOCAL EISs, no impacts on cultural resources are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

3.10.3.2.1.3 Alternative 2

Training

Under Alternative 2, the number of training activities using towed-in-water devices would increase in the OPAREAs in the offshore waters of Hawaii and Southern California. Because training would continue in existing localities, as specified in the HCR, SSTC, and SOCAL EISs, no impacts on cultural resources are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

Testing

Under Alternative 2, the number of testing activities using towed-in-water devices would increase in the OPAREAs in the offshore waters of Hawaii and Southern California. Because training would continue in existing localities, as specified in the HCR, SSTC, and SOCAL EISs, no impacts on cultural resources are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

3.10.3.2.2 Impacts from Seafloor Devices

Physical disturbances on the continental shelf and seafloor, such as precision anchoring, targets or mines resting on the ocean floor, moored mines, bottom-mounted tripods, bottom crawlers, or unmanned underwater vehicles, could damage or destroy submerged prehistoric sites or historic resources. Precision anchoring could crush or snag structural elements of historic resources and damage intact sediments of submerged prehistoric sites; however, this is highly unlikely. Divers are used to set bottom and moored mine anchors (blocks of concrete weighing several hundred pounds) in waters less than 150 ft. (45.7 m) deep and routinely avoid known obstructions, which include historic resources and any unrecorded obstructions they might encounter. Seafloor devices could disrupt the horizontal patterning and vertical stratigraphy of submerged prehistoric sites and historic resources, as well as damage structural elements of the historic resources through crushing and snagging.

3.10.3.2.2.1 No Action Alternative

Training

Under the No Action Alternative, training activities using seafloor deployed devices would continue at current levels in existing designated areas within the offshore waters of the Hawaii and Southern California OPAREAs. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

Testing

Under the No Action Alternative, testing activities using seafloor deployed devices would continue at current levels in existing designated areas in the offshore waters of the Hawaii and Southern California OPAREAs. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing testing areas

3.10.3.2.2.2 Alternative 1

Training

Under Alternative 1, the number of training activities using seafloor deployed devices would not increase in the offshore waters of the Hawaii and Southern California OPAREAs. Because training would continue in existing localities, as specified in the HCR, SSTC, and SOCAL EISs, no impacts on cultural resources are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

Testing

Under Alternative 1, testing activities would not increase in the offshore waters of the Hawaii and Southern California OPAREAs. Because testing would continue in existing localities, as specified in HCR, SSTC, and SOCAL EIS documents, no impacts on cultural resources are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing testing areas.

3.10.3.2.2.3 Alternative 2

Training

Under Alternative 2, the number of annual training activities using seafloor deployed devices would not increase within the offshore waters of the Hawaii and Southern California OPAREAs. Because training would continue in existing localities, as specified in the HCR, SSTC, and SOCAL EISs, no impacts on cultural resources are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

Testing

Under Alternative 2, testing activities would not increase in the offshore waters of the Hawaii and Southern California OPAREAs. Because testing would continue in existing localities, as specified in HCR, SSTC, and SOCAL EIS documents, no impacts on cultural resources are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to PAs that are already in place for existing training areas.

3.10.3.2.3 Impacts of Military Expended Materials

The deposition of non-explosive practice munitions, sonobuoys, and military expended materials other than ordnance could impact submerged cultural resources. The likelihood of these materials either impacting or landing on submerged cultural resources is very low because of the sizes of the regions.

Most of the anticipated expended munitions (e.g., large-caliber, non-explosive practice munitions) would be small objects and fragments that would slowly drift to the sea floor after striking the ocean surface. Larger and heavier objects (e.g., non-explosive practice munitions and ship hulks) could strike the ocean surface with velocity, but they would slow down as they moved through the water. These larger and heavier objects could impact a submerged prehistoric site by creating sediment and artifact displacement. A historic resource could be impacted by damaging structural elements and artifacts in the regions with higher cultural resources density.

If expended materials should sink near or on either type of submerged cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged prehistoric site or the historic resource that contribute to their eligibility for the National Register. The presence of expended materials on submerged sites would reflect post-depositional processes.

3.10.3.2.3.1 No Action Alternative

Training

Under the No Action Alternative, training activities would continue at current levels within existing designated areas within the OPAREA along the offshore waters of Hawaii and Southern California. Expended materials may be deposited on the ocean bottom on or near submerged prehistoric sites and known and previously unidentified historic resources. Because of the size of the Study Area, these materials likely would not contact a submerged prehistoric site or a historic resource. If they sink near either type of cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged prehistoric site or the historic resource.

Testing

Under the No Action Alternative, testing activities would continue at current levels within existing designated areas within the OPAREA along offshore waters of Hawaii and Southern California. Expended materials may be deposited on the ocean bottom on or near submerged prehistoric sites and known and previously unidentified historic resources. Because of the size of the Study Area, these materials likely would not contact a submerged prehistoric site or a historic resource. If they sink near either type of cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged prehistoric site or the historic resource.

3.10.3.2.3.2 Alternative 1

Training

Under Alternative 1, the number of expended items from training activities would increase within designated areas of the OPAREA along the offshore waters of Hawaii and Southern California (most of the expended items are small- to medium-sized caliber that are no larger than a roll of quarters). Expended materials could be deposited on the ocean bottom on or near submerged prehistoric sites and known and previously unidentified historic resources. However, these materials likely would not contact a submerged prehistoric site or a historic resource. If they sink near either type of cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged prehistoric site or the historic resource.

Testing

Under Alternative 1, the number of expended items from testing activities would increase within designated areas of the OPAREA along the offshore waters of Hawaii and Southern California (most of the expended items are small- to medium-sized caliber that are no larger than a roll of quarters). Expended materials could be deposited on the ocean bottom on or near submerged prehistoric sites and known and previously unidentified historic resources. However, these materials likely would not contact a submerged prehistoric site or a historic resource. If they should sink near either type of cultural resource, the expended materials would not affect the archaeological and historic characteristics of the submerged prehistoric site or the historic resource.

3.10.3.2.3.3 Alternative 2

Training

Under Alternative 2, the number of expended items from training activities would increase within designated areas of the OPAREA along the offshore waters of Hawaii and Southern California (most of the expended items are small- to medium-sized caliber that are no larger than a roll of quarters). Expended materials could be deposited on the ocean bottom on or near submerged prehistoric sites and known and previously unidentified historic resources. However, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. If they should sink near either type of cultural resource, the expended materials would not affect the archaeological or historic characteristics of the submerged prehistoric site or the historic resource.

Testing

Under Alternative 2, the number of expended items from testing activities would increase within designated areas of the OPAREA along the offshore waters of Hawaii and Southern California (most of the expended items are small- to medium-sized caliber that are no larger than a roll of quarters). Expended materials could be deposited on the ocean bottom on or near submerged prehistoric sites and known and previously unidentified historic resources. However, it is unlikely these materials would come into contact with a submerged prehistoric site or a historic resource. If they should sink near either type of cultural resource, the expended materials would not affect the archaeological and historic characteristics of the submerged prehistoric site or the historic resource.

3.10.3.2.4 Regulatory Conclusions for Physical Stressors

In accordance with Section 106 of the National Historic Preservation Act, physical stressors resulting from use of in water devices and seafloor devices during training and testing activities under the No Action Alternative, Alternative 1, or Alternative 2 may adversely affect unknown submerged prehistoric sites and unrecorded submerged historic resources in U.S. territorial waters and in areas containing submerged resources protected by the Sunken Military Craft Act. Both Alternative 1 and Alternative 2 would increase the number of training and testing activities. However, because training and testing would only occur in those portions of the Study Area previously identified in the HRC, SSTC, and SOCAL EISs, no impacts on cultural resources are anticipated.

3.10.3.3 Summary of Potential Impacts (Combined Impact of All Stressors) on Cultural Resources

3.10.3.3.1 No Action Alternative

Acoustic and physical stressors associated with training and testing activities could impact submerged cultural resources. Training and testing activities would continue in existing localities, as specified in the HRC, SSTC, and SOCAL EISs, however, so no impacts on cultural resources are expected. Although effects on underwater cultural resources are not anticipated, unknown underwater resources may be discovered. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to Programmatic Agreements (PAs) that are already in place for existing training areas.

3.10.3.3.2 Alternative 1

An increase in training and testing activities would occur under Alternative 1. Acoustic and physical stressors associated with training and testing activities could impact cultural resources. However, because training and testing would continue in existing localities, as specified in the HCR, SSTC, and SOCAL EISs, no impacts on cultural resources are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to Programmatic Agreements (PAs) that are already in place for existing training areas.

3.10.3.3.3 Alternative 2

An increase in training and testing activities would occur under Alternative 2. Acoustic and physical stressors associated with training and testing activities could impact cultural resources. However, because training and testing would continue in existing localities, as specified in the HCR, SSTC, and SOCAL EISs, no impacts on cultural resources are expected. Although effects on underwater cultural resources are not anticipated, the potential for the discovery of unknown underwater resources exists. To ensure that previously unknown submerged cultural resources are protected, the Navy would refer to Programmatic Agreements (PAs) that are already in place for existing training areas.

3.10.3.4 Regulatory Determinations

Table 3.10-1 summarizes the potential effects of the Proposed Action on submerged resources under the No Action Alternative, Alternative 1, and Alternative 2. The Proposed Action is not anticipated to affect known cultural resources within the Study Area, and Programmatic Agreements between the Navy and State Historic Preservation Offices exist to address the discovery of previously unknown resources. Accordingly, the Navy does not intend to formally consult with the California or Hawaii State Historic Preservation Office. Consultation could be required in the future under Section 106 of the

National Historic Preservation Act, however, to resolve any adverse effects on cultural resources anticipated to occur within state territorial waters (within 3 nm).

Table 3.10-1: Summary of Section 106 Effects of Training and Testing Activities on Cultural Resources

Alternative and Stressor	Section 106 Effects of Training and Testing Activities
No Action Alternative	
Acoustic Stressors	Acoustic stressors resulting from underwater explosions creating shock (pressure) waves and cratering of the sea floor could adversely affect unrecorded submerged historic resources. Training and testing would continue only in areas currently utilized for these activities. As a result, effects on cultural resources are not anticipated. Pile-driving is not expected to affect submerged prehistoric sites or unrecorded submerged historic resources.
Physical Stressors	Physical stressors resulting from use of towed-in water devices, and use of seafloor devices could adversely affect unknown submerged prehistoric sites and unrecorded submerged historic resources. Testing and training would continue only in areas currently utilized for these activities. As a result, effects on cultural resources are not anticipated. MEM is not expected to affect unknown submerged prehistoric sites or unrecorded submerged historic resources.
Alternative 1	
Acoustic Stressors	Acoustic stressors resulting from underwater explosions creating shock (pressure) waves and cratering of the seafloor could adversely affect unrecorded submerged historic resources. Testing and training would continue only in areas currently utilized for these activities. As a result, effects on cultural resources are not anticipated. Pile-driving is not expected to affect submerged prehistoric sites or unrecorded submerged historic resources.
Physical Stressors	Physical stressors resulting from use of towed-in water devices, and use of seafloor devices during training and testing activities could adversely affect unknown submerged prehistoric sites and unrecorded submerged historic resources. Testing and training would continue only in areas currently utilized for these activities. As a result, effects on cultural resources are not anticipated. MEM is not expected to affect unknown submerged prehistoric sites or unrecorded submerged historic resources.
Regulatory Determination	Alternative 1 contains increases in the number of training and testing activities. Depending on the location, an increase in the number of activities could increase the probability of disturbing submerged cultural resources. Adverse effects could occur to unknown submerged prehistoric sites and unrecorded submerged historic resources; however, testing and training would continue only in areas currently utilized for these activities. As a result, effects on cultural resources are not anticipated. If previously unknown submerged cultural resources are found, the Navy would refer to PAs that are already in place for existing training and testing areas.
Alternative 2	
Acoustic Stressors	Acoustic stressors resulting from underwater explosions creating shock (pressure) waves and cratering of the seafloor could adversely affect unrecorded submerged historic resources. Testing and training would continue only in areas currently utilized for these activities. As a result, effects on cultural resources are not anticipated. Pile-driving is not expected to affect unknown submerged prehistoric sites or unrecorded submerged historic resources.
Physical Stressors	Physical stressors resulting from use of towed-in water devices, and use of seafloor devices during training and testing activities could adversely affect unknown submerged prehistoric sites and unrecorded submerged historic resources. Testing and training would continue only in areas currently identified for these activities. As a result, effects on cultural resources are not anticipated. MEM is not expected to affect unknown submerged prehistoric sites or unrecorded submerged historic resources.
Regulatory Determination	Alternative 2 contains increases in the number of training and testing activities compared to the no action alternative. Depending on the location, an increase in the number of activities could increase the probability of disturbing submerged cultural resources. Adverse effects could occur to unknown submerged prehistoric sites and unrecorded submerged historic resources; however, testing and training would continue only in areas currently utilized for these activities. As a result, effects on cultural resources are not anticipated. If previously unknown submerged cultural resources are found, the Navy would refer to PAs that are already in place for existing training and testing areas.

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3.11 SOCIOECONOMIC RESOURCES

SOCIOECONOMIC RESOURCES SYNOPSIS

The United States Department of the Navy considered all potential stressors and the following have been analyzed for socioeconomic resources:

- Accessibility (limiting access to the ocean and the air)
- Physical disturbances and strikes (aircraft, vessels and in-water devices, military expended materials)
- Airborne acoustics (weapons firing, aircraft and vessel noise)
- Secondary stressors from changes to the availability of marine resources

Preferred Alternative

- Accessibility stressors are not expected to result in impacts on commercial transportation and shipping, commercial and recreational fishing, subsistence use, or tourism because inaccessibility to areas of co-use would be temporary and of short duration (hours).
- Physical disturbance and strikes are not expected to result in impacts on commercial and recreational fishing, subsistence use, or tourism because of the large size of the Study Area, the limited areas of operations, and implementation of the Navy's standard operating procedures.
- Airborne acoustic stressors are not expected to result in impacts to tourism or recreational activity because the Navy's training and testing would occur well out to sea, far from tourism and recreation locations.
- Secondary stressors are not expected to result in impacts to fishing, subsistence use, or tourism, based on the level of impacts described in other resources sections.

3.11.1 INTRODUCTION AND METHODS

This section provides an overview of the characteristics of socioeconomic resources in the Hawaii-Southern California Training and Testing (HSTT) Study Area (Study Area) and describes in general terms the methods used to analyze potential impacts on these resources from the Proposed Action.

The Council on Environmental Quality regulations implementing the National Environmental Policy Act (NEPA) state that when economic or social effects and natural or physical environmental effects are interrelated, the Environmental Impact Statement (EIS) will discuss these effects on the human environment (40 Code of Federal Regulations [C.F.R.] 1508.14). The Council on Environmental Quality regulations state that the "human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment." To the extent that the ongoing and proposed United States (U.S.) Department of the Navy (Navy) training and testing activities in the Study Area could affect the natural or physical environment, the socioeconomic analysis evaluates how elements of the human environment might be affected. The Navy identified four broad socioeconomic topics based on their association with human activities and livelihoods in the Study Area.

Each of these socioeconomic resources is an aspect of the human environment that involves economics (i.e., employment, income, or revenue) and social conditions (i.e., enjoyment and quality of life) associated with the marine environment of the Study Area. Therefore, this evaluation considered potential impacts on four topics:

- Commercial transportation and shipping
- Commercial and recreational fishing
- Subsistence Use
- Tourism

The baseline for identifying the socioeconomic conditions in the Study Area was derived using relevant published information from sources that included federal, state, regional and local government agencies and databases, academic institutions, conservation organizations, technical and professional organizations, and private groups. Previous environmental studies were also reviewed for relevant information.

The alternatives were evaluated based upon the potential for and the degree to which training and testing activities could impact socioeconomics. The potential for impacts depends on the likelihood that the testing and training activities would interface with public activities or infrastructure. Factors considered in the analysis include whether there would be temporal or spatial interfaces between the public or infrastructure and Navy testing and training. If there is potential for this interface, factors considered to estimate the degree to which an exposure could impact socioeconomics include whether there could be an impact on livelihood, quality of experience, resource availability, income, or employment. If there is no expected potential for the public to interface with an activity, the impacts would be considered negligible.

3.11.2 Affected Environment

The area of interest for assessing potential impacts on socioeconomic resources is the U.S. Territorial Waters of Hawaii and Southern California coasts (seaward of the mean high water line to 12 nautical miles [nm]). This section describes the four socioeconomic resources associated with human activities and livelihoods in the Study Area from shore to 12 nm from shore consistent with NEPA.

3.11.2.1 Transportation and Shipping

Current military and civilian use of the offshore sea and air areas is compatible, with Navy ships accounting for six percent of the total ship presence out to 200 nm (Mintz and Filadelfo 2011). The Navy conducts training and testing activities in operation areas away from commercially used waterways and inside (Mintz and Filadelfo 2011). The Navy conducts training and testing activities in OPAREAs away from commercially used waterways and within special use airspace. Notifications of potentially hazardous operations are communicated to all vessels and operators by use of Notices to Mariners, issued by the U.S. Coast Guard and Notices to Airmen, issued by the Federal Aviation Administration. The Department of Defense (DoD) also publishes separate Notices to Airmen about runway closures, missile launches, special traffic management procedures, and malfunction of navigational aids.

3.11.2.1.1 Ocean Traffic

Ocean traffic is the transit of commercial, private, or military vessels at sea, including submarines. The ocean traffic flow in congested waters, especially near coastlines, is controlled by the use of directional shipping lanes for large vessels, including cargo, container ships, and tankers. Traffic flow controls are also implemented to ensure that harbors and ports-of-entry remain as uncongested as possible. There is less control on open-ocean traffic involving recreational boating, sport fishing, commercial fishing, and activity by naval vessels. In most cases, the factors that govern shipping or boating traffic include the following: adequate depth of water, weather conditions (primarily affecting recreational vessels), availability of fish, and temperature. Higher air and water temperatures increase recreational boat traffic (e.g., sailing, power boating, windsurfing, kayaking and using jet skis) as well as diving activities. Recreational activities also fluctuate seasonally, with increased activity in summer when, along with warmer weather, there are more daylight hours and greater opportunity for recreational activities.

Areas of surface water within the Study Area are designated as danger zones and restricted areas as described in the C.F.R., Title 33 (Navigation and Navigable Waters), Part 334 (Danger Zone and Restricted Area Regulations) and established by the U.S. Army Corps of Engineers. Danger zones are areas used for target practice, bombing, rocket firing, or other especially hazardous training operations. A danger zone may be closed to the public full-time or on an intermittent basis, as stated in the regulations. A restricted area is designated for the purpose of prohibiting or limiting public access to an area. Restricted areas generally provide security for government property and protection to the public from risks of damage or injury arising from government activities occurring in the area (33 C.F.R. 334.2). Danger zones and restricted areas located within 12 nm from shore in the Study Area have the potential to impact the four socioeconomic resources identified above.

3.11.2.1.1.1 Hawaii Range Complex

Ocean shipping is a significant component to Hawaii's economy. Major inter-island ports include Honolulu, Barbers Point, Hilo, Kawaihae, and Kahului. The U.S. Army Corps of Engineers ranked 149 U.S. ports by cargo volume in 2009. Based on those rankings, Barbers Point (Oahu) ranked 48th in total trade (domestic and foreign) with over 9.6 million tons of imports and exports. Other ranked cities in Hawaii were Honolulu at 49th, Kahului at 96th, Kawaihae at 125th, Hilo at 126th, and Nawiliwili (Kauai) at 130 (Table 3.11-1). The top ranked port was South Louisiana (New Orleans) with foreign and domestic imports and exports totaling over 212 milling tons (Association of Port Authorities 2009).

Shipping routes around the Hawaiian Islands are shown in Figure 3.11-1.

Table 3.11-1: United States Port Rankings by Cargo Volume for Hawaii Ports in 2009

Port Name	Total Trade Rank (Domestic and Foreign)	Total Foreign Trade	Total Domestic Trade
Barbers Point, Oahu	48th	35th	101st
Honolulu, Oahu	49th	81st	31st
Kahului, Maui	96th	113th	74th
Kawaihae Harbor, Hawaii	125th	130th	105th
Hilo, Hawaii	126th	116th	106th
Hawiliwili, Kauai	130th	118th	108th

Source: (Association of Port Authorities 2009)

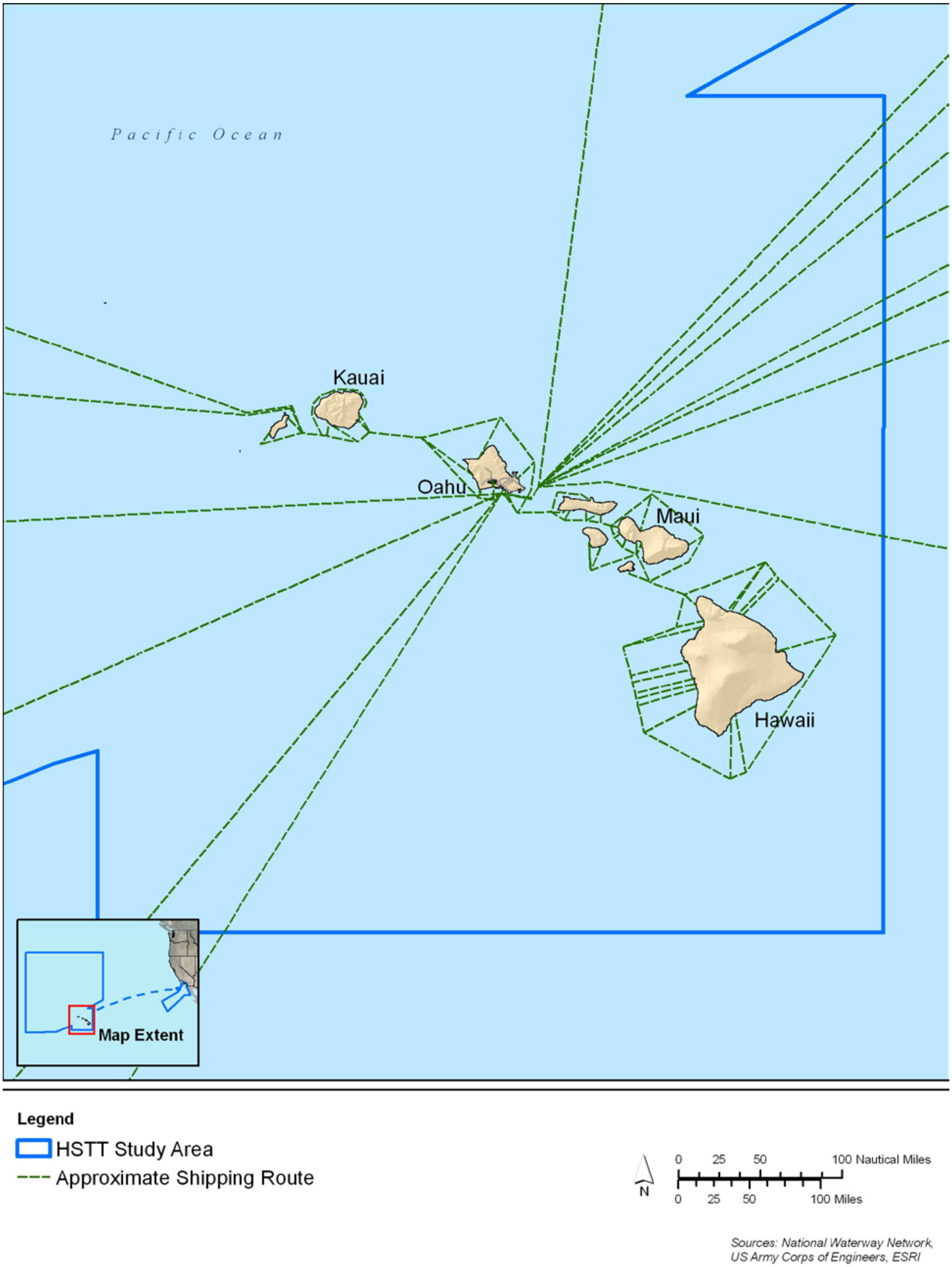

Figure 3.11-1: Hawaiian Islands Shipping Routes

3.11.2.1.1.2 Southern California Range Complex and Silver Strand Training Complex

Ocean shipping is a significant component of the Southern California regional economy. Key ports in Southern California include Los Angeles, Long Beach, and, to a lesser degree, Port Hueneme and San Diego. Of 149 U.S. ports evaluated by the U.S. Army Corps of Engineers, Los Angeles and Long Beach ranked fourth and ninth, respectively, in total trade (measured in tons) in 2009 (the most recent year data are available); Port Hueneme ranked 118th and San Diego ranked 123rd (Intermodal Association of North America 2008; Association of Port Authorities 2009)(Table 3.11-2). Total trade at Long Beach exceeded 72 million tons of foreign and domestic imports and exports. Total trade at Los Angles was over 58 million tons.

Table 3.11-2: United States Port Rankings by Cargo Volume for Southern California Ports in 2009

Port Name	Total Trade Rank (Domestic and Foreign)	Total Foreign Trade	Total Domestic Trade
Long Beach	4th	4th	20th
Los Angeles	9th	5th	38th
Port Hueneme	118th	71st	142nd
San Diego	123rd	76th	139th

Source: (Association of Port Authorities 2009)

A significant amount of ocean traffic, consisting of both large and small vessels, transits through the Southern California (SOCAL) Range Complex. For instance, there was an annual average of over 1,200 commercial ship transits into and out of the Port of San Diego between 2007 and 2010 (San Diego Unified Port District 2011). For commercial vessels, the major transoceanic routes to the southwest pass north and south of San Clemente Island (Figure 3.11-2).

The approach and departure routes into San Diego and the ports of Los Angeles-Long Beach Harbor pass to the east of San Clemente Island and Santa Catalina Island. Naval vessels operate within and transit through the SOCAL Range Complex. The location of San Clemente Island creates a separation zone within the SOCAL Range Complex. Most vessels entering or leaving the ports of Los Angeles or Long Beach travel northwest through the Santa Barbara Channel, west just south of the northern Channel Islands, or south along the coast to San Diego, the Panama Canal, or South America.

Shipping to and from the south includes an inshore route to the east of San Clemente Island within the SOCAL Range Complex. Ships traveling between Los Angeles/Long Beach and Hawaii via the most direct route pass to the north of the SOCAL Range Complex. Vessels coming or going from the Port of San Diego generally travel along shipping routes north or south near the coast, which includes inshore waters of the SOCAL Range Complex but bypass San Clemente Island to the east. Another commercial shipping route extends from the Port of San Diego to Japan and the eastern Pacific crossing the SOCAL Range Complex just south of San Clemente Island.

Recreational traffic is typically found within a mile from shore and rarely found in the outer waters, shipping lanes, or near San Clemente Island, with the exception of recreational fishing (i.e., charter) vessels traveling to deeper water. Within the SOCAL Range Complex, fishing is centered primarily around San Clemente Island and secondarily in the shallower waters over the Tanner and Cortes Banks. Because those banks are inherently more hazardous, the nearshore waters of San Clemente Island are a more popular destination than the more remote banks.

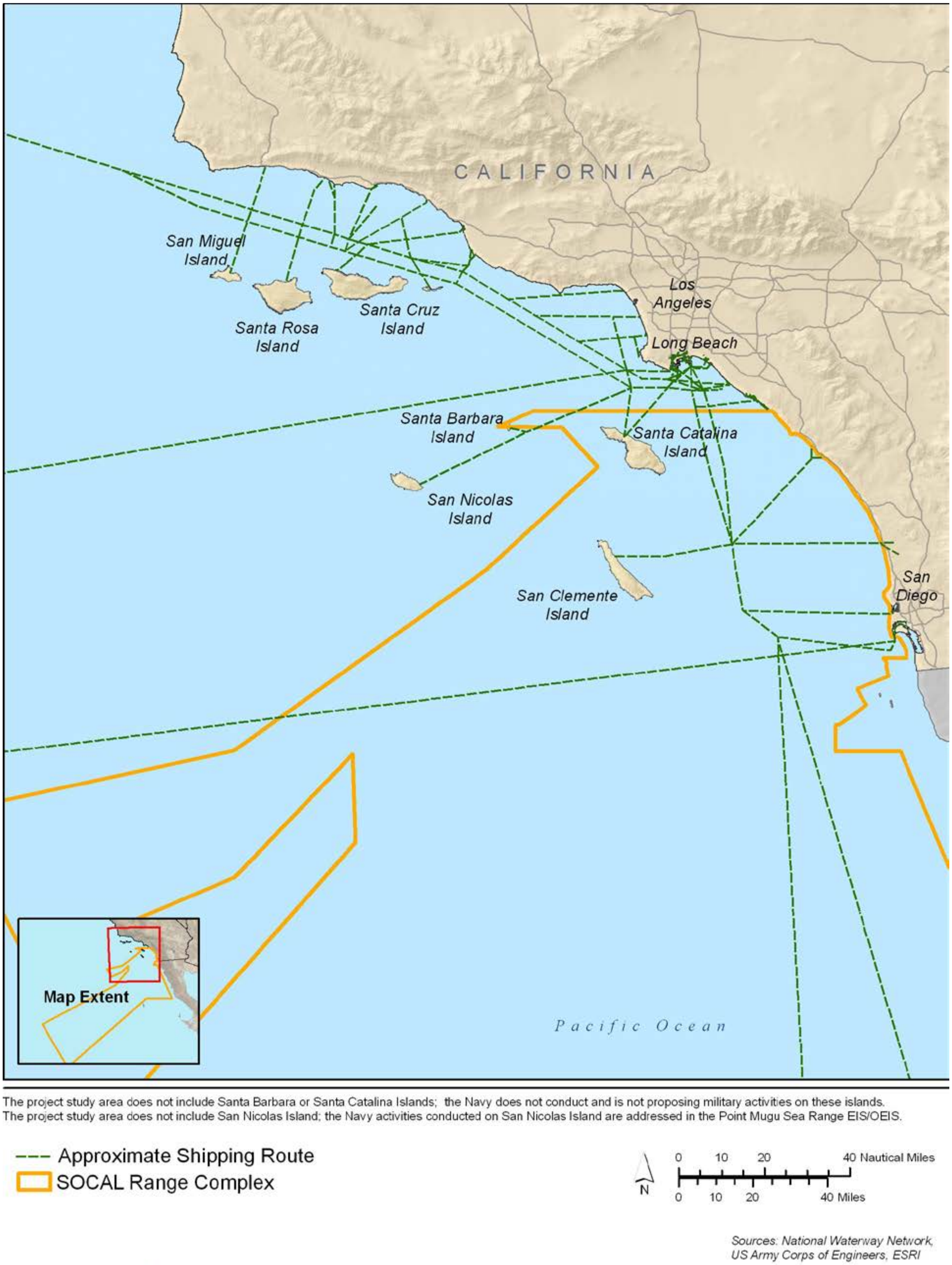

Figure 3.11-2: Southern California Range Complex Shipping Routes

Marine traffic in the Silver Strand Training Complex (SSTC) region consists of vessels transiting to multiple marinas, mooring locations, commercial ports, fishing harbors, and military installations. San Diego Bay is bordered by the cities of San Diego, National City, Chula Vista, Imperial Beach, and Coronado. The SSTC Boat Lanes located on the ocean side of the SSTC are commonly used by sportfishing charters, baitfishing to support sportfishing, lobster fishing, and competition sailing regattas. Access to San Diego Bay by incoming vessels is through the mouth of the harbor to the north, or through the many marinas and boat launch facilities located along the perimeter of the Bay.

3.11.2.1.1.3 Transit Corridor

Major commercial shipping vessels use the transit corridor for shipping goods between Southern California and Hawaii because it is the shortest distance between these two points (Figure 2.1-1). Vessels using this corridor are outside of military training areas and typically follow all U.S. Coast Guard maritime regulations. The Navy also uses this corridor for training and testing activities while en route between Southern California and Hawaii.

3.11.2.1.2 Air Traffic

Air traffic refers to movements of aircraft through airspace (Figure 3.11-3). Safety and security factors dictate that use of airspace and control of air traffic be closely regulated. Accordingly, regulations applicable to all aircraft are promulgated by the Federal Aviation Administration to define permissible uses of designated airspace, and to control that use. These regulations are intended to accommodate the various categories of aviation, whether military, commercial, or general aviation.

The system of airspace designation uses various definitions and classifications of airspace in order to facilitate control. Airspace is categorized generally as either “controlled” airspace or “uncontrolled” airspace. Controlled airspace is further organized into several difference classes of airspace distinguished by altitude range, use (e.g., commercial or military), and proximity to a major airport. Controlled airspace means that services supporting aircraft flying under Instrument Flight Rules are available. Such services include air-to-ground radio communication, navigational aids, and air traffic control services for maintaining separation between aircraft. Controlled airspace does not mean that all flights are controlled by air traffic control.

Special use airspace consists of both controlled and uncontrolled airspace and has defined dimensions where flight and other activities are confined because of their nature and the need to restrict or prohibit non-participating aircraft for safety reasons. Special use airspace are established under procedures outlined in 14 C.F.R. Part 73.1. The majority of special use airspace is established for military flight activities and, with the exception of prohibited areas (e.g., over the White House) may be used for commercial or general aviation when not reserved for military activities. There are multiple types of special use airspace, including prohibited, restricted, warning, alert, and military operations areas (FAA 2009). One type of special use airspace, of particular relevance to the Study Area, is a warning area, which is defined in 14 C.F.R. Part 1 as follows:

> “A warning area is airspace of defined dimensions, extending from 3 nm outward from the coast of the United States that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both.”

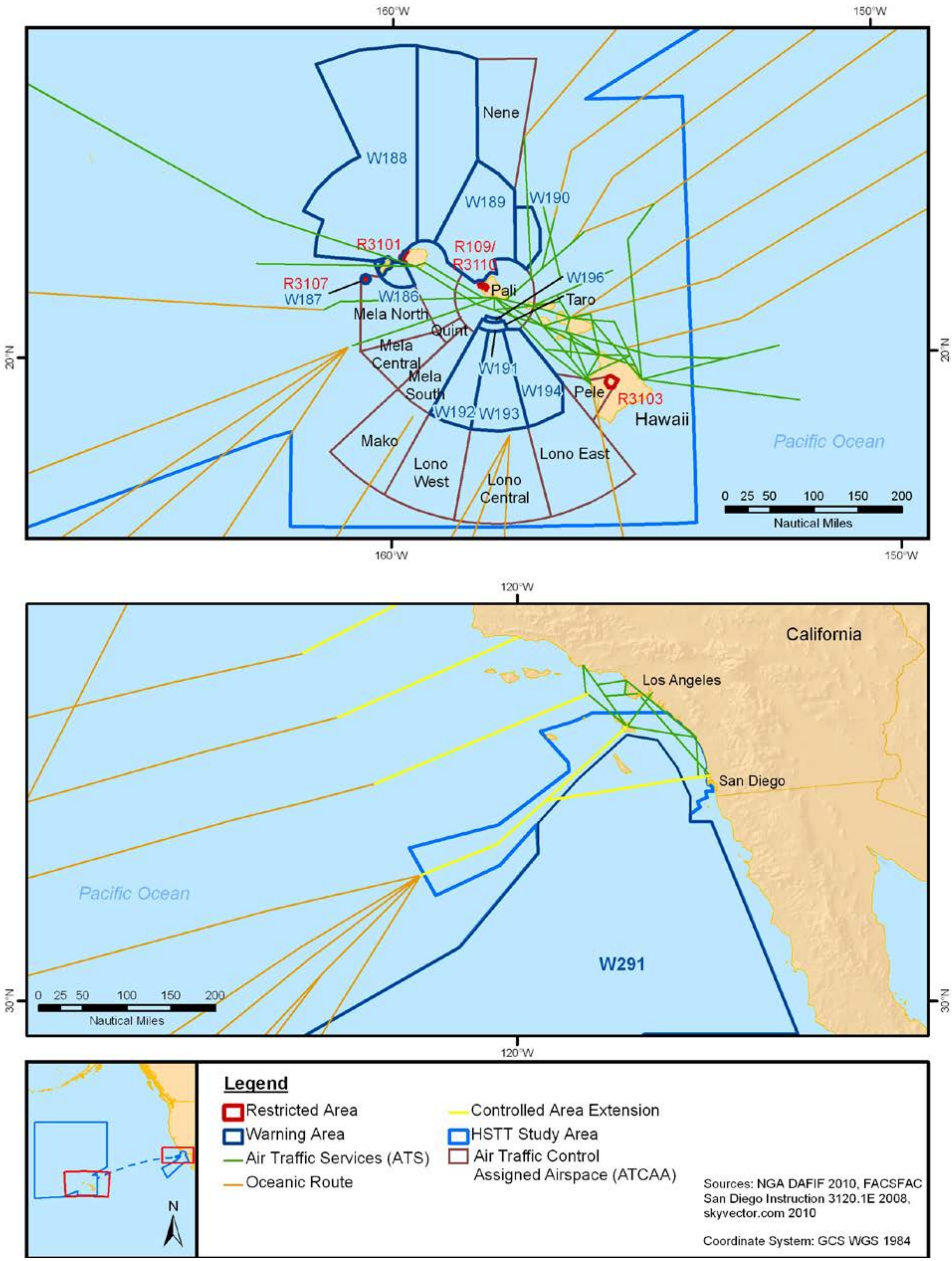

Figure 3.11-3: Air Traffic Routes in the Study Area, Hawaii Range Complex (top) and Southern California Range Complex (bottom)

Warning areas are established to contain a variety of hazardous aircraft and non-aircraft activities, such as aerial gunnery, air and surface missile firings, bombing, aircraft carrier operations, surface and subsurface operations, and naval gunfire. When these activities are conducted in international airspace, the Federal Aviation Administration regulations may warn against, but do not have the authority to prohibit, flight by nonparticipating aircraft. A restricted area, such as Restricted Area 3107 (R-3107), is a type of special use airspace within which nonmilitary flight activities are closely restricted.

3.11.2.1.2.1 Hawaii Range Complex

Military Air Transit

The special use airspace in the region of influence (Figure 3.11-3) consists of W-188 and R-3101 north and west of Kauai, and W-186 southwest of Kauai, controlled by Pacific Missile Range Facility. Warning Areas 188 Rainbow, W-189 and W-190 north of Oahu, W-187 and R-3107 surrounding Kaula, and W-191, W-192, W-193, W-194, and W-196 south of Oahu are scheduled through the Navy Fleet Area Control and Surveillance Facility Pearl Harbor, which then coordinates with the Honolulu Combined Facility. There are also 12 Air Traffic Control Assigned Airspace areas within the Hawaii Range Complex (HRC). These Air Traffic Control Assigned Airspace areas provide additional controlled airspace adjacent to and between the warning areas.

Commercial and General Aviation

Most of the airspace within the region of influence is in international airspace, and air traffic is managed by the Honolulu Control Facility. The Honolulu Control Facility includes the Air Route Traffic Control Center, the Honolulu Control Tower, and the Combined Radar Approach Control collocated in a single facility. Airspace outside that managed by the Hawaii Combined Facility is managed by the Oakland Air Route Traffic Control Center.

The airspace within the HRC has several en route high-altitude jet routes, as shown on Figure 3.11-2. Most of the oceanic routes enter the HRC from the northeast and southwest and are generally outside the special use airspace warning areas described above. The Air Traffic Services routes are concentrated along the Hawaiian islands chain. Most of the open-ocean area region of influence is well removed from the jet routes that crisscross the north Pacific Ocean.

3.11.2.1.2.2 Southern California Range Complex

Military Air Transit

The SOCAL Range Complex contains three warning areas (W): W-290, W-291, and a small portion of W-289. Each extends from the surface to 80,000 ft. (24,384 m) above mean sea level (Figure 3.11-4). All three warning areas can be activated by the Federal Aviation Administration at the Navy's request when operations that would pose a hazard to nonparticipating aircraft. are being conducted. Other special use airspace within W-291 includes nine Tactical Maneuvering Areas and two Missile Ranges.

Military pilots travel under an Instrument Flight Rules from local air bases until they reach W-291 and proceed under a Visual Flight Rules to their instructed tactical maneuvering areas or missile range operating area (OPAREA). Activation by the Federal Aviation Administration is performed by notifying the controlling air traffic agency of the change in status in the area. This allows the agency to issue notices to pilots to alter their courses to avoid military activities.

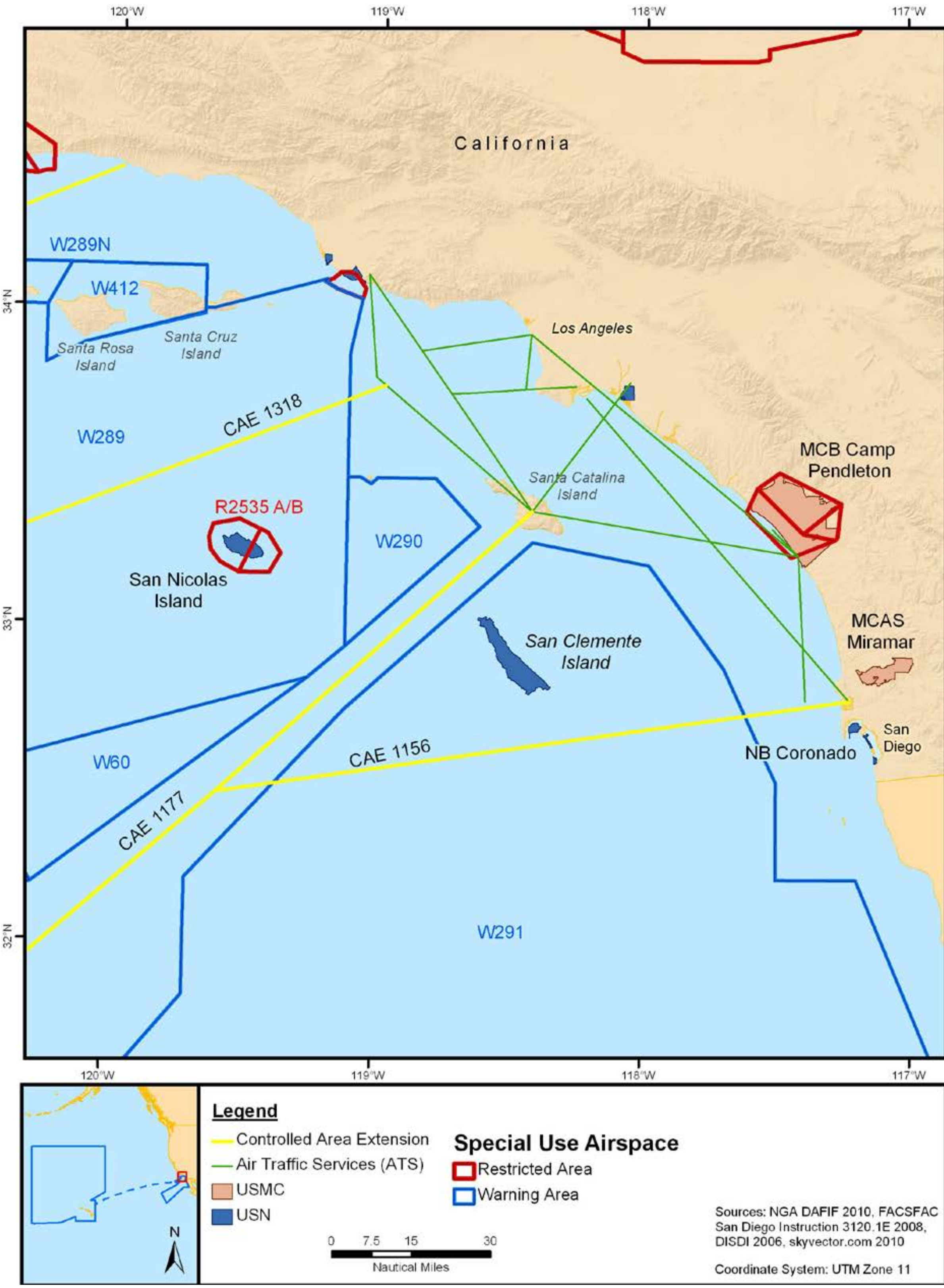

Figure 3.11-4: Southern California Offshore Airspace

In the Fleet Area Control and Surveillance Facility San Diego annual utilization report for fiscal year 2010, there were 36,194 air operations in W-291, exclusive of air operations that utilize the Naval Auxiliary Landing Field at San Clemente Island (see below). During fiscal year 2010, W-291 airspace was released to the controlling agency, Los Angeles Air Route Traffic Control Center, for 619 hours of public use.

The Study Area off the coast of Southern California contains a restricted area over San Nicolas Island, R-2535 A/B, which is located within the Pt. Mugu Sea Range. Other types of special use airspace are found within the SOCAL Range Complex OPAREAs including missile ranges and tactical maneuvering areas.

The Naval Auxiliary Landing Field at San Clemente Island is located within W-291 airspace. To support the safe and efficient air traffic movement to/from Naval Auxiliary Landing Field San Clemente Island, Class D airspace has been established. Class D airspace is airspace tailored to the specific needs of the airport to ensure separation between aircraft. The airspace above San Clemente Island consists of a five nautical mile (nine kilometer) radius circle centered on Fleet Area Control and Surveillance Facility San Clemente Island and includes the airspace from the surface to 2,700 ft. (823 m) mean sea level. All aircraft entering this airspace, or operating within it, must maintain radio contact with the Fleet Area Control and Surveillance Facility San Clemente Island control tower. An aircraft operation at Fleet Area Control and Surveillance Facility San Clemente Island is defined as an aircraft event that involves a takeoff, landing, low approach to the airfield, or touch-and-go landing. Thus, a single sortie from the airfield could generate several reportable "operations." The baseline level of airfield operations at Fleet Area Control and Surveillance Facility is 25,120 operations.

Commercial and General Aviation

Aircraft operating under Visual Flight Rules can fly along the coast between San Diego and Orange County and out to Santa Catalina Island largely unconstrained, except by safety requirements and mandated traffic flow requirements. Aircraft operating under Instrument Flight Rules clearances, authorized by the Federal Aviation Administration, normally fly on the airway route structures. In Southern California, these routes include both high and low altitude routes between San Diego and Los Angeles and to Santa Catalina Island. There are two control area extensions from Southern California through nearby W-291 to facilitate easier access to air routes out to Hawaii and other transpacific locations. These routes allow general aviation and commercial air travel to coexist with military operations. Control area extension 1177 extends from Santa Catalina Island southwest between W-291 and the Pt. Mugu Sea Range. Control area extension 1156 extends west from San Diego through the northern portion of W-291. When W-291 is active, control area extension 1156 is normally closed. Control area extension 1177, the more important route through the coastal warning areas, is closed only when weapons hazard patterns extend into the area, and this closure is fully coordinated with the Federal Aviation Administration. When W-291 is active, aircraft on Instrument Flight Rules clearances are precluded from entering W-291 by the Federal Aviation Administration. However, since W-291 is located entirely over international waters, nonparticipating aircraft operating under Visual Flight Rules are not prohibited from entering the area. Examples of aircraft flights of this nature include light aircraft, fish spotters, and whale watchers, which occur under Visual Flight Rules throughout W-291 on a variable basis.

3.11.2.1.2.3 Silver Strand Training Complex

Military Air Transit

Military overflights generated for SSTC activities are based out of Naval Air Station North Island and Navy Outlying Landing Field Imperial Beach. The airspace over both facilities is classified as Class D airspace defined by a five nautical miles (nine kilometers) radius and extending to 2,800 ft (853 m) over Naval Air Station North Island and to 1,500 ft (457 m) over Navy Outlying Landing Field Imperial Beach. The two airspace extend over the SSTC and much of San Diego Bay and the surrounding area. These airspace are under Navy control, and air operations in support of SSTC training, including helicopter insertions and extractions, and parachute drops into designated drop zones must comply with the Air Operations Manual. Flight paths servicing nearby San Diego Airport are geographically separate from helicopter sorties bound for SSTC training areas and approach and departure patterns for fixed wing aircraft into Naval Air Station North Island.

Commercial and General Aviation

Commercial and general aviation air traffic is controlled by the San Diego Air Route Traffic Control Center. Flight paths servicing San Diego Airport located to the North of Naval Air Station North Island are geographically separate from helicopter sorties traveling to SSTC training areas and approach and departure patterns for fixed wing aircraft into Naval Air Station North Island.

3.11.2.1.2.4 Transit Corridor

There are numerous commercial air routes over the transit corridor between Southern California and Hawaii. Commercial aircraft typically fly above 30,000 ft. (9,144 m) in this area. These air routes are controlled by the Federal Aviation Administration.

3.11.2.2 Commercial and Recreational Fishing

Commercial fishing takes place throughout the Study Area from nearshore waters adjacent to the mainland and offshore islands, to the offshore banks and waters within the transit area. Many different types of fishing gear are used by commercial and recreational fishermen in the Study Area, such as gillnets, longline gear, troll gear, trawls, seines, traps or pots, and hook and line.

3.11.2.2.1.1 Hawaii Range Complex

The data that individual fisherman report on commercial fishing reports are confidential, protected by Hawaii state law (189-3, Hawaii Revised Statutes), and can only be released to the public in summarized form. Table 3.11-3 shows that commercial landings for all fisheries from 2006-2010 in Hawaiian waters totaled 140,142,310 lb. Based on the catch data presented in Table 3.11-3, the total value of reported commercial landings for all accounted species in Hawaii from 2006-2010 was $381,742,062 (National Marine Fisheries Service 2011).

Hawaii does not collect data on non-commercial marine fishing consistently, although occasional surveys have been conducted. In 2001, NMFS and the Hawaii Division of Aquatic Resources began collecting data on recreational fishing in Hawaii using the Marine Recreational Fishing Survey. Results of the survey are reported through the Marine Recreational Fishery Statistics Survey website, which has been reporting similar data for other coastal states since 1979. Hawaii does not have a mandatory recreational marine fishing license as many other coastal states do, and does not have mandatory reporting of recreational catches (National Marine Fisheries Service and Hawaii Division of Aquatic Resources 2010). Fishing destinations vary in response to changing fishing conditions, and many charter boats fish HRC waters on a routine basis. Sport fishermen pursue various fish species with hook and line; some divers also spearfish or take invertebrates by hand within the Hawaii nearshore waters.

Table 3.11-3: Total Commercial Landings (Pounds) and Total Value (Dollars) within the Hawaii Range Complex (2006-2010)

Major Species and Species Group		Total Catch 2006-2010 (lb)
Fish	Tuna (yellowfin, skipjack, bluefin, albacore, etc.)	81,749,.277
	Billfish (blue marlin, striped marlin, swordfish)	25,616,726
	Bottomfish (opakapaka, onaga, uku)	1,522,474
	Other Pelagic Fish (mahimahi and wahoo)	10,433,429
	All Other Fish	20,774,305
	Total Fish	**140,096,211**
Invertebrates	Spiny Lobster	45,046
	Saltwater Shrimp	1,053
Totals	**Total Invertebrates**	**46,099**
	Combined Total	**140,142,310**

Source: (National Marine Fisheries Service 2011; Pacific Islands Fisheries Science Center 2011; National Marine Fisheries Service 2012)

Nearshore target fish species include akule, opelu, ta'ape, snapper, moana, weke, ulua, menpachi, o'ie, and bonefish. Longer charters target species typically found father offshore, such as mahi mahi, ono, ahi, swordfish, tuna, and marlin (blue, black, striped). Although, many of these species are caught relatively close to shore (within three nautical miles), because water depth increases dramatically only a short distance from shore creating habitat attract to many pelagic species. In many areas, such as off Kona, fishing takes place year round. Tournaments held off of Oahu, Maui, and Kona occur from February through early November; however, most tournaments are scheduled between June and August (Sportfish Hawaii 2008).

The U.S. Fish and Wildlife Service conducts a telephone survey every five years to estimate the total numbers of fishermen and hunters in each state. On average, in 1995, about 260,000 people fished recreationally in Hawaii, of which about half were residents. The estimated 130,000 Hawaii residents who fish recreationally far outnumber the 3,500+ licensed commercial fishermen in Hawaii (National Marine Fisheries Service and Hawaii Division of Aquatic Resources 2010).

State and federal agencies protect a variety of marine areas in Hawaii; fisheries have improved as a result. These areas include Marine Life Conservation Districts, Fisheries Management Areas, Fisheries Replenishment Areas, Bottomfish Restricted Fishing Areas, Hawaii Marine Laboratory Refuge-Coconut Island, Kahoolawe Island Reserve, Paiko Lagoon Wildlife Sanctuary, Ahihi-Kinau Natural Area Reserve, South Kona Opelu Fishing Area, the Hawaiian Islands Humpback Whale National Marine Sanctuary, and the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (Friedlander, Aeby et al. 2004).

3.11.2.2.1.2 Southern California Range Complex and Silver Strand Training Complex

The California Department of Fish and Game maintains commercial catch block data for waters in the northern part of W-291 (Section 3.9, Fish), and all statements referring to catch are for that part of the Study Area for which data are available. For 2009, the most commonly harvested commercial species in the SOCAL Range Complex were tuna, Pacific sardine, swordfish, lobster, crab, squid, and other invertebrates (Table 3.11-4). During 2009, the SOCAL Range Complex OPAREAs accounted for 10 percent of all California fish landings and 10 percent of invertebrate landings. In 2006 and 2007, SOCAL Range Complex OPAREAs accounted for 14.8 and 18.3 percent of all fish landings, respectively and 26 and 3.4 percent of all invertebrates and crustaceans, respectively for California waters.

Table 3.11-4: Annual Commercial Landing of Fish and Invertebrates and Value within the SOCAL Range Complex and Silver Strand Training Complex (2010)

Major Species and Species Group		Annual 2010 Catch (lb)	Value ($)
Fish	Tuna (yellowfin, bluefin, and albacore)	340,624	$1,277,340
	Pacific Sardine	61,351,111	$3,334,365
	Swordfish	100,458	$477,810
	All Other Fish	6,830,864	$33,138,957
	Total Fish	**68,623,057**	**$38,228,472**
Invertebrates	Lobster	254,230	$4,012,453
	Crab	239,439	$239,439
	Other Crustaceans (shrimp and prawn)	119,550	$869,407
	Sea Urchins	1,594,877	$1,748,600
	Squid	118,089,552	$29,522,388
	Other Invertebrates	208,136	$481,977
Totals	**Total Invertebrates**	**120,505,784**	**$36,874,264**
	Combined Total	**189,128,841**	**$75,102,736**

Source: (California Department of Fish and Game 2010)

In the SOCAL Range Complex, groundfishes (e.g., flatfishes, skates, sharks, chimeras, rockfishes) are important recreational and commercial species. Highly migratory species (e.g., tuna, billfish, sharks, dolphinfish, and swordfish) and coastal pelagic species such as anchovies, mackerel, sardines, and squid also support extensive fisheries in the area. The harvest of coastal pelagic species is one of the largest fisheries in the SOCAL Range Complex in terms of landed biomass and volume, as well as revenue (California Department of Fish and Game 2010). In 2010, California ranked fourth in the nation for commercial fisheries landings (measured in pounds) (National Marine Fisheries Service 2011). For recreational fisheries, California ranked 14th in the nation in landings of finfish (bony and cartilaginous fish that use fins for locomotion).

Pelagic, flatfish, demersal fish, and other fish associated with the ocean bottom account for about 50 percent of the average annual catch of fish within the Study Area OPAREAs (Table 3.11-4). Pelagic species encompass the majority of the commercial portion of the average annual pound of catch. The average annual catch of pelagic, flatfish, demersal, and all other fish amounts to 36,951,285 pounds (lb.) (16,760,818 kilograms [kg]) and $8,152,845. The Pacific sardine fishery is one of the most valuable fisheries among the coastal pelagic finfish in California, with the majority of the fish landed in SOCAL and Ensenada (California Department of Fish and Game 2005).

The average annual catch of crustaceans is comprised of approximately half lobster (377,607 lb. [171,279.6 kg] per year) and half crab and shrimp (average 340,845 lb. [154,604.7 kg] per year). The catch of crustaceans in the SOCAL Range Complex OPAREAs was worth approximately $5,870,208 in

2009. In comparison, total commercial landings of squid in 2009 were worth approximately $12,046,298 and urchins were worth about $1,005,857. Red sea urchins are the most commonly harvested invertebrate species within the SOCAL OPAREA. Other invertebrates (e.g., snails, sea cucumbers, sea stars, whelks) were worth about $290,569 in 2009 (Table 3.11-4)(California Department of Fish and Game 2009).

Fishing activities occur at varying degrees of intensity and duration throughout the year within the SOCAL Range Complex. Fishermen often fish for more than one species and land their catch in various ports depending on the season in order to maximize their economic return. Key commercial fishing ports in Southern California include Los Angeles and San Diego, with numerous smaller ports and harbors located between these major port complexes. A wide range of commercial fishing methods are used in this region that are fishery-specific such as drift gillnets, longline gear, troll gear, trawls, seining, and traps or pots (Naval Undersea Warfare Center 2009).

The SOCAL Range Complex marine environments are popular locations for recreational fishing. Charter and privately operated boats enter the SOCAL Range Complex and San Clemente Island waters for salt-water sport fishing, recreational diving, and other boating activities. Commercial passenger fishing vessels, more commonly target fish further offshore compared to private boats, due to the high cost of private large boat ownership, the capability of the larger vessels to go farther, and the greater experience of professional captains. Recreational fishing and diving are centered primarily around San Clemente Island and secondarily in the shallower waters over Tanner and Cortes banks. These banks are inherently more hazardous due to their distance from shore and open-ocean diving conditions. Therefore, the near shore waters off San Clemente Island are a more popular destination than the more remote banks. Commercial passenger fishing vessels usually perform full-day trips, and some charter boats occasionally may spend nights at sea (Naval Undersea Warfare Center 2009). More than 200 Commercial passenger fishing vessels operate between Point Conception and the U.S./Mexican border (California Marine Life Protection Act Initiative 2009). These vessels operate from ports including San Diego, Oceanside, Dana Point, Newport Beach, Long Beach, Los Angeles, and from other locations all along the coast.

Major sport fish species include albacore and yellowfin tuna, shallow water rockfish (*Sebastes* spp.), yellowtail rockfish (*Sebastes flavidus*), kelp bass (*Paralabrax clathratus*), yellowtail (*Seriola lalandi*), California sheephead (*Semicossyphus pulcher*), ocean whitefish (*Caulolatilus princeps*), dolphin (*Coryphaena hippurus*), marlin (*Tetrapturus audax*), barracuda (*Sphyraena argentea*), swordfish (*Xiphias gladius*) and lingcod (*Opiodon elongatus*) (Naval Undersea Warfare Center 2009). Sport fishermen fish for bluefin tuna, yellowfin tuna, yellowtail rockfish, and rock cod (*Sebastes* spp.) in the vicinity of the offshore islands and on Tanner and Cortes banks (Naval Undersea Warfare Center 2009). Halibut (*Paralichthys californicus*) and white seabass (*Atractoscion nobilis*) are fished in sand channels and kelp beds around San Clemente Island.

Fishing destinations are generally fluid, in response to changing fishing conditions, but a number of charter boats fish waters of the SOCAL Range Complex on a routine basis. Sport fishermen pursue various fish species with almost exclusively rod and reel gear (hook and line); some divers also spearfish or take invertebrates (mainly lobster) by hand within the SOCAL Range Complex. The recreational fishing season is dependent on oceanographic conditions and generally occurs in late spring through the fall (Naval Undersea Warfare Center 2009).

3.11.2.2.1.3 Transit Corridor

There are no data on commercial or recreational fishing within the transit corridor area because of the distance from land.

3.11.2.3 Subsistence Use

The U.S. Environmental Protection Agency considers subsistence fishers to be people who rely on noncommercial fish as a major source of protein. Subsistence fishers tend to consume noncommercial fish and/or shellfish at higher rates than other fishing populations, and for a greater percentage of the year, because of cultural and/or economic factors. There are very few studies in the United States that have focused specifically on subsistence fishers. The United States has issued no regulations to determine what or who would be considered a subsistence fisher. In addition, in the United States, there are no particular criteria or thresholds (such as income level or frequency of fishing) that definitively describe subsistence fishers. The U.S. Environmental Protection Agency issued guidance to state that at least 10 percent of licensed fishers in any area will be subsistence fishers (U.S. Environmental Protection Agency 2011). Because the 10 percent estimate is not based on actual subsistence fishing data, the number may overestimate or underestimate the number. U.S. Environmental Protection Agency (2011)suggests that Native Americans, lower income urban populations, and Asian-Americans are often subsistence fishers (Gassel, Brodberg et al. 1997). Therefore, an increased number of individuals below the poverty rate or an increased percentage of population classified as Native American or Asian may indicate an area with a higher amount of subsistence fishers.

Low-income populations would have limited means and opportunity to travel offshore to federal waters (i.e., beyond 3 nm from shore) for fishing. Nearshore waters surrounding the city of Coronado and the Silver Strand Training Complex provide fishing opportunities in San Diego Bay and along the Pacific coast of the peninsula. A variety of fish are caught mainly by hook and line from beaches, piers, and small boats (USA Today 2012). Thus, it is assumed that the majority of subsistence fishing would occur in waters close to the coastline. Inshore fishing usually occurs within sight of the shoreline in bays, flats, and marshes or under piers, bridges, or near the jetties where water is generally less than 100 ft. (30.5 m) deep. Boats used by subsistence fishers are generally smaller and more affordable.

3.11.2.3.1.1 Hawaii Range Complex

There have been no comprehensive surveys of subsistence-fishing activities in Hawaii and economic surveys have been episodic. Therefore, there is limited information from which to fully assess the subsistence fishing contribution to island economies, but the value of fishing for subsistence by contemporary Native Hawaiians is known to be an important component of some communities, particularly rural communities (Pooley 1993). However, it is believed that offshore recreational and subsistence catch is likely equal to or greater than the offshore commercial fisheries catch, with more species taken using a wider range of fishing gear (Friedlander, Aeby et al. 2004).

3.11.2.3.1.2 Southern California Range Complex and Silver Strand Training Complex

In Southern California, people fish off piers and in local bays, harbors, and waterways for regular subsistence rather than for recreation. In Los Angeles County, where a high cost of living and low incomes have produced food insecurity among certain populations, subsistence fishing is more and more common. Although the economic value of subsistence fisheries may often be low, they may be critical for the livelihoods of many communities.

3.11.2.3.1.3 Transit Corridor

It is assumed that there is limited to no subsistence fishing activity within the Transit Corridor because of the distance from land to the Transit Corridor and because the majority of subsistence use occurs nearshore.

3.11.2.4 Tourism

Coastal tourism and recreation can be defined as the full range of tourism, leisure, and recreationally oriented activities that take place in the coastal zone and the offshore coastal waters. These activities include coastal tourism development (hotels, resorts, restaurants, food industry, vacation homes, second homes, etc.), and the infrastructure supporting coastal development (retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, recreational fishing facilities, etc.). Also included is ecotourism (e.g. whale watching) and recreational activities such as recreational boating, cruises, swimming, recreational fishing, surfing, snorkeling, and diving (National Oceanic Atmospheric Administration 1998).

3.11.2.4.1.1 Hawaii Range Complex

Navy vessels present on the waters of the HRC represent a small fraction of the overall commercial and recreational boat traffic and, correspondingly, account for only a small fraction of the potentially restrictive circumstances present in the open-ocean area around Hawaii.

The waters surrounding the main Hawaiian Islands are used for a variety of recreational, commercial, scientific, transportation, cultural, and institutional purposes. The intensity of use generally declines with increasing distance from shore, although specific resources in the open-ocean area may result in a concentration of use (e.g., seamounts are preferred fishing and diving locations). Offshore areas that are shielded by landmasses from the full force of wind and waves, such as the channels between Maui and adjacent islands, are preferred areas for recreational boating and diving. In addition, there are numerous beaches and parks throughout the islands (Figure 3.11-5 through Figure 3.11-7).

Recreational fishing in Hawaii is very important economically with anglers spending over $755 million on trip and durable expenditures in 2006. This level of expenditures generated $253.6 million in income, supported 7,000 jobs, and generated $105.0 million in government revenue in2006 (Gentner 2009). Tourism, and by extension recreational fishing by tourists, varies seasonally. Additionally, the country or region of origin (e.g., U.S. west coast, U.S. east coast, Japan, etc.) of the tourists varies seasonally, influencing the types of activities in which tourists participate (Hawai'i Tourism Authority 2010). Surfing can also be found in the nearshore areas of all the Hawaiian Islands depending on the seasonal swell direction. Swells typically approach from the north in the winter months and from the south in the summer.

Humpback whale watching around the Hawaiian Islands peaks from late February through early April (Mobley, Spitz et al. 2001; Carretta, Forney et al. 2005). Direct revenues attributed to whale watching were $11 - $16 million in Hawaii during the 1999 whale season (National Oceanic and Atmospheric Administration 2000; Pendleton 2006). Marine mammal sightings are expected to occur from the coast to 50 nm offshore, including the areas off Pacific Missile Range Facility, close to shore at Pyramid Rock Beach on Oahu, or areas within the 100-fathom contours such as the Molokai–Lanai– Maui–Kahoolawe channels and Penguin Bank. However, tourist day trips typically stay closer to shore or from beach vantage points, these activities can occur throughout the HRC. Additional information on humpback whales, including description, habitat, abundance, and distribution, is provided in Section 3.4, Marine Mammals.

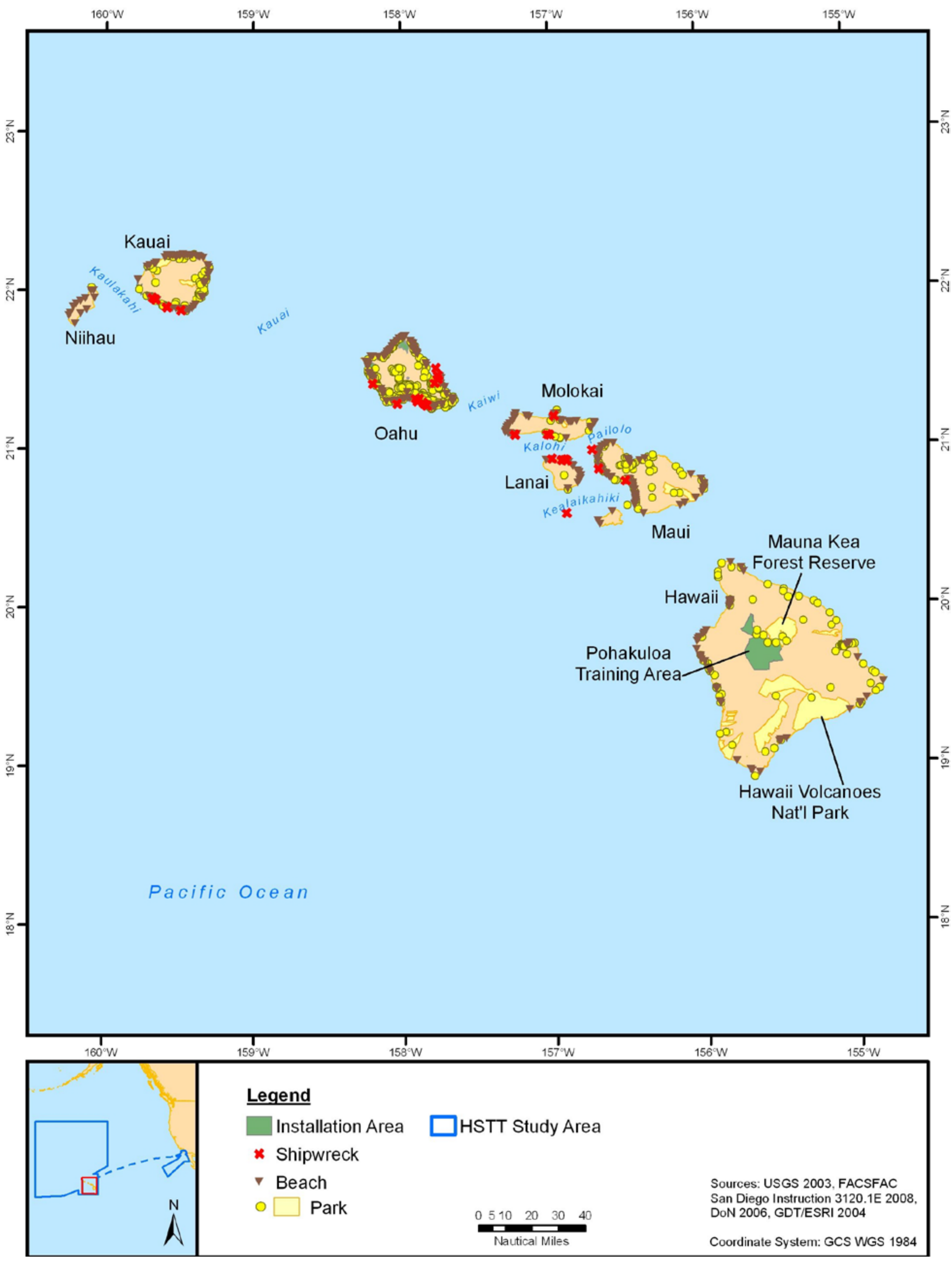

Figure 3.11-5: Hawaiian Island Recreational Areas

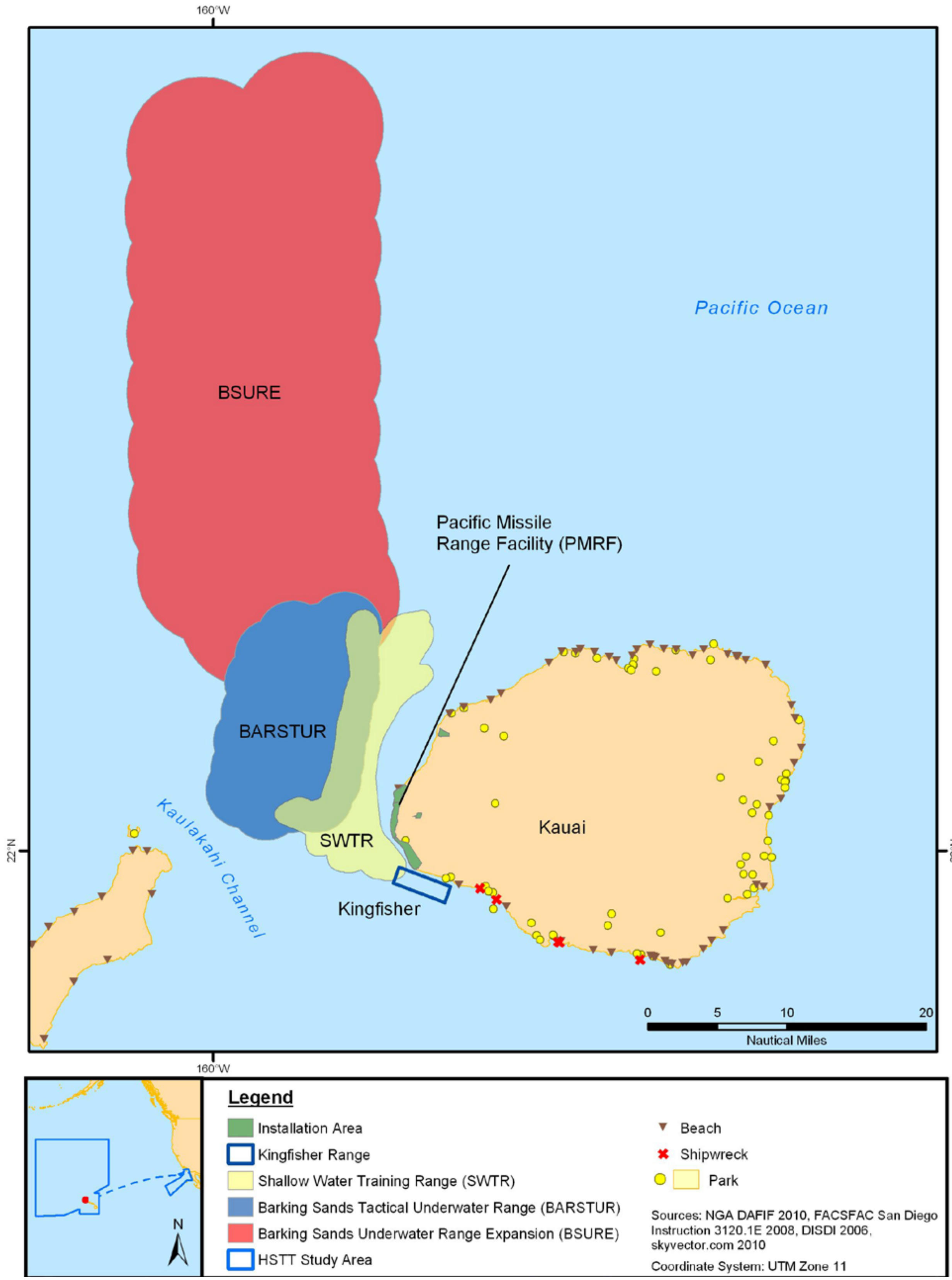

Figure 3.11-6: Kauai –Niihau Island Recreation Areas

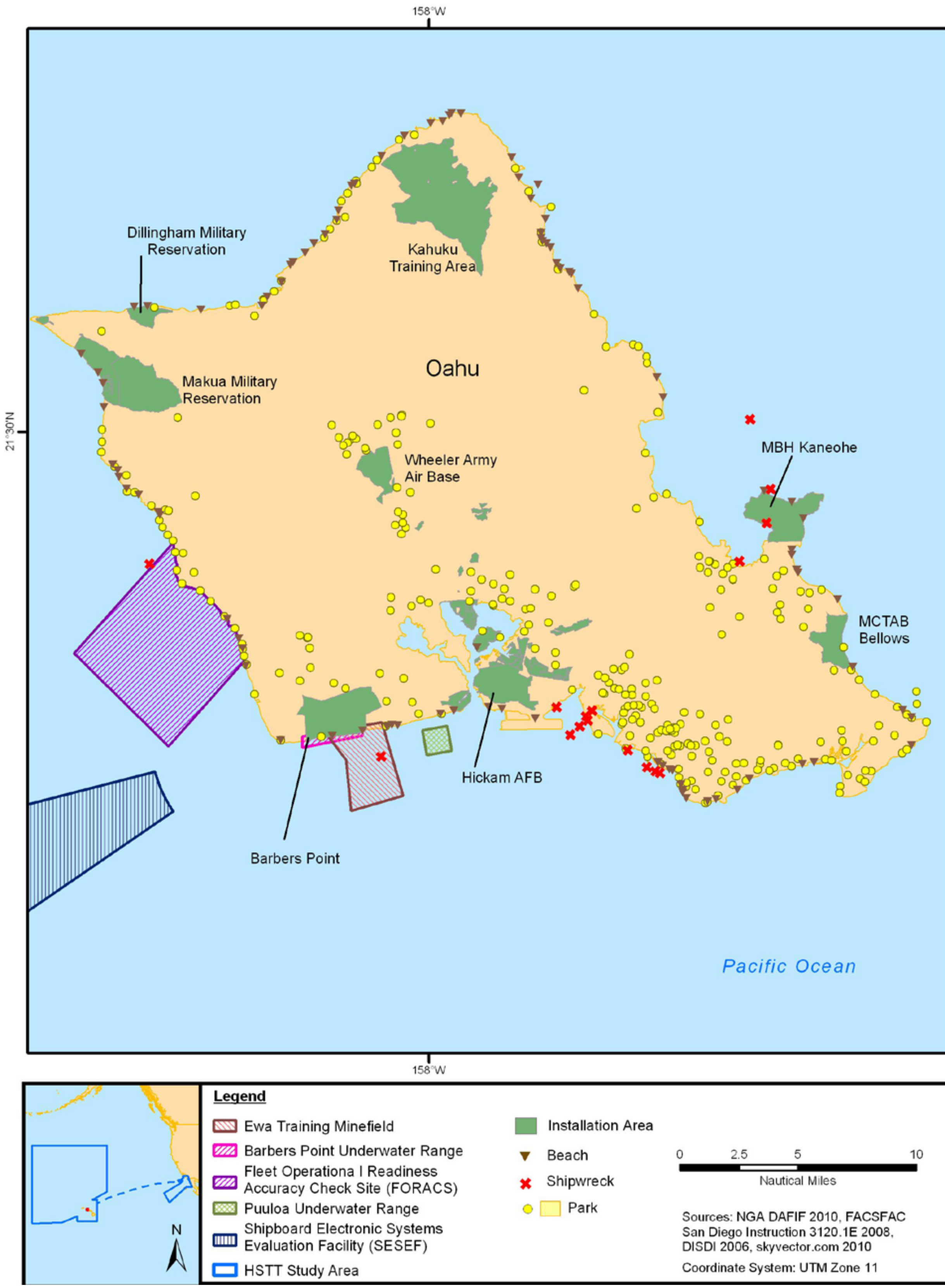

Figure 3.11-7: Oahu Island Recreation Areas

3.11.2.4.1.2 Southern California Range Complex

The SOCAL Range Complex marine environments are popular locations for recreational activities including sightseeing, whale watching, sport fishing, boating, diving, and surfing. Most recreation and tourism activities occur close to the mainland coast of Southern California or between the mainland and the Channel Islands. The shallower waters near the Channel Islands and some offshore banks, such as Tanner and Cortes Banks, are especially popular areas for self-contained underwater breathing apparatus (SCUBA) diving, fishing, and occasionally surfing. There is very little recreational activity in the southwestern portion of the SOCAL Range Complex due to its distance from land and its water depth.

Santa Catalina and Santa Barbara Islands are within the Study Area and visited by tourists. While Navy activities are conducted offshore of these islands, there is little interaction between the public and Navy activities.

Whale watching takes place primarily from December through March, for the annual gray whale southward migration and the northward migration. Though tourist day trips typically stay closer to the mainland, these activities can occur throughout the SOCAL Range Complex.

During the fall-winter period, primary charter and privately operated boats enter the SOCAL Range Complex OPAREAs and San Clemente Island waters for salt-water sport fishing (Figure 3.11-8), recreational diving, surfing, and other boating activities. Salt-water sport fishing and recreational diving take place primarily around San Clemente Island, and to a lesser extent in the shallower waters over the Tanner and Cortes Banks. Some limited, seasonal surfing can occur near the Tanner and Cortes Banks. Due to distance from shore, Tanner and Cortes Banks are inherently more hazardous due to their open ocean diving conditions. Therefore, the nearshore waters off San Clemente Island are a more popular destination than the more remote banks. This makes them suitable primarily for skilled divers, a more limited market for charter operators.

San Clemente Island’s relatively warm waters, good underwater visibility, and largely pristine diving conditions make it a popular destination. Charter dive trips to specific sites are often published and booked as many as six months in advance. Diving occurs year-round, though the number of trips to San Clemente Island and the banks appear to peak during lobster season (October-March).

Fishing destinations are generally more fluid, in response to changing fishing conditions, but a number of charter boats operate in SOCAL Range Complex waters on a routine basis. Sport fishermen pursue various fish species with hook and line; some divers also spearfish or take invertebrates (mainly lobster) by hand within the SOCAL Range Complex OPAREAs. Surfing can also be found in the offshore OPAREAs and nearshore San Clemente Island areas.

In the winter months, when large northern Pacific ocean swell is generated, some charter and private vessels travel out to Cortes Bank to surf the waves created by the rapidly rising seamounts. In addition, surfers can venture year-round to the breaks off of San Clemente Island to surf the island’s south points (China and Pyramid Points) and up the west shore of the island depending on the swell direction of the season (Figure 3.11-8). Although both areas within the SOCAL Range Complex OPAREAs are accessed throughout the year, due to the difficulty in access and a rare culmination of conditions necessary for surfing these spots, these areas are rarely accessed.

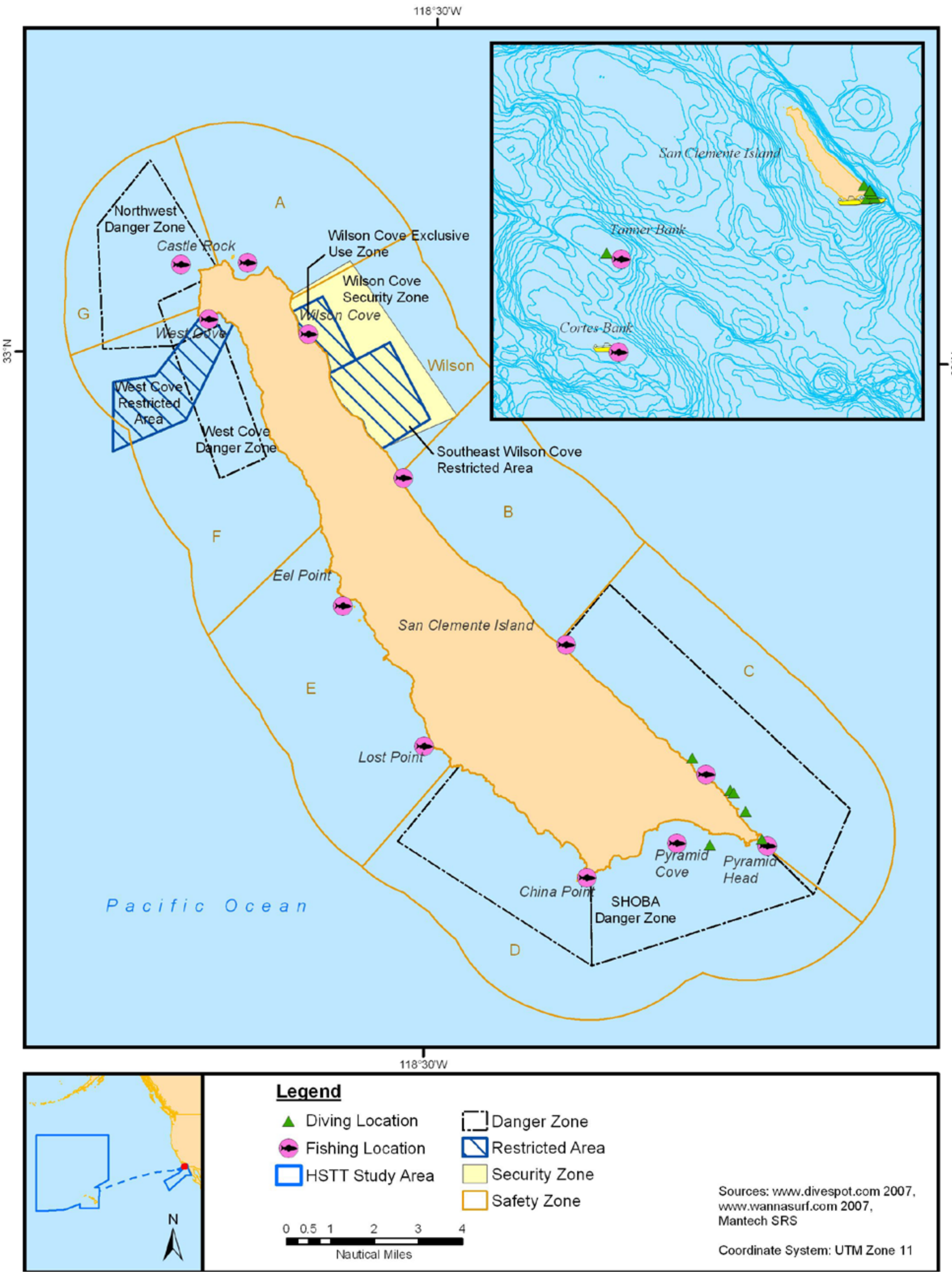

Figure 3.11-8: Recreation Areas around San Clemente Island

Other limited surf spots and dive sites occur throughout the nearshore areas, for diving, at various shipwrecks and reefs and, for surfing, off of Point Loma and around Santa Catalina Island. In addition, “big wave” surfers are known to travel farther offshore to Tanner and Cortez banks when ocean conditions produce large swells that form into giant waves in excess of 60 ft (18.3 m) in height when they reach the shallow banks (Casey 2010).

3.11.2.4.1.3 Silver Strand Training Complex

The San Diego Bay is a natural harbor adjacent to downtown San Diego. The San Diego Bay is frequently used by recreational boaters from surrounding marinas and mooring areas. The City of San Diego, City of Coronado, City of Imperial Beach, City of Chula Vista, and National City all surround, and have an interest in activities within San Diego Bay. The Sweetwater Canal, located in south San Diego Bay is the site of the National City Marina and Pepper Park. Further south in San Diego Bay is the Chula Vista Marina. Both marinas are recreational boating access points that contribute to the amount of vessels within San Diego Bay (Figure 3.11-9).

Fiddler’s Cove Marina, operated by the Navy, is located to the south of SSTC-North on the bayside along Silver Strand State Highway/SR-75, just north of Loews Coronado Resort. The marina has approximately 150 moorings and approximately 130 dock slips; the recreational vehicle park offers year-round camping. Both facilities are open to active duty, retirees, DoD civilians, and sponsored civilian guests.

Glorietta Bay is located to the north of SSTC-North on the bayside and is used by the public for recreation and pleasure boating (Figure 3.11-9). Navy piers at the Naval Amphibious Base Coronado extend into Glorietta Bay from its southern shore and support small boat training activities at the SSTC.

In San Diego Bay, there is a designated restricted area from the northern and eastern boundary of Naval Amphibious Base Coronado (33 C.F.R. 334.860) (Figure 3.11-9); activities such as swimming, fishing, waterskiing, and mooring are not allowed within this area. All vessels entering the restricted area must proceed across the area by the most direct route and without unnecessary delay. For vessels under sail, necessary tacking constitutes a direct route. A portion of the restricted area extending 120 feet from pierheads and from the low water mark on shore where piers do not exist is closed to all persons and vessels except those owned by, under hire to, or performing work for, the Naval Amphibious Base.

Recreational activities offshore of SSTC and the Naval Amphibious Base Coronado are permitted outside of the restricted areas and include sportfishing, bait fishing for the sport fishermen, lobster fishing, and sailboat regattas. Organized activities (such as sail races and regattas) within the restricted area may be allowed providing that a request has been made to the Commanding Officer, Naval Amphibious Base, Coronado. Silver Strand State Beach offers ocean side camping, kite surfing, and surfing. The City of Coronado beach, which lies between Naval Air Station North Island and Naval Amphibious Base Coronado, is a major public beach. The YMCA Surf Camp at SSTC-S is a major recreational facility for military and civilian families with surfing and beach activities.

3.11.2.4.1.4 Transit Corridor

It is assumed that there is limited to no tourism activity within the transit corridor because of the distance from land to the transit corridor and because the majority of tourism activity occurs nearshore.

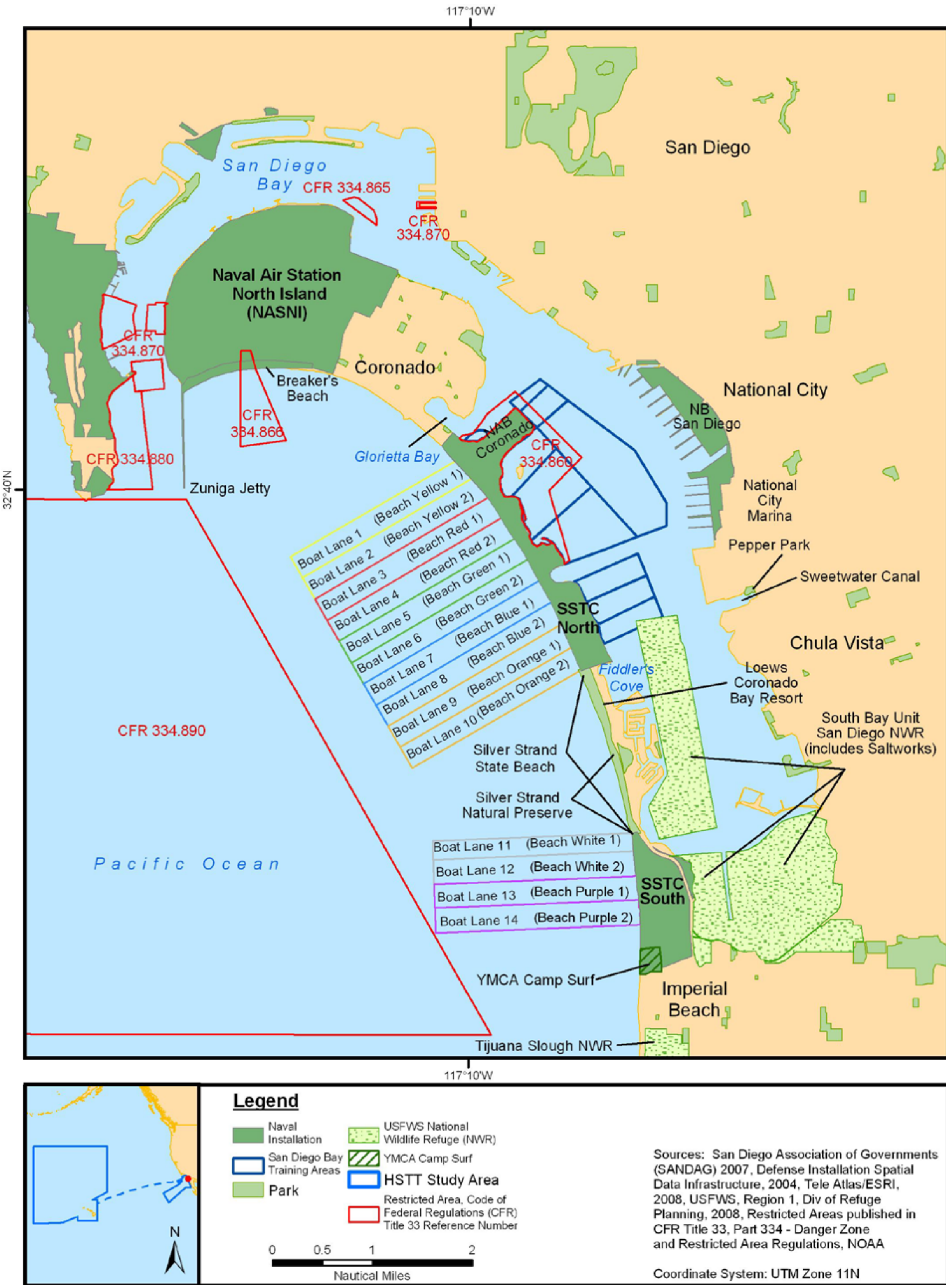

Figure 3.11-9: Recreational Map of the Silver Strand Training Complex

3.11.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) could impact socioeconomic resources of the Study Area. Tables 2.8-1 through 2.8-5 present the baseline and proposed training and testing activity locations for each alternative (including number of events and ordnance expended). Each socioeconomic resource stressor is introduced, analyzed by alternative, analyzed for training and testing activities, and then a NEPA determination is made by stressor. Table H-3 in Appendix H shows the warfare areas and associated stressors that were considered for analysis of socioeconomic resources. The stressors vary in intensity, frequency, duration, and location within the Study Area. The primary stressors applicable to socioeconomic resources in the Study Area and that are analyzed include the following:

- Accessibility
- Physical disturbance and strikes
- Airborne acoustics

Secondary stressors resulting in indirect impacts to socioeconomic resources are discussed in Section 3.11.4. Analysis of economic impacts evaluates the impacts of the alternatives on the economy of the region of influence while analysis of social impacts considers the change to human populations and how the action alters the way individuals live, work, play, relate to one another, and function as members of society. Because proposed HSTT activities are predominantly offshore, socioeconomic impacts would be associated with economic activity, employment, income, and social conditions (i.e., livelihoods) of industries or operations that use the ocean resources within the Study Area. Although there are no permanent population centers in the region of influence and the typical socioeconomic considerations such as population, housing, and employment are not applicable, this section will analyze the potential for fiscal impacts on marine-based activities and coastal communities. When considering impacts on recreational activities such as fishing, boating, and tourism, both the economic impact associated with revenue from recreational tourism and public enjoyment of recreational activities are considered.

The proposed HSTT training and testing activities were evaluated to identify specific components that could act as stressors by having direct or indirect effects on sources of commercial transportation and shipping, commercial and recreational fishing, subsistence use, and tourism. For each stressor, a discussion of impacts on these sources is included for each alternative.

The evaluation indicated that the relative potential for socioeconomic impacts would be similar across various areas and marine ecosystems in the Study Area. Therefore, the analysis of environmental consequences was not broken down by large marine ecosystem. Based on an initial screening of potential impacts of sonar maintenance and testing, pierside locations have been eliminated from detailed consideration in the analysis of impacts on energy, mineral extraction, and transportation and shipping. Elimination of these resources was based on the extremely limited potential for active sonar to damage infrastructure or interfere with transportation operations.

3.11.3.1 Accessibility

Navy training and testing activities have the potential to temporarily limit access to areas of the ocean for a variety of human activities associated with commercial transportation and shipping, commercial recreation and fishing, subsistence use, and tourism in the Study Area.

When training or testing activities are scheduled that require specific areas to be free of nonparticipating vessels due to public safety concerns, the Navy requests that the U.S. Coast Guard issue

Notices to Mariners to warn the public of upcoming Navy activities. Training and testing activities occur in established restricted or danger areas as published on navigation charts.

The changes in accessibility to human activities in the ocean would be an impact if it directly contributed to loss of income, revenue, or employment. Disturbance to human activities that result in impacts on payrolls, revenue, or employment is quantified by the amount of time the activity may be halted or rerouted or the ability to move to another location.

Accessibility, or restrictions to the availability of ocean space, would be a temporary condition. While mariners have a responsibility to be aware of conditions on the ocean, it is not expected that direct conflicts in accessibility would occur. The locations of restricted areas are published and available to mariners, who typically review such information before boating in any area. Restricted areas are typically avoided by experienced mariners. Prior to initiating a training activity, the Navy would follow standard operating procedures to visually scan an area to ensure that nonparticipants are not present. If nonparticipants are present, the Navy delays, moves, or cancels its activity. Public accessibility is no longer restricted once the activity concludes.

3.11.3.1.1 Socioeconomic Activities

3.11.3.1.1.1 Commercial Transportation and Shipping

The offshore and nearshore areas of the Study Areas include established Navy OPAREAs used for military training and testing activities. Commercial vessels entering OPAREAs, including established restricted areas and danger zones, within the Study Area operate under maritime regulations and are not limited by Navy activities. Potential disruptions to commercial shipping are limited or avoided by the Navy issuing Notices to Mariners through the U.S Coast Guard. Notices to Mariners advise commercial ship operators, commercial fisherman, recreational boaters, and other users of the area that the military will be operating in a specific area, allowing them to plan their activities accordingly. These temporary clearance procedures are established and implemented for the safety of the public and have been employed regularly over time without significant socioeconomic impacts on commercial shipping activities.

3.11.3.1.1.2 Commercial and Recreational Fishing

Commercial and recreational fishing activities make an appreciable contribution to the overall economy within the Study Area. The Navy has performed military activities within this region in the past and has not barred fishing or recreational uses. Commercial and recreational interests such as fishing, boating, and beach use are not restricted. Temporary closing of areas within the Study Area (typically offshore areas of the Pacific Missile Range Facility and areas in the vicinity of San Clemente Island) for security and safety does not limit public access to surrounding areas. These areas that are temporarily closed are only closed for the duration of the activity and are re-opened at the completion of the activity.

These temporary range clearance procedures for safety purposes do not adversely affect commercial and recreational fishing activities because displacement is of short duration (less than 24 hours). When range clearance is required, the public is notified via Notices to Mariners. These measures provide mariners with advance notice of areas being used by the Navy for training and testing activities. This allows the public to select an alternate destination without appreciable effect to their activities.

Scheduled closures to Navy training and testing areas are also posted on several publicly accessible Navy websites. Online searches for San Clemente Island or the Southern California Offshore Range (SCORE) should provide links with information on closures around San Clemente Island. The public website for the Naval Base Coronado provides advance notice of training activities originating from the base.

The Notices to Mariners and postings on Navy websites are intended to prevent fishermen from expending time and fuel resources transiting to a closed location. In 2009, the Navy completed a study to assess the effects of Navy activities on commercial and recreational fishing in the SOCAL Range Complex (Naval Undersea Warfare Center 2009). The SOCAL Fisheries Study reported the results of a survey of local fishermen and resulted in several recommendations to improve communications between the Navy and commercial and recreational fishermen. Improved communications would enable fishermen to be better informed of range closures, and would reduce the number of times fishermen traveled to closed areas. Recommendations from the survey included, (1) regular and up-to-date broadcasts of scheduled closures on VHF radio, (2) frequent updates to the San Clemente Island website, (3) establishing a single Navy point of contact with the most up-to-date information on closures for fishermen without website access, and (4) specifying if a scheduled Navy activity requires a complete closure or if fishing can occur simultaneously with the Navy activity. During the course of the study, some of the recommendations have already been addressed by the Southern California Offshore Range, which has operational authority over the San Clemente Island ranges. In particular, the Southern California Offshore Range initiated development of more robust range operations control, which allows fishermen to contact the San Clemente Island range in real-time using marine band VHF radio or cellular phones to obtain the status of OPAREA availability. In addition, a list of acronyms and codes was generated and posted as a link on the main page of the San Clemente Island website, which, along with other user-friendly website implementations (i.e., “Tool Tips”), is in the process of being added to the San Clemente Island website.

Upon completion of training, the range would be reopened and fishermen would be able to return to fish in the previously closed area. To help manage competing demands and maintain public access in the Study Area, the Navy conducts its offshore operations in a manner that minimizes restrictions to commercial fisherman. Navy ships, fishermen, and recreational users operate within the area together, and keep a safe distance between each other, and the Navy exercise participants relocate as necessary to avoid conflicts with nonparticipants. Only specific areas within the HRC, SSTC, and SOCAL Range Complex have been designated as danger zones or restricted areas. In addition to these areas, the Navy may temporarily establish an exclusion zone for the duration of a specific activity (e.g., an activity involving the detonation of explosives) to prevent non-participating vessels and aircraft from entering and unsafe area. Exclusion zones typically have a radius of only a couple of miles (this varies depending on the activity), are surveyed before during, and after the activity takes place, and end after the activity is completed (see Section 3.12 Public Health and Safety).

The Navy does not exclude fishing activities from occurring in areas of the HRC, SOCAL Range Complex, and SSTC that are not being used by the Navy during training and testing activities. The Navy has been conducting training and testing activities within the Study Area for decades, and has taken and will continue to take measures to prevent interruption of commercial and recreational fishing activities. To minimize potential military/civilian interactions, the Navy will continue to publish scheduled operation times and locations on publicly accessible Navy websites and through U.S Coast Guard issued Notices to Mariners up to 6 months in advance. These efforts are intended to ensure that commercial and recreational users are aware of the Navy’s plans and allow users to plan their activities to avoid scheduled Navy activities. Therefore, decreases in the frequency of fishing trips or in the availability of desirable fishing locations due to Navy activities is not expected. For safety reasons, the Navy may restrict access to a specific surface water area through the establishment of an exclusion zone, which would temporarily limit commercial and recreational fishing in that specific area; however, other areas in the Study Area would remain open to commercial and recreational fishing. A Navy activity involving the use of explosive ordnance is one example of an activity that could require establishment of a temporary exclusion zone. Typically, an exclusion zone is established only for a few hours and extends over a circular area with a radius of a couple of miles (depending on the activity). Commercial and recreational fishing activities could occur in the area before and after the temporary restriction. Should the Navy find nonparticipants present in an exclusion zone, the Navy would halt or delay (and reschedule, if necessary) all potentially hazardous activity until the nonparticipants have exited the exclusion zone.

3.11.3.1.1.3 Subsistence Use

Subsistence uses typically occur from the shore or from small vessels within state waters (3 nautical miles or closer to shore). Navy training and testing activities occur farther from shore in offshore waters where subsistence fishing typically does not occur. Therefore, there would be no foreseeable impact on subsistence uses from conducting proposed training and testing activities in the Study Area.

3.11.3.1.1.4 Tourism

Tourism activities make an appreciable contribution to the overall economy within the Study Area. Temporary range clearance procedures in the area, mainly around the Pacific Missile Range Facility and San Clemente Island, for safety purposes, do not adversely affect tourism activities because displacement is of short duration (typically less than 24 hours) and are in areas where tourism activities are not as prevalent. The Navy temporarily limits public access only to areas where there is a risk of injury or property damage and publishes scheduled activities through the use of Notices to Mariners and publically accessible websites. The Navy strives to conduct its operations in a manner that is compatible with recreational ocean users by minimizing temporary access restrictions. Published notices allow recreational users to adjust their routes to avoid temporary restricted areas. If civilian vessels are within a testing or training area at the time of a scheduled operation, Navy personnel would continue operations only where and when it is safe and possible to avoid the civilian vessels. If avoidance is not safe or possible, the operation would be halted and may relocate or be delayed. In some instances where safety requires exclusive use of a specific area, nonparticipants in the area are asked to relocate to a safer area for the duration of the operation.

3.11.3.1.2 No Action Alternatives

<u>Training</u>

Under the No Action Alternative, potential accessibility impacts would be associated primarily with anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, amphibious warfare, and naval special warfare. Training activities would continue at current levels and within established ranges and training locations. There would be no anticipated impacts on commercial transportation and shipping, commercial and recreational fishing, subsistence use, or tourism because inaccessibility to areas of co-use would be temporary and of short duration (hours). In addition, the Navy is implementing recommendations from the SOCAL Fisheries Study which should improve communications between the Navy and recreational fishermen and reduce the number of instances when fishermen must leave a temporarily closed area (Naval Undersea Warfare Center 2009). Based on the Navy's standard operating procedures and the large expanse of the Study Area that would be available to the public, accessibility impacts would remain negligible.

Testing

Under the No Action Alternative, the impact on accessibility would be negligible for the same reasons stated for training activities above.

3.11.3.1.3 Alternative 1

Alternative 1 consists of the No Action Alternative plus the expansion of the Study Area boundaries, adjustments to the tempo of training and testing activities, and the addition of new weapons, platforms, and systems. The changes in the tempo of training and testing activities would result in an increase in sonar activities, underwater detonations, aircraft transits, and weapons firing throughout the Study Area.

Training

Training activities as described under the No Action Alternative would continue but with an increase in tempo within the Study Area. There would be no changes to the Navy's current standard operating procedures defining safety precautions and actions taken by the Navy to protect the public during hazardous training activities on the ocean. Under Alternative 1, potential impacts affecting accessibility to areas of the Study Area would be the same as those associated with the No Action Alternative. Despite the increase in tempo of training activities and the expansion of the Study Area, no impacts from Alternative 1 activities on commercial transportation and shipping, commercial and recreational fishing, subsistence use, or tourism are anticipated, because training activities would place only temporary and short duration (hours) restrictions on public use of scheduled training areas. In addition, the Navy is implementing recommendations from the SOCAL Fisheries Study which should improve communications between the Navy and recreational fishermen and reduce the number of instances when fishermen must leave a temporarily closed area (Naval Undersea Warfare Center 2009). Based on the Navy's standard operating procedures and the large expanse of the Study Area that would be available to the public, accessibility impacts would remain negligible.

Testing

Under the Alternative 1, the impact on accessibility would be negligible for the same reasons stated for training activities above.

3.11.3.1.4 Alternative 2

Alternative 2 consists of Alternative 1 plus an increase in training and testing tempo. Changes in training and testing tempo under Alternative 2 would result in an increase in sonar activities, underwater detonations, aircraft transiting, and weapons firing throughout the Study Area.

Training

Training activities as described under Alternative 1 would continue but with an increase in tempo within the Study Area. There would be no changes to the Navy's current standard operating procedures defining safety precautions and actions taken by the Navy to protect the public during hazardous training activities on the ocean. Despite the increase in tempo of training activities, no impacts from Alternative 2 activities on commercial transportation and shipping, commercial and recreational fishing, subsistence use, or tourism are anticipated, because training activities would place only temporary and short duration (hours) restrictions on public use of scheduled training areas. In addition, the Navy is implementing recommendations from the SOCAL Fisheries Study which should improve communications between the Navy and recreational fishermen and reduce the number of instances when fishermen must leave a temporarily closed area (Naval Undersea Warfare Center 2009). Based on the Navy's standard operating procedures and the large expanse of the Study Area that would be available to the public, accessibility impacts would remain negligible.

Testing

Under the Alternative 2, the impact on accessibility would be negligible for the same reasons stated for training activities above.

3.11.3.2 Physical Disturbances and Strikes

The evaluation of impacts on socioeconomic resources from physical disturbance and strike stressors focuses on direct physical encounters or collisions with objects moving through the water or air (e.g., vessels, aircraft, unmanned devices, and towed devices), dropped or fired into the water (non-explosive practice munitions, other military expended materials, and ocean bottom deployed devices), or resting on the ocean floor (anchors, mines, targets) that may damage or encounter civilian equipment. Physical disturbances that damage equipment and infrastructure could disrupt the collection and transport of products, which may impact industry revenue or operating costs.

Navy training and testing equipment and vessels moving through the water could collide with non-Navy vessels and equipment. Most of the training and testing activities involve vessel movement and use of towed devices. However, the likelihood that a Navy vessel would collide with a non-Navy vessel is remote because of the prevalent use of navigational aids or buoys separating vessel traffic, shipboard lookouts, radar, and marine band radio communications by both Navy and civilians. Therefore, the potential to impact commercial transportation and shipping by physical disturbance or strike is negligible and requires no further analysis.

Aircraft conducting training or testing activities in the Study Area operate in designated military special use airspace (e.g., warning areas). All aircraft, military and civilian, are subject to Federal Aviation Administration regulations, which define permissible uses of designated airspace, and are implemented to control those uses. These regulations are intended to accommodate the various categories of aviation, whether military, commercial, or general aviation. By adhering to these regulations, the likelihood of civilian aircraft coming into contact with military aircraft or ordnance is remote. In addition, Navy aircraft follow procedures outlined in Navy air operations manuals, which are specific to a warning area or other special use airspace, and which describe procedures for operating safely when civilian aircraft are in the vicinity.

Military expended materials can physically interact with civilian equipment and infrastructure. Almost all training and testing activities produce military expended materials such as chaff, flares, projectiles, casings, target fragments, missile fragments, rocket fragments, and ballast weights.

3.11.3.2.1 Socioeconomic Activities

3.11.3.2.1.1 Commercial and Recreational Fishing/Subsistence Use

The majority of commercial and recreational fishing in the Study Area takes place in state waters, where the Navy conducts very limited training and testing activities. Less than 10 percent of recreational fishing takes place in federal waters, which are located beyond 3 nm from shore. Therefore, most recreational fishing would occur away from physical disturbances and strikes associated with training and testing activities. Some commercial fishing may occur beyond 3 nm in Navy training and testing areas and could be affected by the proposed activities if those activities were to alter fish population levels in those areas to such an extent that commercial fishers would no longer be able to find their target species. As described in Section 3.9.3, Fish, Environmental Consequences, the behavioral responses that could occur from various types of physical stressors associated with training and testing activities would not compromise the general health or condition of fish and, as such, commercial or recreational fishing resources.

Commercial fishing activities have the potential to interact with equipment placed in the ocean or on the ocean floor for use during proposed Navy training and testing activities. This equipment could include ship anchors, moored or bottom mounted targets, mines and mine shapes, tripods, and use of towed system and attachment cables. Many different types of commercial fishing gear are used in the Study Area, including gillnets, longline gear, troll gear, trawls, seines, and traps or pots. Commercial bottom fishing activities that use these types of gear have a greater potential to be affected by interaction with Navy training and testing equipment, resulting in the loss of or damage to both the Navy equipment and the commercial fishing gear. The Navy recovers many of the targets (e.g., mines and mine shapes) and target fragments used in training and testing activities, and would continue to do so to minimize the potential for interaction with fishing gear and fishing vessels. Unrecoverable items are typically small, constructed of soft materials (such as target cardboard boxes or tethered target balloons), or are intentionally designed to sink to the bottom after serving their purpose (such as expended 55-gallon steel drums), so that they would not represent a collision risk to vessels, including commercial fishing vessels.

3.11.3.2.1.2 Tourism

While Navy training and testing activities can occur throughout the Study Area, most (especially hazardous) activities occur well out to sea. Most civilian recreational activities engaged in by both tourists and residents take place within a few miles of land.

Snorkeling and diving take place primarily at known recreational sites, including shipwrecks and reefs. Temporary range clearance procedures in the areas, mainly around the Pacific Missile Range Facility and San Clemente Island, for safety purposes, do not adversely affect tourism activities because displacement is of short duration (typically less than 24 hours) and are in areas where tourism activities are not as prevalent. The Navy temporarily limits public access to areas where there is a risk of injury or property damage through the use of Notices to Mariners. The Navy also maintains a website which provides information on scheduled closures around San Clemente Island. Published notices allow recreational users to adjust their routes to avoid temporary restricted areas. If civilian vessels are within a testing or training area at the time of a scheduled operation, Navy personnel continue operations and avoid them if it is safe and possible to do so. If avoidance is not safe or possible, the operation may relocate or be delayed. In some instances where safety requires exclusive use of a specific area, nonparticipants in the area are asked to relocate to a safer area for the duration of the operation. Because Navy training and testing activities vary in location and are primarily short-term in duration, impacts on tourism activities from rerouting or postponing activities would be negligible.

Other tourism activities such as whale watching, boating, or use of other watercraft occur farther out at sea and are conducted by boat, aircraft, or from land. These activities would be conducted with boats that are typically well marked and visible to Navy ships conducting training and testing activities. Individual boaters engaged in tourism activities, such as whale watching, plan and monitor navigational information to avoid Navy training and testing areas. Vessels are responsible for being aware of designated danger areas in surface waters and any Notices to Mariners that are in effect. Operators of recreational or commercial vessels have a duty to abide by maritime requirements as administered by the U.S. Coast Guard. At the same time, Navy vessels ensure that an area is clear of nonparticipants prior to testing and training exercises. As a result, conflicts between Navy training and testing activities in offshore areas and whale watching or other offshore recreational use would not occur. Changes to current offshore tourism activities in the Study Area would not be expected from the proposed training and testing activities. Therefore, loss of revenue or employment associated with tourism would not occur.

The Navy would continue to recover many of the targets (e.g., mines and mine shapes) and target fragments used in training and testing activities so that they would not pose a collision risk to vessels. Unrecoverable items are typically small, constructed of soft materials (such as target cardboard boxes or tethered target balloons), or are intentionally designed to sink to the bottom after serving their purpose (such as expended 55-gallon steel drums), so that they would not represent a collision risk to vessels.

3.11.3.2.2 No Action Alternative

Training

Under the No Action Alternative, potential physical disturbance and strike impacts would be associated primarily with anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, and amphibious warfare. Training activities would continue at current levels and within established ranges and training locations.

There would be no anticipated impacts on commercial and recreational fishing, subsistence use, or tourism because of the large size of the Study Area, the limited areas of operations, and implementation of the Navy's standard operating procedures, which includes ensuring that an area is clear of all nonparticipating vessels before training activities take place. In addition, the Navy provides advance notification of training activities to the public through Notices to Mariners and postings on Navy websites (e.g., the San Clemente Island website). Damage to or loss of commercial fishing gear from interaction with Navy equipment or other expended materials is unlikely. The Navy recovers many practice munitions (e.g., mines and mine shapes) for reuse following the activity. The Navy also recovers larger floating objects or materials, such as targets or target fragments, to avoid having them become hazards to navigation. Smaller objects that remain in the water column would be unlikely to pose a risk to fishing gear. Considering the expansive size of the Navy's OPAREAs, the disbursement of military expended materials over these large areas, and the affect of the Navy's standard operation procedures and mitigation measures (see Chapter 5), impacts from physical disturbances and strikes on commercial and recreational fishing, subsistence use, or tourism would be negligible.

Testing

Under the No Action Alternative, the impact associated with physical disturbances and strikes would be negligible for the same reasons stated for training activities above.

3.11.3.2.3 Alternative 1

Alternative 1 consists of the No Action Alternative plus the expansion of the Study Area boundaries, adjustments to the tempo of training and testing activities, and the addition of new weapons, platforms and systems. The changes in training tempo would result in an increase in sonar activities, underwater detonations, aircraft transiting, and weapons firing throughout the Study Area.

Training

Under Alternative 1, potential physical disturbance and strike impacts would be the same as those associated with the No Action Alternative. Training activities would continue but with an increase in tempo and associated increase in the quantity of military expended materials released within the Study Area. There would be no changes to the Navy's standard operating procedures for hazardous training activities performed in the Study Area. The expansive size of the Navy's OPAREAs, the disbursement of military expended materials over these large areas, and implementation of the Navy's standard operating procedures and mitigation measures (see Chapter 5) ensure that impacts from physical disturbances and strikes would be negligible. The advance public release of Notices to Mariners and postings of upcoming activities on Navy websites (e.g., the San Clemente Island website) would inform the public of upcoming activities, and enable them to plan to avoid the area. Therefore, impacts from physical disturbance and strike on commercial and recreational fishing, subsistence use, and tourism would be negligible.

Testing

Under Alternative 1, the impact associated with physical disturbances and strikes would be negligible for the same reasons stated for training activities above.

3.11.3.2.4 Alternative 2

Alternative 2 consists of Alternative 1 plus an increase in training and testing tempo. Changes in training tempo under Alternative 2 would result in an increase in sonar activities, underwater detonations, aircraft transiting, and weapons firing throughout the Study Area.

Training

Under Alternative 2, potential physical disturbance and strike impacts would be the same as those associated with the No Action Alternative. Training activities would continue but with an increase in tempo and associated increase in the quantity of military expended materials released within the Study Area. There would be no changes to the Navy's standard operating procedures for hazardous training activities performed in the Study Area. The expansive size of the Navy's OPAREAs, the disbursement of military expended materials over these large areas, and implementation of the Navy's standard operating procedures and mitigation measures (see Chapter 5) ensure that impacts from physical disturbances and strikes would be negligible. The advance public release of Notices to Mariners and postings of upcoming activities on Navy websites (e.g., the San Clemente Island website) would inform the public of upcoming activities, and enable them to plan to avoid the area. Therefore, impacts from physical disturbance and strike on commercial and recreational fishing, subsistence use, or tourism would be negligible.

Testing

Under Alternative 2, the impact associated with physical disturbances and strikes would be negligible for the same reasons stated for training activities above.

3.11.3.3 Airborne Acoustics

As an environmental stressor, loud noises, sonic booms, and vibrations generated from Navy training and testing activities such as weapons firing, in-air explosions, and aircraft transiting have the potential to disrupt wildlife and humans in the Study Area.

3.11.3.3.1 Socioeconomic Activities

3.11.3.3.1.1 Tourism

Noise interference could decrease public enjoyment of recreational activities. These effects would occur on a temporary basis, only when weapons firing, in-air explosions, and aircraft transiting occur. Of these activities, Navy training and testing activities involving weapons firing and in-air explosions would only occur when the Navy can confirm the area is clear of nonparticipants, reducing the likelihood that noise from these activities would disturb tourists. Most naval training would occur well out to sea, while tourism and civilian recreational activities are largely conducted within a few miles of shore. Tourism and recreational activity revenue is not expected to be impacted by airborne noise.

3.11.3.3.2 No Action Alternative

Training

Under the No Action Alternative, potential airborne noise impacts would be associated primarily with anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, and amphibious warfare. Training activities would continue at current levels and within established ranges and training locations. There would be no anticipated impacts on tourism because 1) most Navy training occurs well out to sea, while most tourism and recreational activities occur near shore, and 2) Navy training activities producing airborne noise are normally short term and temporary. Therefore, airborne noise impacts on tourism would be negligible.

Testing

Under the No Action Alternative, impacts associated with airborne acoustics would be negligible for the same reasons stated for training activities above.

3.11.3.3.3 Alternative 1

Alternative 1 consists of the No Action Alternative plus the expansion of the Study Area boundaries, adjustments to the tempo of training and testing activities, and the addition of new weapons, platforms and systems. The changes in training tempo would result in an increase in sonar activities, underwater detonations, aircraft transiting, and weapons firing throughout the Study Area.

Training

Under Alternative 1, potential airborne noise would be the same as that associated with the No Action Alternative. Training activities would continue but with an increase in tempo within the Study Area. Similar to the No Action Alternative and despite the increase in tempo, there would be no anticipated impacts on tourism because 1) most Navy training occurs well out to sea, while most tourism and recreational activities occur near shore and 2) Navy training activities producing airborne noise are normally short term and temporary. Therefore, airborne noise impacts on tourism would be negligible.

Testing

Under Alternative 1, impacts associated with airborne acoustics would be negligible for the same reasons stated for training activities above.

3.11.3.3.4 Alternative 2

Alternative 2 consists of Alternative 1 plus an increase in training and testing tempo. Changes in training tempo under Alternative 2 would result in an increase in sonar activities, underwater detonations, aircraft transiting, and weapons firing throughout the Study Area.

Training

Under Alternative 2, potential airborne noise would be the same as that associated with the No Action Alternative. Training activities would continue but with an increase in tempo within the Study Area. Similar to Alternative 1, there would be no anticipated impacts on tourism because 1) most Navy training occurs well out to sea, while most tourism and recreational activities occur near shore and 2)

Navy training activities producing airborne noise are normally short term and temporary. Therefore, airborne noise impacts on tourism would be negligible.

Testing

Under Alternative 2, impacts associated with airborne acoustics would be negligible for the same reasons stated for training activities above.

3.11.4 Analysis of Secondary Stressors

Socioeconomics could be impacted if the proposed activities led to changes to physical and biological resources to the extent that they would alter the way industries can utilize those resources. The secondary stressor of resource availability pertains to the potential for loss of fisheries resources within the Study Area.

Fishing, subsistence use, and tourism could be impacted if the proposed activities altered fish population levels to such an extent that these activities would no longer be able to find their target species. Similarly, disturbances to marine mammal populations could impact the whale watching industry. Analyses in Sections 3.4 (Marine Mammals), 3.8 (Marine Invertebrates), and 3.9 (Fish) concluded that impacts to marine species from training and testing activities are not anticipated. Based on these conclusions, secondary impacts on commercial or recreational fishing, subsistence use, or tourism are not anticipated.

3.11.5 Summary of Potential Impacts (Combined Impacts of All Stressors) on Socioeconomics

Stressors described in this EIS/OEIS that could result in potential impacts on socioeconomic resources include accessibility to areas within the Study Area, physical disturbance and strikes, airborne acoustics, and secondary stressors resulting from effects to marine species populations. Under the No Action Alternative, Alternative 1, and Alternative 2, these activities would be widely dispersed throughout the Study Area. These activities are also dispersed temporally (i.e., few stressors would occur in the same location at the same time). Therefore, no greater impacts from the combined operation of more than one stressor are expected. The aggregate impact on socioeconomics would not observably differ from existing conditions.

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3.12 Public Health and Safety

PUBLIC HEALTH AND SAFETY SYNOPSIS

The United States Department of the Navy considered all potential stressors and the following have been analyzed for public health and safety:

- Underwater energy
- In-air energy
- Physical interactions
- Secondary stressors from sediment and water quality changes

Preferred Alternative

Because of the Navy's standard operating procedures, impacts on public health and safety would be unlikely.

3.12.1 Introduction and Methods

3.12.1.1 Introduction

This section analyzes potential impacts on public health and safety within the Hawaii-Southern California Training and Testing (HSTT) Study Area (Study Area). Unlike military training and testing activities conducted within the boundaries of a fenced-land installation, public access to ocean areas or to the overlying airspace cannot be physically controlled. The United States (U.S.) Department of the Navy (Navy) coordinates use of these areas through the scheduling of activities, and issues warnings and notices to the public prior to conducting potentially hazardous activities (Section 3.12.2.2). Sensitivity to public health and safety concerns within the Study Area is heightened in areas where the public may be close to certain activities (e.g., pierside testing or littoral training).

Generally, the greatest potential for a proposed activity to affect the public is near the coast because that is where public activities are concentrated. These coastal areas could include dive sites or other recreational areas where the collective health and safety of groups of individuals that could be exposed to the hazards of training and testing would be of concern. Most commercial and recreational marine activities are close to the shore, and are usually limited by the capabilities of the boat used. Commercial and recreational fishing may extend as far as 100 nautical miles (nm) from shore, but are concentrated near the coast.

3.12.1.2 Methods

Baseline public health and safety conditions were derived from the current training and testing activities in the Southern California (SOCAL) Range Complex and the Hawaii Range Complex (HRC). The No Action Alternative does not include the Transit Corridor of the Study Area (Chapter 2). Existing procedures for assuring public health and safety and other elements of the baseline (e.g., restricted areas) were derived from federal regulations, Department of Defense (DoD) directives, and Navy instructions for training and testing. The directives and instructions provide specifications for mission planning and execution that describe criteria for public health and safety considerations. These directives and instructions include criteria for public health and safety considerations for training and testing planning and execution.

The alternatives were evaluated based on two factors: the potential for a training or testing activity to impact public health and safety and the degree to which those activities could have an impact. The likelihood that the public would be near a training or testing activity determines the potential for exposure to the activity. If the potential for exposure exists, the degree of the potential impacts on public health and safety, including increased risk of injury or loss of life, is determined. If the potential for exposure were zero, then public health and safety would not be affected. Isolated incidents and other conditions that affect single individuals, although important for safety awareness, may not rise to the level of a public health or safety issue, and are not considered in this assessment (i.e., airborne noise effects are not addressed in this section).

3.12.2 AFFECTED ENVIRONMENT

3.12.2.1 Overview

Military, commercial, institutional, and recreational activities take place simultaneously in the Study Area (Figure 3.12-1), and have coexisted safely for decades. These activities coexist because established rules and practices lead to safe use of the waterway and airspace. The following paragraphs briefly discuss the rules and practices for recreational, commercial, and military use in sea surface areas and airspace.

The Study Area is shared by military, commercial, institutional, and recreational users. The United States Navy is committed to ensuring public safety during training and testing activities. To protect public safety, access to certain ocean areas must be temporarily limited during certain training and testing activities.

Figure 3.12-1: Simultaneous Activities within the Hawaii-Southern California Training and Testing Study Area

3.12.2.1.1 Sea Space

Most of the sea space in the Study Area is accessible to recreational and commercial activities. However, some activities are prohibited or restricted in certain areas (e.g., danger zones and restricted areas) in accordance with Title 33 Code of Federal Regulations, Part 334 (Danger Zone and Restricted Area Regulations). These restrictions can be permanent or temporary. Nautical charts issued by the National Oceanic and Atmospheric Administration include these federally designated zones and areas. Operators of recreational and commercial vessels have a duty to abide by maritime regulations administered by the United States (U.S.) Coast Guard.

In accordance with Title 33 Code of Federal Regulations 72 (Aids to Navigation), the U.S. Coast Guard and the Department of Homeland Security inform private and commercial vessels about temporary closures via Notices to Mariners. These Notices provide information about durations and locations of closures because of activities that are hazardous to surface vessels. Broadcast notices on maritime frequency radio, weekly publications by the appropriate U.S. Coast Guard Navigation Center, and global positioning system navigation charts disseminate these navigational warnings.

3.12.2.1.2 Airspace

Most of the airspace in the Study Area is accessible to general aviation (recreational, private, corporate) and commercial aircraft. Like waterways, however, some areas are temporarily off limits to civilian and commercial use. The Federal Aviation Administration has established Special Use Airspace - airspace of defined dimensions wherein activities must be confined because of their nature or wherein limitations may be imposed upon aircraft operations that are not part of those activities (Federal Aviation Administration 2011). Special Use Airspace in the Study Area includes:

- **Restricted Airspace**: Areas where aircraft are restricted because of unusual (often invisible) hazards to aircraft (e.g., release of ordnance). Some areas are under strict control of the DoD, and some are shared with nonmilitary agencies.
- **Military Operations Areas:** Areas typically below 18,000 feet (ft.) used to separate certain nonhazardous military flight activities from instrument flight rules traffic and to identify visual flight rules traffic where these activities are conducted.
- **Warning Areas**: Areas of defined dimensions, beyond three nm from the coast of the United States, which warn nonparticipating aircraft of potential danger.
- **Air Traffic Controlled Assigned Airspace**: Airspace that is Federal Aviation Administration-defined and is not over an existing operating area. This airspace is used to contain specified activities, such as military flight training, that are segregated from other instrument flight rules air traffic.

Notices to Airmen are created and transmitted by government agencies and airport operators to alert aircraft pilots of any hazards en route to or at a specific location. The Federal Aviation Administration issues Notices to Airmen to disseminate information on upcoming or ongoing military exercises with airspace restrictions. Civilian aircraft are responsible for being aware of restricted airspace and any Notices to Airmen that are in effect. Pilots have a duty to abide by aviation rules as administered by the Federal Aviation Administration.

Weather conditions dictate whether aircraft (general aviation, commercial, or military) can fly under visual flight rules, or whether instrument flight rules are required. Under visual flight rules, the weather is favorable and the pilot is required to remain clear of clouds by specified distances to ensure separation from other aircraft under the concept of see and avoid. Pilots flying under visual flight rules must be able to see outside of the cockpit, control the aircraft's attitude, navigate, and avoid obstacles and other aircraft based on visual cues. Pilots flying under visual flight rules assume responsibility for their separation from all other aircraft, and are generally not assigned routes or altitudes by air traffic control.

During unfavorable weather, pilots must follow instrument flight rules. Factors such as visibility, cloud distance, cloud ceilings, and weather phenomena cause visual conditions to drop below the minimums required to operate by visual flight referencing. Instrument flight rules are the regulations and restrictions a pilot must comply with when flying in weather conditions that restrict visibility. Pilots can fly under instrument flight rules in visual flight rules weather conditions; however, pilots cannot fly under visual flight rules in instrument flight rules weather conditions.

3.12.2.2 Safety and Inspection Procedures

During training and testing, Navy policy is to ensure the safety and health of personnel and the general public (U.S. Department of the Navy 2011c). The Navy achieves these conditions by considering a location when planning activities, scheduling and notifying potential users of an area, and ensuring that an area is clear of nonparticipants. The Navy also has a proactive and comprehensive program of compliance with applicable standards and implementation of safety management systems.

As previously stated, the greatest potential for a training or testing activity to affect the public is in coastal areas because of the concentration of public activities. When planning a training or testing event, the Navy considers proximity of the activity to public areas in choosing a location. Important factors considered include the ability to control access to an area; schedule (time of day, day of week); frequency, duration, and intensity of activities; range safety procedures; operational control of activities or events; and safety history.

The Navy's Fleet Area Control and Surveillance Facilities actively manage assigned airspace, operating areas, ranges, and training and testing resources to enhance combat readiness of U.S. Pacific Fleet units. The Navy schedules activities through the Fleet Area Control and Surveillance Facilities, which coordinate air and surface use of the operating areas (OPAREAs) with the Federal Aviation Administration and the U.S. Coast Guard, which issue Notices to Airmen and Notices to Mariners, respectively.

During training and testing activities in the Study Area, the Navy ensures that the appropriate safety zone is clear of non-participants before engaging in certain activities, such as firing weapons. Inability to obtain a "clear range" could cause an event to be delayed, cancelled, or relocated. Navy procedures ensure public safety during Navy activities that otherwise could harm nonparticipants. Navy practices employ the use of sensors and other devices (e.g., radar) to ensure public health and safety while conducting training and testing activities. The following subsections outline the current requirements and practices for human safety as they pertain to range safety procedures, range inspection procedures, exercise planning, and scheduling and coordinating procedures for the Navy.

Training activities comply with Fleet Area Control and Surveillance Facility procedures. Fleet Area Control and Surveillance Facilities San Diego and Hawaii have published safety procedures for activities on the offshore and nearshore areas (U.S. Department of the Navy 2011a, b). These guidelines (and others) apply to range users, as follows:

- Navy personnel are responsible for ensuring that impact areas and targets are clear before commencing hazardous activities.
- The use of underwater ordnance must be coordinated with submarine operational authorities. The coordination also applies to towed sound navigation and ranging (sonar) arrays and torpedo decoys.
- Aircraft or vessels expending ordnance shall not commence firing without permission of the Range Safety Officer for their specific range area.
- Firing units and targets must remain in their assigned areas, and units must fire in accordance with current safety instructions.

- Aircraft carrying ordnance to or from ranges shall avoid populated areas to the maximum extent possible.
- Strict on-scene procedures include the use of ship sensors, visual surveillance of the range from aircraft and range safety boats, and radar and acoustic data to confirm the firing range and target area are clear of civilian vessels, aircraft, or other nonparticipants.

Testing activities have their own comprehensive safety planning instructions (U.S. Department of the Navy 2008b, 2009). These instructions provide guidance on how to identify the hazards, assess the potential risk, analyze risk control measures, implement risk controls, and review safety procedures. They apply to all testing activities including ground, waterborne, and airborne testing activities involving personnel, aircraft, inert minefields, equipment, and airspace. The guidance applies to system program managers, program engineers, test engineers, test directors, and aircrews that are responsible for incorporating safety planning and review when conducting test programs.

The following safety and inspection procedures are implemented for training activities. Each commanding officer is responsible for implementing safety and inspection procedures for activities inside and outside established ranges. In the absence of specific guidance on matters of safety, the Navy follows the most prudent course of action. The following section contains information on the Navy's program of compliance with applicable standards and implementation of safety management systems.

3.12.2.2.1 Aviation Safety

Navy procedures on planning and managing Special Use Airspace are provided in Chief of Naval Operations Instruction 3770.2K, *Airspace Procedures and Planning Manual* (U.S. Department of the Navy 2007). Scheduling and planning procedures for air operations on range complexes are issued through the Navy's Fleet Area Control and Surveillance Facilities San Diego and Hawaii (U.S. Department of the Navy 2011b). Testing ranges have their own procedures for aviation safety, like the Naval Surface Warfare Center Instruction (U.S. Department of the Navy 2008b) and Naval Undersea Warfare Center Division Instruction (U.S. Department of the Navy 2009).

Aircrews involved in a training or testing exercise must be aware that nonparticipating aircraft and ships are not precluded from entering the area and may not comply with Notices to Airmen or Notices to Mariners. Aircrews are required to maintain a continuous lookout for nonparticipating aircraft while operating in warning areas under visual flight rules. In general, aircraft carrying ordnance are not allowed to fly over surface vessels.

3.12.2.2.2 Submarine Navigation Safety

Submarine crews use various methods to avoid collisions while they are surfaced, including visual and radar scanning, acoustic depth finders, and state-of-the-art satellite navigational systems. When transiting submerged, submarines use all available ocean navigation tools, including inertial navigation charts that calculate position based on the submerged movements of the submarine. Areas with surface vessels can then be avoided to protect both the submarines and surface vessels.

3.12.2.2.3 Surface Vessel Navigational Safety

The Navy practices the fundamentals of safe navigation. While in transit, Navy surface vessel operators are alert at all times, use extreme caution, use state-of-the-art satellite navigational systems, and are trained to take proper action if there is a risk. Surface vessels are also equipped with trained and qualified Navy Lookouts. Individuals trained as lookouts have the necessary skills to detect objects or activity in the water that could be a risk for the vessel.

For specific testing activities, like unmanned surface vehicle testing, a support boat would be used near the testing to ensure safe navigation. Before firing or launching a weapon or radiating a non-eyesafe laser, Navy surface vessels are required to determine that all safety criteria have been satisfied. When applicable, the surface vessel would use aircraft and other boats to aid in navigation. In accordance with Navy instructions presented in this chapter, safety and inspection procedures ensure public health and safety.

3.12.2.2.4 Sound Navigation and Ranging Safety

Surface vessels and submarines may use active sonar in the pierside locations listed in Chapter 2 and during transit to the training or testing exercise location. To ensure safe and effective sonar use, the Navy applies the same safety procedures for pierside sonar use as described in Section 3.12.2.2, Safety and Inspection Procedures.

Naval Sea Systems Command Instruction 3150.2, Appendix 1A, *Safe Diving Distances from Transmitting Sonar*, is the Navy's governing document for protecting divers during active sonar use (U.S. Department of the Navy 1999). This instruction provides procedures for calculating safe distances from active sonar. These procedures are derived from experimental and theoretical research conducted at the Naval Submarine Medical Research Laboratory and the Navy Experimental Diving Unit. Safety distances vary based on conditions that include diver attire type of sonar, and duration of time in the water. Some safety procedures include on-site measurements during testing activities to identify an exclusion area for nonparticipating swimmers and divers.

3.12.2.2.5 Electromagnetic Energy Safety

All frequencies (or wavelengths) of electromagnetic energy are referred to as the electromagnetic spectrum, and include electromagnetic radiation and radio frequency radiation. Communications and electronic devices such as radar, electronic warfare devices, navigational aids, two-way radios, cell phones, and other radio transmitters produce electromagnetic radiation. While such equipment emits electromagnetic energy, some of these systems are the same as, or similar to, civilian navigational aids and radars at local airports and television weather stations. Radio waves and microwaves emitted by transmitting antennas are a form of electromagnetic energy collectively referred to as radio frequency radiation. Radio frequency energy includes frequencies ranging from 0 to 3,000 gigahertz. Exposure to radio frequency energy of sufficient intensity at frequencies between 3 kilohertz and 300 gigahertz can adversely affect people, ordnance, and fuel.

To avoid excessive exposures to electromagnetic energy, military aircraft are operated in accordance with standard operating procedures that establish minimum separation distances between electromagnetic energy emitters and people, ordnance, and fuels (U.S. Department of Defense 2009). Thresholds for determining hazardous levels of electromagnetic energy to humans, ordnance, and fuel have been determined for electromagnetic energy sources based on frequency and power output, and current practices are in place to protect the public from electromagnetic radiation hazards (U.S. Department of Defense 2002, 2009). These procedures include setting the heights and angles of electromagnetic energy transmissions to avoid direct exposure, posting warning signs, establishing safe operating levels, activating warning lights when radar systems are operational, and not operating some platforms that emit electromagnetic energy within 15 nm of shore. Safety planning instructions provide clearance procedures for nonparticipants in operational areas prior to conducting training (U.S. Department of the Navy 2011a, b) and testing (U.S. Department of the Navy 2008b, 2009) activities that involve underwater electromagnetic energy (e.g., mine warfare).

Mine warfare devices are analyzed under other resource topics in this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) because they emit electromagnetic energy. The electromagnetic effects of mine warfare devices are very local, however, unlike radars and radios. Measures to avoid public interaction with mine warfare devices are effective in protecting the public from these effects.

3.12.2.2.6 Laser Safety

Lasers produce light energy. The Navy uses tactical lasers for precision range finding, as target designation and illumination devices for engagement with laser-guided weapons, and for mine detection and mine countermeasures. Laser safety procedures for aircraft require an initial pass over the target prior to laser activation to ensure that target areas are clear. The Navy observes strict precautions, and has written instructions in place for laser users to ensure that nonparticipants are not exposed to intense light energy. During actual laser use, aircraft run-in headings are restricted to avoid unintentional contact with personnel or nonparticipants. Personnel participating in laser training activities are required to complete a laser safety course (U.S. Department of the Navy 2008a).

3.12.2.2.7 High-Explosive Ordnance Detonation Safety

Pressure waves from underwater detonations can pose a physical hazard in surrounding waters. Before conducting an underwater training or testing activity, Navy personnel establish an appropriately sized exclusion zone to avoid exposure of nonparticipants to the harmful intensities of pressure. Naval Sea Systems Command Instruction 3150.2, Chapter 2, *Safe Diving Distances from Transmitting Sonar*, provides procedures for determining safe distances from underwater explosions (U.S. Department of the Navy 1999). In accordance with training and testing procedures for safety planning related to detonations (see Section 3.12.2.2.8), the Navy uses the following general and underwater detonation procedures:

- Navy personnel are responsible for ensuring that impact areas and targets are clear before commencing hazardous activities.
- The use of underwater ordnance must be coordinated with submarine operational authorities.
- Aircraft or vessels expending ordnance shall not commence firing without permission of the Range Safety Officer or Test Safety Officer for their specific range area.
- Firing units and targets must remain in their assigned areas, and units must fire in accordance with current safety instructions.
- Detonation activities will be conducted during daylight hours.

3.12.2.2.8 Weapons Firing and Ordnance Expenditure Safety

In accordance with safety and inspection procedures (U.S. Department of the Navy 2011b), any unit firing or expending ordnance shall ensure that all possible safety precautions are taken to prevent accidental injury or property damage. The Officer Conducting the Exercise shall permit firing or jettisoning of aerial targets only when the area is confirmed to be clear of nonparticipating units, both civilian and military.

Safety is a primary consideration for all training and testing activities. The range must be able to safely contain the hazard area of the weapons and equipment employed. The hazard area is based on the size and net explosive weight of the weapon. The type of activity determines the size of the buffer zone. For activities with a large hazard area, special sea and air surveillance measures are implemented to ensure that the area is clear before activities commence. Before aircraft can drop ordnance, they are required to make a preliminary pass over the intended target area to ensure that it is clear of boats, divers, or other nonparticipants. Aircraft carrying ordnance are not allowed to fly over surface vessels.

Training and testing activities are delayed, moved, or cancelled if there is a question about the safety of the public. Target areas must be clear of nonparticipants before conducting training and testing. When using ordnance with flight termination systems (which terminate the flight of airborne missiles or launch vehicles when they veer from their targeted path), the Navy is required to follow standard operating procedures to ensure public health and safety. In those cases where a weapons system does not have a flight termination system, the size of the target area that needs to be clear of nonparticipants is based on the flight distance of the weapon plus an additional distance beyond the system's performance capability.

3.12.3 Environmental Consequences

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) could impact public health and safety. In this section, each public health and safety stressor is introduced, analyzed by alternative, and analyzed for training activities and testing activities. Tables 2.8-1 through 2.8-5 present the baseline and proposed training and testing activity locations for each alternative (including the number of events and ordnance expended). Tables F-1 and F-2 in Appendix F describes all of the warfare areas and associated stressors that were considered for analysis of public health and safety. The stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to public health and safety are:

- underwater energy
- in-air energy
- physical interactions

Alternatives 1 and 2 include an expansion of the Study Area and pierside training areas, as described in Chapter 2, Description of the Proposed Action and Alternatives. Alternatives 1 and 2 would adjust locations and tempo of training and testing activities, but existing safety procedures and standard operating procedures would be employed such that no new or additional impacts to public health and safety would occur. Therefore, the Study Area expansion will not be addressed in the analysis below.

Potential public health and safety impacts were evaluated assuming continued implementation of the Navy's current safety procedures for each training and testing activity or group of similar activities. Generally, the greatest potential for the proposed activities to be co-located with public activities would be in coastal areas because most commercial and recreational activities occur close to the shore.

Training and testing activities in the Study Area are conducted in accordance with guidance provided in Fleet Area Control and Surveillance Facility Instructions (U.S. Department of the Navy 2011a,b) and Test and Safety Planning Instructions (U.S. Department of the Navy 2008b, 2009). These instructions provide operational and safety procedures for all normal range events. They also provide information to range users that is necessary to operate safely and avoid affecting nonmilitary activities such as shipping, recreational boating, diving, and commercial or recreational fishing. Ranges are managed in accordance with standard operating procedures that ensure public health and safety. Current requirements and practices (e.g., standard operating procedures) designed to prevent public health and safety impacts are identified in Chapter 5, Standard Operating Procedures, Mitigation, and Monitoring.

3.12.3.1 Underwater Energy

Underwater energy can come from acoustic sources or from electromagnetic devices. Active sonar, underwater explosions, airguns, and vessel movements all produce underwater acoustic energy. Sound will travel from air to water during aircraft overflights. Electromagnetic energy can enter the water from mine warfare training devices and from unmanned underwater systems. The potential for the public to be exposed to these stressors would be limited to individuals, such as recreational swimmers or self-contained underwater breathing apparatus (SCUBA) divers, that are underwater and within unsafe proximity of a training or testing event.

Many of the proposed activities generate underwater acoustic energy; however, not all sources rise to the level of consideration in this EIS/OEIS. Swimmers or divers might intermittently hear ship noise or underwater acoustic energy from aircraft overflights if they are near a training or testing event, but public health and safety would not be affected because these events would be infrequent and short in duration. Pierside integrated swimmer defenses are tested with underwater airguns during swimmer defense and diver deterrent training and testing activities; public health and safety would be ensured for these local activities because access to pierside locations by nonparticipants is controlled for safety and security reasons. Because of the infrequency and short duration of the events, underwater acoustic energy from vessel movements, aircraft overflights, and airguns is not analyzed in further detail. Active sonar and underwater explosions are the only sources of underwater acoustic energy evaluated for potential impacts on public health and safety.

The proposed activities that would result in underwater acoustic energy include anti-surface warfare, anti-submarine warfare, mine warfare, surface warfare testing, littoral combat ship testing, sonar maintenance, pierside sonar testing, and unmanned vehicle testing. A limited amount of active sonar would be used during transit between range complexes and training and testing locations.

The effect of active sonar on humans varies with the sonar frequency. Of the four types of sonar (very high-, high-, mid-, and low-frequency), mid-frequency and low-frequency sonar have the greatest potential to impact humans because of the range of human hearing. Underwater explosives cause a physical shock front that compresses the explosive material, and the pressure wave then passes into the surrounding water. Generally, the pressure wave would be the primary cause of injury. The effects of an underwater explosion depend on several factors, including the size, type, and depth of the explosive charge and where it is in the water column.

Systems like the Organic Airborne and Surface Influence Sweep emit an electromagnetic field and sound to simulate the presence of a ship. Unmanned underwater vehicles, some unmanned surface vehicles, and towed devices use electromagnetic energy. Electronic warfare activities involve aircraft, surface ship, and submarine crews attempting to control portions of the electromagnetic spectrum to degrade or deny the enemy’s ability to take defensive actions. An electromagnetic signal dissipates quickly with increasing distance from its source. The literature lacks evidence to conclude that any adverse health effects result from exposure to electromagnetic energy, which is why no federal standards have been set for occupational exposures to this type of energy. Because standard operating procedures require an exercise area to be clear of participants, the public would not be exposed to electromagnetic energy the way a worker could experience long-term, occupational exposures. In the unlikely event that the public was exposed, the level of electromagnetic energy associated with the Proposed Action would not be enough to pose a health or safety risk.

As previously stated, the potential for the public to be exposed to these stressors would be limited to divers within unsafe proximity of an event. SCUBA diving is a popular recreational activity that is typically concentrated around known dive attractions such as reefs and shipwrecks. In general, recreational divers should not exceed 130 ft. (40.02 m) (Professional Association of Diving Instructors 2011). This depth limit typically limits this activity's distance from shore. Therefore, training and testing activities closest to shore have the greatest potential to co-occur with the public.

Swimmers and recreational SCUBA divers are not expected to be near Navy pierside locations (which include shipyards) because access to these areas is controlled for safety and security reasons. Locations of popular offshore diving spots are well documented, and dive boats (typically well marked) and diver-down flags would be visible from the ships conducting the training and testing. Therefore, co-occurrence of recreational divers and Navy activities is unlikely. Swimmers and recreational divers are not expected to be near training and testing locations where active sonar, underwater explosions, and electromagnetic activities would occur because of the strict procedures for clearance of nonparticipants before conducting activities.

The U.S. Navy Dive Manual (U.S. Department of the Navy 1999) prescribes safe distances for divers from active sonar sources and underwater explosions. Safety precautions for use of electromagnetic energy are specified in DoD Instruction 6055.11 (U.S. Department of Defense 2002, 2009) and Military Standard 464A (U.S. Department of Defense 2002). These distances would be used as the standard safety buffers for underwater energy to protect public health and safety. If unauthorized personnel were detected within the exercise area, the activity would be temporarily halted until the area was again cleared and secured. Therefore, the public is unlikely to be exposed to underwater energy at Navy pierside locations, in training or testing areas, or in ports.

3.12.3.1.1 No Action Alternative

3.12.3.1.1.1 Training

Under the No Action Alternative, active sonar training activities such as anti-submarine warfare, mine warfare, and sonar maintenance would continue at current levels and within established ranges and training locations, including the Hawaii Range Complex and the SOCAL Range Complex, and other HSTT areas. Most of the sonar training events would be in the SOCAL and HRC range complexes.

Activities involving underwater explosions, such as anti-surface warfare and mine warfare, also would continue at current levels and within established ranges and training locations. Current locations for underwater explosions include specific training areas in the HRC, in the SOCAL Range Complex, and in Silver Strand Training Complex.

The analysis indicates that no impact on public health and safety would result from training activities using underwater energy, based on the Navy's implementation of strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing training activities involving underwater energy. Because of the Navy's safety procedures, the potential for training activities using underwater energy to impact public health and safety under the No Action Alternative would be low.

3.12.3.1.1.2 Testing

Under the No Action Alternative, active sonar testing activities such as anti-submarine warfare, mine warfare, pierside sonar testing, unmanned vehicle testing, and sonar maintenance would continue at current levels and in current locations, including areas such as the Hawaii and SOCAL OPAREAS. Pierside testing of active sonar would continue in Pearl Harbor and in San Diego Bay. Most of these activities would occur in the SOCAL Range Complex.

Testing activities involving underwater explosions, such as anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, and surface combatant sea trials also would continue at current levels and within established ranges and locations. Current locations for underwater explosions include specific training areas in HRC (Puuloa Underwater Range, Marine Corps Base Hawaii, Marine Corps Training Area Bellows, Barbers Point Underwater Range, Ewa Training Minefield, and Lima Landing) and in the SOCAL Range Complex (San Clemente Island's Northwest Harbor and Horse Beach Cove, Shallow Water Training Range), and SSTC's Boat Lanes 1-14.

The analysis indicates that no impact on public health and safety would result from testing activities using underwater energy, based on the Navy's implementation of strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing testing activities involving underwater energy. Because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under the No Action Alternative would be low.

3.12.3.1.2 Alternative 1

Alternative 1 consists of the activities in the No Action Alternative plus the expansion of the Study Area and adjustments in the locations and tempos of training and testing activities. Alternative 1 includes changes in force structure (personnel, weapons and assets), new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems. Alternative 1 includes the expansion of the Study Area to include the Transit Corridor and pierside activities in San Diego Bay and Pearl Harbor. This expansion would not increase the potential for public exposure over the No Action Alternative because the same safety procedures would be in place to assure that these areas were clear of nonparticipants.

3.12.3.1.2.1 Training

Active sonar training would continue at current locations under Alternative 1. In many instances, however, the potential activity areas would be expanded (see tables in Chapter 2). Locations for active sonar training include the same areas as described under the No Action Alternative, as well as the Transit Corridor and pierside areas in San Diego Bay and Pearl Harbor. While Alternative 1 would expand the locations and increase the tempos of active sonar training activities, the Navy would continue to implement standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely to increase.

Activities involving underwater explosions, such as anti-surface warfare, mine warfare, and civilian port defense, would also continue within established ranges and training locations, as described under the No Action Alternative. While Alternative 1 would adjust locations and tempos of underwater explosives training activities, the Navy would continue to implement standard operating and safety procedures; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely. The Navy's safety procedures would ensure that the potential for training activities to impact public health and safety under Alternative 1 would be low.

3.12.3.1.2.2 Testing

The locations and tempo of active sonar testing activities would increase over the No Action Alternative. Alternative 1 also includes the expansion of the Study Area, plus changes in force structure (personnel, weapons, and assets), new or upgraded weapons and platforms, and the testing required for these systems.

Under Alternative 1, active sonar testing activities such as anti-submarine warfare, mine warfare, pierside sonar testing, unmanned vehicle testing, and sonar maintenance would increase. These activities would occur in established locations and ranges, as described under the No Action Alternative. Pierside testing of active sonar would continue to occur in San Diego Bay and Pearl Harbor. While Alternative 1 would increase the locations and tempo of active sonar testing activities, the Navy would continue to implement standard operating and safety procedures, so the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely to increase.

Testing activities involving underwater explosions, such as anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, surface combatant sea trials, littoral combat ship testing, combat ship qualifications, and at-sea explosive testing would occur within established ranges and locations. Proposed locations for underwater explosions are the same as described under the No Action Alternative. While Alternative 1 would increase the tempo of underwater explosives testing activities, the Navy would continue to implement standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely to increase. Because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under Alternative 1 would be negligible.

3.12.3.1.3 Alternative 2

Alternative 2 consists of the activities in the No Action Alternative, plus adjustments to locations and tempo of training and testing activities. Alternative 2 includes changes in force structure (personnel, weapons, and assets), new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems. Alternative 2 includes the expansion of the Study Area and pierside areas of San Diego Bay and Pearl Harbor. This expansion would not increase the potential for public exposure over the No Action Alternative because the same safety procedures would be in place to make sure these areas are clear of nonparticipants.

3.12.3.1.3.1 Training

Alternative 2 is similar to Alternative 1 in the increase in active sonar, underwater explosions, and electromagnetic activities over the No Action Alternative. Alternative 2 is identical to Alternative 1 in the proposed locations for these activities. As concluded under Alternative 1, because of the Navy's safety procedures, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely to increase.

3.12.3.1.3.2 Testing

Similar to Alternative 1, Alternative 2 would increase active sonar testing activities such as anti-submarine warfare, mine warfare, pierside sonar testing, unmanned vehicle testing, and sonar maintenance. These activities would continue in established locations and ranges, as described under the No Action Alternative. Pierside testing of active sonar would continue in Pearl Harbor and in San Diego Bay. Changes in the locations and tempo of active sonar testing activities would not impact public health or safety because the safety procedures used under the No Action Alternative would still be in place.

Testing activities involving underwater explosions, such as anti-air warfare, anti-surface warfare, anti-submarine warfare, mine warfare, surface combatant sea trials, littoral combat ship testing, combat ship qualifications, and at-sea explosive testing would occur within established ranges and locations, as described under the No Action Alternative. Changes in the locations and tempo of underwater explosion testing activities could not impact public health or safety because the safety procedures used under the No Action Alternative would still be in place. Because of the Navy's safety procedures, the potential for underwater testing activities to impact public health and safety under Alternative 2 would be negligible.

3.12.3.2 In-Air Energy

In-air energy stressors include sources of electromagnetic energy and lasers. The sources of electromagnetic energy include radar, navigational aids, and electronic warfare systems. These systems operate similarly to other navigational aids and radars at local airports and television weather stations throughout the United States. Electronic warfare systems emit electromagnetic energy similar to that from cell phones, hand-held radios, commercial radio stations, and television stations. Current practices protect Navy personnel and the public from electromagnetic energy hazards. These procedures include setting the heights and angles of electromagnetic energy transmissions to avoid direct human exposure, posting warning signs, establishing safe operating levels, and activating warning lights when radar systems are operational. Procedures also are in place to limit public and participant exposure from electromagnetic energy emitted by military aircraft. As stated in Section 3.12.3.1 (Underwater Energy), the level of electromagnetic energy associated with the Proposed Action would not be enough to pose a health or safety risk to the public.

A comprehensive safety program exists for the use of lasers. Current Navy practices protect individuals from the hazard of severe eye injury caused by laser energy. Laser safety requires pilots to verify that target areas are clear prior to commencement of an exercise. In addition, during actual laser use, the aircraft run-in headings are restricted to preclude inadvertent lasing of areas where the public may be present.

Training and testing activities involving electromagnetic energy include electronic warfare activities that use airborne and surface electronic jamming devices to defeat tracking and communications systems. Training activities involving low-energy lasers include anti-surface warfare, mine warfare, and Homeland Security/Anti-Terrorism Force Protection with Unmanned Vehicles. Testing activities involving low-energy lasers include surface warfare, air exercises at the test range, and mine warfare testing.

3.12.3.2.1 No Action Alternative

3.12.3.2.1.1 Training

Under the No Action Alternative, electronic warfare training activities involving electromagnetic energy sources would continue at current levels and locations, including the Hawaii OPAREA and the SOCAL Range Complex's Electronic Warfare Range. Laser targeting activities and mine detection activities using lasers also would continue at current levels and within established ranges and training locations, including the HRC's Warning Area 188 and the SOCAL Range Complex's Southern California Anti-Submarine Warfare Range and San Clemente Island Shore Bombardment Range.

The public would not likely be exposed to electromagnetic energy sources or lasers under the No Action Alternative. Based on the Navy's strict safety procedures for use of lasers and electronic warfare, these activities would not likely be conducted close enough to the public to pose an increased risk. Because of the Navy's safety procedures, the potential for these training activities to impact public health and safety under the No Action Alternative would be negligible.

3.12.3.2.1.2 Testing

Under the No Action Alternative, electronic warfare testing activities involving electromagnetic energy sources would continue at current levels and within established ranges and testing locations. Laser targeting activities and mine detection activities using lasers would continue at current levels and within established ranges and locations.

The public would not likely be exposed to electromagnetic energy sources or lasers from testing activities under the No Action Alternative. Based on the Navy's strict safety procedures for use of lasers and electronic warfare, these activities would not likely be conducted close enough to the public to pose an increased risk. Because of the Navy's safety procedures, the potential for these testing activities to impact public health and safety under the No Action Alternative would be negligible.

3.12.3.2.2 Alternative 1

Alternative 1 consists of the activities in the No Action Alternative plus adjustments to locations and tempos of training and testing activities. Alternative 2 includes changes in force structure (personnel, weapons, and assets), new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems. Alternative 1 includes the expansion of the Study Area to include the Transit Corridor, and Navy piers in San Diego Bay and Pearl Harbor. This expansion would not increase the potential for public exposure over the No Action Alternative because the same safety procedures would be in place to ensure that these areas are clear of nonparticipants.

3.12.3.2.2.1 Training

Under Alternative 1, the number of training activities that use electromagnetic energy would increase, and would continue to occur within established ranges and training locations, as described under the No Action Alternative. Laser targeting activities and mine detection activities using lasers would increase but also would occur within established ranges and training locations.

While Alternative 1 would increase locations and tempos of training activities involving electromagnetic energy and lasers, the Navy would continue to implement standard operating and safety procedures. Therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely to increase.

3.12.3.2.2.2 Testing

Under Alternative 1, the number of testing activities that use electromagnetic energy would increase, and would continue to occur within established ranges and testing locations. Testing activities that use electromagnetic energy would take place in the same areas as described under the No Action Alternative. Additional locations proposed under this alternative include pierside locations in San Diego and in Pearl Harbor.

While Alternative 1 would increase locations and tempos of testing activities involving electromagnetic energy and lasers, the Navy would continue to implement standard operating and safety procedures. Therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

3.12.3.2.3 Alternative 2

Alternative 2 consists of the activities in the No Action Alternative plus adjustments to locations and tempo of training and testing activities. This alternative includes changes in force structure (personnel, weapons, and assets), new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems. Alternative 2 includes the expansion of the Study Area to include the Transit Corridor and Navy piers in San Diego Bay and Pearl Harbor. This expansion would not increase the potential for public exposure over the No Action Alternative because the same safety procedures would be in place to make sure these areas are clear of nonparticipants.

3.12.3.2.3.1 Training

Alternative 2 is similar to Alternative 1 in the increase in electromagnetic energy and laser training activities over the No Action Alternative. Alternative 2 is identical to Alternative 1 in the proposed locations for these activities. As concluded under Alternative 1, impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

While Alternative 2 would adjust locations and tempo of training activities involving electromagnetic energy and lasers, the Navy would continue to implement standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely to increase.

3.12.3.2.3.2 Testing

Similar to Alternative 1, Alternative 2 would increase electromagnetic energy and laser testing activities. Electromagnetic energy activities would continue to occur in established location and ranges, as described under the No Action Alternative, and at pierside locations in San Diego and Pearl Harbor. Laser targeting activities would occur in the HRC's Warning Area 188 and the SOCAL Range Complex's Southern California Anti-Submarine Warfare Range and San Clemente Island's Shore Bombardment Range. Changes in the locations and tempo of in-air testing activities and the addition of new activities would not impact public health or safety because safety procedures would be in place.

While Alternative 2 would adjust locations and tempos of testing activities involving electromagnetic energy and lasers, the Navy would continue to implement standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely to increase.

3.12.3.3 Physical Interactions

Public health and safety could be impacted by direct physical interactions with Navy activities. Navy aircraft, vessels, targets, munitions, towed devices, seafloor devices, and other training and testing expended materials could have a direct physical encounter with recreational, commercial, institutional, and governmental aircraft, vessels, and users such as swimmers, divers, and anglers.

Both Navy and public aircraft operate under visual flight rules requiring them to observe and avoid other aircraft. In addition, Notices to Airmen advise pilots about when and where Navy training and testing activities are scheduled. Finally, Navy personnel are required to verify that the range is clear of nonparticipants before initiating any potentially hazardous activity. Together, these procedures would minimize the potential for adverse interactions between Navy and nonparticipant aircraft. The Navy's standard operating procedures assure that private and commercial aircraft traversing the Study Area during training or testing activities do not interact with Navy aircraft, ordnance, or aerial targets.

Both Navy and public vessels operate under maritime navigational rules requiring them to observe and avoid other vessels. In addition, Notices to Mariners advise vessel operators about when and where Navy training and testing activities are scheduled. Finally, Navy personnel are required to verify that the range is clear of nonparticipants before initiating any potentially hazardous activity. Together, these procedures minimize the potential for adverse interactions between Navy and nonparticipant vessels. The Navy's standard operating procedures assure that private and commercial vessels traversing the Study Area during training or testing activities do not interact with Navy vessels, ordnance, or surface targets.

Recreational diving within the Study Area takes place primarily at known diving sites such as shipwrecks and reefs. The locations of these popular dive sites are well documented, dive boats are typically well-marked, and diver-down flags are visible from a distance. As a result, ships conducting training or testing activities would easily avoid dive sites. Interactions between training and testing activities and recreational divers thus would be minimized, reducing the potential for collisions or ship strikes. Similar knowledge and avoidance of popular fishing areas would minimize interactions between training and testing activities and recreational fishing.

Commercial and recreational fishers could encounter military expended materials that could entangle fishing gear and could pose a safety risk. The Navy would continue to recover targets at or near the surface that were used during training or testing to ensure that they would not pose a collision risk. Unrecoverable pieces of military expended materials are typically small (such as sonobuoys), constructed of soft materials (such as target cardboard boxes or tethered target balloons), or intended to sink to the bottom after their useful function was completed, so they would not be a collision risk to civilian vessels or equipment. Thus, these targets do not pose a safety risk to individuals using the area for recreation because the public would not likely be exposed to these items before they sank to the seafloor.

As discussed in Sediments and Water Quality (Section 3.1), a west coast study categorized types of marine debris collected by a trawler during a groundfish survey. Military expended materials were categorized as plastic, metal, fabric and fiber, and rubber comprising 7.4, 6.2, 13.2, and 4.7 percent of the total count of items collected, respectively. The footprint of military expended materials in the Study Area is discussed in Marine Habitats (Section 3.3), which concluded that if all military expended materials were located side by side in the Study Area, the footprint would be approximately 0.19 m^2 (0.48 km^2). Because the footprint of military expended materials in the Study Area is small, recreational and commercial fishers probably would not encounter military expended materials.

Section 3.1 (Sediments and Water Quality) also discussed the low failure rates of munitions, which indicate that most munitions function as intended. While fish trawls may encounter undetonated ordnance lying on the ocean floor, such an encounter would be unlikely because the density of munitions in the Study Area is low. The Army Corps of Engineers prescribes the following procedure if military munitions are encountered: recognize when you may have encountered a munition, retreat from the area without touching or disturbing the item, and report the item to local law enforcement by calling 911 or the U.S. Coast Guard.

The analysis focuses on the potential for a direct physical interaction with an aircraft, vessel, target, or expended training item. All proposed activities have some potential for a direct physical interaction that could pose a risk to public health or safety, so the following analysis is not activity-specific. While some of the activities may not pose a potential for a direct physical interaction (like pierside testing) the platforms used in the activity (aircraft, vessel, towed device) could have a direct physical interaction that could pose a risk. The greatest potential for a physical interaction would be along the coast because of the high concentration there of public activities.

3.12.3.3.1 No Action Alternative

3.12.3.3.1.1 Training

Under the No Action Alternative, training activities would continue at current levels and within established locations. The potential for a direct physical interaction between the public and aircraft, vessels, targets, or expended materials would not change from the baseline. The Navy implements strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area prior to commencing training activities.

The analysis indicates that public health and safety would not be affected by physical interactions with training activities, based on the Navy's implementation of strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing training activities involving physical interactions. Because of the Navy's safety procedures, the potential for training activities to impact public health and safety under the No Action Alternative would be negligible.

3.12.3.3.1.2 Testing

Because the potential for a physical interaction is not activity-specific or location-specific, the analysis of the training activities above applies to testing activities under the No Action Alternative. As concluded above, because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under the No Action Alternative would be negligible.

3.12.3.3.2 Alternative 1

Alternative 1 consists of the activities included in the No Action Alternative, plus adjustments in the locations and tempos of training and testing activities. This alternative includes changes in force structure (personnel, weapons and assets), new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems. Alternative 1 includes the expansion of the Study Area to include the Transit Corridor, and Navy piers in San Diego Bay and Pearl Harbor. This expansion would not increase the potential for public exposure over the No Action Alternative because the same safety procedures would be in place to make sure these areas are clear of nonparticipants.

3.12.3.3.2.1 Training

Under Alternative 1, the number of training activities would increase, but would continue within established locations. However, the increased number of aircraft and vessel movements or use of targets and expended materials would be conducted under the same safety and inspection procedures as under the No Action Alternative. While Alternative 1 would adjust locations and tempos of training activities, the Navy would continue to implement standard operating and safety procedures. Therefore, the potential for impacts on public health and safety, beyond those identified under the No Action Alternative, would be negligible.

3.12.3.3.2.2 Testing

Because the potential for a physical interaction is not activity-specific or location-specific, the analysis of the training activities presented above also applies to testing activities under Alternative 1. As concluded above, because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under Alternative 1 would be negligible.

3.12.3.3.3 Alternative 2

Alternative 2 consists of the activities included in the No Action Alternative plus adjustments to locations and tempos of training and testing activities. This alternative includes changes in force structure (personnel, weapons, and assets), new or upgraded weapons and platforms, and the training and testing required for proficiency with these systems. Alternative 2 includes the expansion of the Study Area to include the Transit Corridor and Navy piers in San Diego Bay and Pearl Harbor. This expansion would not increase the potential for public exposure over the No Action Alternative because the same safety procedures would be in place to make sure these areas are clear of nonparticipants.

3.12.3.3.3.1 Training

Under Alternative 2, the number of training activities would increase. The potential for a direct physical interaction between the public and aircraft, vessels, targets, or expended materials would also increase. While Alternative 2 would adjust locations and tempos of training activities, the Navy would continue to implement standard operating and safety procedures. Therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be negligible.

3.12.3.3.3.2 Testing

The potential for a physical interaction is not activity-specific or location-specific, so the analysis of the training activities presented above also applies to testing activities under Alternative 2. As concluded above, because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under Alternative 1 would be negligible.

3.12.4 Secondary Impacts

Public health and safety could be impacted if sediment or water quality were degraded. Section 3.1 (Sediments and Water Quality) considered the impacts on marine sediments and water quality of explosives and explosion byproducts, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). The analysis determined that neither state nor federal standards or guidelines would be violated by the No Action Alternative, Alternative 1, or Alternative 2. Because these standards and guidelines are structured to protect human health, and the proposed activities do not violate them, no secondary impacts on public health and safety would result from the training and testing activities proposed by the No Action Alternative, Alternative 1, or Alternative 2.

3.12.5 Summary of Potential Impacts (Combined Impacts of All Stressors) on Public Health and Safety

Activities described in this EIS/OEIS that could affect public health or safety include those that release underwater energy, in-air energy, or physical interactions, or that have secondary impacts from changes in sediment or water quality. Under the No Action Alternative, Alternative 1, or Alternative 2, these activities would be widely dispersed throughout the Study Area. Such activities also are dispersed temporally (i.e., few stressors would be present at the same time). For these reasons, no greater impacts from the combined operation of more than one stressor are expected. The aggregate impact on public health and safety would not observably differ.

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4 CUMULATIVE IMPACTS

4.1 INTRODUCTION

The analysis of cumulative impacts (or cumulative effects)[1] presented in this section follows the requirements of the National Environmental Policy Act (NEPA) and Council on Environmental Quality guidance (Council on Environmental Quality 1997). The Council on Environmental Quality regulations (40 Code of Federal Regulations [C.F.R.] §§ 1500-1508) provide the implementing regulations for NEPA. The regulations define cumulative impacts as

> "…the impact on the environment which results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 C.F.R. § 1508.7)."

While a single project may have minor impacts, overall impacts may be collectively significant when the project is considered together with other projects on a regional scale. A cumulative impact is the additive effect of all projects in the geographic area. The Council on Environmental Quality provides guidance on cumulative impact analysis in *Considering Cumulative Impacts under the National Environmental Policy Act* (Council on Environmental Quality 1997). This guidance further identifies cumulative impacts as those environmental impacts resulting "from spatial and temporal crowding of environmental perturbations. The impacts of human activities will accumulate when a second perturbation occurs at a site before the ecosystem can fully rebound from the impacts of the first perturbation." This guidance observes that "no universally accepted framework for cumulative impacts analysis exists…" while noting that certain general principles have gained acceptance. The Council on Environmental Quality provides guidance on the extent to which agencies of the federal government are required to analyze the environmental impacts of past actions when they describe the cumulative environmental effect of an action. This guidance provides that an analysis of cumulative impacts might encompass geographic boundaries beyond the immediate area of an action and a timeframe that includes past actions and foreseeable future actions. Thus, the Council on Environmental Quality guidelines observe, "[it] is not practical to analyze cumulative impacts of an action on the universe; the list of environmental impacts must focus on those that are truly meaningful."

4.2 APPROACH TO ANALYSIS

4.2.1 OVERVIEW

Cumulative impacts were analyzed for each resource addressed in Chapter 3 (Affected Environment and Environmental Consequences) for the No Action Alternative, Alternative 1, and Alternative 2 (the alternatives) in combination with past, present, and reasonably foreseeable future actions. The cumulative impacts analysis included the following steps, described in more detail below:

1. Identify appropriate level of analysis for each resource.
2. Define the geographic boundaries and timeframe for the cumulative impacts analysis.
3. Describe current resource conditions and trends.

[1] Council on Environmental Quality Regulations provide that the terms "cumulative effects" and "cumulative impacts" are synonymous (40 C.F.R. § 1508.8[b]); the terms are used interchangeably by various sources, but the term "cumulative impacts" will be used in this document except for quotations, for continuity.

4. Identify potential impacts of each alternative that might contribute to cumulative impacts.
5. Identify past, present, and other reasonably foreseeable future actions that affect each resource.
6. Analyze potential cumulative impacts.

4.2.2 Identify Appropriate Level of Analysis for Each Resource

In accordance with Council on Environmental Quality guidance (Council on Environmental Quality 1997), the cumulative impacts analysis focused on impacts that are "truly meaningful." The level of analysis for each resource was commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences). The rationale for the level of analysis applied to each resource is described in Section 4.4 (Resource-Specific Cumulative Impacts).

4.2.3 Define the Geographic Boundaries and Timeframe for Analysis

The geographic boundaries for the cumulative impacts analysis included the entire Hawaii-Southern California Training and Testing (HSTT) Study Area (Study Area) (Figure 2.1-1). The geographic boundaries for cumulative impacts analysis for marine mammals and sea turtles were expanded to include activities outside the HSTT Study Area that might impact migratory marine mammals and sea turtles. Primary considerations from outside the Study Area include impacts associated with maritime traffic (e.g., vessel strikes and underwater noise) and commercial fishing (e.g., bycatch and entanglement).

Determining the timeframe for the cumulative impacts analysis requires estimating the length of time the impacts of the Proposed Action would last (Council on Environmental Quality 1997) and considering the specific resource in terms of its history of degradation. The Proposed Action includes ongoing and anticipated future training and testing activities. While Navy training and testing requirements change over time in response to world events and several other factors, the general types of activities addressed by this Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) are expected to continue indefinitely, and the associated impacts would occur indefinitely. Likewise, some reasonably foreseeable future actions and other environmental considerations addressed in the cumulative impacts analysis are expected to continue indefinitely (e.g., oil and gas production, maritime traffic, commercial fishing). Therefore, the cumulative impacts analysis is not bounded by a specific future timeframe. For past actions, the cumulative impacts analysis only considers those actions or activities that have ongoing impacts.

While the cumulative impacts analysis is not limited by a specific timeframe, it should be recognized that available information, uncertainties, and other practical constraints limit the ability to analyze cumulative impacts for the indefinite future. Navy environmental planning and compliance for training and testing activities is an ongoing process. The Navy intends to submit applications to the National Marine Fisheries Service (NMFS) for Marine Mammal Protection Act (MMPA) authorizations supported by this EIS/OEIS. The anticipated effective dates for these MMPA authorizations would be a five-year period from January 2014 through December 2018. Future environmental planning documents will include cumulative impacts analysis based on information available at that time.

4.2.4 Describe Current Resource Conditions and Trends

The Affected Environment sections of Chapter 3 (Affected Environment and Environmental Consequences) describe current resource conditions and trends, and they discuss how past and present human activities influence each resource. The current aggregate impacts of past and present actions are reflected in the baseline information presented in Chapter 3 (Affected Environment and Environmental

Consequences). This information is used in the cumulative impacts analysis to understand how past and present actions are currently impacting each resource and to provide the context for the cumulative impacts analysis.

4.2.5 Identify Potential Impacts of The Alternatives That Might Contribute to Cumulative Impacts

Direct and indirect impacts of the alternatives, presented in Chapter 3 (Affected Environment and Environmental Consequences), were reviewed to identify impacts relevant to the cumulative impacts analysis. Key factors considered included the current status and sensitivity of the resource and the intensity, duration, and spatial extent of the impacts for each stressor. In general, long-term rather than short-term impacts and widespread rather than localized impacts were considered more likely to contribute to cumulative impacts. For example, for biological resources, population-level impacts were considered more likely to contribute to cumulative impacts than were individual-level impacts. Negligible impacts were not considered further in the cumulative impacts analysis. For marine mammals, any stressor that is expected to result in Level A harassment or Level B harassment, as defined by MMPA, was considered in the cumulative impacts analysis. For Endangered Species Act (ESA)-listed species, any stressor that may affect and is likely to adversely affect the species was considered in the cumulative impacts analysis. Stressors that were determined by the Navy to have no effect or that may affect but are not likely to adversely affect ESA-listed species were not analyzed in detail in the cumulative impacts analysis. A determination of may affect, not likely to adversely affect indicates that the impacts would be discountable (extremely unlikely) or insignificant.

4.2.6 Identify Other Actions and Other Environmental Considerations That Affect Each Resource

A list of other actions was compiled for the Study Area and surrounding areas based on information obtained during the scoping process (Appendix E [Public Participation]), communications with other agencies, a review of other military activities, literature review, previous NEPA analyses for some of the other actions, and other available information. Identified future actions were reviewed to determine if they should be considered further in the cumulative impacts analysis. Factors considered when identifying other actions to be included in the cumulative impacts analysis included the following:

- Whether the other action is likely or probable (i.e., reasonably foreseeable), rather than merely possible or speculative.
- The timing and location of the other action in relationship to proposed training and testing activities.
- Whether the other action and each alternative would affect the same resources.
- The current conditions, trends, and vulnerability of resources affected by the other action.
- The duration and intensity of the impacts of the other action.
- Whether the impacts have been truly meaningful, historically significant, or identified previously as a cumulative impact concern.

In addition to identifying reasonably foreseeable future actions, other environmental considerations for the cumulative impacts analysis were identified and described. These other considerations include major environmental stressors or issues (e.g., ocean pollution, ocean noise, coastal development, etc.) that tend to be widespread and arise from routine human activities and multiple past, present, and future actions. Including these other environmental considerations allows an analysis of the current aggregate impacts of past and present actions, as well as reasonably foreseeable actions.

4.2.7 Analyze Potential Cumulative Impacts

The current impacts of past and present actions and the anticipated impacts of reasonably foreseeable future actions were characterized and summarized. The incremental impacts of each alternative were then added to the combined impacts of all other actions to describe the cumulative impacts that would result if the No Action Alternative, Alternative 1, or Alternative 2 were implemented. The cumulative impacts analysis considered additive, synergistic, and antagonistic impacts. A qualitative analysis was conducted in most cases based on the available information. The analysis in Chapter 3 (Affected Environment and Environmental Consequences) indicates that the direct and indirect impacts of the No Action Alternative, Alternative 1, and Alternative 2 would be similar for many of the stressors. Therefore, much of the cumulative impacts discussion applies to all three alternatives. Specific differences between the alternatives are discussed when appropriate.

4.3 Other Actions Analyzed in the Cumulative Impacts Analysis

4.3.1 Overview

Table 4.3-1 lists the other actions and other environmental considerations identified for the cumulative impacts analysis. Descriptions of each action and environmental consideration carried forward for analysis are provided in the following sections.

4.3.2 Oil and Natural Gas Exploration, Extraction, and Production

4.3.2.1 Proposed Outer Continental Shelf Oil and Gas Leasing Program 2012-2017

Oil and gas resources of the Outer Continental Shelf are governed by the Outer Continental Shelf Lands Act which requires a 5-year leasing program. Areas off the Pacific coast are not included in the 2012-2017 Outer Continental Shelf Oil and Gas Leasing Program proposed by the U.S. Department of the Interior Bureau of Ocean Energy Management based upon an agreement signed by the governors of California, Washington, and Oregon in 2006 (Bureau of Ocean Energy Management 2011).

4.3.2.2 Liquefied Natural Gas Terminals

Liquefied natural gas facilities have been proposed at several locations throughout North America in recent years in response to the quickly escalating domestic demand for this fuel. Currently the only existing terminal near the Study Area is in Baja California, Mexico and only one additional terminal is proposed for the area immediately north of the Study Area (Federal Energy Regulatory Commission 2011).

Potential environmental impacts include those associated with additional ship traffic, underwater noise from construction and operation, and potential releases of liquefied natural gas. Releases of liquefied natural gas can result from equipment leaks or spills during operations. Releases can be accidental (e.g., ship collision), or intentional (i.e., sabotage or terrorist acts).

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis

#	Name of Action	Lead Agency or Proponent	Location in the Study Area/LME	Timeframe	Retained for Further Analysis?
Oil and Natural Gas Exploration, Extraction, and Production					
1	Proposed Outer Continental Shelf Oil and Gas Leasing Program 2012-2017	Bureau of Ocean Energy Management	All LMEs	Past, present, and foreseeable future	Retained.
2	Liquefied Natural Gas Terminals	Bureau of Ocean Energy Management, Regulation and Enforcement	California Current LME	Past, present, and foreseeable future	Retained.
Offshore Power Generation					
3	Marine Hydrokinetic Projects	Federal Energy Regulatory Commission	All LMEs	Foreseeable future	Retained.
Dredge Disposal, Beach Nourishment, and Mining					
4	Offshore Dredge Disposal Program	U.S. Army Corps of Engineers	All LMEs	Past, present, and future	Dismissed because action involves programs related to dredging and beach nourishment projects. These activities (if applicable) would be analyzed on an individual basis for cumulative impacts..
5	Beach Nourishment Programs	U.S. Army Corps of Engineers	All LMEs	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action.
Other Military Activities					
6	Scripps Pier Replacement at Point Loma	U.S. Department of the Navy	California Current LME	Present and future	Retained.
7	Naval Base Point Loma Fuel Pier	U.S. Department of the Navy	California Current LME	Past, present, and future	Retained.
9	Submarine Drive-In Magnetic Silencing Facility Beckoning Point, Oahu, Hawaii	U.S. Department of the Navy	Insular Pacific-Hawaiian LME	Past, present, and future	Retained.

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

#	Name of Action	Lead Agency or Proponent	Location in the Study Area/LME	Timeframe	Retained for Further Analysis?
Other Military Activities (continued)					
10	Establishment and Realignment of Navy Helicopter Squadrons on the West Coast	U.S. Department of the Navy	California Current LME	Future	Retained.
11	San Clemente Island Fuel Storage and Distribution System	U.S. Department of the Navy	California Current LME	Past, present, and future	Retained.
12	Wave Energy Test Site	U.S. Department of the Navy University of Hawaii U.S. Department of Energy	Insular Pacific-Hawaiian LME	Future	Retained.
13	Pier 12 Replacement and Dredging Naval Base San Diego	U.S. Department of the Navy	California Current LME	Future	Retained.
14	Homeporting Littoral Combat Ships on the West Coast	U.S. Department of the Navy	California Current LME	Future	Retained for activities associated with homeporting. While NEPA has not been completed and a decision has not been made, the Navy's envisaged homeporting location for the west coast Littoral Combat Ships is Naval Base San Diego. Impacts from Littoral Combat Ship training are considered under Alternatives 1 and 2 and are not considered in cumulative impacts.
15	Surveillance Towed Array Sensor System Low Frequency Active Sonar	U.S. Department of the Navy	All LMEs	Future	Retained

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

#	Name of Action	Lead Agency or Proponent	Location in the Study Area/LME	Timeframe	Retained for Further Analysis?
Other Military Activities (continued)					
16	Space and Naval Warfare Systems Command Electronic Harbor Security System	U.S. Department of the Navy	California Current LME	Current	Retained.
17	Construction of SEAL Delivery Vehicle Team-One Waterfront Operations Facility	U.S. Department of the Navy	Insular Pacific-Hawaiian LME	Current	Retained.
18	Basing of MV-22 and H-1 Aircraft in Support of III Marine Expeditionary Force Elements in Hawaii	U.S. Department of the Navy	Insular Pacific-Hawaiian LME	Future	Retained.
19	Marine Corps Base Hawaii Pyramid Beach Cottage Construction	U.S. Department of the Navy	Insular Pacific-Hawaiian LME	Future	Retained.
20	U.S. Marine Corps Joint Strike Fighter	U.S. Marine Corps	All LMEs	Future	Dismissed. Homebasing activities such as new construction and personnel relocation are not expected to impact marine resources. Joint Strike Fighter training activities are addressed under Alternatives 1 and 2.
21	U.S. Navy Climate Change Roadmap	U.S. Department of the Navy	All LMEs	Present and future	Retained.
22	Hawaii Air National Guard F-22 Beddown	U.S. Air Force	All LMEs	Future	Retained.

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

#	Name of Action	Lead Agency or Proponent	Location in the Study Area/LME	Timeframe	Retained for Further Analysis?
Other Military Activities (continued)					
	Environmental Regulations and Planning				
23	Coastal and Marine Spatial Planning	Regional Ocean Commissions	All LMEs	Future	Dismissed because action involves only planning and policy-related activities (discussed in Chapter 6 [Additional Regulatory Considerations]).
24	Marine Mammal Protection Act incidental take authorizations	National Marine Fisheries Service	All LMEs	Past, present, and future	Retained.
	Other Environmental Considerations				
25	Commercial and Recreational Fishing	National Marine Fisheries Service and private industry	All LMEs and open ocean areas	Past, present, and future	Retained.
26	Maritime Traffic	Not applicable	All LMEs and open ocean areas	Past, present, and future	Retained.
27	Development of Coastal Lands	Local regulatory agencies	All LMEs	Past, present, and future	Retained.
28	Oceanographic Research	Numerous	All LMEs and open ocean areas	Past, present, and future	Retained.
29	Ocean Noise	Not applicable	All LMEs and open ocean areas	Past, present, and future	Retained.
30	Ocean Pollution	U.S. Environmental Protection Agency Applicable State Agencies	All LMEs and open ocean areas	Past, present, and future	Retained.
31	Marine Tourism	Numerous	All LMEs	Past, present, and future	Retained.
32	Commercial and General Aviation	Not applicable	All LMEs and open ocean areas	Past, present, and future	Retained.

Notes: LME=Large marine ecosystem; U.S. = United States; EA = Environmental Assessment; MDA = Missile Defense Agency

4.3.3 Offshore Power Generation

4.3.3.1 Marine Hydrokinetic Projects

Emerging water power technologies offer the potential to capture energy from waves, thermal gradients, tides, and ocean currents. These new technologies once developed will offer alternatives to fossil fuels. At the present time, there is significant research into the performance and economic viability of hydropower technologies. Because no fully developed marine hydrokinetic projects exist in the North American or Polynesia region, the impact on marine species and ecosystems in the region remains largely speculative. Concerns raised include the potential for collisions, noise, physical disturbance, disruption of marine species' behavioral patterns, impacts to local community and fishing industry, ability to monitor projects, cumulative impacts of multiple hydrokinetic projects along the coasts, habitat alteration due to anchors and cables, and release of toxins and chemicals by the projects or by vessels servicing the project. Other considerations include habitat disturbance and the displacement of benthic organisms. These concerns provide the potential for habitat loss and changes to the ecology of a region (Pacific Fishery Management Council 2011); however initial studies have indicated that with appropriate protocols for siting and design indicates that these impacts are likely to be minimal (Union of Concerned Scientists 2008).

As of June 2011, the Federal Energy Regulatory Commission has issued 70 preliminary permits for hydrokinetic projects and 147 preliminary permits are pending. In California there are four wave preliminary permits and one tidal preliminary permit. In Hawaii there is one wave preliminary permit that has been issued (Center for Climate and Energy Solutions 2012).

4.3.4 Dredge Disposal, Beach Nourishment, and Mining

4.3.4.1 Offshore Dredge Disposal Program

The offshore dredge disposal program is dismissed from analysis because the action involves programs related to dredging and beach nourishment projects. These activities (if applicable) would be analyzed on an individual basis for cumulative impacts.

4.3.4.2 Beach Nourishment Programs

Beach nourishment programs are dismissed from analysis because they result in negligible to minor impacts on resources in the area affected by this activity and the Proposed Action.

4.3.5 Other Military Activities

4.3.5.1 Scripps Pier Replacement at Point Loma

The proposed project is a joint project between the Navy and University of California San Diego that involves the replacement of the existing Scripps Pier. The project is proposed to begin in the fall of 2013.

4.3.5.2 Naval Base Point Loma Fuel Pier

The proposed project involves the replacement of the existing fuel pier at Point Loma, which will likely require the temporary relocation of the marine mammals from the Space and Naval Warfare Systems Command mammal program and dredging approximately 87,000 cubic yards of sediment to facilitate navigation in the vicinity of the fuel pier.

4.3.5.3 Submarine Drive-In Magnetic Silencing Facility Beckoning Point, Oahu, Hawaii

Construction of a new drive-in submarine magnetic silencing facility was completed on December 31, 2010 at Joint Base Pearl Harbor-Hickam's Beckoning Point. The project was a two year effort that replaced existing submarine deperming piers and structures and construction of landbased facilities to include a new rectifier building, back-up generator building, and renovations to the existing control building. Deperming (also known as degaussing) is accomplished by wrapping heavy gauge copper cables around the hull and superstructure of the vessel; very high electrical currents are pulsed through the cables in order to erase the permanent magnetism from ships and submarines to camouflage them against magnetic detection vessels and interference with communications and navigation equipment (U.S. Department of the Navy 2008a, b).

4.3.5.4 Establishment and Realignment of Navy Helicopter Squadrons on the West Coast

The Navy will add four helicopter squadrons on the west coast: establishing three new squadrons and relocating one squadron from the east coast. The realignment will increase the number of helicopters homebased at North Island by 52, from the current number of 151, to 203 helicopters by 2016. Most helicopter squadrons homebased at North Island will transition to the MH-60R and MH-60S helicopters to gradually replace older model H-60 helicopters. A new organizational maintenance hangar and supporting facilities will be constructed and 800 personnel (738 military and 62 civilian) will be added at North Island to support the additional squadrons (U.S. Department of the Navy 2011c).

4.3.5.5 San Clemente Island Fuel Storage and Distribution System

An Environmental Assessment has been implemented to replace the aging underground JP-5 jet fuel tanks and improve the receipt, storage, and delivery capabilities at San Clemente Island.

Navy, University of Hawaii, and United States Department of Energy Wave Energy Test Site

Naval Facilities Engineering Command Engineering Services Center (NAVFAC ESC) proposes to construct and operate a deep-water wave energy test site (WETS) for offshore wave energy conversion (WEC) devices at a water depth of up to 328 feet (ft) (100 m [meters]), roughly 8,200 ft (2,500 m) offshore from North Beach of MCBH. Upon completion of deep-water test site construction, two (2) additional WEC devices would be installed and operated at the deep test site, and the existing site (one) operating at about 98 ft (30 m) depth (known as the medium depth site would remain. Therefore, the existing and expanded test sites would accommodate a maximum of three (3) WEC devices (U.S. Department of the Navy 2012a).

4.3.5.6 Pier 12 Replacement and Dredging Naval Base San Diego

An Environmental Assessment has been implemented to evaluate the potential environmental consequences for a project at Naval Base San Diego, California that would involve demolition of Pier 12, dredging in berthing and approach for a new pier, dredged material disposal at an approved ocean disposal site and permitted upland landfill, construction of a new pier and associated pier utilities, including upgrades to the electrical infrastructure at the adjacent Pier 13, and re-use of demolition concrete to create fish enhancement structures (artificial reefs) (U.S. Department of the Navy 2011d).

4.3.5.7 Homeporting Littoral Combat Ships on the West Coast

An Environmental Assessment has been implemented to evaluate the potential environmental effects of a naval proposal to homeport up to 16 Littoral Combat Ships and unmanned aerial systems at Naval Base Ventura County Point Mugu and Naval Base San Diego. No in-water construction is proposed and the homeporting would take place between fiscal years 2013 and 2020 (U.S. Department of the Navy 2012b).

4.3.5.8 Surveillance Towed Array Sensor System Low Frequency Active Sonar

In August 2011, the Navy released a Draft Supplemental EIS/Supplemental OEIS that evaluated the potential environmental impacts of employing the Surveillance Towed Array Sensor System Low Frequency Active Sonar (U.S. Department of the Navy 2011b). The Navy currently plans to operate up to four Surveillance Towed Array Sensor System Low Frequency Active Sonar systems for routine training, testing, and military operations. Based on current Navy national security and operational requirements, routine training, testing, and military operations using these sonar systems could occur in the Pacific Ocean, Atlantic Ocean (including the HSTT Study Area), Indian Ocean, and Mediterranean Sea.

4.3.5.9 Space and Naval Warfare Systems Command - Electronic Harbor Security System Environmental Assessment

Swimmer detection system to be installed near Naval Base Point Loma and Naval Base San Diego.

4.3.5.10 Construction of Sea, Air, Land Delivery Vehicle Team One Waterfront Operations Facility

This project will construct a 20,000 $ft.^2$ addition to Building 987 for Sea, Air, Land (SEAL) Delivery Vehicle Team One platoon operators, divers, and support technicians. Work is expected to begin in 2013.

4.3.5.11 Basing of MV-22 and H-1 Aircraft in Support of III Marine Expeditionary Force Elements in Hawaii

An EIS is currently being prepared for the proposed basing and operation of MV-22 Osprey tiltrotor aircraft and H-1 helicopters in Hawaii. The Proposed Action includes basing and operating up to two Marine Medium Tiltrotor squadrons with a total of 24 MV-22 Osprey aircraft and one Marine Light Attack Helicopter squadron with 15 AH-1Cobra and 12 UH-1 Huey attack and utility helicopters and conducting aviation training, readiness, and special exercise operations at training facilities statewide. Demolition, new construction, and renovation are proposed to develop basing facilities at Marine Corps Base Hawaii, Kaneohe Bay for the squadrons. Personnel increases would occur from 2012 through 2018 (U.S. Department of the Navy 2011e). The EIS analyzes the impacts of developing basing facilities at Marine Corps Base Hawaii Kaneohe Bay; conducting aviation operations at training areas on the islands of Kauai, Oahu, Molokai, Maui, and Hawaii; and constructing improvements at three existing training facilities.

4.3.5.12 Marine Corps Base Hawaii Pyramid Beach Cottage Construction

Construction of 10 new beach cottages is expected to begin in FY 2015.

4.3.5.13 United States Marine Corps Joint Strike Fighter

This project has been dismissed from further analysis as the homebasing activities included new construction and personnel relocation which are not expected to impact marine resources. Joint Strike Fighter training activities are addressed under Alternatives 1 and 2.

4.3.5.14 United States Department of the Navy Climate Change Roadmap

The Navy Climate Change Roadmap outlines the Navy's approach to observing, predicting, and adapting to climate change by providing a chronological list of Navy-associated action items, objectives and desired effects for fiscal years 2010-2014 (U.S. Department of the Navy 2010).

4.3.5.15 Hawaii Air National Guard F-22 Beddown

The Hawaii Air National Guard and the U.S. Air Force will be conducting “joint” training with the F-22 aircraft which will be a replacement of the existing F-15 aircraft. Training in the F-22 aircraft will be similar to the training currently conducted with the F-15 aircraft (U.S. Department of the Navy 2011a).

4.3.6 Environmental Regulations and Planning

4.3.6.1 Coastal and Marine Spatial Planning

Dismissed because action involves only planning and policy-related activities.

4.3.6.2 Marine Mammal Protection Act Incidental Take Authorizations

The MMPA generally prohibits “take” of marine mammals in U.S. waters by any person and by U.S. citizens in international waters. The National Oceanic and Atmospheric Administration can authorize “take” for specific activities (National Oceanic and Atmospheric Administration 2012).

4.3.7 Other Environmental Considerations

4.3.7.1 Commercial and Recreational Fishing

Commercial and recreational fishing constitutes an important and widespread use of the ocean resources throughout the Study Area. Fishing can adversely affect fish populations, other species, and habitats. Potential impacts of fishing include overfishing of targeted species and bycatch, both of which negatively affect fish stocks and other marine resources. Bycatch is the capture of fish, marine mammals, sea turtles, seabirds, and other nontargeted species that occur incidental to normal fishing operations. Use of mobile fishing gear such as bottom trawls disturbs the seafloor and reduces habitat structural complexity. Indirect impacts of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing (i.e., lost fishing gear continuing to ensnare fish and other marine animals), and generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats and have the potential to entangle or be ingested by marine animals.

Fishing can have a profound influence on individual targeted species populations. In a study of retrospective data, Jackson et al. (2001) analyzed paleoecological records of marine sediments from 125,000 years ago to present, archaeological records from 10,000 years before the present, historical documents, and ecological records from scientific literature sources over the past century. Examining this longer-term data and information, they concluded that ecological extinction caused by overfishing precedes all other pervasive human disturbance of coastal ecosystems, including pollution and anthropogenic climatic change. Fisheries bycatch has been identified as a primary driver of population declines in several marine species, including sharks, mammals, seabirds, and sea turtles (Wallace et al. 2010).

4.3.7.2 Maritime Traffic

Portions of the Study Area are heavily traveled by commercial, recreational, and government marine vessels, with several commercial ports occurring in or near the Study Area. The United States has grown increasingly dependent on international trade over the past 50 years. Section 3.11 (Socioeconomic Resources) provides additional information for marine vessel traffic in the Study Area. Primary concerns for the cumulative impacts analysis include vessels striking marine mammals and sea turtles, introduction of non-native species through ballast water, and underwater sound from ships and other vessels.

4.3.7.3 Development of Coastal Lands

Coastal land development adjacent to the Study Area is both intensive and extensive. Development has impacted and continues to impact coastal resources through point and nonpoint source pollution; concentrated recreational use; and intensive ship traffic using major port facilities. The Study Area coastline also includes extensive coastal tourism development (hotels, resorts, restaurants, food industry, residential homes, etc.) and the infrastructure supporting coastal development (retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, recreational fishing facilities, etc.).

Coastal development intensifies use of coastal resources, resulting in potential impacts on water quality, marine habitat, and air quality. Coastal development is therefore closely regulated by California and Hawaii through the Coastal Zone Management Act. New development in the coastal zone requires a permit from the state or local government to which permitting authority has been delegated (Chapter 6 [Additional Regulatory Consideration] provides additional information on coastal zone management in each state).

4.3.7.4 Oceanographic Research

AGOR 28 Research Vessel – The Auxiliary General Purpose Oceanographic Research (AGOR) 28 research vessel is entering a final design and construction phase and is anticipated to be launched in 2015. The vessel is owned by the U.S. Office of Naval Research for the U.S. Department of the Navy and operated by Scripps. The AGOR 28 is designed to operate globally and support both U.S. Department of the navy and national oceanographic research objectives to include exploring science and technology in the areas of oceanographic and meteorological observations, modeling and prediction in the battlespace environment, submarine detection and classification and mine warfare application for detecting and neutralizing mines in the ocean and littoral environment. The vessel will be based in the Scripps Nimitz Marine Facility in San Diego Port Loma (Scripps Institution of Oceanography 2012a, c).

Projects are under development to deploy seismometers, pressure gauges, and temperature sensors to measure the size and direction of tsunamis. Future use of the cables could include installation of climate instruments to measure acoustic tomography and water column temperature and conductivity to measure ocean warming. The initial project will focus along a cable route spanning 12,950 kilometers (8,105 miles) from Sydney to Auckland and across the Pacific Ocean to Los Angeles (Scripps Institution of Oceanography 2012b).

The Ocean Conservation Society has three on-going projects in the HSTT Study Area. The L.A. Dolphin Project 1 (Ocean Conservation Society 2012a) studies the ecology, social structure and contaminant load comparison of inshore/offshore bottlenose dolphins in the Southern California Bight; the L.A. Dolphin Project 2 (Ocean Conservation Society 2012b) studies dolphin, sea lion and seabird aggregations during foraging and feeding activities in the Santa Monica bay; and the L.A. Dolphin Project 3 (Ocean Conservation Society 2012c) studies the effects of coastal pollution and importance of oceanographic features for marine mammals in the waters off Los Angeles, California.

The National Oceanic and Atmospheric Administration has on-going projects involving such projects as integrated ocean mapping, laser line scanning for habitat assessment, locating and mapping deep-sea coral habitats, species inventory, growth and reproductive studies and food web and species interaction studies, studies designed to understand the use of specific deep-sea species of corals as indicators of climatic change, and the effects on the oceans of deep-sea volcanoes and hydrothermal systems (National Oceanic and Atmospheric Administration 2011b).

4.3.7.5 Ocean Noise

Noise is generally described as unwanted sound—sound that clutters and masks other sounds of interest (Richardson et al. 1995). Anthropogenic sources of noise that are most likely to contribute to increases in ocean noise are vessel noise from commercial shipping and general vessel traffic, oceanographic research, oil and gas exploration, underwater construction, and naval and other use of sound navigation and ranging (sonar).

Any potential for cumulative impact should be put into the context of recent changes to ambient sound levels in the world's oceans as a result of anthropogenic activities. However, there is a large and variable natural component to the ambient noise level as a result of events such as earthquakes, rainfall, waves breaking, and lightning hitting the ocean as well as biological noises such as those from snapping shrimp and the vocalizations of marine mammals.

Andrew et al. (2002) compared ocean ambient sound from the 1960s to the 1990s from a receiver off the California coast. The data showed an increase in ambient noise of approximately 10 decibels (dB) in the frequency ranges of 20 to 80 hertz (Hz) and 200 to 300 Hz, and about 3 dB at 100 Hz over a 33-year period. Each 3 dB increase is noticeable to the human ear and a doubling in sound level. A possible explanation for the rise in ambient noise is the increase in shipping noise. There are approximately 11,000 supertankers worldwide, each operating 300 days per year, producing constant broadband noise at source levels of 198 dB (Hildebrand 2004). Generally the most energetic regularly operated sound sources are seismic airgun arrays from approximately 90 vessels with typically 12 to 48 individual guns per array, firing about every 10 seconds (Hildebrand 2004).

Section 3.0.4 (Acoustic and Explosives Primer), provides additional information about sources of anthropogenic sound in the ocean and other background information about underwater noise. This section describes the different types of effects that are possible and the potential relationships between sound stimuli and long-term consequences for individual animals and populations. A variety of impacts may result from exposure to sound-producing activities. The severity of these impacts can vary greatly between minor impacts that have no real cost to the animal, to more severe impacts that may have lasting consequences. The major categories of potential impacts are: behavioral reactions, physiological stress, auditory fatigue, auditory masking, and direct trauma.

4.3.7.6 Ocean Pollution

Pollution is the introduction of harmful contaminants that are outside the norm for a given ecosystem. Ocean pollution has and will continue to have serious impacts on the marine ecosystems. Common ocean pollutants include toxic compounds such as metals, pesticides, and other organic chemicals; excess nutrients from fertilizers and sewage; detergents; oil; plastics; and other solids. Pollutants enter oceans from non-point sources (i.e., stormwater runoff from watersheds), point sources (i.e., wastewater treatment plant discharges), other land-based sources (i.e., windblown debris), spills, dumping, vessels, and atmospheric deposition.

4.3.7.6.1 Non-Point Sources, Point Sources, and Atmospheric Deposition

Polluted runoff, or nonpoint source pollution, is considered the major cause of impairment of ocean waters. Stormwater runoff from coastal urban areas and beaches carries waste such as plastics and Styrofoam into coastal waters. Sewer outfalls also are a source of ocean pollution. Sewage can be treated to eliminate potentially harmful releases of contaminants; however, releases of untreated sewage occur due to malfunctions or overloads to the infrastructure, resulting in releases of bacteria usually associated with feces, such as *Escherichia coli* and *Enterococci spp*. Bacteria levels are used routinely to determine the quality of water at recreational beaches and as indicators of the possible presence of other harmful microorganisms. In the past, toxic chemicals have been released into sewer systems. While such dumping has long been forbidden by law, the practice left ocean outflow sites contaminated. Sewage treatment facilities generally do not treat or remove persistent organic pollutants, such as polychlorinated biphenyl (PCB) and dichlorodiphenyltrichloroethane (DDT), or other toxins.

Hypoxia (low dissolved oxygen concentration) is a major impact associated with point and non-point sources of pollution. Hypoxia occurs when waters become overloaded with nutrients such as nitrogen and phosphorus, which enter oceans from non-point source runoff, wastewater treatment plants, and atmospheric deposition. Too many nutrients can stimulate algal blooms—the rapid expansion of microscopic algae (phytoplankton). When excess nutrients are consumed, the algae population dies off and the remains are consumed by bacteria. Bacterial consumption causes dissolved oxygen in the water to decline to the point where marine life that depend on oxygen can no longer survive (Boesch et al. 1997).

Harmful algal blooms are proliferations of marine and freshwater algae (including cyanobacteria and non-photosynthetic algae-like organisms) that can produce toxins, causing human illness and massive animal mortalities. They also can accumulate in sufficient numbers to alter ecosystems in detrimental ways.

Non-point sources, point sources, and atmospheric deposition also contribute toxic pollutants such as metals, pesticides, and other organic compounds to the marine environment. Toxic pollutants may cause lethal or sublethal effects if present in high concentrations, and can build up in tissues over time and suppress immune system function, resulting in disease and death.

4.3.7.6.2 Marine Debris

Marine debris is any anthropogenic object intentionally or unintentionally discarded, disposed of, or abandoned that enters the marine environment. Common types of marine debris include various forms of plastic and abandoned fishing gear. Marine debris degrades marine habitat quality and poses ingestion and entanglement risks to marine life and bird (National Marine Fisheries Service 2006).

Plastic marine debris is a major concern because it degrades slowly and many plastics float, allowing the debris to be transported by currents throughout the oceans. Currents in the oceanic convergence zone in the North Pacific Subtropical Gyre act to accumulate the floating plastic marine debris. Additionally, plastic waste in the ocean chemically attracts hydrocarbon pollutants such as PCB and DDT, which accumulate up to one million times more in plastic than in ocean water (Mato et al. 2001). Fish, marine animals, and birds can mistakenly consume these wastes containing elevated levels of toxins instead of their prey. In the North Pacific Subtropical Gyre it is estimated that the fishes in this area are ingesting 12,000 to 24,000 U.S. tons (10,886,216 to 21,772,433 kilograms [kg]) of plastic debris a year (Davison and Asch 2011).

Marine debris has been discovered to be accumulating in gyres throughout the oceans. Law et al. (2010) presented a time series of plastic content at the surface of the western North Atlantic Ocean and Caribbean Sea from 1986 to 2008. More than 60 percent of 6,136 surface plankton net tows collected small, buoyant plastic pieces. The data identified an accumulation zone east of Bermuda that is similar in size to the accumulation zone in the eastern Pacific Ocean.

4.3.7.7 Marine Tourism

Between 1990 and 2000 the ocean-related gross state product for California grew by 10.64 percent with one of the largest growth trends experienced in coastal recreation and tourism. California's trend reflects the international trend of coastal tourism and recreation growth which has continued in past decades while other industries have declined. Additionally, the growth is seen in the development of "services" rather than "goods-related" activities (Kildow and Colgan 2005). Stakeholders in tourism services have economical motivation to ensure positive management of marine resources on which their industries are based therefore the impacts of marine tourism are generally localized and of small magnitude; however, rapid expansion of tourism could increase pressure for additional coastal and urban development which would result in potential indirect and cumulative effects on marine resources (Harriott 2002). The Marine Institute found that the issues relating to tourism included visitor pressures on coastal ecology; carrying capacity; information gap (i.e., insufficient data to assess impacts of tourism); anthropogenic impacts (i.e., displacement of seabirds, habitat and roosting opportunities, conflicts with users and wildlife, altering food sources); threats to ecology; development pressure; infrastructural support; user conflicts; and motorized crafts (Connolly et al. 2001).

4.3.7.8 Commercial and General Aviation

Commercial and general aviation are retained for analysis and discussion in Section 4.4.3.2 (Greenhouse Gases).

4.4 RESOURCE-SPECIFIC CUMULATIVE IMPACTS

4.4.1 RESOURCE AREAS DISMISSED FROM CURRENT IMPACTS ANALYSIS

In accordance with Council on Environmental Quality guidance (Council on Environmental Quality 2010), the cumulative impacts analysis focused on impacts that are "truly meaningful." The level of analysis for each resource was commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences). The analysis focused on marine mammals, sea turtles, and cultural resources. While each of the following resources is discussed in the following section, detailed analysis of cumulative impacts was not necessary for the following resources as the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low. Further analysis of cumulative impacts is not warranted on the following resources:

- Sediments and water quality
- Marine habitats
- Seabirds
- Marine vegetation
- Marine invertebrates
- Fish
- Socioeconomic resources
- Public health and safety

4.4.2 SEDIMENTS AND WATER QUALITY

The analysis in Section 3.1 (Sediments and Water Quality) indicates that the alternatives could result in local, short- and long-term changes in sediment and water quality. However, chemical, physical, or biological changes to sediments or water quality would be below applicable standards, regulations, and guidelines and would be within existing conditions or designated uses (Section 3.1.1.2 [Methods] lists applicable standards, regulations, and guidelines). The short-term impacts would arise from explosions and the byproducts of explosions and combusted propellants. It is unlikely these short-term impacts would overlap in time and space with other future actions that produce similar constituents. For example, training and testing with explosives would not be expected to occur near an oil rig structure-removal operation that could use explosives. Therefore, the short-term impacts described in Section 3.1 (Sediments and Water Quality) are not expected to contribute to cumulative impacts.

The long-term impacts would arise from unexploded ordnance, noncombusted propellant, metals, and other materials. Long-term impacts of each alternative would be cumulative with other actions that cause increases in similar constituents. However, the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to long-term cumulative impacts would be negligible because

- Most training and testing activities are widely dispersed in space and time;
- Most components of expended materials are inert or corrode slowly;
- Numerically, most of the metals expended are small- and medium-caliber projectiles, metals of concern comprise a small portion of the alloys used in expended materials, and metal corrosion is a slow process that allows for dilution;
- Most of the components are subject to a variety of physical, chemical, and biological processes that render them benign; and
- Potential areas of impacts would be limited to small zones immediately adjacent to the explosive, metals, or chemicals other than explosives.

Furthermore, none of the alternatives would result in long-term and widespread changes in environmental conditions, such as nutrient loading, turbidity, salinity, or pH (a measure of the degree to which a solution is either acidic [pH less than 7.0] or basic [pH greater than 7.0]). Based on the analysis presented in Section 3.1 (Sediments and Water Quality) and the reasons summarized above, the changes in sediment or water quality would be measurable, but would still be below applicable standards and guidelines; therefore the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low and further analysis of cumulative impacts is not warranted.

4.4.3 AIR QUALITY

As detailed in Section 3.2 (Air Quality) increased training and testing activities conducted under Alternatives 1 and 2 would result in increased criteria pollutant emissions and hazardous air pollutant emissions throughout the Study Area. Sources of the increased emissions would include vessels and aircraft, and to a lesser extent munitions. Potential impacts include localized and temporarily elevated pollutant concentrations. Recovery would occur quickly as emissions disperse, and there would be no significant impact on air quality. The impacts of Alternatives 1 or 2 would be cumulative with other actions that involve criteria air pollutant and hazardous air pollutant emissions. However, the incremental contribution of Alternatives 1 or 2 to cumulative impacts would be low for the following reasons:

- Prevailing winds along the Pacific coast generally trend east to west, thus reducing the likelihood that offshore emissions would impact air quality control regions ashore.
- For those proposed activities occurring at latitudes consistent with air quality control region nonattainment or maintenance areas in the SOCAL region, most training and testing-related emissions are projected to occur at distances greater than 12 nautical miles (nm) from shore
- Few stationary offshore air pollutant emission sources exist within the Study Area and few are expected in the foreseeable future.

- International regulations by the International Maritime Organization require commercial shipping vessels to switch to lower-sulfur fuel near U.S. and international coasts beginning in 2012 (National Oceanic and Atmospheric Administration 2011a). The Department of Defense has released the Operational Energy Strategy: Implementation Plan which will reduce demand, diversify energy sources, and integrate energy consideration into planning (Department of Defense 2012). The U.S. Department of the Navy policy commits to a reduction of oil consumption by 50 percent by 2015, 40 percent of the Navy's total energy will come from fossil fuel alternatives and 50 percent of its onshore energy will come from renewable sources by 2020 (Environmental and Energy Study Institute 2009; Paige 2009). Similar low-sulfur fuel regulations in California, including a voluntary state slowdown policy, were found to reduce several pollutants, including sulfur dioxide and particulate matter by as much as 90 percent (Lack et al. 2011).

Based on the analysis presented in Section 3.2 (Air Quality) and the reasons summarized above, the incremental contribution of Alternatives 1 or 2 to cumulative impacts would be low. Further analysis of cumulative impacts on air quality is not warranted.

4.4.4 CLIMATE CHANGE

This section provides background information and an analysis of the cumulative impacts of climate change and greenhouse gas emissions for the Proposed Action. Climate change is also considered in the overall cumulative impacts analysis as another environmental consideration. The Intergovernmental Panel on Climate Change (2007) reports that physical and biological systems on all continents and in most oceans are already being affected by recent climate changes. Global-scale assessment of observed changes shows that it is likely that anthropogenic warming over the last three decades has had a discernible influence on many physical and biological systems. Some of the major potential concerns for the marine environment include

- Sea temperature rise
- Melting of polar ice
- Rising sea levels
- Changes to major ocean current systems
- Ocean acidification

4.4.4.1 Greenhouse Gases

Greenhouse gases are compounds that contribute to the greenhouse effect. The greenhouse effect is a natural phenomenon in which these gases trap heat within the surface-troposphere (lowest portion of the earth's atmosphere) system, causing heating (radiative forcing) at the surface of the earth. Scientific evidence indicates a trend of increasing global temperature over the past century due to an increase in greenhouse gas emissions from human activities (U.S. Environmental Protection Agency 2012). Without greenhouse gases the planet's surface would be about 60 °F cooler than present, according to the National Oceanic and Atmospheric Administration and National Aeronautics and Space Administration data the average surface temperature has increase by about 1.2 to 1.4°F since 1900. If greenhouse gases continue to increase models predict that the average temperature at the earth's surface could increase from 2.0 to 11.5°F above the 1990 levels by the end of this century (Le Treut et al. 2007).

Predictions of long-term negative environmental impacts due to global warming include sea level rise, changing weather patterns with increases in the severity of storms and droughts, changes to local and regional ecosystems (including the potential loss of species), shrinking glaciers and sea ice, thawing permafrost, a longer growing season, and shifts in plant and animal ranges.

Over the next several decades, temperatures are projected to rise. The projected warming and more extensive climate-related changes could dramatically alter the region's economy, landscape, character, and quality of life (Le Treut et al. 2007).

In 2009, the U.S. generated about 6,633.2 teragrams (Tg) (or million metric tons) of carbon dioxide (CO_2) equivalents (U.S. Environmental Protection Agency 2012). The 2009 inventory data (U.S. Environmental Protection Agency 2012) show that CO_2, methane (CH_4), and nitrous oxide (N_2O) contributed from fossil fuel combustion processes from mobile and stationary sources (all sectors) include approximately:

- 5,505.2 Tg of CO_2
- 686.3 Tg CH_4
- 295.6 Tg N_2O

The 6,633.2 Tg CO_2 equivalent (CO_2 Eq) generated in 2009 is a decrease from the 7,263.4 Tg CO_2 Eq generated in 2007 (U.S. Environmental Protection Agency 2011). Among domestic transportation sources, light-duty vehicles (including passenger cars and light-duty trucks) represented 64 percent of CO_2 emissions, medium- and heavy-duty trucks 20 percent, commercial aircraft 6 percent, and other sources 9 percent. Across all categories of aviation, CO_2 emissions decreased by 21.6 percent (38.7 Tg) between 1990 and 2009. This includes a 59 percent (20.3 Tg) decrease in emission from domestic military operations. To place military aircraft in context with other aircraft CO_2 emissions, in 2009, commercial aircraft generated 111.4 Tg CO_2 Eq, military aircraft generated 14.1 Tg CO_2 Eq, and general aviation aircraft generated 13.3 Tg CO_2 Eq. Military aircraft represent roughly 10 percent of emissions from the overall jet fuel combustion category (U.S. Environmental Protection Agency 2012).

This section begins by providing the background and regulatory framework for greenhouse gases. It then provides a quantitative evaluation of changes in greenhouse gas emissions that would occur under the Proposed Action and analyzes the cumulative impacts of greenhouse gas emissions.

4.4.4.1.1 Regulatory Framework

Federal agencies address emissions of greenhouse gases by reporting and meeting reductions mandated in laws, executive orders and policies. The most recent of these are Executive Order (EO) 13514 *Federal Leadership in Environmental, Energy, and Economic Performance* of 5 October 2009 and EO 13423 *Strengthening Federal Environmental, Energy, and Transportation Management* of 26 January 2007.

Executive Order 13514 shifts the way the government operates by (1) establishing greenhouse gases as the integrating metric for tracking progress in federal sustainability; (2) requiring a deliberative planning process; and (3) linking to budget allocations and Office of Management and Budget scorecards to ensure goal achievement.

The targets for reducing greenhouse gas emissions discussed in EO 13514 for Scope 1 (direct greenhouse gas emissions from sources that are owned or controlled by a federal agency) and Scope 2 (direct greenhouse gas emissions resulting from the generation of electricity, heat, or steam purchased by a federal agency) have been set for the Department of Defense at a 34 percent reduction of greenhouse gas from the 2008 baseline by 2020. Scope 3 targets (greenhouse gas emissions from sources not owned or directly controlled by a federal agency but related to agency activities such as vendor supply chains, delivery services, and employee travel and commuting) were set at a 13.5 percent reduction. Executive Order 13514 *Strategic Sustainability Performance Plan* submitted to the Council on Environmental Quality on 2 June 2010 contains a guide for meeting these goals.

Executive Order 13423 established a policy that federal agencies conduct their environmental, transportation, and energy-related activities in support of their respective missions in an environmentally economic way. It included a goal of improving energy efficiency and reducing greenhouse gas emissions of the agency through reduction of energy intensity by 3 percent annually through the end of fiscal year 2015, or 30 percent by the end of fiscal year 2015, relative to the baseline of the agency's energy use in fiscal year 2003.

The *Draft NEPA Guidance on Consideration of the Impacts of Climate Change and Greenhouse Gas Emissions* (Council on Environmental Quality 2010) states that "if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO_2 Carbon dioxide) equivalent (CO_2-eq) greenhouse gas emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public."

The Navy is committed to improving energy security and environmental stewardship by reducing reliance on fossil fuels. The Navy is actively developing and participating in energy, environmental, and climate change initiatives that will increase use of alternative energy and help conserve the world's resources for future generations. The Navy Climate Change Roadmap identifies actions the Environmental Readiness Division is taking to implement EO 13514 (U.S. Department of the Navy 2010). The Navy's Task Force Energy is responding to the Secretary of the Navy Energy Goals through energy security initiatives that reduce the Navy's carbon footprint. The Climate Change Roadmap (five-year roadmap) action items, objectives, and desired impacts are organized to focus on strategies, policies and plans; operations and training; investments; strategic communications and outreach; and environmental assessment and prediction.

4.4.4.1.2 Cumulative Greenhouse Gas Impacts

Climate change is a global issue, and greenhouse gas emissions are a concern from a cumulative perspective because individual sources of greenhouse gas emissions are not large enough to have an appreciable impact on climate change. This greenhouse gas analysis considers the incremental contribution of Alternatives 1 and 2 to total estimated U.S. greenhouse emissions and their significance on climate change as compared to the No Action Alternative.

To estimate total greenhouse gas emissions, each greenhouse gas was assigned a global warming potential; that is, the ability of a gas or aerosol to trap heat in the atmosphere. The global warming potential rating system is standardized to CO_2, which has a value of one. For example, CH_4 (methane) has a global warming potential of 21, which means that it has a global warming effect 21 times greater than CO_2 on an equal-mass basis (Intergovernmental Panel on Climate Change 2007). To simplify greenhouse gas analyses, total greenhouse gas emissions from a source are often expressed as CO_2 Eq. The CO_2 Eq is calculated by multiplying the emissions of each greenhouse gas by its global warming potential and adding the results together to produce a single, combined emission rate representing all greenhouse gases. While CH_4 and N_2O (nitrous oxide) have much higher global warming potentials than CO_2, CO_2 is emitted in much higher quantities, so it is the overwhelming contributor to CO_2 Eq from both natural processes and human activities. Global warming potential-weighted emissions are presented in terms of equivalent emissions of CO_2, using units of Tg (1 million metric tons, or 1 billion kilograms) of carbon dioxide equivalents (Tg CO_2 Eq).

Greenhouse gas emissions were calculated (Appendix D Air Quality Calculations) for ships and aircraft, which contribute the majority of emissions associated with training and testing in the Study Area. Greenhouse gas emissions from minor sources such as munitions, weapons platforms, and auxiliary equipment are considered negligible and were not calculated. Ship greenhouse gas emissions were estimated by determining annual ship fuel (typically diesel) use based on proposed activities and multiplying total annual ship fuel consumption by the corresponding emission factors for CO_2, CH_4, and N_2O. Aircraft greenhouse gas emissions were calculated by multiplying jet fuel use rates by the total operating hours, by the corresponding jet fuel emission factors for CO_2, CH_4, and N_2O, and by the total annual sorties. Ship and aircraft greenhouse gas emissions are compared to U.S. 2009 greenhouse gas emissions in Table 4.4-1. The estimated CO_2 Eq emissions from the No Action Alternative and Alternative 1 are 0.030 percent of the total CO_2 Eq emissions generated by the United States in 2009. The estimated CO_2 Eq emissions from Alternative 2 would increase as a result of increased training and testing activities to about 0.031 percent of the total CO_2 Eq emissions generated by the United States in 2009.

Based on the analysis presented in Section 3.2 (Air Quality) and the reasons summarized above, the changes in air quality would be measurable, but would still be below applicable standards and guidelines; therefore the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low and further analysis of cumulative impacts is not warranted.

Table 4.4-1: Comparison of Ship and Aircraft Greenhouse Gas Emissions to U.S. 2009 Greenhouse Gas Emissions

Alternative	Annual Greenhouse Gas Emissions (teragrams CO_2 Eq)	Percentage of U.S. 2009 Greenhouse Gas Emissions
No Action Alternative	1.97	0.030%
Alternative 1	2.06	0.031%
Alternative 2	2.08	0.031%
U.S. 2009 Greenhouse Gas Emissions	6,633.2	

Source: U.S. Environmental Protection Agency 2011
Notes: CO_2 Eq = carbon dioxide equivalent

4.4.5 Marine Habitats

The analysis presented in Section 3.3 (Marine Habitats) indicates that marine habitats would be affected by acoustic stressors (underwater detonations) and physical disturbance or strikes (interactions with vessels and in-water devices, military expended materials, or seafloor devices). Potential impacts include localized disturbance of the seafloor, cratering of soft bottom sediments, and structural damage to hard bottom habitats. Impacts on soft bottom habitats would be short-term, and impacts on hard bottom would be long-term. The impacts of Alternatives 1 and 2 would be cumulative with other actions that cause similar disturbances. However, the incremental contribution of Alternatives 1 or 2 to cumulative impacts would be low for the following reasons:

- Most of the proposed activities that might affect marine habitats would occur in areas where hard bottom does not occur.

- Impacts on soft bottom habitats would be confined to a limited area, and recovery would occur quickly.

Based on the analysis presented in Section 3.3 (Marine Habitats) and the reasons summarized above, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low. Further analysis of cumulative impacts on marine habitats is not warranted.

4.4.6 MARINE MAMMALS

4.4.6.1 Impacts of Alternatives 1 and 2 That May Contribute to Cumulative Impacts

Based on the analysis presented in Section 3.4 (Marine Mammals) impacts of Alternatives 1 and 2 that might contribute to cumulative impacts on marine mammals include mortality, injury (Level A harassment under the MMPA), and disturbance or behavioral modification (MMPA Level B harassment). Mortality or injury could be caused by underwater explosions or vessel strikes. Injury, in the form of permanent threshold shift, could also be caused by sonar use. Underwater explosions and sonar use would result in disturbance that meets the definition of MMPA Level A and B harassment. The remaining stressors analyzed in Section 3.4 (Marine Mammals) are not expected to result in mortality or Level A or B harassment. The incremental contribution of these remaining stressors to cumulative impacts on marine mammals would be negligible. These stressors are discussed in Section 3.4.3.1 through 3.4.3.8. The impacts of Alternatives 1 and 2 considered in the cumulative impacts analysis are summarized in Chapter 3, Section 3.4 (Marine Mammals).

4.4.6.2 Impacts of Other Actions

4.4.6.2.1 Overview

The potential impacts of other actions that are relevant to the cumulative impact analysis for marine mammals include the following:

- Mortality associated with vessel strikes, bycatch in fisheries, and entanglement in fishing and other gear
- Injury associated with vessel strikes, bycatch, entanglement, and underwater sound
- Disturbance, behavioral modifications, and reduced animal fitness associated with underwater noise
- Reduced animal fitness associated with water pollution

Most of the other actions and considerations retained for analysis in Table 4.3-1 would include operation of marine vessels. Exceptions include the actions listed under environmental regulations and permitting. Stressors associated with marine vessel operations that are of primary concern for the cumulative impacts analysis includes vessel strikes and underwater noise. Many of the actions would also result in underwater noise from sources other than vessels, including use of explosives for oil rig removal, seismic surveys, and construction activities. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as “other environmental considerations” in the maritime traffic and ocean noise subsections. Similarly, many of the actions would result in water pollution. The aggregate impacts of water pollution are addressed below in the ocean pollution section (section 4.4.6.2.5). Bycatch is associated with commercial fishing, and the primary cause of entanglement is commercial fishing. Therefore, these stressors are discussed below in the commercial fishing section (section 4.4.6.2.6).

4.4.6.2.2 Surveillance Towed Array Sensor System Low Frequency Active Sonar

Potential impacts on marine mammals from Surveillance Towed Array Sensor System Low Frequency Active Sonar operations include (1) nonauditory injury[2]; (2) permanent loss of hearing; (3) temporary loss of hearing; (4) behavioral change; and (5) masking. The potential effects from Surveillance Towed Array Sensor System Low Frequency Active Sonar operations on any stock of marine mammals from injury (nonauditory or permanent loss of hearing) are considered negligible, and the potential effects on the stock of any marine mammal from temporary loss of hearing or behavioral change (significant change in a biologically important behavior) are considered minimal. Any auditory masking in marine mammals due to low-frequency active sonar signal transmissions is not expected to be severe and would be temporary. The operation of Surveillance Towed Array Sensor System Low Frequency Active Sonar with monitoring and mitigation would result in no mortality. The likelihood of low-frequency active sonar transmissions causing marine mammals to strand is negligible (U.S. Department of the Navy 2011b).

4.4.6.2.3 Maritime Traffic and Vessel Strikes

Vessel strikes have been and will continue to be a cause of marine mammal mortality and injury throughout the Study Area. A review of the impacts of vessel strikes on marine mammals is presented in Section 3.4.3.3.1 (Impacts from Vessels). In particular, certain large whales, such as the blue whale, are more prone to vessel strikes (Berman-Kowalewski et al. 2010; Betz et al. 2011). The most vulnerable marine mammals are thought to be those that spend extended periods at the surface or species whose unresponsiveness to vessel sound makes them more susceptible to vessel collisions (Gerstein 2002; Laist and Shaw 2006; Nowacek et al. 2004). Marine mammals such as dolphins, porpoises, and pinnipeds that can move quickly throughout the water column are not as susceptible to vessel strikes. Most vessel strikes of marine mammals reported involve commercial vessels and occur over or near the continental shelf (Laist et al. 2001). The literature review by Laist et al. (2001) concluded that vessel strikes likely have a negligible impact on the status of most whale populations, but that for small populations, vessel strikes may have considerable population-level impacts. The conservation status and abundance of the species struck would determine in large part whether the injury would have population-level impacts on that species (Laist et al. 2001; Vanderlaan and Taggart 2009).

In August 2011, the NMFS Southwest Regional Office provided the Navy with a data summary of all known or suspected ship strikes to marine mammals within California for the period 1988 to June 2011 (National Marine Fisheries Service 2011a). In order to look at a standardized period for the California data, a 20-year subset of the Southwest Regional Office stranding data from 1991 to 2010 was used for this analysis. Similar data for Hawaii was provided by the NMFS' Pacific Island Regional Office in the fall of 2011, and subsequently updated by the Pacific Island Regional Office in March 2012 to cover the period from 2003 to 2010.

In California, there were 86 large whale ship strikes over the 20-year period of the Southwest Regional Office data set analyzed (1991-2010). In looking at the 15-year interval from 1991 to 2005, however, average ship strikes were reported at the rate of three per year. Since 2006, and for the five-year period from 2006 to 2010, there was an average of eight strikes reported per year.

[2] Nonauditory injury can be defined as not relating to or functioning in hearing (Merriam-Webster 2012), this includes mortality, strike, and lung injury.

It is unclear if the differences in pre and post 2006 averages are the result of increasing commercial ship traffic, increasing animal populations, changes in reporting, a statistical anomaly, or any combination of these factors. Some of this pattern of increase must be cautiously viewed in terms of how ship strike data is reported to the NMFS in California. NMFS stranding data is all reported via either self-reporting or from the California stranding network. Vessel-based reporting provides information about the type of ship and exact location where a strike occurred, but may potentially be lacking biological information on the whale struck (species, sex, length/age class, etc.). Stranding network reporting may provide more detailed biological information about the whale struck with determination of ship strike made based on injuries noted during necropsy, but not much may be known about the strike event itself (vessel type, location, ship speed, etc.). Additional temporal variation may arise from increased necropsies over the 20-year interval as more research is conducted to determine large whale mortality from stranded carcasses and from increased interest in the impacts of ship strike as a mortality source.

The California stranding network is composed of up to 16-17 regional partners throughout the state each with its own area of response and availability of resources. For instance, due to personnel staffing and resources on-hand, necropsies to determine ship strike may be more likely in one geographic region over another. In general, NMFS Southwest Regional Office believes that the state of interest is such that now most if not all of the California stranding network responders will attempt a large whale necropsy. But again over the 20-year time frame of the strike dataset, the percentages of ship strike reporting may have changed (i.e., increased) in some locations (Ms. Sarah Wilkin, Southwest Regional Office stranding coordinator; personal communication Feb 2012).

The most common species reported struck in the Southwest Regional Office data for all of California include gray whales (35%), blue whales (16%), fin whales (13%), humpback whales (9%), and sperm whales (1%). However, 25% of strikes were to species not identified (either unknown species or unidentified Balaenopterid) and these strikes could have been any of the above species including other large whale species (Bryde’s whale, minke whale, sei whale).

Within the portion of California containing the Navy’s Southern California Range Complex and for the most part equivalent to Southwest Regional Office’s county listing for San Diego County, there were 23 whale strikes in the period from 1993 to 2010. There were no reported whale strikes from 1991-1992. Unknown whale species was the largest percentage of strikes (n=10 or 43%). Gray whales were the second most common (n=9 or 39%). Two fin whales were struck in 2009 by a Navy ship, but there have been no Navy ship strikes in the SOCAL Range Complex since 2009. Of the two blue whale strikes, one was struck by a research vessel in 2003 and the other by a Navy ship in 2004.The number and percentage of ship strikes to large whales in all of California by vessel category were: unknown type (43% or n= 37); Navy ship (19% or n=16); commercial ship (10% or n=9); recreational boat (7% or n=6); Coast Guard boat (6% or n=5); research vessel or tug (5% or n=4); ferry (3% or n=3); cruise ship (2% or n=2); whale watching boat (2% or n=2); and fishing boat (25 or n=2). It should be noted that U.S. Navy reports 100% of all Navy ship strikes to the NMFS. Only the Navy and the U.S. Coast Guard report vessel strike in this manner.

Therefore these statistics are skewed by a lack of comprehensive reporting from all non-Navy vessels that may experience vessel strike. For instance, many of the unknown strikes (n= 37 or 43% of total) may have been from commercial vessels or other non-Navy vessel types. Of the 16 reported Navy ship strikes, 15 occurred within the SOCAL Range Complex (San Diego County).

The Navy stratified the Southwest Regional Office 20-year data set to reflect the relative sub-region along the California coast where a given whale ship strike was reported. Four strata were used and strikes assigned to the most appropriate strata: SOCAL (area only containing Southern California Range Complex which was mostly equivalent to San Diego County); SOCAL NORTH (area from SOCAL Range Complex northern boundary including, Orange County, Los Angeles County, and Ventura County to Point Conception. In other words, areas still within the Southern California Bight but north and outside of the HSTT Study Area); Central California (area from Point Conception to San Francisco); and Northern California (from Marin County to the California-Oregon boundary).

Approximately 74% of all reported whale ship strikes occurred north and outside of the Navy's HSTT Study area. By geographic sub-strata, the highest percentage of strikes (37%) was reported off the northern portion of Southern California (SOCAL NORTH), an area north of the HSTT boundary to Point Conception. This region includes the high volume commercial ship traffic ports of Los Angeles/Long Beach. The second highest percentage of ship strikes (31%) was off of central California which includes the commercial ship traffic ports of San Francisco/Oakland.

For the period from 2003-2010, there were 53 reported whale ship strikes in Hawaii. Approximately 94% of the 2003-2010 Hawaii ship strikes were to humpback whales (n=50), 4% to unknown species (n=2), and 2% to sperm whale (n=1). The number and percentage of ship strikes to large whales in Hawaii by vessel category were: unknown (34% or n=18); tour boat (26% or n=14); whale watching boat (9% or n=5); Navy ship (8% or n=4); research boat (6% or n=3); ferry (4% or n=2), fishing boat (4% or n=2); other non-specified boat (4% or n=2); recreational boat (2% or n=1); commercial ship (2% or n=1); and USCG boat (2% or n=1).Island-specific ship strikes in Hawaii for the years 2003-2010 were: Maui (55% or n=29); Hawaii (13% or n=7); Kauai (9% or n=5); Lanai (9% or n=5); Oahu (8% or n=4) and at-sea within 300 nm of Hawaii (6% or n=3).

4.4.6.2.4 Ocean Noise

As summarized by the National Academies of Science, the possibility that anthropogenic sound could harm marine mammals or significantly interfere with their normal activities is an issue of concern (National Research Council of the National Academies 2005). Noise is of particular concern to marine mammals because many species use sound as a primary sense for navigating, finding prey, and communicating with other individuals. Noise can cause behavioral disturbances, mask other sounds (including their own vocalizations), result in injury, and in some cases, even lead to death (Tyack 2009a; Tyack 2009b; Würsig and Richardson 2008). Human-caused noises in the marine environment come from shipping, seismic and geologic exploration, military training, and other types of pulses produced by government, commercial, industry, and private sources. In addition, noise from whale-watching vessels near marine mammals has received a great deal of attention (Wartzok 2009).

Assessing whether a sound may disturb or injure a marine mammal involves understanding the characteristics of the acoustic sources, the marine mammals that may be present near the sound, and the effects that sound may have on the physiology and behavior of those marine mammals. Although it is known that sound is important for marine mammal communication, navigation, and foraging (National Research Council of the National Academies 2003, 2005), there are many unknowns in assessing the specific effects and significance of responses by marine mammals to sound exposures such as what activity the animal is engaged in at the time of the exposure (Nowacek et al. 2007; Southall et al. 2007). Potential impacts on marine mammals from ocean noise include behavioral reactions, hearing loss in the form of TTS or PTS, auditory masking, injury, and mortality. Section 3.4.3.1 (Acoustic Stressors) discusses these and other possible impacts of ocean noise on marine mammals.

4.4.6.2.5 Ocean Pollution

As discussed in Section 3.4.3 (Environmental Consequences), pollutants from multiple sources are present in, and continue to be released into, the oceans. Elevated concentrations of certain compounds have been measured in tissue samples from marine mammals. Long-term exposure to pollutants poses potential risks to the health of marine mammals, although for the most part, the impacts are just starting to be understood (Reijnders et al. 2008). Section 3.4.3 (Environmental Consequences) provides an overview of these potential impacts, which include organ anomalies and impaired reproduction and immune function (Reijnders et al. 2008).

If the health of an individual marine mammal were compromised by long-term exposure to pollutants, it is possible that this condition could alter the animal's expected response to stressors associated with Alternatives 1 and 2. The behavioral and physiological responses of any marine mammal to a potential stressor, such as underwater sound, could be influenced by a number of other factors, including disease, dietary stress, body burden of toxic chemicals, energetic stress, percentage body fat, age, reproductive state, size, and social position. Synergistic impacts are also possible. For example, animals exposed to some chemicals may be more susceptible to noise-induced loss of hearing sensitivity (Fechter 2005). While the response of a previously stressed animal might be different than the response of an unstressed animal, there are no data available at this time to accurately predict how stress caused by various ocean pollutants would alter a marine mammal's response to stressors associated with Alternatives 1 and 2.

4.4.6.2.6 Commercial Fishing

Several commercial fisheries operate in the Study Area. Potential impacts from these activities include marine mammal injury and mortality from bycatch and entanglement. Fisheries have also resulted in profound changes to the structure and function of marine ecosystems that adversely affect marine mammals.

Eleven ports in Southern California contain both commercial and commercial passenger fishing vessel (commercial passenger fishing vessel; i.e., recreational) fishing fleets that use the ocean areas within the SOCAL Range Complex portion of the HSTT (U.S. Department of the Navy 2009). Commercial fishing occurs throughout the SOCAL Range Complex from near shore waters adjacent to the mainland and offshore islands, to offshore banks (e.g., Tanner and Cortes Banks), and waters in between. In recent years, the overall number of commercial fishing vessels has decreased which has been attributed to changes in environmental conditions, fishing regulations,and market forces (California Department of Fish and Game 2008a, b).

Between 1990 and 1999, the annual mean bycatch of marine mammals in U.S. fisheries was more than 6,000 animals, and most of these were killed in gill-net fisheries (Read et al. 2006). The impacts of bycatch on marine mammal populations vary based on removal rates, population size, and reproductive rates. Small populations with relatively low reproductive rates are most susceptible. Bycatch rates for about 12 percent of U.S. marine mammal stocks (almost all cetaceans) exceed their potential biological removal levels (Read 2008). The potential biological removal level is the number of animals that can be removed each year without preventing a stock from reaching or maintaining its optimal sustainable population level.

As discussed in Section 3.4.3.4 (Entanglement Stressors), entanglement in fishing gear is another major threat to marine mammals in the Study Area. In addition, overfishing of many fish stocks has resulted in significant changes in trophic structure, species assemblages, and pathways of energy flow in marine ecosystems (Jackson et al. 2001; Myers and Worm 2003; Pauly et al. 1998). These ecological changes may have important and likely adverse consequences for populations of marine mammals (DeMaster et al. 2001).

In summary, future commercial fishing activities in the Study Area are expected to result in significant impacts on some marine mammal species based on the relatively high injury and mortality rates associated with bycatch and entanglement. This mortality could result in or contribute to population declines for some species. Ecological changes brought about by commercial fishing are also expected to adversely impact marine mammals in the Study Area.

Along the U.S. West Coast from 1982 to 2010 there have been 272 reported entangled whales (Saez et al. 2012). Entanglements were seen throughout the coast with concentrations near areas where there is higher human population. Identified entangling gear types have included: trap/pot, bottom set longline, and gillnets. Gillnets were the entangling gear type in the majority of reports pre-2000 (64%) and trap/pot are the majority post-2000 (45%). In the late 1990's California gillnet regulations changed resulting in a shift and reduction of gillnet fishing effort. Gray and humpback whales are the most frequently reported entangled large whale species along the U.S. West. In California, there were a reported 150 gray whales, 47 humpback whales, 27 unidentified whales, 14 sperm whales, 6 minke whales, and 3 fin whales entangled in fishing gear (Saez et al. 2012). National Marine Fisheries Service provided the Navy with a further breakdown of 16 reported whale fishing gear entanglements within parts of Southern California overlapped by the Navy's SOCAL range complex from 2000-2011: 8 gray whales (50.0%), 3 humpback whales (18.8%), 2 unidentified whales (12.5%), 2 sperm whales (12.5%), and 1 fin whale (6.3%) (Saez 2012). National Marine Fisheries Service cautioned that these data represent locations where whales were sighted entangled and may or may not be near the actual location where the entanglement first occurred.

4.4.6.3 Cumulative Impacts on Marine Mammals

The current aggregate impacts of past, present actions and reasonably foreseeable future actions are expected to result in significant impacts on some marine mammal species in the Study Area. The impacts are considered significant because vessel strikes, bycatch, and entanglement associated with other actions are expected to result in relatively high rates of injury and mortality that could cause population declines in some species. Alternatives 1 and 2 could also result in injury and mortality to individuals of some marine mammal species from underwater explosions, sonar, and vessel strikes. Injury and mortality that might occur under Alternatives 1 and 2 would be additive to injury and mortality associated with other actions. However, the relative contribution of the Proposed Action to the overall injury and mortality would be low compared to other actions. While quantitative estimates of marine mammal mortality from other actions are not available, bycatch for cetaceans and pinnipeds in the United States accounted for 4,146 mortalities in 1999 (Read et al. 2006). Some of these mortalities likely occurred in the Study Area or affected individuals that used the Study Area seasonally.

Ocean noise associated with other actions (see Section 4.4.6.2.4 [Ocean Noise]) and acoustic stressors (underwater explosions and sonar) associated with Alternatives 1 and 2 could also result in additive behavioral impacts on marine mammals. Other future actions such as construction and operation of liquefied natural gas terminals, and wave and tidal energy facilities would be expected to result in MMPA Level B harassment. However, it is unlikely that these actions and underwater explosions or sonar use would overlap in time and space because these activities are dispersed and the sound sources are intermittent. Furthermore, most of these other actions are not compatible with or could interfere with training and testing activities that involve underwater explosions and sonar use. The Navy takes appropriate coordination and scheduling steps (described in Section 3.11 [Socioeconomic Resources]) to avoid activities that interfere with or are not compatible with training and testing.

It is likely that distant shipping noise, which is more universal and continuous, and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the co-occurrence of shipping noise and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on marine mammals.

As discussed in Section 4.4.6.2.5 (Ocean Pollution), the potential also exists for the impacts of ocean pollution and acoustic stressors associated with Alternatives 1 and 2 to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal.

In summary, based on the analysis presented in Section 3.4 (Marine Mammals) the current aggregate impacts of past and present actions and reasonably foreseeable future actions are expected to result in significant impacts on some marine mammal species in the Study Area. Therefore, cumulative impacts on marine mammals would be significant without consideration of the impacts of Alternatives 1 or 2. Alternatives 1 and 2 would contribute to and increase cumulative impacts, but the relative contribution would be low compared to other actions. Further analysis of cumulative impacts on marine mammals is not warranted.

4.4.7 SEA TURTLES

4.4.7.1 Impacts of Alternatives 1 and 2 That May Contribute to Cumulative Impacts

Impacts of Alternatives 1 and 2 that might contribute to cumulative impacts on sea turtles include mortality, injury, and short-term disturbance or behavioral modification. Mortality or injury could be caused by underwater explosions or vessel strikes. Injury, in the form of permanent threshold shift, could also be caused by sonar use. Noninjurious impacts of underwater explosions and sonar use would include short-term disturbance or behavioral modification. The Navy's Endangered Species Act (ESA) determinations presented in Table 3.5-16 are "no effect" or "may affect, not likely to adversely affect" for the remaining stressors analyzed in Section 3.5 (Sea Turtles). The incremental contribution of these remaining stressors to cumulative impacts on sea turtles would be negligible. Therefore, these stressors are not considered further in the cumulative impacts analysis. The impacts of Alternatives 1 and 2 considered in the cumulative impacts analysis are summarized in Table 3.5-15 (Summary of Effects and Impact Conclusions).

4.4.7.2 Impacts of Other Actions

The potential impacts of other actions that are relevant to the cumulative impact analysis for sea turtles include the following:

- Mortality associated with vessel strikes, bycatch in fisheries, entanglement, and stressors associated with coastal development and human use of coastal environments (e.g., beach vehicular driving, power plant entrainment [sea turtles being caught in power plant outflow water], etc.)
- Injury associated with vessel strikes, bycatch, entanglement, and underwater sound
- Disturbance, behavioral modifications, and reduced animal fitness associated with underwater noise
- Reduced animal fitness associated with ocean pollution

- Habitat loss related to coastal development

Most of the other actions and considerations retained for analysis in Chapter 3, Section 3.5 (Sea Turtles) would include operation of marine vessels. Exceptions include the actions listed under environmental regulations and planning. Stressors associated with marine vessel operations that are of primary concern for the cumulative impacts analysis includes vessel strikes and underwater noise. Many of the actions would also result in underwater noise from sources other than vessels. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as “other environmental considerations” in maritime traffic (Section 4.4.6.2.3 [Maritime Traffic and Vessel Strikes]) and ocean noise (Section 4.4.6.2.4 [Ocean Noise]). Similarly, many of the actions would result in ocean pollution. The aggregate impacts of water pollution are addressed below in the ocean pollution section (see Section 4.4.6.2.5 [Ocean Pollution]). Bycatch is associated with commercial fishing, and the primary cause of entanglement is commercial fishing. Therefore, these stressors are discussed below in the commercial fishing section (Section 4.4.6.2.6 [Commercial Fishing]).

4.4.7.3 Maritime Traffic and Vessel Strikes

Maritime traffic has increased over the past 50 years, and continued increases are expected in the future. Vessel strikes have been and will continue to be a cause of sea turtle mortality and injury throughout portions of the Study Area where sea turtles regularly occur. Because of the wide dispersal of large vessels in open ocean areas and the widespread, scattered distribution of turtles at sea, strikes during open-ocean transits are unlikely.

Some vessel strikes would cause temporary reversible impacts, such as diverting the turtle from its previous activity or causing minor injury. A National Research Council report qualitatively ranked the relative importance of various mortality factors for sea turtles. Vessel strikes were ranked 10th, behind leading factors of shrimp trawling and other fisheries (National Research Council 1990). Major strikes would cause permanent injury or death from bleeding, infection, or inability to feed. Apart from the severity of the physical strike, the likelihood and rate of a turtle’s recovery from a strike may be influenced by its age, reproductive state, and general condition. Much of what is written about recovery from vessel strikes is inferred from observing individuals some time after a strike. Numerous living sea turtles bear scars that appear to have been caused by propeller cuts or collisions with vessel hulls (Hazel et al. 2007; Lutcavage et al. 1997), suggesting that not all vessel strikes are lethal. Conversely, fresh wounds on some stranded animals may strongly suggest a vessel strike as the cause of death. The actual incidence of recovery versus death is not known, given available data.

4.4.7.4 Ocean Noise

Potential impacts on sea turtles from ocean noise include behavioral reactions, hearing loss in the form of TTS or PTS, auditory masking, injury, and mortality. Section 3.5.3.1 (Acoustic Stressors) discusses these and other possible impacts of ocean noise on marine mammals.

4.4.7.5 Ocean Pollution

Marine debris can also be a problem for sea turtles through entanglement or ingestion. Sea turtles can mistake debris for prey; one study found 37 percent of dead leatherbacks to have ingested various types of plastic (Mrosovsky et al. 2009). Other marine debris, including abandoned fishing gear and cargo nets, can entangle and drown turtles in all life stages.

4.4.7.6 Commercial Fishing

Bycatch is one of the most serious threats to the recovery and conservation of sea turtle populations (National Research Council 1990; Wallace et al. 2010). Among fisheries that incidentally capture sea turtles, certain types of trawl, gillnet, and longline fisheries generally pose the greatest threat. One comprehensive study estimated that worldwide, 447,000 turtles are killed each year from bycatch in commercial fisheries (Wallace et al. 2010).

Other fisheries that result in sea turtle bycatch in the Study Area include pelagic fisheries for swordfish, tuna, shark, and billfish; purse seine fisheries for tuna; commercial and recreational rod and reel fisheries; gillnet fisheries for shark; driftnet fisheries; and bottom longline fisheries (National Marine Fisheries Service 2009).

4.4.7.7 Coastal Development

Coastal development and increased human populations in coastal areas will continue to have impacts on sea turtles such as nesting beach habitat degradation, beach vehicular driving, beach lighting, power plant entrainment, and degradation of nearshore water quality and seagrass beds (see Section 3.5 [Sea Turtles] for more information on impacts on sea turtles).

4.4.7.8 Cumulative Impacts on Sea Turtles

The current aggregate impacts of past, present and reasonably foreseeable future actions are expected to result in significant impacts on sea turtles. These aggregate impacts are considered significant because bycatch, vessel strikes, entanglement and other stressors associated with other actions are expected to result in high rates of injury and mortality that could cause population declines to ESA-listed species or inhibit species recovery. Alternatives 1 and 2 could also result in injury and mortality to individual sea turtles from underwater explosions, sonar, and vessel strikes. Injury and mortality that might occur under Alternatives 1 and 2 would be additive to injury and mortality associated with other actions. However, the relative contribution of Alternatives 1 and 2 to the overall injury and mortality would be low compared to other actions. A total of four potential sea turtle mortalities per year are estimated for the No Action Alternative and five for Alternatives 1 and 2 (see Tables 3.5-9 through 3.5-13).

Ocean noise associated with other actions and acoustic stressors (underwater explosions and sonar) associated with Alternatives 1 and 2 could also result in additive behavioral impacts on sea turtles. Other future actions such as construction and operation of liquefied natural gas terminals, and wave and tidal energy facilities would be expected to result in similar impacts. However, it is unlikely that these actions and underwater explosions or sonar use would overlap in time and space because all of these activities are widespread and the sound sources are intermittent. Furthermore, most of these other actions are not compatible with or could interfere with training and testing activities that involve underwater explosions and sonar use. The Navy takes appropriate steps to avoid activities that interfere with or are not compatible with training and testing.

It is likely that distant shipping noise (which is more pervasive and continuous) and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the co-occurrence of shipping noise and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on sea turtles.

The potential also exists for the impacts of ocean pollution and acoustic stressors associated with Alternatives 1 and 2 to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal. However, there are no data indicating that a sea turtle affected by ocean pollution would be more susceptible to stressors associated with Alternatives 1 and 2.

In summary, based upon the analysis in Section 3.5 (Sea Turtles) the current aggregate impacts of past and present actions and reasonably foreseeable future actions are expected to result in significant impacts on sea turtles. Therefore, cumulative impacts on sea turtles would be significant without consideration of the impacts of Alternatives 1 and 2. Alternatives 1 and 2 would contribute to and increase cumulative impacts, but the relative contribution would be low compared to other actions. Further analysis of cumulative impacts on sea turtles is not warranted.

4.4.8 SEABIRDS

The analysis in Section 3.6 (Seabirds) indicates that birds could be affected by acoustic stressors (tactical acoustic sonar, other acoustic devices, pile driving, underwater explosions, weapons firing noise, aircraft noise, vessel noise), energy stressors (electromagnetic, lasers), physical disturbance and strikes (aircraft, vessels and in-water devices, military expended materials), and ingestion (military expended materials). Potential responses would include a startle response, which includes short-term behavioral (i.e., movement) and physiological components (i.e., increased heart rate). Recovery from the impacts of most stressor exposures would occur quickly, and impacts would be localized. Some stressors, including underwater explosions, physical strikes, and ingestion of military expended materials, could result in mortality. However, the number of individual birds affected would be low, and no population-level impacts are expected. The impacts of Alternatives 1 and 2 would be cumulative with other actions that cause short-term behavioral and physiological impacts and mortality to birds, such as ingestion and entanglement in marine debris. However, the incremental contribution of Alternatives 1 or 2 to cumulative impacts on birds would be low for the following reasons:

- Most of the proposed activities would be widely dispersed in offshore areas where bird distribution is patchy and concentrations of individuals are low. Therefore, the potential for interactions between birds and training and testing activities is low. It is unlikely that training and testing activities would influence nesting because most activities take place in water and away from nesting habitats on land. Alternatives 1 and 2 would not result in destruction or loss of nesting habitat.
- For most stressors, impacts would be short term and localized, and recovery would occur quickly.
- While a limited amount of mortality could occur, no population level impacts would be expected.
- Alternatives 1 and 2 are not likely to adversely affect ESA-listed bird species.

Based on the analysis in Section 3.6 (Seabirds) and the reasons summarized above, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be negligible. Further analysis of cumulative impacts on birds is not warranted.

4.4.9 MARINE VEGETATION

The analysis presented in Section 3.7 (Marine Vegetation) indicates that marine vegetation could be affected by acoustic stressors (underwater explosions) and physical stressors (interactions with vessels and in-water devices, military expended materials, or seafloor devices). Potential impacts include localized disturbance and mortality. Recovery would occur quickly, and population level impacts are not anticipated. The impacts of Alternatives 1 or 2 would be cumulative with other actions that cause disturbance and mortality of marine vegetation. However, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low for the following reasons:

- Most of the proposed activities would occur in areas where seagrasses and other attached marine vegetation do not grow.
- Impacts would be localized, recovery would occur quickly, and no population level impacts would be expected.
- Alternatives 1 and 2 would not result in impacts that have been historically significant to marine vegetation. For example, Alternatives 1 and 2 would not increase nutrient loading, which can cause algal blooms, decrease light penetration, and impact photosynthesis of seagrasses. Furthermore, Alternatives 1 and 2 would not result in long-term or widespread changes in environmental conditions, such as turbidity, salinity, pH, or water temperature that could impact marine vegetation.
- The Proposed Action would have no effect on ESA-listed species of marine vegetation and would not result in the destruction or adverse modification of critical habitat.

Based on the analysis presented in Section 3.7 (Marine Vegetation) and the reasons summarized above, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be low. Further analysis of cumulative impacts on marine vegetation is not warranted.

4.4.10 Marine Invertebrates

The analysis presented in Section 3.8 (Marine Invertebrates) indicates that marine invertebrates could be affected by acoustic stressors (tactical acoustic sonar, other acoustic devices, pile driving, underwater explosions, weapons firing noise, aircraft noise, vessel noise), electromagnetic stressors, physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices), entanglement (cables and wires, parachutes), and ingestion (military expended materials). Potential impacts include short-term behavioral and physiological responses. Some stressors could also result in injury or mortality to a relatively small number of individuals, but not to ESA-listed corals. No population-level impacts are anticipated. Stressors from Alternatives 1 and 2 would have no effect or would be not likely to adversely affect ESA-listed corals.

Based upon the analysis in Section 3.8 (Marine Invertebrates) the invertebrate mortality impacts of Alternatives 1 and 2 would be cumulative with other actions that cause mortality (e.g., commercial fishing). However, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be negligible. Therefore, further analysis of cumulative impacts on marine invertebrates is not warranted.

4.4.11 Fish

The analysis presented in Section 3.9 (Fish) indicates that fishes could be affected by acoustic stressors (tactical acoustic sonar, other acoustic devices, pile driving, underwater explosions, weapons firing noise, aircraft noise, vessel noise), electromagnetic stressors, physical disturbance or strikes (vessels and in-water devices, military expended materials, seafloor devices), entanglement (cables and wires, parachutes), and ingestion (military expended materials). Potential impacts include short-term behavioral and physiological responses. Some stressors could also result in injury or mortality to a relatively small number of individuals, but not to ESA-listed fishes. No population level impacts are anticipated. Stressors from Alternatives 1 and 2 would have no effect or would be not likely to adversely affect ESA-listed fishes.

Based upon the analysis presented in Section 3.9 (Fish) the fish mortality impacts of Alternatives 1 and 2 would be cumulative with other actions that cause mortality (e.g., commercial fishing). However, the incremental contribution of Alternatives 1 and 2 to cumulative impacts would be negligible. Therefore, further detailed analysis of cumulative impacts on fishes is not warranted.

4.4.12 CULTURAL RESOURCES

4.4.12.1 Impacts of Alternatives 1 and 2 That May Contribute to Cumulative Impacts

As discussed in Section 3.10 (Cultural Resources), Alternatives 1 and 2 could result in impacts on submerged prehistoric sites and previously unidentified submerged historic resources if certain training and testing activities are conducted where these resources occur. Stressors that could impact cultural resources include underwater explosions on or near the bottom, use of towed-in-water devices, and use of ocean bottom deployed devices. Because cultural resources are considered nonrenewable resources, these impacts would be considered long-term and permanent.

The Navy routinely avoids locations of known obstructions to prevent damage to sensitive Navy equipment and vessels and to ensure the accuracy of training and testing exercises. Known obstructions include some historic shipwrecks; however, not all submerged historic resources have been identified in the Study Area.

4.4.12.2 Impacts of Other Actions

With a few exceptions, most of the other actions retained for cumulative impacts analysis (see Table 4.3-1) would involve some form of disturbance to the ocean bottom. Exceptions include environmental regulations and planning actions, ocean pollution, and most forms of ocean noise. Actions that would disturb the ocean bottom could impact submerged cultural resources. For example, ocean bottom disturbance would occur from construction related activities such as installation of offshore natural gas terminals and pipelines, ship anchoring, and installation of wind turbine piers and excavation of cable trenches. Any physical disturbance on the continental shelf and ocean floor could inadvertently damage or destroy submerged prehistoric sites and submerged historic resources. Excavation such as pipeline installation for liquefied natural gas terminals could disrupt the horizontal patterning and vertical stratigraphy of submerged prehistoric sites and submerged historic resources.

The other actions that result in ocean bottom disturbance require some form of federal authorization or permitting. Therefore, requirements of the National Historic Preservation Act apply to actions in territorial waters. Federal agency procedures have been implemented to identify cultural resources, avoid impacts, and mitigate if impacts cannot be avoided. For example, the Bureau of Ocean Energy Management, Regulation and Enforcement has procedures in place to identify the probability for the presence of submerged historic resources and the locations submerged prehistoric sites shoreward from the 148 feet (45.1 meters) isobath, and for project redesign and relocation to avoid identified resources (Minerals Management Service 2007). Nonetheless, inadvertent impacts could occur if unidentified submerged cultural resources are present.

4.4.12.3 Cumulative Impacts on Cultural Resources

Impacts on submerged cultural resources from other actions would typically be avoided or mitigated through implementing federal agency programs. However, impacts could occur if avoidance or mitigation measures are not implemented or if inadvertent disturbance or destruction of unidentified resources occurs. Disturbance or destruction of submerged prehistoric sites would diminish the overall archaeological record and decrease the potential for meaningful research on Paleoindian (late Pleistocene) and Early Archaic (early Holocene) occupations. Disturbance or destruction of submerged historic sites, including shipwrecks, would diminish the overall record for these resources and decrease the potential for meaningful research on these resources. Based upon the analysis in Section 3.10 (Cultural Resources), when considered with other actions, Alternatives 1 and 2 would contribute to and increase the cumulative impacts on submerged prehistoric and historic resources. Further analysis of cumulative impacts on cultural resources is not warranted.

4.4.13 SOCIOECONOMICS

The analysis in Section 3.11 (Socioeconomics) indicates that the impacts of Alternatives 1 and 2 on socioeconomic resources would be negligible. Alternatives 1 and 2 are not expected to contribute incrementally to cumulative socioeconomic impacts. Therefore, further analysis of cumulative impacts on socioeconomic resources is not warranted.

4.4.14 PUBLIC HEALTH AND SAFETY

The analysis presented in Section 3.12 (Public Health and Safety) indicates that the impacts of Alternatives 1 and 2 on public health and safety would be negligible. Alternatives 1 and 2 are not expected to contribute incrementally to cumulative health and safety impacts. Therefore, further analysis of cumulative impacts on public health and safety is not warranted.

4.5 SUMMARY OF CUMULATIVE IMPACTS

Marine mammals and sea turtles are the primary resources of concern for cumulative impacts analysis:

- Past human activities have impacted these resources to the extent that several marine mammal species and all sea turtles species occurring in the Study Area are ESA-listed.
- These resources would be impacted by multiple ongoing and future actions.
- Explosive detonations and vessel strikes under the No Action Alternative, Alternative 1, and Alternative 2 have the potential to disturb, injure, or kill marine mammals and sea turtles.

The aggregate impacts of past, present, and other reasonably foreseeable future actions are expected to result in significant impacts on some marine mammal and all sea turtle species in the Study Area. The No Action Alternative, Alternative 1, or Alternative 2 would contribute to cumulative impacts, but the relative contribution would be low compared to other actions. Compared to potential mortality, strandings, or injury resulting from Navy training and testing activities, marine mammal and sea turtle mortality and injury from bycatch, commercial vessel ship strikes, entanglement, ocean pollution, and other human causes are estimated to be orders of magnitude greater (hundreds of thousands of animals versus tens of animals) (Culik 2004; International Council for the Exploration of the Sea 2005; Read et al. 2006).

The analysis presented in this chapter and Chapter 3 (Affected Environment and Environmental Consequences) indicate that the incremental contribution of the No Action Alternative, Alternative 1, or Alternative 2 to cumulative impacts on sediments and water quality, air quality, marine habitats, birds, marine vegetation, marine invertebrates, fish, socioeconomic resources, and public health and safety would be negligible. When considered with other actions, the No Action Alternative, Alternative 1, or Alternative 2 might contribute to cumulative impacts on submerged prehistoric and historic resources, if such resources are present in areas where bottom-disturbing training and testing activities take place. The No Action Alternative, Alternative 1, or Alternative 2 would also make an incremental contribution to greenhouse gas emissions, representing approximately 0.030 percent, 0.031 percent, and 0.031 percent of U.S. 2009 greenhouse gas emissions, respectively.

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5 STANDARD OPERATING PROCEDURES, MITIGATION, AND MONITORING

This chapter describes the United States (U.S.) Department of the Navy (Navy) standard operating procedures, mitigation measures, and marine species monitoring efforts. Standard operating procedures are essential to maintaining safety and mission success, and in many cases have the added benefit of reducing potential environmental impacts. Mitigation measures are designed to help reduce or avoid potential impacts to marine resources. Marine species monitoring efforts are designed to track compliance with take authorizations, evaluate the effectiveness of mitigation measures, and improve our understanding of the effects training and testing activities have on marine resources within the Hawaii-Southern California Training and Testing (HSTT) Study Area (Study Area).

5.1 STANDARD OPERATING PROCEDURES

Effective training, maintenance, research, development, testing, and evaluation (hereafter referred to collectively as the Proposed Action) require that participants utilize their sensors and weapon systems to their optimum capabilities as required by the activity objectives. The Navy currently employs standard practices to provide for the safety of personnel and equipment, including ships and aircraft, as well as the success of the training and testing activities. For the purpose of this document, we will refer to standard practices as standard operating procedures. Because of their importance for maintaining safety and mission success, standard operating procedures have been considered as part of the Proposed Action under each alternative, and therefore are included in the Chapter 3 environmental analyses for each resource.

Navy standard operating procedures have been developed and refined over years of experience, and are broadcast via numerous naval instructions and manuals, including the following sources:

- Ship, Submarine and Aircraft Safety Manuals
- Ship, Submarine and Aircraft Standard Operating Manuals
- Fleet Area Control and Surveillance Facility Range Operating Instructions
- Fleet Exercise Publications and Instructions
- Naval Sea Systems Command Test Range Safety and Standard Operating Instructions
- Navy Instrumented Range Operating Procedures
- Naval Shipyard Sea Trial Agendas
- Research, Development, Test and Evaluation Plans
- Naval Gunfire Safety Instructions
- Navy Planned Maintenance System Instructions and Requirements
- Federal Aviation Administration Regulations

In many cases there are incidental environmental, socioeconomic, and cultural benefits resulting from standard operating procedures. Standard operating procedures serve the primary purpose of providing for safety and mission success, and are implemented regardless of their secondary benefits. This is what distinguishes standard operating procedures, which are a component of the Proposed Action, from mitigation measures, which are designed entirely for the purpose of reducing environmental impacts resulting from the Proposed Action. Because standard operating procedures are crucial to safety and mission success, the Navy will not modify them as a way to further reduce effects to environmental resources. Rather, mitigation measures will be used as the tool for avoiding and reducing potential environmental impacts. Standard operating procedures that are recognized as providing a potential secondary benefit are provided below.

5.1.1 Vessel Safety

Surface ships, which for the purposes of this chapter also includes surfaced submarines, operated by or for the Navy have personnel assigned to stand watch at all times, day and night, when the vessel is moving through the water (underway). Bridge watch personnel undertake extensive training in accordance with the Lookout Training Handbook or civilian equivalent, including on-the-job instruction and a formal Personal Qualification Standard Program (or equivalent program for supporting contractors or civilians), to certify that they have demonstrated all necessary skills (such as detection and reporting of floating or partially submerged objects). Bridge watch personnel are composed of officers and enlisted men and women. Their duties may be performed in conjunction with other job responsibilities, such as navigating the vessel or supervising other personnel. While on watch, personnel employ visual search techniques, including the use of binoculars, using a scanning method in accordance with the United States Navy Lookout Training Handbook. After sunset and prior to sunrise, personnel standing watch employ night lookout techniques, which include the use of night vision devices.

A primary duty of personnel standing watch on surface ships is to detect and report all objects and disturbances sighted in the water that may be indicative of a threat to the vessel and its crew, such as debris, a periscope, surfaced submarine, or surface disturbance. Per vessel safety requirements, personnel standing watch also report any marine mammals sighted that have the potential to be in the direct path of the vessel as a standard collision avoidance procedure. Because personnel standing watch are primarily posted for safety of navigation, range clearance, and man-overboard precautions, they are not normally posted while vessels are moored to a pier. When anchored or moored to a buoy, a bridge team is still maintained but with fewer personnel than when a vessel is underway. When vessels are moored or at anchor, watch personnel may maintain security and safety of the ship by scanning the water for any indications of a threat (as described above).

While underway, Navy surface ships greater than 65 feet (ft.) (20 meters [m]) in length have at least two personnel standing watch with binoculars; Navy surface ships less than 65 ft. (20 m) in length, surfaced submarines, and contractor vessels, have at least one personnel standing watch with binoculars. While underway, personnel standing watch are alert at all times. Due to limited manning and space limitations, smaller vessels and watercraft (e.g., rigid hull inflatable boats) do not have dedicated personnel standing watch, and the boat crew is responsible for maintaining the safety of the boat and surrounding environment.

All vessels use extreme caution and proceed at a “safe speed” so they can take proper and effective action to avoid a collision with any sighted object or disturbance, and can be stopped within a distance appropriate to the prevailing circumstances and conditions.

5.1.2 Aircraft Safety

Pilots of Navy aircraft make every attempt to avoid large flocks of birds in order to reduce the safety risk involved with a potential bird strike.

5.1.3 Laser Procedures

The following procedures are applicable to lasers of sufficient intensity to cause human eye damage.

5.1.3.1 Laser Operators

Only properly trained and authorized personnel operate lasers.

5.1.3.2 Laser Activity Clearance

Prior to commencing activities involving lasers, the operator ensures that the area is clear of unprotected or unauthorized personnel in the laser impact area by performing a personnel inspection or a flyover. The operator also ensures that any personnel within the area are aware of laser activities and are properly protected.

5.1.4 Weapons Firing Procedures

5.1.4.1 Notice to Mariners

A Notice to Mariners is routinely issued in advance of missile firing activities. A notice is also issued in advance of explosive bombing activities when they are conducted in an area that does not already have a standing Notice to Mariners. For activities involving large caliber gunnery, the Navy evaluates the need to publish a Notice to Mariners based on the scale, location, and timing of the activity. More information on the Notice to Mariners is found in Chapter 3, Section 3.12, Public Health and Safety.

5.1.4.2 Weapons Firing Range Clearance

The weapons firing hazard range must be clear of non-participating vessels and aircraft before firing activities will commence. The size of the firing hazard range is based on the farthest firing range capability of the weapon being used. All missile and rocket firing activities are carefully planned in advance and conducted under strict procedures which place the ultimate responsibility for range safety on the Officer Conducting the Exercise or civilian equivalent. All weapons firing ceases when cease fire orders are received from the Range Safety Officer or when the line of fire is endangering any object other than the designated target.

Pilots of Navy aircraft are not authorized to expend ordnance, fire missiles, or drop other airborne devices through extensive cloud cover where visual clearance of the air and surface area is not possible. The two exceptions to this requirement are: (1) when operating in the open ocean, air and surface clearance through visual means or radar surveillance is acceptable; and (2) when the operational commander conducting the exercise accepts responsibility for the safeguarding of airborne and surface traffic.

During activities that involve recoverable targets, such as aerial drones, the Navy recovers the target and any associated parachutes to the maximum extent practicable consistent with operational requirements and personnel safety.

5.1.4.3 Target Deployment Safety

Firing exercises involving the Integrated Maritime Portable Acoustic Scoring System are conducted in daylight hours in calm conditions. When small boats are used to deploy or recover buoys the conditions must measure less than three on the Beaufort Scale. When buoys are deployed and recovered from ships, firing exercises are conducted at less than four on the Beaufort Scale. These standards are in place to ensure safe operating conditions during buoy deployment and recovery.

The Beaufort Scale is a standardized measurement of the weather conditions, based primarily on wind speed. The scale is divided into levels from 0 to 12, with 12 indicating the most severe weather conditions (e.g., hurricane force winds). At Beaufort number 3, the wind speed in 7 to 10 knots, and the wave height is 2 to 3.5 ft. (0.5 to 1.1 m). At Beaufort number 4, the wind speed in 11 to 15 knots, and the wave height is 3.5 to 6 ft (1.1 to 1.8 m).

5.1.5 Swimmer Defense Testing Procedures

5.1.5.1 Notice to Mariners

A Notice to Mariners is issued in advance of all swimmer defense testing.

5.1.5.2 Swimmer Defense Testing Clearance

A daily in situ calibration of the source levels is used to establish a clearance area to the 145 decibels (dB) referenced to (re) 1 micro (µ) Pascal (Pa) sound pressure level threshold for non-participant personnel safety. A hydrophone is stationed during the calibration sequences in order to confirm the area. Boats patrol the 145 dB re 1 µPa sound pressure level area during all test activities. Boat crews are equipped with binoculars and remain vigilant for non-participant divers and boats, swimmers, snorkelers, and dive flags. If a non-participating swimmer, snorkeler, or diver is observed entering into the area, of the swimmer defense system, the power levels of the defense system are reduced. An additional 100 yard (yd.) (91.4 m) buffer is applied to the entry point of the non-participant as an additional precaution. If the area cannot be maintained free of non-participating swimmers, snorkelers, and divers, testing will cease until the non-participant has moved outside the area.

5.1.6 Unmanned Aerial and Underwater Vehicle Procedures

For activities involving unmanned aerial and underwater vehicles, the Navy evaluates the need to publish a Notice to Airmen or Mariners based on the scale, location, and timing of the activity. Unmanned Aerial Vehicles and Unmanned Aircraft Systems are operated in accordance with Federal Aviation Administration air traffic organization policy as issued in Office of the Chief of Naval Operations Instruction 3710, 3750 and 4790.

5.1.7 Towed In-Water Device Procedures

Prior to deploying a towed device, there is a standard operating procedure to search the intended path of the device for any floating debris (e.g., driftwood) or other potential obstructions (e.g., Sargassum rafts and animals), since they have the potential to cause damage to the device.

5.2 Introduction to Mitigation

The Navy recognizes that the Proposed Action has the potential to impact the environment. Unlike standard operating procedures, which are established for reasons other than environmental benefit, mitigation measures are modifications to the Proposed Action that are implemented for the sole purpose of reducing a specific potential environmental impact on a particular resource. The procedures discussed in this chapter, most of which are currently or were previously implemented as a result of past environmental compliance documents, Endangered Species Act (ESA) biological opinions, Marine Mammal Protection Act (MMPA) letters of authorization, or other formal or informal consultations with regulatory agencies, are being coordinated with the National Marine Fisheries Service (NMFS) through the consultation and permitting process.

In order to make the findings necessary to issue an MMPA letter of authorization, it may be necessary for NMFS to require additional mitigation measures or monitoring beyond those contained in this Draft EIS/OEIS. These could include measures considered, but eliminated in this EIS/OEIS, or as yet undeveloped measures. The public will have an opportunity to provide information to NMFS through the MMPA process, both during the comment period following NMFS' notice of receipt of the application for a letter of authorization, and during the comment period following publication of the proposed rule. NMFS may propose additional mitigation measures or monitoring in the proposed rule.

Additionally, the Navy is engaging in consultation processes under the ESA with regard to listed species that may be affected by the Proposed Action described in this EIS/OEIS. For the purposes of the ESA section 7 consultation, the mitigation measures proposed here may be considered by NMFS as beneficial actions taken by the Federal agency or applicant (50 Code of Federal Regulations [C.F.R.] 402.14(g)(8)). If required to satisfy requirements of the ESA, NMFS, in coordination with the U.S. Fish and Wildlife Service, may develop an additional set of measures contained in reasonable and prudent alternatives, reasonable and prudent measures, or conservation recommendations in any biological opinion issued for this Proposed Action.

The Navy also will consider public comments on proposed mitigation measures described in this Draft EIS/OEIS.

5.2.1 Regulatory Requirements for Mitigation

An Environmental Impact Statement (EIS) must analyze the affected environment, discuss the environmental impacts of the Proposed Action and each alternative, and assess the significance of the impacts to the environment. Mitigation measures help reduce the severity or intensity of impacts of the Proposed Action and can occur early in the planning process by choosing not to take the action or by moving the location of the action. Mitigation measure development also occurs throughout the analysis process whenever an impact is minimized by limiting the degree or magnitude of the action or its implementation. Mitigation measures can also include actions that repair, rehabilitate, or restore the affected environment or reduce impacts over time through constant monitoring and corrective adjustments. The White House Council on Environmental Quality issued guidance for mitigation and monitoring on 14 January 2011. This guidance affirms that federal agencies, including the Navy, should:

- commit to mitigation in decision documents when they have based environmental analysis upon such mitigation (by including appropriate conditions on grants, permits, or other agency approvals, and making funding or approvals for implementing the Proposed Action contingent on implementing the mitigation commitments);
- monitor the implementation and effectiveness of mitigation commitments;
- make information on mitigation and monitoring available to the public, preferably through agency web sites; and
- remedy ineffective mitigation when the federal action is not yet complete.

The Council on Environmental Quality guidance encourages federal agencies to develop internal processes for post-decision monitoring to ensure the implementation and effectiveness of the mitigation. It also states that federal agencies may use adaptive management as part of an agency's action. Adaptive management, when included in the NEPA analysis, allows for the agency to take alternate mitigation actions if mitigation commitments originally made in the planning and decision documents fail to achieve projected environmental outcomes. Adaptive management generally involves four phases: plan, act, monitor, and evaluate. This process allows the use of the results to update knowledge and adjust future management actions accordingly. Through implementing mitigation measures from the Navy's previous planning, consultations, permits, and monitoring of those efforts, the Navy can use collected data to further refine proposed mitigation measures.

Through the planning, consultation, and permitting processes, federal regulatory agencies may also suggest that the Navy analyze additional mitigation measures for inclusion in Final EIS/OEISs and associated consultation and permitting documents. Any proposals for additional mitigation measures should be based on the federal agency's assessment of the likelihood that such measures will contribute to a notable reduction of the environmental impact. If additional measures are identified, the Navy will apply the effectiveness and operational assessment protocol discussed in Section 5.3 to determine whether the additional measure will be proposed for implementation. This additional analysis will be presented in the Final EIS/OEIS, and, the final suite of mitigations resulting from the ongoing planning, consultation, and permitting processes will be documented in the Record of Decision.

5.2.2 Overview of Mitigation Approach

This section describes the approach to the Navy's process of developing its recommended mitigation measures. The Navy's overall approach to assessing potential mitigation measures is based on two principles:(1) mitigations will be effective at reducing potential impacts to the resource, and(2) from the Fleet stakeholder's perspective, mitigation is consistent with existing training and testing objectives, range procedures, and safety measures. The assessment process involves using information directly from the initial Chapter 3 Environmental Consequences unmitigated impact determinations, and assessing all existing mitigation and proposals for new or modified mitigation in order to determine if establishing and committing to a mitigation measure would be appropriate. As described throughout Chapter 3, the environmental consequences impact determinations were developed without consideration of mitigation and therefore offer a portrayal of the unmitigated potential impacts to each resource as a result of the Proposed Action.

This document is organized to present, and where appropriate, analyze training and testing activities separately. Separate organization and analysis was needed because the training and testing communities perform activities for differing purposes, and in some cases, with different personnel and in different locations. An example would be the difference in testing a new mine warfare system at an established testing range, with civilian scientists and engineers, versus the eventual training of sailors and aviators with that same system. As such, suggested mitigations that are appropriate for both training and testing events will be presented once. Those specific mitigations that are designed for and executable only by the testing community will be presented separately.

5.2.2.1 Lessons Learned from Previous Environmental Impact Statements/Overseas Environmental Impact Statements

In an effort to improve upon past processes, the Navy has considered all mitigations previously implemented and adapted its mitigation assessment approach based on lessons learned from previous EISs, ESA biological opinions, MMPA letters of authorization, and other formal or informal consultations with regulatory agencies. For example, dirt and seeds are removed from tracked vehicles prior to embarking to San Clemente Island and the Silver Strand Training Complex as a means of reducing the introduction of non-native plant species to these areas. This measure is the result of an iterative consultation process over many years with the U.S. Fish and Wildlife Service on operational impacts to resources on San Clemente Island and the Silver Strand. As a result, this practice has become a Standard Operating Procedure on military land ranges.

The Navy will assess the effectiveness of a full suite of recommended mitigation measures (a portion of which will include specific mitigation areas) on a case-by-case basis. The recommended measures are a combination of currently implemented measures, modifications of currently implemented measures, and newly proposed measures. The list of recommended measures is a result of the Navy's internal adaptive management process, and the assessment of planners, scientists, and the operational community. This chapter contains an explanation, with operational and environmental assessments, of discontinued or modified mitigation measures.

5.2.2.2 Protective Measures Assessment Protocol

The Navy has developed an information technology-based program, known as the Protective Measures Assessment Protocol, to promulgate environmental protection requirements during training and testing. The Protective Measures Assessment Protocol is a computer-based application that is available to all Navy personnel involved in training and testing activities. The Protective Measures Assessment Protocol program is a decision support and situational awareness tool designed to help reduce potential impacts to marine species and the ocean environment by informing Navy personnel involved in training and testing activities of all required event-specific mitigation measures. The program provides a visual display of the exercise area, unit's position in relation to the target area, and any relevant environmental data. The Navy requires that the Protective Measures Assessment Protocol be used before applicable training or testing activities analyzed in this document are conducted. The final suite of mitigations resulting from the ongoing planning for this EIS/OEIS, as well as the regulatory consultation and permitting processes will be integrated into the Protective Measures Assessment Protocol.

5.2.3 Assessment Methodology

As shown in the flow diagram in Figure 5.2-1 and described below, the Navy's mitigation measures are organized into two categories: (1) procedural measures, and (2) proposed mitigation areas. Category 1 (Procedural Measures), involve employing techniques or technology to modify an activity, or decrease the number of activities that occur per year in order to avoid or reduce a potential impact on a particular resource. For the purposes of organization based on the suite of mitigation measures analyzed below, the procedural measures are discussed within two subcategories: lookouts and mitigation zones.

For category 2 (Proposed Mitigation Areas), in order to avoid or reduce a potential impact on a particular resource the Navy would either: (1) limit the time of day or duration in which a particular activity could take place, or (2) move or relocate a particular activity outside of a specific geographic area. Within proposed mitigation areas, the measures would only apply to the specific activity that resulted in the requirement for mitigation, and would not prevent or restrict other activities from occurring during that time or in that area.

The Navy undertook two assessment steps for each recommended mitigation measure to ensure its compatibility with Section 5.2.2, Overview of Mitigation Approach. Step 1 is an effectiveness assessment to ensure that mitigations are effective at reducing potential impacts to the resource. Step 2 is an operational assessment of the impacts to safety, practicality, and readiness from the proposed mitigation measure. Steps 1 and 2 are organized according to stressor category throughout Section 5.3, Mitigation Assessment. In determining effectiveness at avoiding or reducing the impact, information was collected from published and readily available sources, as well as Navy after-action and monitoring reports. When available, these data were used when they represented the best available science and if they were generally accepted by the scientific community to ensure that they were applicable and contributed to the analysis. The result of the assessments is a summary of recommended measures and changes from currently implemented measures, organized by stressor category (Table 5.4-1). In addition, Section 5.5 includes a complete list of mitigation measures that the Navy has considered but eliminated due to either being ineffective at reducing environmental impacts or having an unacceptable operational impact.

5.2.3.1 Step 1: Effectiveness Assessment

Category 1: Procedural Measures. A procedural measure was deemed effective if implementing the measure was likely to result in avoidance or reduction of an impact to a resource.

The level of avoidance or reduction of the impact gained from implementing a procedural measure will be weighed against the potential for a shift in impacts resulting from the activity modification. For example, if predictive modeling results indicate that the use of underwater explosives could cause unacceptable impacts to a particular resource, those impacts could possibly be reduced by substituting non-explosive activities for explosive activities. However, if the increased use of non-explosive activities will consequently produce an unacceptable impact to habitats due to an associated physical disturbance or strike risk from military expended materials, the measure would not necessarily be justifiable.

A procedural measure was deemed ineffective if its implementation would not result in avoidance or reduction of an impact to a resource, or if an unacceptable impact will simply be shifted from one resource to another. An ineffective procedural measure that is not currently being implemented was not considered further in this document. See Section 5.5 (Mitigation Measures Considered but Eliminated) for further discussion of specific ineffective measures considered. For ineffective procedural measures that are currently being implemented, the rationale for terminating, modifying, or continuing to carry out the measure is included in the discussion.

Category 2: Proposed Mitigation Areas. A proposed mitigation area, as defined in Section 5.2.3, was deemed effective if implementing the measure may be likely to result in avoidance or reduction of the impact to the resource. The specific season, time of day, or geographic area must be important to the resource. In determining importance, special consideration will be given to time periods or geographic areas having characteristics, such as especially high overall density or percent population use, seasonal bottlenecks for a migration corridor, and identifiable key foraging and reproduction areas.

Avoidance or reduction of the impact in the specific time period or geographic area was weighed against the potential for causing new impacts in alternative time periods or geographic areas. For example, if the use of underwater explosives was predicted to cause unacceptable impacts to a particular resource in a known foraging location, those impacts could possibly be reduced by relocating those activities to a new location. However, if the use of explosives at the new location would consequently produce an unacceptable impact to the same or a different resource at the new location, the measure would not necessarily be justifiable.

A proposed mitigation area was deemed ineffective if implementing the measure would not result in avoidance or reduction of an impact to a resource, or if an unacceptable impact will simply be shifted from one time period or location to another. An ineffective mitigation area that the Navy does not currently implement was not considered further in this document. For ineffective mitigation areas that are currently being implemented, the rationale for terminating, modifying, or continuing to carry out the measure is included in the discussion.

5.2.3.2 Step 2: Operational Assessment

The Navy conducted the operational assessment for category 1, procedural measures, and category 2, proposed mitigation areas, using the criteria described below. The Navy deemed procedural measures and proposed mitigation areas to have acceptable operational impacts to a particular proposed activity if the following three conclusions were reached:

1. Implementing the measure is practical, as defined by the following factors:
   - The measure is consistent with operational Tactics, Techniques and Procedures.
   - The measure is consistent with Navy range use instructions and policies.
   - The measure has Operations and Maintenance resourcing.
   - The measure is consistent with Department of Defense (DoD) Personnel Tempo policy.
2. The measure does not result in national security concerns. Should national security require an increase in or modification to training and testing activities addressed in this EIS/OEIS, the Navy reserves the right to provide the regulatory federal agency with prior written notification. The increased tempo or tactical modification will be included in associated exercise or monitoring reports.
3. The Navy has legal authority under Title 10 to implement the measure.

If the above conclusions can be reached, then the mitigation measure will be recommended for funding and implementation.

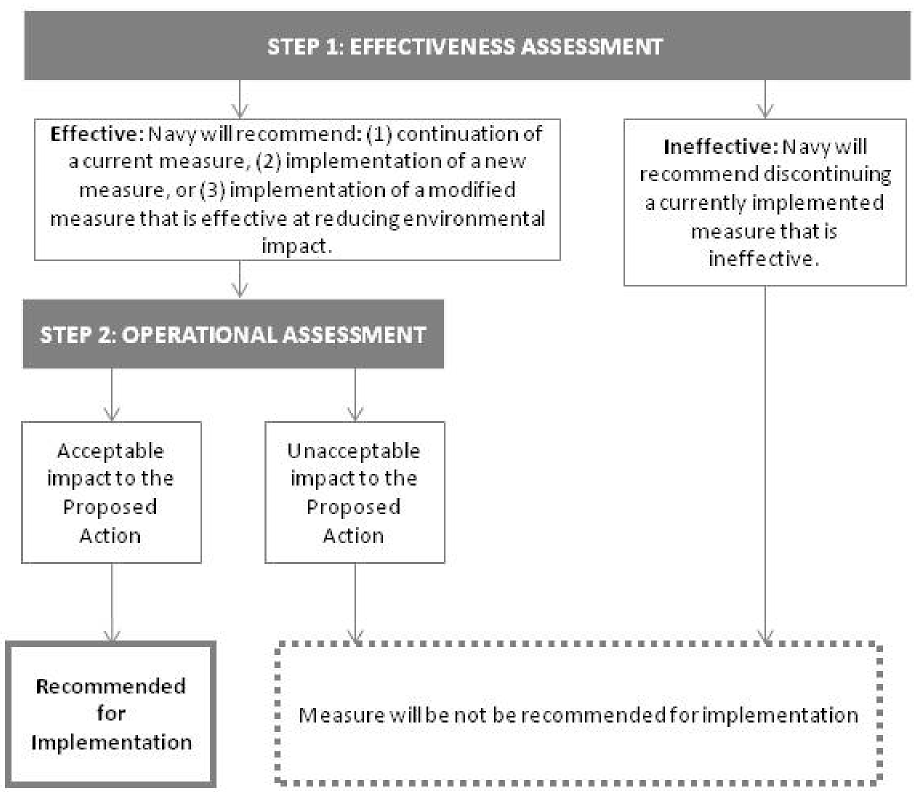

Figure 5.2-1: Flowchart of Process for Determining Proposed Mitigation Measures

5.3 Mitigation Assessment

5.3.1 Lookout Procedural Measures

As described in the Section 5.1, Standard Operating Procedures, surface ships, which for the purposes of this chapter also includes surfaced submarines, have personnel assigned to stand watch at all times when the vessel is underway. Standard watch personnel may perform watch duties in conjunction with job responsibilities that extend beyond looking at the water or air (such as supervision of other personnel). This section will introduce lookouts, which perform similar duties to standard personnel standing watch, and whose duties satisfy both operational and mitigation requirements.

The Navy will have two types of lookouts for the purposes of conducting visual observations: (1) those positioned on surface ships, and (2) those positioned in aircraft or on boats. Lookouts positioned on surface ships will be dedicated solely to diligent observation of the air and surface of the water. They will have multiple observation objectives, which include but are not limited to detecting the presence of biological resources and recreational or fishing boats, observing the mitigation zones described in Section 5.3.1.2, and monitoring for vessel and personnel safety concerns.

Due to aircraft and boat manning and space restrictions, lookouts positioned in aircraft or on boats will consist of the aircraft crew, pilot, or boat crew. Lookouts positioned in aircraft and boats may be responsible for tasks in addition to observing the air or surface of the water (for example, navigation of a helicopter or rigid hull inflatable boat). However, aircraft and boat lookouts will, to the maximum extent practicable and consistent with aircraft and boat safety and training and testing requirements, comply with the observation objectives described above for lookouts positioned on surface ships.

The procedural measures described below primarily consist of having lookouts during specific training and testing activities.

5.3.1.1 Specialized Training

5.3.1.1.1 Training for Personnel Standing Watch and Lookouts

5.3.1.1.1.1 United States Navy Marine Species Awareness Training

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue implementing the Marine Species Awareness Training program. All personnel standing watch on the bridge, Commanding Officers, Executive Officers, maritime patrol aircraft aircrews, anti-submarine warfare helicopter crews, civilian equivalents, and lookouts will successfully complete the United States Navy Marine Species Awareness Training prior to standing watch or serving as a lookout.

Effectiveness and Operational Assessment

Navy personnel undergo extensive training in order to stand watch on the bridge. Standard training includes on-the-job instruction under the supervision of experienced personnel, followed by completion of the Personal Qualification Standard program. The Personal Qualification Standard program certifies that personnel have demonstrated the skills needed to stand watch, such as detecting and reporting floating or partially submerged objects.

The United States Navy Marine Species Awareness Training is a specialized multimedia training program designed to help Navy operational and test communities best avoid potentially harmful interactions with marine species. The program provides specific training on how to visually detect marine species, focusing on marine mammals. The training also includes instruction for visually identifying sea turtles, floating vegetation (*Sargassum* or kelp concentrations), fish, jellyfish aggregations, and birds, which are often indicators of marine mammal or sea turtle presence. Marine Species Awareness Training also addresses the lookout's role in environmental protection and compliance, an overview of the laws governing the protection of marine species, Navy stewardship commitments, and general observation information to aid in avoiding interactions with marine species.

In summary, the Navy believes that the Marine Species Awareness Training is the best and most practicable forum for teaching personnel standing watch and lookouts about their responsibilities for helping reduce impacts to the marine environment while underway. Marine Species Awareness Training also provides the Navy with invaluable training for a relatively large number of personnel assigned to the command. This is important because of constantly shifting assignments of personnel within the command and accommodates training personnel during periods of high turnover. Training onboard the command and based on the command’s schedule also reduces costs during fiscally constrained periods. Overall, the Marine Species Awareness Training is an effective tool for improving the potential for lookouts to detect marine species while on duty.

Implementing the Marine Species Awareness Training program has acceptable operational impacts to the Proposed Action with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.1.2 Lookouts

The Navy proposes to use one or more lookouts during the training and testing activities described below, which are organized by stressor category. The effectiveness and operational assessments are discussed for all lookout measures collectively in Section 5.3.1.2.4, Effectiveness Assessment for Lookouts and Section 5.3.1.2.5, Operational Assessment for Lookouts.

5.3.1.2.1 Acoustic Stressors – Non-Impulsive Sound

5.3.1.2.1.1 Low-Frequency and Hull Mounted Mid-Frequency Active Sonar

Mitigation measures do not currently exist for low-frequency active sonar sources associated with new platforms or systems, such as the Littoral Combat Ship. The Navy is proposing to add mitigation measures for low-frequency active sonar and the Littoral Combat Ship, as well as maintain the number of lookouts currently implemented for ships using hull mounted mid-frequency active sonar.

With the exception of vessels less than 65 ft. (20 m) in length, the Littoral Combat Ship (and similar vessels which are minimally manned), ships using low-frequency or hull mounted mid-frequency active sonar sources associated with anti-submarine warfare and mine warfare activities at sea will have two lookouts at the forward position of the vessel. For the purposes of this document, low-frequency active sonar does not include surface towed array surveillance system low frequency active sonar.

While using low-frequency or hull mounted mid-frequency active sonar sources associated with anti-submarine warfare and mine warfare activities at sea, the Littoral Combat Ship (and similar vessels which are minimally manned) and vessels less than 65 feet in length will have one lookout at the forward position of the vessel due to space and manning restrictions.

Ships conducting active sonar activities while moored or at anchor (including pierside testing or maintenance) will maintain one lookout.

5.3.1.2.1.2 High-Frequency and Non-Hull Mounted Mid-frequency Active Sonar

Mitigation measures do not currently exist for high-frequency active sonar activities associated with anti-submarine warfare and mine warfare, or for new platforms, such as the Littoral Combat Ship; therefore, the Navy is proposing to add a new measure for these activities or platforms. The Navy is proposing to continue using the number of lookouts currently implemented for ships or aircraft conducting non-hull mounted mid-frequency active sonar, such as helicopter dipping sonar systems. Surface ships or aircraft conducting high-frequency or non-hull mounted mid-frequency active sonar activities associated with anti-submarine warfare and mine warfare activities at sea will have one lookout.

5.3.1.2.2 Acoustic Stressors - Explosives and Impulsive Sound

5.3.1.2.2.1 Improved Extended Echo Ranging Sonobuoys

The Navy is proposing to continue using the number of lookouts currently implemented for this activity. Aircraft conducting improved extended echo ranging sonobuoy activities will have one lookout.

5.3.1.2.2.2 Anti-Swimmer Grenades

The Navy is proposing to continue using the number of lookouts currently implemented for this activity. Surface vessels conducting anti-swimmer grenade activities will have one lookout.

5.3.1.2.2.3 Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices

Mine countermeasure and neutralization activities can be divided into two main categories: (1) general activities that can be conducted from a variety of platforms and locations, and (2) activities involving the use of diver placed charges that typically occur close to shore. When either of these activities are conducted using a positive control firing device, the detonation is controlled by the personnel conducting the activity and is not authorized until the area is clear at the time of detonation.

The Navy is modifying the number of lookouts currently implemented for general mine countermeasure and neutralization activities to account for additional categories of net explosive weights. The Navy is proposing the following number of lookouts to be used during general mine countermeasure and neutralization activities:

- During activities using up to a 500 lb. net explosive weight detonation(bin E10 and below), vessels greater than 200 ft. will have two lookouts, while vessels less than 200 ft. will have one lookout.
- During activities using a 501-650 lb. net explosive weight (bin E11) detonation, the Navy will use two lookouts (one positioned in an aircraft and one in a support vessel).

The Navy is proposing to continue using the number of lookouts currently implemented for mine neutralization activities involving diver placed charges using up to a 20 lb. net explosive weight detonation. Mitigation measures for activities involving diver placed charges do not currently exist for the 21-100 lb. net explosive weight detonations. The Navy is proposing that activities using up to a 100 lb. net explosive weight (bin E8) detonation will have a total of two lookouts (one lookout positioned in each of the two support vessels). In addition, when aircraft are used, the pilot or member of the aircrew will serve as an additional lookout. All divers placing the charges on mines will support the lookouts while performing their regular duties. The divers will report all marine mammal and sea turtle sightings to their dive support vessel.

As an additional measure, to mitigate the risk of harm to seabirds at SSTC, Navy personnel will monitor the detonation area for 30 minutes prior to and 30 minutes after a detonation. If successive detonations are to be conducted, they will be separated by more than 30 minutes, or will occur within 10 seconds of each other. This measure applies to all charges, whether detonated via positive control firing devices or time delay firing devices.

5.3.1.2.2.4 Mine Neutralization Activities Using Diver Placed Time–Delay Firing Devices

When mine neutralization activities using diver placed charges (up to a 20 lb. net explosive weight) are conducted with a time-delay firing device, the detonation is fused with a specified time-delay by the personnel conducting the activity and is not authorized until the area is clear at the time the fuse is initiated. During these activities, the detonation cannot be terminated once the fuse is initiated due to human safety concerns.

The Navy is proposing to modify the number of lookouts currently used for mine neutralization activities using diver-placed time-delay firing devices. As a reference, the current mitigation involves the use of six lookouts and three small rigid hull inflatable boats (two lookouts positioned in each of the three boats) for mitigation zones equal to or larger than 1,400 yd. (1,280 m), or four lookouts and two boats for mitigation zones smaller than 1,400 yd. (1,280 m). Using six lookouts and three boats in the long-term is impracticable to implement from an operational standpoint due to the unacceptable impact that it is causing on resource requirements (i.e., limited personnel resources and boat availability).

During activities using up to a 20 lb. net explosive weight (bin E6) detonation, the Navy will have four lookouts and two small rigid hull inflatable boats (two lookouts positioned in each of the two boats). In addition, when aircraft are used, the pilot or member of the aircrew will serve as an additional lookout. Additionally, all divers placing the charges on mines will support the lookouts while performing their regular duties. The divers will report all marine mammal and sea turtle sightings to their dive support vessel.

5.3.1.2.2.5 Ordnance Testing (Line Charge Testing)

The Navy is proposing to continue using the number of lookouts currently implemented for this activity. Surface vessels conducting line charge testing will have one lookout.

5.3.1.2.2.6 Gunnery Exercises-Small and Medium Caliber (Surface Target)

The Navy is proposing to continue using the number of lookouts currently implemented for this activity. Surface vessels or aircraft conducting small- and medium-caliber gunnery exercises using a surface target will have one lookout.

5.3.1.2.2.7 Gunnery Exercises-Large Caliber (Surface Target)

The Navy is proposing to continue using the number of lookouts currently implemented for this activity. Surface vessels or aircraft conducting large–caliber gunnery exercises using a surface target will have one lookout.

5.3.1.2.2.8 Missile Exercises (Surface Target)

The Navy is proposing to continue using the number of lookouts currently implemented for this activity. Surface vessels or aircraft conducting missile exercises against surface targets will have one lookout.

5.3.1.2.2.9 Bombing Exercises

The Navy is proposing to continue using the number of lookouts currently implemented for this activity. Aircraft conducting bombing exercises will have one lookout.

5.3.1.2.2.10 Torpedo (Explosive) Testing

The Navy is proposing to continue using the number of lookouts currently implemented for this activity. During explosive torpedo testing, the Navy will have one lookout positioned in an aircraft.

5.3.1.2.2.11 Sinking Exercises

The Navy is proposing to continue using the number of lookouts currently implemented for this activity. During sinking exercises, the Navy will have two lookouts (one positioned in an aircraft, and one on a surface vessel).

5.3.1.2.2.12 At-Sea Explosives Testing

Lookout measures do not currently exist for at-sea explosives testing. The Navy is proposing to add this measure. Each surface vessel supporting at-sea explosive testing will have a minimum of one lookout.

5.3.1.2.2.13 Elevated Causeway System – Pile Driving

Lookout measures do not currently exist for elevated causeway system – pile driving activities. The Navy is proposing to add this measure. During pile driving, the Navy will have one lookout positioned on the platform (which could include the shore, an elevated causeway, or on a ship) that will maximize the potential for sightings.

5.3.1.2.3 Physical Strike and Disturbance – Vessels and In-Water Devices

5.3.1.2.3.1 Vessels

The Navy is proposing to continue using the mitigation measures currently implemented for this activity (including full power propulsion testing). While underway, surface ships will have a minimum of one lookout.

5.3.1.2.3.2 Towed In-Water Devices

The Navy is proposing to continue using the number of Lookouts currently implemented for activities using towed in-water devices (e.g., towed mine neutralization). The Navy will have one Lookout during activities using towed in-water devices.

5.3.1.2.4 Physical Strike and Disturbance – Non-Explosive Practice Munitions

5.3.1.2.4.1 Small-, Medium-, and Large-Caliber Gunnery Exercises Using a Surface Target

The Navy is proposing to continue using the number of Lookouts currently implemented for these activities. Activities involving non-explosive practice munitions (e.g., small-, medium-, and large-caliber gunnery exercises) using a surface target will have one Lookout.

5.3.1.2.4.2 Bombing Exercises

The Navy is proposing to continue using the number of Lookouts currently implemented for these activities. The Navy will have one Lookout during activities involving non-explosive bombing exercises.

5.3.1.2.5 Effectiveness Assessment for Lookouts

Personnel standing watch in accordance with Navy standard operating procedures have multiple job responsibilities. While on duty, these standard personnel standing watch often conduct marine species observation in addition to their primary job duties (e.g., aiding in the navigation of the vessel). By having one or more lookouts dedicated solely to observing the air and surface of the water during certain training and testing activities, the Navy increases the likelihood that marine species will be detected.

Although using lookouts is expected to increase the likelihood that marine species will be detected at the surface of the water, it is unlikely that using lookouts will be able to help avoid impacts to all species entirely due to the inherent limitations of visually detecting marine mammals. The probability of visually detecting a marine animal is dependent upon two things. An animal must be present in an area to be seen (known as the availability bias), and an animal that is present in the area of observation must be positioned or behaving in a way that will allow for a visual detection. For example, an animal may not be visually detectable if it is swimming entirely under the water at a relatively far distance from a boat. Second, the observer must perceive the animal when the animal is in a position to be detected (Marsh and Sinclair 1989).

The factors affecting the detection of the animal may be probabilistically quantified as g(0). That is, g(0) represents the chance that the animal will be available for detection (i.e., on the surface and in the observer's field of view) and that the observer will perceive the animal. As a reference, a g(0) value of 1 indicates that 100 percent of the animals are detected. Various factors are involved in estimating g(0), including sightability and detectability of the animal (species-specific behavior and appearance, school size, blow characteristics, dive characteristics, and dive interval), viewing conditions (sea state, wind speed, wind direction, sea swell, and glare), and observer (experience, fatigue, and concentration) and platform characteristics (pitch, roll, yaw, speed, and height above water). Table 5.3-1 provides a range of values for g(0) for cetacean species in the Study Area. The sources of the g(0) estimations are provided in the table. The values in Table 5.3-1 were either determined by the source listed in the table or applied by the source for abundance or density estimation analyses in the particular geographic location. The purpose of providing Table 5.3-1 is to demonstrate the range of detection probabilities, which range widely between species and sighting platforms.

5.3.1.2.5.1 Detection Probabilities of Marine Mammals in the Study Area

Several variables that play into how easily a marine mammal may be detected by a dedicated observer are directly related to the animal; its external appearance and size; surface, diving and social behavior; and life history. The following is a generalized discussion of the behavior and external appearance of the marine mammals with the potential to occur in the Study Area as these characters relate to the detectability of each species. The species are grouped loosely based on either taxonomic relatedness or commonalities in size and behavior, and include large whales, cryptic species delphinids, beluga whales, and pinnipeds. Not all statements may hold true for all species in a grouping and exceptions are mentioned where applicable. The information presented in this section may be found in Jefferson et al. (2008) and sources within unless otherwise noted (Jefferson et al. 2008).

<u>Large Whales</u>

Species of large whales found in the Study Area include all the baleen whales and the sperm whale. Baleen whales are generally large, with adults ranging in size from 30-89 ft. (9 to 27 m), often making them immediately detectable. Many species of baleen whales have a prominent blow ranging from 10 ft. (3 m) to as much as 39 ft. (12 m) above the surface. However, there are at least two species (Bryde's whale and common minke whale) that often have no visible blow. Baleen whales tend to travel singly or in small groups ranging from pairs to groups of five. The exception to this is the fin whale, which is known to travel in pods of seven or more individuals. All species of baleen whales are known to form larger-scale aggregations in areas of high localized productivity or on breeding grounds. Baleen whales may or may not fluke at the surface before they dive; some species fluke regularly (humpback whale), some fluke variably (blue whale, fin whale) and some rarely fluke (sei whale, common minke whale, and Bryde's whale). Baleen whales may remain at the surface for extended periods of time as they forage or socialize. North Atlantic right whales are known to form surface-active groups and humpback whales to corral prey at the surface. Dive behavior varies amongst species, as well. Many species will dive and remain at depth for as long as 30 minutes. Some will adjust their diving behavior according to the presence of vessels (humpback whale, fin whale). Sei whales are known to sink just below the surface and remain there between breaths. Baleen whales have g(0) values ranging from 0.11 to 1.00 (Table 5.3-1).

Sperm whales are also considered large whales, with adult males reaching as much as 50 ft. (18 m) in total length. Sperm whales at the surface would likely be easy to detect. They are large, have a prominent, 16 ft. (5 m) blow, and may remain at the surface for long periods of time. They are known to raft (i.e., loll at the surface) and to form surface-active groups when socializing. Sperm whales may travel or congregate in large groups of as many as 50 individuals. Although sperm whales engage in conspicuous surface behavior such as fluking, breaching and tail-slapping, they are long, deep divers and may remain submerged for over one hour. Sperm whales have g(0) values ranging from 0.19 to 1.00 (see Table 5.3-1).

Cryptic Species

Cryptic and deep-diving species are those that do not surface for long periods of time and are often difficult to see when they surface, which ultimately limits the ability of lookouts to detect them even in good sighting conditions (Barlow et al. 2006). Cryptic species include beaked whales (family Ziphiidae), dwarf and pygmy sperm whales (*Kogia* species), and harbor porpoises. Beaked whales are notoriously difficult to detect at sea. In the Study Area, beaked whales may occur in a variety of group sizes, ranging from single individuals to groups of as many 22 individuals (MacLeod and D'Amico 2006). Beaked whale diving behavior in general consists of long, deep dives that may last for nearly 90 minutes followed by a series of shallower dives and intermittent surfacings (Tyack 2006, Baird et al. 2007). Some individuals remain at the surface for an extended period of time (perhaps 1 hr. or more) or make shorter dives (MacLeod and D'Amico, 2006). Detection of beaked whales is further complicated because beaked whales often dive and surface in a synchronous pattern and they travel below the surface of the water (MacLeod and D'Amico 2006). Beaked whales have g(0) values ranging from 0.13 to 1.00 (Table 5.3-1).

Dwarf and pygmy sperm whales (referred to broadly as *Kogia* species) are small cetaceans (10-13 ft. [3-4 m] adult length) that are not seen commonly at sea. *Kogia* species have g(0) values ranging from 0.19 to 0.79 (Table 5.3-1). *Kogia* species are some of the most commonly stranded species in some areas, which suggests that sightings are not indicative of their overall abundance. This supports the idea that they are cryptic, perhaps engaging in inconspicuous surface behavior or actively avoiding vessels. When *Kogia* species are sighted, they are seen in groups of no more than five to six individuals. They have no visible blow, do not fluke when they dive, and are known to log (i.e., lie motionless) at the surface. When they do dive, they often will sink out of sight with no prominent behavioral display.

Harbor porpoises are difficult to detect in all but the best of conditions (i.e., no swell, no whitecaps). Harbor porpoises have g(0) values ranging from 0.08 to 0.85 (Table 5.3-1). Harbor porpoises travel singly or in small groups of less than six individuals, but may aggregate into groups of several hundred. They are inconspicuous at the surface, rarely lifting their heads above the surface and often lying motionless. They are small and may actively avoid vessels.

Table 5.3-1: Detection Probability g(0)[1] Values for Marine Mammal Species

g(0)	Location	Platform	Source
Threatened/Endangered Cetacean Species			
Right whale (*Eubalaena* species)			
0.29-1.00	United States Atlantic Coast	Shipboard	(Palka 2006)
0.11-0.71	United States Atlantic Coast	Aerial	(Hain et al. 1999)
0.19-0.29	United States Atlantic Coast	Aerial	(Palka 2005b)
0.95	United States West Coast	Aerial	(Forney et al. 1995)
Humpback (*Megaptera novaeangliae*)			
0.19-0.21	United States Atlantic Coast	Shipboard	(Palka 2005a)
0.90-1.00	United States West Coast	Shipboard	(Barlow 1995); Calambokidis and Barlow 2004)
0.95	United States West Coast	Aerial	(Forney et al. 1995)
0.26	Hawaii	Aerial	(Mobley et al. 2001)
Blue whale (*Balaenoptera musculus*)			
0.41	United States West Coast	Aerial	(Barlow et al. 1997; Carretta et al. 2000)
0.9-1.00	United States West Coast	Shipboard	(Barlow and Taylor 2001)
0.92	United States West Coast	Shipboard	(Barlow and Forney 2007; Forney 2007)
Sei whale (*Balaenoptera borealis*)			
0.92	United States West Coast	Shipboard	(Barlow and Forney 2007; Forney 2007)
Fin whale (*Balaenoptera physalus*)			
0.32-0.94	United States Atlantic Coast	Shipboard	(Blaylock et al. 1995; Palka 2006)
0.19-0.29	United States Atlantic Coast	Aerial	(Palka 2005b)
0.90-1.00	United States West Coast	Shipboard	(Barlow 1995); 2003a)
0.95-0.98	United States West Coast	Aerial	(Forney and Barlow, 1993; (Forney et al. 1995)
0.90-1.00	Hawaii	Shipboard	(Barlow 2003b)
Sperm whale (*Physeter macrocephalus*)			
0.28-0.57	United States Atlantic Coast	Shipboard	(Palka 2005a; (Palka 2006)
0.19-0.29	United States Atlantic Coast	Aerial	(Palka 2005b)
0.53-1.00	United States West Coast	Shipboard	(Barlow 1995); Barlow and Gerrodette 1996; Barlow and Sexton 1996; Barlow 2003a; Barlow and Taylor 2005)
0.95-0.98	United States West Coast	Aerial	(Forney and Barlow 1993; (Forney et al. 1995)
0.87	Hawaii	Shipboard	(Barlow 2003b; 2006)
0.32	Antarctic	Shipboard	(Kasamatsu and Joyce 1995)
Non-Threatened/Non-Endangered Cetacean Species			
Minke whale (*Balaenoptera acutorostrata*)			
0.31-0.70	United States Atlantic Coast	Shipboard	(Blaylock et al. 1995; (Palka 2006)
0.19-0.29	United States Atlantic Coast	Aerial	(Palka 2005b)
0.25-0.90	Eastern North Atlantic	Shipboard	(Butterworth and Borchers 1988; Øien, 1990; Schweder et al. 1991; Schweder and Høst 1992; Schweder et al. 1992; Schweder et al. 1997; Skaug and Schweder 1999; Skaug et al. 2004)
0.84	United States West Coast	Shipboard	(Barlow 1995), Barlow 2003a)
0.95-0.98	United States West Coast	Aerial	(Forney and Barlow 1993; (Forney et al. 1995)
0.63-0.83	Antarctic	Shipboard	(Doi et al. 1982; IWC 1982; 1983)
Bryde's whale (*Balaenoptera edeni*)			
0.90-1.00	United States West Coast	Shipboard	(Barlow 1995), 2003a)
0.90	Hawaii	Shipboard	(Barlow 2003b; 2006)

Table 5.3-1: Detection Probability g(0) Values for Marine Mammal Species (continued)

g(0)[1]	Location	Platform	Source
Non-Threatened/Non-Endangered Cetacean Species (continued)			
***Kogia* species**			
0.29-0.55	United States Atlantic Coast	Shipboard	(Palka 2006)
0.19-0.79	United States West Coast	Shipboard	(Barlow 1995); Barlow and Sexton 1996; Barlow 1999; 2003a)
0.35	Hawaii	Shipboard	(Barlow 2003b; 2006)
Ziphiidae (Beaked Whales)			
0.46-0.51	United States Atlantic Coast	Shipboard	(Palka 2005a; (Palka 2006)
0.19-0.21	United States Atlantic Coast	Aerial	(Palka, 2005b)
0.13-1.00	United States West Coast	Shipboard	(Barlow 1995); Barlow and Sexton 1996; Barlow 1999; Carretta et al. 2001; Barlow 2003a; Barlow et al. 2006)
0.23-0.45	Hawaii	Shipboard	(Barlow 2003b; 2006)*
0.27	Antarctic	Shipboard	(Kasamatsu and Joyce, 1995)
0.95-0.98	United States West Coast	Aerial	(Forney and Barlow, 1993; (Forney et al. 1995)
Bottlenose dolphin (*Tursiops truncatus*)			
0.62-0.99	United States Atlantic Coast	Shipboard	(Palka 2005a; (Palka 2006)
0.58-0.77	United States Atlantic Coast	Aerial	(Palka 2005b)
0.74-1.00	United States West Coast	Shipboard	(Barlow 1995); 2003a)
0.67-0.96	United States West Coast	Aerial	(Forney and Barlow 1993; (Forney et al. 1995)
0.74-1.00	Hawaii	Shipboard	(Barlow 2003b; 2006)
Spinner dolphin (*Stenella longirostris*)			
0.61-0.76	United States Atlantic Coast	Shipboard	(Palka 2006)
0.77-1.0	United States West Coast	Shipboard	(Barlow 2003a)
0.77-1.0	Hawaii	Shipboard	(Barlow 2003b; 2006)
Pantropical spotted dolphin (*Stenella attenuate*)			
0.37-0.94	United States Atlantic Coast	Shipboard	(Palka 2006)*
0.77-1.00	United States West Coast	Shipboard	(Barlow 2003a)
0.76-1.00	Hawaii	Shipboard	(Barlow 2003b; 2006)
Striped dolphin (*Stenella coeruleoalba*)			
0.61-0.77	United States Atlantic Coast	Shipboard	(Palka 2005a; (Palka 2006)
0.77-1.00	United States West Coast	Shipboard	(Barlow 1995; 2003a)
0.76-1.00	Hawaii	Shipboard	(Barlow 2003b; 2006)
Common dolphin (*Delphinus delphis*)			
0.52-0.95	United States Atlantic Coast	Shipboard	(Palka 2005a; (Palka 2006)
0.58-0.77	United States Atlantic Coast	Aerial	(Palka 2005b)
0.79-0.81	Eastern North Atlantic	Shipboard	(Cañadas et al. 2004)
0.77-1.0	United States West Coast	Shipboard	(Barlow 1995), 2003a)
0.67-0.96	United States West Coast	Aerial	(Forney and Barlow, 1993; (Forney et al. 1995)
Rough-toothed dolphin (*Steno bredanensis*)			
0.74-1.00	United States West Coast	Shipboard	(Barlow 2003a)
0.74-1.00	Hawaii	Shipboard	(Barlow 2003b; 2006)
Fraser's dolphin (*Lagenodelphis hosei*)			
0.76-1.00	Hawaii	Shipboard	(Barlow, 2003b; 2006)

Table 5.3-1: Detection Probability g(0) Values for Marine Mammal Species (continued)

g(0)[1]	Location	Platform	Source
Non-Threatened/Non-Endangered Cetacean Species (continued)			
White-sided dolphin (*Lagenorhynchus acutus and L. obliquidens*)			
0.27-0.38	United States Atlantic Coast	Shipboard	(Palka 2006)
0.58-0.77	United States Atlantic Coast	Aerial	(Palka 2005b)
0.77-1.00	United States West Coast	Shipboard	(Barlow 1995); 2003a)
0.67-0.96	United States West Coast	Aerial	(Forney and Barlow 1993; (Forney et al. 1995)
White-beaked dolphin (*Lagenorhynchus albirostris*)			
None available.			
Risso's dolphin (*Grampus griseus*)			
0.51-0.84	United States Atlantic Coast	Shipboard	(Palka 2005a; (Palka 2006)
0.58-0.77	United States Atlantic Coast	Aerial	(Palka 2005b)
0.74-1.00	United States West Coast	Shipboard	(Barlow 1995; 2003a)
0.67-0.96	United States West Coast	Aerial	(Forney and Barlow 1993; (Forney et al. 1995)
0.74-1.00	Hawaii	Shipboard	(Barlow 2003b; 2006)
False killer whale (*Pseudorca crassidens*)			
0.74-1.00	Hawaii	Shipboard	(Barlow 2003b; 2006)
Pygmy killer whale (*Feresa attenuata*)			
0.74-1.00	Hawaii	Shipboard	(Barlow 2003b; 2006)
Killer whale (*Orcinus orca*)			
0.90	United States West Coast	Shipboard	(Barlow 2003a)
0.95-0.98	United States West Coast	Aerial	(Forney et al. 1995)
0.90	Hawaii	Shipboard	(Barlow 2003b; 2006)
0.96	Antarctic	Shipboard	(Kasamatsu and Joyce 1995)
Melon-headed whale (*Peponocephala electra*)			
0.74-1.00	Hawaii	Shipboard	(Barlow 2003b; 2006)
Pilot whale (*Globicephala* species)			
0.48-0.67	United States Atlantic Coast	Shipboard	(Palka 2005a; (Palka 2006)
0.19-0.29	United States Atlantic Coast	Aerial	(Palka 2005b)
0.74-1.00	United States West Coast	Shipboard	(Barlow 2003a)
0.74-1.00	Hawaii	Shipboard	(Barlow 2003b; 2006)
0.93	Antarctic	Shipboard	(Kasamatsu and Joyce 1995)
Harbor porpoise (*Phocoena phocoena*)			
0.35-0.73	United States Atlantic Coast	Shipboard	(Palka 1995; Palka 1996; (Palka 2006)
0.24-0.49	United States Atlantic Coast	Aerial	(Palka 2005b)
0.41-0.71	Eastern North Atlantic	Aerial	(Grünkorn et al. 2005)
0.08-0.85	United States West Coast	Aerial	(Barlow et al. 1988; Calambokidis et al. 1993a; (Forney et al. 1995); Laake et al. 1997; Carretta et al. 2001; Carretta et al. 2007)
0.54-0.79	United States West Coast	Shipboard	(Calambokidis et al. 1993b; Barlow 1995; Carretta et al. 2001)
Non-Threatened/Non-Endangered Pinniped Species			
Harbor seal (*Phoca vitulina*)			
0.28	United States West Coast	Aerial	(Barlow et al. 1997; Carretta et al. 2000)

*These numbers were either determined by the source or applied by the source for abundance/density estimation analyses in the particular geographic location.
[1] A g(0) value of 1.00 indicates that 100 percent of the animals are detected

Delphinids

Delphinids are some of the most likely species to be detected at sea by observers. Delphinids have g(0) values ranging from 0.19 to 1.00, with many species having higher g(0) values (Table 5.3-1). Many species of delphinids engage in very conspicuous surface behavior, including leaping, spinning, bow riding, and traveling along the surface in large groups. Delphinid group sizes may range from 10 to 10,000 individuals, depending upon the species and the geographic region. Species such as pilot whales, rough-toothed dolphins, white-beaked dolphins, white-sided dolphins, bottlenose dolphins, stenellid dolphins, common dolphins, and Fraser's dolphins are known to either actively approach and investigate vessels, or bow ride along moving vessels. Fraser's dolphins and common dolphins form huge groups that travel quickly along the surface, churning up the water and making them visible from a great distance. Delphinids may dive for as little as 1 minute to more than 30 minutes, depending upon the species.

Beluga Whales

Beluga whales have an extremely conspicuous coloration (all white) and reach up to 16 ft. (5 m) in total length. They travel in groups ranging from 15 individuals to thousands. They dive for lengths of up to 25 minutes There are no g(0) values available for beluga whales.

Pinnipeds

Pinnipeds (seals and sea lions) are more difficult to detect at sea than cetaceans. Pinnipeds are much smaller, often solitary and generally do not engage in conspicuous surface behavior. There is not a lot of information regarding pinniped behavior at sea. Pinnipeds have a low profile, no dorsal appendage and small body size in comparison with most cetaceans, limiting accurate visual detection to sea states of less than 2 on the Beaufort Scale (Carretta et al. 2000). Some species, such as harbor seals, are known to approach and observe human activities on land or on stationary vessels. The only g(0) values available for pinnipeds occurring in the Study Area are for the harbor seal. Harbor seals have a g(0) value of 0.28 (see Table 5.3-1). Harbor seals and gray seals are solitary at sea. Harp seals appear to be an exception, traveling in large groups at the surface and churning up whitewater like dolphins. Gray seals are known to rest vertically at the surface with only the head exposed. Gray seals may dive for as long as 30 minutes and hooded seals for up to 60 minutes.

5.3.1.2.5.2 Detection Probabilities of Sea Turtles in the Study Area

Sea turtles spend a majority of their time below the surface and are difficult to sight from a vessel until the animal is at close range (Hazel et al. 2007). Sea turtles often spend over 90 percent of their time underwater and are not visible more than 6.5 ft. (2 m) below the surface (Mansfield 2006). Sea turtles are generally much smaller than cetaceans, so while shipboard surveys designed for sighting marine mammals are adequate for detecting large sea turtles (e.g., adult leatherbacks), they are usually not adequate for detecting the smaller-sized turtles (e.g., juveniles, Kemp's ridley). Juvenile sea turtles may be especially difficult to detect. Aerial detection may be more effective in spotting sea turtles on the surface, particularly in calm seas and clear water, but it is possible that the smallest age classes are not detected even in good conditions (Marsh and Saalfeld 1989). Visual detection of sea turtles, especially small turtles, is further complicated by their startle behavior in the presence of ships. Turtles on the surface may dive below the surface of the water in the presence of a vessel before it is detected by shipboard or aerial observers (Kenney 2005). The detection probability of sea turtles is generally lower than that of cetaceans; however, there is no information available on specific g(0) values for turtles. The use of lookouts for visual detection of sea turtles is likely effective only at close range, and is thought to be less effective for small individuals than large individuals.

5.3.1.2.5.3 Summary of Lookout Effectiveness

Due to the various detection probabilities, levels of experience, and dependence on sighting conditions, lookouts will not always be effective at avoiding impacts to all species. However, lookouts are expected to increase the overall likelihood that certain marine mammal species will be detected at the surface of the water, when compared to the likelihood that these same species would be detected if lookouts are not used. The Navy believes the continued use of lookouts contributes to helping reduce potential impacts to these marine mammal species from training and testing activities.

5.3.1.2.6 Operational Assessment for Lookouts

As written, the preceding recommended lookout measures all have acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy. The number of lookouts recommended for each measure often represents the maximum lookout capacity based on limited resources (e.g., space and manning restrictions). These operational factors are specifically noted in the sections below where applicable.

5.3.2 MITIGATION ZONE PROCEDURAL MEASURES

Safety zones described in Section 5.1 (Standard Operating Procedures) are zones designed for human safety, whereas this section will introduce mitigation zones. A mitigation zone is designed solely for the purpose of reducing potential impacts to marine mammals and sea turtles from training and testing activities. Mitigation zones are measured as the radius from a source. Unique to each activity category, each radius represents a distance that the Navy will visually observe to help reduce injury to marine species. Visual detections of applicable marine species will be communicated immediately to the appropriate watch station for information dissemination and appropriate action. If the presence of marine mammals is detected acoustically, lookouts posted in aircraft and on surface vessels will increase the vigilance of their visual surveillance. As a reference, aerial surveys are typically made by flying at 1,500 ft. (457 m) altitude or lower at the slowest safe speed.

Many of the proposed activities have mitigation measures that are currently being implemented, as required by previous environmental documents or consultations. Most of the current mitigation zones for activities that involve the use of impulsive and non-impulsive sources were originally designed to reduce the potential for onset of temporary threshold shift (TTS). For the HSTT EIS/OEIS, the Navy updated the acoustic propagation modeling to incorporate updated hearing threshold metrics (i.e., upper and lower frequency limits), updated density data for marine mammals, and factors such as an animal’s likely presence at various depths. An explanation of the acoustic propagation modeling process can be found in the Marine Species Modeling Team (2012) Technical Report.

As a result of the updates described above to the acoustic propagation modeling, in some cases the ranges to effects are much larger than those output by previous models. Due to the ineffectiveness and unacceptable operational impacts associated with mitigating such large areas, the Navy is unable to mitigate for onset of TTS for every activity. However, in some cases the ranges to effects are smaller than previous models estimated, and the mitigation zones were adjusted accordingly to provide consistency across the measures. Navy developed each proposed mitigation zone to avoid or reduce the potential for onset of the lowest level of injury, permanent threshold shift (PTS), out to the predicted maximum range. Mitigating to the predicted maximum range to PTS consequently also mitigates to the predicted maximum range to onset mortality (1% mortality), onset slight lung injury, and onset slight gastrointestinal tract injury, since the maximum range to effects for these criteria are shorter than for PTS. Furthermore, in most cases, the predicted maximum range to PTS also consequently covers the predicted average range to TTS. Table 5.3-2 summarizes the predicted average range to TTS, average range to PTS, maximum range to PTS, and recommended mitigation zone for each activity category, based on the Navy’s acoustic propagation modeling results.

Table 5.3-2: Predicted Range to Effects and Recommended Mitigation Zones

Activity Category	Representative Source (Bin)*	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone
Non-Impulsive Sound					
Low-Frequency and Hull-Mounted Mid-Frequency Active Sonar	SQS-53 ASW hull-mounted sonar (MF1)	4,251 yd. (3,887 m)	281 yd. (257 m)	<292 yd. (<267 m)	6 dB power down at 1,000 yd. (914 m); 4 dB power down at 500 yd. (457 m); and shutdown at 200 yd. (183 m)
High-Frequency and Non-Hull Mounted Mid-Frequency Active Sonar	AQS-22 ASW dipping sonar (MF4)	226 yd. (207 m)	<55 yd. (<50 m)	<55 yd. (<50 m)	200 yd. (183 m)
Explosive and Impulsive Sound					
Improved Extended Echo Ranging Sonobuoys	Explosive sonobuoy (E4)	434 yd. (397 m)	156 yd. (143 m)	563 yd. (515 m)	600 yd. (549 m)
Explosive Sonobuoys using 0.6–2.5 lb. NEW	Explosive sonobuoy (E3)	290 yd. (265 m)	113 yd. (103 m)	309 yd. (283 m)	350 yd. (320 m)
Anti-Swimmer Grenades	Up to 0.5 lb. NEW (E2)	190 yd. (174 m)	83 yd. (76 m)	182 yd. (167 m)	200 yd. (183 m)
Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices	NEW dependent (see Table 5.3-3)				
Mine Neutralization Diver Placed Mines Using Time-Delay Firing Devices	Up to 20 lb. NEW (E6)	647 yd. (592 m)	232 yd. (212 m)	469 yd. (429 m)	1,000 yd. (915 m)
Ordnance Testing (Line Charge Testing)	Numerous 5 lb. charges (E4)	434 yd. (397 m)	156 yd. (143 m)	563 yd. (515 m)	900 yd. (823 m)**
Gunnery Exercises – Small- and Medium-Caliber (Surface Target)	40 mm projectile (E2)	190 yd. (174 m)	83 yd. (76 m)	182 yd. (167 m)	200 yd. (183 m)
Gunnery Exercises – Large-Caliber (Surface Target)	5 in. projectiles (E5 at the surface***)	453 yd. (414 m)	186 yd. (170 m)	526 yd. (481 m)	600 yd. (549 m)
Missile Exercises up to 250 lb. NEW (Surface Target)	Maverick missile (E9)	949 yd. (868 m)	398 yd. (364 m)	699 yd. (639 m)	900 yd. (823 m)
Missile Exercises up to 500 lb. NEW (Surface Target)	Harpoon missile (E10)	1,832 yd. (1,675 m)	731 yd. (668 m)	1,883 yd. (1,721 m)	2,000 yd. (1.8 km)
Bombing Exercises	MK-84 2,000 lb. bomb (E12)	2,513 yd. (2.3 km)	991 yd. (906 m)	2,474 yd. (2.3 km)	2,500 yd. (2.3 km)**
Torpedo (Explosive) Testing	MK-48 torpedo (E11)	1,632 yd. (1.5 km)	697 yd. (637 m)	2,021 yd. (1.8 km)	2,100 yd. (1.9 km)

Table 5.3-2: Predicted Range to Effects and Recommended Mitigation Zones (continued)

Activity Category	Representative Source (Bin)*	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone
Sinking Exercises	Various sources up to the MK-84 2,000 lb. bomb (E12)	2,513 yd. (2.3 km)	991 yd. (906 m)	2,474 yd. (2.3 km)	2.5 nm (4.6 km)**
At-Sea Explosive Testing	Various sources less than 10 lb. NEW (E5 at various depths***)	525 yd. (480 m)	204 yd. (187 m)	649 yd. (593 m)	1,600 yd. (1.4 km)**
Elevated Causeway System – Pile Driving	24 in. steel impact hammer	1,094 yd. (1,000 m)	51 yd. (46 m)	51 yd. (46 m)	60 yd. (55 m)

ASW: anti-submarine warfare; JAX: Jacksonville; NEW: net explosive weight; PTS: permanent threshold shift; TTS: temporary threshold shift;
* This table does not provide an inclusive list of source bins; bins presented here represent the source bin with the largest range to effects within the given activity category.
** Recommended mitigation zones are larger than the modeled injury zones to account for multiple types of sources or charges being used.
*** The representative source bin E5 has different range to effects depending on the depth of activity occurrence (at the surface or at various depths).

The mitigation zones were based on the longest range for all the functional hearing groups (based on the hearing threshold metrics described in 3.4, Marine Mammals, and 3.5, Sea Turtles). In the majority of the times, the mitigation zones were driven by either the high frequency cetaceans or the sea turtles functional hearing groups. Therefore, the mitigation zones are even more protective for the remaining functional hearing groups (low frequency cetaceans, mid-frequency cetaceans, and pinnipeds), and likely cover a larger portion of the potential range to onset of TTS.

In some instances, the Navy recommends mitigation zones that are larger or smaller than the predicted maximum range to PTS based on the effectiveness and operational assessments. As described in Section 5.2.3 (Assessment Methodology), the Navy will only recommend implementing mitigation that results in avoidance or reduction of an impact to a resource and that has acceptable operational impacts to a particular proposed activity. Additional details about the activity-specific mitigation zones and their associated effectiveness and operational assessments are provided throughout the remainder of this section. The recommended measures are either currently implemented, are modifications of current measures, or are new measures.

5.3.2.1 Acoustic Stressors

5.3.2.1.1 Non-Impulsive Sound

5.3.2.1.1.1 Low-Frequency and Hull Mounted Mid-Frequency Active Sonar

<u>Recommended Mitigation and Comparison to Current Mitigation</u>

The Navy is proposing to continue implementing the current mitigation measure for low-frequency and hull mounted mid-frequency active sonar. Training and testing activities that involve the use of low-frequency and hull mounted mid-frequency active sonar will use lookouts for visual observation from a surface vessel immediately before and during the exercise. Mitigation zones for these activities involve powering down the sonar by 6 dB when a marine mammal is sighted within 1,000 yd. (914 m), and by an additional 4 dB when sighted within 500 yd. (457 m) from the source, for a total reduction of 10 dB. The Navy will cease transmissions when a marine mammal is sighted within 200 yd. (183 m). The exercise will re-commence if one of the following conditions are met: the animal is thought to have exited the mitigation zone and the mitigation zone has been clear from any additional sightings for a pre-established amount of time; the vessel has transited more than a pre-established distance beyond the location of the last sighting; or if the ship concludes that dolphins are deliberately closing in on the ship to ride the vessel's bow wave. Active transmission may resume when dolphins are bowriding because they are out of the main transmission axis of the active sonar while in the shallow-wave area of the vessel bow.

<u>Effectiveness and Operational Assessments</u>

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for low-frequency and hull mounted mid-frequency active sonar sources is approximately 292 yd. (267 m) for one ping. This range was determined by the high-frequency cetacean functional hearing group. The distance for all other marine mammal functional hearing groups is less than 104 yd. (95 m) for one ping, so the power down and shutdown mitigation zones will provide greater protection for these species. Injury (PTS) to marine mammals is mitigated by both types of mitigation zones, not just the shutdown zone. For example, if a marine mammal is spotted at a distance or 292 yd. (267 m) from the vessel, the sonar would be powered down by 10 dB, which would reduce the range to PTS to well within the 200 yd. (183 m) shutdown zone. Implementing the 200 yd. (183 m) shutdown zone will further reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when animals are sighted within the200 yd. (183 m) zone. Implementing the 500 yd. (457 m) and 1,000 yd. (514 m) sonar power down zones will also reduce the potential for both injury and TTS to occur when individual marine mammals are sighted farther from the vessel and within these zones, especially in cases where the vessel and animal are approaching each other.

The mitigation zones the Navy has developed are within a range for which lookouts can reasonably be expected to maintain situational awareness and visually observe during most conditions. Since the average range to onset of TTS is 4,251 yd. (3,887 m), the entire range to TTS is not reasonably observable. By establishing mitigation zones that can be realistically maintained from surface ships, the lookouts will be more effective at sighting individual animals. The probability of detection decreases dramatically with distance from the ship. By keeping lookouts focused within the ranges where exposure to higher levels of energy is possible, the effectiveness at reducing potential impacts will increase.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.1.2 High-Frequency and Non-Hull Mounted Mid-Frequency Active Sonar

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for all high-frequency and non-hull mounted mid-frequency active sonar activities (i.e., new sources or sources not previously analyzed). The Navy is proposing to: (1) continue implementing the current mitigation measures for activities currently being executed, such as dipping sonar activities, and (2) extend the implementation of its current mitigation to all other activities in this category.

Mitigation will include visual observation from a surface vessel or aircraft immediately before and during the exercise within a mitigation zone of 200 yd. (183 m) from the active sonar source. Should a marine mammal be detected within the mitigation zone, active sonar transmissions will cease if the source can be turned off during the activity. Active transmission will re-commence when the animal is thought to have exited the mitigation zone.

For activities involving helicopter deployed dipping sonar, visual observation from aircraft will begin 10 minutes before the first deployment of active dipping sonar and during the exercise. Helicopters will not begin to dip their sonar in observed floating vegetation (*Sargassum* or kelp concentrations), or within 200 yd. (183 m) of a marine mammal. Helicopters will cease pinging if a marine mammal closes within 200 yd. (183 m) of the helicopter dipping sonar after pinging has begun. The exercise will re-commence once the animal is thought to have exited the mitigation zone.

For activities involving active sonobuoys, aircraft, with the exception of platforms operating at high altitudes, (e.g., certain types of fixed-wing aircraft), will visually observe a 200 yd. (183 m) mitigation zone while sonobuoys are in use.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for high-frequency and non-hull mounted mid-frequency active sonar sources is less than 55 yd. (50 m) for one ping. This range was the same for all functional hearing groups. The average range to onset of TTS across all functional hearing groups is 237 yd. (217 m) for one ping. Implementing the 200 yd. (183 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted. Depending on the source, the lookout is visually observing either close aboard the vessel or from directly above the source by aircraft. Therefore, this measure should be effective at reducing these risks to all marine mammals that are available to be observed within this zone.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2 Explosives and Impulsive Sound

5.3.2.1.2.1 Improved Extended Echo Ranging Sonobuoys

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to modify the mitigation measures currently implemented for this activity by reducing the mitigation zone from 1,000 yd. (914 m) to 600 yd. (549 m). Mitigation will include pre-exercise aerial and passive acoustic monitoring, which will begin 30 minutes before the first source/receiver pair detonation and continue throughout the duration of the exercise. The pre-exercise aerial observation will include the time it takes to deploy the sonobuoy pattern (deployment is conducted by aircraft dropping sonobuoys in the water). Improved Extended Echo Ranging sonobuoys will not be deployed within 400 yd. (366 m) of observed floating vegetation (*Sargassum* or kelp concentrations). Visual observation for marine mammals and sea turtles will take place within a 600 yd. (549 m) mitigation zone around an Improved Extended Echo Ranging sonobuoy. If a marine mammal or sea turtle is visually detected within the mitigation zone during sonobuoy deployment, the Navy will only deploy the receiver portion of the sonobuoy pair. The deployment of the active source portion of the sonobuoy pair will re-commence once the animal is thought to have exited the mitigation zone. If a marine mammal or sea turtle is visually detected within the mitigation zone after the sonobuoy pair has been deployed but prior to detonation, the exercise will cease until the mitigation zone has been clear from any additional sightings for 30 minutes.

Passive acoustic monitoring would be conducted with Navy assets, such as sonobuoys, already participating in the activity. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to lookouts posted in aircraft and on surface vessels in order to increase vigilance of their visual surveillance.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for Improved Extended Echo Ranging sonobuoys is approximately 563 yd. (515 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 434 yd. (397 m). Implementing the 600 yd. (549 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted. Since lookouts will be positioned in aircraft and will visually observe the mitigation zone from directly above, this measure should be effective at reducing these risks to all marine mammals and sea turtles that are available to be observed within this zone.

The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will likely consequently increase the likelihood of avoidance of injury and TTS to marine mammals and sea turtles.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.2 Mini Source/Seeker Sonobuoys

Recommended Mitigation and Comparison to Current Mitigation

No mitigation measures are currently implemented for the use of mini source/seeker sonobuoys, because these sonobuoys are newly developed and are not currently being used in training or testing activities. The detonation of these sonobuoys is conducted using a positive control firing device by the personnel conducting the activity and is not authorized until the area is clear at the time of detonation.

The Navy is proposing a mitigation zone of 60 yd. () centered on the detonation site for mine source/seeker sonobuoys. These sonobuoys will be deployed from a hovering helicopter, and visual surveillance will take place the helicopter for 30 minutes before, during, and after completion of the exercise. During activities using these devices, visual observation for marine mammals, sea turtles, and sea birds will take place within the mitigation zone around the detonation site. If a marine mammal, sea turtle, or sea bird is visually detected within the mitigation zone, then the exercise will cease until the mitigation zone has been clear from any additional sightings for 30 minutes.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. The range to effects activities using mini source/seeker sonobuoys were determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had shorter ranges to onset of PTS, so the mitigation zone specified for these sonobuoys will provide further protection for these species. Implementing the mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS when individuals are sighted.

As described in Section 5.3.1 (Lookout Procedural Measures), lookouts positioned in the aircraft would be responsible for tasks in addition to observing the air or surface of the water. For example, a lookout for this activity may also be responsible for navigation of the vessel or assistance with sonobuoy deployment. As described in Section 5.3.1.2.4 (Effectiveness Assessment for lookouts), the ability of a lookout to detect an animal can vary greatly based on what observing platform is being used. Observations made from a hovering helicopter positioned at a relatively low altitude should provide an excellent vantage point for surveying the mitigation zone. This measure should be effective at reducing potential impacts to marine mammals, sea turtles, and sea birds that are sighted.

5.3.2.1.2.3 Anti-Swimmer Grenades

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue implementing the current mitigation measures for this activity. Activities involving anti-swimmer grenades will include visual observation from a small boat immediately before and during the exercise. Prior to the commencement of the activity, there will be a visual observation of the training area to determine whether the intended impact location is clear of floating vegetation (*Sargassum* or kelp concentrations). Visual observation for marine mammals and sea turtles will take place within the 200 yd. (183 m) mitigation zone around the anti-swimmer grenades. If a marine mammal or sea turtle is visually detected within the mitigation zone, then the exercise will cease until the animal is thought to have exited the mitigation zone.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for anti-swimmer grenades is approximately 182 yd. (167 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 190 yd. (174 m). Implementing the 200 yd. (183 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted. Since the lookout is visually observing close aboard the boat, this measure should be effective at reducing the risk to all marine mammals and sea turtles that are available to be observed.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.4 Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices

Recommended Mitigation and Comparison to Current Mitigation

Mine countermeasure and neutralization activities can be divided into two main categories: (1) general activities that can be conducted from a variety of platforms and locations, and (2) activities involving the use of diver placed charges that typically occur close to shore. When either of these activities are conducted using a positive control firing device, the detonation is controlled by the personnel conducting the activity and is not authorized until the area is clear at the time of detonation.

The Navy is proposing to modify the currently implemented mitigation measures for general mine countermeasure and neutralization activities to account for additional categories of net explosive weights, in order to align with the explosive bins that were modeled. The Navy is proposing the mitigation zones to be used during general mine countermeasure and neutralization activities as outlined in Table 5.3-3.

Table 5.3-3: Predicted Range to Effects and Mitigation Zone Radius for Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices

Charge Size Net Explosive Weight (Bins)	General Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices*				Mine Countermeasure and Neutralization Activities Using Diver Placed Charges under Positive Control**			
	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone	Predicted Average Range to TTS	Predicted Average Range to PTS	Predicted Maximum Range to PTS	Recommended Mitigation Zone
2.6–5 lb. (E4)	434 yd. (474 m)	197 yd. (180 m)	563 yd. (515 m)	600 yd. (549 m)	545 yd. (498 m)	169 yd. (155 m)	301 yd. (275 m)	350 yd. (320 m)
6–10 lb. (E5)	525 yd. (480 m)	204 yd. (187 m)	649 yd. (593 m)	800 yd. (732 m)	587 yd. (537 m)	203 yd. (185 m)	464 yd. (424 m)	500 yd. (457 m)
11–20 lb. (E6)	766 yd. (700 m)	288 yd. (263 m)	648 yd. (593 m)	800 yd. (732 m)	647 yd. (592 m)	232 yd. (212 m)	469 yd. (429 m)	500 yd. (457 m)
21–60 lb. (E7)***	1,670 yd. (1,527 m)	581 yd. (531 m)	964 yd. (882 m)	1,200 yd. (1.1 km)	1,532 yd. (1,401 m)	473 yd. (432 m)	789 yd. (721 m)	800 yd. (732 m)
61–100 lb. (E8)****	878 yd. (802 m)	383 yd. (351 m)	996 yd. (911 m)	1,600 yd. (1.4 m)	969 yd. (886 m)	438 yd. (400 m)	850 yd. (777 m)	850 yd. (777 m)
250–500 lb. (E10)	1,832 yd. (1,675 m)	731 yd. (668 m)	1,883 yd. (1,721 m)	2,000 yd. (1.8 km)				Not Applicable
501–650 lb. (E11)	1,632 yd. (1,492 m)	697 yd. (637 m)	2,021 yd. (1,848 m)	2,100 yd. (1.9 km)				Not Applicable

PTS: permanent threshold shift; TTS: temporary threshold shift

* These mitigation zones are applicable to all mine countermeasure and neutralization activities conducted in all locations that Tables 2.8-1 through 2.8-5 specifies.

** These mitigation zones are only applicable to mine countermeasure and neutralization activities involving the use of diver placed charges. These activities are conducted in shallow-water and the mitigation zones are based only on the functional hearing groups with species that occur in these areas (mid-frequency cetaceans and sea turtles).

*** The E7 bin was only modeled in shallow-water locations so there is no difference for the diver placed charges category.

**** The E8 bin was only modeled for surface explosions, so some of the ranges are shorter than for sources modeled in the E7 bin which occur at depth.

The Navy is establishing different mitigation zones depending on the depth of the water in which the detonation takes place. The Navy used the Reflection and Refraction in a Multilayered Ocean/Ocean Bottoms with Shear Wave Effects model to predict the pressure-wave propagation for underwater detonations in deep and shallow water. Due to the complicated nature of propagation in very shallow water (less than 24 ft. [7.3 m]), as well as substantial differences between very shallow water sites, this model cannot accurately predict pressure propagation from underwater detonations occurring in very shallow water environments. In very shallow water, surface- and bottom-boundary effects, thermal layering and mixing of layers, bottom substrate composition, vegetation in the water column, and surface blowout, along with charge size, configuration, and distance from the bottom, provide significant contributions to propagation characteristics. The Navy's model assumes a uniform, flat bottom throughout the energy field, does not take into account variations in bathymetry, and assumes all charges are elevated off the bottom. Because of this, the deepest point within a scenario modeling box was used to preclude diving animals from being "hidden" beneath the modeled bottom depth and, therefore, not exposed to any energy or sound. Due to modeling limitations for very shallow water, discontinuities in the modeling output over estimated propagated pressure and energies at specific distances from the charge. Models of pressure propagation from underwater detonations predict the distances at which marine mammals may be harmed and thus, are important in anticipating and mitigating potential harmful effects of underwater explosion training and testing. However, in order to establish accurate mitigation zones for determining physiological effects on marine mammals, measured waveform propagation data was collected at the actual very shallow water locations at San Clemente Island and the Silver Strand Training Complex, and were used to determine the zone of influence and mitigation zone for very shallow water detonations training and testing at these sites.

General mine countermeasure and neutralization activities will include visual surveillance from surface vessels or aircraft beginning 30 minutes before, during, and 30 minutes after the completion of the exercise. During activities using positively controlled firing devices, visual observation for marine mammals, sea turtles, and sea birds will take place within the mitigation zones around the detonation site as identified in Table 5.3-3. If a marine mammal, sea turtle, or sea bird is visually detected within the mitigation zone, then the exercise will cease until the mitigation zone has been clear from any additional sightings for 30 minutes. For activities involving explosives in bin E11 (501-650 lb. net explosive weight), aerial observation of the mitigation zone will be conducted.

Mitigation measures currently do not exist for mine neutralization activities involving diver placed charges using 21-100 lb. net explosive weight charges. The Navy is proposing to modify the currently implemented mitigation measures for activities involving diver placed charges using less than or equal to 20 lb. net explosive weight charges to account for additional categories of net explosive weights, in order to align with the explosive bins that were modeled. The Navy is proposing the mitigation zones to be used during activities involving diver placed charges as outlined in Table 5.3-3. For comparison, the currently implemented mitigation zone for less than or equal to 20 lb. net explosive weight charges is 700 yd. (640 m).

For mine neutralization activities involving diver placed charges, visual observation will be conducted by either two boats (rigid hull inflatable boats), or one boat and one helicopter. Survey boats will position themselves near the mid-point of the mitigation zone radius (but always outside the detonation plume radius and human safety zone) and travel in a circular pattern around the detonation location. When using two boats, each boat will be positioned on opposite sides of the detonation location, separated by 180 degrees.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. The range to effects shown in Table 5.3-3 for general mine countermeasure and neutralization activities were determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had shorter ranges to onset of PTS, so the mitigation zones will provide further protection for these species. Implementing the mitigation zones outlined in Table 5.3-3 will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted.

As described in Section 5.3.1 (Lookout Procedural Measures), lookouts positioned in aircraft or small boats may be responsible for tasks in addition to observing the air or surface of the water. For example, a lookout for this activity may also be responsible for navigation of the vessel or assistance with mine countermeasure and neutralization deployment. The decrease in mitigation zone size for activities using diver placed charges will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller area, and will likely consequently increase the likelihood of avoidance of injury and TTS to marine mammals. Having a lookout observe a mitigation zone that is too large could potentially increase the safety risk due to an increased level of distraction from normal job duties. Observation of an area beyond what the Navy is proposing to implement would not be likely to result in avoidance or reduction of injury to marine mammals or sea turtles because the effort spent observing those more distant areas would inevitably be minimal.

As described in Section 5.3.1.2.4 (Effectiveness Assessment for lookouts), the ability of a lookout to detect an animal can vary greatly based on what observing platform is being used. For large ranges, aerial observation is more effective. In addition, when observing from a surface vessel, sea turtle and cryptic marine mammal species can be very difficult to detect further that a few meters away from the vessel. However, this measure should be effective at reducing potential impacts for individuals that are sighted.

Mine neutralization activities involving diver placed charges occur primarily close to shore and in shallow water where only mid-frequency cetaceans and sea turtles are expected to occur with any regularity. The range to effects shown in Table 5.3-3 for mine neutralization activities involving diver placed charges were determined by the sea turtle functional hearing group. The mid-frequency hearing group had shorter ranges to onset of PTS, so the mitigation zones will provide further protection for these species. However, mitigation would be implemented for any species observed within the mitigation zone. Implementing the mitigation zones outlined in Table 5.3-3 will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted. The decrease in mitigation zone size for activities using diver placed charges (up to 20 lb. NEW charges) will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller area, and will likely consequently increase the likelihood of avoidance of injury and TTS to marine mammals.

During activities using diver placed charges, lookouts are visually observing from small boats (rigid hull inflatable boats) or helicopters. As discussed above, aerial observation is more effective than observation from a small boat. Since small boats do not have a very elevating observing platform, the distance over which animals can be observed is much shorter. Sea turtles and cryptic marine mammal species would be very difficult to detect further that a few meters away from the boat.

For activities using diver placed charges, maintaining an additional lookout to observe for hatchling sea turtles is impracticable to implement from an operational standpoint due to the unacceptable impact to resource requirements (i.e., limited personnel resources), and does not effectively reduce the potential for impacts to sea turtles to occur due to the extreme difficulty of sighting hatchings at sea (see Section 5.3.1.2.4, Effectiveness Assessment for lookouts). The measure regarding distance from shore was initially intended to reduce potential impacts to nesting sea turtles and hatchlings that may be close to shore.

5.3.2.1.2.5 Mine Neutralization Diver Placed Mines Using Time-Delay Firing Device

Recommended Mitigation and Comparison to Current Mitigation

When mine neutralization activities using diver placed charges (up to a 20 lb. net explosive weight) are conducted with a time-delay firing device, the detonation is fused with a specified time-delay by the personnel conducting the activity and is not authorized until the area is clear at the time the fuse is initiated. During these activities, the detonation cannot be terminated once the fuse is initiated due to human safety concerns. Refer to Section 5.3.2.1.2.4 (Mine Countermeasure and Neutralization Activities Using Positive Control Firing Devices) for a general discussion of mitigation measures applicable to mine neutralization activities using diver placed mines. This section will specify unique mitigation zones and observation methods for diver placed mine activities that use time-delay firing devices.

The Navy is proposing to modify the mitigation zones and observation requirements currently implemented for mine countermeasure and neutralization activities using diver placed time-delay firing devices. For comparison, the current mitigation zones are based on size of charge and length of time-delay, ranging from a 1,000 yd. (914 m) mitigation zone for a 5 lb. net explosive weight charge using a 5 minute time-delay to a 1,450 yd. (1,326 m) mitigation zone for a 20 lb. net explosive weight charge using a 10 minute time-delay.

The Navy recommends one mitigation zone for all net explosive weights and lengths of time-delay. Mine neutralization involving diver placed charges will not include time-delay longer than 10 minutes Visual observation from small boats (rigid hull inflatable boats) or aircraft will be conducted 30 minutes before, during, and until 30 minutes after the completion of the exercise. During activities using time-delay firing devices involving up to a 20 lb. charge, visual observation for marine mammals and sea turtles will take place using two boats with a mitigation zone of 1,000 yd. (915 m). The exercise will cease if a marine mammal or sea turtle is observed in the mitigation zone. The exercise will re-commence once the animal is thought to have exited the mitigation zone and the mitigation zone has been clear from any additional sightings for 30 minutes.

Survey boats will position themselves near the mid-point of the mitigation zone radius (but always outside the detonation plume radius/human safety zone) and travel in a circular pattern around the detonation location. One lookout from each boat will look inward toward the detonation site and the other lookout will look outward away from the detonation site. When using two boats, each boat will be positioned on opposite sides of the detonation location, separated by 180 degrees. If available for use, helicopters will travel in a circular pattern around the detonation location.

Effectiveness and Operational Assessments

This time-delay firing device mitigation zone was determined by including additional distance on top of the mitigation zones outlined in Table 5.3-3 to account for a portion of the time that a marine mammal, sea turtle, or seabird could enter the mitigation zone during the time-delay. Due to operational impacts with regards to practicability, a 1,000 yd. (915 m) mitigation zone represents the maximum distance that the lookouts on small boats can adequately observe given the number of personnel that will be involved. Since small boats do not have a very elevating observing platform, the distance over which animals can be observed is much shorter. Sea turtles and cryptic marine mammal species would be very difficult to detect further that a few meters away from the boat. Sighting a sea turtle is only likely if a helicopter is used. In addition, even with the extended mitigation zone to account for as much of the time-delay as possible, there is still a remote chance that animals may swim into the area after the charge is already set. However, implementing the mitigation will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted.

The Navy proposes implementing the recommended measures described above because: (1) they are likely to result in avoidance or reduction of injury to most marine mammal species; and (2) they have acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.6 Ordnance Testing (Line Charge Testing)

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue implementing the current mitigation zone for this activity; however, the Navy recommends modifying the currently implemented mitigation measure to add the requirement to cease the activity after a marine mammal or sea turtle is sighted in the mitigation zone. In addition, the Navy proposes discontinuing visual observations for other protected species in general.

Activities involving line charge testing will include visual observation from a surface vessel immediately before and during the exercise. Visual observation for marine mammals and sea turtles will take place within the 880 yd. (804 m) mitigation zone around the line charges. If a marine mammal or sea turtle is visually detected within the mitigation zone, then the exercise will cease until the animal is thought to have exited the mitigation zone.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for line charge testing is approximately 563 yd. (515 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 434 yd. (397 m). Implementing the 880 yd. (804 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted.

This activity involves launching the line charge array at the beach. Therefore it is necessary for the lookout to be able to visually observe the mitigation zone from this distance. Very few marine mammal species would be present in the surf zone, except coastal dolphins. Although the lookout will observe for all marine mammals or sea turtles in the area, as discussed in Section 5.3.1.2.4 (Effectiveness Assessment for lookouts), it is highly unlikely that anything but a large pod of dolphins will be seen from long distances from this vantage point. Although this measure is likely ineffective at reducing the risk of injury to sea turtles, it does reduce the risk for those individuals that may be observed.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to some marine mammal species, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.7 Gunnery Exercises-Small and Medium Caliber (Surface Target)

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue implementing the current mitigation measures for this activity. Gunnery exercises will include visual observation from a surface vessel or aircraft immediately before and during the exercise. Surface vessels will observe the mitigation zone from the firing position. When aircraft are firing, the crew/pilot will maintain visual watch of the mitigation zone during the activity. Prior to the commencement of the activity, there will be a visual observation of the training area to determine whether the intended impact location is clear of floating vegetation (*Sargassum* or kelp concentrations). Visual observation for marine mammals and sea turtles will take place within the 200 yd. (183 m) mitigation zone around the intended impact location. If a marine mammal or sea turtle is visually detected within the mitigation zone, then the exercise will cease until the animal is thought to have exited the mitigation zone.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for small and medium caliber gunnery is approximately 182 yd. (167 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 190 yd. (174 m). Implementing the 200 yd. (183 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted.

Small and medium caliber gunnery exercises involve the participating vessel or aircraft firing munitions at a target location from up to 4,000 yd. (3.7 km) away, although typically closer than this. Therefore it is necessary for the lookout to be able to visually observe the mitigation zone from this distance. Large vessel or aircraft platforms would provide a more effective observation platform for lookouts than small boats. However, as discussed in Section 5.3.1.2.4 (Effectiveness Assessment for lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen at long distances. Although the lookout will also be observing for sea turtles, it is highly unlikely that they will be seen at this distance from a vessel or aircraft. Although this measure is likely ineffective at reducing the risk of injury to sea turtles and some species of marine mammals, it does reduce the risk for those individuals that may be observed.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to some marine mammal species, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.8 Gunnery Exercises-Large Caliber (Surface Target)

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to modify the mitigation measures currently implemented for this activity by reducing the mitigation zone from 600 yd. (549 m) to 550 yd. (503 m). Large caliber gunnery exercises will include visual observation from a surface vessel or aircraft immediately before and during the exercise. Surface vessels will observe the mitigation zone from the firing position. When aircraft are firing, the crew/pilot will maintain visual watch of the mitigation zone during the activity. Prior to the commencement of the activity, there will be a visual observation of the training area to determine whether the intended impact location is clear of floating vegetation (*Sargassum* or kelp concentrations). Visual observation for marine mammals and sea turtles will take place within the 550 yd. (503 m) mitigation zone around intended impact location. If a marine mammal or sea turtle is visually detected within the mitigation zone, then the exercise will cease until the mitigation zone has been clear from any additional sightings for 30 minutes. Specifically for activities involving acoustic scoring system, to maintain consistency for activities within this category and improve the practicability of implementing the measure, the Navy is proposing to decrease the wait period from 45 to 30 minutes.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for large caliber gunnery is approximately 526 yd. (481 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 453 yd. (414 m). Implementing the 550 yd. (503 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted.

Large caliber gunnery exercises involve the participating vessel or aircraft firing munitions at a target location from ranges up to 6 nm away. Therefore it is necessary for the lookout to be able to visually observe the mitigation zone from this distance. Although the lookout will observe for all marine mammals or sea turtles in the area, as discussed in Section 5.3.1.2.4 (Effectiveness Assessment for lookouts), it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen. Although this measure is likely ineffective at reducing the risk of injury to sea turtles and some species of marine mammals, it does reduce the risk for those individuals that may be observed. Due to the extreme difficulty of sighting animals at the far range typical of large caliber exercises, the Navy feels that a 30-minute wait period will be more practicable to implement and will not result in an increased potential impact to any species.

The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will likely consequently increase the likelihood of avoidance of injury and TTS to marine mammals and sea turtles.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to some marine mammal species, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.9 Weapons Firing Noise

Recommended Mitigation and Comparison to Current Mitigation

The Navy recommends modifying the currently implemented mitigation measure to clarify that the mitigation zone is only on the firing side of the ship. For all large caliber gunnery exercises, visual surveillance will be conducted by the firing surface vessel immediately before and during the exercise.

Visual observation for marine mammals and sea turtles will take place within the 70 yd. (46 m) mitigation zone within 30 degrees on either side of the gun target line on the firing side of the ship. If a marine mammal or sea turtle is visually detected within the mitigation zone along the firing bearing, the activity will cease until the animal is thought to have exited the mitigation zone.

Effectiveness Assessment

The mitigation zone is designed to reduce the potential for injury from weapons firing noise during large caliber gunnery exercises conducted from a surface vessel. Since the lookout is visually observing close aboard the vessel (70 yd.) this measure should be effective at reducing the risk to all marine mammals and sea turtles that are available to be observed on the firing side of the ship. The majority of the energy that an animal would be exposed to would occur on the firing side of the vessel and would follow in the direction of fire. In addition, it is not operationally feasible to have lookouts stationed on all sides of the vessel to visually observe for marine mammals and sea turtles due to limited resources (e.g., manning restrictions).

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.10 Missile Exercises up to 250 Pound Net Explosive Weight (Surface Target)

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to modify the mitigation measures currently implemented for this activity by reducing the mitigation zone from 1,800 yd. (1.6 km) to 700 yd. (640 m). In addition, the Navy recommends modifying the currently implemented mitigation measure to only include visual observation from an aircraft (when aircraft are firing) immediately before the exercise. Previously, the mitigation measure also included visual observation from a surface vessel when the surface vessel fired the missile.

For missile exercises (up to 250 lb. net explosive weight [Bin E9]) when aircraft are firing, the crew or pilot will visually observe the intended impact location prior to commencement of the activity (when practicable). There will be a visual observation of the training area to determine whether the intended impact location is clear of floating vegetation (*Sargassum* or kelp concentrations). Visual observation for marine mammals and sea turtles will take place within the 700 yd. (640 m) mitigation zone around intended impact location. If a marine mammal or sea turtle is visually detected within the mitigation zone, then the exercise will cease until the animal is thought to have exited the mitigation zone.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for a missile exercise (up to 250 lb. NEW [Bin E9]) is approximately 699 yd. (639 m). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 949 yd. (868 m). Implementing the 700 yd. (640 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted. The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will likely consequently increase the likelihood of avoidance of injury and TTS to marine mammals and sea turtles.

Missile exercises involve the participating vessel or aircraft firing munitions at a target location typically up to 15 nm away and infrequently include ranges up to 75 nm away. When an aircraft is firing, the aircraft can travel close to the intended impact area (when practicable) so that it can be visually observed. However, this is not practicable for a surface vessel. When visual observation of the intended impact area is possible prior to commencement of the activity, animals within the mitigation zone may be observed. However, animals may enter the impact area after the surface vessel or aircraft has completed their visual observation. This measure is not effective at reducing the risk of injury to animals once the activity has begun, but it does reduce the risk for those individuals that may be observed prior to commencement of the activity.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.11 Missile Exercises up to 500 Pound Net Explosive Weight (Surface Target)

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for this activity. For missile exercises (up to 500 lb. net explosive weight [Bin E10]) when aircraft are firing, the crew or pilot will visually observe the intended impact location prior to commencement of the activity (when practicable). There will be a visual observation of the training area to determine whether the intended impact location is clear of floating vegetation (*Sargassum* or kelp concentrations). Visual observation for marine mammals and sea turtles will take place within the 1,900 yd. (1,737 m) mitigation zone around intended impact location. If a marine mammal or sea turtle is visually detected within the mitigation zone, then the exercise will cease until the animal is thought to have exited the mitigation zone.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for a missile exercise (up to 500 lb. NEW [Bin E10]) is approximately 1,883 yd. (1,721 m). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 1,832 yd. (1,675 m). Implementing the 1,900 yd. (1,737 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted.

Missile exercises involve the participating vessel or aircraft firing munitions at a target location typically up to 15 nm away and infrequently include ranges up to 75 nm away. When an aircraft is firing, the aircraft can travel close to the intended impact area (when practicable) so that it can be visually observed. However, this is not practicable for a surface vessel. When visual observation of the intended impact area is possible prior to commencement of the activity, animals within the mitigation zone may be observed. However, animals may enter the impact area after the surface vessel or aircraft has completed their visual observation. This measure is not effective at reducing the risk of injury to animals once the activity has begun, but it does reduce the risk for those individuals that may be observed prior to commencement of the activity.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.12 Bombing Exercises

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to modify the mitigation measures currently implemented for this activity by reducing the mitigation zone from 5,100 yd. (4.7 km) to 2,500 yd. (2.3 km). Bombing exercises will include visual observation from the aircraft immediately before and during the exercise at an altitude of 1,500 ft. (457 m). Aircraft will visually observe the mitigation zone prior to the exercise beginning and then will maintain visual surveillance of the mitigation zone as it approaches the target and releases the bomb. Prior to the commencement of the activity, there will be a visual observation of the training area to determine whether the intended impact location is clear of floating vegetation (*Sargassum* or kelp concentrations). Visual observation for marine mammals and sea turtles will take place within the 2,500 yd. (2.3 km) mitigation zone around intended impact location. If a marine mammal or sea turtle is visually detected within the mitigation zone, then the exercise will cease until the animal is thought to have exited the mitigation zone.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for large caliber gunnery is approximately 2,474 yd. (2.3 km). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 2,513 yd. (2.3 km). Implementing the 2,500 yd. (2.3 km) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted.

As described in Section 5.3.1 (Lookout Procedural Measures), lookouts positioned in aircraft may be responsible for tasks in addition to observing the air or surface of the water. For example, a lookout for this activity may also be responsible for navigation of the aircraft. Having a lookout observe a mitigation zone that is too large could potentially increase the safety risk due to an increased level of distraction from normal job duties. Similarly, lookouts posted in aircraft during bombing activities will, by necessity, focus their attention on the water surface below and surrounding the location of bomb deployment. Due to the nature of this activity (e.g., aircraft maintaining a relatively steady altitude of approximately 1,500 ft. [457 m] and approaching the intended impact location), lookouts will be able to observe a larger area during bombing activities than other proposed activities that involve the use of lookouts positioned in aircraft (e.g., Improved Extended Echo Ranging sonobuoy activities). However, observation of an area beyond what the Navy is proposing to implement for bombing activities is not practicable and would not likely result in avoidance or reduction of injury to marine mammals or sea turtles because the effort spent observing those more distant areas would inevitably be minimal.

The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will likely consequently increase the likelihood of avoidance of injury and TTS to marine mammals and sea turtles.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.13 Torpedo (Explosive) Testing

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to modify the mitigation measures currently implemented for this activity by reducing the mitigation zone from 5,063 yd. (4.6 km) to 2,100 yd. (1.9 km). In addition, the Navy is proposing to remove an additional measure currently implemented that requires review of remotely sensed sea surface temperature maps prior to conducting the activity. With the exception of platforms operating at high altitudes, explosive torpedo testing will include visual observation by aircraft immediately before, during, and after the exercise within the mitigation zone. Prior to the commencement of the activity, there will be a visual observation of the training area to determine whether the intended impact location is clear of floating vegetation (*Sargassum* or kelp concentrations) and jellyfish aggregations. Visual observation for marine mammals and sea turtles will take place within the 2,100 yd. (1.9 km) mitigation zone around intended impact location. If a marine mammal or sea turtle is visually detected within the mitigation zone, then the exercise will cease until the mitigation zone has been clear from any additional sightings for 30 minutes.

In addition to visual observation, passive acoustic monitoring would be conducted with Navy assets, such as passive ships sonar systems or sonobuoys, already participating in the activity. Passive acoustic observation would be accomplished through the use of remote acoustic sensors or expendable sonobuoys, or via passive acoustic sensors on submarines when they participate in the Proposed Action. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to the lookout posted in the aircraft in order to increase vigilance of the visual surveillance; and to the person in control of the activity for their consideration in determining when the mitigation zone is determined free of visible marine mammals.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for explosive torpedoes is approximately 2,021 yd. (1.8 km). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 1,632 yd. (1.5 km). Implementing the 2,100 yd. (1.9 km) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted.

As described in Section 5.3.1 (Lookout Procedural Measures), lookouts positioned in aircraft may be responsible for tasks in addition to observing the air or surface of the water. For example, a lookout for this activity may also be responsible for navigation of the aircraft. Having a lookout observe a mitigation zone that is too large could potentially increase the safety risk due to an increased level of distraction from normal job duties. Observation of an area beyond what the Navy is proposing to implement for torpedo testing activities is not practicable and would not likely result in avoidance or reduction of injury to marine mammals or sea turtles because the effort spent observing those more distant areas would inevitably be minimal.

The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will likely consequently increase the likelihood of avoidance of injury and TTS to marine mammals and sea turtles. The original intent of the measure requiring the review of remotely sensed sea surface temperature maps was to help predict areas in which protected species could occur. However, while the presence of sea surface temperature fronts may indicate suitable habitat for marine species and may sometimes lead observers to pay more attention to an area of the ocean likely to be associated with a marine species, sea surface temperature fronts alone are insufficient to locate and prevent avoidance of marine species during this type of exercise.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.14 Sinking Exercises

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to modify the mitigation measures currently implemented for this activity by increasing the mitigation zone from 2.0 nm to 2.5 nm. Prior to the commencement of sinking exercises, there will be a visual observation of the mitigation zone to ensure that it is clear of floating vegetation (*Sargassum* or kelp concentrations), kelp beds, and jellyfish aggregations. Sinking exercises will include aerial observation beginning 90 minutes before the first firing, visual observations from surface vessels throughout the duration of the exercise, and both aerial and surface vessel observation immediately after any planned or unplanned breaks in weapons firing of longer than 2 hr. Prior to conducting the exercise, the Navy will review remotely sensed sea surface temperature and sea surface height maps to aid in deciding where to release the target ship hulk.

The Navy will also monitor using passive acoustics during the exercise. Passive acoustic monitoring would be conducted with Navy assets, such as passive ships sonar systems or sonobuoys, already participating in the activity. These assets would only detect vocalizing marine mammals within the frequency bands monitored by Navy personnel. Passive acoustic detections would not provide range or bearing to detected animals, and therefore cannot provide locations of these animals. Passive acoustic detections would be reported to lookouts posted in aircraft and on surface vessels in order to increase vigilance of their visual surveillance.

Lookouts will also increase observation vigilance before the use of torpedoes or unguided ordnance with a net explosive weight of 500 lb. or greater, or if the sea state registers a 4 or above on the Beaufort Scale. If a marine mammal or sea turtle is visually detected within the mitigation zone, then the exercise will cease until the mitigation zone has been clear from any additional sightings for 30 minutes Upon sinking of the vessel, the Navy will conduct post-exercise visual surveillance of the mitigation zone for 2 hours (or until sunset, whichever comes first).

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. During a sinking exercise, multiple weapons sources may be used (projectiles, missiles, bombs, torpedoes), the largest of which is the 2,000 lb. bomb. The recommended mitigation zone is approximately double the predicted maximum range to onset of PTS of the largest weapon source, and is designed to account for multiple detonations during the activity. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for a bombing exercise is approximately 2,500 yd. (2.3 km). This range was determined by the sea turtle functional hearing group. The marine mammal functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 2,513 yd. (2.3 km). Implementing the 2,500 yd. (2.3 km) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted.

As described in Section 5.3.1 (Lookout Procedural Measures), lookouts positioned in aircraft or surface vessel may be responsible for tasks in addition to observing the air or surface of the water. For example, a lookout for this activity may also be responsible for navigation of the aircraft. Having a lookout observe a mitigation zone that is too large could potentially increase the safety risk due to an increased level of distraction from normal job duties. Observation of an area beyond what the Navy is proposing to implement for sinking exercises is not practicable and would not likely result in avoidance or reduction of injury to marine mammals or sea turtles because the effort spent observing those more distant areas would inevitably be minimal.

The decrease in mitigation zone size will result in no mitigation for exposure to lower levels of potential onset of TTS; however, it will allow for a more focused survey effort over a smaller survey distance, and will likely consequently increase the likelihood of avoidance of injury and TTS to marine mammals and sea turtles. The amount of time it takes for an aircraft to conduct line transects around a detonation point within the currently implemented 4.5 nm mitigation zone could result in animals entering the mitigation zone at one end while the aircraft completes the survey at the other end of the mitigation zone.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of exposure to high levels of energy to marine mammals and sea turtles, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.15 At-Sea Explosives Testing

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for at-sea explosives testing activities. At-sea explosive testing, such as the sinking of a vessel by a sequential firing of multiple small charges (e.g., explosives in bin E5) for use as an artificial reef, will include visual observation from supporting surface vessels immediately before and during the activity. Prior to the commencement of the activity, there will be a visual observation of the training area to determine whether the intended impact location is clear of floating vegetation (*Sargassum* or kelp concentrations). Visual observation for marine mammals and sea turtles will take place within the 1,600 yd. (1.4 km) mitigation zone around intended impact location.

This recommended mitigation zone is larger than the modeled injury zone to account for multiple types of sources or charges being used. If a marine mammal or sea turtle is visually detected within the mitigation zone, then the exercise will cease until the animal is thought to have exited the mitigation zone.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. During at-sea explosives testing, multiple weapons sources or charges may be used (projectiles and charges), the largest of which is a 10 lb. NEW charge. The recommended mitigation zone is approximately double the predicted maximum range to onset of PTS of the largest source, and is designed to account for multiple detonations during the activity. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for at-sea explosives testing is approximately 649 yd. (593 m). This range was determined by the high-frequency cetacean functional hearing group. The remaining functional hearing groups had a shorter range to onset of PTS, so the mitigation zone will provide further protection for these species. The average range to onset of TTS across all functional hearing groups is 525 yd. (480 m). Implementing the 1,600 yd. (1.4 km) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted.

As discussed in Section 5.3.1.2.4 (Effectiveness Assessment for lookouts), the likelihood of sighting individual animals from a surface vessel, particularly sea turtles and some species of small or cryptic marine mammals, decreases at long distances. Although this measure is likely ineffective at reducing the risk of injury to sea turtles and some species of marine mammals, it does reduce the risk for other species that may be observed.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of injury to some species of marine mammals, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.1.2.16 Elevated Causeway System - Pile Driving

Recommended Mitigation and Comparison to Current Mitigation

Mitigation measures do not currently exist for this activity. Pile driving exercises will include visual observation from a support vessel or from shore starting 30 minutes prior and during the exercise. Visual observation for marine mammals and sea turtles will take place within the 60 yd. (55 m) mitigation zone around the pile driver. If a marine mammal or sea turtle is visually detected within the mitigation zone, then the activity will cease until the animal is thought to have exited the mitigation zone.

Effectiveness and Operational Assessments

See the introduction of Section 5.3.2 (Mitigation Zone Procedural Measures) for a general discussion of mitigation zones, how they are implemented, and the potential effects they are designed to reduce. As shown in Table 5.3-2, the predicted maximum range to onset of PTS for pile driving exercises is approximately 51 yd. (46 m). This range was determined by the injury threshold of 180 dB rms for cetaceans. The average range to onset of TTS is 1,094 yd. (1,000 m). Implementing the 60 yd. (55 m) mitigation zone will reduce the potential for exposure to higher levels of energy that would result in injury and TTS, when individuals are sighted. Since the mitigation zone is so small, this measure should be effective at reducing the risk to all marine mammals and sea turtles that are available to be observed within the mitigation zone.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of injury to marine mammals and sea turtles, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.2 Physical Strike and Disturbance

5.3.2.2.1 Vessels and In-Water Devices

5.3.2.2.1.1 Vessels

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue using the mitigation measures currently implemented. Ships will avoid approaching marine mammals head on and will maneuver to maintain a 500 yd. (457 m) mitigation zone for observed whales, and a 200 yd. (183 m) mitigation zone for all other marine mammals, providing it is safe to do so.

Effectiveness and Operational Assessments

Since the lookout is visually observing within a reasonable distance of the vessel (within 500 yd. [457 m]), this measure should be effective at reducing the risk to marine mammals that are available to be observed. However, as discussed above in Section 5.3.1.2.4, Effectiveness Assessment for lookouts, large whales and pods of dolphins are more likely to be seen than other more cryptic species, such as beaked whales.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of injury to marine mammals, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.2.1.2 Towed In-Water Devices

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue using the mitigation measures currently implemented. The Navy will ensure that towed devices avoid coming within a 250 yd. (229 m) mitigation zone from any observed marine mammal, providing it is safe to do so.

Effectiveness and Operational Assessments

Since the lookout is visually observing within a reasonable distance of the vessel (250 yd. [229 m]), this measure should be effective at reducing the risk to marine mammals that are available to be observed. However, as discussed above in Section 5.3.1.2.4, Effectiveness Assessment for lookouts, large whales and pods of dolphins are more likely to be seen than other more cryptic species such as beaked whales.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of injury to marine mammals, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.2.2 Non-Explosive Practice Munitions

5.3.2.2.2.1 Gunnery Exercises – Small, Medium, and Large-Caliber Using a Surface Target

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue using the mitigation measures currently implemented for this activity. The mitigation zone (i.e., area around the intended impact location) of 200 yd. (183 m) will be free of floating vegetation (*Sargassum* or kelp concentrations). If a marine mammal or sea turtle is visually detected within the mitigation zone, the activity will cease until the animal is thought to have exited the mitigation zone.

Effectiveness and Operational Assessments

The mitigation zone is designed to reduce the potential for direct strike from a non-explosive projectile. Large caliber gunnery exercises involve the participating vessel or aircraft firing munitions at a target location from ranges up to 6 nm away. Small and medium caliber gunnery exercises involve the participating vessel or aircraft firing munitions at a target location from up to 2 nm away, although typically closer than this. Therefore it is necessary for the lookout to be able to visually observe the mitigation zone from these distances. Although the lookout will observe for all marine mammals or sea turtles in the area, as discussed in Section 5.3.1.2.4, Effectiveness Assessment for lookouts, it is highly unlikely that anything but a whale blow or large pod of dolphins will be seen. Although this measure is likely ineffective at reducing the risk of injury to sea turtles and some species of marine mammals, it does reduce the risk for those individuals that may be observed.

The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of injury to some species of marine mammals, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.2.2.2.2 Bombing Exercises

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to continue using the mitigation measures currently implemented for this activity. Bombing exercises will include visual observation from the aircraft immediately before and during the exercise within the mitigation zone (1,000 yd. [914 m]). Aircraft will visually observe the mitigation zone around the intended impact location prior to the exercise beginning and then will maintain visual surveillance of the area as it approaches the target and releases the bomb (typically at altitudes of 1,500 ft. [457 m]). The mitigation zone (i.e., area around the intended impact location) will be free of floating vegetation (*Sargassum* or kelp concentrations). If a marine mammal or sea turtle is visually detected within the mitigation zone, then the exercise will cease until the animal is thought to have exited the mitigation zone.

Effectiveness and Operational Assessments

The mitigation zone is designed to reduce the potential for direct strike from a non-explosive bomb. The Navy proposes implementing the recommended measure described above because: (1) it is likely to result in avoidance or reduction of injury to marine mammals or sea turtles, and (2) it has acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.3.3 PROPOSED MITIGATION AREAS

The Navy is proposing to implement several mitigation measures within pre-defined habitat areas in the Study Area. For the purposes of this document, the Navy will refer to these areas as "proposed mitigation areas." As described throughout this section, these proposed mitigation areas may be based off endangered species critical habitats, endangered species reproductive areas, or certain bottom features. The size and location of certain habitat areas, such as the critical habitats, is subject to change over time; however, the Navy's effectiveness and operational assessments, and resulting mitigation recommendations, are entirely dependent on the current definition of each area. Therefore, it is important to note that the Navy is recommending implementing the mitigation measures only within each area's currently defined or described area. Applying these mitigations to additional or expanded areas could potentially result in an unacceptable impact to readiness.

5.3.3.1 Marine Mammal Habitats

5.3.3.1.1 Humpback Whale

5.3.3.1.1.1 Humpback Whale Cautionary Area

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to implement mitigation measures within the Humpback Whale National Marine Sanctuary. Humpback whales migrate to the Hawaiian Islands each winter to mate and rear their calves. Data clearly indicate that, historically, high densities of humpback whales have concentrated in certain areas around the Hawaiian Islands. NMFS has reviewed the Navy's data on mid-frequency active sonar training in these dense humpback whale areas since June 2006 and found it to be rare and infrequent. While past data is no guarantee of future activity, it documents a history of low level mid-frequency active sonar activity in dense humpback areas. In order to be successful at operational missions and against the threat of quiet, diesel-electric submarines, the Navy has, for more than 40 years, routinely conducted anti-submarine warfare training in major exercises in the waters off the Hawaiian Islands, including the Humpback Whale National Marine Sanctuary. During this period, no harmful effects to humpback whales attributed to mid-frequency active sonar use have been observed. Coincident with this use of mid-frequency active sonar, abundance estimates reflect an annual increase in the humpback whale stock (Mobley, 2001, 2004).

NMFS and the Navy have explored ways of reducing or avoiding impacts to humpback whales from exposure to mid-frequency active sonar. Factors including how practical the measure is to implement and how the measure could affect training fidelity are considered before implementing the measure. The Navy recognizes the significance of the Hawaiian Islands for humpback whales. The Navy has designated a humpback whale cautionary area (described below), which consists of a 5 km (3.1 miles [mi.]) buffer zone that has been identified as having one of the highest concentrations of humpback whales during the critical winter months. The Navy has agreed that training exercises in the humpback whale cautionary area will require a much higher level of clearance than is normal practice in planning and conducting mid-frequency active sonar training. Should national security needs require mid-frequency active sonar training and testing in the cautionary area between 15 December and 15 April, it shall be personally authorized by the Commander, U.S. Pacific Fleet. The Commander, U.S. Pacific Fleet shall base such authorization on the unique characteristics of the area from a military readiness perspective, taking into account the importance of the area for humpback whales and the need to reduce adverse impacts on humpback whales from mid-frequency active sonar whenever practicable. Approval at this level for this type of activity is extraordinary. The Commander, U.S. Pacific Fleet is a four-star Admiral and the highest ranking officer in the U.S. Pacific Fleet. This case-by-case authorization cannot be delegated and represents the Navy's commitment to fully consider and balance mission requirements with environmental stewardship. Further, the Commander, U.S. Pacific Fleet will provide specific direction on required mitigation prior to operational units transiting to and training in the cautionary area. This process will ensure the decisions to train in this area are made at the highest level in the Pacific Fleet, heighten awareness of humpback whale activities in the cautionary area, and serve to reemphasize that mitigation measures are to be scrupulously followed. The Navy will provide NMFS with advance notification of any such activities.

Effectiveness and Operational Assessments

Mid-frequency active sonar training will not regularly occur within the humpback whale cautionary area between 15 December and 15 April. This training can occur in this area during this time period only with approval by the Commander, U.S. Pacific Fleet. This approach will reduce potential interactions between humpback whales and U.S. Navy training activities.

5.3.3.2 Sea Turtles

Although the Navy has no mitigation measures specific to sea turtles, the Navy's current measures used to mitigate harm to marine mammals are also effective in mitigating harm to sea turtles. In all cases where lookouts are posted or monitoring is conducted, the presence of sea turtles would have the same effect with regards to halting or modifying an activity, as would the presence of marine mammals.

5.3.3.3 Seafloor Habitats and Shipwrecks

Recommended Mitigation and Comparison to Current Mitigation

The Navy is proposing to: (1) modify some of the mitigation measures for seafloor habitats and shipwrecks, (2) discontinue the currently implemented measures for medium and large caliber gunnery exercises and missile exercises using airborne targets, and (3) add a mitigation requirement for at-sea explosives testing. The Navy will include maps of known shallow coral reefs, artificial reefs, shipwrecks, and live hardbottom in the Protective Measures Protocol Assessment.

The Navy will not conduct precision anchoring within the anchor watch circle diameter, or explosive mine countermeasure and neutralization activities within 350 yd. (320 m) of known mapped shallow coral reefs, live hardbottom, artificial reefs, and shipwrecks.

The Navy will not conduct explosive or non-explosive small, medium, and large caliber gunnery exercises using a surface target, explosive missile exercises using a surface target, explosive and non-explosive bombing exercises, or at-sea explosives testing within 350 yd. (320 m) of known mapped shallow coral reefs.

Effectiveness and Operational Assessments

The Navy's currently implemented seafloor habitats and shipwreck mitigation zones are based off the range to effects for marine mammals or sea turtles, which are driven by hearing thresholds. Instead, the recommended measures are modified to focus on reducing potential physical impacts to seafloor habitats and shipwrecks from explosives, and physical strike from military expended materials. The recommended 350 yd. (320 m) mitigation zone is based off the estimated maximum seafloor impact zone for explosions discussed in Section 3.3, Habitats. The use of non-explosive military expended materials would result in a smaller footprint of potential impact; however, the Navy recommends applying the explosive mitigation zone to all explosive and non-explosive activities as listed above for ease of implementation. This standard mitigation zone will consequently result in an additional protection buffer during the non-explosive activities listed above.

It is impracticable to predict or to effectively monitor where the military expended materials from airborne gunnery and missile exercises using aerials targets would be likely to strike seafloor habitats and shipwrecks. The potential debris fall zone can only be predicted within tens of miles for long range events, which can be in excess of 80 nm from the firing location during some missile exercises, and thousands of yards for shorter events, which can occur within several thousand yards of the firing location.

Live hard bottom, shallow water coral reefs, artificial reefs, and shipwrecks fulfill important ecosystem functions. Avoiding or minimizing physical disturbance and strike of these resources will likely reduce the impact on these resources. This measure is only effective with regard to known mapped resources since the Navy needs specific locations to restrict the specified activities. It is impracticable for the Navy to avoid these seafloor features when their exact locations are unknown.

The Navy proposes implementing the recommended measures described above because: (1) they are likely to result in avoidance or reduction of physical disturbance and strike to seafloor habitats and shipwrecks, and (2) they have acceptable operational impacts to the proposed activity with regard to safety, practicability, impact to readiness, and Navy policy.

5.4 Mitigation Summary

Table 5.4-1 provides a summary of the Navy's proposed mitigation measures. Each mitigation measure is described, along with the anticipated benefit of the mitigation, as well as the criteria used to evaluate the effectiveness of the mitigation. The table also includes a description of how each mitigation measure will be implemented, the command assigned responsibility for implementing the measure, and the estimated completion date for implementation.

Table 5.4-2 compares the current and recommended (proposed) mitigations measures for acoustic (non-impulsive and impulsive) stressors and for physical disturbance and strike stressors.

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Table 5.4-1: Mitigation Identification and Implementation

<table>
<tr><th>Mitigation Measure</th><th>Benefit</th><th>Evaluation Criteria</th><th>Implementation</th><th>Responsible Command</th><th>Date Implemented</th></tr>
<tr><td>Marine Species Awareness Training

All personnel standing watch on the bridge and lookouts will successfully complete the training before standing watch or serving as a lookout.</td><td>To learn the procedures for searching for and recognizing the presence of marine species, including detection cues (e.g., congregating seabirds) so that potentially harmful interactions can be avoided.</td><td>Successful completion of training by all personnel standing watch and all personnel serving as lookouts.

Personnel successfully applying skills learned during training.</td><td>The multimedia training program has been made available to personnel required to take the training.

Personnel have been and will continue to be required to take the training prior to standing watch and serving as lookouts.</td><td>Officer Conducting the Exercise or Test</td><td>Ongoing</td></tr>
<tr><td colspan="6">Lookouts</td></tr>
<tr><td>Use of Four or Eight Lookouts for Underwater Detonations

Mine countermeasure and neutralization activities using time delay will use four or eight lookouts, depending on the explosives being used. If applicable, aircrew and divers will report sightings of marine mammals or sea turtles.</td><td>Lookouts can visually detect marine species so that potentially harmful impacts to marine mammals and sea turtles from explosives use can be avoided.

Dedicated lookouts can more quickly, and effectively relay sighting information so that corrective action can be taken. Support from aircrew and divers, if they are involved in the activity, will increase the probability of sightings, reducing the potential for impacts.</td><td rowspan="3">Annual report documenting marine mammal and sea turtle sightings, including an accuracy assessment (actual vs. false sightings).

Annual report documenting the number of marine mammals and sea turtles sighted, including trend analysis after 3 years and organized by species.

Annual report documenting the number of incidents when a Navy activity was halted or delayed as a direct result of a marine mammal or sea turtle sighting.

Reduction in the number of known incidents of marine mammal and sea turtle fatalities associated with Navy activities.</td><td rowspan="3">All lookouts will receive marine species awareness training and will be positioned on vessels, boats, and aircraft as described in Section 5.3.1.2 1 and Section 5.3.1.2.1.</td><td rowspan="3">Officer Conducting the Exercise or Test</td><td rowspan="3">Ongoing</td></tr>
<tr><td>Use of One or Two Lookouts

Vessels using low-frequency active sonar or hull-mounted mid-frequency active sonar associated with ASW activities will have either one or two lookouts, depending on the activity and size of the vessel.

Mine countermeasure and neutralization activities with positive control will use two lookouts, with one on each support vessel. If applicable, aircrew and divers will also report the presence of marine mammals or sea turtles. One lookout may be used under certain circumstances specific in Section 5.3.1.2.1.

Sinking Exercises will use two lookouts (one in an aircraft and one on a vessel).

At sea explosives testing will have at least one lookout.</td><td>Lookouts can visually detect marine species so that potentially harmful impacts to marine mammals and sea turtles from Navy sonar and explosives use can be avoided.

Dedicated lookouts can more quickly and effectively relay sighting information so that corrective action can be taken. Support from aircrew and divers, if they are involved in the activity, will increase the probability of sightings, reducing the potential for impacts.</td></tr>
<tr><td>Use of One Lookout

Surface ships and aircraft conducing ASW, ASUW,or MIW activities using HFAS, non-hull mounted mid-frequency active sonar, helicopter dipping mid-frequency active sonar, anti-swimmer grenades, IEER sonobuoys, line charge testing, surface gunnery activities, surface missile activities, bombing activities, explosive torpedo testing, elevated causeway system pile driving, towed mine neutralization activities, full power propulsion testing of surface vessels, and activities using non-explosive practice munitions, will have one lookout.</td><td>Lookouts can visually detect marine species so that potentially harmful impacts to marine mammals and sea turtles from Navy sonar, explosives, sonobuoys, gunnery rounds, missiles, explosive torpedoes, pile driving, towed systems, surface vessel propulsion, and non-explosive munitions can be avoided.

A dedicated lookout can more quickly and effectively relay sighting information so that corrective action can be taken.</td></tr>
</table>

Table 5.4-1: Mitigation Identification and Implementation (continued)

Mitigation Measure	Benefit	Evaluation Criteria	Implementation	Responsible Command	Date Implemented
Mitigation Zones					
Use of a Mitigation Zone A mitigation zone is an area defined by a radius and centered on the location of a sound source or activity. The size of each mitigation zone is specific to a particular training or testing activity (e.g., sonar use or explosive use).	A mitigation zone defines the area in which lookouts survey for marine mammals and sea turtles. Mitigation zones reduce the potential for injury to marine species.	For those activities where monitoring is required, record observations of marine mammals and sea turtles located outside of the mitigation zone and note any apparent reactions to on-going Navy activities. Observation of acute reactions may be used as an indicator that the radius of the mitigation zone needs to be increased.	Mitigation zones have been and will continue to be implemented as described in Section 5.3.2. Lookouts are trained to conduct observations within mitigation zones of different sizes.	Officer Conducting the Exercise or Test	Ongoing
Establishment of the Humpback Whale Cautionary Area The Navy has designated a humpback whale cautionary area (described in Section 5.3.3), which consists of a 5 km (3.1 miles [mi.]) mitigation zone that has been identified as having one of the highest concentrations of humpback whales during the period between 15 December and 15 April.	Expanded mitigation zone, greater than mitigation zones typically established for applicable activities, would provide greater protection for humpback whales from mid-frequency active sonar between 15 December and 15 April. This approach will reduce potential interactions between humpback whales and U.S. Navy training activities during the period when the whales are most common. This training can occur in this area during this time period only with approval by the Commander, U.S. Pacific Fleet. This requirement elevates awareness of the importance of environmental stewardship at all levels within the Navy.	Record observations of humpback whales within the mitigation zone and note any apparent reactions to on-going Navy activities. Observation of acute reactions may be used as an indicator that the radius of the mitigation zone needs to be increased or that the cautionary area needs to be centered on a different location. Reduction in the number of interactions with humpback whales between 15 December and 15 April.	The cautionary area has been and will continue to be implemented as described in Section 5.3.3. Lookouts are trained to conduct observations within the cautionary area.	Commander, Pacific Fleet	Implemented as of 28 June, 2008.
Recognize the Importance of Marine Protected Areas In general, most Armed Forces activities are exempt from the prohibitions marine protected areas Nevertheless, the Navy would carry out its training and testing activities in a manner that will avoid, to the maximum extent practicable and consistent with training and testing requirements, adverse impacts to National Marine Sanctuary resources.	Avoiding or minimizing impacts while operating in or near marine protected areas could result in improved health of the resources in the areas.	No known evaluation criteria	The Navy includes maps in the Protective Measures Assessment Protocol to define marine protected areas. To the greatest extent practicable, adverse impacts to these areas will be avoided.	Officer Conducting the Exercise or Test	Ongoing

Table 5.4-2: Comparison of Current and Recommended Mitigation Measures

Stressor	Recommended Lookouts	Recommended Mitigation Zone	Current Mitigation Zone
Acoustic (Non-Impulsive)			
Low-frequency and Hull Mounted Mid-frequency Active Sonar during Anti-submarine Warfare and Mine Warfare	2 (general); 1 (minimally manned); 1 (moored or anchored)	6 dB power down at 1,000 yd. (914 m); 4 dB power down at 500 yd. (457 m); and shutdown at 200 yd.(183 m)	6 dB power down at 1,000 yd. (914 m); 4 dB power down at 500 yd. (457 m); and shutdown at 200 yd.(183 m)
High-frequency and Non-hull Mounted Mid-frequency Active Sonar	1	200 yd. (183 m)	Non-hull mounted MFAS: 200 yd. (183 m); HF: None
Acoustic (Explosive/Impulsive)			
Improved Extended Echo Ranging Sonobuoys	1	1,000 yd. ([914.4 m] marine mammals and turtles); 400 yd. (365.8 m] floating vegetation (*Sargassum* or kelp)	1,000 yd. (914.4 m)
Anti-Swimmer Grenades	1	250 yd. (228.6 m)	200 yd. (182.9 m)
Mine Countermeasures and Mine Neutralization using Positive Control	(NEW dependent)	NEW dependent	700 yd. (640.1 m) for up to 20 lb. (9.07 kg) charge
Mine Countermeasures and Mine Neutralization (Time-Delay Firing Devices)	(NEW dependent)	NEW dependent	None
Ordnance Testing (Line Charges)	1	880 yd. (804.7 m)	880 yd. (804.7 m)
Gunnery Exercises using Small or Medium Caliber (Surface Target)	1	250 yd. (228.6 m)	200 yd. (182.9 m)
Gunnery Exercises using Large Caliber (Surface Target)	1	800 yd. (731.5 m)	600 yd. (548.6 m)
Weapons Firing Noise (Large Caliber Gunnery Exercises)	1	70 yd. (64.01 m)along firing line	70 yd. (64.01 m) around entire ship
Missile Exercises (Surface Target)	1	1,000 yd. (914.4 m)	1,800 yd. (1,645.9 m)
Bombing Exercises	1	2,900 yd. (2,651.8 m)	1,000 yd. (914.4 m)
Torpedo (Explosive) Testing	1	2,800 yd. (2,560.3 m)	2.5 nm
Sinking Exercises	2	2.5 nm	2.0 nm (exclusion and safety zones)
At-sea Explosive Testing	1	1,600 yd. (1,463.04 m)	None
Pile Driving	1	60 yd. (54.9 m)	None

Table 5.4-2: Comparison of Current and Recommended Procedural Mitigation Measures (continued)

Activity	Recommended Lookouts	Recommended Buffer Zone	Current Buffer Zone
Physical Disturbance and Strike			
Vessels	1	500 yd. (457.2 m) (whales); 200 yd. (182.9 m) (other marine mammals)	500 yd. (457.2 m) (whales); 200 yd. (182.9 m) (other marine mammals)
Towed Devices	1	250 yd. (228.6 m)	250 yd. (228.6 m)
Non-Explosive Practice Munitions (Small, Medium, and Large Caliber with a Surface Target)	1	200 yd. (182.9 m)	200 yd. (182.9 m)
Non-Explosive Practice Munitions (Bombing Exercises)	1	1,000 yd. (914.4 m)	1,000 yd. (914.4 m)

Note: yd.=yards; m=meters; nm=nautical miles; kg=kilograms; MFAS=Mid-Frequency Active Sonar

5.5 MITIGATION MEASURES CONSIDERED BUT ELIMINATED

A number of possible alternative or additional mitigation measures have been suggested during the public comment periods of previous Navy environmental documents. In addition, through the evaluation process identified in Section 5.2, some measures were deemed to either be ineffective, have an unacceptable impact on the proposed training and testing activities, or both, and will not be carried forward for further consideration. This section presents the measures initially considered and gives an evaluation of the likely effectiveness at reducing impacts to the resource and the impact on the proposed training and testing activities (implementing the measure is practicable, the measure does not result in national security concerns, and the Navy has legal authority under Title 10 to implement the measure). Measures previously considered but eliminated include the following:

- Reducing training and testing
- Conducting visual observations using third-party observers (air or surface platforms), in addition to existing Navy-trained lookouts
- Adopting mitigation measures of foreign nation navies
- Reporting marine mammal sightings to augment scientific data collection
- Using active sonar only when necessary and with output levels as low as possible consistent with mission requirements
- Using ramp-up procedures to attempt to clear an exercise area, prior to the use of active sonar
- Reducing power or securing active sonar during the following conditions: nighttime, low visibility, high sea-states, and strong surface duct conditions
- Limiting the locations where active sonar events occur (avoid areas seasonally, areas with problematic complex/steep bathymetry or seamounts, or particular habitats)
- Avoiding active sonar use within (1) 12 nm from shore; (2) 13.5 nm from the 656 ft. (200 m) isobath; or (3) 25 nm from shore
- Reducing vessel speed
- Using larger mitigation zones

Measures previously accepted, but, now eliminated as a result of current analysis:

- Implementing a mitigation zone for missile exercises with airborne targets
- Implementing a mitigation zone for medium and large caliber gunnery exercises with airborne targets
- Implementing measures for laser test operations
- Marine protected areas

There is a distinction between effective and feasible observation procedures for data collection and measures employed to prevent impacts or otherwise serve as mitigation. The discussion below is in reference to those procedures meant to serve as mitigation measures.

5.5.1 Reduction of Training and Testing

These training requirements are designed to provide the experience needed to ensure Sailors are properly prepared for operational success. These requirements have been developed through many years of iteration and are designed to ensure Sailors achieve the levels of readiness needed to properly respond to the many contingencies that may occur during an actual mission. There is no extra training built in to the plan, as this would not be an efficient use of the resources needed to support the training (e.g. fuel, time). Therefore, any reduction of training would not allow Sailors to achieve satisfactory levels of readiness needed to accomplish their mission.

The requirements to test systems prior to their implementation in military activities are identified in DoD Directive 5000.1. This directive states that test and evaluation support is to be integrated throughout the defense acquisition process. The Navy rigorously collected data during the developmental stages of this EIS/OEIS to accurately quantify test activities necessary to meet requirements of DoD Directive 5000.1. These testing requirements are designed to determine whether systems perform as expected and are operationally effective, suitable, survivable, and safe for their intended use. Any reduction of testing activities would not allow the Navy to meet its purpose and need to achieve requirements set forth in DoD Directive 5000.1.

5.5.2 Conducting Visual Observations Using Third-Party Observers (Air or Surface Platforms), in Addition to Existing Navy-Trained Lookouts

Utilization of third party observers during the Proposed Action would be impracticable to implement for the following reasons:

- The use of third-party observers would compromise security for some activities involving active sonar, due to the requirement to provide advance notification of specific times and locations of Navy platforms.
- Reliance on the availability of third-party personnel would impact training and testing flexibility. The presence of other aircraft in the vicinity of naval activities would raise safety concerns for both the commercial observers and naval aircraft.
- Use of Navy lookouts is the most effective means to ensure quick and effective implementing mitigation measures if marine species are spotted. A critical skill set of effective Navy training is communication. Navy lookouts are trained to act swiftly and decisively to ensure that appropriate actions are taken.
- Use of third-party observers is not necessary because Navy personnel are extensively trained in spotting items on or near the water surface. Navy spotters receive more hours of training, and use their spotting skills more frequently, than many third-party trained personnel.

- Surface ships have limited passenger capacity. Training and testing event planning includes careful consideration of this limited capacity in the placement of personnel on ships involved in the event. Inclusion of non-Navy observers onboard these ships would require that in some cases there would be no additional space for essential Navy personnel required to meet the exercise objectives.
- The areas where training events will most likely occur in the Study Area cover approximately 1 million nm^2 (3.4 million km^2). Contiguous anti-submarine warfare events may cover many hundreds or even thousands of square miles. The number of civilian ships or aircraft required to monitor the area of these events would be considerable. It is, thus, not feasible to survey or monitor the large exercise areas in the time required. In addition, marine mammals may move into or out of an area, if surveyed before an event, or an animal could move into an area after an event took place. Given that there are no adequate controls to account for these or other possibilities, there is little utility to performing extensive before or after event surveys of large exercise areas as a mitigation measure.
- Surveying during an event raises safety issues with multiple, slow civilian aircraft operating in the same airspace as military aircraft engaged in combat training activities. In addition, many of the training and testing events take place far from land, limiting both the time available for civilian aircraft to be in the event area and presenting a concern should aircraft mechanical problems arise.
- Scheduling civilian vessels or aircraft to coincide with training events would impact training effectiveness, since exercise event timetables cannot be precisely fixed and are instead based on the free-flow development of tactical situations. Waiting for civilian aircraft or vessels to complete surveys, refuel, or be on station would slow the progress of the exercise and impact the effectiveness of the military readiness activity.
- Multiple training and testing events can occur simultaneously and in various regions throughout the Study Area, and can last for days or weeks at a time. It is not feasible to have enough qualified third-party personnel to accomplish the task for every event.

5.5.3 ADOPT MITIGATION MEASURES OF FOREIGN NATION NAVIES

Other nations' navies do not have the same critical requirement to train in warfare areas in the same manner as does the U.S. Navy. For example, most other navies do not possess an integrated strike group and do not have integrated training requirements. Therefore, many of these navies employ mitigation during training as their measures do not impact their training requirements. In addition, the U.S. Navy is relied upon in combined battle groups to conduct the integrated anti-submarine warfare that protects the entire battle group. That is why the Navy‘s training is built around the integrated warfare concept and is based on the Navy‘s capabilities, the threats faced, the operating environment, and the overall mission. Implementing other navies‘ mitigation would be incompatible with our requirements.

5.5.4 REPORTING MARINE MAMMAL SIGHTINGS TO AUGMENT SCIENTIFIC DATA COLLECTION

Ships, submarines, aircraft, and personnel engaged in training events are intensively employed throughout the duration of training and testing activities. Any additional workload assigned that is unrelated to their primary duty would adversely impact the effectiveness of the military readiness activity they are undertaking. In addition, lookouts cannot identify animals to the species level and would not be able to provide the detailed information that the scientific community would use. Alternatively, the Navy has an integrated comprehensive monitoring program (see Section 5.6) that does provide information that is available and useful to the scientific community in annual monitoring reports.

5.5.5 Using Active Sonar with Output Levels as Low as Possible Consistent with Mission Requirements and Use of Active Sonar Only When Necessary

Operators of sonar equipment are always cognizant of the environmental variables affecting sound propagation. In this regard, the sonar equipment power levels are always set consistent with mission requirements. Active sonar is only used when required by the mission since it has the potential to alert opposing forces to the sonar platform‘s presence. Passive sonar and all other sensors are used in concert with active sonar to the maximum extent practicable when available and when required by the mission.

5.5.6 Using Ramp-Up Procedures to Attempt to Clear the Range, Prior to the Conduct of Activities

Ramp-up procedures, (slowly increasing the sound in the water to necessary levels), are not a viable alternative for training exercises because the ramp-up would alert opponents to the participants' presence. This affects the realism of training in that the target submarine would be able to detect the searching unit before the searching unit would be able to detect the target submarine, enabling the target submarine to take evasive measures. This is not representative of a real-world situation, thereby impacting training realism and effectiveness. Though ramp-up procedures have been used in testing, the procedure is not effective in training Sailors to react to tactical situations, as it provides an unrealistic advantage by alerting the target. Using these procedures would not allow the Navy to conduct realistic training, that is to "train as they fight", thus adversely impacting the effectiveness of the military readiness activity.

5.5.7 Reducing or Securing Active Sonar During the Following Conditions

5.5.7.1 Low-Visibility or at Night

The Navy must train in the same manner as it will fight. Anti-submarine warfare can require a significant amount of time to develop the "tactical picture", or an understanding of the battle space such as area searched or unsearched, identifying false contacts, understanding the water conditions, etc. Reducing or securing power in low-visibility conditions would affect a commander‘s ability to develop this tactical picture as well as not provide the needed training realism. Mid-frequency active sonar training is required year round in all environments, including nighttime and low visibility conditions. Anti-submarine warfare occurs over many hours or days. Unlike an aerial dogfight, which is over in minutes or even seconds, anti-submarine warfare is a "cat and mouse game" that requires large teams of personnel working together in shifts around the clock to work through a scenario. Training at night is vital, because environmental differences between day and night affect the detection capabilities of sonar systems. Ambient noise levels are higher at night, because many species are more active at night (e.g., foraging). Temperature layers in the water column affect sound propagation and move up and down in the water column throughout the day and night. Consequently, personnel must train during daylight and nighttime hours to ensure they can identify and respond to changing environmental conditions. An ASW team trained solely during the day cannot be sent to deployment and be expected to fight effectively at night, because they would not have had the experience and training to identify and respond to changing conditions. Similarly, sea state conditions vary greatly over the course of seasons and months. The Navy cannot afford to wait days, let alone months, for the sea to calm in order to conduct effective training. On the job training in combat is the worst possible way of training personnel and places both the Strike Group and the success of the military mission at significant risk.

The Navy must test its systems in the same way they would be used for military readiness activities. Reducing or securing power in adverse weather conditions or at night would impact the ability to determine whether systems are operationally effective, suitable, survivable, and safe. Additionally, some systems have a nighttime testing requirement. Therefore, Navy personnel cannot operate only in daylight hours or wait for the weather to clear before or during all test events.

5.5.7.2 Strong Surface Duct

The Navy must train in the same manner as it will fight. As described above, the complexity of anti-submarine warfare requires the most realistic training possible for the effectiveness and safety of the Sailors. Ocean conditions contributing to surface ducting change frequently, and surface ducts can be of short duration. Surface ducting also lacks uniformity and does not extend over a large geographic area, making it difficult to determine where to reduce power and for what time periods. As a result, implementing a measure that requires power-downs during the presence of a strong surface duct would result in powering down when surface ducting is not actually present, thereby preventing realistic training.

5.5.8 Limiting Active Sonar Use to a Few Specific Locations

Areas where events are scheduled to occur are carefully chosen to provide for the safety of events and to allow for the realistic tactical development of the training scenario. Otherwise limiting the training event to a few areas would adversely impact the effectiveness of the training. Major exercises using integrated warfare components require large areas of the littorals and open ocean for realistic and safe training.

5.5.9 Avoiding Active Sonar Use Within: (1) 12 nm From Shore, (2) 13 nm From the 656 ft. (200 m) Isobath, or (3) 25 nm From Shore

The measure requiring avoidance of mid-frequency active sonar within 13 nm of the 656 ft. (200 m) isobaths was part of the RIMPAC 2006 authorization by NMFS. This measure, as well as similar measures of like distances, lacks any scientific basis when applied to the context of the HSTT Study Area (i.e. the bathymetry, sound propagation, width of channels). There is no scientific analysis indicating this measure is protective and no known basis for these specific metrics. The RIMPAC 2006 mitigation measure precluded active anti-submarine training in the littoral region, which significantly impacted realism and training effectiveness (such as for amphibious landings). This procedure had no observable effect on the protection of marine mammals during RIMPAC 2006 and its value is unclear. However, its effect on realistic training, as with all arbitrary distance from land restrictions, is significant.

5.5.10 Reducing Vessel Speed

Navy personnel are already required to use extreme caution and operate at a slow, safe speed consistent with mission and safety. Ships and submarines need to be able to react to changing tactical situations in training as they would in actual combat. Placing arbitrary speed restrictions would not allow them to properly react to these situations. By training differently than what would be needed in an actual combat scenario would decrease training effectiveness and reduce the crew’s abilities.

5.5.11 Using Larger Mitigation Zones

The mitigation zone distance from the source varies depending on the type of activity. In addition, consideration needs to be given regarding what type of platform lookouts are expected to observe the mitigation zone from. When lookouts are required to observe extremely large mitigation zones, the potential for reducing impacts decreases greatly. For instance, if a mitigation zone increases from 1,000 to 4,000 yd. (914 to 3,658 m), the area that must be monitored increases sixteen fold. The Navy balances the need to reduce potential impacts with the ability to observe animals over a given area. Implementing mitigation zones is most effective when the zone is small enough to be realistically monitored.

5.5.12 Implementing a Mitigation Zone for Missile Exercises with Airborne Targets

Per current mitigation, a mitigation zone of 1,000 yd. (915 m) is observed around the expected expended material field. The Navy is proposing to eliminate the need for a lookout to maintain a mitigation zone for missile exercises involving airborne targets. Most airborne targets are recoverable aerial drones, and missile impact with the target does not typically occur. Most anti-air missiles used in training are telemetry configured, which means they don't have an actual warhead. Impact of a target is unlikely because missiles are designed to detonate (simulated detonation for telemetry missiles) in the vicinity of the target and not as a result of a direct strike on the target. Given the speed of the missile and the target, the high altitudes involved, and the long ranges of missile travel possible, it is impracticable to predict or to effectively observe where the missile fragments will fall. The potential expended material fall zone can only be predicted within tens of miles for long range events, which can be in excess of 80 nm from the firing location, and thousands of yards for shorter events, which can occur within several thousand yards from the firing location.

The potential risk to any marine mammal or sea turtle from a missile exercise with an airborne target is a direct strike from falling expended material. Based on the extremely low potential for a target strike and associated expended material field to co-occur in space and time with a marine species at or near the surface of the water, the potential for a direct strike is negligible. Establishment of a mitigation zone for activities involving airborne targets is ineffective at reducing potential impacts.

5.5.13 Implementing a Mitigation Zone for Medium and Large Caliber Gunnery Exercises with Airborne Targets

Per current mitigation, a mitigation zone is observed in the vicinity of the expected expended material field. The Navy is proposing to eliminate the need for a lookout to observe in the vicinity of the expected expended for medium and large caliber gunnery exercises involving airborne targets. The potential expended material fall zone can only be predicted thousands of yards, which can be up to 7 nm from the firing location.

The potential risk to any marine mammal or sea turtle from a gunnery exercise with an airborne target is a direct strike from falling expended material. Based on the extremely low potential for an expended material field to co-occur in space and time with a marine species at or near the surface of the water, the potential for a direct strike is negligible. Establishment of a mitigation zone for activities involving airborne targets is ineffective at reducing potential impacts.

5.5.14 Implementing Measures for Laser Test Operations

Visual surveys would be conducted for all testing activities involving laser line scan, light imaging detection, and ranging lasers. Per current standard operating procedures, only trained personnel operate lasers and visual observation of the area is conducted to ensure human safety. The Navy is proposing to discontinue this procedure as a mitigation measure for two reasons: (1) it is currently a standard operating procedure conducted for human safety, and (2) the environmental consequences analysis suggests that impacts to resources from laser activities are not expected.

5.6 MONITORING

5.6.1 APPROACH TO MONITORING

The Navy is committed to demonstrating environmental stewardship while executing its National Defense Mission and complying with the suite of Federal environmental laws and regulations. As a complement to the Navy's commitment to avoiding and reducing impacts of the Proposed Action through mitigation (Section 5.4), the Navy will undertake monitoring efforts to track compliance with take authorizations, to help evaluate the effectiveness of implemented mitigation measures, and to better understand the effects of the Proposed Action on marine resources.. Taken together, mitigation and monitoring comprise the Navy's integrated approach for reducing environmental impacts from the Proposed Action. The Navy's overall monitoring approach will seek to leverage and build on existing research efforts whenever possible.

Consistent with the cooperating agency agreement with NMFS, mitigation and monitoring measures presented in this EIS/OEIS focus on the requirements for protection and management of marine resources. A well-designed monitoring program can provide important feedback for validating assumptions made in analyses and allow for adaptive management of marine resources. Since monitoring will be required for compliance with the final rule issued for the Proposed Action under the Marine Mammal Protection Act, details of the monitoring program will be developed in coordination with NMFS through the regulatory process. Discussions with resource agencies during the consultation and permitting processes may result in changes to the mitigation as described in this document. Such changes will be reflected in the final EIS/OEIS, Record of Decision, and consultation documents such as the Endangered Species Act Biological Opinion.

5.6.1.1 Integrated Comprehensive Monitoring Plan Top-Level Goals

The Integrated Comprehensive Monitoring Program is intended to coordinate monitoring efforts across all regions where the Navy trains and to allocate the most appropriate level and type of effort for each range complex (Department of the Navy 2010). The current Navy monitoring program is composed of a collection of "range-specific" monitoring plans, each developed individually as part of Marine Mammal Protection Act and Endangered Species Act compliance processes as environmental documentation was completed. These individual plans establish specific monitoring requirements for each range complex and are collectively intended to address the Integrated Comprehensive Monitoring Program top-level goals.

A 2010 Navy-sponsored monitoring meeting in Arlington, Virginia, initiated a process to critically evaluate the current Navy monitoring plans and begin development of revisions and updates to both existing region-specific plans as well as the Integrated Comprehensive Monitoring Program. Discussions at that meeting as well as the following Navy and NMFS annual adaptive management meeting established a way ahead for continued refinement of the Navy's monitoring program. This process included establishing a Scientific Advisory Group of leading marine mammal scientists with the initial task of developing recommendations that would serve as the basis for a Strategic Plan for Navy monitoring. The Strategic Plan is intended to be a primary component of the Integrated Comprehensive Monitoring Program and provide a "vision" for Navy monitoring across geographic regions - serving as guidance for determining how to most efficiently and effectively invest the marine species monitoring resources to address Integrated Comprehensive Monitoring Program top-level goals and satisfy MMPA Letter of Authorization regulatory requirements.

The objective of the Strategic Plan is to continue the evolution of Navy marine species monitoring towards a single integrated program, incorporating Scientific Advisory Group recommendations, and establishing a more transparent framework for soliciting, evaluation, and implementing monitoring work across the Fleet range complexes. The Strategic Plan must consider a range of factors in addition to the scientific recommendations including logistic, operational, and funding considerations and will be revised regularly as part of the annual adaptive management process.

The Integrated Comprehensive Monitoring Program establishes top-level goals that have been developed in coordination with NMFS (Department of the Navy 2010). The following top-level goals will become more specific with regard to identifying potential projects and monitoring field work through the Strategic Plan process as projects are evaluated and initiated in the HSTT Study Area.

- An increase in our understanding of the likely occurrence of marine mammals or ESA-listed marine species in the vicinity of the action (i.e., presence, abundance, distribution, and density of species);
- An increase in our understanding of the nature, scope, or context of the likely exposure of marine mammals and ESA-listed species to any of the potential stressor(s) associated with the action (e.g., tonal and impulsive sound), through better understanding of one or more of the following: (1) the action and the environment in which it occurs (e.g., sound source characterization, propagation, and ambient noise levels); (2) the affected species (e.g., life history or dive patterns); (3) the likely co-occurrence of marine mammals and ESA-listed marine species with the action (in whole or part) associated with specific adverse effects, or; (4) the likely biological or behavioral context of exposure to the stressor for the marine mammal and ESA-listed marine species (e.g., age class of exposed animals or known pupping, calving or feeding areas);
- An increase in our understanding of how individual marine mammals or ESA-listed marine species respond (behaviorally or physiologically) to the specific stressors associated with the action (in specific contexts, where possible, e.g., at what distance or received level);
- An increase in our understanding of how anticipated individual responses, to individual stressors or anticipated combinations of stressors, may impact either: (1) the long-term fitness and survival of an individual; or (2) the population, species, or stock (e.g., through effects on annual rates of recruitment or survival);
- An increase in our understanding of the effectiveness of mitigation and monitoring measures;
- A better understanding and record of the manner in which the authorized entity complies with the Incidental Take Authorization and Incidental Take Statement;
- An increase in the probability of detecting marine mammals (through improved technology or methods), both specifically within the mitigation zone (thus allowing for more effective implementation of the mitigation) and in general, to better achieve the above goals; and
- A reduction in the adverse impact of activities to the least practicable level, as defined in the MMPA.

5.6.1.2 Scientific Advisory Group Recommendations

Navy established the Scientific Advisory Group in 2011 with the initial task of evaluating current Navy monitoring approaches under the Integrated Comprehensive Monitoring Program and existing MMPA Letters of Authorization and developing objective scientific recommendations that would form the basis for this Strategic Plan. While recommendations were fairly broad and not prescriptive from a range complex perspective, the Scientific Advisory Group did provide specific programmatic recommendations that serve as guiding principles for the continued evolution of the Navy Marine Species Monitoring Program and provide a direction for the Strategic Plan to move this development. Key recommendations include:

- Working within a conceptual framework of knowledge, from basic information on the occurrence of species within each range complex, to more specific matters of exposure, response, and consequences.
- Facilitating collaboration among researchers in each region, with the intent to develop a coherent and synergistic regional monitoring and research effort.
- Striving to move away from a "box-checking" mentality. Monitoring studies should be designed and conducted according to scientific objectives, rather than on merely cataloging effort expended.
- Approach the monitoring program holistically and select projects that offer the best opportunity to advance understanding of the issues, as opposed to establishing range-specific requirements.

5.7 REPORTING

The Navy is committed to documenting and reporting relevant aspects of training and testing activities in order to document species sightings, reduce environmental impact, and improve future environmental assessments, including the reporting initiatives described below.

5.7.1 EXERCISE AND MONITORING REPORTING

The Navy will submit annual exercise and monitoring reports to the Office of Protected Resources at NMFS. The exercise report will describe the level of training and testing conducted during the reporting period, and the monitoring report will describe both the nature of the monitoring that has been conducted and the actual results of the monitoring. All of the details regarding the content of the annual reports will be coordinated with NMFS through the permitting process. All reports submitted to date can be found on the NMFS Office of Protected Resources webpage.

5.7.2 STRANDING RESPONSE PLAN

In coordination with NMFS, the Navy will have a stranding response plan. All of the details regarding the content of the stranding response plan will be coordinated with NMFS through the permitting process.

5.7.3 BIRD STRIKES

The Navy will report all damaging and non-damaging bird strikes to the Naval Safety Center.

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6 ADDITIONAL REGULATORY CONSIDERATIONS

In accordance with the Council on Environmental Quality regulations for implementing the National Environmental Policy Act (NEPA), federal agencies shall, to the fullest extent possible, integrate the requirements of NEPA with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively. This chapter summarizes environmental compliance for the Proposed Action, consistency with other federal, state, and local plans, policies, and regulations; the relationship between short-term impacts; and the maintenance and enhancement of long-term productivity in the affected environment; irreversible and irretrievable commitments of resources, and energy conservation.

6.1 CONSISTENCY WITH OTHER APPLICABLE FEDERAL, STATE, AND LOCAL PLANS, POLICIES, AND REGULATIONS

Implementation of the Proposed Action for the Hawaii-Southern California Training and Testing (HSTT) Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS), would comply with applicable federal, state, and local laws, regulations, and executive orders. The Navy is consulting with and will continue to consult with regulatory agencies, as appropriate, during the NEPA process and prior to implementation of the Proposed Action to ensure that requirements are met. Table 6.1-1 summarizes environmental compliance requirements that that were considered in preparing this EIS/OEIS (including those that may be secondary considerations in the resource evaluations). Section 3.0.1 provides brief excerpts of the primary federal statutes, executive orders, international standards, and guidance that form the regulatory framework for the resource evaluations. Documentation of consultation and coordination with regulatory agencies is provided in Appendix C. Formal Endangered Species Act consultation will start following the Draft EIS release. However, the Navy has been coordinating this ESA and CZMA efforts prior to initiating the formal consultation. Therefore, not all consultation documentation is included in Appendix C or the website at this time, but all compliance will be completed prior to the signing of the Record of Decision for the Proposed Action.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action

Laws, Executive Orders, International Standards, and Guidance	Status of Compliance
Laws	
Abandoned Shipwreck Act (43 United States Code [U.S.C.] §§ 2101 - 2106)	The 1987 Abandoned Shipwreck Act establishes requirements for educational and recreational access to abandoned shipwrecks; the protection of such resources through the establishment of underwater parks and protected areas; the development of specific guidelines for management and protection in consultation with various stakeholders; defines the jurisdiction and responsibility of federal and state agencies; and explicitly states that the law of salvage and the law of finds do not apply. Under the Act, the Department of the Interior and National Park Service issued guidelines in 2007 to help states manage shipwrecks in their waters. The Act defines the federal government's title to any abandoned shipwreck that meets criteria for inclusion in the National Register of Historic Places within state submerged lands, with the stipulation that title to these shipwrecks will be transferred to the appropriate state. For abandoned shipwrecks in U.S. Territorial Waters, the federal government asserts title to the resource. See Section 3.10, Cultural Resources, for assessment and conclusion that the Proposed Action is consistent with the Act.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Laws, Executive Orders, International Standards, and Guidance	Status of Compliance
Laws	
Act to Prevent Pollution from Ships (33 U.S.C. §1901 et seq.)	Requirements associated with the Act to Prevent Pollution from Ships are implemented by the Navy Environmental Readiness Program Manual and related Navy guidance documents governing waste management, pollution prevention, and recycling. At sea, the Navy complies with these regulations and operates in a manner that minimizes or eliminates any adverse affects to the marine environment. See Section 3.1, Sediment and Water Quality for the assessment.
Antiquities Act (16 U.S.C. § 431)	The Proposed Action is consistent with the Act's objectives for protection of archaeological and historical sites and objects, preservation of cultural resources, and the public's access to them. See Section 3.10, Cultural Resources for the assessment.
Coastal Zone Management Act (16 C.F.R. §1451 et seq.)	The Navy will continue compliance with the Coastal Zone management Act. See Section 6.1.1, below, for discussion of Navy activities and compliance with the Coastal Zone Management Act.
Historic Sites Act (16 U.S.C. §§ 461-467)	The Proposed Action is consistent with the national policy for the preservation of historic sites, buildings, and objects of national significance. See Chapter 3.10, Cultural Resources for assessment.
Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801-1802)	The Navy prepared an Essential Fish Habitat Assessment. The Proposed Action may have potential impacts on essential fish habitat and managed species. Consultation with NMFS will be conducted for affected species and their habitats. The Essential Fish Habitat Assessment was prepared as a separate document.
Migratory Bird Treaty Act (16 U.S.C. §§ 703-712)	The 2003 National Defense Authorization Act provides that the Armed Forces may take migratory birds incidental to military readiness activities provided that, for those ongoing or proposed activities that the Armed Forces determine may result in a significant adverse effect on a population of a migratory bird species, the Armed Forces must confer and cooperate with the Service to develop and implement appropriate conservation measures to minimize or mitigate such significant adverse effects. Implementation of the Proposed Action would cause no significant adverse effect on a population of migratory bird species. See Section 3.6, Birds, for the assessment.
National Fishery Enhancement Act (33 U.S.C. § 2101 et seq.)	The Proposed Action is consistent with regulations administered by NMFS and U.S. Army Corps of Engineers concerning artificial reefs in the navigable waters of the United States. See Section 3.9, Fish, for the assessment.
National Marine Sanctuaries Act (16 U.S.C. § 1431 et seq.)	Five National Marine Sanctuaries administered by National Oceanic and Atmospheric Administration Office of National Marine Sanctuaries lie within the Study Area. These are discussed further in Section 6.1.2.
Rivers and Harbors Act (33 U.S.C. § 401 et seq.)	In accordance with U.S. Army Corps of Engineers regulations, no permit is required under the Rivers and Harbors Act because no construction in navigable waterways is proposed.
Submerged Lands Act of 1953 (43 U.S.C. §§ 1301-1315)	The Proposed Action is consistent with regulations concerning the Submerged Lands Act.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Laws, Executive Orders, International Standards, and Guidance	Status of Compliance
Laws	
Sunken Military Craft Act (Public Law 108-375, 10 U.S.C. § 113 Note and 118 Stat. 2094-2098)	The Proposed Action would have no adverse effects on sunken U.S. military ships and aircraft within the Study Area. If a site is determined to be eligible for the National Register of Historic Places, the State Historic Preservation Officer would be consulted to address potential effects. See Section 3.10, Cultural Resources, for the assessment.
California Coastal National Monument Designation (Presidential Proclamation, January 11, 2000)	The proclamation designates all non-major U.S.-owned lands (rocks, islands, etc.) along the coast of California from mean high tide out to a distance of 12 nm as national monuments. The Southern California Range Complex includes resources designated as part of the California Coastal National Monument area. The Navy and the Bureau of Land Management have agreed on the terms of a Memorandum of Understanding dated November 5, 2007 regarding Navy activities in the vicinity of monument resources. Implementation of the Proposed Action would be consistent with the Memorandum of Understanding and would not affect monument resources.
California Marine Life Protection Act and Marine Managed Areas Improvement Act (California Fish and Game Code §§ 2850-2863)	California Marine Life Protection Act requires California Department of Fish and Game to confer with the Navy regarding issues related to Navy activities that may affect Marine Managed Areas.
EXECUTIVE ORDERS	
Executive Order 11990*, Protection of Wetlands*	Implementation of the Proposed Action would not affect wetlands as defined in Executive Order 11990.
Executive Order 12114*, Environmental Effects Abroad of Major Department of Defense Actions*	The Navy prepared this OEIS in accordance with EO 12114 and Navy-implementing regulations found at 32 C.F.R. Part 187, Environmental Effects Abroad of Major Department of Defense Actions.
Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	Because all of the proposed activities occur in the ocean where there are no minority or low-income populations present, there are no disproportionately high and adverse human health or environmental impacts from the Proposed Action on minority populations or low-income populations. See Section 3.0.5.2 for the assessment.
Executive Order 12962*, Recreational Fisheries*	The Proposed Action would not affect federal agencies' ability to fulfill certain duties with regard to promoting the health and access of the public to recreational fishing areas. See Section 3.11, Socioeconomics, for the assessment.
Executive Order 13045*, Protection of Children from Environmental Health Risks and Safety Risks*	Because all of the proposed activities occur in the ocean where there are no child populations present, the Proposed Action would not lead to disproportionate risks to children that result from environmental health risks or safety risks. See Section 3.0.5.2 for the assessment.
Executive Order 13089*, Coral Reef Protection*	The Navy has prepared this EIS/OEIS in accordance with requirements that federal agencies whose actions affect U.S. coral reef ecosystems shall provide for implementation of measures needed to research, monitor, manage, and restore them, including reducing impacts from pollution and sedimentation. See Section 3.3, Marine Habitats, for assessment.
Executive Order 13112*, Invasive Species*	The Proposed Action would not increase the number of or introduce new invasive species nor require the Navy to take measures to avoid introduction and spread of those species. Naval vessels are exempt from 33 C.F.R. 151 Subpart D, Ballast Water Management for Control of Nonindigenous Species in Waters of the United States.

Table 6.1-1: Summary of Environmental Compliance for the Proposed Action (continued)

Laws, Executive Orders, International Standards, and Guidance	Status of Compliance
Laws	
Executive Order 13158, *Marine Protected Areas*	The Navy has prepared this EIS/OEIS in accordance with requirements for the protection of existing national system marine protected areas. See Section 6.1.2 for more information.
Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*	The Proposed Action is consistent with the integrated strategy toward sustainability in the federal government and to making reduction of greenhouse gas emissions a priority for federal agencies.
Executive Order 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*	The Proposed Action is consistent with the comprehensive national policy for the Stewardship of the Ocean, Our Coasts, and the Great Lakes.
Military Munitions Rule	The Military Munitions Rule identifies when conventional and chemical military munitions are considered solid waste under the Resource Conservation and Recovery Act (42 U.S.C. § 6901 et seq.). Military munitions are not considered solid waste based on two conditions stated at 40 Code of Federal Regulations (C.F.R.) § 266.202(a)(1)(i-iii). These two conditions are when munitions are used for their intended purpose and when unused munitions or a component of are subject to materials recovery activities. These two conditions cover the uses of munitions included in the Proposed Action; therefore, the Resource Conservation and Recovery Act does not apply.
INTERNATIONAL STANDARDS	
International Convention for the Prevention of Pollution from Ships	This standard prohibits certain discharges of oil, garbage, and other substances from vessels. The convention and its annexes are implemented by national legislation, including the Act to Prevent Pollution from Ships (33 U.S.C. §§ 1901 to 1915) and the Federal Water Pollution Control Act (33 U.S.C. §§ 1321 to 1322). The Proposed Action does not include vessel operation and discharge from ships; however, the Navy vessels operating in the Study Area would comply with the discharge requirements established in this program, minimizing or eliminating potential impacts from discharges from ships.

6.1.1 COASTAL ZONE MANAGEMENT ACT COMPLIANCE

The Coastal Zone Management Act of 1972 (16 United States Code [U.S.C.] § 1451, et seq.) encourages coastal states to be proactive in managing coastal zone uses and resources. The Act established a voluntary coastal planning program under which participating states submit a Coastal Management Plan to the National Oceanographic and Atmospheric Administration for approval. Under the Act, federal actions that have an effect on a coastal use or resource are required to be consistent, to the maximum extent practicable, with the enforceable policies of federally approved Coastal Management Plans. See Section 4.3.8 in Cumulative Impacts.

The Coastal Zone Management Act defines the coastal zone as extending “to the outer limit of State title and ownership under the Submerged Lands Act” (i.e., 3 nm or 9 nm from the shoreline, depending on the location). The extent of the coastal zone inland varies from state to state, but the shoreward extent is not relevant to this Proposed Action.

A Consistency Determination, or a Negative Determination may be submitted for review of federal agency activities. A federal agency submits a consistency determination when it determines that its activity may have either a direct or an indirect effect on a state coastal use or resource. In accordance with 15 C.F.R. § 930.39, the consistency determination will include a brief statement indicating whether the proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the management program. The consistency determination should be based on evaluation of the relevant enforceable policies of the management program. In accordance with 15 C.F.R. § 930.35, "if a Federal agency determines that there will not be coastal effects, then the Federal agency shall provide the State agencies with a negative determination for a Federal agency activity: (1) Identified by a State agency on its list, as described in §930.34(b), or through case-by-case monitoring of unlisted activities; or (2) Which is the same as or is similar to activities for which consistency determinations have been prepared in the past; or (3) For which the Federal agency undertook a thorough consistency assessment and developed initial findings on the coastal effects of the activity." Thus, a negative determination must be submitted to a state if the agency determines no coastal effects and one or more of the triggers above is met.

6.1.1.1 California Coastal Management Program

The state of California has an approved Coastal Management Plan, administered by the California Coastal Commission. The California Coastal Act of 1976 (California Public Resources Code, § 30000 et seq.) implements California's Coastal Management Program. The California Coastal Act includes policies to protect and expand public access to shorelines, and to protect, enhance, and restore environmentally sensitive habitats, including intertidal and nearshore waters, wetlands, bays and estuaries, riparian habitat, certain woods and grasslands, streams, lakes, and habitat for rare and endangered plants and animals.

Under the Coastal Zone Management Act, the California Coastal Commission must provide an opportunity for public comment and involvement in the federal coastal consistency determination process.

6.1.1.2 Hawaii Coastal Zone Management Program

Hawaii has an approved Coastal Zone Management Program (Chapter 205A, Hawaii Revised Statutes), administered by the Office of State Planning. The program meets the federal coastal zone management requirements in managing coastal areas and resources, including beaches, fishponds, scenic areas, marinas, wetlands, harbors, recreational areas, historic sites, and marine resources.

Hawaii's Coastal Zone Management Program employs a wide variety of regulatory and non-regulatory techniques to address coastal issues and uphold environmental law. Among them are stewardship, planning, permitting, education, and outreach.

6.1.2 Marine Protected Areas

Many areas of the marine environment have some level of federal, state, or local management or protection. Marine protected areas have conservation or management purposes, defined boundaries, and some legal authority to protect resources. Marine protected areas vary widely in purpose, managing agency, management approaches, level of protection, and restrictions on human uses. They have been designated to achieve objectives ranging from conservation of biodiversity, to preservation of sunken historic vessels, to protection of spawning habitats important to commercial and recreational fisheries. Executive Order(EO) 13158*, Marine Protected Areas,* was created to "strengthen the management, protection, and conservation of existing marine protected areas and establish new or expanded marine protected areas; develop a scientifically based, comprehensive national system of marine protected areas representing diverse U.S. marine ecosystems, and the nation's natural and cultural resources; and avoid causing harm to marine protected areas through federally conducted, approved, or funded activities."

Executive Order 13158, requires each Federal agency whose actions affect the natural or cultural resources that are protected by a national system of marine protected areas to identify such actions, and in taking such actions, avoid harm to those natural and cultural resources. Pursuant to Section 5 of EO 13158, agency requirements apply only to the natural or cultural resources specifically afforded protection by the site as described by the List of National System Marine Protected Areas. For sites that have both a terrestrial and marine area, only the marine portion and its associated protected resources are included on the List of National System Marine Protected Areas and subject to Section 5 of EO 13158. A full list and map of areas accepted in the National System of Marine Protected Areas is available from the National Marine Protected Areas Center.

The National Marine Protected Areas Center, which is federally managed through the National Oceanic and Atmospheric Administration (NOAA), is tasked with implementing EO 13158. In order to meet the qualifications for the various terms within EO 13158, the National Marine Protected Areas Center developed a Marine Protected Areas Classification system. This system uses six criteria to describe the key features of most marine protected areas, as follows:

1. Primary conservation focus, such as natural heritage, cultural heritage, or sustainable production
2. Level of protection (e.g., no access, no impact, no take, zoned with no-take areas, zoned multiple use, or uniform multiple use)
3. Permanence of protection
4. Constancy of protection
5. Ecological scale of protection
6. Restrictions on extraction

The National Marine Protected Areas Center utilizes these criteria to evaluate marine protected areas for inclusion in the National System of Marine Protected Areas. Implementation of the National System of Marine Protected Areas is managed by the Department of Commerce and the Department of the Interior. Executive Order 13158 requires the Department of Commerce and the Department of the Interior to consult with other federal agencies about the inclusion of sites into the National System of Marine Protected Areas, including the Department of Defense. The National System of Marine Protected Areas includes marine protected areas managed under the following six systems:

National Marine Sanctuary System. Under the National Marine Sanctuaries Act, the National Oceanic and Atmospheric Administration established national marine sanctuaries for marine areas with special conservation, recreational, ecological, historical, cultural, archaeological, scientific, educational, or aesthetic qualities. Within the HSTT Study Area there are three National Marine Sanctuary System sites (two national marine sanctuaries [Hawaiian Islands Humpback Whale National Marine Sanctuary, Channel Island National Marine Sanctuary] and one marine national monument [Papahanaumokuakea Marine National Monument]) all of which are included in the National System of Marine Protected Areas.

Marine National Monuments. Marine national monuments are designated through Presidential Proclamation under the authority of the Antiquities Act of 1906 (16 U.S.C. § 431). Marine national monuments are often co-managed by state, federal, and local governments, in order to preserve diverse habitats and ecosystem functions. Within the HSTT Study Area there is one marine national monument, Papahanaumokuakea Marine National Monument, which is also included in the National Marine Sanctuary System and the National System of Marine Protected Areas.

National Wildlife Refuge System. The U.S. Fish and Wildlife Service manages ocean and Great Lakes refuges for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats. There are two national wildlife refuge areas within the HSTT Study Area, Johnston Island National Wildlife Refuge and Midway Atoll National Wildlife Refuge, both of which are included in the National System of Marine Protected Areas.

State and Local Marine Protected Areas. State and local governments have established marine protected areas for the management of fisheries, nursery grounds, shellfish beds, recreation, tourism, and other uses; these areas have a diverse array of conservation focuses, from protecting ecological functions, to preserving shipwrecks, to maintaining traditional or cultural interaction with the marine environment. There are 18 state or local marine protected areas within the HSTT Study Area that are included in the National System of Marine Protected Areas (see Table 6.1-2).

National Parks System. The National Park System contains ocean and Great Lakes parks, including some national monuments, administered by the U.S. Department of the Interior National Park Service to conserve the scenery and the natural and historic objects and wildlife contained within. There is one National Parks System site, Channel Islands National Park, within the HSTT Study Area that is included in the National System of Marine Protected Areas.

National Estuarine Research Reserve System. National Estuarine Research Reserve System sites protect estuarine land and water and provide essential habitat for wildlife, educational opportunities for student, teachers, and the public, and living laboratories for scientists. There are no National Estuarine Research Reserve System sites within the HSTT Study Area.

This EIS/OEIS has been prepared in accordance with requirements for natural or cultural resources protected under the National System of Marine Protected Areas. While several marine protected areas are located within the HSTT Study Area and are included in the National System of Marine Protected Areas, it is important to note that the Navy rarely trains or tests in many of these areas. Navy activities within these marine protected areas abide by the regulations of the individual marine protected area, Table 6.3-1 provides information on the individual marine protected area regulations and the Navy activities that occur in these areas. Additionally, there are three National Marine Sanctuaries within the Study Area that are included in the National System of Marine Protected Areas: the Channel Islands National Marine Sanctuary, the Papahanaumokuakea Marine National Monument, and the Hawaiian Islands Humpback Whale National Marine Sanctuary. These areas receive protection under both EO 13158 and the National Marine Sanctuaries Act, and are described in more detail below

6.1.2.1.1 Channel Islands National Marine Sanctuary

The Channel Islands National Marine Sanctuary consists of an area of 1,109 square nautical miles (nm^2) (3,804 square kilometers [km^2]) around Anacapa Island, Santa Cruz Island, Santa Rosa Island, San Miguel Island and, Santa Barbara Island to the south (Figure 6.1-1). Only 92 nm^2 (316 km^2) of Santa Barbara Island, or about eight percent of the sanctuary, occurs within the Southern California portion of the Study Area.

Figure 6.1-1: Channel Islands National Marine Sanctuary

Key habitats within the sanctuary include kelp forest, surfgrass and eelgrass, intertidal zone, nearshore subtidal, deepwater benthic, and water column habitat. The diversity of habitats onshore and offshore contributes to the high species diversity in the Channel Islands National Marine Sanctuary, with more than 195 species of birds using open water, shore, or island habitats in the area (National Marine Sanctuaries 2009a). At least 33 species of cetaceans have been reported in the Channel Islands National Marine Sanctuary (National Marine Sanctuaries 2009a). Four species of sea turtles have been reported in the region—green, loggerhead, olive ridley, and leatherback—and all four species may be found within the sanctuary at any time of year. At least 492 species of algae and four species of sea grasses make up the marine plants of the sanctuary (National Marine Sanctuaries 2009a). Due to its transitional location between cold and warm water currents and the diversity of bottom habitats, the Channel Islands National Marine Sanctuary supports a variety of invertebrates, including two endangered species (black abalone and the white abalone). Of the 481 species of fish commonly found in the region, many occur in the sanctuary. See Section 3.4 (Marine Mammals), Section 3.5 (Sea Turtles), Section 3.6 (Sea Birds) Section 3.7 (Marine Vegetation), Section 3.8 (Marine Invertebrates), and Section 3.9 (Fish) for additional information on these species.

The sanctuary is managed by its advisory council, of which the Navy is a member. According to the National Marine Sanctuary Program Regulations for the Channel Islands National Marine Sanctuary (15 C.F.R., § 922.73), the prohibitions "…do not apply to military activities carried out by DoD [Department of Defense] as of the effective date of these regulations." However, any activity that is "modified in such a way that requires the preparation of an environmental assessment or environmental impact statement…relevant to a Sanctuary resource or quality" is not considered a pre-existing activity. The National Marine Sanctuary Program Regulations also states "all DoD activities must be carried out in a manner that avoids to the maximum extent practicable any adverse impacts on sanctuary resources and qualities." If a DoD activity causes any destruction, loss or injury to a Sanctuary resource then the "DoD, in coordination with the Director, must promptly prevent and mitigate further damage and must restore or replace the Sanctuary resource or quality in a manner approve by the Director."

To ensure compliance with the National Marine Sanctuary Program Regulations, the Navy considered all proposed training and testing activities to determine which activities may destroy, cause the loss of, or injure sanctuary resources, or result in adverse impacts on sanctuary resources or qualities. The Navy continues to conduct minimal sonar-related activities (anti-submarine warfare training and testing), only in the vicinity of the Santa Barbara Island Marine Reserve portion of the sanctuary. No other activities are conducted in any other part of the sanctuary. The Navy does not propose new activities in the Channel Island National Marine Sanctuary, or activities that are different from those currently conducted in this area. Therefore, proposed activities are consistent with those activities currently conducted in this area, are consistent with those described in the sanctuary's designation document, and are not being changed or modified in a way that would require consultation.

6.1.2.1.2 Hawaiian Islands Humpback Whale National Marine Sanctuary

The Hawaiian Islands Humpback Whale National Marine Sanctuary is composed of 1,035 nm^2 of the waters around Maui, Lanai, and Molokai and smaller areas off the north shore of Kauai, off Hawaii's west coast, and off the north and southeast coasts of Oahu (Figure 6.1-2) and is entirely within the Hawaii portion of the Study Area. This sanctuary constitutes one of the world's most important North Pacific humpback whale (*Megaptera novaeangliae*) habitats and is a primary region for humpback reproduction in the U.S. (National Marine Sanctuary Program 2002).

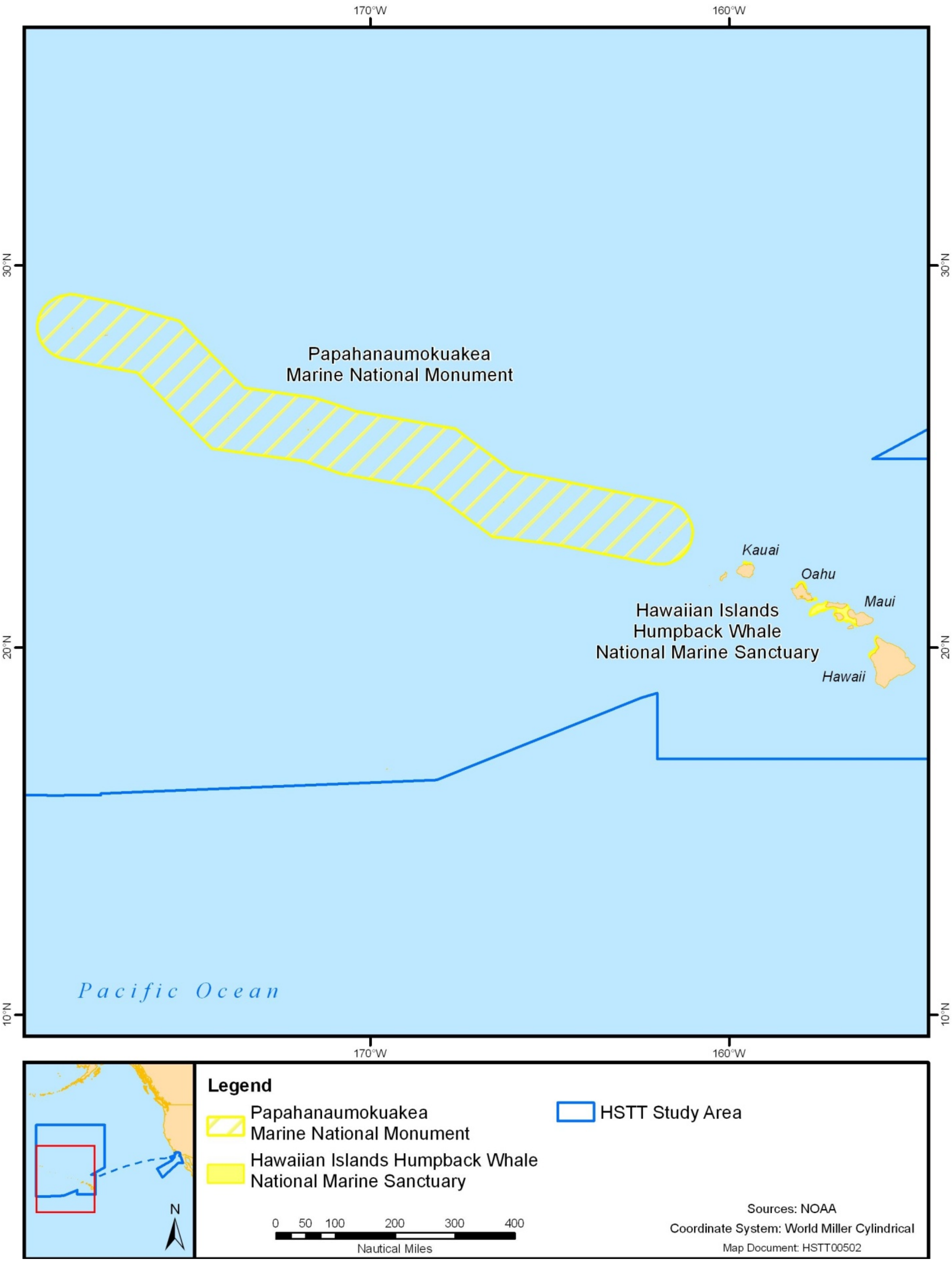

Figure 6.1-2: Papahanaumokuakea Marine National Monument and the Hawaiian Islands Humpback Whale National Marine Sanctuary

The sanctuary boundaries extend from the shoreline to 600 feet (ft.) (183 meters[m]) deep in many areas, encompassing a variety of marine ecosystems, including sea grass beds and coral reefs. Corals and coralline algae are the dominant reef-building organisms in Hawaii's reef ecosystems. Endangered Hawaiian monk seals and sea turtles are found in the sanctuary (Office of National Marine Sanctuaries 2010). Important reef biota include finger coral, cauliflower coral, lobe coral, algae, and marine invertebrates, such as shrimp, lobsters, crabs, and sea urchins. Fish populations on the sanctuary reefs include parrotfish, wrasses, damselfish, surgeon fish, goatfish, jacks, and sharks. See Section 3.4 (Marine Mammals), Section 3.5 (Sea Turtles), Section 3.7 (Marine Vegetation), Section 3.8 (Marine Invertebrates), and Section 3.9 (Fish) for additional information on these species.

A management review process for the Hawaiian Islands Humpback Whale National Marine Sanctuary is underway. A proposal to expand the scope of the sanctuary to conserve other living marine resources was made available to the public for comment between July and October 2010, and public scoping meetings were held in August 2010 (National Oceanic and Atmospheric Administration 2010). According to the National Marine Sanctuary Program Regulations for the Hawaiian Islands Humpback Whale National Marine Sanctuary (15 C.F.R., § 922.184), there are no prohibitions specifically related to military activities.

According to the National Marine Sanctuary Program Regulations for the Hawaiian Islands Humpback Whale National Marine Sanctuary (15 C.F.R., § 922.183), "…all classes of military activities, internal or external to the Sanctuary, that are being or have been conducted before the effective date of these regulations …[the prohibitions] do not apply to these classes of activities." Additionally, any activity that is "modified in such a way that it is likely to destroy, cause the loss of, or injure a Sanctuary resource in manner significantly greater than was considered in a previous consultation under section 304(d) of the National Marine Sanctuary Act (NMSA) and § 922.187 of this subpart, the modified activity will be treated as a new military activity under paragraph (c) of this section." Within the sanctuary, the Navy conducts primarily anti-submarine warfare training and testing, consisting of mid- and high-frequency active sonar use. This type of training occurs throughout the range complex, but overlaps with the boundaries of the sanctuary only in that portion around the islands of Maui, Lanai, and Molokai. The Navy does not propose new activities in the Hawaiian Islands Humpback Whale National Marine Sanctuary, or activities that are different from those currently conducted in this area. Therefore, proposed activities are consistent with those activities currently conducted in this area, are consistent with those described in the sanctuary's designation document, and are not being changed or modified in a way that would require consultation. Additionally, the Navy has designated a humpback whale cautionary area within the sanctuary, around an area that has been identified as having one of the highest concentrations of humpback whales during the critical winter months. Should national security needs require MFA sonar training and testing in the cautionary area between December 15 and April 15, it shall be personally authorized by the Commander, U.S. Pacific Fleet. Further, the Navy will provide specific direction on required mitigation prior to operational units transiting to and training in the cautionary area. The Navy will provide the National Marine Fisheries Service with advance notification of any such activities.

6.1.2.1.3 Papahanaumokuakea Marine National Monument

Papahanaumokuakea Marine National Monument is the single largest conservation area in the U.S., encompassing 105,560 nm^2 (362,060 km^2) in a chain of islands, reefs, and banks that extends to the northwest of the main Hawaiian Islands (Figure 6.1-2) (National Marine Sanctuaries 2009b). This monument is entirely within the Hawaii portion of the Study Area. The monument hosts a complex mix of reef, slope, bank, seamount (underwater mountains/volcanoes), abyssal (deep sea), and open ocean environments, and is managed by the monument's advisory council; the Department of Defense is a member of this council. The Papahanaumokuakea Marine National Monument also contains seamounts and approximately 30 submerged banks (U.S. Fish and Wildlife Service et al. 2008). The more than 4,450 square miles (m^2) (11,525 km^2) of shallow-water coral reef contains at least 57 coral species, 355 algae species, and 838 invertebrate species, with an exceptionally high number of corals and algae found only in the Hawaiian Islands (National Marine Sanctuaries 2009b). More than 260 fish species inhabit the reefs, with relatively fewer herbivores, such as surgeonfishes, and an abundance of carnivores, such as damselfishes, goatfishes, and scorpionfishes. Predators such as sharks and jacks dominate the reef fish communities. Most of the area is in the open ocean, with oceanic fish species, such as tuna, marlin, and wahoo. See Section 3.7 (Marine Vegetation), Section 3.8 (Marine Invertebrates), and Section 3.9 (Fish) for additional information on species and bathymetry in the Study Area.

The monument's ecosystem supports a range of marine mammals, including the Hawaiian monk seal, the Hawaiian spinner dolphin, and bottlenose dolphins (National Marine Sanctuaries 2009b). The Hawaiian monk seal, which does not exist outside of this area, is the most endangered marine mammal in the U.S. and the only seal that depends on coral reefs. Transient marine mammals in the Papahanaumokuakea Marine National Monument include spotted dolphins and humpback whales. Seasonally or periodically present whales include the sperm, blue, fin, sei, and North Pacific right whales. See Section 3.3 (Marine Mammals) for additional information on these species.

Five species of sea turtles occur in the monument: the loggerhead, olive ridley, leatherback, hawksbill, and green sea turtles (U.S. Fish and Wildlife Service et al. 2008). The Papahanaumokuakea Marine National Monument islands provide important nesting habitat for the threatened green sea turtle, with French Frigate Shoals alone supporting more than 80 percent of the nesting population for all the Hawaiian Islands. See Section 3.4 (Sea Turtles) for additional information on these species.

The regulations implementing the Papahanaumokuakea Marine National Monument (50 C.F.R., § 404), state that "all activities and exercises of the Armed Forces shall be carried out in a manner that avoids, to the extent practicable and consistent with operational requirements, adverse impacts on monument resources and qualities." Additionally, these regulations require that "in the event of threatened or actual destruction of, loss of, or injury to a monument resource or quality resulting from an incident, including but not limited to spill and groundings, caused by a component of the [DoD] or the United States Coast Guard, the cognizant component shall promptly coordinate with the Secretaries for the purpose of taking appropriate actions to respond to and mitigate the harm and, if possible, restore or replace the monument resource or quality." The Navy's proposed action includes activities conducted east of Nihoa Island and just inside the eastern edge of the monument boundaries. These activities may include:

- Anti-air warfare
- Anti-surface warfare
- Anti-submarine warfare
- Electronic warfare

The Navy does not propose new activities in the Papahanaumokuakea Marine National Monument, or activities that are different from those currently conducted in this area. Therefore, proposed activities are consistent with those activities currently conducted in this area, are consistent with those described in the sanctuary's designation document, and are not being changed or modified in a way that would require consultation.

6.2 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

In accordance with the Council on Environmental Quality regulations (Part 1502), this EIS/OEIS analyzes of the relationship between the short-term impacts on the environment and the effects those impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This means that choosing one option may reduce future flexibility in pursuing other options, or that committing a resource to a certain use may often eliminate the possibility for other uses of that resource. The Navy, in partnership with National Marine Fisheries Service (NMFS), is committed to furthering the understanding of marine resources and developing ways to lessen or eliminate the impacts Navy training and testing activities may have on these resources. For example, the Navy and NMFS collaborate on the Integrated Comprehensive Monitoring Program for marine species to assess the impacts of training activities on marine species and investigate population-level trends in marine species distribution, abundance, and habitat use in various range complexes and geographic locations where Navy training occurs.

The Proposed Action could result in both short- and long-term environmental impacts. However, these are not expected to result in any impacts that would reduce environmental productivity, permanently narrow the range of beneficial uses of the environment, or pose long-term risks to health, safety, or general welfare of the public. The Navy is committed to sustainable military range management, including co-use of the Study Area with the general public and commercial and recreational interests. This commitment to co-use of the Study Area will maintain long-term accessibility of the HSTT EIS/OEIS training and testing areas. Sustainable range management practices are specified in range complex management plans under the Navy’s Tactical Training Theater Assessment and Planning Program. Among other benefits, these practices protect and conserve natural and cultural resources and preserve access to training areas for current and future training requirements while addressing potential encroachments that threaten to impact range and training area capabilities.

6.3 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

The National Environmental Policy Act requires that environmental analysis include identification of “any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented.” (42 U.S.C. § 4332). Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy or minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., the disturbance of a cultural site).

For the Proposed Action, most resource commitments would be neither irreversible nor irretrievable. Most impacts would be short term and temporary, or long lasting but within historical or desired conditions. Because there would be no building or facility construction, the consumption of material typically associated with such construction (e.g., concrete, metal, sand, fuel) would not occur. Energy typically associated with construction activities would not be expended and irretrievably lost.

Table 6.3-1: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Navy Proposed Activities and Potential Impacts
Channel Islands National Marine Sanctuary	California	Ecosystem	Prohibitions "…do not apply to military activities carried out by DoD [Department of Defense] as of the effective date (22 September 1980) of these regulations. (15 C.F.R. § 922.73)" However, if any activities "modified in such a way that requires the preparation of an environmental assessment or environmental impact statement…relevant to a Sanctuary resource or quality" said activity is not considered a pre-existing activity under these regulations. The regulations also state that "all DoD activities must be carried out in a manner that avoids to the maximum extent practicable any adverse impacts on sanctuary resources and qualities." If a DoD activity causes any destruction, loss, or injury to a Sanctuary resource then the "DoD, in coordination with the Director, must promptly prevent and mitigate further damage and must restore or replace the Sanctuary resource or quality in a manner approved by the Director."	The Navy continues to conduct anti-submarine warfare training and testing in the vicinity of the Santa Barbara Island Marine Reserve portion of the sanctuary. No other activities are conducted in any other part of the sanctuary. The Navy does not propose new activities in the Channel Island National Marine Sanctuary, or activities that are different from those currently conducted in this area. Therefore, proposed activities are consistent with those activities currently conducted in this area, and those described in the sanctuary's designation document and military activities of the Proposed Action would continue to be exempt from the prohibitions identified in the sanctuary's regulations.
Channel Islands National Park	California	Ecosystem	This marine protected area falls completely within the footprint of the Channel Islands National Marine Sanctuary and therefore, the same provisions apply.	The Navy continues to conduct sonar-related activities in the vicinity of the Santa Barbara Island No other activities are conducted in the vicinity of this area. The Navy does not propose new activities in the Channel Island National Marine Sanctuary (including the Channel Islands National Park), or activities that are different from those currently conducted in this area. Therefore, proposed activities are consistent with those activities currently conducted in this area, and those described in the sanctuary's designation document.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Navy Proposed Activities and Potential Impacts
Farnsworth Bank ASBS[1] State Water Quality Protection Area	California	Ecosystem	Waste discharges are prohibited.	The Navy conducts training and testing in all warfare areas, including sonar-related activities outside of, but in the vicinity of, this area. The Navy does not discharge waste in or near this area.
Heisler Park ASBS[1] State Water Quality Protection Area	California	Ecosystem	Waste discharges are prohibited.	The Navy conducts training and testing in all warfare areas, including amphibious activities south of this area in the Camp Pendleton Amphibious Assault Area. The Navy does not discharge waste in or near this area.
La Jolla ASBS[1] State Water Quality Protection Area	California	Ecosystem	Waste discharges are prohibited.	The Navy conducts training and testing in all warfare areas, including mine warfare training activities and underwater communications testing activities just offshore (within 3 nm) of this water quality protection area. The Navy does not discharge any waste in or near this area.
Northwestern Santa Catalina Island ASBS[1] State Water Quality Protection Area	California	Ecosystem	Waste discharges are prohibited.	The Navy conducts training and testing in all warfare areas, including sonar-related activities outside of this, but in the vicinity of this area. The Navy does not discharge waste in or near this area.
Robert E. Badham ASBS[1] State Water Quality Protection Area	California	Ecosystem	Waste discharges are prohibited. However, discharges incidental to military training and research, development, test, and evaluation operations are allowed. Discharges incidental to underwater demolition and other in-water explosions are not allowed in the two military closure areas in the vicinity of Wilson Cove and Castle Rock. Discharges must not result in a violation of the water quality objectives, including the protection of the marine aquatic life beneficial use, anywhere in the ASBS.	The Navy conducts training and testing in all warfare areas, including amphibious activities in this area. The Navy does not discharge waste in or near this area. in violation of the site specific regulations.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Navy Proposed Activities and Potential Impacts
San Clemente Island ASBS[1] State Water Quality Protection Area	California	Ecosystem	Waste discharges are prohibited. However, discharges incidental to military training and research, development, test, and evaluation operations are allowed. Discharges incidental to underwater demolition and other in-water explosions are not allowed in the two military closure areas in the vicinity of Wilson Cove and Castle Rock. Discharges must not result in a violation of the water quality objectives, including the protection of the marine aquatic life beneficial use, anywhere in the ASBS.	The Navy conducts training and testing in all warfare areas, including amphibious, anti-surface warfare, anti-submarine warfare, electronic warfare, mine warfare, and naval special warfare training and testing activities in this area. The Navy does not discharge waste in or near this area in violation of the site specific regulations.
San Diego-Scripps ASBS[1] State Water Quality Protection Area	California	Ecosystem	Waste discharges are prohibited.	The Navy conducts training and testing in all warfare areas, including mine warfare training activities and underwater communications testing activities just offshore (within 3 nm) of this water quality protection area. The Navy does not discharge any waste in or near this area.
San Nicolas Island and Begg Rock ASBS[1] State Water Quality Protection Area	California	Ecosystem	Waste discharges are prohibited. However, discharges incidental to military research, development, testing, and evaluation of, and training with, guided missile and other weapons systems, fleet training exercises, small-scale amphibious warfare training, and special warfare training are allowed. Discharges incidental to underwater demolition and other in-water explosions are not allowed. Discharges must not result in a violation of the water quality objectives, including the protection of the marine aquatic life beneficial use, anywhere in the ASBS.	The Navy conducts training and testing in all warfare areas, including sonar-related activities outside of, but in the vicinity of this area, primarily to the southeast. The Navy does not discharge waste in or near this area in violation of the site specific regulations.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Navy Proposed Activities and Potential Impacts
Santa Barbara and Anacapa Islands ASBS[1] State Water Quality Protection Area	California (Santa Barbara Island only)	Ecosystem	Waste discharges are prohibited.	The Navy conducts training and testing in all warfare areas, including sonar-related activities in and near this area. The Navy does not discharge waste in or near this area.
Southeast Santa Catalina Island ASBS[1] State Water Quality Protection Area	California	Ecosystem	Waste discharges are prohibited.	The Navy conducts training and testing in all warfare areas, including sonar-related activities outside of this, but in the vicinity of this area. The Navy does not discharge waste in or near this area.
Western Santa Catalina Island ASBS[1] State Water Quality Protection Area	California	Ecosystem	Waste discharges are prohibited.	The Navy conducts training and testing in all warfare areas, including sonar-related activities outside of this, but in the vicinity of this area. The Navy does not discharge waste in or near this area.
Ahihi-Kinau Natural Area Reserve	Hawaii	Ecosystem	Prohibited: anchoring in any manner, injuring or removing any marine organism, damaging or disturbing any geological features, moving or damaging historic or prehistoric remains.	The Navy conducts no activities in this area.
Hanauma Bay Marine Life Conservation District	Hawaii	Ecosystem	Prohibited: operating any watercraft, injuring or removing any marine organism, damaging or disturbing any geological features.	The Navy conducts no activities in or near Hanauma Bay.
Kahoolawe Island Reserve	Hawaii	Ecosystem	Prohibited: all entrance into and activities within the reserve (such as boating, fishing and diving) unless specifically authorized by the Island Reserve Commission.	The Navy conducts no activities on or near Kahoolawe Island. Submarines may conduct underwater mine detection activities several nautical miles west of Kahoolawe.
Kalaupapa National Historical Park	Hawaii	Ecosystem	Prohibited: restrictions on commercial and recreational fishing.	The Navy conducts no activities near Kalaupapa National Historical Park.
Kaloko-Honokohau National Historical Park	Hawaii	Ecosystem	Prohibited: unpermitted uses of lay nets and aquarium collections.	The Navy conducts no activities near Kaloko-Honokohau National Historical Park.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Navy Proposed Activities and Potential Impacts
Hawaiian Islands Humpback Whale National Marine Sanctuary	Hawaii	Focal Resource	Prohibitions on activities within the sanctuary, as outlined in the National Marine Sanctuary Program Regulations for the Hawaiian Islands Humpback Whale National Marine Sanctuary (15 C.F.R. § 922.183), do not apply to "…all classes of military activities, internal or external to the Sanctuary, that are being or have been conducted before the effective date of these regulations." (2 June 1997) and as identified in the Final EIS and Management Plan. Additionally, any activity that is "modified in such a way that it is likely to destroy, cause the loss of, or injure a Sanctuary resource in manner significantly greater than was considered in a previous consultation under section 304(d) of the National Marine Sanctuary Act (NMSA) and § 922.187 of this subpart, the modified activity will be treated as a new military activity under paragraph (c) of this section."	Within the sanctuary, the Navy primarily conducts anti-submarine warfare training and testing, consisting of mid- and high-frequency active sonar use. This type of activity occurs throughout the range complex, but overlaps with the boundaries of the sanctuary only around the islands of Maui, Lanai, and Molokai.
Johnston Island National Wildlife Refuge	U.S. Territory	Ecosystem	Prohibitions do not apply to activities and exercises of the Armed Forces. Any activities carried forward within the area will be conducted in a manner consistent "so far as is reasonable and practical" with the prohibitions. If an activity causes any destruction, loss, or injury to a resource within the refuge then the DoD will coordinate with the Secretary of the Interior or Commerce, to take appropriate actions respond, mitigate, restore or replace the affected areas.	The Navy conducts no activities in or near the Johnston Island National Wildlife Refuge. Ships may transit in the vicinity of the refuge.
Molokini Shoal Marine Life Conservation District	Hawaii	Ecosystem	Prohibited: injuring or removing any marine organism (except in Subzone B), damaging or disturbing any geological features, moor and anchoring of boats.	The Navy conducts no activities on or near Molokini.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Navy Proposed Activities and Potential Impacts
Midway Atoll National Wildlife Refuge	Hawaii	Ecosystem	Same prohibitions as listed under the Papajanaumokuakea Marine National Monument.	The Navy's proposed action includes activities conducted east of Nihoa Island and inside the eastern edge of the monument boundaries. These activities may include: - Anti-air warfare - Anti-surface warfare - Anti-submarine warfare - Electronic warfare
Papahanaumokuakea Marine National Monument	Hawaii	Ecosystem	Prohibitions on activities within the Papahanaumokuakea Marine National Monument (50 C.F.R. § 404), state that "all activities and exercises of the Armed Forces shall be carried out in a manner that avoids, to the extent practicable and consistent with operational requirements, adverse impacts on Monument resources and qualities." Additionally, these regulations require that "in the event of threatened or actual destruction of, loss of, or injury to a Monument resource or quality resulting from an incident, including but not limited to spill and groundings, caused by a component of the [DoD] or the United States Coast Guard, the cognizant component shall promptly coordinate with the Secretaries for the purpose of taking appropriate actions to respond to and mitigate the harm and, if possible, restore or replace the Monument resource or quality."	The Navy's proposed action includes activities conducted east of Nihoa Island and inside the eastern edge of the monument boundaries. These activities may include: - Anti-air warfare - Anti-surface warfare - Anti-submarine warfare - Electronic warfare
Pupukea Marine Life Conservation District	Hawaii	Ecosystem	Prohibited: injuring or removing any marine organism (outside of species and gear specific regulations), damaging or disturbing any geological features.	The Navy conducts no activities in this area.

Table 6.1-2: Marine Protected Areas within the Hawaii-Southern California Training and Testing Study Area (continued)

Marine Protected Area	Location Within the Study Area	Protection Focus	Regulations Applicable to Navy Activities	Navy Proposed Activities and Potential Impacts
Kealakekua Bay Marine Life Conservation District	Hawaii	Ecosystem	Prohibited: injuring or removing any marine organism (except within Subzone B), damaging or disturbing any geological features, anchoring of boats in Subzone A (may be anchored in Subzone B only in sand).	The Navy conducts no activities in this area.
West Hawaii Regional Fishery Management Area	Hawaii	Focal Resource	Prohibited: unpermitted uses of lay nets and aquarium collections.	The Navy conducts no activities in this area.

Note: [1]ASBS - Area of Special Biological Significance

Implementation of the Proposed Action would require fuels used by aircraft and vessels. Since fixed- and rotary-wing aircraft and ship activities could increase relative to the baseline, total fuel use would increase. Therefore, total fuel consumption would increase under the Proposed Action (see Section 6.4), and this nonrenewable resource would be considered irretrievably lost (see Chapter 4, Cumulative Impacts) and the following discussion on the Navy's Climate Change Roadmap).

6.4 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL OF ALTERNATIVES AND MITIGATION MEASURES

The federal government consumes two percent of the total U.S. energy share (Jean 2010). Of that 2 percent, the DoD consumes 93 percent. The Navy consumes one quarter of the total DoD share. The Navy consumes 1.2 billion to 1.6 billion gallons of fuel each year. The Navy expects a 25 percent increase in fuel consumption in the future because of new ships coming into the fleet and the growth in mission areas (Jean 2010).

Increased training and testing activities within the Study Area would result in an increase in energy demand over the No Action Alternative. The increased energy demand would arise from an increase in fuel consumption, mainly from aircraft and vessels participating in training and testing. Details of fuel consumption by training and testing activities on an annual basis are set forth in the air quality emissions calculation spreadsheets available on the project website. Vessel and aircraft fuel consumption is estimated to increase by 6.9 and 5.8 million gallons per year under Alternative 1 and Alternative 2, respectively, when compared to the No Action Alternative. Conservative assumptions were made in developing the estimates, and therefore the actual amount of fuel consumed during training and testing events may be less than estimated. Nevertheless, the demand for fuel consumption would increase from baseline levels, given the proposed increases in training and testing activities.

Energy requirements would be subject to any established energy conservation practices. The use of energy sources has been minimized wherever possible without compromising safety, training, or testing activities. No additional conservation measures related to direct energy consumption by the proposed activities are identified.

The Navy is committed to improving energy security and environmental stewardship by reducing its reliance on fossil fuels. The Navy is actively developing and participating in energy, environmental, and climate change initiatives that will increase use of alternative energy and help conserve the world's resources for future generations. The Navy Climate Change Roadmap identifies actions the Environmental Readiness Division is taking to implement EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*. The Navy's Task Force Energy is responding to the Secretary of the Navy's Energy Goals through energy security initiatives that reduce the Navy's carbon footprint.

Two Navy programs—the Incentivized Energy Conservation Program and the Naval Sea Systems Command's Fleet Readiness, Research and Development Program—are helping the fleet conserve fuel via improved operating procedures and long-term initiatives. The Incentivized Energy Conservation Program encourages the operation of ships in the most efficient manner while conducting their mission and supporting the Secretary of the Navy's efforts to reduce total energy consumption on naval ships. The Naval Sea Systems Command's Fleet Readiness, Research, and Development Program includes the High-Efficiency Heating, Ventilating, and Air Conditioning and the Hybrid Electric Drive for DDG-51 class ships, which are improvements to existing shipboard technologies that will both help with fleet readiness and decrease the ships' energy consumption and greenhouse gas emissions. These initiatives are expected to greatly reduce the consumption of fossil fuels (see Section 3.02, Air Quality). Furthermore, to offset the impact of its expected near-term increased fuel demands and achieve its goals to reduce fossil fuel consumption and greenhouse gas emissions, the Navy plans to deploy by 2016 a green strike group (a "great green fleet") composed of nuclear vessels and ships powered by biofuel in local operations and with aircraft flying only with biofuels (Jean 2010).

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Jeremy Farr (Parsons Infrastructure and Technology), Environmental Planner
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Years of Experience: 3

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Years of Experience: 19

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Years of Experience: 30

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M.S., Marine Science, Moss Landing Marine Labs, San Francisco State University
B.S., Wildlife and Fisheries Biology, University of California at Davis
Years of Experience: 20

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B.S., Natural Resource Management
Years of Experience: 12

Donald Jolly (Parsons Infrastructure and Technology), Principal Archaeologist
M.S., Quaternary Studies
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Ph.D., Ecology, Evolution & Behavior, The Graduate School, City University of New York
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Years of Experience: 7

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M.S., Wildlife Science, Oregon State University
Years of Experience: 13

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Ph.D., Entomology, Ohio State University
Years of Experience: 24

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B.A., Biology, University of California at Santa Cruz
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M.A.S., Marine Biodiversity and Conservation, Scripps Institution of Oceanography, University of California, San Diego
B.S., Environmental Science, University of California, Berkeley
Years of Experience: 4

Suzanne Villacorta (Tetra Tech, Inc.), Regulatory Analyst and Environmental Scientist
J.D., Syracuse University College of Law
Years of Experience: 15

Karen Waller (ManTech SRS Technologies, Inc.), Vice President/Quality Assurance
B.S., Public and Environmental Affairs, Indiana University
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B.S., Administrative Management, University of Arkansas
B.S., Industrial Management, University of Arkansas
Years of Experience: 26

Lawrence Wolski (ManTech SRS), Marine Scientist
M.S., 1999, Marine Sciences, University of San Diego
B.S., 1994, Biology, Loyola Marymount University
Years of Experience: 14

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B.S., Physics, College of William and Mary
Years of Experience: 14

Ann Zoidis (Tetra Tech, Inc.), Senior Biologist
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Years of Experience: 24

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B.S., Organismic Biology and Ecology, Florida Atlantic University
Years of Experience: 9

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APPENDIX A NAVY ACTIVITIES DESCRIPTIONS

The Navy's activities can generally be categorized as either training or testing. Training activities involve Navy service members employing tactics and established weapons systems in a realistic manner to prepare for combat or similar situations. Testing activities, which include research, development, test, evaluation, and experimentation, are performed to ensure that U.S. military forces have the latest technologies with which to engage in hostile or hazardous situations.

The descriptions that follow are intended to provide a better understanding of each training and testing activity commonly conducted by naval forces.

The Navy's training activities are organized generally into eight primary mission areas and a miscellaneous category (other training) that includes those activities that don't fall within one of the eight primary mission areas, but are an essential part of Navy training. Many of the activities described here may have a land component, occurring both at sea and on or over land. In this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS), only the at-sea component is analyzed.

In addition, because the Navy conducts a number of activities within major range events, descriptions of those major range events are also included in this appendix. It is important to note that these major range events are comprised entirely of individual activities described in the primary mission areas.

A.1.1 ANTI-AIR WARFARE TRAINING

Anti-air warfare is the primary mission area that addresses combat operations by air and surface forces against hostile aircraft. Navy ships contain an array of modern anti-aircraft weapon systems, including naval guns linked to radar-directed fire-control systems, surface-to-air missile systems, and radar-controlled cannons for close-in point defense. Strike/fighter aircraft carry anti-aircraft weapons, including air-to-air missiles and aircraft cannons. Anti-air warfare training encompasses events and exercises to train ship and aircraft crews in employment of these weapons systems against simulated threat aircraft or targets. Anti-air warfare training includes surface-to-air gunnery, surface-to-air and air-to-air missile exercises, and aircraft force-on-force combat maneuvers.

A.1.1.1 Air Combat Maneuver

Activity Name	Activity Description	
Anti-Air Warfare		
Air Combat Maneuver	**Short Description:** Aircrews engage in flight maneuvers designed to gain a tactical advantage during combat.	
Long Description	Basic flight maneuvers where aircrew engage in offensive and defensive maneuvering against each other. During an air combat maneuver engagement, no ordnance is fired, countermeasures such as chaff and flares may be used. These maneuvers typically involve two aircraft; however, based upon the training requirement, air combat maneuver exercises may involve over a dozen aircraft. Participants typically are two or more aircraft. No weapons are fired.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft (e.g., F/A-18, F-35, F-5) **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1 to 2 hours	**Location:** Hawaii Range Complex: Warning Areas: 188,189, 190,192, 193, 194 Southern California Range Complex: Warning Area 291 (Tactical Maneuvering Areas)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:**	
Detailed Military Expended Material Information	None anticipated	
Assumptions used for Analysis	No munitions fired. Flare and chaff may be used. All flare and chaff accounted for in flare exercise and chaff exercise events.	

A.1.1.2 Air Defense Exercise

Activity Name	**Activity Description**	
Anti-Air Warfare		
Air Defense Exercises	**Short Description:** Air and vessel crews conduct defensive measures against threat aircraft or missiles.	
Long Description	Air and vessel personnel perform measures designed to defend against attacking threat aircraft or missiles or reduce the effectiveness of such attack. This exercise involves full detection though engagement sequence. Aircraft operate at varying altitudes and speeds. This exercise may include Air Intercept Control exercises which involve aircraft controllers on vessels, in fixed wing aircraft or at land based locations, use search radars to track and direct friendly aircraft to intercept the threat aircraft, and Detect to Engage exercises in which personnel on vessels use their search radars in the process of detecting, classifying, and tracking enemy aircraft or missiles up to the point of engagement.	
Information Typical to the Event	**Platform:** Fixed wing aircraft (e.g., FA-18, F-35, E-2), Surface vessels (all) **Systems:** None **Ordnance/Munitions:** None **Targets:** Other aircraft, unmanned drones **Duration:** 1 to 4 hours	**Location:** Hawaii Range Complex : Warning Areas: 188,189, 190,192, 193, 194 Southern California Range Complex: Warning Area 291
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information		
Assumptions used for Analysis	No weapons fired	

A.1.1.3 Gunnery Exercise (Air-to-Air)

Activity Name	Activity Description	
Anti-Air Warfare		
Gunnery Exercise (Air-to-Air) Medium caliber	**Short Description:** Aircrews defend against threat aircraft with cannons (machine gun).	
Long Description	Fighter jet aircrews defend against threat aircraft with cannons (machine gun). An event involves two or more fighter aircrafts and a target banner towed by a contracted aircraft (e.g., Lear jet). The banner target is recovered after the event.	
Information Typical to the Event	**Platform:** Fixed- wing aircraft (e.g., FA-18C, F-35) **Systems:** None **Ordnance/Munitions:** Medium-caliber munition (non-explosive) **Targets:** Towed banner **Duration:** 1 to 2 hours	**Location:** Southern California Range Complex: Warning Area 291
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material (non-explosive projectile) strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Medium caliber projectiles, Casings	
Detailed Military Expended Material Information	Projectiles Casings	
Assumptions used for Analysis	Only non-explosive munitions used Target is recovered	

A.1.1.4 Missile Exercise (Air-to-Air)

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Air Warfare</td></tr>
<tr><td>Missile Exercise (Air-to-Air)</td><td colspan="2">Short Description:
Aircrews defend against threat aircraft with missiles.</td></tr>
<tr><td>Long Description</td><td colspan="2">An event involves two or more jet aircraft and a target. Missiles have either a high explosive warhead or are non-explosive practice munitions. The target is either an unmanned aerial target drone (e.g.: BQM-34, BQM-74), a Tactical Air-Launched Decoy, or a parachute suspended illumination flare. Target drones deploy parachutes and are recovered by boat or helicopter; Tactical Air-Launched Decoys and illumination flares are expended and not recovered. These events typically occur at high altitudes.
Anti-air missiles may also be employed when training against threat missiles.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Fixed wing aircraft (e.g., FA-18C, F-35)
Systems: None
Ordnance/Munitions: Anti-air missiles (e.g., AIM-7, AIM-9, AIM-120, AIM-132 [non-explosive and high explosive])
Targets: BQM-34, BQM-74, Tactical Air-Launched Decoy, illumination flare (e.g., LUU-2)
Duration: 1 to 2 hours</td><td>Location:
Hawaii Range Complex: Warning Area 188
Southern California: Warning Area 291, Southern California Anti-submarine Warfare Range , Fleet Training Area Hot, Missile Range</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: None
Energy: None
Physical Disturbance and Strike: Military expended material strike (target and missile fragment), Aircraft strike (seabirds only)
Entanglement: Parachutes
Ingestion: Military expended materials (missile fragments, parachute, flare casing, target fragments)</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Missile and target fragments
Parachutes
Flare Casings</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">All missiles are explosive (Alternatives 1 and 2), and all missiles explode at high altitude
All propellant and explosives are consumed
Assume 1.5 flares per Missile Exercise event</td></tr>
</table>

A.1.1.5 Gunnery Exercise (Surface-to-Air) – Large Caliber

Activity Name	Activity Description	
Anti-Air Warfare		
Gunnery Exercise (Surface-to-Air) – Large Caliber	**Short Description:** Surface vessel crews defend against threat aircraft or missiles with large caliber guns.	
Long Description	Surface vessel personnel defend against threat aircraft or missile targets with guns to disable or destroy the threat. An event involves one vessel and a simulated threat aircraft or anti-vessel missile that is detected by the vessel's radar. Large caliber guns fire projectiles, either non-explosive or high explosive (configured to explode in air); to disable or destroy the threat before it reaches the vessel. The target is towed by a commercial air services jet.	
Information Typical to the Event	**Platform:** Surface combatant vessel (e.g., DDG, FFG, Littoral Combat Ship) **Systems:** None **Ordnance/Munitions:** Large caliber (e.g., 5-inch gun, 76 mm, 57 mm [non-explosive] under the No Action Alternative and high explosive under Alternatives 1 and 2) **Targets:** Towed banners behind aircraft **Duration:** 1 to 2 hours	**Location:** Hawaii Range Complex: Warning Areas 188, 192, Mela South Southern California Range Complex: Warning Area 291
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, Vessel noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles), Vessel strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Projectile fragments, Target fragments	
Detailed Military Expended Material Information	Projectiles Projectile fragments Target fragments	
Assumptions used for Analysis	All projectiles under the No Action Alternative are assumed to be non-explosive All projectiles under Alternatives 1 and 2 assumed to be high explosive. All projectiles explode well above surface	

A.1.1.6 Gunnery Exercise (Surface-to-Air) – Medium Caliber

Activity Name	Activity Description
Anti-Air Warfare	
Gunnery Exercise (Surface-to-Air) – Medium Caliber	**Short Description:** Surface vessel crews defend against threat aircraft or missiles with medium caliber guns.
Long Description	Surface vessel personnel defend against threat aircraft or missile targets with guns to disable or destroy the threat. An event involves one vessel and a simulated threat aircraft or anti-vessel missile that is detected by the vessel's radar. Medium caliber guns fire projectiles, typically non-explosive, to disable or destroy the threat before it reaches the vessel. The target is towed by a commercial air services jet.
Information Typical to the Event	**Platform:** Surface vessel (all) **Systems:** None **Ordnance/Munitions:** Medium caliber munitions (non-explosive) **Targets:** Towed banners behind aircraft **Duration:** 1 to 2 hours **Location:** Hawaii Range Complex: Warning Areas 188, 192, Mela South Southern California Range Complex: Warning Area 291
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise, Vessel noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles), Vessel strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Projectiles, Casings
Detailed Military Expended Material Information	Projectiles Casings
Assumptions used for Analysis	All projectiles non explosive. Close In Weapon System employed in all events. Routine Close In Weapon System maintenance related firing can occur throughout study area, as long as a clear range is established.

A.1.1.7 Missile Exercise (Surface-to-Air)

Activity Name	Activity Description	
Anti-Air Warfare		
Missile Exercise (Surface-to-Air)	**Short Description:** Surface vessel crews engage threat missiles and aircraft with missiles.	
Long Description	Surface vessel crews defend against threat missiles and aircraft with vessel launched missiles. The event involves a simulated threat aircraft or anti-ship missile which is detected by the vessel's radar. Vessel launched anti-air missiles are fired (high explosive) to disable or destroy the threat. The target typically is a remote controlled drone. Anti-Air missiles may also be used to train against land attack missiles.	
Information Typical to the Event	**Platform:** Surface vessels (all) **Systems:** None **Ordnance/Munitions:** Anti-air missiles (e.g., Sea Sparrow, Standard Missile SM-2, Rolling Airframe Missile [high explosive]) **Targets:** Unmanned drones (e.g., BQM-34, BQM-74) **Duration:** 1 to 2 hours	**Location:** Hawaii Range Complex: Warning Area 188 Southern California Range Complex: Warning Area 291
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (missile fragments), Vessel strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Missile fragments,	
Detailed Military Expended Material Information	Missile fragments,	
Assumptions used for Analysis	Assume all anti-air missiles are high explosive. Missile explodes well above surface. All explosive and propellant consumed. Target typically not destroyed, unmanned drones are recovered.	

A.1.1.8 Missile Exercise - Man-portable Air Defense System

Activity Name	**Activity Description**	
Anti-Air Warfare		
Missile Exercise-Man Portable Air Defense System	**Short Description:** Marines employ the man-portable air defense systems, a shoulder fired surface to air missile, against threat missiles or aircraft.	
Long Description	Marines employ the man-portable air defense systems, a shoulder fired surface to air missile, against threat missiles or aircraft. An event involves Marines firing the man-portable air defense system at remote piloted or ballistic aerial targets. Missile Exercise-Man Portable Air Defense System may also be conducted by combat forces from shore locations. The exercise may involve live fire or tracking only, without the firing of an actual missile.	
Information Typical to the Event	**Platform:** **Systems:** Man Portable Defense Systems **Ordnance/Munitions:** Stinger or other Man Portable missiles (explosive) **Targets:** Remotely piloted target, Ballistic aerial target **Duration:**	**Location:** Southern California Range Complex: Shore Bombardment Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** Missile and target fragments **Entanglement:** None **Ingestion:** Missile and target fragments	
Detailed Military Expended Material Information	Missile and target fragments	
Assumptions used for Analysis		

A.1.2 AMPHIBIOUS WARFARE TRAINING

Amphibious warfare is a type of naval warfare involving the utilization of naval firepower and logistics, and Marine Corps landing forces to project military power ashore. Amphibious warfare encompasses a broad spectrum of operations involving maneuver from the sea to objectives ashore, ranging from reconnaissance or raid missions involving a small unit, to large-scale amphibious operations involving over one thousand Marines and Sailors, and multiple ships and aircraft embarked in a Strike Group.

Amphibious warfare training includes tasks at increasing levels of complexity, from individual, crew, and small unit events to large task force exercises. Individual and crew training include the operation of amphibious vehicles and naval gunfire support training. Small-unit training operations include events leading to the certification of a Marine Expeditionary Unit as “deployment ready” or “special operations capable”, depending on if Marine Special Forces are attached to the unit. Such training includes shore assaults, boat raids, airfield or port seizures, and reconnaissance. Larger-scale amphibious exercises involve ship-to-shore maneuver, shore bombardment and other naval fire support, and air strike and close air support training.

A.1.2.1 Fire Support Exercise Land-based Target

Activity Name	**Activity Description**
Amphibious Warfare	
Naval Surface Fire Support Exercise (Land)	**Short Description:** Surface vessel crews use large caliber guns to fire on land-based targets in support of forces ashore.
Long Description	Surface vessel crews use small, medium, and large caliber (main battery) guns to support forces ashore. One or more vessels position themselves up to six nautical miles from the target area and a land based spotter relays type and exact location of the target. After observing the fall of the shot, the spotter relays any adjustments needed to reach the target. Once the rounds are on target, the spotter requests a sufficient number to effectively destroy the target. This exercise occurs on land ranges where high explosive and non-explosive practice ordnance is authorized and is often supported by target shapes such as tanks, truck, trains, or aircraft on the ground.
Information Typical to the Event	**Platform:** Surface combatant vessels (e.g., CG, DDG) **Systems:** None **Ordnance/Munitions:** Small, medium, and large Caliber (explosive and non explosive) **Targets:** Other aircraft, Unmanned drones **Duration:** 4 to 6 hours **Location:** Southern California Range Complex: Shore Bombardment Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** Projectile casings
Detailed Military Expended Material Information	Casings
Assumptions used for Analysis	NO LAND BASED IMPACTS INCLUDED IN THIS DOCUMENT-Projectile impact is on the land and is not further analyzed for this DEIS/OEIS

A.1.2.2 Fire Support Exercise at Sea

Activity Name	Activity Description
Amphibious Warfare	
Naval Surface Fire Support Exercise (At Sea)	**Short Description:** Surface vessel crews use large caliber guns to support forces ashore; however, the land target is simulated at sea. Rounds are scored by passive acoustic hydrophones located at or near the target area.
Long Description	Surface vessel crews use large caliber guns to support forces ashore; however, the land target is simulated at sea. Rounds are scored by passive acoustic hydrophones located at or near the target area. The portable scoring system is comprised of sonobuoys (Integrated Maritime Potable Acoustic Scoring and Simulation Buoys) set in a pre-designed pattern at specific intervals, which are retrieved after the exercise. An onboard scoring system provides a realistic presentation, such as a land mass with topography, to the vessel's combat system. This virtual land target area overlays the sonobuoy array. The vessel fires its ordnance into the target area and the acoustic noise resulting from the impact of the round landing in the water is detected by the sonobuoys. The global positioning system position and bearing of the impact is transmitted to the vessel and the onboard scoring system triangulates the exact point of impact of the round, allowing the exercise to be conducted as if the vessel were firing at an actual land target. Surface vessel crews use large caliber (main battery) guns to support forces ashore.
Information Typical to the Event	**Platform:** Surface combatant vessels (e.g., DDG, CG), Rigid hull inflatable boat (for recovering buoys) **Systems:** None **Ordnance/Munitions:** Large caliber (5-inch rounds) explosive and non explosive **Targets:** Integrated Maritime Potable Acoustic Scoring and Simulation Buoys **Duration:** 2 to 4 hours of firing, 18 hours total **Location:** Hawaii Range Complex: Warning Area-188 (including Barking Sands Underwater Range Extension and Barking Sands Tactical Underwater Range)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles and projectile fragments), Vessel strike **Entanglement:** None **Ingestion:** Projectile fragments
Detailed Military Expended Material Information	Projectiles Projectile fragments
Assumptions used for Analysis	Events occur greater than 12 nautical miles from shore Non-explosive practice munitions may be used when Integrated Maritime Potable Acoustic Scoring and Simulation Buoys can detect projectile splash. High explosives will be used during all other events Assume all explosive rounds detonate on impact with water surface

A.1.2.3 Amphibious Assault

Activity Name	Activity Description	
Amphibious Warfare		
Amphibious Assault	**Short Description:** Forces move ashore from vessels at sea for the immediate execution of inland objectives.	
Long Description	Landing forces embarked in vessels, craft, or helicopters launch an attack from the sea onto a hostile shore. Amphibious assault is conducted for the purposes of prosecuting further combat operations, obtaining a site for an advanced naval or airbase, or denying the enemy use of an area. Unit Level Training exercises involve one or more amphibious vessels, and their associated watercraft and aircraft, to move personnel and equipment from vessel to shore without the command and control and supporting elements involved in a full scale event. The goal is to practice loading, unloading, and movement and to develop the timing required for a full-scale exercise.	
Information Typical to the Event	**Platform:** Amphibious and landing vessels (e.g., LHA, LHD, LPD, LSD), Amphibious vehicles, Rotary wing aircraft **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 2 weeks	**Location:** Hawaii Range Complex: Pacific Missiles Range Facility (Main Base), Marine Corps Base Hawaii, Marine Corps Training Area Bellows Southern California Range Complex Silver Strand Training Complex: Boat Lanes 11-14
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike; Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None anticipated	
Assumptions used for Analysis	Typical event: One to three amphibious vessels (e.g., LHA or LHD, LPD, LSD); two to eight landing craft (Landing Craft, Air Cushioned; Landing Craft, Utility); four to 14 amphibious assault vehicles; up to 22 aircraft (e.g., MH-53, H-46/MV-22, AH-1, UH-1, AV-8); a Marine Expeditionary Unit (2,200 Marines)	

A.1.2.4 Amphibious Assault – Battalion Landing

Activity Name	Activity Description	
Amphibious Warfare		
Amphibious Assault – Battalion Landing	**Short Description:** Marine Corps Battalion Landing Team forces launch an attack from sea to a hostile or potentially hostile shore for the immediate execution of inland maneuver.	
Long Description	Marine Corps Battalion Landing Team moves from amphibious vessels at sea, into hostile territory, establish a beachhead, then occupy the area, or move further inland for an extended period. Battalion Landing Team is a task organization composed of an infantry battalion reinforced by combat support and Combat Service Support units for amphibious assaults. The Battalion Landing Team is the ground force element of a Marine expeditionary unit when formed into a Marine air-ground task force.	
Information Typical to the Event	**Platform:** Amphibious vessels **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 4 days	**Location:** Southern California Range Complex: San Clemente Island, Shore Bombardment Area, Shallow Water Training Range (Nearshore),Eel Cove, West Cove, Wilson Cove
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information		
Assumptions used for Analysis		

A.1.2.5 Amphibious Raid

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Amphibious Warfare</td></tr>
<tr><td>Amphibious Raid</td><td colspan="2">Short Description:
Small unit forces move swiftly from vessels at sea for a specific short term mission. These are quick operations with as few personnel as possible.</td></tr>
<tr><td>Long Description</td><td colspan="2">Small unit forces swiftly move from amphibious vessels at sea into hostile territory for a specific mission, including a planned withdrawal. Raids are conducted to inflict loss or damage, secure information, create a diversion, confuse the enemy, or capture or evacuate individuals or material. Amphibious raid forces are kept as small as possible to maximize stealth and speed of the operation.
An event may employ assault amphibian vehicle units, small boat units, small unit live-fire and non-live-fire operations. Surveillance or reconnaissance unmanned surface and aerial vehicles may be used during this event.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Amphibious assault vessels (e.g., LHA, LHD), Amphibious transport dock and dock landing ships (e.g., LPD, LSD), Amphibious vehicles (Landing Crafts, Air Cushioned, and amphibious assault vehicles), Small boats (e.g., rigid hull inflatable boats)
Systems: Unmanned surface and aerial vehicles
Ordnance/Munitions: Non-explosive practice munitions
Targets: None
Duration: 4 to 8 hours</td><td>Location:
Hawaii Range Complex: Pacific Missile Range Facility (Main Base), Marine Corps Base Hawaii, Marine Corps Training Area Bellows
Silver Strand Training Complex: Boat Lanes 1-8, 11-14 (Bravo, Delta I, II, III, Echo, Fox, Golf, Hotel)
Southern California Range Complex: West Cove, Horse Beach Cove, North West Harbor, Camp Pendleton Amphibious Assault Area</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Vessel noise, weapons firing noise
Energy: None
Physical Disturbance and Strike: Vessel strike
Entanglement: None
Ingestion:</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None anticipated</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Firing of weapons during these events accounted for in gunnery exercises, surface to surface activities</td></tr>
</table>

A.1.2.6 Expeditionary Fires Exercise/Supporting Arms Coordination Exercise

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Amphibious Warfare</td></tr>
<tr><td>Expeditionary Fires Exercise/Supporting Arms Coordination Exercise</td><td colspan="2">Short Description:
Military units provide integrated and effective close air support, Naval Surface Fire Support fire, and Marine Corps artillery fire in support of amphibious operations.</td></tr>
<tr><td>Long Description</td><td colspan="2">Military units provide integrated and effective close air support, Naval Surface Fire Support fire, and Marine Corps artillery fire in support of amphibious operations.
The mission of the exercises is to achieve effective integration of Naval gunfire, close air support, and Marine Corps artillery fire support.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface vessels, 4 AH-1Ws attack rotary wing aircraft, 6 fixed-wing strike fighter or attack aircraft
Systems:
Ordnance/Munitions: Large caliber (e.g., howitzers, 81 mm mortars, 5-inch rounds, MK-80 series bombs [explosive and non explosive])
Targets: None
Duration: 8 days</td><td>Location:
Southern California Range Complex: San Clemente Island, Shore Bombardment Area, Shallow Water Training Range (Nearshore)</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: None
Energy: None
Physical Disturbance and Strike:
Entanglement: None
Ingestion:</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Large caliber rounds</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">NOT APPLICABLE TO THIS DOCUMENT – NO LAND BASED IMPACTS INCLUDED IN THIS DOCUMENT</td></tr>
</table>

A.1.2.7 Humanitarian Assistance Operations

Activity Name	Activity Description	
Amphibious Warfare		
Humanitarian Assistance Operation/Non-Combatant Evacuation Operation	**Short Description:** Military units evacuate noncombatants from hostile or unsafe areas or provide humanitarian assistance in times of disaster.	
Long Description	Military units evacuate noncombatants from hostile or unsafe areas to safe havens or to provide humanitarian assistance in times of disaster. Non-Combatant Evacuation Operation is conducted by military units (generally Marine Corps) usually operating in conjunction with Navy ships and aircraft. Non-combatants are evacuated when their lives are endangered by war, civil unrest, or natural disaster. Marine Corps Marine expeditionary unit train for evacuations in hostile environments that require the use of force, though usually there is no opposition to evacuation from the host country. Helicopters and landing crafts could be expected to participate in this operation during day or night. No ordnance is used.	
Information Typical to the Event	**Platform: Systems:** Rotary and fixed-wing aircraft **Ordnance/Munitions:** None **Targets:** None **Duration:**	**Location:** Hawaii Range Complex: Pacific Missiles Range Facility (Main Base), Niihau, Marine Corps Base Hawaii, Marine Corps Training Area Bellows Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis		

A.1.3 Strike Warfare Training

Strike warfare includes training of fixed-wing fighter/attack aircraft or rotary-wing aircraft in delivery of precision guided munitions, non-guided munitions, rockets, and other ordnance against land targets in all weather and light conditions. Training events typically involve a simulated strike mission with a flight of four or more aircraft. The strike mission may simulate attacks on “deep targets” (i.e., those geographically distant from friendly ground forces), or may simulate close air support of targets within close range of friendly ground forces. Laser designators from aircraft or ground personnel may be employed for delivery of precision guided munitions. Some strike missions involve no-drop events in which prosecution of targets is simulated, but video footage is often obtained by onboard sensors.

A.1.3.1 Bombing Exercise (Air-to-Ground)

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Strike Warfare</td></tr>
<tr><td>Bombing Exercise (Air-to-Ground)</td><td colspan="2">Short Description:
Bombing exercise involves training of strike fighter aircraft delivery of ordnance against land targets in day or night conditions.</td></tr>
<tr><td>Long Description</td><td colspan="2">Bombing exercise involves training of strike fighter aircraft delivery of ordnance against land targets in day or night conditions. The bombing exercise may involve close air support training in direct support of and in close proximity to forces on the ground, such as Navy or Marine forces engaged in training exercises on land, and may include the use of targeting laser.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Fixed wing strike fighter,
Systems: Targeting laser systems
Ordnance/Munitions: MK-76, BDU-45, and BDU-45 (non explosive), and MK-80 series bombs (explosive)
Targets: Land Targets
Duration: 1 to 2 hours</td><td>Location:
Hawaii Range Complex: Kaula Rock</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Aircraft noise
Energy: Targeting laser
Physical Disturbance and Strike: Military expended materials (non-explosive munitions) (seabirds only)
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Bomb and target fragments</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">The typical bomb release altitude is below 3,000 feet (914 meters) and within a range of 1,000 yards (914 meters) for unguided munitions
Only the in-water impacts of strike warfare activities are analyzed in the EIS/OEIS– NO LAND BASED IMPACTS INCLUDED IN THIS DOCUMENT</td></tr>
</table>

A.1.3.2 Gunnery Exercise (Air-to-Ground)

Activity Name	Activity Description
Strike Warfare	
Gunnery Exercise (Air-to-Ground)	**Short Description:** Strike fighter aircraft and helicopter crews use guns to attack ground targets, day or night, with the goal of destroying or disabling enemy vehicles, structures, or personnel.
Long Description	Strike fighter aircraft and helicopter crews use guns to attack ground targets, day or night, with the goal of destroying or disabling enemy vehicles, structures, or personnel. A flight of two strike fighter aircraft will begin its descent to the target from an altitude of about 3,000 feet (914 meters) while still several miles away. Within a distance of 4,000 feet (1,219 meters) from the target, each aircraft will fire a burst of rounds before reaching an altitude of 1,000 feet (305 meters), then break off and reposition for another strafing run until each aircraft expends its exercise ordnance allowance. This exercise may include the use of targeting laser.
Information Typical to the Event	**Platform:** Fixed wing strike fighter, Rotary aircraft **Systems:** **Ordnance/Munitions:** Small and medium caliber, weapons (e.g., 20/25 mm, 50-caliber, and 7.63 mm) **Targets:** Land Targets **Duration:** 1 hour **Location:** Hawaii Range Complex: Kaula Rock
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft Noise **Energy:** Targeting laser **Physical Disturbance and Strike:** Military expended materials(non-explosive munitions)**Entanglement:** None **Ingestion:** Projectile casings
Detailed Military Expended Material Information	Small-caliber projectiles
Assumptions used for Analysis	Only the in-water impacts of strike warfare activities are analyzed in the EIS/OEIS– NO LAND BASED IMPACTS INCLUDED IN THIS DOCUMENT.

A.1.4 ANTI-SURFACE WARFARE TRAINING

Anti-surface warfare is a type of naval warfare in which aircraft, surface ships, and submarines employ weapons and sensors in operations directed against enemy surface ships or boats. Air-to-surface exercises are conducted by long-range attacks using air-launched cruise missiles or other precision guided munitions, or using aircraft cannon. Anti-surface warfare also is conducted by warships employing torpedoes, naval guns, and surface-to-surface missiles. Submarines attack surface ships using torpedoes or submarine-launched, anti-ship cruise missiles. Training in anti-surface warfare includes surface-to-surface gunnery and missile exercises, air-to-surface gunnery and missile exercises, and submarine missile or torpedo launch events. Gunnery and missile training generally involves expenditure of ordnance against a towed target. A sinking exercise is a specialized training event that provides an opportunity for ship, submarine, and aircraft crews to use multiple weapons systems to deliver high explosive ordnance on a deactivated vessel, which is deliberately sunk.

Anti-surface warfare also encompasses maritime security, that is, the interception of a suspect surface ship by a Navy ship for the purpose of boarding-party inspection or the seizure of the suspect ship. Training in these tasks is conducted in visit, board, search and seizure exercises.

A.1.4.1 Maritime Security Operations

Activity Name	Activity Description	
Anti-Surface Warfare		
Maritime Security Operations	**Short Description:** Helicopter and surface vessel crews conduct a suite of Maritime Security Operations (e.g., visit, search, board, and seizure; maritime interdiction operations; force protection; and anti-piracy operation).	
Long Description	Helicopter and surface ship crews conduct a suite of Maritime Security Operations (e.g., visit search, board, and seizure; maritime interdiction operations; force protection; and anti piracy operation). These activities involve training of boarding parties delivered by helicopters and surface ships to surface vessels for the purpose of simulating vessel search and seizure operations. Various training scenarios are employed and may include small arms with non-explosive blanks and surveillance or reconnaissance unmanned surface and aerial vehicles. The entire exercise may last two to three hours. Vessel Visit, Board, Search, and Seizure: Military personnel from vessels and aircraft board suspect vessels, potentially under hostile conditions. Maritime Interdiction Operations: Vessels and aircraft train in pursuing, intercepting, and ultimately detaining suspect vessels. Oil Platform Defense: Naval personnel train to defend oil platforms or other similar at sea structures. Warning Shot/Disabling Fire: Naval personnel train in the use of weapons to force fleeing or threatening small boats (typically operating at high speeds) to come to a stop. Ship Force Protection: Vessel crews train in tracking multiple approaching, circling small craft, assessing threat potential, and communicating amongst crewmates and other vessels to ensure vessels are protected against attack. Anti Piracy Training: Naval personnel train in deterring and interrupting piracy activity. Training includes large vessels (pirate "mother ships"), and multiple small, maneuverable, and fast craft.	
Information Typical to the Event	**Platform:** Surface vessel (any), Rotary wing aircraft, Small boats, High speed vessels, Unmanned vehicles (surface and aerial) **Systems:** None **Ordnance/Munitions:** Small caliber (non-explosive) **Targets:** Range support vessel, High performance boats, Unmanned vessels **Duration:** Up to 3 hours	**Location:** Hawaii Operating Area Southern California Range Complex: W-291, Operating Area 3803, Southern California Anti-Submarine Warfare Range Silver Strand Training Complex: Boat Lanes 1-10
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Aircraft noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles), Vessel strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Small caliber projectiles, Casings	
Detailed Military Expended Material Information	Small caliber projectiles Casings	

Assumptions used for Analysis	Maritime security operations is a broad term used to describe activities intended train naval forces in the skills necessary to protect naval vessels from small boat attack, counter piracy and drug operations (maritime interdiction operations and visit, board, search, and seizure), and protect key infrastructure (e.g. oil platforms). Maritime security operations need to remain broad as naval forces need to be able to tailor training events to respond to emergent threats. Maritime security operations events typically do not involve live fire of weapons. All maritime security operations events involve vessel movement, sometimes at high rates of speed (naval vessels maneuvering to overtake suspect vessel and/or small boats (targets) closing in and maneuvering around naval vessels), and some event involve helicopters and boarding parties. Maritime security operations training events are conducted proximate to naval homeports (San Diego, California) including during times of transit in and out of port, as well as during major training events.

A.1.4.2 Gunnery Exercise Surface-to-Surface (Ship) – Small Caliber

Activity Name	Activity Description	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Ship) – Small Caliber	**Short Description:** Vessel crews engage surface targets with vessel's small caliber guns designed to provide close range defense against patrol boats, smaller boats, swimmers, and floating mines.	
Long Description	This exercise involves vessel crews engaging surface targets at sea with small caliber (0.50 caliber or smaller) weapons. Vessels use small caliber weapons to practice defensive marksmanship, typically against stationary floating targets. The target may be a 10-foot diameter red balloon (Killer Tomato), a 50 gallon steel drum, or other available target, such as a cardboard box. Some targets are expended during the exercise and are not recovered. Vessel crew qualifications conducted at sea employ stationary targets on deck. Small caliber projectiles fired during these events will be expended in the water. Shipboard protection systems utilizing small caliber projectiles will train against high speed mobile targets.	
Information Typical to the Event	**Platform:** Surface vessels **Systems:** None **Ordnance/Munitions:** Small caliber (non-explosive) **Targets:** Recoverable or expendable floating target (stationary or towed), Remote controlled high speed targets **Duration:** 2 to 3 hours	**Location:** Hawaii Range Complex: Warning Areas -188, 191, 192, 193, 194, 196, Mela South Southern California Range Complex: Warning Area-291, Southern California Anti-Submarine Warfare Range, Shore Bombardment Area HSTT Transit Corridor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike, Military expended material strike (projectile), Target strike **Entanglement:** None **Ingestion:** Small caliber projectiles, Casings, Target fragments	
Detailed Military Expended Material Information	Small caliber projectiles Casings Target fragments	
Assumptions used for Analysis	Small caliber gun rounds per event: 1,000 to 3,000 non-explosive practice munitions Majority of events will occur proximate to Naval stations	

A.1.4.3 Gunnery Exercise Surface-to-Surface (Ship) – Medium Caliber

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Surface Warfare</td></tr>
<tr><td>Gunnery Exercise Surface-to-Surface (Ship) – Medium Caliber</td><td colspan="2">Short Description:
Vessel crews engage surface targets with vessel's medium caliber guns designed to provide close range defense against patrol boats, smaller boats, swimmers, and floating mines.</td></tr>
<tr><td>Long Description</td><td colspan="2">This exercise involves vessel crews engaging surface targets at sea with medium caliber (larger than 0.50 calibers up to 56 mm) weapons.
Vessels use medium caliber weapons to practice defensive marksmanship, typically against a stationary floating target (a 10-foot diameter red balloon [Killer Tomato]) and high speed mobile targets. Some targets are expended during the exercise and are not recovered.
Shipboard protection systems (Close In Weapon System) utilizing medium caliber projectiles will train against high speed mobile targets.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface vessels
Systems: None
Ordnance/Munitions: Medium caliber (high explosive or non-explosive)
Targets: Recoverable and expendable floating target (stationary or towed), Remote control high-speed targets
Duration: 2 to 3 hours</td><td>Location:
Hawaii Range Complex: Warning Areas -188, 191, 192, 193, 194, 196, Mela South
Southern California Range Complex: Warning Area-291, Southern California Anti-Submarine Warfare Range, Shore Bombardment Area
HSTT Transit Corridor</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Underwater explosives, Vessel noise, Weapons firing noise
Energy: None
Physical Disturbance and Strike: Vessel strike, Target strike, Military expended material strike (projectiles)
Entanglement: None
Ingestion: Medium caliber projectiles and casings, Target fragments, Projectile fragments</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Medium caliber projectiles and casings, Target fragments, Projectile fragments
Approximately 200 medium-caliber rounds per event
One target used per event. Approximately 50 percent of targets are “Killer Tomatoes” (usually recovered). Approximately 35 percent are high-speed maneuvering targets, which are recovered. Approximately 15 percent of targets are other stationary targets such as a steel drum</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2"></td></tr>
</table>

A.1.4.4 Gunnery Exercise Surface-to-Surface (Ship) – Large Caliber

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Surface Warfare</td></tr>
<tr><td>Gunnery Exercise Surface-to-Surface (Ship) – Large Caliber</td><td colspan="2">Short Description:
Vessel crews engage surface targets with vessel's large caliber guns designed to provide defense against vessels, patrol boats, smaller boats.</td></tr>
<tr><td>Long Description</td><td colspan="2">This exercise involves vessels' gun crews engaging surface targets at sea with their main battery large caliber (typically 57 mm, 76 mm, and 5-inch) guns. Targets include the QST-35 seaborne powered target, high speed maneuverable surface target, or a specially configured remote controlled water craft. Some targets are expended during the exercise and are not recovered.
The exercise proceeds with the target boat approaching from about 10 nm distance. The target is tracked by radar and when within a predetermined range, it is engaged first with large caliber “warning shots”. As threats get closer all weapons may be used to disable the threat.
This exercise may involve a single firing vessel, or be undertaken in the context of a coordinated larger exercise involving multiple ships, including a major training event.
Large-caliber guns will also be fired during weapon certification events and in conjunction with weapon maintenance.
During all events, either high explosive or non-explosive rounds may be used. High explosive rounds can either be fused for detonation on impact (with water surface or target), or for proximity to the target (in air detonation).</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface vessels (e.g., CG, DDG, LCS)
Systems: None
Ordnance/Munitions: Large caliber (e.g., 57 mm, 76 mm, and 5-inch [high explosive and non-explosive])
Targets: Remote controlled high speed targets
Duration: Up to 3 hours</td><td>Location:
Hawaii Range Complex: Warning Areas -188, 191, 192, 193, 194, 196, Mela South
Southern California Range Complex: Warning Area-291, Southern California Anti-Submarine Warfare Range, Shore Bombardment Area
HSTT Transit Corridor</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Underwater explosions, Vessel noise, Weapons firing noise
Energy: None
Physical Disturbance and Strike: Vessel strike, Target strike, Military expended material strike (projectile)
Entanglement: None
Ingestion: Target fragments, Projectile fragments</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Large-caliber projectiles
Casings
Target fragments
Projectile fragments</td></tr>
</table>

Assumptions used for Analysis	For analytical purposes assume all high explosive rounds are fused to detonate upon impact with water surface or target After impacting the water, the high explosive rounds are expected to detonate within three feet of the surface. Non-explosive rounds and fragments from the high explosive rounds will sink to the bottom of the ocean For Alternative 2, analysis considers the introduction of (two) kinetic weapon equipped vessels being introduced to the fleet. Increases in events (six) and projectiles expended (240) reflect the likely training requirements of this new weapon system Assume each non-explosive projectile will be up to 5-inch diameter and 30-inch length, and each firing will also expend a metallic sleeve used to convey the projectile down the gun barrel

A.1.4.5 Gunnery Exercise Surface-to-Surface (Boat) – Small Caliber

Activity Name	**Activity Description**	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Boat) – Small Caliber	**Short Description:** Small boat crews engage surface targets with small caliber weapons.	
Long Description	Boat crews engage surface targets with small caliber weapons. Boat crews may use high or low speeds to approach and engage targets simulating other boats, swimmers, floating mines, or near shore land targets with small caliber (up to and including .50 caliber) weapons. A commonly used target is an empty steel drum. A number of different types of boats are used depending on the unit using the boat and their mission. Boats are most used to protect ships in harbors and high value units, such as: aircraft carriers, nuclear submarines, liquid natural gas tankers, etc., while entering and leaving ports, as well as to conduct riverine operations, and various naval special warfare operations. The boats used by these units include: small unit river craft, combat rubber raiding craft, rigid hull inflatable boats, patrol craft, and many other versions of these types of boats. These boats use inboard or outboard, diesel or gasoline engines with either propeller or water jet propulsion.	
Information Typical to the Event	**Platform:** Boats **Systems:** None **Ordnance/Munitions:** Small caliber (non-explosive]) **Targets:** Recoverable or expendable floating target **Duration:** 1 hour	**Location:** Southern California Range Complex: Warning Area-291, Southern California Anti-Submarine Warfare Range, Shore Bombardment Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, Target strike, Military expended material strike (projectile) **Entanglement:** None **Ingestion:** Projectiles, Casings, and Target fragments	
Detailed Military Expended Material Information	Small caliber projectiles Casings Target fragments	
Assumptions used for Analysis	*The specific areas are where activities typically occur. They can occur throughout the full area listed in Table 2.8-1 of Chapter 2. Majority of events will occur proximate to naval stations. Events will occur relatively near shore due to short range of boats and safety concerns. Events mostly occur within three nm of the shoreline, but can occur further from shore.	

A.1.4.6 Gunnery Exercise Surface-to-Surface (Boat) – Medium Caliber

Activity Name	**Activity Description**	
Anti-Surface Warfare		
Gunnery Exercise Surface-to-Surface (Boat) – Medium Caliber	**Short Description:** Small boat crews engage surface targets with medium caliber weapons.	
Long Description	Boat crews engage surface targets with medium caliber weapons. Boat crews may use high or low speeds to approach and engage targets simulating other boats, floating mines, or near shore land targets with medium caliber (up to and including 40mm) weapons. A commonly used target is an empty steel drum. A number of different types of boats are used depending on the unit using the boat and their mission. Boats are most used to protect ships in harbors and high value units, such as: aircraft carriers, nuclear submarines, liquid natural gas tankers, etc., while entering and leaving ports, as well as to conduct riverine operations, and various naval special warfare operations. The boats used by these units include: small unit river craft, combat rubber raiding craft, rigid hull inflatable boats, patrol craft, and many other versions of these types of boats. These boats use inboard or outboard, diesel or gasoline engines with either propeller or water jet propulsion.	
Information Typical to the Event	**Platform:** Boats **Systems:** None **Ordnance/Munitions:** Medium caliber (up to and including 40mm [explosive and non-explosive]) **Targets:** Recoverable or expendable floating target (stationary or towed) **Duration:** 1 hour	**Location:** Hawaii Range Complex: Warning Area - 188 Southern California Range Complex: Warning Area-291, Shore Bombardment Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions, Vessel noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectile), Vessel and in-water device strike **Entanglement:** None **Ingestion:** Projectiles and target fragments, Projectiles, Casings	
Detailed Military Expended Material Information	Projectiles and target fragments, Projectiles, Casings One target used per event, typically a stationary target such as a 50-gallon (189 liter) steel drum	
Assumptions used for Analysis	Assume all Alternatives 1 and 2 events include the use of some explosive rounds Most events will involve boat crews training with MK 203 40mm grenade launcher Most events will occur proximate to Navy homeports (San Diego)	

A.1.4.7 Missile Exercise Surface-to-Surface

Activity Name	Activity Description	
Anti-Surface Warfare		
Missile Exercise (Surface-to-Surface)	**Short Description:** Surface vessel crews defend against surface threats (vessels or boats) with missiles.	
Long Description	Surface vessels launch missiles at surface maritime targets with the goal of destroying or disabling enemy vessels or boats. After detecting and confirming a surface threat, the vessel will fire precision guided anti-surface missile. Events with destroyers and cruisers will involve long range (over the horizon) harpoon (or similar) anti surface missiles. While past harpoon events occurred during sinking exercises, requirement exists for non sinking exercise events to certify ship crews. If a sinking exercise target is unavailable, towed sled would likely be used. Events with Littoral Combat Ships will involve shorter range anti-surface missiles, similar to Hellfire missiles. Events with Littoral Combat Ships would be to certify vessel's crew to defend against "close in" (less than 10 miles) surface threats. These exercises are live fire, that is, a missile is fired down range. Anti-surface missiles could be equipped with either high explosive or non explosive warheads.	
Information Typical to the Event	**Platform:** Surface vessels (e.g., CG, DDG, LCS) **Systems:** None **Ordnance/Munitions:** Anti-surface missiles, Harpoons (explosive and non-explosive) **Targets:** High speed surface targets, Towed sleds **Duration:** 2 to 4 hours	**Location:** Hawaii Range Complex: Warning Area-188 Southern California Range Complex: Warning Area-291
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions, Vessel noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike; military expended material strike (missile, harpoon, and target, fragments) **Entanglement:** None **Ingestion:** Missile fragments, Target fragments, Harpoon fragments	
Detailed Military Expended Material Information	Missiles, Harpoons Missile fragments Target fragments	
Assumptions used for Analysis	Assume one missile and one target per event While missile could explode above water's surface after contacting target, analysis assumes all warheads explode at or just below surface	

A.1.4.8 Gunnery Exercise Air-to-Surface – Small Caliber

Activity Name	**Activity Description**	
Anti-Surface Warfare		
Gunnery Exercise (Air-to-Surface) – small caliber	**Short Description:** Helicopter aircrews, including embarked personnel, use small caliber guns to engage surface targets.	
Long Description	Helicopters, carrying several air crewmen, fly a racetrack pattern around an at-sea target. Each gunner will engage the target with small caliber weapons. Targets range from a smoke float, an empty steel drum, to high speed remote controlled boats and jet-skis.	
Information Typical to the Event	**Platform:** Helicopter **Systems:** None **Ordnance/Munitions:** Small caliber (non-explosive) **Targets:** Recoverable or expendable floating target (stationary or towed), Remote high speed target **Duration:** 1 hour	**Location:** Hawaii Range Complex: Warning Areas-188, 191, 192, 193, 194, 196, Mela South Southern California Range Complex: Southern California Anti-Submarine Warfare Range, (T-3, T-4, T-5, Mine Training Range-2), Warning Area-291
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** In-water device strike, Military expended material strike (projectiles), Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Projectiles, Target fragments, Casings	
Detailed Military Expended Material Information	Projectiles, Target fragments, Casings One target used per event. Expendable smoke float (50 percent), stationary target (45 percent), or remote controlled target (5 percent)	
Assumptions used for Analysis	Most events will occur proximate to Naval Stations where MH-60 helicopters are home based and target services are available	

A.1.4.9 Gunnery Exercise Air-to-Surface – Medium Caliber

Activity Name	**Activity Description**	
Anti-Surface Warfare		
Gunnery Exercise (Air-to-Surface) – medium caliber	**Short Description:** Fixed-wing and helicopter aircrew, including embarked personnel, use medium caliber guns to engage surface targets.	
Long Description	Fighter and helicopter aircrew, including embarked personnel, engage surface targets with medium caliber guns. Targets simulate enemy ships, boats, swimmers, and floating/near-surface mines. Fighter aircraft descend on a target firing high explosive or non-explosive practice munitions medium caliber projectiles. Helicopters, carrying several air crewmen, fly a racetrack pattern around an at-sea target. Crew will engage the target with medium caliber weapons. Targets range from a smoke float, an empty steel drum, to high speed remote controlled boats and jet-skis.	
Information Typical to the Event	**Platform:** Fixed wing (e.g., F/A-18, F-35); Helicopter (e.g., MH-60) **Systems:** None **Ordnance/Munitions:** Medium caliber (non-explosive and explosive) **Targets:** Recoverable or expendable floating target (stationary or towed), Remote high speed target **Duration:** 1 hour	**Location:** Hawaii Range Complex: Warning Areas-188, 191, 192, 193, 194, 196, Mela South Southern California Range Complex: Southern California Anti-Submarine Warfare Range, (T-3, T-4, T-5, Mine Training Range-2), Warning Area-291
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectile), In-water device strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Projectile, casings and target fragments	
Detailed Military Expended Material Information	Projectiles, Casings, Projectile and target fragments One target used per event. Expendable smoke float (50 percent), stationary target (45 percent), or remote controlled target (five percent)	
Assumptions used for Analysis	Most medium-caliber air to surface gunnery exercises will be with non-explosive training projectiles. High-explosive rounds will supplement when non-explosive training projectiles are not available	

A.1.4.10 Missile Exercise Air-to-Surface – Rocket

Activity Name	Activity Description
Anti-Surface Warfare	
Missile Exercise (Air-to-Surface) Rocket	**Short Description:** Fixed-wing and helicopter aircrew fire both precision-guided and unguided rockets against surface targets.
Long Description	Fighter, maritime patrol aircraft, and helicopter aircrews fire both precision-guided and unguided rockets against surface targets. Aircraft involved may be unmanned. Fixed wing aircraft (fighters or maritime patrol aircraft) approach an at-sea surface target from high altitude and launch high explosive or non explosive practice munitions precision guided rockets. Helicopters designate an at-sea surface target with a laser or optics for precision guided high explosive or non explosive practice munitions rockets.
Information Typical to the Event	**Platform:** Fixed wing (e.g., F-18, F-35, P-8, P-3, unmanned aerial vehicle) Helicopters (MH-60, Fire scout) **Systems:** None **Ordnance/Munitions:** Rockets (explosive or non-explosive) **Targets:** Recoverable floating target (stationary or towed) **Duration:** 1 hour **Location:** Hawaii Range Complex: Warning Area 188 Southern California Range Complex: Warning Area 291, Southern California Anti-Submarine Warfare Range, Fleet Training Area Hot, Missile Ranges
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions, Aircraft noise **Energy:** target Laser **Physical Disturbance and Strike:** In-water device strike, Military expended material strike (rocket) **Entanglement:** None **Ingestion:** Target fragments, Rocket fragments
Detailed Military Expended Material Information	Rockets Target fragments Rocket fragments
Assumptions used for Analysis	Assume all explosive rockets detonate in water. Assume all rockets under the No Action Alternative are non-explosive. Assume all rockets under Alternatives 1 and 2 are explosive Rockets may be used in conjunction with force protection events

A.1.4.11 Missile Exercise Air-to-Surface

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Surface Warfare</td></tr>
<tr><td>Missile Exercise (Air-to-Surface)</td><td colspan="2">Short Description:
Fixed-wing and helicopter aircrew fire precision-guided missiles against surface targets.</td></tr>
<tr><td>Long Description</td><td colspan="2">Fighter, maritime patrol aircraft, and helicopter aircrews fire both precision-guided missiles and unguided rockets against surface targets. Aircraft involved may be unmanned.
Fixed wing aircraft (fighters or maritime patrol aircraft) approach an at-sea surface target from high altitude, and launch high explosive precision guided missiles.
Helicopters designate an at-sea surface target with a laser or optics for a precision guided high explosive or non explosive practice munitions missile. Helicopter launched missiles typically pass through the targets “sail”, and if explosive, detonate at, or just below the water’s surface.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Fixed wing aircraft and helicopters
Systems: None
Ordnance/Munitions: Missiles (high explosive)
Targets: Recoverable floating target (stationary or towed), Remotely operated target
Duration: 2 hours</td><td>Location:
Hawaii Range Complex: Warning Area-188
Southern California range Complex: Shore Bombardment Area, Southern California Anti-Submarine Warfare Range (Laser Training Range 1/2)</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Underwater explosions, Aircraft noise, tow vessel noise
Energy: None
Physical Disturbance and Strike: In-water device strike, Military expended material strike (missile fragment), Aircraft strike (seabirds only)
Entanglement: None
Ingestion: Missile fragments, Target fragments</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Missile fragments
Target fragments</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Assume one missile and one target per event
While missile could explode above water’s surface after contacting target, analysis assumes all warheads explode at or just below surface</td></tr>
</table>

A.1.4.12 Bombing Exercise Air-to-Surface

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Surface Warfare</td></tr>
<tr><td>Bombing Exercise (Air-to-Surface)</td><td colspan="2">Short Description:
Fixed-wing aircrews deliver bombs against surface targets.</td></tr>
<tr><td>Long Description</td><td colspan="2">Fixed-wing aircrews deliver bombs against surface targets.
Fixed-wing aircraft conduct a bombing exercise against stationary floating targets (e.g.: MK-58 smoke buoy). An aircraft clears the area, deploys a smoke buoy or other floating target, and then delivers high explosive or non-explosive practice munitions bomb(s) on the target. A range boat may be used to deploy targets for an aircraft to attack.
Exercises for strike fighters typically involve a flight of two aircraft delivering unguided or guided munitions that may be either high explosive or non-explosive practice munitions. The following munitions may be employed by strike fighter aircraft in the course of the bombing exercise: Unguided munitions: Non explosive Sub Scale Bombs (MK-76 and BDU-45); explosive and non explosive general purpose bombs (MK-80 series); MK-20 Cluster Bomb (explosive, non explosive). Precision-guided munitions: Laser-guided bombs (explosive, non explosive); Laser-guided Training Rounds (non explosive); Joint Direct Attack Munition (explosive, non explosive).</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Fixed wing (e.g., F/A-18, F-35, P-8, P-3)
Systems: None
Ordnance/Munitions: Bombs (e.g., MK-76, BDU-45, MK-80 series, MK-20 [high explosive, non-explosive])
Targets: Expendable floating target (e.g., smoke float)
Duration: 1 hour</td><td>Location:
Hawaii Range Complex: Hawaii Operating Area
Southern California Range Complex: Southern California Anti-Submarine Warfare Range T-3, T-4, T-5, Mine Training Range-2, Shore Bombardment Area
HSTT Transit Corridor</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Underwater explosions, Aircraft noise
Energy: None
Physical Disturbance and Strike: Military expended material strike (non-explosive bomb), Aircraft strike (seabirds only)
Entanglement: None
Ingestion: Bomb fragments, Target fragments, Smoke floats</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Bomb fragments
Target fragments
Smoke floats</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Approximately 90 percent of non-explosive bombs are the sub-scale bombs such as the MK-76 and BDU-48</td></tr>
</table>

A.1.4.13 Laser Targeting

Activity Name	Activity Description	
Anti-Surface Warfare		
Laser Targeting	**Short Description:** Fixed-winged, helicopter, and vessel crews illuminate enemy targets with lasers.	
Long Description	Fixed-winged and helicopter aircrew and shipboard personnel illuminate enemy targets with lasers for engagement by aircraft with laser guided bombs or missiles. This exercise may be conducted alone or in conjunction with other events utilizing precision guided munitions, such as anti surface missiles and guided rockets. Events where weapons are fired are addressed in the appropriate activity (e.g. air-to-surface missile exercise). Lower powered lasers may also be used as non-lethal deterrents during maritime security operations (force protection).	
Information Typical to the Event	**Platform:** Vessels, Boats, Fixed wing aircraft, Helicopters **Systems:** None **Ordnance/Munitions:** None unless conducted with other event (e.g., missile exercise) **Targets:** Land targets, Remote-controlled surface targets **Duration:** 1 to 2 hours	**Location:** Hawaii Range Complex: Warning Area-188 Southern California Range Complex: Southern California Anti-Submarine Warfare Range, Shore Bombardment Area, (Laser Training Range 1/2)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	Laser targeting for missile/rocket guidance will occur in areas where these events also occur Use of lasers as force protection non-lethal deterrents will primarily occur proximate to Navy homeports **Land target impacts are not analyzed within this EIS/OEIS**	

A.1.4.14 Sinking Exercise

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Surface Warfare</td></tr>
<tr><td>Sinking Exercise</td><td colspan="2">Short Description:
Aircraft, vessel, and submarine crews deliver ordnance on a seaborne target, usually a deactivated ship, which is deliberately sunk using multiple weapon systems.</td></tr>
<tr><td>Long Description</td><td colspan="2">Ship personnel and aircrew deliver high explosive ordnance on a seaborne target, (large deactivated vessel), which is deliberately sunk using multiple weapon systems. A sinking exercise is typically conducted by aircraft, surface vessels, and submarines in order to take advantage of the ability to fire high explosive ordnance on a full size ship target.
The target is typically a decommissioned ship made environmentally safe for sinking according to U.S. Environmental Protection Agency standards. The location is greater than 50 nautical miles from shore and in water depths greater than 6,000 feet.
Vessel, aircraft, and submarine crews attack with coordinated tactics and deliver live high explosive ordnance to sink the target. Non-explosive practice munitions may be used during the initial stages to extend target life. Typically, the exercise lasts for four to eight hours and possibly over one to two days, however it is unpredictable, and ultimately ends when the ship sinks.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Vessels, Aircraft, Submarines
Systems: None
Ordnance/Munitions: Potentially all available (explosive and non-explosive)
Targets: Decommissioned ship made environmentally safe for sinking (according to U.S. Environmental Protection Agency standards)
Duration: 4 to 8 hours, possibly over 1 to 2 days (unpredictable and ultimately ends when the ship sinks)</td><td>Location:
Hawaii Range Complex: Hawaii Operating Area
Southern California Range Complex: Warning Area-291</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Underwater explosions, Vessel noise, Aircraft noise, Weapons firing noise
Energy: None
Physical Disturbance and Strike: Military expended material strike (non-explosive projectiles, projectile fragments), Vessel strike, Aircraft strike (seabirds only)
Entanglement: Guidance wires
Ingestion: Munitions fragments, Small caliber projectiles, Casings</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Munitions fragments, Non-explosive ordnance, Guidance wires, Munitions fragments, Casings
Ship hulk (decommissioned ship made environmentally safe for sinking according to U.S. Environmental Protection Agency standards)</td></tr>
</table>

Assumptions used for Analysis	Greater than 50 nautical miles from shore and in water depths greater than 6,000 feet The participants and assets could include: • One full-size target ship hulk • One to five CG, DDG, or FFG ships • One to 10 F/A-18, or MPA aircraft • One or two HH-60H, MH-60R/S, or SH-60B helicopters • One E-2 aircraft for Command and Control • One submarine • One to three range clearance aircraft. • Two to four Harpoon surface-to-surface or air-to-surface missiles • Two to eight air-to-surface Maverick missiles • Two to sixteen MK-82 general purpose bombs • Two to four Hellfire air-to-surface missiles • One or two SLAM-ER air-to-surface missiles • Fifty to 500 rounds 5-inch and 76 mm gun • One to two MK-48 heavyweight submarine-launched torpedo • Two to Ten Thousand rounds .50 cal and 7.62 mm. • Assume 2 guidance wires expended per event

A.1.5 ANTI-SUBMARINE WARFARE TRAINING

Anti-submarine warfare involves helicopter and maritime patrol aircraft, ships, and submarines. These units operate alone or in combination, in operations to locate, track, and neutralize submarines. Controlling the undersea battlespace is a unique naval capability and a vital aspect of sea control. Undersea battlespace dominance requires proficiency in anti-submarine warfare. Every deploying strike group and individual surface combatant must possess this capability.

Various types of active and passive sonar are used by the Navy to determine water depth, locate mines, and identify, track, and target submarines. Passive sonar “listens” for sound waves by using underwater microphones, called hydrophones, which receive, amplify, and process underwater sounds. No sound is introduced into the water when using passive sonar. Passive sonar can indicate the presence, character, and movement of submarines. However, passive sonar provides only a bearing (direction) to a sound-emitting source; it does not provide an accurate range (distance) to the source. Active sonar is needed to locate objects because active sonar provides both bearing and range to the detected contact (such as an enemy submarine).

Active sonar transmits pulses of sound that travel through the water, reflect off objects and return to a receiver. By knowing the speed of sound in water and the time taken for the sound wave to travel to the object and back, active sonar systems can quickly calculate direction and distance from the sonar platform to the underwater object.

The Navy’s anti-submarine warfare training plan, including the use of active sonar in at-sea training scenarios, includes multiple levels of training. Individual-level anti-submarine warfare training addresses basic skills such as detection and classification of contacts, distinguishing discrete acoustic signatures including those of ships, submarines, and marine life, and identifying the characteristics, functions, and effects of controlled jamming and evasion devices.

More advanced, integrated anti-submarine warfare training exercises involving active sonar is conducted in coordinated, at-sea operations during multi-dimensional training events involving submarines, ships, aircraft, and helicopters. This training integrates the full anti-submarine warfare continuum from detecting and tracking a submarine to attacking a target using either exercise torpedoes or simulated weapons. Training events include detection and tracking exercises against “enemy” submarine contacts; torpedo employment exercises against the target; and exercising command and control tasks in a multi-dimensional battlespace.

A.1.5.1 Tracking Exercise/Torpedo Exercise – Submarine

Activity Name	Activity Description	
Anti-Submarine Warfare		
Tracking Exercise/Torpedo Exercise – Submarine	**Short Description:** Submarine crews search, track, and detect submarines. Exercise torpedoes may be used during this event.	
Long Description	The anti-submarine warfare tracking/torpedo exercise-submarine involves a submarine employing hull mounted and/or towed array sonar against an anti-submarine warfare target such as a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30, or another submarine. During this event, passive sonar is used almost exclusively; active sonar use is restricted because it would reveal the tracking submarine's presence to the target submarine. The preferred type of range for this exercise is an instrumented underwater training range with the capability to track the locations of submarines and targets, to enhance the after-action learning component of the training. Three such ranges exist in the Hawaii-Southern California Training and Test (HSTT) Study Area; the Barking Sands Tactical Underwater Range and Barking Sands Underwater Range Extension west of Kauai under the control of the Pacific Missile Range Facility, and the Southern California Anti-submarine Warfare Range west of San Clemente Island. This exercise may involve a single submarine, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event. The tracking exercise becomes a torpedo exercise when the submarine launches an exercise torpedo. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other Operating Areas (OPAREAs) depending on training requirements and available assets.	
Information Typical to the Event	**Platform:** Submarines **Systems:** Mid-frequency (primarily passive) and high-frequency sonar **Ordnance/Munitions:** Exercise torpedoes (non-explosive torpedo exercise only) **Targets:** Submarine MK-30, MK-39 Expendable Mobile Anti-Submarine Warfare Training Target **Duration:** 8 hours	**Location:** Hawaii Operating Area, (including Barking Sands Underwater Range Extension; Barking Sands Tactical Underwater Range; Shallow Water Training Range, North Maui Submarine Operating Area Southern California Operating Area, Southern California Anti-submarine Warfare Range , Shallow Water Training Range (Offshore/ Nearshore) HSTT Transit Corridor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (hull mounted sonar), High frequency sonar (heavyweight torpedo) **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike, Military expended material strike (torpedo accessories) **Entanglement:** Guidance wires **Ingestion:** Torpedo accessories	
Assumptions used for Analysis	Tracking exercise can occur in all locations, torpedo exercise will not occur in Hawaii-Southern California Training and Test Transit Corridor. Torpedoes are recovered Guidance wire has a low breaking strength and breaks easily. Weights and flex tubing sink rapidly Other Hawaii-Southern California Training and Test area events typically refer to those events that occur while vessels are in transit (e.g., HSTT Transit Corridor)	

A.1.5.2 Tracking Exercise/Torpedo Exercise – Surface

Activity Name	Activity Description	
Anti-Submarine Warfare		
Tracking Exercise/Torpedo Exercise – Surface	**Short Description:** Surface vessel crews search, track, and detect submarines. Exercise torpedoes may be used during this event.	
Long Description	Surface ships search, detect, and track threat submarines to determine a firing position to launch a torpedo and attack the submarine. A surface vessel operates at slow speeds while employing hull mounted and/or towed array sonar. Passive or active sonar is employed depending on the type of threat submarine, the tactical situation, and environmental conditions. The target for this exercise is a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, MK-30 Recoverable Training Target, or live submarine. Tracking exercise/torpedo exercise – surface could occur anywhere throughout the Hawaii-Southern California Training and Test Study Area. This exercise may involve a single ship, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft, ships, and submarines, including a major range event. The tracking exercise becomes a torpedo exercise when the ship launches an exercise torpedo. The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other operating areas depending on training requirements and available assets.	
Information Typical to the Event	**Platform:** Surface vessels **Systems:** Mid-frequency sonar, Nixie (countermeasure system) **Ordnance/Munitions:** Exercise torpedoes (non-explosive torpedo exercise only) **Targets:** Submarine MK-30 or MK-39 Expendable Mobile Anti-Submarine Warfare Training Target **Duration:** 2 to 4 hours	**Location:** Hawaii Range Complex: Hawaii Operating Area (including Barking Sands Underwater Range Extension; Barking Sands Tactical Underwater Range; Shallow Water Training Range Southern California Range Complex: Southern California Operating Areas, Point Mugu Sea Range (overlap area only)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (hull mounted sonar, high-frequency torpedo), Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike; military expended material strike **Entanglement:** None **Ingestion:** Torpedo accessories, Target fragments	
Detailed Military Expended Material Information	MK-39 Expendable Mobile Anti-Submarine Warfare Training Target Torpedo accessories (ballast weights) from exercise torpedoes	
Assumptions used for Analysis	Tracking exercise can occur in all locations, torpedo exercise will not occur in Point Mugu Sea Range portion of Southern California. Submarines may provide service as the target except for torpedo exercise events. Torpedoes are recovered Other Hawaii-Southern California Training and Test area events typically refer to those events that occur while vessels are in transit	

A.1.5.3 Tracking Exercise/Torpedo Exercise – Helicopter

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Submarine Warfare</td></tr>
<tr><td>Tracking Exercise/ Torpedo Exercise-Helicopter</td><td colspan="2">Short Description:
Helicopter crews search, track, and detect submarines. Recoverable air launched torpedoes may be employed against submarine targets.</td></tr>
<tr><td>Long Description</td><td colspan="2">This exercise involves helicopters using sonobuoys and dipping sonar to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine.
Sonobuoys are typically employed by a helicopter operating at altitudes below 3,000 feet (914 meters). Both passive and active sonobuoys are employed.
The dipping sonar is employed from an altitude of about 50 feet (15 meters) after the search area has been narrowed based on the sonobuoy search. Both passive and active sonar are employed.
The anti-submarine warfare target used for this exercise will likely be an Expendable Mobile Anti-submarine Warfare Training Target, a MK-30 recoverable exercise target or a live submarine if available. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and vessels, including a major range event.
The tracking exercise becomes a torpedo exercise when the helicopter launches an exercise torpedo.
The exercise torpedo is recovered by a special recovery helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other operating areas depending on training requirements and available assets.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Fixed-wing aircraft; helicopters; surface vessels
Systems: Mid-frequency helicopter dipping sonar, Sonobuoys
Ordnance/Munitions: Exercise torpedoes (non-explosive)
Targets:MK-39 Expendable Mobile Anti-Submarine Warfare Training Target or MK-30 recoverable target, or live submarine
Duration: 2 to 4 hours</td><td>Location:
Hawaii Range Complex: Hawaii Operating Area (including Barking Sands Underwater Range Extension; Barking Sands Tactical Underwater Range; Shallow Water Training Range
Southern California Range Complex: Southern California Anti-submarine Warfare Range, Shallow Water Training Range, San Clemente Island Underwater Range
HSTT Transit Corridor</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Mid-frequency sonar (Sonobuoy, dipping sonar, high-frequency torpedo), Aircraft noise, Vessel noise
Energy: None
Physical Disturbance and Strike: Military expended material strike, Aircraft strike (seabirds only), Vessel and in-water device strike
Entanglement: Parachutes
Ingestion: Parachutes</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">One Expendable Mobile Anti-Submarine Warfare Training Target
If target is air-dropped, one parachute per target
Up to 20 sonobouys per event (one parachute for each sonobuoy)
Torpedo accessories (ballast weights, parachutes)</td></tr>
</table>

Assumptions used for Analysis	Tracking exercise can occur in all locations, torpedo exercise will not occur in Hawaii-Southern California Training and Testing Transit Corridor or Point Mugu Sea Range portion of Southern California. Submarines may provide service as the target.

A.1.5.4 Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Submarine Warfare</td></tr>
<tr><td>Tracking Exercise/ Torpedo Exercise – Maritime Patrol Aircraft</td><td colspan="2">Short Description:
Maritime patrol aircraft crews search, detect, and track submarines. Recoverable air launched torpedoes may be employed against submarine targets.</td></tr>
<tr><td>Long Description</td><td colspan="2">This exercise involves fixed-wing maritime patrol aircraft employing sonobuoys to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine.
Sonobuoys are typically employed by a maritime patrol aircraft operating at altitudes below 3,000 feet (914 meters), however, sonobouys may be released at higher altitudes. Sonobuoys are deployed in specific patterns based on the expected threat submarine and specific water conditions. Depending on these two factors, these patterns will cover many different size areas. Both passive and active sonobuoys are employed. For certain sonobuoys, tactical parameters of use may be classified. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 target, or a live submarine. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and vessels, including a major range event.
The tracking exercise becomes a torpedo exercise when the aircraft launches an exercise torpedo.
The exercise torpedo is recovered by helicopter or small craft. The preferred range for this exercise is an instrumented underwater range, but it may be conducted in other operating areas depending on training requirements and available assets.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Fixed (Maritime Patrol Aircraft [manned or unmanned]), rotary wing aircraft surface combatant or small vessels
Systems: Sonobuoys
Ordnance/Munitions: Exercise torpedoes (non-explosive)
Targets: Mk-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 recoverable target, or a live submarine
Duration: 2 to 8 hours</td><td>Location:
Hawaii Operating Area, (including Barking Sands Underwater Range Extension; Barking Sands Tactical Underwater Range; Shallow Water Training Range
Southern California Operating Area, Southern California Anti-submarine Warfare Range , Shallow Water Training Range (Offshore/ Nearshore)</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Mid-frequency sonar (sonobuoy, lightweight torpedo), Vessel noise, Aircraft noise
Energy: Radar in periscope detection mode
Physical Disturbance and Strike: Aircraft strike (seabirds only), Vessel and in-water device strike, Military expended material strike
Entanglement: Parachutes
Ingestion: Parachutes</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">One Expendable Mobile Anti-Submarine Warfare Training Target (MK-39); MK-30 are recovered
Torpedo accessories (ballast weights, parachutes) from exercise torpedoes
Expended sonobuoys with parachutes</td></tr>
</table>

Assumptions used for Analysis	Tracking exercise can occur in all locations, torpedo exercise will not occur in Point Mugu Sea Range portion of Southern California Submarine may provide service as the target. If target is air-dropped, one parachute per target Other Hawaii-Southern California Training and Test area events typically refer to those events that occur while vessels are in transit

A.1.5.5 Tracking Exercise – Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Submarine Warfare</td></tr>
<tr><td>Tracking Exercise-Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys</td><td colspan="2">Short Description:
Maritime patrol aircraft crews search, detect and track submarines using extended echo ranging sonobuoys. Recoverable air launched torpedoes may be employed against submarine targets.</td></tr>
<tr><td>Long Description</td><td colspan="2">This exercise involves fixed-wing maritime patrol aircraft employing Improved Extended Echo Ranging and Multistatic Active Coherent sonobuoy systems to search for, detect, classify, localize, and track a simulated threat submarine with the goal of determining a firing solution that could be used to launch a torpedo and destroy the submarine. The Improved Extended Echo Ranging events use the SSQ-110A sonobuoy as an impulsive source, while the Multistatic Active Coherent events utilize the SSQ-125 sonobuoy as a tonal source. Each exercise would include the use of approximately 10 SSQ-110A or SSQ-125 sonobuoys. The anti-submarine warfare target used for this exercise may be a MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 target, or a live submarine. This exercise may involve a single aircraft, or be undertaken in the context of a coordinated larger exercise involving multiple aircraft and ships, including a major range event.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Maritime Patrol Aircraft
Systems: Improved Extended Echo Ranging and multistatic active coherent sonobuoy systems
Ordnance/Munitions: None
Targets: MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, a MK-30 recoverable target, or a live submarine
Duration: 2 to 8 hours</td><td>Location:
Hawaii Operating Area
Southern California Operating Areas, Point Mugu Sea Range (overlap area only), Shallow Water Training Range (Nearshore/Offshore)</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Sonar (Sonobuoy), Underwater explosions, Aircraft noise
Energy: None
Physical Disturbance and Strike: Aircraft strike (seabirds only), military expended material strike
Entanglement: Parachutes
Ingestion: Parachutes</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">One Expendable Mobile Anti-Submarine Warfare Training Target (MK-39); MK-30 are recovered
Expended sonobuoys with parachutes</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">If target is air-dropped, one parachute per target</td></tr>
</table>

A.1.5.6 Kilo Dip – Helicopter

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Submarine Warfare</td></tr>
<tr><td>Kilo Dip-Helicopter</td><td colspan="2">Short Description:
Helicopter crews briefly deploy their dipping Acoustic Sources to ensure the system’s operational status.</td></tr>
<tr><td>Long Description</td><td colspan="2">This brief exercise involves an MH-60 helicopter and its dipping sonar. The helicopter transits to one of the Helicopter Offshore Training Areas located off the coast of southern California. There, the helicopter lowers its dipping sonar into the ocean and transmits the sonar briefly to ensure that the sonar system is operating correctly.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: MH-60 helicopter
Systems: Mid-frequency helicopter dipping sonar
Ordnance/Munitions: None
Targets: None
Duration: 20 minutes</td><td>Location:
Southern California Range Complex: Helicopter Offshore Training Areas</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Mid-frequency helicopter dipping sonar (e.g., MF4)
Energy: None
Physical Disturbance and Strike: Helicopter strike (seabirds only)
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2"></td></tr>
</table>

A.1.5.7 Submarine Command Course Operations

Activity Name	**Activity Description**	
Anti-Submarine Warfare		
Submarine Command Course	**Short Description:** Train prospective submarine Commanding Officers to operate against surface, air, and subsurface threats	
Long Description	Train prospective Commanding Officers on submarines to operate against each other to locate and conduct simulated attacks. Submarine Command Course Operations is a Commander, U.S. Submarine Forces requirement to provide training to prospective submarine commanders in rigorous and realistic scenarios. This training assesses prospective commanding officers' abilities to operate in numerous hostile environments, encompassing surface vessels, aircraft, as well as other submarines. The course incorporates anti-submarine warfare tracking exercise, anti-submarine warfare torpedo exercise.	
Information Typical to the Event	**Platform:** Submarines **Systems:** Mid-frequency (primarily passive) and high-frequency sonar **Ordnance/Munitions:** Exercise torpedoes (torpedo exercise only) **Targets:** MK-30 recoverable target **Duration:** 3 to 5 days (at-sea portion)	**Location:** Hawaii Operating Area, Maui North/South
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency and high frequency sonar (heavyweight torpedo, hull mounted sonar) **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike, Military expended material strike **Entanglement:** Guidance wires **Ingestion:** Torpedo accessories (ballast weights)	
Detailed Military Expended Material Information	Torpedo accessories (guidance wires, ballast weights, flex tubing) Expended countermeasures	
Assumptions used for Analysis	Torpedoes are recovered Guidance wire brittle, breaks easily. Weights sink rapidly, etc. For Alternatives 1 and 2 the anti-submarine warfare portion of this event is incorporated in Tracking Exercise/Torpedo Exercise Submarine	

A.1.6 ELECTRONIC WARFARE TRAINING

Electronic warfare is the mission area of naval warfare that aims to control use of the electromagnetic spectrum and to deny its use by an adversary. Typical electronic warfare activities include threat avoidance training, signals analysis for intelligence purposes, and use of airborne and surface electronic jamming devices to defeat tracking systems.

A.1.6.1 Electronic Warfare Operations

Activity Name	Activity Description
Electronic Warfare	
Electronic Warfare Operations	**Short Description:** Aircraft, surface vessel, and submarine personnel attempt to control portions of the electromagnetic spectrum used by enemy systems to degrade or deny the enemy's ability to take defensive actions.
Long Description	Aircraft, surface ship, and submarine personnel attempt to control critical portions of the electromagnetic spectrum used by enemy systems to degrade or deny their ability to defend its forces from attack or recognize an emerging threat early enough to take defensive actions. Electronic Warfare Operations can be active or passive, offensive or defensive. Fixed wing aircraft employ active jamming and deception against enemy search radars to mask the friendly inbound strike aircraft mission. Surface vessels and submarines detect and evaluate enemy electronic signals from enemy aircraft or missile radars, evaluate courses of action concerning the use of passive or active countermeasures, then use vessel maneuvers and either chaff, flares, active electronic countermeasures, or a combination of them to defeat the threat.
Information Typical to the Event	**Platform:** Fixed and rotary wing aircraft, Surface combatant vessels **Systems:** None **Ordnance/Munitions:** None **Targets:** Land based fixed/mobile threat emitters **Duration:** 1 to 2 hours **Location:** Hawaii Operating Area Southern California Waters (Electronic Warfare Range)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None
Detailed Military Expended Material Information	
Assumptions used for Analysis	All Chaff and flares involved in this event are covered under Chaff exercise and Flare exercises, respectively

A.1.6.2 Counter Targeting Flare Exercise

Activity Name	Activity Description	
Electronic Warfare		
Counter Targeting - Flare Exercise	**Short Description:** Fixed-winged aircraft and helicopters defend against an attack by deploying flares to disrupt threat infrared missile guidance systems.	
Long Description	Train fixed-winged aircraft and helicopter crews to deploy flares to disrupt threat infrared missile guidance systems to defend against an attack. Aircraft detect electronic targeting signals from threat radars or missiles or a threat missile plume when it is launched; dispense flares; and immediately maneuver to defeat the threat. This exercise trains aircraft personnel in the use of defensive flares designed to confuse infrared sensors or infrared homing missiles, thereby causing the sensor or missile to lock onto the flares instead of the real aircraft. Typically an aircraft will expend five flares in an exercise while operating above 3,000 feet. Flare exercises are often conducted with chaff exercises, rather than as a stand-alone exercise. Pyrotechnics are used on the range to simulate missile firings.	
Information Typical to the Event	**Platform:** Fixed wing aircraft, Helicopters **Systems:** None **Ordnance/Munitions:** Flares and pyrotechnics **Targets:** None **Duration:** 1 to 2 hours	**Location:** Hawaii Operating Area Southern California Waters (Electronic Warfare Range)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft Noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Expended components of flares (pistons)	
Detailed Military Expended Material Information	Flares and residuals from pyrotechnics	
Assumptions used for Analysis	Approximately five flares per aircraft	

A.1.6.3 Counter Targeting Chaff Exercise – Ship

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Electronic Warfare</td></tr>
<tr><td>Counter Targeting Chaff Exercise – Ship</td><td colspan="2">Short Description:
Surface vessel crews defend against an attack by deploying chaff, a radar reflective material, which disrupt threat targeting and missile guidance radars.</td></tr>
<tr><td>Long Description</td><td colspan="2">Surface vessel crews deploy chaff to disrupt threat targeting and missile guidance radars to defend against an attack.
Surface vessel crews detect electronic targeting signals from threat radars or missiles, dispense chaff, and immediately maneuver to defeat the threat. The chaff cloud deceives the inbound missile, and the vessel clears away from the threat.
Chaff is a radar reflector material made of thin, narrow, metallic strips cut in various lengths to elicit frequency responses, which deceive enemy radars. Chaff is employed create a target from the chaff that will lure enemy radar and weapons system away from the actual friendly platform.
Ships may also train with advanced countermeasure systems, such as the MK 53 Decoy Launching System (Nulka).</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface vessels
Systems: None
Ordnance/Munitions: None
Targets: MK 53 expendable decoys
Duration: 1.5 hours</td><td>Location:
Hawaii Operating Area
Southern California Waters (Electronic Warfare Range)</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: None
Energy: None
Physical Disturbance and Strike: Vessel strike
Entanglement: None
Ingestion: Expended components of chaff (end caps, pistons, chaff)</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Chaff canisters
Expended components of chaff (end caps, pistons, chaff)
MK 53 expendable decoys</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2"></td></tr>
</table>

A.1.6.4 Counter Targeting Chaff Exercise – Aircraft

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Electronic Warfare</td></tr>
<tr><td>Counter Targeting Chaff Exercise – Aircraft</td><td colspan="2">Short Description:
Fixed-winged aircraft and helicopter crews defend against an attack by deploying chaff, a radar reflective material, which disrupt threat targeting and missile guidance radars.</td></tr>
<tr><td>Long Description</td><td colspan="2">Fixed-winged aircraft and helicopter crews deploy chaff to disrupt threat targeting and missile guidance radars and to defend against an attack.
Fixed-winged aircraft and helicopter crews detect electronic targeting signals from threat radars or missiles, dispense chaff, and immediately maneuver to defeat the threat. The chaff cloud deceives the inbound missile and the aircraft clears away from the threat.
Chaff is a radar reflector material made of thin, narrow, metallic strips cut in various lengths used to lure an enemy radar and weapons system away from the actual friendly platform.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Fixed wing aircraft, Helicopters
Systems: None
Ordnance/Munitions: None
Targets: None
Duration: 1.5 hours</td><td>Location:
Hawaii Operating Area
Southern California Waters (Electronic Warfare Range)</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Aircraft noise
Energy: None
Physical Disturbance and Strike: Aircraft strike (seabirds only)
Entanglement: None
Ingestion: Expended components of chaff (end caps, pistons, chaff)</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Chaff cartridges
Plastic end caps
Pistons</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Chaff is usually expended while conducting other training activities, such as air combat maneuvering</td></tr>
</table>

A.1.7 MINE WARFARE TRAINING

Mine warfare training is the naval warfare area involving the detection, avoidance, and neutralization of mines to protect Navy ships and submarines, and offensive mine laying in naval operations. A naval mine is a self-contained explosive device placed in water to destroy ships or submarines. Naval mines are deposited and left in place until triggered by the approach of, or a contact with an enemy ship, or are destroyed or removed. Naval mines can be laid by purpose-built minelayers, other ships, submarines, or airplanes. Mine warfare training includes mine countermeasures exercises and mine laying exercises.

A.1.7.1 Mine Countermeasure Exercise – Mine Countermeasure Sonar – Ship Sonar

Activity Name	**Activity Description**	
Mine Warfare		
Mine Countermeasure Exercise – Ship Sonar	**Short Description:** Surface vessel crews detect and avoid mines while navigating restricted areas or channels using active sonar.	
Long Description	Surface vessel crews detect and avoid mines or other underwater hazardous objects while navigating restricted areas or channels using active sonar. Littoral Combat Ship utilizes unmanned surface vehicles and remotely operated vehicles to tow mine detection (hunting) equipment. Systems will operate from shallow zone greater than 40 feet to deep water. Events could be embedded in major training events.	
Information Typical to the Event	**Platform:** Surface combatant vessels (e.g., Littoral Combat Ships), Unmanned surface vehicles **Systems:** AN/AQS-20, Remote Mine hunting System, AN/AQS-24, 53C **Ordnance/Munitions:** None **Targets:** Minefields, Temporary placed mine (training to deploy or operate gear) **Duration:** 1.5 to 4 hours	**Location:** Hawaii Range Complex: Hawaii Operating Area, Kingfisher, Shallow-water Minefield Sonar Training Area Southern California Range Complex: Kingfisher, Shallow Water Training Range -Offshore or Shallow Water Minefield
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar and other sonar sources. Vessel noise **Energy:** Sub-surface laser imaging **Physical Disturbance and Strike:** Vessel and in-water device strike, Seafloor devices **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None anticipated Temporary placed mines will be recovered	
Assumptions used for Analysis	No explosives used Constraints: Assume system will be operated in areas free of obstructions, and will be towed well above the seafloor. Towed system will be operated in a manner to avoid entanglement and damage. Events will take place in water depths 40 feet and greater Existing placed mineshapes to be used. Potential for temporary placement of mineshapes	

A.1.7.2 Mine Countermeasure Exercise – Surface

Activity Name	Activity Description	
Mine Warfare		
Mine Countermeasure Exercise – Surface	**Short Description:** Mine countermeasure ship crews detect, locate, identify, and avoid mines while navigating restricted areas or channels, such as while entering or leaving port.	
Long Description	This event trains mine countermeasure ship crews to detect mines for future neutralization or to alert other ships. Training utilizes simulated minefields constructed of moored or bottom mines, or instrumented mines that can record effectiveness of mine detection efforts. Ships will accurately fix their position while navigating through the restricted mine threat area at slow speeds of about 5 to 10 knots or less, while using active sonar to search the area ahead of the ship for moored mines or other hazards of navigation.	
Information Typical to the Event	**Platform:** Surface combatant vessel **Systems:** Sonar (e.g., AN/SQQ-32) **Ordnance/Munitions:** None **Targets:** None **Duration:** The exercise may last as long as 15 hours	**Location:** Southern California Range Complex: Kingfisher, Shallow Water Training Range-Offshore, Shallow Water Minefield, Silver Strand Training Complex, Camp Pendleton Amphibious Assault Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (e.g., AN/SQQ-32) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information		
Assumptions used for Analysis		

A.1.7.3 Mine Neutralization – Explosive Ordnance Disposal

Activity Name	Activity Description	
Mine Warfare		
Mine Neutralization – Explosive Ordnance Disposal	**Short Description:** Personnel disable threat mines. Explosive charges are used.	
Long Description	Navy divers, typically explosive ordnance disposal personnel, disable threat mines with explosive charges to create a safe channel for friendly vessels to transit. Personnel detect, identify, evaluate, and neutralize mines in the water with an explosive device and may involve detonation of one or more explosive charges from 10 to 60 pounds of TNT equivalent. These operations are normally conducted during daylight hours for safety reasons. Time delay fuses may be used for these events.	
Information Typical to the Event	**Platform:** Rotary wing aircraft, Small boats **Systems:** None **Ordnance/Munitions:** Underwater detonation charges **Targets:** Minefields **Duration:** Up to 4 hours	**Location:** Hawaii Range Complex: Puuloa Underwater Range, Marine Corps Base Hawaii, Marine Corps Training Area Bellows, Barbers Point Underwater Range, Naval Inactive Ship Maintenance Facility, Lima Landing, Ewa Training Minefield Southern California Range Complex: Northwest Harbor, Horse Beach Cove, Southern California Anti-submarine Warfare Range, Shallow Water Training Range, in Special Warfare Training Area, Offshore waters Silver Strand Training Complex: Boat Lanes 1-14
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Under water explosions, Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, Aircraft strike (seabirds only), Seafloor devices **Entanglement:** None **Ingestion:** Target fragments	
Detailed Military Expended Material Information	Target fragments	
Assumptions used for Analysis	Time delayed fuses may be used (up to 15 minutes). Charge placed anywhere in water column, including bottom Mine shapes will be recovered	

A.1.7.4 Mine Countermeasure – Towed Mine Neutralization

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Mine Warfare</td></tr>
<tr><td>Mine Countermeasures – Towed Mine Neutralization</td><td colspan="2">Short Description:
Helicopter aircrews employ towed mine neutralization systems (e.g. OASIS, MK-104/105)</td></tr>
<tr><td>Long Description</td><td colspan="2">Naval helicopters use towed devices to clear minefields by triggering mines that sense and explode when they detect ships/submarines by engine/propeller sounds or magnetic (steel construction) signature. Towed devices can also employ cable cutters to detach floating moored mines.
Training will either be conducted against non-explosive training mineshapes, or, without any mineshapes. A high degree of pilot skill is required in deploying devices, safely towing them at relatively low speeds and altitudes, and then recovering devices.
Devices used include the following:
Organic Airborne and Surface Influence Sweep (OASIS). The Organic Airborne and Surface Influence Sweep is a towed device that imitates the magnetic and acoustic signatures of naval ships and submarines.
MK 105 sled: the MK 105 sled, similar to the Organic Airborne and Surface Influence Sweep, creates a magnetic field used to trigger mines. The MK 105 sled can also be used in conjunction with the MK 103 cable cutter system and the MK 104 acoustic countermeasure.
AN/SPU-1/W “Magnetic Orange Pipe”: As the name implies, the AN/SPU-1/W is a magnetic pipe that is used to trigger magnetically influenced mines.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface combatant vessel (e.g., LCS), Unmanned surface vehicle, Unmanned underwater vehicles, Rotary wing aircraft
Systems: None
Ordnance/Munitions: Cable cutters (MK-103)
Targets: Existing minefields, temporary placed mines, or no targets (training to deploy/operate gear)
Duration: Typically 1.5 hours, up to 4 hours</td><td>Location:
Southern California Range Complex: Pyramid Cove, Northwest Harbor, Kingfisher Training Range, Mine Training Range-1/2, Shallow Water Minefield, Helicopter Offshore Training Area, Camp Pendleton Amphibious Assault Area
All Silver Strand Training Complex Boat Lanes 1-14, in water greater than 40 ft. deep</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: None
Energy: Electromagnetic influence sweep
Physical Disturbance and Strike: Vessel strike, Towed devices, Bottom placed mine shapes
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Towed from helicopters, ships, unmanned surface vehicles and unmanned underwater vehicles.
Mechanical sweeping (cable cutting), acoustic, and magnetic influence sweeping.
Cable cutters utilize an insignificant charge (similar to shotgun shell). Acoustic sweeps generate ship type noise via mechanical system.
Towing systems though minefields (or without mines, to train to deploy, tow, and recover). May involve instrumented mines (VIMS).</td></tr>
</table>

A.1.7.5 Mine Countermeasure – Mine Detection

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Mine Warfare</td></tr>
<tr><td>Mine Countermeasures – Mine Detection</td><td colspan="2">Short Description:
Vessel crews and helicopter aircrews detect mines using towed or laser mine detection systems (e.g., ANSQ-20, Airborne Laser Mine Detection System).</td></tr>
<tr><td>Long Description</td><td colspan="2">Helicopter crews use towed and airborne devices to detect, locate, and classify potential mines. Towed devices employ active acoustic sources, such as high frequency and side scanning sonar. These devices are similar in function to systems used to map the seafloor or locate submerged structures or items. Airborne devices utilize laser systems to locate mines located below the surface.
Devices used include the AN/AQS-20/A, towed minehunting sonar used to detect and classify bottom and floating/moored mines in deep and shallow water, and the Airborne Laser Mine Detection System, developed to detect and classify floating and near-surface, moored mines.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Rotary wing aircraft, Unmanned surface vehicles, Unmanned underwater vehicles
Systems: Airborne Laser Mine Detection System (e.g., AN/AQS-20A, AN/AQS-24A)
Ordnance/Munitions: None
Targets: Existing minefields, temporary placed mines, or no targets (training to deploy/operate gear)
Duration: Typically 1.5 hours, up to 4 hours</td><td>Location:
Southern California Range Complex: Pyramid cove, Northwest Harbor, Kingfisher Training Range, Mine Training Range-1/2, Shallow Water Minefield, Helicopter Offshore Training Area , Camp Pendleton Amphibious Assault Area
Silver Strand Training Complex: Boat Lanes 1-14, in water greater than 40 ft. deep</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Sonar (mine detection systems), Vessel noise, Aircraft noise
Energy: None
Physical Disturbance and Strike: Vessel and in-water device strike, Aircraft strike (seabirds only), Seafloor device strike (bottom placed mine shapes)
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Sonar mine detection systems towed from helicopters, vessels, unmanned surface vehicles
Use of airborne laser systems to detect mineshapes
Laser systems similar to commercial Light Detection And Ranging (LIDAR) systems
Mine shapes will be recovered</td></tr>
</table>

A.1.7.6 Mine Countermeasure – Mine Neutralization

Activity Name	Activity Description	
Mine Warfare		
Mine Countermeasures – Mine Neutralization, Small and Medium Caliber	**Short Description:** Vessel crews or helicopter aircrews disable mines by firing small and medium caliber projectiles.	
Long Description	Vessel and Helicopter crews utilize small and medium caliper weapons to neutralize potential mines. Weapons may employ laser detection and targeting systems. Small and medium caliper projectiles are non explosive, and neutralize mines by breaching casing, causing the mine to flood or detonate.	
Information Typical to the Event	**Platform:** Rotary wing aircraft, Surface combatant vessels **Systems:** None **Ordnance/Munitions:** Small caliber and medium caliber (non-explosive) **Targets:** Existing minefields, Temporarily placed mines **Duration:** Typically 1.5 hours, up to 4 hours	**Location:** Southern California Range Complex: Pyramid cove, Northwest Harbor, Kingfisher Training Range, Mine Training Range-1/2, Shallow Water Minefield
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike; military expended material strike (projectiles); seafloor device strike (bottom placed mine shapes); aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Small and medium caliber projectiles, Casings	
Detailed Military Expended Material Information	Small and medium caliber projectiles Casings	
Assumptions used for Analysis		

A.1.7.7 Mine Neutralization – Remotely Operated Vehicle

Activity Name	Activity Description
Mine Warfare	
Mine Countermeasures – Mine Neutralization – Remotely Operated Vehicles	**Short Description:** Vessel crews or helicopter aircrews disable mines using remotely operated underwater vehicles.
Long Description	Vessel and helicopter crews utilize remotely operated vehicles to neutralize potential mines. Remotely operated vehicles will use sonar and optical systems to locate and target mineshapes. Explosive mine neutralizers may be used during live fire events.
Information Typical to the Event	**Platform:** Rotary wing aircraft, Surface combatant vessels **Systems:** Acoustic mine targeting system **Ordnance/Munitions:** High explosive neutralizers (possibly) **Targets:** Existing minefields, Temporary placed mines **Duration:** Typically 1.5 hours, up to 4 hours **Location:** Southern California Range Complex: Kingfisher, Shallow Water Training Range-Offshore, Shallow Water Minefield, Camp Pendleton Amphibious Assault Area Silver Strand Training Complex: Boat Lanes 1-14; Breakers Beach, Delta I, II, and Delta North, Echo
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions, Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel and in-water device strike, Sea floor device strike (bottom placed mine shapes), Aircraft strike (seabirds only) **Entanglement:** Fiber optic cable **Ingestion:** Neutralizer fragments
Detailed Military Expended Material Information	Neutralizer fragments Fiber optic cables
Assumptions used for Analysis	Acoustic sources associated with remotely operated vehicle mine neutralization systems do not require quantitative analysis. See Section 2.3.7.2.

A.1.7.8 Mine Laying

Activity Name	**Activity Description**	
Mine Warfare		
Mine Laying	**Short Description:** Fixed-winged aircraft and submarine crews drop or launch non explosive mine shapes.	
Long Description	Fixed-winged aircraft and submarine crews lay offensive or defensive mines for a tactical advantage for friendly forces. Fixed-winged aircraft lay a precise minefield pattern for specific tactical situations. The aircrew typically makes multiple passes in the same flight pattern, and drops one or more training shapes (four shapes total). Training shapes are non-explosive and are recovered when possible.	
Information Typical to the Event	**Platform:** Fixed wing aircraft (e.g., F-18, P-3, P-8, F-35) **Systems:** None **Ordnance/Munitions:** Non-explosive mine shapes, “Quick-strike“ mines **Targets:** None **Duration:** 1 hour	**Location:** Hawaii Range Complex: R-3101 Southern California Range Complex: Mine Training Range, Shallow Water Training Ranges, Pyramid Cove, China Point
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive mine shapes) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	Non-explosive mine shapes	
Assumptions used for Analysis	Similar to non-explosive bombing exercise These events primarily occur during major training exercises While mineshapes will be recovered if possible, assume they will not for the analysis Mine laying will take place in waters less than 100 feet Assume 12 mineshapes used per event	

A.1.7.9 MK-8 Marine Mammal System

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Mine Warfare</td></tr>
<tr><td>MK-8 Marine Mammal Systems Operations</td><td colspan="2">Short Description:
Navy personnel and Navy marine mammals work together to detect specified underwater objects.</td></tr>
<tr><td>Long Description</td><td colspan="2">The Navy deploys trained bottlenose dolphins (Tursiops trucatus) and California sea lions (Zalophus californianus) as part of the marine mammal mine-hunting and object-recovery system. Each system consists of a motorized small craft, several crewmembers and a trained dolphin or sea lion.
Self-Contained Underwater Breathing Apparatus (SCUBA) assisted personnel and Navy marine mammals work together to detect specified underwater objects. Personnel work with the help of marine mammals to detect underwater objects. Approximately 10 percent of training involves the setting of a 13- or 29-lbs (5.9- or 13 kilograms) Net Explosive Weight charge to detonate the objects.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Small boats
Systems: None
Ordnance/Munitions: 13- or 29-lbs Net Explosive Weight
Targets: None
Duration:</td><td>Location:
Hawaii Range Complex: Hawaii Operating Area, Kingfisher, Shallow Waters Minefield, Sonar Training Area
Silver Strand Training Complex: Boat Lanes 1-14; Breakers Beach</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: None
Energy: None
Physical Disturbance and Strike: None
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Minimal mine detonation residue (only during the 10 percent of training that includes an explosive charge)</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Sequential detonations operate at water depths of 10 to 72 ft (3 to 22 m) and are bottom laid. Single charges are laid within water depths of 24 to 72 ft (7 to 22 m), 20 ft (6 m) from the surface or below.</td></tr>
</table>

A.1.7.10 Shock Wave Generator

Activity Name	Activity Description	
Mine Warfare (MIW)		
Shock Wave Generator	**Short Description:** Navy divers place a small charge on a simulated underwater mine.	
Long Description	For shock wave generator training, a metal sheet containing a non-explosive limpet mine is lowered into the water, sometimes from the side of a small vessel, such as an LCM-8 craft. Divers place a single shock wave generator on the mine that is located mid-water column, within water depths of 10 to 20 feet (3 to 6 m). A bag is placed over the mine to catch falling debris.	
Information Typical to the Event	**Platform:** None **Systems:** None **Ordnance/Munitions:** One 15g explosive charge **Targets:** Metal sheet with limpet mine **Duration:** 2 hours	**Location:** Silver Strand Training Complex: Boat Lanes 1-14; San Diego Bay-Echo
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** **Energy:** **Physical Disturbance and Strike:** **Entanglement:** **Ingestion:**	
Military Expended Material	Minimal mine detonation residue (most materials are recovered after each event)	
Assumptions Used for Analysis		

A.1.7.11 Surf Zone Test Detachment/Equipment Test and Evaluation

Activity Name	**Activity Description**	
Mine Warfare (MIW)		
Surf Zone Test Detachment/Equipment Test and Evaluation	**Short Description:** Navy personnel test and evaluate the effectiveness of new detection and neutralization equipment designated for surf conditions.	
Long Description	Navy personnel test and evaluate the effectiveness of new detection and neutralization equipment designated for surf conditions. To support clearance capability in the surf zone (out to 10 ft [3 m] of water), Explosive Ordnance Disposal would test and evaluate the effectiveness of new detection and neutralization equipment designated for surf conditions. Use of explosives will occur during 1 percent of training activities (0.1 to 20 lb. [.045 to 9 kilograms] Net Explosive Weight) and will only occur in the Silver Strand Training Complex Boat Lanes. Time delay fuses may be used for these events.	
Information Typical to the Event	**Platform:** None **Systems:** Hand-held sonar systems **Ordnance/Munitions:** Explosive charges **Targets:** Simulated mines **Duration:** 3 hours	**Location:** Silver Strand Training Complex: Boat Lanes 1-14; San Diego Bay-Echo
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Impulsive and non-impulsive (Hand-held sonar systems) **Energy:** None **Physical Disturbance and Strike:** **Entanglement:** None **Ingestion:** None	
Military Expended Material	Minimal mine detonation residue (only during the 1 percent of training that includes an explosive charge)	
Assumptions Used for Analysis		

A.1.7.12 Submarine Mine Exercise

Activity Name	Activity Description	
Mine Warfare (MIW)		
Submarine Mine Exercise	**Short Description:** Submarine crews practice detecting mines in a designated area.	
Long Description	Submarine crews use active sonar to detect and avoid mines or other underwater hazardous objects, while navigating restricted areas or channels, such as while entering or leaving port. This event trains submarine crews to detect and avoid mines. Training utilizes simulated minefields constructed of moored or bottom mines, or instrumented mines that can record effectiveness of mine detection efforts. In a typical training exercise, submarine crews will use the AN/BQS-15 high-frequency active sonar to locate and avoid the mine shapes. Each mine avoidance exercise involves one submarine operating the AN/BQS-15 sonar for 6 hours to navigate through the training minefield. During mine warfare exercises submarines will expend several submarine-launched expendable bathythermographs to determine water conditions affecting sonar performance.	
Information Typical to the Event	**Platform:** Submarine **Systems:** Sonar (AN/BQS-15) **Ordnance/Munitions:** None **Targets:** Mine shapes **Duration:** 6 hours	**Location:** Hawaii Operating Area, Kahoolawe Submarine Training Minefield Advanced Research Projects Agency Training Minefield, Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (e.g., AN/BQS-15) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Military Expended Material	None	
Assumptions Used for Analysis		

A.1.7.13 Maritime Homeland Defense/Security Mine Countermeasures

Activity Name	Activity Description	
Mine Warfare		
Maritime Homeland Defense/Security Mine Countermeasures	**Short Description:** Maritime security operations for military and civilian ports and harbors.	
Long Description	Naval forces provide Mine Warfare capabilities to Department of Homeland Security led event. The three pillars of Mine Warfare, Airborne (helicopter), Surface (ships and unmanned vehicles), and Undersea (divers, marine mammals, and unmanned vehicles) mine countermeasures will be brought to bear in order to ensure strategic U.S. ports remain free of mine threats. Various Mine Warfare sensors, which utilize active acoustics, will be employed in the detection, classification, and neutralization of mines. Along with traditional Mine Warfare techniques, such as helicopter towed mine countermeasures, new technologies (unmanned vehicles) will be utilized. Event locations and scenarios will vary according to Department of Homeland Security strategic goals and evolving world events. Purpose of HSTT analysis is to ensure adequate Marine Mammal Protection Act (MMPA) authorizations are in place to support the use of acoustic mine detection sensors. Additional analysis and regulatory engagement will be conducted as appropriate as planning for the actual events begin.	
Information Typical to the Event	**Platform:** Surface combatant vessels, Small boats, Rotary wing aircraft **Systems:** Unmanned underwater and surface vehicles, various mine detection sensors (AN/AQS-20, AN/AQS-24) **Ordnance/Munitions:** High explosive charges **Targets:** Temporary mineshapes **Duration:** Multiple days	**Location:** San Diego Bay
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar (mine hunting); underwater explosions; vessel noise; aircraft noise (e.g., AN/SQQ 32, Unmanned underwater vehicle, MK 18 Swordfish, AN/PQS 2A, MK8 Marine Mammal Systems Bottlenose Dolphin bio-sonar) **Energy:** Magnetic influence mine sweeping **Physical Disturbance and Strike:** Vessel and in-water device strikes; seafloor device strike (bottom placed mine shapes); aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information		
Assumptions used for Analysis	Non-permanent mine shapes will be laid in various places on the bottom of San Diego Bay. Shapes are varied, from about 1 meter circular to about 2.5m long by 1 meter wide. They will be recovered using normal assets, with diver involvement. Programmatic analysis for acoustic effects only. While goal is to conduct once per year, alternating east/west coast, assume that a West Coast event will occur every year with a total of three per five year period.	

A.1.8 NAVAL SPECIAL WARFARE TRAINING

Naval special warfare and other Navy forces train to conduct military operations in five Special Operations mission areas: unconventional warfare, direct action, special reconnaissance, foreign internal defense, and counterterrorism. Naval special warfare training involves specialized tactics, techniques, and procedures, employed in training events that include: insertion/extraction operations using parachutes rubber boats, or helicopters; boat-to-shore and boat-to-boat gunnery; underwater demolition training; reconnaissance; and small arms training.

A.1.8.1 Personnel Insertion/Extraction – Non-submarine

Activity Name	Activity Description	
Naval Special Warfare		
Personnel Insertion/Extraction – Non-Submarine	**Short Description:** Personnel train to approach or depart an objective area using various transportation methods and tactics.	
Long Description	Personnel train to approach or depart an objective area using various transportation methods and tactics. These operations train forces to insert and extract personnel and equipment day or night. Tactics and techniques employed include insertion from aircraft by parachute, by rope, or from low, slow-flying helicopters from which personnel jump into the water. Parachute training is required to be conducted on surveyed drop zones to enhance safety. Insertion and extraction methods also employ small inflatable boats.	
Information Typical to the Event	**Platform:** Fixed and rotary wing aircraft **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 2 to 8 hours	**Location:** Southern California Range Complex: Southern California Operating Area, San Clemente Island Silver Strand Training Complex: Boat Lanes 1-14, Echo
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Military Expended Material	None	
Assumptions Used for Analysis		

A.1.8.2 Personnel Insertion/Extraction – Submarine

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Naval Special Warfare</td></tr>
<tr><td>Personnel Insertion/Extraction - Submarine</td><td colspan="2">Short Description:
Military personnel train for covert insertion and extraction into target areas using submarines.</td></tr>
<tr><td>Long Description</td><td colspan="2">Military personnel train for covert insertion and extraction into target areas using submarines. Often, an undersea delivery vehicle, similar to a “mini-sub” may be used to transfer the personnel from the submarine to their objective near shore.
Several methods are used by submarines and embarked personnel to move from the submarine to the objective area:
• The lock-in/lock-out procedure allows personnel to swim out of submerged submarines.
• The Sea, Air, Land (SEAL) Delivery Vehicle may be used by Naval Special Warfare personnel to move from the submarine to an underwater area closer to shore.
Submarines approach a hostile area and move at a very slow speed while inserting or extracting Naval Special Warfare or other personnel by using one, or a combination of the procedures discussed above. Once the personnel have inserted or extracted, the submarine will leave the area.
Opposition force personnel may be employed as well as small arms with blanks or live ammunition once the personnel reach the beach area.
These operations will vary in length depending on the transportation method and systems being used.
Training may include navigation runs into and out of the San Diego Bay or Pearl Harbor that may be conducted in coordination with other training activities.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Sea, Air, Land Delivery Vehicle
Systems: None
Ordnance/Munitions: None (if used, small-caliber)
Targets: None
Duration: 2 to 8 hour</td><td>Location:
Hawaii Range Complex: Hawaii Operating Area, Marine Corps Training Area Bellows; Pacific Missile Range Facility (Main Base)
Silver Strand Training Complex: Boat Lanes 1-10, Delta III, Echo, Foxtrot, Golf, Hotel</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: None
Energy: None
Physical Disturbance and Strike: None
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">Small-caliber projectiles, if used</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2"></td></tr>
</table>

A.1.8.3 Underwater Demolition Multiple Charge – Mat Weave and Obstacle Loading

Activity Name	**Activity Description**	
Naval Special Warfare		
Underwater Demolitions Multiple Charge-Mat Weave and Obstacle Loading	**Short Description:** Military personnel use explosive charges to destroy barriers or obstacles to amphibious vehicle access to beach areas.	
Long Description	Navy personnel train to construct, place, and safely detonate multiple charges laid in a pattern for underwater obstacle clearance. Naval Special Warfare or Explosive Ordnance Disposal personnel locate barriers or obstacles designed to block amphibious vehicle access to beach areas, then use explosive charges to destroy them. Pattern charges (mat weaves) may use as much as 500 lb (227 kilograms) of high explosive. Time delay fuses may be used for these events.	
Information Typical to the Event	**Platform:** Small boats **Systems:** None **Ordnance/Munitions:** High Explosive charges (up to 500 lb) **Targets:** None **Duration:**	**Location:** Southern California Range Complex: Northwest Harbor (Training Areas and Ranges 2 and 3), Special Warfare Training Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater detonations **Energy:** None **Physical Disturbance and Strike:** **Entanglement:** None **Ingestion:** None	
Military Expended Material	Minimal mine detonation residue (most materials are recovered after each event)	
Assumptions Used for Analysis		

A.1.8.4 Underwater Demolition Qualification/Certification

Activity Name	Activity Description	
Naval Special Warfare		
Underwater Demolition Qualification/Certification	**Short Description:** Navy divers conduct training and certification in placing underwater demolition charges.	
Long Description	Demolition re-qualifications and training provides teams with experience in underwater detonations by conducting detonations on metal plates near the shoreline. At water depths of 10 to 72 ft. (3 to 22 m), two sequential 12.5 to 13.75 lb (5.7 to 6.2 kilograms) Net Explosive Weight charges are placed on the bottom or a single 25.5-lb (11.5 kilogram) charge is placed from a depth of 20 ft. (6 m) to the bottom.	
Information Typical to the Event	**Platform:** Small boats **Systems:** None **Ordnance/Munitions:** High Explosive charges (up to 25 lb) **Targets:** None **Duration:**	**Location:** Southern California Range Complex Silver Strand Training Complex: Boat and Beach Lanes 1-14
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** Military expended material explosive strike **Entanglement:** None **Ingestion:** None	
Military Expended Material	Minimal mine detonation residue (most materials are recovered after each event)	
Assumptions Used for Analysis		

A.1.9 OTHER TRAINING

A.1.9.1 Precision Anchoring

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Other Training</td></tr>
<tr><td>Precision Anchoring</td><td colspan="2">Short Description:
Releasing of anchors in designated locations.</td></tr>
<tr><td>Long Description</td><td colspan="2">Vessels navigate to a pre-planned position and deploy the anchor. The vessel uses all means available to determine its position when anchor is dropped to demonstrate calculating and plotting the anchor's position within 100 yards of center of planned anchorage.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: All surface vessels
Systems: None
Ordnance/Munitions: None
Targets: None
Duration: Up to 1 hour</td><td>Location:
Hawaii Range Complex: Pearl Harbor Defense Sea Area
Silver Strand Training Complex: Anchorages</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: None
Energy: None
Physical Disturbance and Strike: Vessel strike, Seafloor device strike (anchor)
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2"></td></tr>
</table>

A.1.9.2 Small Boat Attack

Activity Name	Activity Description	
Other		
Small Boat Attack	**Short Description:**	
Long Description	Small attacks are conducted on boats. For this activity, one or two small boats or personal watercraft conduct attack activities on units afloat.	
Information Typical to the Event	**Platform:** Small boats or watercraft **Systems:** **Ordnance/Munitions:** Small caliber (non-explosive) **Targets:** High-performance small boats and unmanned vehicles **Duration:**	**Location:** Hawaii Operating Areas Silver Strand Training Complex: Boat Lanes 1-10
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	Small-caliber projectiles	
Assumptions used for Analysis		

A.1.9.3 Offshore Petroleum Discharge System

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Other</td></tr>
<tr><td>Offshore Petroleum Discharge System</td><td colspan="2">Short Description:
This activity trains personnel in the transfer of petroleum (though only sea water is used during training) from ship to shore</td></tr>
<tr><td>Long Description</td><td colspan="2">Offshore petroleum discharge system training consists of five training subcomponents including the beach termination unit; operation utility boat technicians; boat coxswain; dive boat operation technician; and single anchor leg moor training. This activity trains personnel in the transfer of petroleum (though only sea water is used during training) from ship to shore. From approximately one mile offshore, technicians and underwater construction team divers roll out conduit from a ship offshore, deploy the single anchor leg mooring which sinks to and settles on the ocean floor, and use anchors at various points along the conduit to secure it to the seafloor. The conduit terminates at the shore location of the termination unit manifold.
The current training at Silver Strand Training Complex consists of rolling out a four mile fluid-transfer conduit from the beach out to approximately one mile offshore and anchoring it to the seafloor with a Single Anchor Leg Moor. The improved offshore petroleum discharge system would have a self-sinking hose that could extend up to eight miles offshore, but like the current system, would still be rolled out to approximately one mile offshore during training activities at Silver Strand Training Complex.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface combatant vessels, small boats, Support Craft/Other
Systems: None
Ordnance/Munitions: None
Targets: None
Duration:</td><td>Location:
Silver Strand Training Complex: Boat Lanes 1-10, Bravo, Waters outside of boat lanes</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: None
Energy: None
Physical Disturbance and Strike: None
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">None</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2"></td></tr>
</table>

A.1.9.4 Elevated Causeway System

Activity Name	Activity Description	
Other		
Elevated causeway System	**Short Description:** A temporary pier is constructed off of the beach. Piles are driven into the sand and then later removed.	
Long Description	A pier is constructed off of the beach. The pier is designed to allow for offload of materials and equipment from supply ships. Piles are driven into the sand with an impact hammer. Causeway platforms are then hoisted and secured onto the piles with hydraulic jacks and cranes. It is assembled by joining standard causeway sections together and can be assembled in 10 days. The pier, including associated piles, is removed at the conclusion of training.	
Information Typical to the Event	**Platform:** Support Craft/Other, **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 10 days for assembly	**Location:** Silver Strand Training Complex: Boat Lanes 1-10, Designated Bravo Beach training lane
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Pile driving and removal **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	Programmatic analysis (only assessing acoustic impacts from the pile driving)	

A.1.9.5 Submarine Navigation

Activity Name	Activity Description	
Other		
Submarine Navigational	**Short Description:** Submarine crews operate sonar for navigation and object detection while transiting in and out of port during reduced visibility.	
Long Description	Submarine crews train to operate sonar for navigation. The ability to navigate using sonar is critical for object detection while transiting in and out of port during periods of reduced visibility.	
Information Typical to the Event	**Platform:** Submarines **Systems:** High frequency submarine sonar system **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 2 hours	**Location:** Hawaii Range Complex: Pearl Harbor Channel and virtual channel south of Pearl Harbor Southern California Range Complex: Subase Point Loma and seaward virtual channel
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High frequency submarine sonar system **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis		

A.1.9.6 Submarine Under Ice Certification

Activity Name	Activity Description	
Other		
Submarine Under Ice Certification	**Short Description:** Submarine crews train to operate under ice. Ice conditions are simulated during training and certification events.	
Long Description	Submarine crews train to operate under ice. Ice conditions are simulated during training and certification events.	
Information Typical to the Event	**Platform:** Submarine **Systems:** Submarine high frequency sources **Ordnance/Munitions:** None **Targets:** None **Duration:** A single exercise is comprised of 36 hours of training, spread out over 6 days in 6-hour training sessions.	**Location:** Hawaii Operating Areas Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High frequency sonar (Submarine sources) **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis		

A.1.9.7 Salvage Operations

Activity Name	Activity Description	
Other		
Salvage Operations	**Short Description:** Navy divers train to tow disabled ships, repair damaged ships, remove sunken ships, and conduct deep ocean recovery.	
Long Description	Navy divers train to tow disabled ships, repair damaged ships, remove sunken ships, and conduct deep ocean recovery. The Navy's Mobile Diving and Salvage Unit One and divers from other countries practice swift and mobile ship and barge salvage, towing, battle damage repair, deep ocean recovery, harbor clearance, removal of objects from navigable waters, and underwater ship repair capabilities.	
Information Typical to the Event	**Platform:** Surface vessels, other support vessels **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Variable	**Location:** Hawaii Range Complex: Puuloa Underwater Range, Pearl Harbor Defensive Sea Area, Keehi Lagoon, Pearl Harbor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis		

A.1.9.8 Surface Ship Sonar Maintenance

Activity Name	**Activity Description**	
Other		
Surface Ship Sonar Maintenance	**Short Description:** Pierside and at-sea maintenance of sonar systems.	
Long Description	This scenario consists of surface combatant vessels performing periodic maintenance to the AN/SQS-53 or AN/SQS-56 sonar while in port or at sea. This maintenance takes up to four hours. Surface vessels operate active sonar systems for maintenance while in shallow water near their homeport, however, sonar maintenance could occur anywhere as the system's performance may warrant.	
Information Typical to the Event	**Platform:** Surface combatant vessels **Systems:** Hull mounted sonar systems (AN/SQS-53 or AN/SQS-56) **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 4 hours	**Location:** Hawaii Range Complex: Hawaii Operating Area; Pearl Harbor; Fleet Operational Readiness Accuracy Check Site Range Southern California Range Complex: Southern California Operating Area; San Diego Bay and ports HSTT Transit Corridor
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (hull mounted sonar), Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis		

A.1.9.9 Submarine Sonar Maintenance

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Other-Maintenance</td></tr>
<tr><td>Submarine Sonar Maintenance</td><td colspan="2">Short Description:
Pierside and at-sea maintenance of sonar systems.</td></tr>
<tr><td>Long Description</td><td colspan="2">A submarine performs periodic maintenance on the AN/BQQ-10 and submarine high-frequency sonar systems while in port or at sea. Submarines conduct maintenance to their sonar systems in shallow water near their homeport however, sonar maintenance could occur anywhere as the system's performance may warrant</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Submarines
Systems: High frequency submarine sonar system , AN/BBQ-10
Ordnance/Munitions: None
Targets: None
Duration: 45 minutes up to 1 hour</td><td>Location:
Hawaii Range Complex: Hawaii Operating Area; Pearl Harbor; Fleet Operational Readiness Accuracy Check Site Range
Southern California Range Complex: Southern California Operating Area ; San Diego Bay and ports
HSTT Transit Corridor</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: High frequency sonar (submarine sonar)
Energy: None
Physical Disturbance and Strike: Vessel strike
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2"></td></tr>
</table>

A.1.10 Integrated Training and Major Range Events

A major range event is comprised of several unit-level range operations conducted by several units operating together while commanded and controlled by a single commander. These exercises typically employ an exercise scenario developed to train and evaluate the Strike Group/Force in required naval tactical tasks. In a major range event, most of the operations and activities being directed and coordinated by the Strike Group commander are identical in nature to the operations conducted in the course in individual, crew, and smaller-unit training events. In a major range event, however, these disparate training tasks are conducted in concert, rather than in isolation.

A.1.10.1 Composite Training Unit Exercise

Activity Name	**Activity Description**
Major Training Events	
Anti-Submarine Warfare for Composite Unit Training Exercise	**Short Description:** Anti-submarine warfare activities conducted during a Composite Training Unit Exercise
Long Description	Intermediate level battle group exercise designed to create a cohesive Strike Group prior to deployment or Joint Task Force Exercise. Typically seven surface ships, helicopters, maritime patrol aircraft, two submarines, and various unmanned vehicles. Each Strike Group performs a rehearsal called Composite Training Unit Exercise before deployment. Prior to the Composite Training Unit Exercise, each ship and aircraft in the strike group trains in their specialty. The Composite Training Unit Exercise is an intermediate-level strike group exercise designed to forge the group into a cohesive fighting team. Composite Training Unit Exercise is normally conducted during a 1 to 3 week period 6 to 8 weeks before Joint Task Force Exercise and consists of an 18 day schedule of event driven exercise, and a 3 day Final Battle Problem. The Composite Training Unit Exercise is an integration phase, at-sea, major range event. For the carrier strike group, this exercise integrates the aircraft carrier and carrier air wing with surface and submarine units in a challenging operational environment. For the expeditionary strike group/amphibious readiness group, this exercise integrates amphibious ships with their associated air wing, surface ships, submarines, and the Marine Expeditionary Unit. Live-fire operations that may take place during Composite Training Unit Exercise include long-range air strikes, Naval Surface Fire Support, and surface-to-air, surface-to-surface, and air-to-surface missile exercises. The Marine Expeditionary Unit also conducts realistic training based on anticipated operational requirements and to further develop the required coordination between Navy and Marine Corps forces. Special Operations training may also be integrated with the exercise scenario.
Information Typical to the Event	**Platform:** Surface vessels, Fixed wing aircraft, Helicopters, Unmanned vehicles, Submarines **Systems:** All sonar systems **Ordnance/Munitions:** All ship and aircraft weapons, explosive sonobuoys may be used **Targets:** All surface, air, and anti-submarine warfare targets (e.g., MK-39 Expendable Mobile Anti-submarine Warfare Training Targets) **Duration:** 21 days **Location:** Southern California Operating Area and Point Mugu Sea Range (overlap area only)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar and active acoustic sources (acoustic countermeasures, hull-mounted sonar, dipping sonar, sonobuoys, towed arrays, Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, Vessel and in-water device strike, Aircraft strike (seabirds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, Countermeasures, Sonobuoy fragments
Detailed Military Expended Material Information	One MK-39 Expendable Mobile Anti-submarine Warfare Training Targets Air deployed sonobuoy will have a parachute Expended countermeasures
Assumptions used for Analysis	For Composite Training Unit Exercise only the anti-submarine warfare activities were analyzed as a Composite Training Unit Exercise. Other warfare area training conducted during the Composite Training Unit Exercise was analyzed as unit level training (gunnery exercise, missile exercise, etc.)

A.1.10.2 Joint Task Force Exercise/Sustainment Exercise

Activity Name	Activity Description	
Major Training Events		
Joint Task Force Exercise	**Short Description:** Final Fleet exercise prior to deployment of the Strike Group. Serves as a ready-to-deploy certification for all units involved. Typically nine surface ships, helicopters, maritime patrol aircraft, two submarines, and various unmanned vehicles.	
Long Description	The Joint Task Force Exercise is a dynamic and complex major range event that is the culminating exercise in the Sustainment Phase training for the Carrier Strike Groups and Expeditionary Strike Groups. For an Expeditionary Strike Group, the exercise incorporates an Amphibious Ready Group Certification Exercise for the amphibious ships and a Special Operations Capable Certification for the Marine Expeditionary Unit. When schedules align, the Joint Task Force Exercise may be conducted concurrently for an Expeditionary Strike Group and Carrier Strike Group. Joint Task Force Exercise emphasizes mission planning and effective execution by all primary and support warfare commanders, including command and control, surveillance, intelligence, logistics support, and the integration of tactical fires. Joint Task Force Exercises are complex scenario-driven exercises that evaluate a strike group in all warfare areas. Joint Task Force Exercise is normally 10 days long, not including a 3-day in-port Force Protection Exercise, and is the final at-sea exercise for the Carrier Strike Group or Expeditionary Strike Group prior to deployment. Joint Task Force Exercise occurs 3 to 4 times per year.	
Information Typical to the Event	**Platform:** Multiple surface combatant vessels, Fixed wing aircraft, Rotary wing aircraft, unmanned vehicles, and submarines **Systems:** Anti-Submarine Warfare systems, Anti-Surface Warfare and Anti-Air Warfare gun and missile systems **Ordnance/Munitions:** Numerous gun rounds, bombs, and missiles, all captured in specific events **Targets:** MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, MK-30 Recoverable Training Target, submarine **Duration:** 10 days	**Location:** Southern California Operating Area and Point Mugu Sea Range (overlap area only)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF1K, MF2, MF2K, MF3, MF4, MF5, MF6, ASW2, ASW3, ASW4,) Light and heavyweight torpedoes, (e.g., TORP1, TORP2), High Frequency Acoustic Modems and Tracking Pingers (e.g., P1-P4) **Energy:** None **Physical Disturbance and Strike:** Submarine strike, Vessel strike, Aircraft strike, MK-30 strike, Military expended materials, Bottom disturbance **Entanglement:** Torpedo guidance wires, parachutes **Ingestion:** Parachutes, Target remnants, Small caliber gun rounds, Chaff	
Detailed Military Expended Material Information	Anti-Submarine Warfare target: One MK-39 or MK-30 target (MK-30 is recovered and reused, MK-39 is not) per event. If target is air-dropped, one parachute per target Target remnants, chaff, flares Sonobuoys: (one parachute for each sonobuoy) Large, medium, and small-caliber projectiles, bombs, missiles, rockets Torpedo guidance wire Expendable acoustic countermeasures	
Assumptions used for Analysis	All Military expended materials, ordnance, explosives, and sonar use is included in individual events	

A.1.10.3 Rim of the Pacific Exercise

Activity Name	Activity Description
Major Training Events	
Rim of the Pacific Exercise	**Short Description:** A biennial multinational training exercise in which navies from Pacific Rim nations and the United Kingdom assemble in Pearl Harbor, Hawaii to conduct training in a number of warfare areas throughout the Hawaiian Islands. Marine mammal systems may be used during a Rim of the Pacific exercise. Components of Rim of the Pacific such as certain Mine Warfare training may be conducted in the Southern California Range Complex.
Long Description	Rim of the Pacific is the world's largest multinational maritime exercise, typically lasting four to five weeks. Hosted by Commander, Pacific Fleet, the exercise is scheduled in the summer on even years. Rim of the Pacific typically consists of 14 nations, 32 ships, 5 submarines, more than 170 aircraft, and 20,000 personnel. The exercise typically consists of three major phases. Phase I, the Harbor Phase, will consist of operational planning meetings, safety briefings, and sporting events. This phase is designed to make final preparations for the at-sea phases of the exercises, as well as build on professional and personal relationships between the participating countries. Phase II, the Operational Phase, is driven by a structured schedule of events. This portion may include live fire gunnery and missile exercises, maritime interdiction and vessel boarding, anti-surface warfare, undersea warfare, and naval maneuvers, air defense exercises, as well as, explosive ordnance disposal, diving and salvage operations, mine clearance operations, and an amphibious landing. This phase exercises the ability of each nation to conduct robust command and control operations with multinational players and enhances each unit's operational capabilities. Phase III, the Tactical Phase of the exercise, is scenario-driven. The intense training during this phase allows participating nations to further strengthen their maritime skills and capabilities and improve their ability to communicate and operate in simulated hostile scenarios. This phase concludes with the ships' return to Pearl Harbor, where participating nations will reconvene to discuss the exercise and overall accomplishments.
Information Typical to the Event	**Platform:** Surface ships, Aircraft, Submarines **Systems:** Anti-Submarine Warfare systems, Anti-Surface Warfare and Anti-Air Warfare gun and missile systems **Ordnance/Munitions:** Numerous gun rounds, bombs, and missiles, all captured in specific events **Targets:** MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, MK-30 Recoverable Training Target, submarine **Duration:** 30 days **Location:** Hawaii Range Complex: Hawaii Operating Area (including Barking Sands Underwater Range Extension; Barking Sands Tactical Underwater Range; Shallow Water Training Range Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF1K, MF2, MF2K, MF3, MF4, MF5, MF6, ASW2, ASW3, ASW4,) Light and heavyweight torpedoes, (e.g., TORP1, TORP2), High Frequency Acoustic Modems and Tracking Pingers (e.g., P1-P4) **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, Vessel and in-water device strike, Aircraft strike (seabirds only) **Entanglement:** Torpedo guidance wires, parachutes **Ingestion:** Parachutes, Target remnants, Small caliber gun rounds, Chaff

Detailed Military Expended Material Information	Anti-Submarine Warfare target: One MK-39 or MK-30 target (MK-30 is recovered and reused, MK-39 is not) per event. If target is air-dropped, one parachute per target Target remnants, chaff, flares Sonobuoys: (one parachute for each sonobuoy) Large, medium, and small-caliber projectiles, bombs, missiles, rockets Torpedo guidance wire Expendable acoustic countermeasures
Assumptions used for Analysis	All Military Expended Material, ordnance, explosives, and sonar use is included in individual events

A.1.10.4 Multi-Strike Group Exercise

Activity Name	Activity Description	
Major Training Events		
Multi-Strike Group Exercise	**Short Description:** A 10-day exercise in which up to three strike groups would conduct training exercises simultaneously.	
Long Description	Elements of the anti-submarine warfare tracking exercise combine in the exercise of multiple air, surface, and subsurface units, over a period of up to 10 days. No explosive ordnance is used. Sonobuoys, active and passive sonar, and Nixie are used. The AN/SLQ-25 Nixie is a surface ship countermeasure system that includes a towed torpedo decoy device and a shipboard signal generator. The decoy emits signals to draw a torpedo away from its intended target. Up to three Strike Groups would conduct training exercises simultaneously in the Hawaii Range Complex. The Strike Groups would not be homeported in Hawaii, but would stop in Hawaii en route to a final destination. The Strike Groups would be in Hawaii for up to 10 days per exercise. The exercise would involve Navy assets engaging in a "free play" battle scenario, with U.S. forces pitted against a replicated opposition force. The exercise provides realistic in-theater training.	
Information Typical to the Event	**Platform:** Multiple surface combatant vessels, aircraft, and submarines **Systems:** Anti-Submarine Warfare systems, Anti-Surface Warfare and Anti-Air Warfare gun and missile systems **Ordnance/Munitions:** Numerous gun rounds, bombs, and missiles, all captured in specific events **Targets:** MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, MK-30 Recoverable Training Target, Submarine **Duration:** Each multi-strike group exercise lasts for up to 10 days and consists of multiple 12-hour Anti-Submarine Warfare events.	**Location:** Hawaii Operating Area Southern California Operating Area and Point Mugu Range (overlap area only)
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF1K, MF2, MF2K, MF3, MF4, MF5, MF6, ASW2, ASW3, ASW4,) Light and heavyweight torpedoes, (e.g., TORP1, TORP2), High Frequency Acoustic Modems and Tracking Pingers (e.g., P1-P4) **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, Vessel and in-water device strike, Aircraft strike (seabirds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, Small caliber gun rounds, Chaff	
Detailed Military Expended Material Information	Anti-Submarine Warfare target: One MK-39 or MK-30 target (MK-30 is recovered and reused, MK-39 is not) per event. If target is air-dropped, one parachute per target Target remnants, chaff, flares Sonobuoys: (one parachute for each sonobuoy) Large, medium, and small-caliber projectiles, bombs, missiles, rockets Expendable acoustic countermeasures	
Assumptions used for Analysis	All Military Expended Material, ordnance, and sonar use is included in individual events	

A.1.10.5 Integrated Anti-Submarine Warfare Course

Activity Name	Activity Description	
Major Training Events		
Integrated Anti-Submarine Warfare Course	**Short Description:** Multiple vessels, aircraft, and submarines integrate the use of their sensors, including sonobuoys, to search, detect, and track threat submarines.	
Long Description	Integrated Anti-Submarine Warfare Course is a tailored course of instruction designed to improve Sea Combat Commander and Strike Group integrated anti-submarine warfare warfighting skill sets. Integrated Anti-Submarine Warfare Course is a coordinated training scenario that typically involves five surface ships, two to three embarked helicopters, a submarine and one maritime patrol aircraft searching for, locating, and attacking one submarine. The scenario consists of two 12-hour events that occur five times per year. The submarine may practice simulated attacks against the ships while being tracked. Hull mounted, towed array and dipping sonar is employed by ships and helicopters. The submarine also periodically operates its sonar.	
Information Typical to the Event	**Platform:** Surface vessels, Fixed and rotary wing aircraft, Submarines, Unmanned vehicles **Systems:** Hull mounted, Towed array, and Dipping sonar, Mid-frequency sonar (e.g., MF1, MF1K, MF2, MF2K, MF3, MF4, MF5, MF6, ASW2, ASW3, ASW4), Sonobuoys **Ordnance/Munitions:** Sonobuoys **Targets:** Expendable mobile anti-submarine warfare training targets **Duration:** 2 to 5 days	**Location:** Southern California Operating Area: Southern California Anti-submarine Warfare Range
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar and active acoustics (acoustic countermeasures, dipping sonar, hull-mounted sonar, sonobuoys), Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, Vessel and in-water device strike, Aircraft strike (seabirds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, countermeasures, sonobuoy fragments	
Detailed Military Expended Material Information	Parachutes, Sonobuoy fragments, Expended countermeasures	
Assumptions used for Analysis	Two MK-39 Expendable Mobile Anti-Submarine Warfare Training Target may be used in place of an actual submarine target Air deployed sonobuoy will have a parachute	

A.1.10.6 Group Sail

Activity Name	**Activity Description**
Major Training Events	
Group Sail	**Short Description:** Multiple ships and helicopters integrate the use of sensors, including sonobuoys, to search, detect, and track a threat submarine. Group sail exercises are not dedicated Anti-Submarine Warfare events and involve multiple warfare areas.
Long Description	Multiple ships and helicopters integrate the use of sensors, including sonobuoys, to search, detect, classify, localize, and track a threat submarine to launch a torpedo. Group sail exercises are not dedicated ASW events and involve multiple warfare areas. Group Sail is an intermediate training exercise primarily intended to introduce coordinated operations after Unit Level Training and prior to Composite Training. This event stresses planning, coordination, and communications during multiple warfare training scenarios. Two or more ships and up to two helicopters searching for, locating, and attacking one submarine. Typically, one ship and helicopter are actively prosecuting while the other ship and helicopter are repositioning. Simultaneously, the submarine may practice simulated attacks against the ships. Multiple acoustic sources may be active at one time. Typical participants and systems used during a Group Sail include: • Navy Destroyer (2) – AN/SQS-53: 10 hours; Nixie: 12 hours; AN/SSQ-62: 2 buoys • Navy Frigate (1) – AN/SQS-56: 10 hours; Nixie: 12 hours; AN/SSQ-62: 2 buoys • Submarine (1) – AN/BQQ-10: 10 hrs (2 pings/hr); SUB HF: 0.5 hour • Maritime Patrol Aircraft (1) – AN/SSQ-62: 12 buoys; AN/SSQ-110 7 buoys; AN/SSQ-125 7 buoys • MH-60 (3) – AN/AQS-22: 1 hour dipping; AN/SSQ-62: 4 buoys
Information Typical to the Event	**Platform:** Rotary wing aircraft, Surface combatant vessels, Submarine **Systems:** Mid-frequency hull mounted sonar, Towed array and dipping sonar (e.g., MF1, MF2, MF3, MF4, MF5, MF6, ASW4), High Frequency Acoustic Modems and Tracking Pingers (e.g., P1-P4) **Ordnance/Munitions:** None **Targets:** Expendable Mobile Anti-submarine Warfare Training Targets **Duration:** 2 to 3 days **Location:** Hawaii Operating Area Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency hull mounted sonar, Towed array and dipping sonar, High Frequency Acoustic Modems and Tracking Pingers **Energy:** None **Physical Disturbance and Strike:** Submarine strike, Vessel strike, Aircraft strike, MK-30 strike, Military expended materials, Bottom disturbance **Entanglement:** Parachutes **Ingestion:** Parachutes
Military Expended Material	One MK-39 or MK-30 target (MK-30 is recovered and reused, MK-39 is not) If target is air-dropped, one parachute per target Sonobuoys: (one parachute for each sonobuoy), expended countermeasures
Assumptions Used for Analysis	One Destroyer Squadron in Hawaii will conduct two Group Sails per year. These exercises are also known by the Hawaiian name "Koa Kai" (ocean warrior). Koa Kai is a 2 to 3 day event including Anti-Submarine Warfare. While preference will be to train against an actual submarine, or MK 30 recoverable target, assume only MK 39 expendable targets will be used.

A.1.10.7 Undersea Warfare Exercise

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Major Training Events</td></tr>
<tr><td>Undersea Warfare Exercise</td><td colspan="2">Short Description:
Elements of Anti-Submarine Warfare Tracking Exercises combine in this exercise of multiple air, surface, and subsurface units, over a period of several days. Sonobuoys released from aircraft. Active and passive sonar used.</td></tr>
<tr><td>Long Description</td><td colspan="2">Elements of the anti-submarine warfare tracking exercise combine in an exercise of multiple air, surface, and subsurface units, over a period of 4 days. No explosive ordnance. Sonobuoys are released from aircraft, and active and passive sonar is used.
Undersea Warfare Exercise is conducted up to five times annually. Undersea Warfare Exercise is an assessment based anti-submarine warfare exercise conducted by Expeditionary Strike Groups and Carrier Strike Groups while in transit from the west coast of the United States to the Western Pacific Ocean. Undersea Warfare Exercise can involve more than one Carrier Strike Group or Expeditionary Strike Group formation.
Typical systems and participants used during an Undersea Warfare Exercise include:
• AN/SQS-53: 64 hours (total = 192 hours) (3 Guided Missile Destroyers (DDGs) x 64 hours each)
• Nixie (DDG): 70 hours (total = 210 hours) (3 DDG x 70 hours each)
• AN/SSQ-62: 2 buoys (total = 6 buoys) (3 DDG x two buoys each)
• AN/SQS-56: 64 hours
• Nixie (Fast Frigate): 70 hours
• AN/SSQ-62: 02</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Rotary wing aircraft, Fixed wing Maritime Patrol Aircraft, submarines
Systems: Mid-frequency and high-frequency sonar, dipping sonar (e.g., MF1, MF2, MF3, MF4, MF5, MF6, ASW2, ASW4), High Frequency Acoustic Modems and Tracking Pingers (e.g., P1-P4), sonobuoys
Ordnance/Munitions: None
Targets: MK-30, MK-39 Expendable Mobile Anti-submarine Warfare Training Targets, submarine
Duration: Four days</td><td>Location:
Hawaii Operating Area</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Mid-frequency, high-frequency sonar, and dipping sonar, Aircraft noise
Energy: None
Physical Disturbance and Strike: Submarine strike, Vessel strike, Aircraft strike, MK-30 strike, Military expended materials, Bottom disturbance
Entanglement: Parachutes
Ingestion: Parachutes</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">One MK-39 or MK-30 target (MK-30 is recovered and reused, MK-39 is not)
If target is air-dropped, one parachute per target
Sonobuoys: (one parachute for each sonobuoy)</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2">All MEM, ordnance, explosives, and sonar use is included in individual events.</td></tr>
</table>

A.1.10.8 Ship Anti-Submarine Warfare Readiness and Evaluation Measuring

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Major Training Events</td></tr>
<tr><td>Ship Anti-Submarine Warfare Readiness and Evaluation Measuring</td><td colspan="2">Short Description:
This exercise will typically involve multiple ships, submarines, and aircraft in several coordinated events over a period of a week or less. The Navy uses this exercise to collect and analyze high-quality data to quantitatively “assess” surface ship Anti-Submarine Warfare readiness and effectiveness.</td></tr>
<tr><td>Long Description</td><td colspan="2">Ship Anti-Submarine Warfare Readiness and Evaluation Measuring Exercise is a Chief of Naval Operations chartered program with the overall objective to collect and analyze high-quality data to quantitatively assess surface ship anti-submarine warfare readiness and effectiveness. The exercise will typically involve multiple ships, submarines, and aircraft in several coordinated events over a period of a week or less.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Multiple rotary wing aircraft, Fixed wing Maritime Patrol Aircraft, submarines
Systems: Mid-frequency and high-frequency sonar, Rotary wing aircraft dipping sonar (e.g., MF1, MF2, MF3, MF4, MF5, MF6, ASW2, ASW4), High Frequency Acoustic Modems and Tracking Pingers (e.g., P1-P4), sonobuoys
Ordnance/Munitions: None
Targets: MK-30, MK-39 Expendable Mobile Anti-submarine Warfare Training Targets, Submarine
Duration: 5-7 days/ 1 time per year</td><td>Location:
Southern California Operating Area: Southern California Anti-submarine Warfare Range</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Mid-frequency, high-frequency sonar, and dipping sonar, Aircraft noise
Energy: None
Physical Disturbance and Strike: Submarine strike, Vessel strike, Aircraft strike, MK-30 strike, Military expended materials, Bottom disturbance
Entanglement: Parachutes
Ingestion: Parachutes</td></tr>
<tr><td>Military Expended Material</td><td colspan="2">• One MK-39 or MK-30 target (MK-30 is recovered and reused, MK-39 is not)
• If target is air-dropped, one parachute per target
• Sonobuoys: (one parachute for each sonobuoy)</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2">All MEM, ordnance, explosives, and sonar use is included in individual events.</td></tr>
</table>

A.2 Naval Air Systems Command Testing Activities

Naval Air Systems Command events will closely follow Fleet primary mission areas, such as the testing of airborne mine warfare and anti-submarine warfare weapons and systems. Naval Air Systems Command events include, but are not limited to, the testing of new aircraft platforms, weapons, and systems that have not been integrated into Fleet training events, such as directed energy weapons and the Joint Strike Fighter. In addition to testing new platforms, weapons, and systems, Naval Air Systems Command also conducts lot acceptance testing of airborne weapons and sonobuoys in support of the Fleet. These types of events do not fall within one of the Fleet primary mission areas; however, in general, most Naval Air Systems Command testing events in terms of their potential environmental effects are similar to Fleet training events.

While many of these systems will eventually be used by the Fleet during normal training and will be addressed in this EIS/OEIS for those Fleet activities, testing and development activities involving the same or similar systems as will be used by operational Fleet units may be used in different locations and manners than when actually used by operational Fleet units. Hence, the analysis for testing events and training of Fleet units may differ.

A.2.1 ANTI-AIR WARFARE TESTING

A.2.1.1 Air Combat Maneuver Test

Activity Name	Activity Description
Anti-Air Warfare	
Air Combat Maneuver	**Short Description:** Aircrews engage in flight maneuvers designed to gain a tactical advantage during combat.
Long Description	Air Combat Maneuver is the general term used to describe an air-to-air test event involving two or more aircraft, each engaged in continuous proactive and reactive changes in aircraft attitude, altitude, and airspeed. No weapons are fired during Air Combat Maneuver activities.
Information Typical to the Event	**Platform:** Fixed wing aircraft (e.g., F-35; F/A 18 A-D or E/F variants; E/A-18G) **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 1.5 to 2 flight hours/event **Location:** Hawaii Operating Area Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None
Detailed Military Expended Material Information	
Assumptions used for Analysis	Two Chaff Flares per event

A.2.1.2 Air Platform Vehicle Test

Activity Name	Activity Description	
Anti-Air Warfare		
Air Platform/Vehicle Test	**Short Description:** Testing performed to quantify the flying qualities, handling, airworthiness, stability, controllability, and integrity of an air platform or vehicle, and in-flight refueling capabilities. No weapons are released during an Air Platform/Vehicle Test.	
Long Description	The Air Platform/Vehicle Test describes the testing performed to quantify the flying qualities, handling, airworthiness, stability, controllability, and integrity of an air platform/vehicle. Integration of non-weapons system including-flight refueling tests are also conducted as part of an Air Platform/Vehicle Test. Test results are compared against design and performance specifications for compliance. The test results are also used to define stability and controllability characteristics and limitations and to improve and update existing analytical and predictive models. A wide variety of fixed wing and rotary wing aircraft, including unmanned aerial systems would undergo air platform/vehicle testing. No weapons are released during an Air Platform/Vehicle Test. Aircraft may employ laser detection for targeting systems and trailing antenna. Events may involve two or more fighter jet aircrafts and a towed target tractor by a contracted aircraft (e.g., Lear jet)	
Information Typical to the Event	**Platform:** Fixed and rotary wing (e.g. V-22, F-35, E-2/C-2,), includes Unmanned Aerial Systems **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 2 to 8 flight hours/ event	**Location:** Hawaii Operating Area Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (fuel tanks or similar), Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	Fuel tanks, carriages, dispensers, or similar types of support systems on aircraft may be jettisoned depending on test	
Assumptions used for Analysis	Estimated two to four fuel tanks expended per event; however this can vary based on requirements	

A.2.1.3 Air Platform Weapons Integration Test

Activity Name	Activity Description
Anti-Air Warfare	
Air Platform Weapons Integration Test	**Short Description:** Testing performed to quantify the compatibility of weapons with the aircraft from which they would be launched or released. Mostly non-explosive weapons or shapes are used.
Long Description	The Air Platform Weapons Integration Test describes the testing performed to quantify the compatibility of weapons with the aircraft from which they would be released. Tests evaluate the compatibility of the weapon and its carriage, suspension, and launch equipment with the performance and handling characteristics of the designated aircraft. Additional tests assess the ability of the weapon to separate or launch safely from the aircraft at combat velocities, including at supersonic speeds. Test results are compared against design specifications for compliance. The test results are also used to define performance characteristics and to improve and update existing analytical and predictive models.
Information Typical to the Event	**Platform:** Fixed and rotary wing aircraft (e.g., F/A-18 A-D or F/A-18 E/F; F-35 ; E/A-18G; MH-60R) **Systems:** Gun Systems Integration; Air Intercept Missile Series (e.g., AIM-9x); Advanced Medium Range Air-to-Air Missile; AGM-114R, MK46, MK54, 20mm, Rapid Airborne Mine Clearance System **Ordnance/Munitions:** Missiles, rockets, small and medium caliber projectiles, bombs (non-explosive) **Targets:** The use of drones, such as the BQM-74 and 34, may be used as a target for weapon and mission system test events. Surface targets will also be used as needed for proposed test events. **Duration:** 1.5 to 2.5 flight hours/event **Location:** Hawaii Operating Area Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles, missiles, rockets, bombs), Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Small and medium projectiles, Casings
Detailed Military Expended Material Information	Small projectiles Medium caliber canon rounds Non-explosive rockets and missiles Non-explosive bombs Weapons carriage, suspension, and launch equipment
Assumptions used for Analysis	Estimate two to four weapons carriages expended per event

A.2.1.4 Intelligence, Surveillance, and Reconnaissance Test

Activity Name	Activity Description	
Anti-Air Warfare		
Intelligence, Surveillance, and Reconnaissance Test	**Short Description:** Aircrews use all available sensors to collect data on threat vessels.	
Long Description	An Anti-Air Warfare intelligence, surveillance, and reconnaissance test involves evaluating communications capabilities of fixed-wing and rotary wing aircraft, including unmanned systems that can carry cameras, sensors, communications equipment, or other payloads. New systems are tested at sea to ensure proper communications between aircraft and vessels. Several unmanned aerial systems are planned for testing, including the Broad Area Maritime Surveillance system, Fire Scout vertical take-off and landing tactical unmanned air vehicle, and the Unmanned Combat Air System; Aircraft Carrier Demonstration; Unmanned Aerial System. Unmanned Aerial Systems are remotely piloted or self-piloted aircraft. Tactical Unmanned Aerial Systems are designed to support tactical commanders with near-real-time imagery intelligence at ranges up to 200 kilometers. Most small- to mid-sized unmanned systems, such as Small Tactical Unmanned Aerial System/Tier II, act as eyes in the sky, relaying raw imagery back to military personnel on the ground. The data are then processed, analyzed, and shared up and down the chain of command. New technology systems, such as the MK XII-Mode 5, which provide combat identification Friend or Foe and are used for aircraft and ship-based communications.	
Information Typical to the Event	**Platform:** Fixed-wing aircraft (e.g., E-2 and P-8A, P-3); Rotary-wing aircraft; Broad Area Maritime Surveillance system; Fire Scout vertical take-off and landing tactical unmanned air vehicle; Unmanned Combat Air System; Aircraft Carrier Demonstration; Small Tactical Unmanned Aerial System/Tier II **Systems:** Small Tactical Unmanned Aerial Systems (e.g., MK XII-Mode 5) **Ordnance/Munitions:** None **Targets:** None **Duration:** 2-20 flight hours/event	**Location:** Hawaii Operating Area Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis		

A.2.2 ANTI-SURFACE WARFARE TESTING

A.2.2.1 Air-to-Surface Missile Test

Activity Name	Activity Description	
Anti-Surface Warfare		
Air-to-Surface Missile Test	**Short Description:** This event is similar to the training event missile exercise air-to-surface. Test may involve both fixed wing and rotary wing aircraft launching missiles at surface maritime targets to evaluate the weapons system or as part of another systems integration test.	
Long Description	Similar to a missile exercise air-to-surface, an Air to Surface Missile Test may involve both fixed wing and rotary wing aircraft launching missiles at surface maritime targets to evaluate the weapons system or as part of another systems integration test. Air-to-Surface Missile Tests can include high explosive, non-explosive, or non-firing (captive air training missile) weapons. Both stationary and mobile targets would be utilized during testing, and some operational tests would use explosive missiles (i.e., high explosive warhead). All developmental testing will use non-explosive missile (i.e., non-explosive warhead) with a live motor. NAVAIR plans to conduct integration testing of the MH-60R/S helicopters and the joint air to ground missile. Both stationary and mobile targets would be using during testing. Approximately 25 percent of some operational tests could use explosive missiles (i.e. high explosive warhead). All developmental testing will use non-explosive (i.e., non-explosive warhead). Similar integration tests would be conducted with the MH-60R/S and the Hellfire air to ground missile. Approximately 25 percent of these tests could involve high-explosive missiles (i.e. high-explosive warhead). P-3 and P-8A fixed wing aircraft plan to conduct software and weapons verification testing with Harpoon or Joint Stand-off Weapon (or equivalent) missiles. Some explosive missiles are planned for use.	
Information Typical to the Event	**Platform:** Fixed and rotary wing aircraft (e.g., P3/P8; MH 60R/S) **Systems:** Missile systems **Ordnance/Munitions:** Joint air to surface missile; hellfire air-to-ground missile (high-explosive); Harpoon, Joint Stand-off Weapon (non-explosive); Captive air training missile; SLAM-ER missile **Targets:** Stationary and mobile surface marine targets **Duration:** 2 to 4 flight hours/ event	**Location:** Hawaii Operating Area Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions, Aircraft noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (missiles), Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Missile fragments, Target fragments	
Detailed Military Expended Material Information	Missile and target fragments	
Assumptions used for Analysis	Two air-to-surface missiles per event, 25 percent will be high-explosive	

A.2.2.2 Air-to-Surface Gunnery Test

Activity Name	Activity Description	
Anti-Surface Warfare		
Air-to-Surface Gunnery Test – Medium Caliber	**Short Description:** This event is similar to the training event gunnery exercise air-to-surface. Strike fighter and helicopter aircrews evaluate new or enhanced aircraft guns against surface maritime targets to test that the gun, gun ammunition, or associated systems meet required specifications or to train aircrew in the operation of a new or enhanced weapons system.	
Long Description	Strike fighter and helicopter aircrews evaluate new or enhanced aircraft guns against surface maritime targets to test that the gun, gun ammunition, or associated systems meets required specifications or to train aircrew in the operation of a new or enhanced weapons system. Non-explosive practice munitions are typically used during this type of test; however, a small number of high explosive rounds may be used during final testing. Rounds that may be used include 7.62 mm; 20 mm; 30 mm; 0.30 calibers; and 0.50 caliber gun ammunition (see Mine Warfare Section below).	
Information Typical to the Event	**Platform:** Fixed wing and rotary aircraft (e.g.,F-35; F/A-18 A-D; F/A-18 E/F; and MH 60R/S) **Systems:** Medium caliber gun systems (GAU-17, GAU-21, M197, M230, M240) **Ordnance/Munitions:** Medium caliber projectiles (e.g., 7.62 mm, 20mm, 30mm, 30mm supercavitating, 0.30 caliber, and 0.50 caliber [non-explosive and explosive]) **Targets:** Stationary and mobile surface maritime targets may be used **Duration:** 2 flight hours/event	**Location:** Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives, Weapons firing noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles), Aircraft strike (birds only) **Entanglement:** None **Ingestion:** Projectiles fragments, Casings, Target fragments, Medium caliber projectiles	
Detailed Military Expended Material Information	Projectiles Casings Target fragments Projectile fragments	
Assumptions used for Analysis		

A.2.2.3 Rocket Test

Activity Name	Activity Description	
Anti-Surface Warfare		
Rocket Test	**Short Description:** Rocket tests are conducted to evaluate the integration, accuracy, performance, and safe separation of laser-guided and unguided 2.75-inch rockets fired from a hovering or forward flying helicopter or from a fixed wing strike aircraft.	
Long Description	Rocket tests are conducted to evaluate the integration, accuracy, performance, and safe separation of laser-guided and unguided 2.75-inch rockets fired from a hovering or forward flying helicopter or from a fixed wing strike aircraft. Rocket tests would involve the release of primarily live motor/non-explosive warhead rockets. Some high explosive warhead rockets would be tested, and during a jettison test, rockets with a non-explosive motor and non-explosive warhead would be jettisoned along with the rocket launcher. Rocket tests are also conducted to train aircrew on the use of new or enhanced weapons systems. Rocket types may include variations of the Hydra-70 rocket developed under the Advanced Precision Kill Weapons System program or similar munitions developed under Low-cost Guided Imaging Rocket program as well as MEDUSA rockets. All rockets planned for testing are 2.75-inch rockets. Some rocket tests may be conducted in conjunction with upgrades to or integration of the Forward Looking Infrared targeting system.	
Information Typical to the Event	**Platform:** Fixed wing or rotary aircraft (e.g., F/A 18 variants; F-35; MH-60R/S) **Systems:** **Ordnance/Munitions:** 2.75 inch rockets (e.g., Hydra-70 or similar [explosive and non-explosive]) **Targets:** Stationary and mobile surface maritime targets may be used **Duration:** 1.5 to 2 hours/event	**Location:** Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosives, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (rockets), Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Rocket fragments, Target fragments	
Detailed Military Expended Material Information	Rocket fragments Target fragments Rocket launcher	
Assumptions used for Analysis	Under the No Action Alternative, all rockets are non-explosive Alternatives 1 and 2: Multiple rockets fired per event, 25 percent which will be high-explosive	

A.2.2.4 Laser Targeting Test

Activity Name	Activity Description	
Anti-Surface Warfare		
Laser Targeting Test	**Short Description:** Aircrews illuminate enemy targets with lasers.	
Long Description	Aircrew use laser targeting devices integrated into aircraft or weapons systems to evaluate targeting accuracy and precision and to train aircrew in the use of newly developed or enhanced laser targeting devices designed to illuminate designated targets for engagement with laser-guided weapons. No weapons are released during a laser targeting test.	
Information Typical to the Event	**Platform:** Rotary or fixed wing aircraft (e.g., MH-60R/S; P8-A) **Systems:** Laser targeting systems, including the Laser Range Designator on the MH-60R/S helicopters **Ordnance/Munitions:** None **Targets:** None **Duration:** 2.5 flight hours event	**Location:** Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strikes (seabirds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis	Laser energy for targeting is not carried forward for analysis	

A.2.3 Electronic Warfare Testing

A.2.3.1 Electronic Systems Evaluation

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Electronic Warfare</td></tr>
<tr><td>Electronic Systems Evaluation</td><td colspan="2">Short Description:
Test to evaluate the effectiveness of electronic systems to control, deny, or monitor critical portions of the electromagnetic spectrum. In general, Electronic Warfare testing will assess the performance of three types of Electronic Warfare systems: Electronic Attack, Electronic Protect, and Electronic Support.</td></tr>
<tr><td>Long Description</td><td colspan="2">Electronic Systems Evaluations are performed to determine the effectiveness of designated Electronic Warfare systems to control, deny, or monitor critical portions of the electromagnetic spectrum. In general, Electronic Warfare testing will assess the performance of three types of Electronic Warfare systems; specifically, Electronic Attack, Electronic Protect, and Electronic Support.
Aircraft Electronic Attack systems are designed to confuse the enemy or deny the enemy the use of its electronically-targeted weapons systems. The Suppression of Enemy Air Defenses and active jamming against hostile aircraft and surface combatant radars are examples of the application of Electronic Attack. Aircraft Electronic Protect systems are designed to intercept, identify, categorize, and defeat threat weapons systems that are already targeting that or other friendly aircraft. Aircraft Electronic Support systems employ passive tactics to intercept, exploit, locate (target), collect, collate, and decipher information from the Radio Frequency spectrum for the purpose of determining the intentions of the radiating source. Test results are compared against design specifications to evaluate the performance of the actually Electronic Warfare system. The test results are also used to define performance characteristics and to improve and update existing analytical and predictive models.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Fixed or rotary wing aircraft (e.g., E-2/C-2, P-3C, P-8A, F/A 18 A/D; E 6B; CH 53K)
Systems: Electronic Warfare systems (Electronic Attack, Electronic Protect, and Electronic Support)
Ordnance/Munitions: None
Targets: None
Duration: 2 to 6 flight hours/event</td><td>Location:
Southern California Operating Area</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Aircraft noise
Energy: None
Physical Disturbance and Strike: None
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2"></td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2"></td></tr>
</table>

A.2.4 ANTI-SUBMARINE WARFARE TESTING

A.2.4.1 Anti-Submarine Warfare Torpedo Test

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Anti-Submarine Warfare</td></tr>
<tr><td>Anti-Submarine Warfare Torpedo Test</td><td colspan="2">Short Description:
This event is similar to the training event, Torpedo Exercise. Test evaluates Anti-Submarine Warfare systems onboard rotary wing and fixed wing aircraft and the ability to search for, detect, classify, localize, and track a submarine or similar target.</td></tr>
<tr><td>Long Description</td><td colspan="2">Similar to a Torpedo Exercise, an Anti-Submarine Warfare Torpedo Test evaluates Anti-Submarine Warfare systems onboard rotary wing (e.g., MH-60R helicopter) and fixed wing Marine Patrol Aircraft (e.g., P-8, P-3) aircraft and the ability to search for, detect, classify, localize, track, and attack a submarine or similar target (e.g., MK-39 Expendable Mobile Anti-Submarine Warfare Training Target, or MK-30). The focus of the Anti-Submarine Warfare Torpedo test is on the torpedo and torpedoes (e.g., MK-46 or MK-54), but other Anti-Submarine Warfare systems are often used during the test, such as AN/AQS-22 dipping sonar (MH-60R) and sonobuoys (e.g., AN/SSQ-62). MK-39 or MK-30 targets simulate an actual submarine threat and are deployed at varying depths and speeds. This activity can be conducted in shallow or deep waters and aircraft can originate from a land base or from a surface ship. The Torpedo Test culminates with the release of an exercise torpedo against the target and is intended to evaluate the targeting, release, and tracking process of deploying torpedoes from aircraft. All exercise torpedoes used in testing are either running (EXTORP) or non-running (REXTORP). Non-explosive torpedoes are recovered. A parachute assembly and guidance wire used for aircraft-launched torpedoes is jettisoned and sinks. Ballast (typically lead weights) may be released from the torpedoes to allow for recovery and sink to the bottom.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Fixed and Rotary wing aircraft (e.g., P-3/P-8, MH-60R)
Systems: Dipping sonar(e.g., AN/AQS-22); sonobuoys (e.g., AN/SSQ-62)
Ordnance/Munitions: Torpedoes (e.g.,MK-46, MK-54, MK-50, and MK-56;non explosive)
Targets: MK-39 Expendable Mobile Anti-Submarine Warfare Training Target or MK-30
Duration: 2 to 6 flight hours/event.</td><td>Location:
Hawaii Operating Area
Southern California Operating Area</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Mid-frequency Sonar (AN/AQS-22), Sonobuoys (AN/SSQ-62x);
Energy: None
Physical Disturbance and Strike: Military expended material strike, Aircraft strike (seabirds only)
Entanglement: Parachutes, Guidance wire
Ingestion: Parachutes, Target fragments</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Torpedo accessories (e.g. parachute assembly, guidance wire)
Sonobuoys
Ballast
Target& torpedo fragments</td></tr>
<tr><td>Assumptions used for Analysis</td><td colspan="2">Assume one torpedo accessory package (parachute, ballast, guidance wire) per torpedo
Assume one target per torpedo
Assume 12 sonobuoys per event</td></tr>
</table>

A.2.4.2 Kilo Dip

Activity Name	**Activity Description**	
Anti-Submarine Warfare		
Kilo dip	**Short Description:** Function check of the AN/AQS-22 dipping sonar prior to conducting full test or training event on the dipping sonar.	
Long Description	A kilo dip is the operational term used to describe a functional check of a helicopter deployed dipping sonar system. During a functional check, a single MH-60R helicopter would transit to an area designated for dipping sonar testing (i.e., a dip point usually close to shore) and would deploy the AN/AQS-22 sonar transducer assembly via a reel mechanism to a predetermined depth or series of depths while the helicopter hovers over the dip point. Once at the desired depth, the AN/AQS-22 sonar transducer would be activated and would transmit a pulsed, acoustic signal (i.e., ping) for approximately two to four minutes (enough time to check that all systems are functioning properly). After the check is completed, the AN/AQS-22 sonar transducer assembly would be reeled in, and in some instances the helicopter would transit to a second dip point before the procedure is repeated. A kilo dip is a precursor to more comprehensive testing.	
Information Typical to the Event	**Platform:** Rotary wing aircraft (e.g., MH-60R) **Systems:** Mid-frequency dipping sonar (AN/AQS-22) **Ordnance/Munitions:** None **Targets:** None **Duration:** 1.5 flight hours/event	**Location:** Hawaii Operating Area Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (AN/AQS-22), Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information		
Assumptions used for Analysis		

A.2.4.3 Sonobuoy Lot Acceptance Test

Activity Name	Activity Description
Anti-Submarine Warfare	
Sonobuoys Lot Acceptance Test	**Short Description:** Sonobuoys are deployed from surface vessels and aircraft to verify the integrity and performance of a lot or group of sonobuoys in advance of delivery to the Fleet for operational use
Long Description	Sonobuoys are deployed from surface vessels and aircraft to verify the integrity and performance of a lot or group of sonobuoys in advance of delivery to the Fleet for operational use. Lot acceptance testing would occur for the following types of sonobuoys: AN/SSQ-62x DICASS, AN/SSQ-110x Improved Extended Echo Ranging, AN/SSQ-125 MAC, MK-61 SUS, MK-64 SUS, MK-82 SUS, MK-84 SUS, and Mini Source. Some sonobuoys are high explosive
Information Typical to the Event	**Platform:** Surface combat vessels, fixed wing aircraft, rotary wing aircraft **Systems:** Sonobuoys (AN/SSQ-62x DICASS, AN/SSQ-110x Improved Extended Echo Ranging, AN/SSQ-125 MAC, MK-61 SUS, MK-64 SUS, MK-82 SUS, MK-84 SUS, and Mini Source, High duty cycle sonar) **Ordnance/Munitions:** High explosive sonobuoy systems described above **Targets:** None **Duration:** 6 flight hours/event **Location:** Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Sonar, sonobuoys, Underwater explosions, Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, Vessel strike, Aircraft strike (seabirds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, Sonobuoy fragments
Detailed Military Expended Material Information	Parachutes Sonobuoy fragments
Assumptions used for Analysis	Assume one parachute per sonobuoy Assume an average of 80 non-explosive sonobuoys per event; however the number of sonobuoys used in each event may vary

A.2.4.4 Anti-Submarine Warfare Tracking Test – Helicopter

Activity Name	Activity Description
Anti-Submarine Warfare	
Anti-Submarine Warfare Tracking Test – Helicopter	**Short Description:** This event is similar to the training event, Anti-Submarine Tracking Exercise–Helicopter. The test evaluates the sensors and systems used to detect and track submarines and to ensure that helicopter systems used to deploy the tracking systems perform to specifications.
Long Description	Similar to an Anti-Submarine Tracking Exercise–Helicopter, an Anti-Submarine Tracking Test — Helicopter evaluates the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications. Typically, one MH-60R helicopter conducts Anti-Submarine testing using the AN/AQS-22 dipping sonar, tonal sonobuoys (e.g., AN/SSQ-62), passive sonobuoys (e.g., AN/SSQ-53D/E), or explosive sonobuoys (e.g., mini sound-source seeker buoys). Targets (e.g., MK-39 Expendable Mobile Anti-Submarine Warfare Training Target or MK-30) may also be employed during an Anti-Submarine event. This activity would be conducted in shallow or deep waters and could initiate from a land base or from a surface ship. Helicopter Anti-Submarine tests are intended to evaluate the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications. Some Anti-Submarine Helicopter Tracking Test could be conducted as part of an Anti-Submarine Tracking Coordinated Event with Fleet training activities.
Information Typical to the Event	**Platform:** Rotary wing aircraft (e.g., MH-60R) **Systems:** Dipping sonar (e.g., AN/AQS-22), tonal sonobuoys (e.g., AN/SSQ-62), explosive sonobuoys (e.g., mini sound-source seeker buoys), passive sonobuoys (e.g., AN/SSQ-53D/E),and new development of mid-frequency active sonar buoys (follow-on to DICASS) **Ordnance/Munitions:** High explosive sonobuoys [mini sound-source seeker buoys (i.e., mini-buoys)] **Targets:** MK-39 Expendable Mobile Anti-Submarine Warfare Training Target , MK-30 recoverable target **Duration:** 2 flight hours/event **Location:** Hawaii Operating Area Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (AN/AQS-22), sonobuoys (e.g., AN/SSQ-62), New development mid-frequency sonobuoys, Underwater explosions, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, Aircraft strike (seabirds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, Explosive sonobuoy fragments
Detailed Military Expended Material Information	Sonobuoy debris, Parachutes
Assumptions used for Analysis	One MK-39 or MK-30 target (MK-30 is recovered and reused, MK-39 is not) If target air dropped, one parachute /target 0-24 sonobuoys per event (one parachute /sonobuoy)

A.2.4.5 Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft

Activity Name	Activity Description	
Anti-Submarine Warfare		
Anti-Submarine Warfare Tracking Test – Maritime Patrol Aircraft	**Short Description:** This event is similar to the training event, Anti-Submarine Warfare Tracking Exercise–Maritime Patrol Aircraft. The test evaluates the sensors and systems used by maritime patrol aircraft to detect and track submarines and to ensure that aircraft systems used to deploy the tracking systems perform to specifications and meet operational requirements.	
Long Description	Similar to an Anti-Submarine Warfare Tracking Exercise-Maritime Patrol Aircraft. Anti-Submarine Warfare Tracking Test—Maritime Patrol Aircraft evaluates the sensors and systems used to detect and track submarines and to ensure that platform systems used to deploy the tracking systems perform to specifications and meet operational requirements. P-3 or P-8A fixed wing aircraft conduct Anti-Submarine Warfare testing using tonal sonobuoys (e.g., AN/SSQ-62 DICASS), explosive sonobuoys (e.g., AN/SSQ-110 Improved Extended Echo Ranging), passive sonobuoys (e.g., AN/SSQ-53), torpedoes (e.g., MK-46), smoke devices (e.g., MK-58), SUS devices (e.g., MK-61 SUS), missiles (e.g., harpoons), and chaff. Targets (e.g., MK-39 Expendable Mobile Anti-Submarine Warfare Training Target) may also be employed during an Anti-Submarine Warfare scenario. This activity would be conducted in deep waters and could initiate from a land base or from a surface ship. Some Anti-Submarine Warfare Maritime Patrol Aircraft Tracking Test could be conducted as part of a Coordinated Event with Fleet training activities.	
Information Typical to the Event	**Platform:** Fixed wing Maritime Patrol Aircraft (e.g., P-3, P-8A,) **Systems:** Tonal sonobuoys (e.g., AN/SSQ-62 DICASS); passive sonobuoys (e.g., AN/SSQ-53D/E); Explosive sonobuoys (e.g., AN/SSQ-110 Improved Extended Echo Ranging), **Ordnance/Munitions:** Non-explosive, all recovered; Other non-explosive class stores (1000 lbs.) Torpedoes, Smoke devices, Chaff, Missiles, SUS devices **Targets:** MK-39 or MK-30 **Duration:** 4 to 6 flight hours/event	**Location:** Hawaii Operating Area Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar sonobuoys, Underwater explosions, Torpedoes, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike, In-water device strike, Aircraft strike (seabirds only) **Entanglement:** Parachutes **Ingestion:** Parachutes, Sonobuoy fragments, Torpedo fragments	
Detailed Military Expended Material Information	One MK-39 or MK-30 target (MK-30 is recovered and reused, MK-39 is not) If target air dropped, one parachute per target 20-60 sonobuoys per event (one parachute per sonobuoy)	
Assumptions used for Analysis	Torpedo, missile, and chaff use will be captured under Anti-Submarine Warfare Torpedo Test, Anti-Surface Warfare Missile Test, and Chaff Test, respectively: Analysis of these will not be conducted under this activity	

A.2.5 MINE WARFARE TESTING

A.2.5.1 Airborne Mine Neutralization System Test

Activity Name	**Activity Description**	
Mine Warfare		
Airborne Mine Neutralization Systems Test-AN/AQS-235	**Short Description:** Airborne mine neutralization tests of the AN/ASQ-235 evaluate the system's ability detect and destroy mines off of the MH-60 Airborne Mine Countermeasures capable helicopter. The AN/ASQ-235 uses up to four unmanned underwater vehicles equipped with high frequency sonar, video cameras, and explosive neutralizers.	
Long Description	Mine neutralization tests evaluate aircraft and aircraft systems intended to neutralize or otherwise destroy mines through the use of explosives or other munitions. For most neutralization tests, mine shapes or non explosive mines are used to evaluate new or enhanced mine neutralization systems. The AN/ASQ-235 uses up to four unmanned underwater vehicles equipped with high frequency sonar and video cameras to detect submerged mines. The unmanned underwater vehicles are also equipped with explosives to neutralize the mines after they are located. Data from unmanned underwater vehicles are relayed to the operator in the helicopter through a fiber-optic cable enabling the operator to position the neutralizing charge onto the most vulnerable area of the mine. The explosive charge is then detonated to neutralize the mine. For most tests, recoverable non-explosive neutralizers are used. A mine shape, rather than a high explosive mine, serves as the target and a range support vessel recovers the non-explosive neutralizer and the mine shape following the test. Testing scenarios include a non-explosive neutralizer against an inert mine shape, or a high explosive neutralizer against an explosive mine.	
Information Typical to the Event	**Platform:** Rotary wing aircraft (e.g., MH-60S) **Systems:** Airborne Mine Neutralization System (AN/ASQ-235) **Ordnance/Munitions:** Neutralizers (explosive and non-explosive), Mines (explosive and non-explosive) **Targets:** Floating/moored/bottom mine shapes **Duration:** 2.5 flight hours/event	**Location:** Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High frequency sonar, Underwater explosion, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (birds only), Military expended material strike, Seafloor device strike (mine shapes) **Entanglement:** Fiber optic cable **Ingestion:** Mine fragments, Neutralizer fragments, Fiber optic cable fragments	
Detailed Military Expended Material Information	Fiber-optic cable, plus additional expended material, such as the can that holds and deploys the cable Explosive and target residue (during 20 percent of testing and training when an explosive neutralizer is used) One to four neutralizers deployed per high explosive event Mine shapes are typically retrieved and reused, if they are not too badly damaged from neutralization attempt	
Assumptions used for Analysis		

A.2.5.2 Airborne Towed Minehunting Sonar System Test

Activity Name	Activity Description	
Mine Warfare		
Airborne Towed Minehunting Sonar System Test	**Short Description:** A mine-hunting system that is towed from an MH-60S helicopter with sonar for detection and classification of bottom and moored mines. An electro-optical sensor allows for identification of bottom mines.	
Long Description	Tests of towed mine-hunting sonar systems (e.g., AN/AQS-20A or Q-20) evaluate the search capabilities of this helicopter-towed, mine hunting, detection, and classification system. The sonar on the Q20 identifies mine-like objects in the deeper parts of the water column, but is not designed to identify near-surface mines.	
Information Typical to the Event	**Platform:** Rotary wing (e.g., MH-60S) **Systems:** Towed mine-hunting sonar systems (e.g., AN/AQS-20A, Q-20) **Ordnance/Munitions:** None **Targets:** Floating/moored/ near surface mine or mine shape **Duration:** 2.5 flight hours/event	**Location:** Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High frequency sonar (AN/AQS-20A), Aircraft noise **Energy:** None **Physical Disturbance and Strike:** In-water towed device strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information		
Assumptions used for Analysis		

A.2.5.3 Airborne Towed Minesweeping System Test

Activity Name	Activity Description
Mine Warfare	
Airborne Towed Minesweeping System Test	**Short Description:** Airborne Towed Minesweeping Test (e.g., Organic Airborne and Surface Influence Sweep) would be conducted by a MH-60S helicopter to evaluate the functionality of towed minesweeping devices and the MH-60S at sea. The Organic Airborne and Surface Influence Sweep is towed from a forward flying helicopter and works by emitting an electromagnetic field and mechanically generated underwater sound to simulate the presence of a ship. The sound and electromagnetic signature cause nearby mines to explode.
Long Description	Airborne Towed Minesweeping Test (e.g., Organic Airborne and Surface Influence Sweep) would be conducted by an Airborne Mine Countermeasures capable MH-60S helicopter to evaluate the functionality of Organic Airborne and Surface Influence Sweep and MH-60S at sea. For most tests, mine sweeping would be simulated using Versatile Exercise Mine System (non-explosive mine shapes that emit a plume of smoke rather than exploding) and high explosive mines at the culmination of testing, approximately one per event. The Organic Airborne and Surface Influence Sweep works by emitting an electromagnetic field and underwater sound generated from a mechanical source to simulate a vessel's sound signature. The Organic Airborne and Surface Influence Sweep serves to "sweep" or cause live mines to detonate when exposed to the electromagnetic field and simulated ship sound signature. The sound generated from the Organic Airborne and Surface Influence Sweep is not sonar, but rather a mechanically-generated sound to simulate a vessel prop.
Information Typical to the Event	**Platform:** Rotary wing aircraft (e.g., MH-60S) **Systems:** Towed minesweeping systems (e.g., Organic Airborne and Surface Influence Sweep) **Ordnance/Munitions:** Mines (explosive), Versatile Exercise Mine System **Targets:** Floating/moored/bottom mine shapes (non-explosive and explosive) **Duration:** 2.5 flight hours/event **Location:** Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions, Aircraft noise **Energy:** Electromagnetic **Physical Disturbance and Strike:** In-water towed device strike, Seafloor device strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Mine fragments
Detailed Military Expended Material Information	Mine fragments
Assumptions used for Analysis	Non-explosive mine shapes will be recovered

A.2.5.4 Airborne Laser-Based Mine Detection System Test

Activity Name	**Activity Description**
Mine Warfare	
Airborne Laser-Based Mine Detection System Test	**Short Description:** An airborne mine hunting test of the AN/AES-1 Airborne Laser Mine Detection System, that is operated from the MH-60S helicopter and evaluates the system's ability to detect, classify, and fix the location of floating and near-surface, moored mines. The system uses a laser to locate mines and may operate in conjunction with an airborne projectile-based mine detection system to neutralize mines.
Long Description	During an Airborne Mine Countermeasures test, a MH-60S helicopter evaluates the search capabilities of the AN/AES-1 Airborne Laser Mine Detection System Airborne Laser Mine Detection System is a mine hunting system designed to detect, classify, and localize floating and near-surface, moored sea mines using a laser system. The Airborne Laser Mine Detection System will be integrated into the MH-60S helicopter to provide a rapid wide-area reconnaissance and assessment of mine threats in littoral zones, confined straits, choke points, and amphibious objective areas for Carrier and Expeditionary Strike Groups. The Airborne Laser Mine Detection System uses pulsed laser light to image the entire near-surface volume potentially containing mines. Airborne Laser Mine Detection System is capable of day or night operations without stopping to deploy or recover equipment and without towing any equipment in the water. With un-tethered operations, it can attain high area search rates. This design uses the forward motion of the aircraft to generate image data negating the requirement for complex scanning mechanisms and ensuring high system reliability. Airborne Laser Mine Detection System also provides accurate target geo-location to support follow on neutralization of the detected mines. Airborne Laser Mine Detection System works in conjunction with the mine neutralization system, Rapid Airborne Mine Clearance System.
Information Typical to the Event	**Platform:** Rotary wing aircraft (e.g., MH-60S) **Systems:** AN/AES-1 Airborne Laser Mine Detection System **Ordnance/Munitions:** None **Targets:** Floating/moored mine shapes **Duration:** 2.5 flight hours per event **Location:** Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None
Detailed Military Expended Material Information	None
Assumptions used for Analysis	

A.2.5.5 Airborne Projectile-Based Mine Clearance System

Activity Name	Activity Description	
Mine Warfare		
Airborne Projectile Based Mine Clearance System	**Short Description:** An MH-60S helicopter uses a laser-based detection system to search for mines and to fix mine locations for neutralization with an airborne projectile-based mine clearance system. The system neutralizes mines by firing a small or medium caliber inert, supercavitating projectile from a hovering helicopter.	
Long Description	During an airborne projectile-based mine clearance system test, an MH-60s helicopter evaluates the search capabilities of an Airborne Projectile-based Mine Clearance System (such as the AN/AWS-2 Rapid Airborne Mine Clearance System) to detect mines and fix mine locations using a laser. The airborne projectile-based mine clearance system can work in tandem with the Airborne Laser Mine Detection System by providing a mine neutralizing (destroying) capability for Airborne Laser Mine Detection System — detected, near-surface mines. The gun (e.g., Rapid Airborne Mine Clearance System Bushmaster) fires a small or medium caliber (e.g., 30 mm) non explosive, supercavitating projectile at the target from a hovering MH-60S. The projectile penetrates the target, rendering it non-functional. Mine shapes would almost always be used as the targets during a test. In the event a high explosive mine is used during the final testing phase, an underwater explosion may be generated as the mine is neutralized.	
Information Typical to the Event	**Platform:** Rotary wing aircraft (e.g., MH-60S) **Systems:** Rapid Airborne Mine Clearance System or similar like-system **Ordnance/Munitions:** Small or medium caliber supercavitating projectile (non-explosive), Mines (non-explosive and explosive) **Targets:** Floating/moored/bottom mine or mine shape **Duration:** 2.5 flight hours/event	**Location:** Southern California Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (projectiles), Seafloor device strike (mine shapes), Aircraft strikes (seabirds only) **Entanglement:** None **Ingestion:** Projectiles (small and medium caliber), Target fragments	
Detailed Military Expended Material Information	Projectiles (small and medium caliber) Target fragments Mine shapes are typically retrieved and reused, if they are not too badly damaged from neutralization attempt	
Assumptions used for Analysis	All mines under the No Action Alternative are non-explosive	

A.2.6 OTHER TESTING

A.2.6.1 Test and Evaluation – Catapult Launch

Activity Name	Activity Description	
Other Testing		
Test and Evaluation – Catapult Launch	**Short Description:** Tests evaluate the function of aircraft carrier catapults at sea following enhancements, modifications, or repairs to catapult launch systems, including aircraft catapult launch tests. No weapons or other expendable materials would be released.	
Long Description	Aircraft catapults are systems used to assist aircraft take-off in aircraft carriers. Catapults consist of a track built into the flight deck, below which is a large piston or shuttle that is attached through the track to the nose gear of the aircraft. Navy aircraft launch systems are powered by steam or driven by an electromagnetic motor. Steam-powered catapults draw steam from the ship's boilers to the catapult steam receivers or accumulator, where it is stored at the desired pressure. From the receivers/accumulator, steam is directed to the launching valves, and provides the energy to launch aircraft. The most significant differences between the various types of steam catapults are the length and capacity. An electromagnetic launch system provides higher launch energy capability, reduced weight, volume, and maintenance, increased controllability, availability, reliability, and efficiency. The present electromagnetic aircraft launch system design centers around a linear synchronous motor and supplied power from pulsed disk alternators through a cycloconverter. Average power, obtained from an independent source on the host platform, is stored kinetically in the rotors of the disk alternators. It is then released in a two to three second pulse during a launch. This high-frequency power is fed to the cycloconverter which acts as a rising voltage, rising frequency source to the launch motor. The linear synchronous motor takes the power from the cycloconverter and accelerates the aircraft down the launch stroke, all the while providing "real time" closed loop control. Catapult launch tests would occur on Fleet aircraft carriers during deployment. The specific locations of carriers from 2014-2020 is unknown. No weapons or other expendable materials would be released during catapult tests.	
Information Typical to the Event	**Platform:** Aircraft Carrier (e.g., CVN 68-78), Fixed wing aircraft (e.g., E-2/C-2) **Systems:** Catapult, Electromagnetic aircraft launch system **Ordnance/Munitions:** None **Targets:** None **Duration:** Fixed wing aircraft 2 to 6 flight hours/ event	**Location:** Throughout HSTT Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information		
Assumptions used for Analysis		

A.2.6.2 Air Platform Shipboard Integrate Test

Activity Name	Activity Description	
Other Testing		
Air Platform Shipboard Integrate Test	**Short Description:** Tests evaluate the compatibility of aircraft and aircraft systems with ships and shipboard systems. Tests involve physical operations and verify and evaluate communications and tactical data links. This test function also includes an assessment of carrier-shipboard suitability, such as Hazards of Electromagnetic Radiation to Ordnance, Hazard of Electromagnetic Radiation to Personnel, and High Energy Radio Frequency.	
Long Description	The Air Platform Shipboard Integration Test is performed to evaluate the compatibility of an aircraft to operate from designated shipboard platforms, perform shipboard physical operations, and to verify and evaluate communications and tactical data links. This test function also includes an assessment of carrier-shipboard suitability, such as Hazards of Electromagnetic Radiation to Ordnance, Hazard of Electromagnetic Radiation to Personnel, and High Energy Radio Frequency.	
Information Typical to the Event	**Platform:** Aircraft carrier (e.g., CVN 68-78), Fixed wing aircraft (e.g., E-2/C-2) **Systems:** Data link and Communication Systems, Hazards of Electromagnetic Radiation to Ordnance, Hazard of Electromagnetic Radiation to Personnel, High Energy Radio Frequency **Ordnance/Munitions:** None **Targets:** None **Duration:** 2 to 6 flight hours/event	**Location:** Throughout HSTT Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information		
Assumptions used for Analysis		

A.2.6.3 Shipboard Electronic Systems Evaluation

Activity Name	Activity Description	
Other Testing		
Shipboard Electronic Systems Evaluation	**Short Description:** Tests measure ship antenna radiation patterns and test communication systems with a variety of aircraft.	
Long Description	Shipboard electronic systems evaluation tests measure ship antenna radiation patterns and evaluate communication systems linking vessels and aircraft. Naval Air Systems Command aircraft capable of landing on a vessel (e.g. aircraft carrier or Littoral Combat Ship) temporarily deploy to a nearshore vessel and conduct a variety of tests over a period of days to test newly installed or modified systems onboard the aircraft for compatibility with shipboard electronic systems. Follow-on test and evaluation of unmanned aerial systems would consist of dynamic interface testing, shipboard electromagnetic testing, and envelope expansion tests intended to evaluate capability of the unmanned aerial system to conduct launch and recovery operations from a vessel at sea as well as perform missions in a maritime environment. Altitudes would range from mean seal level to 15,000 feet above mean seal level with the majority of flights occurring between mean seal level and 3,000 feet. Unmanned aerial systems would include Small Tactical Unmanned Aerial System/Tier II tactical unmanned aerial system, Broad Area Maritime Surveillance System, Fire Scout vertical take-off and landing tactical unmanned air vehicle, and Unmanned Combat Air System; and Aircraft Carrier Demonstration testing. Shipboard testing of the Joint Precision Approach and Landing System, test new technology systems to provide precision guidance to aircraft landing on air capable vessels. At-sea flight test of the CH-53K helicopter would consist of shipboard compatibility (dynamic interface/envelope expansion) and, during Operational Evaluation, amphibious assault scenarios. Shipboard electronic systems evaluation tests of the V-22 helicopter would involve flight and wind envelope expansion interface testing with Amphibious Assault Ships, Amphibious Transport Dock, and Dock Landing Ship class vessels.	
Information Typical to the Event	**Platform:** Fixed wing aircraft (e.g., E-2/C-2), Rotary wing aircraft (e.g., CH-53K, V-22), Unmanned aerial systems **Systems:** Joint Precision Approach and Landing System; Broad Area Maritime Surveillance system; Fire Scout vertical take-off and landing tactical unmanned air vehicle; Unmanned Combat Air System; Aircraft Carrier Demonstration; Small Tactical Unmanned Aerial System/Tier II **Ordnance/Munitions:** None **Targets:** None **Duration:** 2-20 flight hours /event	**Location:** Throughout HSTT Study Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions used for Analysis		

A.3 NAVAL SEA SYSTEMS COMMAND TESTING ACTIVITIES

Naval Sea Systems Command testing activities are aligned with its mission of new ship construction, life cycle support, and weapon systems development. Each major category of Naval Sea Systems Command activities is described below.

A.3.1 NEW SHIP CONSTRUCTION

Ship construction activities include pierside testing events, a series of sea trials, and developmental and operational test and evaluation programs. Pierside and at-sea testing of systems aboard a ship may include activation of acoustic sources, acoustic countermeasures, radars, and radio equipment. Pierside events also consist of light-off and operational checks of the vessel's propulsion, weapons, and other combat systems prior to at-sea operations. However, for purposes of this EIS/OEIS, pierside testing at Navy contractor shipyards will consist only of tactical sonar systems. At sea, each new ship is operated at full power and subjected to high-speed runs and steering tests. At-sea test firing of shipboard weapons systems, including guns, are also conducted.

A.3.1.1 Surface Combatant Sea Trials – Pierside Sonar Testing

Activity Name	Activity Description	
New Ship Construction		
Surface Combatant Sea Trials – Pierside Sonar Testing	**Short Description:** Tests vessel's sonar systems pierside to ensure proper operation.	
Long Description	Pierside sonar testing is one part of the total surface combatant sea trial activity. Surface combatant sonar is tested pierside to ensure proper operation prior to conducting the at-sea portion of the sea trial. Surface combatants included in this activity are the ARLEIGH BURKE class (DDG 51) and the ZUMWALT class (DDG 1000) destroyers.	
Information Typical to the Event	**Platform:** Surface combatant vessel (e.g., DDG 51 and DDG 1000) **Systems:** Mid-frequency sonar **Ordnance/Munitions:** None **Targets:** None **Duration:** 3 weeks, with each source run independently and not continuously during this time	**Location:** Pierside: Pearl Harbor, HI Pierside: San Diego, CA
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF1K, ASW3), Fathometer (e.g., FA2), Underwater communications (e.g., MF9) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis		

A.3.1.2 Surface Combatant Sea Trials – Propulsion Testing

Activity Name	Activity Description	
New Ship Construction		
Surface Combatant Sea Trials – Propulsion Testing	**Short Description:** Vessel is run at high speeds in various formations (e.g., straight-line and reciprocal paths).	
Long Description	Propulsion testing is one part of the total surface combatant sea trial activity. Propulsion testing includes vessel maneuvering, including full power runs (speeds in excess of 30 knots) and endurance runs.	
Information Typical to the Event	**Platform:** Surface combatant vessel (e.g., DDG 51 and DDG 1000) **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Full power runs are conducted for a total of 4 hours, and endurance runs are conducted for a total of 2 hours.	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis	Vessels will not be traveling in a straight line Vessels will operate across the full spectrum of capable speeds Vessels will not be conducting test constantly for the entire duration	

A.3.1.3 Surface Combatant Sea Trials – Gun Testing – Large-caliber

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">New Ship Construction</td></tr>
<tr><td>Surface Combatant Sea Trials – Gun Testing – Large Caliber</td><td colspan="2">Short Description:
Gun systems are tested using non explosive rounds.</td></tr>
<tr><td>Long Description</td><td colspan="2">Large caliber gun testing is one part of the total surface combatant sea trial activity. Tests currently include firing of 5 inch and 0.62 caliber guns, and will potentially include a 155 mm gun for future DDG 1000 platforms.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface combatant vessel (e.g., DDG 51 and DDG 1000)
Systems: Large caliber guns (5 inch, 155 mm)
Ordnance/Munitions: Large caliber projectiles (e.g., 5 inch, 155 mm, 20-mm cannon [non-explosive])
Targets: None
Duration: The entire sea trial duration is 4 days, within which gun testing would occur.</td><td>Location:
Hawaii Range Complex
Southern California Range Complex</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Vessel noise, Weapons firing noise
Energy: None
Physical Disturbance and Strike: Vessel strike, Military expended materials strike (non-explosive projectiles)
Entanglement: None
Ingestion: Projectiles, casings</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">26 non-explosive practice munitions/event
Projectiles
Casings</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2">Vessels will not be conducting test constantly for the entire duration
26 rounds per event</td></tr>
</table>

A.3.1.4 Surface Combatant Sea Trials – Missile Testing

Activity Name	**Activity Description**	
New Ship Construction		
Surface Combatant Sea Trials – Missile Testing	**Short Description:** Non-explosive missiles are fired at target drones to test the launching system.	
Long Description	Missile testing is one part of the total surface combatant sea trial activity. During the event, support craft launch target drones, upon which two non-explosive missiles are fired.	
Information Typical to the Event	**Platform:** Surface combatant vessel (e.g., DDG 51 and DDG 1000) **Systems:** Missile launch system **Ordnance/Munitions:** Missiles (non-explosive) **Targets:** Retrievable mobile targets (e.g., drones) **Duration:** The entire sea trial duration is 4 days, within which missile testing would occur.	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive practice munitions), Vessel strike **Entanglement:** None **Ingestion:** Missile fragments	
Detailed Military Expended Material Information	Two missiles (non-explosive)/event	
Assumptions Used for Analysis	Vessels will not be conducting test constantly for the entire duration Two Missiles per event Target drones are recovered by supporting craft	

A.3.1.5 Surface Combatant Sea Trials – Decoy Testing

Activity Name	Activity Description	
New Ship Construction		
Surface Combatant Sea Trials – Decoy Testing	**Short Description:** Includes testing of the MK 36 Decoy Launching system	
Long Description	Testing of the MK 36 Decoy Launching system is one part of the total surface combatant sea trial activity. During the event, chaff cartridges are launched to ensure proper operation of the system.	
Information Typical to the Event	**Platform:** Surface combatant vessel (e.g., DDG 51 and DDG 1000) **Systems:** MK 36 Decoy Launching system **Ordnance/Munitions:** None **Targets:** None **Duration:** The entire sea trial duration is 4 days, within which decoy launching testing would occur.	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel Noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** End caps, Pistons, Chaff	
Detailed Military Expended Material Information	Chaff cartridges (end caps, pistons, and chaff)/event	
Assumptions Used for Analysis	Vessels will not be conducting test constantly for the entire duration 36 chaff cartridges/event	

A.3.1.6 Surface Combatant Sea Trials – Anti-Surface Warfare Testing – Large, Medium, and Small-Caliber

Activity Name	Activity Description	
New Ship Construction		
Surface Combatant Sea Trials – Surface Warfare Testing – Large Caliber	**Short Description:** Vessels defend against surface targets with large caliber guns.	
Long Description	Surface warfare testing is one part of the total surface combatant sea trial activity. During this event, a high speed maneuverable surface target would run a weaving pattern towards the vessel at speeds in excess of 20 knots. The surface combatant would fire non-explosive large caliber rounds at the incoming target.	
Information Typical to the Event	**Platform:** Surface combatant vessel (e.g., DDG 51 and DDG 1000) **Systems:** 0.62 caliber gun **Ordnance/Munitions:** Large caliber projectiles (e.g., 5 inch, 155 mm [non-explosive]) **Targets:** Surface targets (e.g., High Speed Maneuverable Surface Target) **Duration:** The entire sea trial duration is 4 days, within which surface warfare testing would occur.	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, In-water device strike, Military expended material strike (non-explosive practice munitions) **Entanglement:** None **Ingestion:** Projectiles, target fragments	
Detailed Military Expended Material Information	Large caliber projectiles, casings Target fragments	
Assumptions Used for Analysis	Vessels will not be conducting test constantly for the entire duration 48 rounds/event	

A.3.1.7 Surface Combatant Sea Trials – Anti-Submarine Warfare Testing

Activity Name	Activity Description	
New Ship Construction		
Surface Combatant Sea Trials – Anti-Submarine Warfare Testing	**Short Description:** Vessels demonstrate capability of countermeasure systems and underwater surveillance and communications systems.	
Long Description	Anti-submarine warfare testing is one part of the total surface combatant sea trial activity. During this event, hull-mounted sonar systems are operated to test the capability of the systems. Mid- and high-frequency acoustic sources are used during this activity.	
Information Typical to the Event	**Platform:** Surface combatant vessel (e.g., DDG 51 and DDG 1000) **Systems:** Surface ship sonar, Countermeasure systems, Underwater surveillance and communications systems **Ordnance/Munitions:** None **Targets:** Motorized Autonomous Targets (e.g., Expendable Mobile Anti-Submarine Warfare Training Target) **Duration:** The entire sea trial duration is 4 days, within which anti-submarine warfare testing would occur.	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF1K, MF10), Acoustic countermeasures (e.g., ASW3), Fathometers (e.g., FA2), Underwater communications (e.g., MF9), Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	Sonobuoys	
Assumptions Used for Analysis	Vessels will not be conducting test constantly for the entire duration Three passive sonobuoys/event; All sonobuoys have a parachute unless otherwise noted	

A.3.1.8 Other Ship Class Sea Trials – Propulsion Testing

Activity Name	Activity Description	
New Ship Construction		
Other Class Ship Sea Trials – Propulsion Testing	**Short Description:** Vessel is run at high speeds in various formations (e.g., straight-line and reciprocal paths).	
Long Description	Propulsion testing is one part of the total sea trial activity. During this event, the vessel is tested for maneuverability, including full power and endurance runs.	
Information Typical to the Event	**Platform:** Amphibious warfare vessels, Surface combatant vessels (e.g., Littoral Combat Ship), Support craft/other – specialized high speed vessels **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** Propulsion testing occurs during an approximate 4 hour period during the 2-day sea trial.	**Location:** Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis	Vessels will not be conducting test constantly for the entire duration Vessels will not be traveling in a straight line Vessels will operate across the full spectrum of capable speeds	

A.3.1.9 Other Ship Class Sea Trials – Gun Testing – Small-caliber

Activity Name	Activity Description	
New Ship Construction		
Other Class Ship Sea Trials – Gun Testing – Small Caliber	**Short Description:** Vessels defend against surface targets with small caliber guns	
Long Description	Small caliber gun testing is included as part of the total sea trial activity. Small caliber gun testing includes 0.50 caliber guns.	
Information Typical to the Event	**Platform:** Amphibious warfare vessels, Surface combatant vessel (e.g., Littoral Combat Ship), Support craft/other – specialized high speed, **Systems:** Small caliber weapon systems **Ordnance/Munitions:** Small caliber projectiles (e.g., 0.50 caliber [non-explosive]) **Targets:** None **Duration:** Small caliber gun testing would occur within the two-day sea trials	**Location:** Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military Expended Material strike (non-explosive projectiles), Vessel strike **Entanglement:** None **Ingestion:** Small caliber projectiles, Casings	
Detailed Military Expended Material Information	Small caliber projectiles Casings	
Assumptions Used for Analysis	Vessels will not be conducting test constantly for the entire duration	

A.3.1.10 Anti-Submarine Warfare Mission Package Testing

Activity Name	**Activity Description**	
New Ship Construction		
Anti-Submarine Warfare Mission Package Testing	**Short Description:** Vessels and their supporting platforms (e.g., helicopters, unmanned aerial vehicles) detect, localize, and prosecute submarines.	
Long Description	Vessels conduct detect-to-engage operations against modern diesel-electric and nuclear submarines using airborne and surface assets (both manned and unmanned). Active and passive acoustic systems are used to detect and track submarine targets, culminating in the deployment of lightweight torpedoes to engage the threat.	
Information Typical to the Event	**Platform:** Surface Combatant Vessels (e.g., Littoral Combat Ship); Rotary wing aircraft, Submarines **Systems:** Surface ship sonar, Helicopter-deployed sonar, Active sonobuoys, Torpedo sonar **Ordnance/Munitions:** Non-explosive torpedoes **Targets:** Motorized Autonomous Targets (e.g., Expendable Mobile Anti-Submarine Warfare Training Target) **Duration:** Event duration is approximately 1 to 2 weeks, with 4 to 8 hours of active sonar use with intervals of non-activity in between.	**Location:** Hawaii Range Complex Southern California Range Complex: Fleet Exercise Training Area (if not on Southern California Anti-submarine Warfare Range) Southern California Range Complex: Deepwater convergence zone Southern California Range Complex: Southern California Anti-submarine Warfare Range
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF6), Mid-frequency sonar (e.g., MF12), Helicopter-deployed sonar (e.g., MF4), Active sonobuoys (e.g., MF5), Torpedo sonar (e.g., TORP1) **Energy:** None **Physical Disturbance and Strike:** Vessel strike, Towed device strike **Entanglement:** Parachutes **Ingestion:** Parachutes	
Detailed Military Expended Material Information	Torpedo launch accessories Sonobuoys	
Assumptions Used for Analysis	One target per event All sonobuoys have a parachute unless otherwise noted	

A.3.1.11 Surface Warfare Mission Package – Gun Testing – Small Caliber

Activity Name	Activity Description	
New Ship Construction		
Surface Warfare Mission Package Testing – Gun Testing – Small Caliber	**Short Description:** Vessels defend against surface targets with small caliber guns	
Long Description	Vessels conduct surface warfare by detecting, tracking, and prosecuting small-boat threats. The Surface Warfare Mission Package provides a layered strike/defensive capability by use of its embarked support aircraft, medium range surface-to-surface missiles, and 30 mm gun weapon system.	
Information Typical to the Event	**Platform:** Surface combatant vessels (e.g., Littoral Combat Ship) **Systems:** Small caliber gun systems **Ordnance/Munitions:** Missiles, Small caliber projectiles (e.g., 0.50 caliber, or 30 mm) **Targets:** None **Duration:** Event duration is approximately 1 to 2 weeks, with intervals of surface warfare mission package use during this time.	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** None **Energy:** None **Physical Disturbance and Strike:** Military Expended Material strike (non-explosive projectiles) **Entanglement:** None **Ingestion:** Small projectile, Casing	
Detailed Military Expended Material Information	Small projectiles Casings	
Assumptions Used for Analysis	500 rounds/event	

A.3.1.12 Surface Warfare Mission Package –Gun Testing – Medium Caliber

Activity Name	**Activity Description**	
New Ship Construction		
Surface Warfare Mission Package Testing – Gun Testing Medium Caliber	**Short Description:** Vessels defend against surface targets with medium caliber guns	
Long Description	Vessels conduct surface warfare by detecting, tracking, and prosecuting small-boat threats. The surface warfare Mission Package provides a layered strike/defensive capability by use of its embarked support aircraft, medium range surface-to-surface missiles, and 30 mm gun weapon system.	
Information Typical to the Event	**Platform:** Surface Combatant Vessels **Systems:** Medium caliber gun systems **Ordnance/Munitions:** Medium caliber projectiles (non-explosive) **Targets:** None **Duration:** Event duration is approximately 1 to 2 weeks, with intervals of surface warfare mission package use during this time.	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectiles) **Entanglement:** None **Ingestion:** Projectiles, Casings	
Detailed Military Expended Material Information	Projectiles Casings	
Assumptions Used for Analysis	1,400 rounds per event	

A.3.1.13 Surface Warfare Mission Package – Gun Testing – Large Caliber

Activity Name	Activity Description	
New Ship Construction		
Surface Warfare Mission Package Testing – Gun Testing Large Caliber	**Short Description:** Vessels defend against surface targets with large caliber guns	
Long Description	Vessels conduct surface warfare by detecting, tracking, and prosecuting small-boat threats. The Surface Warfare Mission Package provides a layered strike/defensive capability by use of its embarked support aircraft, medium range surface-to-surface missiles, and 57 mm gun weapon system.	
Information Typical to the Event	**Platform:** Surface Combatant Vessels **Systems:** Large caliber weapon systems **Ordnance/Munitions:** Large caliber projectiles (non-explosive) including medium range surface-to-surface missiles **Targets:** None **Duration:** Event duration is approximately 1 to 2 weeks, with intervals of surface warfare mission package use during this time.	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military Expended Material strike (non-explosive projectiles) **Entanglement:** None **Ingestion:** Projectiles, Missile fragments	
Detailed Military Expended Material Information	Casings Projectiles Missile fragments	
Assumptions Used for Analysis	1,400 rounds per event	

A.3.1.14 Surface Warfare Mission Package Testing – Missile/Rocket Testing

Activity Name	Activity Description	
New Ship Construction		
Surface Warfare Mission Package Testing – Missile/Rocket Testing	**Short Description:** Vessels defend against surface targets with medium range missiles or rockets.	
Long Description	Vessels conduct surface warfare by detecting, tracking, and prosecuting small-boat threats. The surface warfare Mission Package provides a layered strike/defensive capability by use of its embarked support aircraft, medium range missiles or rockets, and gun weapon system.	
Information Typical to the Event	**Platform:** Surface Combatant Vessels, Rotary wing aircraft, Unmanned aircraft **Systems:** None **Ordnance/Munitions:** Missiles (e.g., anti-surface) or rockets (non-explosive and explosive) **Targets:** None **Duration:** Event duration is approximately 1 to 2 weeks, with intervals of surface warfare mission package use during this time.	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Underwater explosions (e.g., E6), Weapons firing noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectiles and explosive fragments), Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Missile or rocket fragments	
Detailed Military Expended Material Information	Missile or rocket fragments	
Assumptions Used for Analysis	Two missiles or rockets per event	

A.3.1.15 Mine Countermeasure Mission Package Testing

Activity Name	Activity Description	
New Ship Construction		
Mine Countermeasure Mission Package Testing	**Short Description:** Vessels and associated aircraft conduct mine countermeasure operations.	
Long Description	Littoral Combat Ships conduct mine detection using unmanned submersible and aerial vehicles, magnetic and acoustic sensor systems deployed by vessel or support helicopters, and laser systems. Mines are then neutralized using magnetic, acoustic, and supercavitating systems.	
Information Typical to the Event	**Platform:** Littoral Combat Ship, Unmanned Underwater Vehicles, Rotary aircraft **Systems:** Towed sonar system **Ordnance/Munitions:** Mine neutralization systems (e.g., Airborne Mine Neutralization System) **Targets:** Floating/moored/bottom non-explosive, mines or passive mine simulation systems **Duration:** 1 to 2 weeks with intervals of mine countermeasure mission package use during this time.	**Location:** Southern California Range Complex: Camp Pendleton Amphibious Assault Area; Pyramid Cove; Tanner/Cortes Bank Hawaii Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Towed sonar systems (e.g., HF4), Underwater explosions (e.g., E4), Aircraft noise, Vessel Noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, In water device strike; Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Fragments	
Detailed Military Expended Material Information	Fragments	
Assumptions Used for Analysis	Four charges/event	

A.3.1.16 Post-Homeporting Test (All Classes)

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">New Ship Construction</td></tr>
<tr><td>Post-Homeporting Testing (All classes)</td><td colspan="2">Short Description:
Tests electronic, navigation, and refueling capabilities.</td></tr>
<tr><td>Long Description</td><td colspan="2">Post-Homeporting testing includes Shipboard Electronic Systems Evaluation Facility measurements of antenna radiation patterns, Tactical Air Navigation certification, Identification Friend of Foe Verification, Dynamic Interface test (to validate helicopter operations), and underway replenishments.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: All classes of surface vessels
Systems: Electronic and navigation systems
Ordnance/Munitions: None
Targets: None
Duration: 1 to 5 days, depending upon the test being conducted (e.g., Shipboard Electronic Systems Evaluation Facility testing is 1 day; dynamic interface testing is 5 days).</td><td>Location:
Hawaii Range Complex
Southern California Range Complex</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Vessel noise
Energy: None
Physical Disturbance and Strike: Vessel strike
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2"></td></tr>
</table>

A.3.2 LIFECYCLE ACTIVITIES

Testing activities are conducted throughout the lifecycle of a Navy ship to verify performance and mission capabilities. Tactical sonar system testing occurs pierside during maintenance, repair and overhaul availabilities, and at sea immediately following most major industrial periods. A Combat System Ship Qualification Trial is conducted for new ships and for ships that have undergone modification or overhaul of their combat systems.

Radar cross signature testing of surface ships is accomplished on new vessels and periodically throughout a ship's life cycle to measure how detectable the ship is to radar. Additionally, new construction, post availability, and lifecycle electromagnetic measurements of off-board electromagnetic signature are conducted for submarines.

A.3.2.1 Ship Signature Testing

Activity Name	Activity Description
Lifecycle Activities	
Ship Signature Testing	**Short Description:** Tests vessel and submarine radar signatures and electromagnetic countermeasures.
Long Description	Radar cross signature testing of surface vessels is accomplished on new vessels and periodically throughout a vessel's lifecycle to measure how detectable the vessel is to radar. For example, Assessment Identification of Mine Susceptibility measurements are specific electromagnetic and passive acoustical tests performed on mine countermeasure vessels and on the Littoral Combat Ship mine countermeasure modules to determine their mine susceptibility. Additionally, measurements of deployed electromagnetic countermeasures are conducted during the new construction, post-delivery, and lifecycle phases of the acquisition process for submarines. Signature testing of all surface vessels and submarines verifies that each vessel's signature is within specifications, and may include the use of helicopter-deployed instrumentation, ship-mounted safety and navigation systems, fathometers, tracking devices, radar systems, and underwater communications equipment. Event duration includes all systems checks, including those that do not have active sonar.
Information Typical to the Event	**Platform:** All surface vessel and submarine classes **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** up to 20 days **Location:** Hawaii Range Complex Pierside: Pearl Harbor, HI Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None
Detailed Military Expended Material Information	None
Assumptions Used for Analysis	

A.3.2.2 Surface Ship Sonar Testing/Maintenance (in Operating Areas and Ports)

Activity Name	**Activity Description**	
Lifecycle Activities		
Surface Ship Sonar Testing/Maintenance (in Operating Areas and Ports)	**Short Description:** Pierside and at-sea testing of surface vessel systems occurs periodically following major maintenance periods and for routine maintenance.	
Long Description	Following major and routine maintenance periods, pierside and at-sea testing and maintenance is required. Multiple systems with active and passive acoustic sources such as tactical sonar, navigation systems, fathometers, underwater communications systems, underwater distress beacons, range finders, and other similar systems, would be tested.	
Information Typical to the Event	**Platform:** All surface vessel classes **Systems:** Surface ship sonar, Fathometer, Underwater communications **Ordnance/Munitions:** None **Targets:** None **Duration:** Event duration for each test can be up to 3 weeks, with intermittent use of active sonar.	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF1K), Fathometer (e.g., FA2), Underwater communications (e.g., MF9, MF10), Acoustic countermeasures (e.g., ASW3), Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis	Sonar would not be continuously active for the duration of the test	

A.3.2.3 Submarine Sonar Testing/Maintenance (in Operating Areas and Ports)

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Lifecycle Activities</td></tr>
<tr><td>Submarine Sonar Testing/Maintenance (in Operating Areas and Ports)</td><td colspan="2">Short Description:
Pierside and at-sea testing of submarine systems occurs periodically following major maintenance periods and for routine maintenance.</td></tr>
<tr><td>Long Description</td><td colspan="2">Following major and routine maintenance periods, pierside and at-sea testing and maintenance is required. Multiple systems with active and passive acoustic sources such as navigation systems, fathometers, underwater communications systems, underwater distress beacons, range finders, and other similar systems, would be tested.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Submarine
Systems: Submarine sonar, Fathometer, Underwater communications, Tracking pingers
Ordnance/Munitions: None
Targets: None
Duration: Event duration for each test can be up to 3 weeks, with intermittent use of active sonar.</td><td>Location:
Hawaii Range Complex: Pearl Harbor Naval Shipyard, HI
Southern California Range: Naval Base Point Loma, CA</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Mid-frequency sonar (e.g., MF1, MF3, P1), High-frequency sonar (HF1, HF3), Fathometer (e.g., FA2), Underwater communications (e.g., MF3), Vessel noise
Energy: None
Physical Disturbance and Strike: Vessel strike
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2">Sonar would not be used continuously throughout duration of test</td></tr>
</table>

A.3.2.4 Combat System Ship Qualification Trial – In-port Maintenance Period

Activity Name	**Activity Description**	
Lifecycle Activities		
Combat System Ship Qualification Trial– In-port Maintenance Period	**Short Description:** Each combat system is tested to ensure they are functioning in a technically acceptable manner and are operationally ready to support at-sea Combat System Ship Qualification Trial events.	
Long Description	Each combat system is tested to ensure they are functioning in a technically acceptable manner and are operationally ready to support at-sea Combat System Ship Qualification Trial events. The ship's test plans and procedures, Maintenance Repair/Requirements Cards, and computerized planned maintenance system are used in establishing testing standards for each system and pieces of equipment. Vessel's crew, under supervision of subject matter experts, complete all actions and receive remedial training where required. Trouble Observation Reports are written on noted discrepancies.	
Information Typical to the Event	**Platform:** Surface combatant vessel, Amphibious warfare vessel **Systems:** All combat systems **Ordnance/Munitions:** None **Targets:** None **Duration:** 3 weeks	**Location:** Pierside: Pearl Harbor, HI Pierside: San Diego, CA
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis	Sonar would not be continuously active for the duration of the test.	

A.3.2.5 Combat System Ship Qualification Trial – Air Defense

Activity Name	Activity Description	
Lifecycle Activities		
Combat System Ship Qualification Trial– Air Defense	**Short Description:** Tests the vessel's capability to detect, identify, track, and successfully engage live and simulated targets.	
Long Description	Air Defense events are conducted in clear and varied electronic attack environments, using a mix of missile firings to verify the vessel's capability to detect, identify, track, and successfully engage live and simulated targets. The tests include testing the radar's track load in the presence of debris, long range engagement processing, low-elevation detection and tracking, track load in the presence of electronic attack and chaff, and missile performance.	
Information Typical to the Event	**Platform:** Surface combatant vessel, Amphibious warfare vessel **Systems:** All combat systems **Ordnance/Munitions:** Missiles (e.g., anti-air) (non-explosive and explosive), Medium caliber projectiles (non-explosive), Large caliber projectiles (non-explosive) **Targets:** Retrievable mobile targets (e.g., drones) **Duration:** 1 week	**Location:** Hawaii Range Complex: Pacific Missile Range Facility
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** In-air explosions, Weapons firing noise, Vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive practice munitions, munition fragments), Aircraft strike (seabirds only), Vessel strike **Entanglement:** None **Ingestion:** Chaff, Target fragments, Medium caliber projectiles, End caps, Pistons, Casings	
Detailed Military Expended Material Information	Projectiles Munition fragments Target fragments Chaff, End caps, Pistons Targets	
Assumptions Used for Analysis	2,000 medium-caliber projectiles/event non-explosive; 20 large caliber projectiles/event non-explosive 14 Missiles/event (7 high-explosive) 60 canisters per event	

A.3.2.6 Combat System Ship Qualification Trial – Surface Warfare

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Lifecycle Activities</td></tr>
<tr><td>Combat System Ship Qualification Trial– Surface Warfare</td><td colspan="2">Short Description:
Tests shipboard sensors capabilities to detect and track surface targets, relay the data to the gun weapon system, and engage targets.</td></tr>
<tr><td>Long Description</td><td colspan="2">Surface warfare events are gun weapons system tests conducted in a clear environment to demonstrate shipboard sensors capabilities to detect and track surface targets, relay the data to the gun weapon system, and engage targets. The event qualified the vessel's surface warfare gun capability to receive track data from the sensors, filter it, calculate ballistics, recommend aim-point corrections (spots), generate gun orders, select ammunition properly for targets at differing ranges, and deliver surface direct fire on the surface targets.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface combatant vessel, Amphibious warfare vessel
Systems: Gun weapons system, Missile systems
Ordnance/Munitions: Large caliber projectiles (e.g., 155 mm, 5 inch) (non-explosive and explosive), Medium caliber projectiles (non-explosive), Missiles (non-explosive)
Targets: Mobile surface targets (e.g., High-Speed Maneuvering Surface Target), Towed surface targets (e.g., Low Cost Modular Target)
Duration: 1 week</td><td>Location:
Hawaii Range Complex: Pacific Missile Range Facility
Southern California Range Complex</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: In-air explosions, Weapons firing noise, Vessel noise
Energy: None
Physical Disturbance and Strike: Military expended material strike (non-explosive practice munitions, projectile fragments), Vessel strike, In-water device strike
Entanglement: None
Ingestion: Medium caliber projectiles, Fragments</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Projectiles, Munition fragments</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2">300 large-caliber gun rounds/event (113 high-explosive)
One surface-to-surface missile/event
2,000 medium caliber rounds/event
Explosive large caliber rounds are air-burst</td></tr>
</table>

A.3.2.7 Combat System Ship Qualification Trial – Undersea Warfare

Activity Name	Activity Description
Lifecycle Activities	
Combat System Ship Qualification Trial– Undersea Warfare	**Short Description:** Tests vessel's ability to track and engage undersea targets.
Long Description	Undersea warfare events are comprised of a series of tracking and firing exercises. The events ensure the operability of the undersea warfare suite and its interface with the Light Airborne Multi-Purpose System helicopter. Approximately one week of in-port training precedes exercises on an instrumented underwater range, where vessel's force becomes familiar with operation and maintenance of the undersea warfare system. Personnel then demonstrate the capability to establish the data link between the helicopter and vessel's undersea warfare system.
Information Typical to the Event	**Platform:** Surface combatant vessel, Rotary-wing aircraft **Systems:** Surface ship sonar, Underwater communication systems, Sonobuoys, Missile systems **Ordnance/Munitions:** Non-explosive torpedoes **Targets:** Motorized Autonomous Targets (e.g., Expendable Mobile Anti-Submarine Warfare Training Target) **Duration:** 1 week **Location:** Hawaii Range Complex: Pacific Missile Range Facility Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1, MF2), High-frequency sonar (e.g., HF4), Helicopter-deployed dipping sonar (e.g., MF4), Active sonobuoys (e.g., MF5), Torpedo sonar (e.g., TORP1), Fathometer (e.g., FA2), Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, In-water device strike **Entanglement:** Parachutes **Ingestion:** Parachutes and torpedo launch accessories
Detailed Military Expended Material Information	Torpedo launch accessories (nose cap, suspension bands, air stabilizer, sway brace pad, arming wire, fahnstock clip, parachute) Sonobuoys Expendable targets
Assumptions Used for Analysis	Five targets per event Sonobuoys – 83 per event All sonobuoys have a parachute unless otherwise noted Lightweight torpedoes only; no guidance wires Sonobuoys: 8 DICASS + 75 DIFAR/event

A.3.3 Surface Warfare/Anti-Submarine Warfare Testing

A.3.3.1 Missile Testing

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Surface Warfare/Anti-Submarine Warfare Testing</td></tr>
<tr><td>Missile Testing</td><td colspan="2">Short Description:
Missile testing includes various missiles fired from submarines and surface combatants.</td></tr>
<tr><td>Long Description</td><td colspan="2">Missile testing includes various missiles (e.g., standard missiles, Water Piercing Missile Launch) fired from submarines and surface combatants.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface combatant vessels, Submarines
Systems: None
Ordnance/Munitions: Missiles (e.g. anti-surface[non-explosive])
Targets: Unmanned surface vehicles, Drones
Duration: 1 to 2 hours</td><td>Location:
Hawaii Range Complex: Pacific Missile Range Facility
Southern California Range Complex</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Weapons firing noise, Vessel noise
Energy: None
Physical Disturbance and Strike: Military expended material strike (non-explosive practice munition), Vessel strike, In-water device strike
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Missile fragments</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2">All targets will be recovered
One surface-to-surface missile/event</td></tr>
</table>

A.3.3.2 Kinetic Energy Weapon Testing

Activity Name	Activity Description	
Surface Warfare/Anti-Submarine Warfare Testing		
Kinetic Energy Weapon Testing	**Short Description:** A kinetic energy weapon uses stored energy released in a burst to accelerate a non-explosive projectile.	
Long Description	A kinetic energy weapon uses stored energy released in a burst to accelerate a non-explosive projectile to more than seven times the speed of sound to a range of up to 200 miles.	
Information Typical to the Event	**Platform:** Surface combatant vessel **Systems:** Kinetic energy weapon **Ordnance/Munitions:** Large caliber projectile (non-explosive) **Targets:** Recoverable or expendable floating target **Duration:** 1 day	**Location:** Hawaii Range Complex: Pacific Missile Range Facility
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Weapons firing noise, Vessel noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectile), Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information		
Assumptions Used for Analysis	40 large-caliber projectile per event One event with 5,000 large cal projectiles Assume one expendable target/per event One event with 5,000 projectiles would occur only once before 2019.	

A.3.3.3 Electronic Warfare Testing

Activity Name	Activity Description	
Surface Warfare/Anti-Submarine Warfare Testing		
Electronic Warfare Testing	**Short Description:** Testing will include radiation of military and commercial radar and communication systems (or simulators).	
Long Description	Testing will include radiation of military and commercial radar and communication systems (or simulators). No subsurface transmission would occur during this testing.	
Information Typical to the Event	**Platform:** Submarines **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 3 hours per day over 7 days	**Location:** Pierside: Pearl Harbor, HI Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis		

A.3.3.4 Torpedo (Non-Explosive) Testing

Activity Name	Activity Description	
Surface Warfare/Anti-Submarine Warfare Testing		
Torpedo (Non-explosive) Testing	**Short Description:** Air, surface, or submarine crews employ non-explosive torpedoes against submarines or surface vessels.	
Long Description	Aerial, surface, and subsurface assets fire exercise torpedoes against surface or subsurface targets. Torpedo testing evaluates the performance and the effectiveness of hardware and software upgrades of heavyweight or lightweight torpedoes.	
Information Typical to the Event	**Platform:** Submarines, Surface combatant vessels, Fixed-wing aircraft, Rotary-wing aircraft, Support Craft/Other **Systems:** Surface vessel and submarine sonar, Sonobuoys, Dipping sonar **Ordnance/Munitions:** Non-explosive Lightweight torpedoes, Heavyweight torpedoes **Targets:** Submarines, Surface vessels, Motorized Autonomous Targets (e.g., Expendable Mobile Anti-Submarine Warfare Training Target), Stationary Artificial Targets (e.g., Fleet Training Target) **Duration:** Up to 2 weeks	**Location:** Hawaii Range Complex: Hawaii Area Tracking System; Test area north of Maui or Penguin Bank Hawaii Range Complex: Pacific Missile Range Facility Hawaii Range Complex: Shallow Water Training Range Southern California Range Complex: Tanner/Cortes, or Southern California Anti-Submarine Warfare Range; Shore Bombardment Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (e.g., HF1), Mid-frequency sonar (e.g., MF1, MF3), Helicopter-deployed sonar (e.g., MF4), Active sonobuoy (e.g., MF5), Torpedo sonar (e.g., TORP1, TORP2), Acoustic countermeasure (e.g., ASW3, ASW4), Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, In-water device strike, Aircraft strike (seabirds only) **Entanglement:** Parachutes (sonobuoy and torpedo), Guidance wire **Ingestion:** Parachutes (sonobuoy and torpedo), Torpedo launch accessories	
Detailed Military Expended Material Information	Sonobuoys Expendable targets Acoustic countermeasures Torpedo launch accessories o Lightweight/heavyweight torpedo launch accessories ▪ Nose cap, Suspension bands, Air stabilizer, Sway brace pad, Arming wire, Fahnstock clip, Wing kit, Rocket booster, Parachute, Lead weights o Expended material is dependent upon torpedo fired and firing platform. • Heavyweight torpedo launch accessories • Guidance wire, flex hose	

Assumptions Used for Analysis	Sonobuoys – 384 sonobuoys per year Expendable targets – one target per event Acoustic countermeasures – 356 countermeasures per year All torpedoes are recovered • Lightweight/heavyweight torpedo launch accessories • 124 torpedoes/ year (Alternative 1);140 torpedoes/ year (Alternative 2) Assume all lightweight torpedo launch accessories have all listed material All sonobuoys have a parachute unless otherwise noted Typically, no more than eight torpedoes are fired per day during daylight hours.

A.3.3.5 Torpedo (Explosive) Testing

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Surface Warfare/Anti-Submarine Warfare Testing</td></tr>
<tr><td>Torpedo (Explosive) Testing</td><td colspan="2">Short Description:
Air, surface, or submarine crews employ explosive torpedoes against artificial targets.</td></tr>
<tr><td>Long Description</td><td colspan="2">Non-explosive and explosive torpedoes (carrying a warhead) would be launched at a suspended target by a submarine and fixed- or rotary-winged aircraft or surface combatants. Torpedoes would detonate on an artificial target located at a depth between 200 and 700 ft below the water's surface.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Submarine, Surface combatant vessel, Fixed-wing aircraft, Rotary-wing aircraft, Support Craft/Other
Systems: None
Ordnance/Munitions: Torpedoes (heavyweight and lightweight) (explosive and non-explosive)
Targets: Stationary artificial targets (e.g., MK 28)
Duration: 1 to 2 days during daylight hours. Only one heavyweight torpedo test could occur in 1 day; two heavyweight torpedo tests could occur on consecutive days. Two lightweight torpedo tests could occur in a single day.</td><td>Location:
Hawaii Range Complex
Southern California Range Complex</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Underwater explosion (e.g., E8, E11), Torpedo sonar (e.g., TORP1, TORP2), Vessel noise, Aircraft noise
Energy: None
Physical Disturbance and Strike: Vessel strike, In-water device strike, Aircraft strike (birds only)
Entanglement: Parachutes (sonobuoy and torpedo), Guidance wire
Ingestion: Target and torpedo fragments, Parachutes (sonobuoy and torpedo), Torpedo launch accessories</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Torpedo launch accessories
o Lightweight/heavy weight torpedo launch accessories
o Nose cap, Suspension Bands, Air stabilizer, Sway brace pad, Arming wire, Fahnstock clip, Wing kit, Rocket booster, Parachute, Lead weights
o Expended material is dependent upon torpedo fired and firing platform.
• Heavyweight torpedo launch accessories
• Guidance wire, Flex hose</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2">All sonobuoys have a parachute unless otherwise noted
24 torpedoes per year (Alternatives 1 and 2)
8 high-explosive torpedoes/year</td></tr>
</table>

A.3.3.6 Countermeasure Testing – Acoustic Systems Testing

Activity Name	Activity Description	
Surface Warfare/Anti-Submarine Warfare Testing		
Countermeasure Testing – Acoustic System Testing	**Short Description:** Towed arrays are employed to detect, localize, and track incoming weapons	
Long Description	Countermeasure testing involves the testing of systems that would detect, localize, and track incoming weapons. Acoustic systems testing include towed arrays (e.g., NIXIE).	
Information Typical to the Event	**Platform:** Surface combatant vessels, Aircraft carrier **Systems:** Countermeasure systems **Ordnance/Munitions:** None **Targets:** None **Duration:** Approximately 4 hours	**Location:** Pierside: Pearl Harbor, HI Pierside: San Diego, CA HSTT Transit Corridor Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1), High-frequency sonar (e.g., HF5), Acoustic countermeasure (e.g., ASW3), Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, In-water device strike (towed devices) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis		

A.3.3.7 Countermeasure Testing – Anti-Torpedo Torpedo Defense System Testing

Activity Name	Activity Description	
Surface Warfare/Anti-Submarine Warfare Testing		
Countermeasure Testing – Anti-Torpedo Defense System Testing	**Short Description:** Torpedoes are launched from surface vessels to localize and attack incoming weapons.	
Long Description	Countermeasure testing involves the testing of systems that would detect, localize, and track incoming weapons. An anti-torpedo torpedo defense system testing involves the launch of non-explosive or explosive torpedoes at incoming weapons.	
Information Typical to the Event	**Platform:** Surface combatant vessels **Systems:** Countermeasure systems **Ordnance/Munitions:** Lightweight torpedoes (non-explosive/explosive) **Targets:** None **Duration:** Up to 10 days	**Location:** Pierside: Pearl Harbor, HI Pierside: San Diego, CA HSTT Transit Corridor Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1), High-frequency sonar (e.g., HF5), Acoustic countermeasure (e.g., ASW3), Torpedo sonar (e.g., TORP1), Underwater explosions, and Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike **Entanglement:** Parachute (torpedo) **Ingestion:** Torpedo launch accessories/fragments	
Detailed Military Expended Material Information	Torpedo launch accessories (nose covers, parachutes, ram plates)/fragments	
Assumptions Used for Analysis	Maximum of 40 anti-torpedo torpedoes fired (up to 10 shots occurring per day).	

A.3.3.8 Pierside Sonar Testing

Activity Name	Activity Description	
Anti-Surface Warfare/Anti-Submarine Warfare Testing		
Countermeasure Testing – Anti-Torpedo Defense System Testing	**Short Description:** Torpedoes are launched from surface vessels to localize and attack incoming weapons.	
Long Description	Countermeasure testing involves the testing of systems that would detect, localize, and track incoming weapons. An anti-torpedo torpedo defense system testing involves the launch of non-explosive or explosive torpedoes at incoming weapons.	
Information Typical to the Event	**Platform:** Surface combatant vessels **Systems:** Countermeasure systems **Ordnance/Munitions:** Lightweight torpedoes (non-explosive/explosive) **Targets:** None **Duration:** Up to 10 days	**Location:** Pierside: Pearl Harbor, HI Pierside: San Diego, CA HSTT Transit Corridor Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF1), High-frequency sonar (e.g., HF5), Acoustic countermeasure (e.g., ASW3), Torpedo sonar (e.g., TORP1), Underwater explosions, and Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike **Entanglement:** Parachute (torpedo) **Ingestion:** Torpedo launch accessories/fragments	
Detailed Military Expended Material Information	Torpedo launch accessories (nose covers, parachutes, ram plates)/fragments	
Assumptions Used for Analysis	Maximum of 40 anti-torpedo torpedoes fired (up to 10 shots occurring per day).	

A.3.3.9 At-Sea Sonar Testing

Activity Name	**Activity Description**	
Surface Warfare/Anti-Submarine Warfare Testing		
At-sea Sonar Testing	**Short Description:** At-sea testing to ensure systems are fully functional in an open ocean environment.	
Long Description	At-sea sonar testing is required to calibrate sonar systems while the vessel or submarine is in an open ocean environment. Tests consist of electronic support measurement, photonics, and sonar sensor accuracy testing. In some instances, a submarine's passive detection capability is tested when a second submarine utilizes its active sonar or is equipped with a noise augmentation system in order to replicate acoustic or electromagnetic signatures of other vessel types or classes.	
Information Typical to the Event	**Platform:** Surface combatant vessels, Submarines **Systems:** Tactical sonar **Ordnance/Munitions:** None **Targets:** None **Duration:** 4 hours to 11 days	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF3), High-frequency sonar (e.g., HF1, M3), Acoustic countermeasure (e.g., ASW4), Fathometer (e.g., FA2), Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, Military expended material strike (acoustic countermeasures) **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	Acoustic countermeasures	
Assumptions Used for Analysis	Active sonar use is intermittent throughout the duration of the event Acoustic countermeasures – 10 per event	

A.3.4 MINE WARFARE TESTING

A.3.4.1 Mine Detection and Classification

Activity Name	Activity Description
Mine Warfare Testing	
Mine Detection and Classification Testing	**Short Description:** Air, surface, and subsurface vessels detect and classify mines and mine-like objects.
Long Description	Mine detection and classification systems require testing to evaluate the capability of generating underwater magnetic and acoustic signature fields capable of sweeping a wide range of threat mines at tactically significant water depths, ranging from the surf zone to deep water. In order to develop better and safer methods of minesweeping, the Navy is currently testing new systems to detect, locate, and identify mines including a laser airborne mine detection system that uses laser illumination coupled with sensitive electro-optic receivers to find mines in the upper part of the water column. This type of equipment is currently designed for operation from a manned helicopter; however, the next generation of such equipment is expected to operate from unmanned aerial vehicles.
Information Typical to the Event	**Platform:** Rotary-wing aircraft, Unmanned aerial systems, Surface combatant vessels, Amphibious warfare vessels, Remotely operated vehicles **Systems:** Mine detection and classification systems **Ordnance/Munitions:** None **Targets:** Floating/moored/bottom non-explosive mines or passive mine simulation systems **Duration:** Up to 10 days **Location:** Hawaii Range Complex: Kahoolawe Training Minefield Southern California Range Complex: Mission Bay Training Minefield
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (e.g., HF4), Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, in-water device strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** None
Detailed Military Expended Material Information	None
Assumptions Used for Analysis	Laser systems also used during testing

A.3.4.2 Mine Countermeasure/Neutralization Testing

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Mine Warfare (MIW) Testing</td></tr>
<tr><td>Mine Countermeasure/ Neutralization Testing</td><td colspan="2">Short Description:
Air, surface, and subsurface vessels neutralize threat mines that would otherwise restrict passage through an area.</td></tr>
<tr><td>Long Description</td><td colspan="2">Mine countermeasure/neutralization testing is required to ensure systems can effectively neutralize threat mines that would otherwise restrict passage through an area. Countermeasure systems are deployed from surface ships and helicopters to neutralize mines a number of ways: cutting mooring cables of buoyant mines, producing medium- to high-frequency acoustic energy that fires acoustic-influence mines, producing electrical energy to replicate the magnetic signatures of surface ships in order to detonate threat mines, detonation of mines using remotely-operated vehicles such as the Archerfish Common Neutralizer, and using explosive charges or supercavitating projectiles to destroy threat mines.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface combatant ship, rotary wing aircraft, remotely operated vehicles
Systems:
Ordnance/Munitions: Mine neutralization systems; explosive mines
Targets: Floating/moored/bottom non-explosive and explosive mines and mine simulation systems, HE mines
Duration: Event duration ranges from 1 to 10 days, with intermittent use of countermeasure/neutralization systems during this period.</td><td>Location:
Southern California Range Complex</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Tracking pingers (e.g., P2), mine countermeasure systems (e.g., HF4, M3), underwater explosions (e.g., E4, E11)
Energy: Electromagnetic minesweeping systems
Physical Disturbance and Strike: Vessel strike
Entanglement: Fiber-optic cable
Ingestion: Target fragments</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Target fragments, Fiber-optic cable</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2">Other Sensors: Mine countermeasures systems (e.g., AN/AWS-2 Rapid Airborne Mine Clearance System, AN/ALQ-220 Organic Airborne and Surface Influence Sweep)</td></tr>
</table>

A.3.4.3 Pierside Systems Health Checks

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Mine Warfare Testing</td></tr>
<tr><td>Pierside Systems Health Checks</td><td colspan="2">Short Description:
Mine warfare systems are tested in pierside locations to ensure acoustic and electromagnetic sensors are fully functional prior to at-sea test activities.</td></tr>
<tr><td>Long Description</td><td colspan="2">Mine warfare systems are tested in pierside locations to ensure acoustic and electromagnetic sensors are fully functional prior to at-sea test activities. Systems that are tested pierside include mine hunting and localization sonar, electromagnetic mine neutralization systems, and navigation systems.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface combatant vessel
Systems: Mine detection systems
Ordnance/Munitions: None
Targets: None
Duration: Event duration is up to 5 days, with systems being tested independently and periodically (not continuously) during the total event duration.</td><td>Location:
Pierside: San Diego, CA</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: None
Energy: None
Physical Disturbance and Strike: None
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2"></td></tr>
</table>

A.3.5 SHIPBOARD PROTECTION SYSTEMS AND SWIMMER DEFENSE TESTING

A.3.5.1 Pierside Integrated Swimmer Defense

Activity Name	Activity Description	
Shipboard Protection Systems and Swimmer Defense Testing		
Pierside Integrated Swimmer Defense	**Short Description:** Swimmer defense testing ensures that systems can effectively detect, characterize, verify, and engage swimmer/diver threats in harbor environments.	
Long Description	Swimmer defense testing includes testing of systems to determine if they can effectively detect, characterize, verify, and engage swimmer/diver threats in harbor environments. Swimmer and diver threats are detected with high frequency sonar. The threats are then warned to exit the water through the use of underwater voice communications. If the threat does not comply, non-lethal diver deterrent air guns are used against the threat. Surface loudhailers are also used during the test.	
Information Typical to the Event	**Platform:** Support Craft/Other **Systems:** High frequency sonar; airguns surface loudhailers **Ordnance/Munitions:** None **Targets:** None **Duration:** 14 days with intermittent periods of use for each system during this time.	**Location:** San Diego, CA
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Low-frequency sonar (e.g., LF4), Mid-frequency sonar (e.g., MF8), Swimmer defense sonar (e.g., SD1), Airguns (e.g., AG) **Energy:** None **Physical Disturbance and Strike:** Seafloor device strike (swimmer defense tripod), Vessel strike **Entanglement:** None **Ingestion:** None	
Military Expended Material	None	
Assumptions Used for Analysis	**Other Sensors:** Surface ship protection systems (e.g., communications systems, loudhailers, swimmer deterrents)	

A.3.5.2 Shipboard Protection Systems Testing

Activity Name	Activity Description	
Shipboard Protection Systems and Swimmer Defense Testing		
Shipboard Protection Systems Testing	**Short Description:** Various systems are used to protect surface combatants from various threats.	
Long Description	Surface vessels engage small boat threats through the use of spotlights and loudhailers (pierside) but can also include the use of 0.50 cal guns (at-sea).	
Information Typical to the Event	**Platform:** Surface combatant vessels **Systems:** None **Ordnance/Munitions:** Small caliber projectiles (e.g., 0.50 caliber [non-explosive]) **Targets:** Floating target, rigid-hull inflatable boat **Duration:** 10 days	**Location:** Pierside: San Diego, CA Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Weapons firing noise **Energy:** None **Physical Disturbance and Strike:** Military expended material strike (non-explosive projectiles), Vessel strike **Entanglement:** None **Ingestion:** Small caliber projectiles, Casings	
Detailed Military Expended Material Information	Casings Projectiles Target fragments	
Assumptions Used for Analysis	Small caliber rounds will not be used pierside	

A.3.5.3 Chemical/Biological Simulant Testing

Activity Name	Activity Description	
Shipboard Protection Systems and Swimmer Defense Testing		
Chemical/Biological Simulant Testing	**Short Description:** Chemical/biological agent simulants are deployed against surface ships.	
Long Description	Chemical or biological agent simulants are deployed against surface vessels to verify the integrity of the vessel's defense system including installed detection, protection, and decontamination systems. Methods of stimulant delivery include aerial dispersal and by hand-held spray.	
Information Typical to the Event	**Platform:** Surface combatant vessels, Fixed-wing aircraft **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 3 days	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Vessel noise, Aircraft noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike, Aircraft strike (seabirds only) **Entanglement:** None **Ingestion:** Simulants	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis	Examples Chemical Simulants: Glacial Acetic Acid, Triethyl Phosphate	

A.3.6 UNMANNED VEHICLE TESTING

A.3.6.1 Underwater Deployed Unmanned Aerial Vehicle Testing

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Unmanned Vehicle Testing</td></tr>
<tr><td>Underwater Deployed Unmanned Aerial Vehicle Testing</td><td colspan="2">Short Description:
Submarines launch unmanned aerial vehicles while submerged.</td></tr>
<tr><td>Long Description</td><td colspan="2">During testing, a negatively buoyant capsule is deployed underwater and descends to a programmed depth. The capsule then drops a weight, inflates a flotation collar, rises to the surface, and launches an unmanned aerial system. Personnel use radio frequency communications to control and communicate with the unmanned aerial system during its flight.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Submarine
Systems: Unmanned aerial systems
Ordnance/Munitions: None
Targets: None
Duration: 8 hours (4 hours/day over 2 days)</td><td>Location:
Hawaii Range Complex
Southern California Range Complex</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: None
Energy: None
Physical Disturbance and Strike: Vessel strike, In-water device strike (unmanned aerial system launch), Unmanned aerial system strike (seabirds only)
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">Expandable capsule (with flotation collar)
Ballast weights</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2"></td></tr>
</table>

A.3.6.2 Unmanned Vehicle Development and Payload Testing

Activity Name	Activity Description	
Unmanned Vehicle Testing		
Unmanned Vehicle Development and Payload Testing	**Short Description:** Vehicle development involves the production and upgrade of new unmanned platforms on which to attach various payloads used for different purposes.	
Long Description	Vehicle development involves the production and upgrade of new unmanned platforms on which to attach various payloads used for different purposes. Platforms can include unmanned underwater vehicles, unmanned surface vehicles, and unmanned aerial systems. Payload testing assesses various systems that can be incorporated onto unmanned platforms for mine warfare, bottom mapping, and other missions. Tests range from basic remote control and autonomous navigation tests to deployment and activation of onboard systems which may include hydrodynamic instruments, launchers, and recovery capabilities. These vehicles are capable of expanding the communication and surveillance capabilities of submarines, surface vessels, and terrestrial commands.	
Information Typical to the Event	**Platform:** Unmanned vehicles (underwater, surface, and aerial), Support Craft/Other **Systems:** Unmanned vehicle sonar systems **Ordnance/Munitions:** None **Targets:** None **Duration:** Event duration for unmanned vehicles with traditional propulsion typically lasts up to 40 hours. Some propulsion systems (e.g., gliders) could operate continuously for multiple months.	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid-frequency sonar (e.g., MF9), High-frequency sonar (e.g., SAS2), vessel noise **Energy:** None **Physical Disturbance and Strike:** In-water device strike, Seafloor device (bottom crawling vehicles), Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis		

A.3.7 Other Testing

A.3.7.1 Special Warfare

Activity Name	Activity Description	
Other Testing		
Special Warfare	**Short Description:** Special warfare includes testing of submersibles capable of inserting and extracting personnel and payloads into denied areas from strategic distances.	
Long Description	Special warfare includes testing of submersibles capable of inserting and extracting personnel and payloads into denied areas from strategic distances. Testing could include the use of special operations forces deployed from submerged submarines while at sea.	
Information Typical to the Event	**Platform:** Surface Craft/Other, Submarines **Systems:** Submarine sonar, Doppler sonar, Side scan sonar, Underwater communications **Ordnance/Munitions:** None **Targets:** None **Duration:** Up to 30 days	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** High-frequency sonar (e.g., HF1, M3), Underwater communications (e.g., MF9), Fathometer (e.g., FA2), Vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis	Test will not occur constantly throughout duration	

A.3.7.2 Acoustic Communications Testing

Activity Name	**Activity Description**	
Other Testing		
Acoustic Communications Testing	**Short Description:** Acoustic modems, submarines, and surface vessels transmit signals to communicate.	
Long Description	Acoustic communications testing can include transmission of low-, mid-, and high-frequency signals between acoustic modems, submarines, sub and surface vessels, vessels and shore, and between surface vessels and mines.	
Information Typical to the Event	**Platform:** Surface ships, submarines **Systems:** None **Ordnance/Munitions:** None **Targets:** None **Duration:** 12 hours	**Location:** Hawaii Range Complex Southern California Range Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Acoustic communication (e.g., M2, M3), vessel noise **Energy:** None **Physical Disturbance and Strike:** Vessel strike **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis		

A.4 SPACE AND NAVAL WARFARE SYSTEMS COMMAND TESTING EVENTS

The mission of Space and Naval Warfare Systems Command is to acquire, develop, deliver and sustain decision superiority for the warfighter at the right time and for the right cost. Space and Naval Warfare Systems Center Pacific is the research and development part of Space and Naval Warfare Systems Command focused on developing and transitioning technologies in the area of command, control, communications, computers, intelligence, surveillance, and reconnaissance for the Navy. Space and Naval Warfare Systems Command and Space and Naval Warfare Systems Center Pacific conduct research, development, test, and evaluation projects to support emerging technologies for intelligence, surveillance, and reconnaissance, anti-terrorism and force protection, mine countermeasures, anti-submarine warfare, oceanographic research, remote sensing, and communications. These activities include, but are not limited to, the testing of unmanned undersea and surface vehicles, a wide variety of sensor systems, underwater surveillance technologies, and underwater communications.

A.4.1 Research, Development, Test, and Evaluation

A.4.1.1 Autonomous Undersea Vehicle Anti-Terrorism/Force Protection Mine Countermeasures

Activity Name	**Activity Description**
AT/FP Mine Countermeasures	
Autonomous Undersea Vehicle Anti-Terrorism/Force Protection Mine Countermeasures	**Short Description:** Testing of unmanned undersea vehicles with mine hunting sensors in marine environments in and around rocky outcroppings. Anti-terrorism/force protection mine countermeasures testing is focused on mine countermeasure missions in confined areas between piers and pilings.
Long Description	Autonomous undersea vehicle shallow water mine countermeasure testing is focused on the testing of unmanned undersea vehicles with mine hunting sensors in marine environments in and around rocky outcroppings. Anti-terrorism/force protection mine countermeasures testing are focused on mine countermeasure missions in confined areas between piers and pilings. It provides training to Navy personnel on how to deploy, detect, and defend against mine systems and underwater improvised explosive devices.
Information Typical to the Event	**Platform:** Autonomous Undersea Vehicle **Systems:** Mine hunting sensors (side-scan sub-bottom profilers, synthetic aperture sonar (e.g., SAS1, SAS2, SAS3) **Ordnance/Munitions:** None **Targets:** Mine Shapes **Duration:** Typically 5 days of daily operations for 6 hours per day **Location:** Hawaii Range Complex: Oahu, Hawaii Southern California Range Complex : San Diego Bay, Camp Pendleton Amphibious Assault Area, San Clemente Island Operating Areas Silver Strand Training Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** mine hunting sensors (side-scan sub-bottom profilers, synthetic aperture sonar; (e.g., SAS1, SAS2, SAS3) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None
Detailed Military Expended Material Information	None
Assumptions Used for Analysis	San Diego Bay vehicle depth shallow and slow moving. All other areas are deeper water with the vehicle moving approximately 3 to 4 knots near the sea floor. It may also include glider operations in the San Clemente Island Operating Area and open ocean. Conducted in multiple marine environments within HSTT study to include San Clemente Island Operating Area, Silver Strand Training Complex, and in and around rocky outcroppings and between Naval piers, pilings, and ships.

A.4.1.2 Autonomous Undersea Vehicle Underwater Communications

Activity Name	Activity Description	
Underwater Communications		
Autonomous Undersea Vehicle Underwater Communications	**Short Description:** This testing is focused on providing two-way networked communications below the ocean surface while maintaining mission profile.	
Long Description	This testing is focused on providing two-way networked communications below the ocean surface while maintaining mission profile. The goal of this testing is to enable two-way communications during missions that require Autonomous Underwater Vehicles to remain submerged to minimize counter-detection and maximize tactical positioning.	
Information Typical to the Event	**Platform:** Autonomous Underwater Vehicle **Systems:** Acoustic modems (e.g., M2, M3) **Ordnance/Munitions:** None **Targets:** Mine Shapes **Duration:** Typically 5 days of daily operations for 6 hours per day	**Location:** Hawaii Range Complex: Oahu, Hawaii Southern California Range Complex: San Diego Bay, Camp Pendleton Amphibious Assault Area, San Clemente Island Operating Areas Silver Strand Training Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Acoustic modems (e.g., M2, M3) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis	San Diego Bay vehicle depth shallow and slow moving. All other areas are deeper water with the vehicle moving approximately 3 to 4 knots near the sea floor. It may also include glider operations in the San Clemente Island Operating Area and open ocean. Conducted in multiple marine environments within HSTT study to include San Clemente Island Operating Area, Silver Strand Training Complex, and in and around rocky outcroppings and between Naval piers, pilings, and ships.	

A.4.1.3 Fixed System Underwater Communications

Activity Name	Activity Description
Underwater Communications	
Fixed System Underwater Communications	**Short Description:** Fixed underwater communications systems testing is focused on testing stationary or free floating equipment that provides two-way networked communications below the ocean surface while maintaining mission profile.
Long Description	Fixed underwater communications systems testing is focused on testing stationary or free floating equipment that provides two-way networked communications below the ocean surface while maintaining mission profile. The goal of this testing is to enable two-way communications during missions that require the fixed sensor to remain submerged to minimize counter-detection and maximize tactical positioning. Typical tests last 5 days of 8 hours testing per day.
Information Typical to the Event	**Platform:** Fixed Systems **Systems:** Acoustic Modem (e.g., M3) **Ordnance/Munitions:** None **Targets:** None **Duration:** Typically five days of daily operations for 6 hours per day **Location:** SOCAL Range Complex: San Diego Bay, San Clemente Island Operating Areas Silver Strand Training Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Acoustic Modem (e.g., M3) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None
Detailed Military Expended Material Information	Clump anchors and/or sand bags Expendable communications buoys
Assumptions Used for Analysis	Fixed or free floating, stationary source

A.4.1.4 Autonomous Oceanographic Research and Meteorology and Oceanography

Activity Name	Activity Description	
Autonomous Oceanographic Research and Meteorology and Oceanography		
Autonomous Oceanographic Research and Meteorology and Oceanography (METOC)	**Short Description:** The research is comprised of ocean gliders and autonomous undersea vehicles. Gliders are portable, long-endurance buoyancy driven vehicles that provide a means to sample and characterize ocean water properties. Autonomous undersea vehicles are larger, shorter endurance vehicles.	
Long Description	The research is comprised of ocean gliders and autonomous undersea vehicles. Gliders are portable, long-endurance (weeks to months), buoyancy driven vehicles that provide a low-cost, semi-autonomous, and highly persistent means to sample and characterize the ocean water column properties at spatial and temporal resolutions. Autonomous undersea vehicles are larger, shorter endurance (hours to days), conventionally powered (typically electric motor) vehicles that will increase the spatial extent and resolution of the bathymetry, imagery data, conductivity, temperature and depth data, and optical data.	
Information Typical to the Event	**Platform:** Ocean glider, Autonomous Undersea Vehicles **Systems:** Acoustic Doppler Current Profilers, sub bottom profilers, side scan sonar, vehicle tracking systems, and positioning and navigation systems (e.g., DS2, DS3, DS4, SSS2, SSS3, and HF6) **Ordnance/Munitions:** None **Targets:** None **Duration:** Typically 5 days of daily operations for 6 hours per day	**Location:** Hawaii Range Complex: Oahu, Hawaii SOCAL Range Complex: San Diego Bay, Camp Pendleton Amphibious Assault Area, San Clemente Island Operating Area Silver Strand Training Complex
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Acoustic Doppler Current Profilers , sub bottom profilers, side scan sonar, vehicle tracking systems, and positioning and navigation systems (e.g., DS2, DS3, DS4,, SSS2, SSS3, and HF6) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis	San Diego Bay vehicle depth shallow and slow moving. All other areas are deeper water with the vehicle moving approximately 3 to 4 knots near the sea floor. It may also include glider operations in the San Clemente Island Operating Area and open ocean. Conducted in multiple marine environments within HSTT study to include San Clemente Island Operating Area, Silver Strand Training Complex, and in and around rocky outcroppings and between Naval piers, pilings, and ships.	

A.4.1.5 Fixed Autonomous Oceanographic Research and Meteorology and Oceanography

Activity Name	Activity Description	
Autonomous Oceanographic Research and Meteorology and Oceanography		
Fixed Autonomous Oceanographic Research and Meteorology and Oceanography	**Short Description:** The goal of these systems is to develop, integrate, and demonstrate deployable autonomous undersea technologies that improve the Navy's capability to conduct effective anti-submarine warfare and intelligence, surveillance, and reconnaissance operations in littoral waters.	
Long Description	The goal of these systems is to develop, integrate, and demonstrate deployable autonomous undersea technologies that improve the Navy's capability to conduct effective anti-submarine warfare and intelligence, surveillance, and reconnaissance operations in littoral waters. Fixed systems are portable, long-endurance (weeks to months), that provide a low-cost, semi-autonomous, and highly persistent means to sample and characterize the ocean water column properties at spatial and temporal resolutions. Acoustic releases would be used for the recovery of the hardware.	
Information Typical to the Event	**Platform:** Fixed Systems **Systems:** Acoustic Doppler Current Profilers, acoustic releases (e.g., DS2, DS3, DS4, R2, R3) **Ordnance/Munitions:** None **Targets:** None **Duration:** Typically five days of daily operations for 8 hours per day	**Location:** Silver Strand Training Complex/Imperial Beach/Point Loma San Clemente Island Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Acoustic Doppler Current Profilers, acoustic releases (e.g., DS2, DS3, DS4, R2, R3) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	Clump anchors and/or sand bags	
Assumptions Used for Analysis	Fixed stationary source	

A.4.1.6 Passive Mobile Intelligence, Surveillance, and Reconnaissance Sensor Systems

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">Intelligence, Surveillance, and Reconnaissance (ISR) Sensor Systems</td></tr>
<tr><td>Passive Mobile Intelligence, Surveillance, and Reconnaissance Sensor Systems</td><td colspan="2">Short Description:
These systems use passive arrays hosted by surface and subsurface vehicles and vessels for conducting submarine detection and tracking experiments and demonstrations.</td></tr>
<tr><td>Long Description</td><td colspan="2">These systems use passive arrays hosted by surface and subsurface vehicles and vessels for conducting submarine detection and tracking experiments and demonstrations. The arrays, which are composed of hydrophones to receive acoustic energy radiated by targets of interest, are deployed by surface ships. The unmanned undersea vehicles and associated systems are monitored and controlled by operators stationed aboard another vessel or at a land-based remote host station. The arrays are tested to evaluate various system performance parameters and requirements. Surrogate quiet submarine threats are provided by low-frequency towed projectors as well as existing Fleet assets such as underwater autonomous mobile acoustic sources.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform: Surface or subsurface vehicle
Systems: Towed sound projector with passive towed arrays
Ordnance/Munitions: None
Targets: sub-surface vessels
Duration: Typically 5 days of daily operations for 8 hours per day</td><td>Location:
Silver Strand Training Complex/Imperial Beach/Point Loma
San Clemente Island Operating Area</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic: Towed sound projector (e.g., LF5)
Energy: None
Physical Disturbance and Strike: None
Entanglement: None
Ingestion: None</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2">Towed moving source in the water column</td></tr>
</table>

A.4.1.7 Fixed Intelligence, Surveillance, and Reconnaissance Sensor Systems

Activity Name	Activity Description	
Intelligence, Surveillance, and Reconnaissance (ISR) Sensor Systems		
Fixed Intelligence, Surveillance, and Reconnaissance Sensor Systems	**Short Description:** These systems use stationary fixed arrays for conducting submarine detection and tracking experiments and demonstrations.	
Long Description	These systems use stationary fixed passive arrays for conducting submarine detection and tracking experiments and demonstrations. The arrays are composed of passive hydrophones to receive acoustic energy radiated by targets of interest. Surrogate threats are provided by low frequency towed projectors. This type of testing may also include free floating sensor systems such as buoys, sonobuoys, and other types of sensors floating on the surface or suspended in the water column.	
Information Typical to the Event	**Platform:** Fixed and free floating arrays **Systems:** Towed sound source (e.g., LF5) and free floating buoys (e.g., MF9, HF6, LF4, MF8)**Ordnance/Munitions:** None **Targets:** sub-surface vessels **Duration:** Typically 5 days of daily operations for 8 hours per day	**Location:** **Hawaii Operating Area** Silver Strand Training Complex/Imperial Beach/Point Loma San Clemente Island Operating Area
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Towed sound source (e.g., LF5) and free floating buoys (e.g., MF9, HF6, LF4, MF8) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	Steel framework in deep water only (1 per every 5 years)	
Assumptions Used for Analysis	Towed moving and free floating source in the water column	

A.4.1.8 Anti-Terrorism/Force Protection Fixed Sensor Systems

Activity Name	**Activity Description**	
Anti-Terrorism/Force Protection		
Fixed Sensor Systems	**Short Description:** These systems are for Anti-Terrorism/Force Protection operations in navy ports and bays	
Long Description		
Information Typical to the Event	**Platform:** Fixed system **Systems:** Mid Frequency Source (e.g., MF 9) **Ordnance/Munitions:** None **Targets:** Sub-surface objects of interest **Duration:** Typically 5 days of daily operations for 8 hours per day	**Location:** San Diego Bay
Potential Impact Concerns *(Information regarding deconstruct categories and stressors)*	**Acoustic:** Mid Frequency Source (e.g., MF 9) **Energy:** None **Physical Disturbance and Strike:** None **Entanglement:** None **Ingestion:** None	
Detailed Military Expended Material Information	None	
Assumptions Used for Analysis	Fixed stationary source above sea bottom	

A.5 Office of Naval Research and Naval Research Laboratory Testing Activities

As the Department of the Navy's Science and Technology provider, the Office of Naval Research and the Naval Research Laboratory provide technology solutions for Navy and Marine Corps needs. The Office of Naval Research's mission, as defined by law, is to plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future naval power, and the preservation of national security. Further, the Office of Naval Research manages the Navy's basic, applied, and advanced research to foster transition from science and technology to higher levels of research, development, test and evaluation.

The Ocean Battlespace Sensing Department explores science and technology in the areas of oceanographic and meteorological observations, modeling and prediction in the battlespace environment; submarine detection and classification (anti-submarine warfare); and mine warfare applications for detecting and neutralizing mines in both the ocean and littoral environment. Office of Naval Research events include: research, development, test and evaluation activities; surface processes acoustic communications experiments; shallow water acoustic communications experiments; sediment acoustics experiments; shallow water acoustic propagation experiments; and long range acoustic propagation experiments.

A.5.1 RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

A.5.1.1 Kauai Acoustic Communications Experiment (Coastal)

<table>
<tr><th>Activity Name</th><th colspan="2">Activity Description</th></tr>
<tr><td colspan="3">RDT&E Testing</td></tr>
<tr><td>Kauai Acoustic Communications Experiment (Coastal)</td><td colspan="2">Short Description:
The primary purpose of the Kauai Acoustic Communications Experiment is to collect acoustic and environmental data appropriate for studying the coupling of oceanography, acoustics, and underwater communications.</td></tr>
<tr><td>Long Description</td><td colspan="2">The primary purpose of the Kauai acoustic communications experiment is to collect acoustic and environmental data appropriate for studying the coupling of oceanography, acoustics, and underwater communications. A specific experimental interest is obtaining data that would relate the impact of a fluctuating oceanographic environment and source/receiver motion to fluctuations in the waveguide acoustic impulse response between multiple sources and receivers. These data would ultimately provide insight into the design and performance of shallow underwater systems for acoustic digital data communications. The focus is on fluctuations over scales of a few seconds to a few tens of seconds that directly affect the reception of a data packet and the variability of packet-to-packet reception. These experiments involve the use of underwater acoustic sources to collect acoustic and environmental data appropriate for studying the coupling of oceanography, acoustics, and underwater communications.</td></tr>
<tr><td>Information Typical to the Event</td><td>Platform:
Systems:
Ordnance/Munitions:
Targets:
Duration: 1-2 weeks</td><td>Location:
Hawaii Range Complex: Pacific Missile Range Facility (Warning Areas -72B, and 386 [Air D, G, H, and K])</td></tr>
<tr><td>Potential Impact Concerns
(Information regarding deconstruct categories and stressors)</td><td colspan="2">Acoustic:
Energy:
Physical Disturbance and Strike:
Entanglement:
Ingestion:</td></tr>
<tr><td>Detailed Military Expended Material Information</td><td colspan="2">None</td></tr>
<tr><td>Assumptions Used for Analysis</td><td colspan="2"></td></tr>
</table>

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APPENDIX B

NOTICE OF INTENT

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proposed information collection; (c) ways to enhance the quality, utility, and clarity of the information to be collected; and (d) ways to minimize the burden of the information collection on respondents, including the use of automated collection techniques or other forms of information technology. The Office of Management and Budget (OMB) has approved this information collection requirement for use through November 30, 2010. DoD proposes that OMB extend its approval for these collections to expire three years after the approval date.

DATES: DoD will consider all comments received by September 13, 2010.

ADDRESSES: You may submit comments, identified by OMB Control Number 0704–0252, using any of the following methods:

○ *Federal eRulemaking Portal: http://www.regulations.gov.* Follow the instructions for submitting comments.

○ *E-mail: dfars@acq.osd.mil.* Include OMB Control Number 0704–0252 in the subject line of the message.

○ *Fax:* (703) 602–0350.

○ *Mail:* Defense Acquisition Regulations System, Attn: Ms. Meredith Murphy, OUSD(AT&L)DPAP(DARS), 3060 Defense Pentagon, Room 3B855, Washington, DC 20301–3060.

Comments received generally will be posted without change to *http://www.regulations.gov*, including any personal information provided.

FOR FURTHER INFORMATION CONTACT: Ms. Meredith Murphy, 703–602–1302. The information collection requirements addressed in this notice are available electronically via the Internet at: *http://www.acq.osd.mil/dp/dars/dfars.html.*

Paper copies are available from Ms. Meredith Murphy, OUSD(AT&L)DPAP(DARS), 3060 Defense Pentagon, Room 3B855, Washington, DC 20301–3060.

SUPPLEMENTARY INFORMATION:

Title, Associated Form, and OMB Number: Defense Federal Acquisition Regulation Supplement (DFARS) Part 251, Contractor Use of Government Supply Sources, and the associated clauses at DFARS 252.251–7000, Ordering from Government Supply Sources; and 252.251–7001, Use of Interagency Fleet Management System (IFMS) Vehicles and Related Services; OMB Control Number 0704–0252.

Needs and Uses: This information collection permits contractors to—

• Place orders under Federal Supply Schedule contracts and requirements contracts or for Government stock. The information enables DoD to evaluate whether a contractor is authorized to place such orders.

• Submit requests for use of Government vehicles under the Interagency Fleet Management System (IFMS) and obtain related services. The information submitted enables DoD to evaluate whether the contractor is authorized such use.

Affected Public: Businesses or other for-profit and not-for-profit institutions.

Annual Burden Hours: 5,250.

Number of Respondents: 3,500.

Responses per Respondent: approximately 3.

Annual Responses: 10,500.

Average Burden per Response: approximately 30 minutes.

Frequency: On occasion.

Summary of Information Collection

The clause at DFARS 252.251–7000, Ordering from Government Supply Sources, requires a contractor to provide a copy of an authorization when placing an order under a Federal Supply Schedule, a Personal Property Rehabilitation Price Schedule, or an Enterprise Software Agreement.

The clause at DFARS 252.251–7001, Use of Interagency Fleet Management System Vehicles and Related Services, requires a contractor to submit a request for use of Government vehicles when the contractor is authorized to use such vehicles in the performance of Government contracts.

Ynette R. Shelkin,

Editor, Defense Acquisition Regulations System.

[FR Doc. 2010–17256 Filed 7–14–10; 8:45 am]

BILLING CODE 5001–08–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Prepare an Environmental Impact Statement and Overseas Environmental Impact Statement for Navy Hawaii-Southern California Training and Testing and To Announce Public Scoping Meetings

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to section 102 of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality Regulations (40 Code of Federal Regulations [CFR] Parts 1500–1508), and Executive Order 12114, the Department of the Navy (DON) announces its intent to prepare an Environmental Impact Statement (EIS) and Overseas EIS (OEIS) to evaluate the potential environmental effects associated with military readiness training and research, development, testing, and evaluation (RDT&E) activities (hereinafter referred to as "training and testing" activities) conducted within the Hawaii-Southern California Training and Testing (HSTT) study area. The HSTT study area combines the at-sea portions of the Hawaii Range Complex, the Southern California Range Complex (including the San Diego Bay); the Silver Strand Training Complex; areas where vessels transit between the Hawaii Range Complex and the Southern California Range Complex; and select Navy pierside locations. This EIS and OEIS is being prepared to renew and combine current regulatory permits and authorizations; address current training and testing not covered under existing permits and authorizations; and to obtain those permits and authorizations necessary to support force structure changes and emerging and future training and testing requirements.

The DON will invite the National Marine Fisheries Service to be a cooperating agency in preparation of this EIS and OEIS.

DATES AND ADDRESSES: Six public scoping meetings will be held between 4 p.m. and 8 p.m., unless otherwise stated, on the following dates and at the following locations:

1. Wednesday, August 4, 2010, 3:30 p.m. to 7:30 p.m., Point Loma/Hervey Branch Library, Community Room, 3701 Voltaire Street, San Diego, CA.
2. Thursday, August 5, 2010, Lakewood High School, Room 922/924, 4400 Briercrest Avenue, Lakewood, CA.
3. Tuesday, August 24, 2010, Kauai Community College Cafeteria, 3–1901 Kaumuali'i Highway, Lihue, HI.
4. Wednesday, August 25, 2010, Disabled American Veterans Hall, Weinberg Hall, 2685 North Nimitz Highway, Honolulu, HI.
5. Thursday, August 26, 2010, Hilo High School Cafeteria, 556 Waianuenue Avenue, Hilo, HI.
6. Friday, August 27, 2010, Maui Waena Intermediate School Cafeteria, 795 Onehee Avenue, Kahului, HI.

Each of the six scoping meetings will consist of an informal, open house session with informational stations staffed by DON representatives. Meeting details will be announced in local newspapers. Additional information concerning meeting times is available on the EIS and OEIS Web page located at: *http://www.HawaiiSOCALEIS.com.*

FOR FURTHER INFORMATION CONTACT: Kent Randall, Naval Facilities Engineering Command, Southwest. Attention: HSTT EIS/OEIS, 1220 Pacific Highway, Building 1, Floor 5, San Diego, CA

Federal Register / Vol. 75, No. 135 / Thursday, July 15, 2010 / Notices 41163

92132, or Meghan Byrne, Naval Facilities Engineering Command, Pacific. Attention: HSTT EIS/OEIS, 258 Makalapa Dr, Ste 100, Building 258, Floor 3, Room 258C210, Pearl Harbor, HI 96860–3134.

SUPPLEMENTARY INFORMATION: The DON's proposed action is to conduct training and testing activities that include the use of active sonar and explosives within the at-sea portions of existing DON training range complexes around the Hawaiian Islands and off the coast of Southern California (known as the HSTT study area). While the majority of these training and testing activities take place in operating and warning areas and/or on training and testing ranges, some training activities, such as sonar maintenance and gunnery exercises, are conducted concurrent with normal transits and may occur outside of DON operating and warning areas.

The HSTT study area combines the at-sea portions of the following range complexes: Hawaii Range Complex, Southern California Range Complex, and Silver Strand Training Complex. The existing western boundary of the Hawaii Range Complex is being expanded 60 miles to the west to the International Dateline. The HSTT study area also includes the transit route between Hawaii and Southern California as well as DON and commercial piers at Pearl Harbor, HI and San Diego, CA where sonar may be tested.

The proposed action is to conduct military training and testing activities in the HSTT study area. The purpose of the proposed action is to achieve and maintain Fleet Readiness to meet the requirements of Title 10 of the U.S. Code, which requires DON to "maintain, train, and equip combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas." The proposed action would also allow DON to attain compliance with applicable environmental authorizations, consultations, and other associated environmental requirements, including those associated with new platforms and weapons systems, for example, the Low Frequency Anti-Submarine Warfare capability associated with the Littoral Combat Ship.

The alternatives that will be analyzed in the HSTT EIS and OEIS meet the purpose and need of the proposed action by providing the level of training that meets the requirements of Title 10, thereby ensuring that Sailors and Marines are properly prepared for operational success. Similarly, the level of RDT&E proposed for the HSTT study area is necessary to ensure that Sailors and Marines deployed overseas have the latest proven military equipment. Accordingly, the alternatives to be addressed in the HSTT EIS and OEIS are:

1. No Action—The No Action Alternative continues baseline training and testing activities and force structure requirements as defined by existing DON environmental planning documents. This documentation includes the Records of Decision for the Hawaii and Southern California range complexes and the Preferred Alternative for the Silver Strand Training Complex Draft EIS and OEIS.

2. Alternative 1—This alternative consists of the No Action alternative, plus expansion of the overall study area boundaries, and updates and/or adjustments to locations and tempo of training and testing activities. This alternative also includes changes to training and testing requirements necessary to accommodate force structure changes, and the development and introduction of new vessels, aircraft, and weapons systems.

3. Alternative 2—Alternative 2 consists of Alternative 1 with an increased tempo of training and testing activities. This alternative also allows for additional range enhancements and infrastructure requirements.

Resource areas that will be addressed because of the potential effects from the proposed action include, but are not limited to: Ocean and biological resources (including marine mammals and threatened and endangered species); air quality; airborne soundscape; cultural resources; transportation; regional economy; recreation; and public health and safety.

The scoping process will be used to identify community concerns and local issues to be addressed in the EIS and OEIS. Federal agencies, state agencies, local agencies, Native American Indian Tribes and Nations, the public, and interested persons are encouraged to provide comments to the DON to identify specific issues or topics of environmental concern that the commenter believes the DON should consider. All comments provided orally or in writing at the scoping meetings, will receive the same consideration during EIS and OEIS preparation. Written comments must be postmarked no later than September 14, 2010, and should be mailed to: Naval Facilities Engineering Command, Southwest, 2730 McKean Street, Building 291, San Diego, CA 92136–5198, Attention: Mr. Kent Randall—HSTT EIS/OEIS.

Dated: July 9, 2010.

D.J. Werner

Lieutenant Commander, Office of the Judge Advocate General, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. 2010–17234 Filed 7–14–10; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Prepare an Environmental Impact Statement and Overseas Environmental Impact Statement for Navy Atlantic Fleet Training and Testing and To Announce Public Scoping Meetings

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to section 102 of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality Regulations (40 Code of Federal Regulations [CFR] Parts 1500–1508), and Executive Order 12114, the Department of the Navy (DON) announces its intent to prepare an Environmental Impact Statement (EIS) and Overseas EIS (OEIS) to evaluate the potential environmental effects associated with military readiness training and research, development, testing, and evaluation (RDT&E) activities (hereinafter referred to as "training and testing" activities) conducted within the Atlantic Fleet Training and Testing (AFTT) study area. The AFTT study area includes the western North Atlantic Ocean along the east coast of North America (including the area where the Undersea Warfare Training Range will be used), the Chesapeake Bay, and the Gulf of Mexico. Also included are select Navy pierside locations and channels. The AFTT study area does not include the Arctic. This EIS and OEIS is being prepared to renew and combine current regulatory permits and authorizations; address current training and testing not covered under existing permits and authorizations; and to obtain those permits and authorizations necessary to support force structure changes and emerging and future training and testing requirements.

The DON will invite the National Marine Fisheries Service to be a cooperating agency in preparation of this EIS and OEIS.

DATES AND ADDRESSES: Five public scoping meetings will be held between 4 p.m. and 8 p.m. on the following dates and at the following locations:

APPENDIX C

AGENCY CORRESPONDENCE

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DEPARTMENT OF THE NAVY
COMMANDER
UNITED STATES PACIFIC FLEET
250 MAKALAPA DRIVE
PEARL HARBOR, HAWAII 96860-3131

IN REPLY REFER TO:
5090
Ser N01CE1/0715
14 Jul 10

Dear Sir or Madam:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) FOR NAVY MILITARY READINESS ACTIVITIES IN THE HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING (HSTT) STUDY AREA

This letter is to inform you that the U.S. Navy is preparing an EIS/OEIS for Navy training and testing activities in the HSTT study area. The study area combines the at-sea portions of the Hawaii Range Complex (HRC); the Southern California (SOCAL) Range Complex (including the San Diego Bay); the Silver Strand Training Complex (SSTC); areas where vessels transit between the HRC and the SOCAL Range Complex; and select Navy pierside location (see Enclosure 1). The Navy is requesting your comments on the scope, content and issues to be considered during the development of the HSTT EIS/OEIS.

The Navy's mission is to organize, train, equip and maintain combat-ready naval forces capable of winning wars, deterring aggression and maintaining freedom of the seas. This mission is mandated by federal law (Title 10 U.S. Code (U.S.C.) § 5062), which charges the Chief of Naval Operations (CNO) with the responsibility for ensuring the readiness of the nation's naval forces. The CNO meets that directive, in part, by establishing and executing training programs and ensuring naval forces have access to the ranges, operating areas and airspace needed to develop and maintain skills for the conduct of operations.

The Navy proposes to conduct military readiness training activities and research, development, testing and evaluation (RDT&E) activities (hereinafter referred to as "training and testing") in areas currently used by the Navy in the HSTT study area. To both achieve and maintain Fleet readiness, the Navy proposes to:

- Adjust baseline training and testing activities from current levels to match levels required to support Navy training and testing requirements beginning in 2014.
- Accommodate evolving mission requirements associated with force structure changes, including those resulting from the development, testing and ultimate introduction of new platforms (vessels, aircraft and weapons systems) into the Fleet.

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) FOR NAVY MILITARY READINESS ACTIVITIES IN THE HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING (HSTT) STUDY AREA

The HSTT EIS/OEIS will address Navy activities that occur in the air, under the ocean surface and on the ocean surface for the following range complexes: HRC, SOCAL Range Complex, and SSTC. Land activities occurring at SOCAL installations and within the HRC have been analyzed in other EIS documents and will be incorporated by reference in this EIS/OEIS.

Environmental issues that will be addressed in the EIS/OEIS include, but are not limited to, the following resource areas: oceanography; air quality; airborne soundscape; biological resources, including threatened and endangered species; cultural resources; transportation; regional economy; recreation; and public health and safety. Your input in identifying specific issues and concerns that should be assessed, in these areas and any additional areas, is important to the process.

In compliance with the National Environmental Policy Act (NEPA) of 1969, the Navy is holding open house public scoping meetings to support an early and open process for determining the scope of issues to be addressed and for identifying significant issues related to the proposed action. Scoping meetings will inform the public of the Navy's proposed action and give community members an opportunity to make comments. Input from scoping meetings will be used to help identify potentially significant issues to be analyzed in the Draft EIS/OEIS.

Six public open house scoping meetings will be held in SOCAL and Hawaii. Members of the public can arrive anytime during the scoping meetings. Representatives from the Navy will be available to provide information and answer questions about the proposed action. There will be no formal presentation. The public scoping meeting schedule is as follows:

Wednesday, August 4, 2010
3:30 to 7:30 p.m.
Point Loma/Hervey Branch Library
Community Room
3701 Voltaire St.
San Diego, Calif.

Thursday, August 5, 2010
4:00 to 8:00 p.m.
Lakewood High School
Room 922/924
4400 Briercrest Ave.
Lakewood, Calif.

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SUBJECT: ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) FOR NAVY MILITARY READINESS ACTIVITIES IN THE HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING (HSTT) STUDY AREA

Tuesday, August 24, 2010
4:00 to 8:00 p.m.
Kauai Community College
Cafeteria
3-1901 Kaumualii Highway
Lihue, Hawaii

Wednesday, August 25, 2010
4:00 to 8:00 p.m.
Keehi Lagoon - Disabled American Veterans Hall
Weinberg Hall
2685 North Nimitz Highway
Honolulu, Hawaii

Thursday, August 26, 2010
4:00 to 8:00 p.m.
Hilo High School
Cafeteria
556 Waianuenue Ave.
Hilo, Hawaii

Friday, August 27, 2010
4:00 to 8:00 p.m.
Maui Waena Intermediate School
Cafeteria
795 Onehee Ave.
Kahului, Hawaii

Regardless of whether you are able to participate in the public scoping meetings, you may send written comments to the following address:

Naval Facilities Engineering Command, Southwest
ATTN: Mr. Kent Randall - HSTT EIS/OEIS
1220 Pacific Hwy. Bldg. 1, Floor 5
San Diego, CA 92132

You may also submit comments online at www.HSTTEIS.com. All comments must be postmarked or received by September 14, 2010, to be considered in the Draft EIS/OEIS.

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SUBJECT: ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) FOR NAVY MILITARY READINESS ACTIVITIES IN THE HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING (HSTT) STUDY AREA

For more information about the HSTT EIS/OEIS, please visit the project website. If you would like additional information or to receive a project briefing, please contact Kent Randall at (619)532-3331.

Sincerely,

D. A. MCNAIR
Captain, U. S. Navy
Deputy Fleet Civil Engineer

Enclosure: 1. U.S. Navy Hawaii-Southern California Training and Testing EIS/OEIS Study Area

Distribution:

Federal

U.S. Senators (Hawaii, California)
U.S. Representatives (California Districts 35, 36, 37, 44, 46, 48, 49, 50, 52, 54, 55 and Hawaii Districts 1 and 2)
Federal Aviation Administration
- Washington D.C. headquarters
- Western Pacific Region

U.S. Army Corps of Engineers
- Pacific Ocean Division
  - Honolulu District
- South Pacific Division
  - Los Angeles District

U.S. Department of Commerce
- National Oceanic and Atmospheric Administration
  - National Marine Fisheries Service
    - Washington, D.C. Headquarters
    - Southwest Regional Offices
    - Southwest Fisheries Science Center
    - Pacific Islands Regional Office
    - Pacific Islands Fisheries Science Center
    - Office of Habitat Conservation
      - Southwest and Pacific Islands Region
    - Office of Protected Resources
      - Headquarters and Pacific Islands Region
  - Channel Islands National Marine Sanctuary
  - Hawaiian Islands Humpback Whale National Marine Sanctuary
  - Papahanaumokuakea Marine National Monument

U.S. Coast Guard
- District 11
- District 14
- Office of Operating and Environmental Standards

U.S. Department of the Interior

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) FOR NAVY MILITARY READINESS ACTIVITIES IN THE HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING (HSTT) STUDY AREA

Bureau of Indian Affairs
Pacific Regional Office
Southern California Agency
Bureau of Land Management
California Coastal National Monument
Bureau of Ocean Energy Management, Regulation and Enforcement
National Offshore Office
Pacific OCS Region
Western Fisheries Research Center
National Park Service
Pacific West Region
Channel Islands National Park
Office of Environmental Policy and Compliance
Oakland Region
U.S. Environmental Protection Agency
Washington, D.C. Headquarters
Region 9
NEPA Compliance Division
U.S. Fish and Wildlife Service
Carlsbad Office
Ventura Office
Pacific Regional Office
Pacific Southwest Regional Office
San Diego Bay National Wildlife Refuge
San Diego National Wildlife Refuge
Hanalei National Wildlife Refuge
Kilauea Point National Wildlife Refuge
Huleia National Wildlife Refuge
James Campbell National Wildlife Refuge
Pearl Harbor National Wildlife Refuge
Kealia Pond National Wildlife Refuge
Marine Mammal Commission
U.S. Geological Survey
Western Region Offices
California Water Science Center
Hawaii Water Science Center

State of California

Office of the Governor
Office of Planning and Research, Military Affairs
State Senators (Districts 27, 33, 35, 38, 39)
State Assemblymembers (Districts 54, 55, 74, 75, 76, 77, 78, 79)
California Coastal Commission
Office of Historic Preservation
Department of Conservation
Department of Environmental Protection
Division of Air Quality
Division of Environmental Health
Division of Information and Administrative Services
Division of Water
Department of Fish and Game

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SUBJECT: ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) FOR NAVY MILITARY READINESS ACTIVITIES IN THE HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING (HSTT) STUDY AREA

Region 5, Marine Region
Division of Wildlife Conservation
Marine Life Protection Act Blue Ribbon Task Force
Department of Military & Veterans Affairs
Department of Conservation
Division of Land Resource Protection
Department of Transportation & Public Facilities
Division of Airports
Division of Ports & Harbors
Department of Health Services
Department of Parks and Recreation
Department of Toxic Substance Control, Region 4
State Water Resources Control Board
Los Angeles Regional Water Quality Control Board
San Diego Regional Water Quality Control Board
Santa Ana Regional Water Quality Control Board
Natural Resources Agency
State Lands Commission
Wildlife Conservation Board

State of Hawaii

Office of the Governor
State Senators
State Representatives
Department of Hawaiian Home Lands
Department of Health
Department of Land and Natural Resources
Division of State Parks
Division of Aquatic Resources
Division of Conservation and Resource Enforcement
Historic Preservation Division
Division of Forestry and Wildlife
Office of Conservation and Coastal Lands
Department of Transportation
Airports Division
Harbors Division
Department of Business, Economic Development & Tourism
State Land Use Commission
Hawaii Coastal Zone Management Program
Island Burial Councils
Office of Hawaiian Affairs

Local - California

City of Avalon
City of Coronado
City of Dana Point
City of Huntington Beach
City of Imperial Beach
City of Laguna Beach
City of Long Beach

6

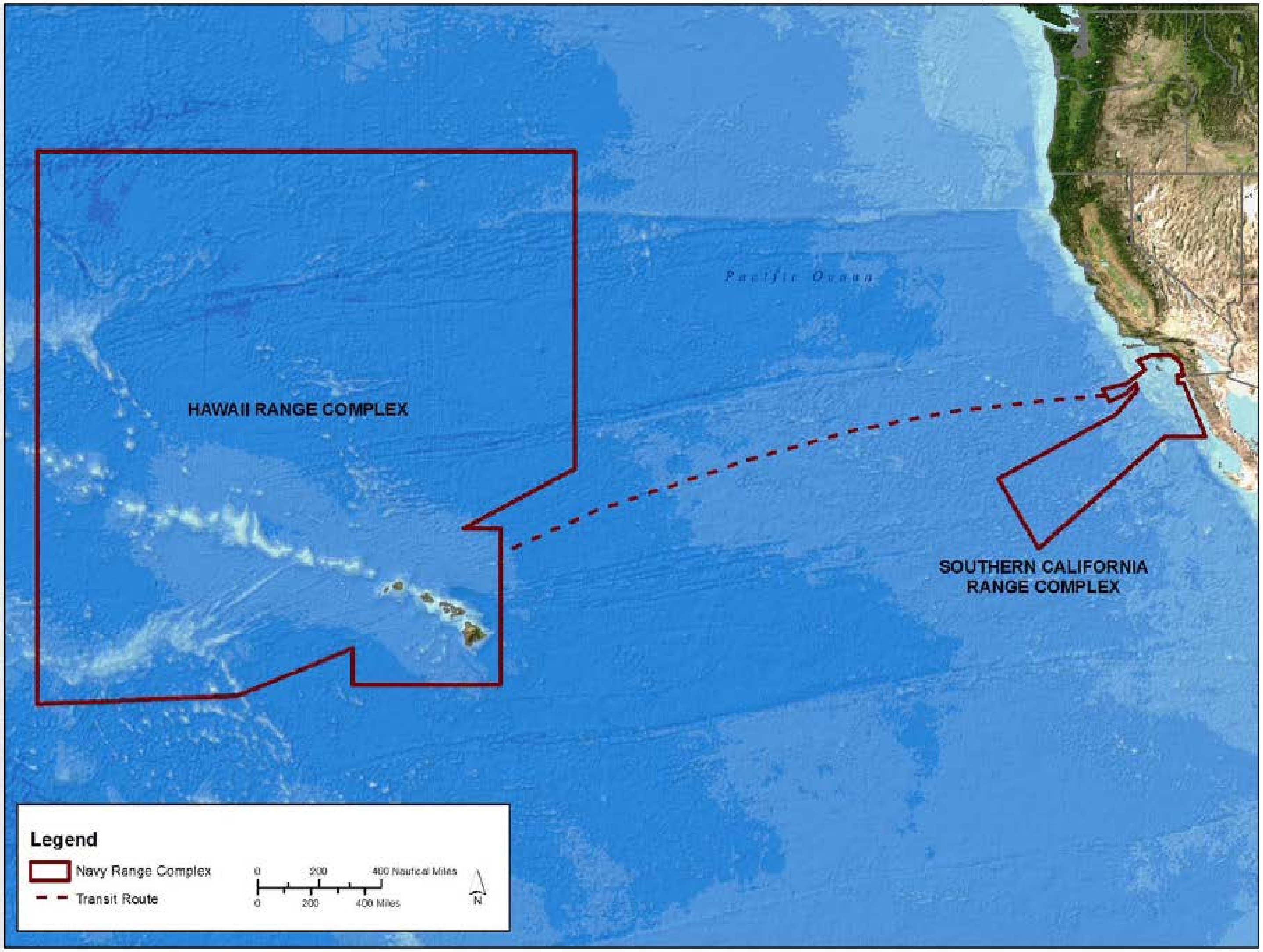
SUBJECT: ENVIRONMENTAL IMPACT STATEMENT/OVERSEAS ENVIRONMENTAL IMPACT STATEMENT (EIS/OEIS) FOR NAVY MILITARY READINESS ACTIVITIES IN THE HAWAII-SOUTHERN CALIFORNIA TRAINING AND TESTING (HSTT) STUDY AREA

City of Los Angeles
City of Malibu
City of Newport Beach
City of Oceanside
City of San Diego
County of Los Angeles
County of Orange
County of San Diego
Port of Long Beach
Port of Los Angeles
San Diego Unified Port District

Local - Hawaii

City of Honolulu
County of Honolulu
County of Maui
County of Kauai
Hawaii County

Enclosure 1: U.S. Navy Hawaii-Southern California Training and Testing EIS/OEIS Study Area



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APPENDIX D

AIR QUALITY EXAMPLE EMISSIONS CALCULATIONS AND EXAMPLE RECORD OF NON-APPLICABILITY

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TABLE OF CONTENTS

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D AIR QUALITY SUMMARIES

This appendix discusses emission factor development, calculations, and assumptions used in the air quality analyses presented in the Air Quality section of Chapter 3 (see Section 3.2).

D.1 SURFACE OPERATIONS EMISSIONS

Surface operations are activities associated with vessel movements. Fleet training activities use a variety of marine vessels, including cruisers, destroyers, frigates, carriers, submarines, amphibious vessels, and small boats. Testing activities use a variety of marine vessels, including various testing support vessels, work boats, torpedo recovery vessels, unmanned surface vehicles, and small boats. These vessels use a variety of propulsion methods, including marine outboard engines, diesel engines, and gas turbines.

Marine Outboard Engines:

USEPA has published emissions factors for air pollutants produced by several types of two-stroke and four-stroke outboard engines. The most conservative emission factors for two-stroke engines of various horsepower are presented in Table D.1-1.

Table D.1-1: Emission Factors for Two Stroke Engines

USEPA Outboard Engine Emissions Factors (grams/hp-hr)			
NO_x	CO	VOC	SO_x
0.018	0.63	0.25	0.00108

Notes: USEPA - United States Environmental Protection Agency; hp - horsepower; hr - hour; NO_x - nitrogen oxides; CO - carbon monoxide; VOC = volatile organic compounds; SO_x = sulfur oxides

Source: USEPA, 1999, Exhaust Emissions Factors for Non-Road Engine Modeling-Spark Ignition. Report No. NR-010b; Office of Mobile Sources, Assessment and Modeling Division, EPA-R-99-009.

Emissions for surface craft using outboard engines were calculated using USEPA AP-42 factors, and multiplied by the engine horsepower and hours of operation.

$$Emissions = HP \times HR/YR \times EF \times ENG$$

Where:

Emissions = surface craft emissions
HP = horsepower (reflective of a particular load factor/engine power setting)
HR/YR = hours per year
EF = emission factor for specific engine type
ENG = number of engines

To obtain the total criteria pollutant emissions for the Proposed Action, emissions were calculated for each training or testing activity, type of surface vessel, and criteria pollutant. These individual estimates of emissions, in units of tons per year, were then summed by criteria pollutant to obtain the aggregate emissions for surface vessel emissions activities.

Diesel Engines:

Limited data were available for large marine diesel engines. Therefore, USEPA AP-42 emissions factors for industrial reciprocating engines were used to calculate diesel engine emissions. Other sources of vessel emissions factors were previous Navy EIS/OEIS documents (citing JJMA 2001). Diesel was assumed to be the primary fuel to ensure a conservative estimate. Calculation methods similar to those described for Marine Outboard Engines were used to obtain emissions estimates for diesel engines.

$$Emissions = HP \times HR/YR \times EF \times ENG$$

Where:

Emissions = surface craft emissions
HP = horsepower (reflective of a particular load factor/engine power setting)
HR/YR = hours per year
EF = emission factor for specific engine type
ENG = number of engines

Diesel engine emission factors were multiplied by the engine horsepower and annual hours of operation to calculate the pollutant emissions per year.

D.2 AIR OPERATIONS EMISSIONS

Fleet training and Naval Air Systems Command testing consists of the activities of various aircraft, including the F/A-18, P-3, SH-60B, MH-53, MH-60S, and Lear jet. RDT&E air operations consist of the activities of various aircraft, including the 1UH-1N, SH-60B, MH-53, MH-60S, and Cessna-172. Aircraft operations of concern are those that occur from ground level up to 3,000 feet (ft) (914 meters [m]) above ground level (AGL). The 3,000 ft. (914 m) AGL ceiling was assumed to be the atmospheric mixing height above which any pollutant generated would not contribute to increased pollutant concentrations at ground level (known as the mixing zone). All pollutant emissions from aircraft generated above 3,000 ft. (914 m) AGL are excluded from analysis of compliance with National Ambient Air Quality Standards. The pollutant emission rate is a function of the aircraft engine's fuel flow rate and efficiency. Emissions for one complete training activity for a particular aircraft are calculated by knowing the specific engine pollutant emission factors for each mode of operation.

For this EIS/OEIS, emission factors for most military engines were obtained from Navy's Aircraft Environmental Support Office (AESO) memoranda and previous Navy EIS/OEIS documentation (primarily citing the Federal Aviation Administration's EDMS model). For those aircraft for which engine data were unavailable, an applicable surrogate was used. Table D-2 is an example of emission factors for the aircraft engines. The table lists the various engine power modes, time in each mode, fuel flow, and corresponding pollutant emission factors. Using these data, as well as information on activity levels (i.e., number of sorties), pollutant emissions for each aircraft/organization were calculated by applying the equation below.

$$Emissions = TIM \times FF \times EF \times ENG \times CF$$

Where:

Emissions = aircraft emissions (lb) (for EF in lb/1,000 gal fuel)
TIM = time-in-mode at a specified power setting (hr/operation).
FF = fuel flow at a specified power setting (gal/hr/engine)
EF = emission factor for specific engine type and power setting (lb/1,000 gallons of fuel used)
ENG = number of engines on aircraft
CF = conversion factor (0.001)

D.3 Ordnance and Munitions Emissions

Available emissions factors (AP-42, *Compilation of Air Pollutant Emission Factors*) were used. These factors were then multiplied by the net weight of the explosive and the number of items that were used per year. This calculation provides estimates of annual emissions.

$$Emissions = EXP/YR \times EF \times Net\ Wt$$

Where:

Emissions = ordnance emissions
EXP/YR = explosives, propellants, and pyrotechnics used per year
EF = emissions factor
Net Wt = net weight of explosive

D.4 Emissions Estimates Spreadsheets

The following spreadsheets are examples of the emissions calculations for aircraft, vessels, and munitions. The examples provided for aircraft are for baseline training within the SOCAL Range Complex. These examples are representative of calculation spreadsheets developed for each range complex or testing area. They are also representative of calculation spreadsheets developed for testing events. Moreover, they are representative of the calculations developed for each alternative analyzed in this EIS/OEIS. The example ordnance emissions calculation is for baseline ordnance emissions. The full set of calculation spreadsheets is available on the HSTT EIS project website.

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Table D.4-1: Sample Air Emissions Calculations Table (Training Ops Information – Sample only)

Training - Aircraft Air Emissions—No-Action Alternative																		
			TRAINING OPS INFORMATION - AIRCRAFT													Training Platform Information		
				Aircraft		Time		Altitude		Distribution (%)			Distribution (hr)					
Training or Testing Event	Location	Annual Operations (#)	Distribution	A/C Sorties (#)	Type	Ave Time on Range (hr)	Total Time on Range (hr)	Time < 3,000 ft (%)	Time < 3,000 ft (hr)	0-3 nm from shore	3-12 nm from Shore	>12 nm from Shore	Total Time 0-3 nm from shore	Total Time 3-12 nm from shore	Total Time >12 nm from shore	Engine Model	Engines (#)	Fuel Flow (lb/hr)
Anti-Air Warfare																		
Air Combat Maneuver	SOCAL	0	1.75	4060	FA-18E/F	1.0	4060.0	0%	0.0	4%	11%	85%	0.00	0.00	0.00	F414-GE-40	2	4049
	Hawaii	2320	0.25	580	AV-8B	1.0	580.0	0%	0.0	4%	11%	85%	0.00	0.00	0.00	F402-RR-40	1	5785
	Transit	385																
	Total	2705																
Air Defense Exercise	SOCAL	0	0.14	83	E-2	1.0	83.3	50%	41.7	0%	0%	100%	0.00	0.00	41.65	T56-A-425 (	2	1100
	Hawaii	595	0.86	512	FA-18E/F	1.0	511.7	50%	255.9	0%	0%	100%	0.00	0.00	255.85	F414-GE-40	2	4049
	Transit	21																
	Total	616																
Gunnery Exercise, Air-to-Air (Medium Caliber)	SOCAL	0	1.75	53	FA-18E/F	1.0	52.5	0%	0.0	4%	11%	85%	0.00	0.00	0.00	F414-GE-40	2	4049
	Hawaii	30	0.25	8	AV-8B	1.0	7.5	0%	0.0	4%	11%	85%	0.00	0.00	0.00	F402-RR-40	1	5785
	Transit	10																
	Total	40																
Missile Exercise, Air-to-Air	SOCAL	0	0.33	53	FA-18A/C	2.0	105.6	0%	0.0	0%	0%	100%	0.00	0.00	0.00	F404-GE-40	2	3318
	Hawaii	160	0.5	80	FA-18E/F	2.0	160.0	0%	0.0	0%	0%	100%	0.00	0.00	0.00	F414-GE-40	2	4049
	Transit	20	0.09	14	E-2C	4.0	57.6	0%	0.0	0%	0%	100%	0.00	0.00	0.00	T56-A-425 (	2	1100
	Total	180																
Gunnery Exercise, Surface-to-Air (Large	SOCAL	0	0.58	10	Learjet	3.0	31.3	50%	15.7	0%	0%	100%	0.00	0.00	15.66	TFE 731-2-2	2	532
	Hawaii	18																
	Transit	0																
	Total	18																
Missile Exercise, Surface-to-Air	SOCAL	0	0.33	8	SH-60B	3.0	23.8	100%	23.8	0%	0%	100%	0.00	0.00	23.76	T700-GE-40	2	600
	Hawaii	24	0.33	8	P-3	3.0	23.8	67%	15.8	0%	0%	100%	0.00	0.00	15.85	T56-A-14 (a	4	1500
	Transit	8	0.33	8	Learjet	3.0	23.8	67%	15.8	0%	0%	100%	0.00	0.00	15.85	TFE 731-2-2	2	531.76
	Total	32																

Table D.4-2: Sample Air Emissions Calculations Table (Emissions Factors – Sample only)

Training - Aircraft Air Emissions—No-Action Alternative												
			EMISSIONS FACTORS									
Training or Testing	Location	Annual Operations	Emission Indices, lb/1,000 lb fuel					Emissions Factors (lb/hr)				
			CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM
Anti-Air Warfare												
Air Combat Maneuver	SOCAL	0	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
	Hawaii	2320	7.70	8.60	0.54	0.40	3.80	44.54	49.75	3.12	2.31	21.98
	Transit	385										
	Total	2705										
Air Defense Exercise	SOCAL	0	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
	Hawaii	595	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
	Transit	21										
	Total	616										
Gunnery Exercise, Air-to-Air (Medium Caliber)	SOCAL	0	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
	Hawaii	30	7.70	8.60	0.54	0.40	3.80	44.54	49.75	3.12	2.31	21.98
	Transit	10										
	Total	40										
Missile Exercise, Air-to-Air	SOCAL	0	2.44	6.74	0.44	0.40	6.36	16.19	44.73	2.92	2.65	42.20
	Hawaii	160	0.89	11.58	0.12	0.40	6.31	7.21	93.77	0.97	3.24	51.10
	Transit	20	2.16	8.06	0.49	0.40	3.97	4.75	17.73	1.08	0.88	8.73
	Total	180										
Gunnery Exercise, Surface-to-Air (Large	SOCAL	0	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
	Hawaii	18										
	Transit	0										
	Total	18										
Missile Exercise, Surface-to-Air	SOCAL	0	6.25	6.40	0.55	0.40	4.20	7.50	7.68	0.66	0.48	5.04
	Hawaii	24	1.82	8.43	0.41	0.40	3.97	10.92	50.58	2.46	2.40	23.82
	Transit	8	22.38	5.90	4.28	0.54	4.20	23.80	6.27	4.55	0.57	4.47
	Total	32										

Table D.4-3: Sample Air Emissions Calculations Table (Emissions – Sample only)

Training - Aircraft Air Emissions—No-Action Alternative																							
			EMISSIONS (lb/yr)																				
Training or Testing	Location	Annual Operations	State (0-3 nm)					U.S. (3-12 nm)					International (>12 nm)					Annual Fuel Use		GHG Emissions (lb)			
			CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	CO	NOx	VOC	SOx	PM	Pounds	Gallons	CO_2	N_2O	CH_4	CO_{2-e}
Anti-Air Warfare																							
Air Combat Maneuver	SOCAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16,438,940	2,417,491	50,897,859	1,651	1,438	51,439,921
	Hawaii	2320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,355,300	493,426	10,388,601	337	294	10,499,239
	Transit	385																					
	Total	2705	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,794,240	2,910,918	61,286,460	1,988	1,732	61,939,161
Air Defense Exercise	SOCAL	0	0	0	0	0	0	0	0	0	0	0	198	739	45	37	364	91,630	13,475	283,703	9	8	286,724
	Hawaii	595	0	0	0	0	0	0	0	0	0	0	1844	23992	249	829	13074	2,071,873	304,687	6,414,885	208	181	6,483,204
	Transit	21																					
	Total	616	0	0	0	0	0	0	0	0	0	0	2,042	24,731	294	865	13,437	2,163,503	318,162	6,698,588	217	189	6,769,928
Gunnery Exercise, Air-to-Air (Medium Caliber)	SOCAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	212,573	31,261	658,162	21	19	665,171
	Hawaii	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43,388	6,381	134,335	4	4	135,766
	Transit	10																					
	Total	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	255,960	37,641	792,497	26	22	800,937
Missile Exercise, Air-to-Air	SOCAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	350,381	51,527	1,084,841	35	31	1,096,394
	Hawaii	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	647,840	95,271	2,005,827	65	57	2,027,189
	Transit	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	63,360	9,318	196,174	6	6	198,263
	Total	180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,061,581	156,115	3,286,841	107	93	3,321,846
Gunnery Exercise, Surface-to-Air (Large	SOCAL	0	0	0	0	0	0	0	0	0	0	0	373	98	71	9	70	16,655	2,449	51,566	2	1	52,115
	Hawaii	18																					
	Transit	0																					
	Total	18	0	0	0	0	0	0	0	0	0	0	373	98	71	9	70	16,655	2,449	51,566	2	1	52,115
Missile Exercise, Surface-to-Air	SOCAL	0	0	0	0	0	0	0	0	0	0	0	178	182	16	11	120	14256	2096	44139	1	1	44,609
	Hawaii	24	0	0	0	0	0	0	0	0	0	0	173	802	39	38	377	35640	5241	110348	4	3	111,523
	Transit	8	0	0	0	0	0	0	0	0	0	0	377	99	72	9	71	12635	1858	39119	1	1	39,536
	Total	32	0	0	0	0	0	0	0	0	0	0	728	1,084	127	59	568	62,531	9,196	193,606	6	5	195,668

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D.5 DRAFT RECORD OF NON-APPLICABILITY

This appendix provides a Record of Non-Applicability (RONA) Memorandum (Figure D.5-1) and draft Records of Non-Applicability and Conformity Analyses (Figures D.5-2 through D.5-5) for each California Air Basin potentially impacted by the Proposed Action (South Coast Air Basin and San Diego Air Basin).

MEMORANDUM FOR THE RECORD

From: __________

Subj: Applicability Analyses for Hawaii-Southern California Training and Testing (HSTT) Environmental Impact Statement/Overseas Environmental Impact Statement – Operations in State of California Waters

Ref: (a) 40 C.F.R., 51.853(b)

Encl: (1) Record of Non-Applicability (RONA) for Hawaii-Southern Training and Testing in State of California Waters, South Coast Air Basin; and

(2) Record of Non-Applicability (RONA) for Hawaii-Southern Training and Testing in State of California Waters, San Diego Air Basin.

1. Enclosure (1) is a RONA for those Pacific Fleet training and testing activities that are expected to occur annually in State of California waters in South Coast Air Basin (SCAB). The Preferred Alternative (Alternative 2) emissions of carbon monoxide (CO), nitrogen oxides (NO_x), volatile organic compounds (VOC), and particulates under 10 microns (PM_{10}) and under 2.5 microns ($PM_{2.5}$), in SCAB are provided in Enclosure 1. A comparison of the relevant criteria air pollutant emissions of the Proposed Action with Reference (a) shows that the anticipated emissions are *de minimis*.

2. Enclosure (2) is a RONA for those Pacific Fleet training and testing activities that are expected to occur annually in State of California waters in San Diego Air Basin (SDAB). The Preferred Alternative (Alternative 2) emissions of CO, NO_x, and VOC in SDAB are provided in Enclosure 2. A comparison of the relevant criteria air pollutant emissions of the Proposed Action with Reference (a) shows that the anticipated emissions are *de minimis*.

2. If there are any questions or if additional information is needed, please call ________ at ______.

____

Name

Title

Figure D.5-1: Record of Non-Applicability Memorandum

NAVY RECORD OF NON-APPLICABILITY FOR CLEAN AIR ACT CONFORMITY

The Proposed Action falls under the Record of Non-Applicability (RONA) category, and is documented with this RONA.

Action Proponents: United States Pacific Fleet

Naval Sea Systems Command

Naval Air Systems Command

Proposed Action: Hawaii-Southern California Training and Testing (HSTT)

Proposed Action Location: Southern California Range Complex, CA

Proposed Action and Emissions Summary:

See attached Conformity Analysis

Affected Air Basin: South Coast Air Basin

Date RONA prepared: ______________________________________

RONA prepared by: Naval Facilities Engineering Command, Southwest

Attainment Area Status and Emissions Evaluation Conclusion:

To the best of my knowledge and belief, the information contained within this General Conformity Applicability Analysis is correct and accurate. By signing this statement, I am in agreement with the finding that the total of all reasonably foreseeable direct and indirect emissions that will result from this action is below the *de minimis* threshold set forth in 40 C.F.R. 51.853(b). Accordingly, it is my determination that this action conforms to the applicable State Implementation Plan (SIP).

RONA Approval:

Signature: ____________________________________

Name/Rank: ___________________________ Date: _________________

Position: ____________Commanding Officer: __________________ Activity: __________________

Enclosure 1

Figure D.5-2: Record of Non-Applicability Form, South Coast Air Basin

Subject: Conformity Analysis for Navy Training and Testing, South Coast Air Basin

INTRODUCTION

The Proposed Action falls under the Record of Non-Applicability (RONA) category pursuant to 40 Code of Federal Regulations (CFR) Parts 52 and 93, and the basis for exemption from conformity requirements is documented with this RONA.

The United States (U.S.) Environmental Protection Agency (USEPA) published *Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule*, in the Federal Register (40 CFR Parts 6, 51, and 93) on November 30, 1993. The U.S. Navy published *Clean Air Act General Conformity Guidance* in Chief of Naval Operations Instruction (OPNAVINST) 5090.1C CH-1 (18 July 2011). These publications provide guidance to document Clean Air Act Conformity requirements. Federal regulations state that no department, agency, or instrumentality of the federal government shall engage in, support in any way, or provide financial assistance for, license or permit, or approve any activity that does not conform to an applicable implementation plan. The federal agency that is the action proponent is responsible for determining whether a federal action conforms to the applicable implementation plan before the Proposed Action is taken (40 CFR Part 1, Section 51.850[a]).

Federal actions may be exempt from conformity determinations if they do not exceed designated *de minimis* levels for criteria pollutants as set forth in 40 CFR § 93.153(c) (Table 1). These standards are reflected in Appendix F of OPNAVINST 5090.1C CH-1.

Table 1: *De Minimis* Thresholds for Conformity Determinations

Pollutant	Nonattainment or Maintenance Area Type	*De Minimis* Threshold (TPY)
Ozone (VOC or NO_x)	Serious nonattainment	50
	Severe nonattainment	25
	Extreme nonattainment	10
	Other areas outside an ozone transport region	100
Ozone (NO_x)	Marginal and moderate nonattainment inside an ozone transport region	100
	Maintenance	100
Ozone (VOC)	Marginal and moderate nonattainment inside an ozone transport region	50
	Maintenance within an ozone transport region	50
	Maintenance outside an ozone transport region	100
CO, SO_2 and NO_2	All nonattainment & maintenance	100
PM_{10}	Serious nonattainment	70
	Moderate nonattainment and maintenance	100
$PM_{2.5}$	All nonattainment & maintenance	100
Lead (Pb)	All nonattainment & maintenance	25

Notes: NO_X = nitrogen oxides; Pb = lead; PM_{10} = particulate matter under 10 microns; SO_x = sulfur oxides; TPY = tons per year; VOC = volatile organic compounds

Figure D.5-3: Conformity Analysis, South Coast Air Basin

PROPOSED ACTION

Proposed Action Summary

The Proposed Action consists of increases in training and testing activities on the at-sea portions of the Southern California (SOCAL) Range Complex required to address a training shortfall, and to accommodate expected force-structure changes and range enhancements. The assessment of air quality impacts includes all military training activities in the SOCAL Range Complex involving vessels, aircraft, and weapons systems in State of California waters.

Proposed Action Emissions

Aircraft

To estimate aircraft emissions, the operating modes (e.g., “cruise” mode), number of hours of operation, and types of engine for each type of aircraft were evaluated. All aircraft are assumed to travel to and from training ranges at or above 3,000 ft. (914 m) above ground level and, therefore, their transits to and from the ranges do not affect surface air quality. Air combat maneuvers and air-to-air missile exercises are primarily conducted at altitudes well in excess of 3,000 ft. (914 m) above ground level and, therefore, are not included in the estimated emissions of criteria air pollutants. Activities or portions of those training or testing activities occurring below 3,000 ft. (914 m) are included in emissions estimates. Examples of activities typically occurring below 3,000 ft. (914 m) include those involving helicopter platforms such as mine warfare, anti-surface warfare, and anti-submarine warfare training and testing activities.

The types of aircraft used and the numbers of flights flown under the No Action Alternative are derived from historical data. The types of aircraft identified include the typical aircraft platforms that conduct a particular training or testing exercise (or the closest surrogate when information is not available), including range support aircraft (e.g., non-Navy commercial air services). For the Preferred Alternative, estimates of future aircraft sorties are based on evolutionary changes in the Navy’s force structure and mission assignments. Where there are no major changes in types of aircraft, future activity levels are estimated from the distribution of baseline activities.

Time on range (activity duration) under the No Action Alternative was calculated from average times derived from range records and Navy subject matter experts. To estimate time on range for each aircraft activity under the Preferred Alternative, the average flight duration approximated in the baseline data was used in the calculations. Estimated altitudes of activities for all aircraft were obtained from aircrew members in operational squadrons. Several testing activities are similar to training activities, and therefore similar assumptions were made for such activities in terms of aircraft type, altitude, and flight duration. Where aircraft testing activities were dissimilar to training activities, assumptions for time on range were derived from Navy subject matter experts.

Air pollutant emissions were estimated based on the Navy’s Aircraft Environmental Support Office Memorandum Reports for individual aircraft categories (Aircraft Emission Estimates: Mission Operations). For aircraft for which Aircraft Environmental Support Office emission factors were not available, emission factors were obtained from other published sources.

Figure D.5-3: Conformity Analysis, South Coast Air Basin (continued)

The emissions calculations for each alternative conservatively assume that each aircraft activity is separately conducted. In practice, a testing activity may be conducted during a training flight. Two or more training activities also may be conducted during one flight (e.g., chaff or flare exercises may occur during electronic warfare operations; or air-to-surface gunnery and air-to-surface bombing activities may occur during a single flight operation). Using conservative assumptions may produce elevated aircraft emissions estimates, but accounts for the possibility (however remote) that each aircraft training and testing activity is separately conducted.

Vessels

The methods of estimating marine vessel emissions involve evaluating the type of activity, the number of hours of operation, the type of propulsion, and the type of onboard generator for each vessel type. The types of surface ships and numbers of activities for the No Action Alternative are derived from range records and Navy subject matter experts regarding vessel participant data. For the Preferred Alternative, estimates of future ship activities are based on anticipated evolutionary changes in the Navy's force structure and mission assignments. Where there are no major changes in types of ships, estimates of future activities are based on the historical distribution of ship use. Navy aircraft carriers and submarines are nuclear-powered, and have no air pollutant emissions associated with propulsion.

For surface ships, the durations of activities were estimated by taking an average over the total number of activities for each type of training and testing. Emissions for baseline activities and for future activities were estimated based on discussions with exercise participants. In addition, information provided by subject-matter experts was used to develop a breakdown of time spent at each operational mode (i.e., power level) used during activities in which marine vessels participated. Several testing activities are similar to training activities, and therefore similar assumptions were made for such activities in terms of vessel type, power level, and activity duration.

Emission factors for marine vessels were obtained from the database developed for Naval Sea Systems Command by John J. McMullen Associates, Inc. (John J. McMullen Associates 2001). Emission factors were provided for each marine vessel type and power level. The resulting calculations provided information on the time spent at each power level in each part of the Study Area, emission factors for that power level (in pounds of pollutant per hour), and total emissions for each marine vessel for each operational type and mode.

The pollutants for which calculations are made include exhaust total hydrocarbons, CO, NO_x, PM, CO_2, and SO_2. For non-road engines, all particulate matter emissions are assumed to be smaller than PM_{10}, and 92 percent of the particulate matter from gasoline and diesel-fueled engines is assumed to be smaller than $PM_{2.5}$. For gaseous-fueled engines (liquefied petroleum gas/compressed natural gas), 100 percent of the particulate matter emissions are assumed to be smaller than $PM_{2.5}$.

The emissions calculations for each alternative conservatively assume that each vessel activity is separately conducted and separately produces vessel emissions. In practice, one or more testing activities may take advantage of an opportunity to travel at sea aboard and test from a vessel conducting a related or unrelated training activity. It is also probable that two or more training activities may be conducted during one training vessel movement (e.g., a ship may conduct large-, medium-, and small-caliber surface-to-surface gunnery exercises during one vessel movement). Furthermore, multiple unit level training activities may be conducted during a larger composite training unit exercise. Using conservative assumptions may produce elevated vessel emissions estimates, but accounts for the possibility (however remote) that each training or testing activity is separately conducted.

Figure D.5-3: Conformity Analysis, South Coast Air Basin (continued)

Naval Gunfire, Missiles, Bombs, Other Munitions and Military Expended Material

Naval gunfire, missiles, bombs, and other types of munitions used in training and testing activities emit air pollutants. To estimate the amounts of air pollutants emitted by ordnance during their use, the numbers and types of munitions used during training or testing activities are first totaled. Then generally accepted emissions factors (AP-42, Compilation of Air Pollutant Emission Factors, Chapter 15: Ordnance Detonation ([USEPA 1995]) for criteria air pollutants are applied to the total amounts. Finally, the total amounts of air pollutants emitted by each munition type are summed to produce total amounts of each criteria air pollutant under each alternative.

The average annual operational emissions for the No Action Alternative and Preferred Alternative are presented in Table 2. Annual emissions are expected to increase from the No Action Alternative levels to the Preferred Alternative levels over several years. All annual Preferred Alternative emissions would be below General Conformity *de minimis* levels.

Table 2: Estimated Air Pollutant Emissions Under the Proposed Action

Parameter	Emissions by Air Pollutant (TPY)				
	CO	NO_X	VOC	PM_{10}	$PM_{2.5}$
No Action Alternative	229	540	285	42	39
Preferred Alternative	252	540	284	42	39
Net Change	**23**	**0**	**-1**	**0**	**0**
De Minimis Threshold	100	10	10	70	100
Exceeds Threshold?	No	No	No	No	No

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding. CO = carbon monoxide; NO_X = nitrogen oxides; PM_{10} = particulates under 10 microns; $PM_{2.5}$ = particulates under 2.5 microns; TPY = tons per year; VOC = volatile organic compounds

EMISSIONS EVALUATION CONCLUSION

The U.S. Navy concludes that the *de minimis* thresholds for applicable criteria pollutants would not be exceeded by implementation of the Proposed Action. The emissions data supporting that conclusion are shown in Table 2, which summarizes the calculated estimates and *de minimis* limits. Therefore, the U.S. Navy concludes that further formal Conformity Determination procedures are not required, resulting in this record of Non-Applicability.

Figure D.5-3: Conformity Analysis, South Coast Air Basin (continued)

NAVY RECORD OF NON-APPLICABILITY FOR CLEAN AIR ACT CONFORMITY

The Proposed Action falls under the Record of Non-Applicability (RONA) category, and is documented with this RONA.

Action Proponents: United States Pacific Fleet

Naval Sea Systems Command

Naval Air Systems Command

Proposed Action: Hawaii-Southern California Training and Testing (HSTT)

Proposed Action Location: Southern California Range Complex, CA

Proposed Action and Emissions Summary:

See attached Conformity Analysis

Affected Air Basin: San Diego Air Basin

Date RONA prepared: ____

RONA prepared by: Naval Facilities Engineering Command, Southwest

Attainment Area Status and Emissions Evaluation Conclusion:

To the best of my knowledge and belief, the information contained within this General Conformity Applicability Analysis is correct and accurate. By signing this statement, I am in agreement with the finding that the total of all reasonably foreseeable direct and indirect emissions that will result from this action is below the *de minimis* threshold set forth in 40 C.F.R. 51.853(b). Accordingly, it is my determination that this action conforms to the applicable State Implementation Plan (SIP).

RONA Approval:

Signature: ______________________________________

Name/Rank: ____________________________ Date: __________________

Position: _____________Commanding Officer: ___________________ Activity: ___________________

Enclosure 2

Figure D.5-4: Record of Non-Applicability Form, San Diego Air Basin

Subject: Conformity Analysis for Navy Training and Testing, San Diego Air Basin

INTRODUCTION

The Proposed Action falls under the Record of Non-Applicability (RONA) category pursuant to 40 Code of Federal Regulations (CFR) Parts 52 and 93, and the basis for exemption from conformity requirements is documented with this RONA.

The United States (U.S.) Environmental Protection Agency (USEPA) published *Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule*, in the Federal Register (40 CFR Parts 6, 51, and 93) on November 30, 1993. The U.S. Navy published *Clean Air Act General Conformity Guidance* in Chief of Naval Operations Instruction (OPNAVINST) 5090.1C CH-1 (18 July 2011). These publications provide guidance to document Clean Air Act Conformity requirements. Federal regulations state that no department, agency, or instrumentality of the federal government shall engage in, support in any way, or provide financial assistance for, license or permit, or approve any activity that does not conform to an applicable implementation plan. The federal agency that is the action proponent is responsible for determining whether a federal action conforms to the applicable implementation plan before the Proposed Action is taken (40 CFR Part 1, Section 51.850[a]).

Federal actions may be exempt from conformity determinations if they do not exceed designated *de minimis* levels for criteria pollutants as set forth in 40 CFR § 93.153(c) (Table 1). These standards are reflected in Appendix F of OPNAVINST 5090.1C CH-1.

Table 1: *De Minimis* Thresholds for Conformity Determinations

Pollutant	Nonattainment or Maintenance Area Type	*De Minimis* Threshold (TPY)
Ozone (VOC or NO_x)	Serious nonattainment	50
	Severe nonattainment	25
	Extreme nonattainment	10
	Other areas outside an ozone transport region	100
Ozone (NO_x)	Marginal and moderate nonattainment inside an ozone transport region	100
	Maintenance	100
Ozone (VOC)	Marginal and moderate nonattainment inside an ozone transport region	50
	Maintenance within an ozone transport region	50
	Maintenance outside an ozone transport region	100
CO, SO_2 and NO_2	All nonattainment & maintenance	100
PM_{10}	Serious nonattainment	70
	Moderate nonattainment and maintenance	100
$PM_{2.5}$	All nonattainment & maintenance	100
Lead (Pb)	All nonattainment & maintenance	25

Notes: NO_X = nitrogen oxides; Pb = lead; PM_{10} = particulate matter under 10 microns; SO_x = sulfur oxides; TPY = tons per year; VOC = volatile organic compounds

Figure D.5-5: Conformity Analysis, San Diego Air Basin

PROPOSED ACTION

Proposed Action Summary

The Proposed Action consists of increases in training and testing activities on the at-sea portions of the Southern California (SOCAL) Range Complex required to address a training shortfall, and to accommodate expected force-structure changes and range enhancements. The assessment of air quality impacts includes all military training activities in the SOCAL Range Complex involving vessels, aircraft, and weapons systems in State of California waters.

Proposed Action Emissions

Aircraft

To estimate aircraft emissions, the operating modes (e.g., “cruise” mode), number of hours of operation, and types of engine for each type of aircraft were evaluated. All aircraft are assumed to travel to and from training ranges at or above 3,000 ft. (914 m) above ground level and, therefore, their transits to and from the ranges do not affect surface air quality. Air combat maneuvers and air-to-air missile exercises are primarily conducted at altitudes well in excess of 3,000 ft. (914 m) above ground level and, therefore, are not included in the estimated emissions of criteria air pollutants. Activities or portions of those training or testing activities occurring below 3,000 ft. (914 m) are included in emissions estimates. Examples of activities typically occurring below 3,000 ft. (914 m) include those involving helicopter platforms such as mine warfare, anti-surface warfare, and anti-submarine warfare training and testing activities.

The types of aircraft used and the numbers of flights flown under the No Action Alternative are derived from historical data. The types of aircraft identified include the typical aircraft platforms that conduct a particular training or testing exercise (or the closest surrogate when information is not available), including range support aircraft (e.g., non-Navy commercial air services). For the Preferred Alternative, estimates of future aircraft sorties are based on evolutionary changes in the Navy’s force structure and mission assignments. Where there are no major changes in types of aircraft, future activity levels are estimated from the distribution of baseline activities.

Time on range (activity duration) under the No Action Alternative was calculated from average times derived from range records and Navy subject matter experts. To estimate time on range for each aircraft activity under the Preferred Alternative, the average flight duration approximated in the baseline data was used in the calculations. Estimated altitudes of activities for all aircraft were obtained from aircrew members in operational squadrons. Several testing activities are similar to training activities, and therefore similar assumptions were made for such activities in terms of aircraft type, altitude, and flight duration. Where aircraft testing activities were dissimilar to training activities, assumptions for time on range were derived from Navy subject matter experts.

Air pollutant emissions were estimated based on the Navy’s Aircraft Environmental Support Office Memorandum Reports for individual aircraft categories (Aircraft Emission Estimates: Mission Operations). For aircraft for which Aircraft Environmental Support Office emission factors were not available, emission factors were obtained from other published sources.

Figure D.5-5: Conformity Analysis, San Diego Air Basin (continued)

The emissions calculations for each alternative conservatively assume that each aircraft activity is separately conducted. In practice, a testing activity may be conducted during a training flight. Two or more training activities also may be conducted during one flight (e.g., chaff or flare exercises may occur during electronic warfare operations; or air-to-surface gunnery and air-to-surface bombing activities may occur during a single flight operation). Using conservative assumptions may produce elevated aircraft emissions estimates, but accounts for the possibility (however remote) that each aircraft training and testing activity is separately conducted.

Vessels

The methods of estimating marine vessel emissions involve evaluating the type of activity, the number of hours of operation, the type of propulsion, and the type of onboard generator for each vessel type. The types of surface ships and numbers of activities for the No Action Alternative are derived from range records and Navy subject matter experts regarding vessel participant data. For the Preferred Alternative, estimates of future ship activities are based on anticipated evolutionary changes in the Navy's force structure and mission assignments. Where there are no major changes in types of ships, estimates of future activities are based on the historical distribution of ship use. Navy aircraft carriers and submarines are nuclear-powered, and have no air pollutant emissions associated with propulsion.

For surface ships, the durations of activities were estimated by taking an average over the total number of activities for each type of training and testing. Emissions for baseline activities and for future activities were estimated based on discussions with exercise participants. In addition, information provided by subject-matter experts was used to develop a breakdown of time spent at each operational mode (i.e., power level) used during activities in which marine vessels participated. Several testing activities are similar to training activities, and therefore similar assumptions were made for such activities in terms of vessel type, power level, and activity duration.

Emission factors for marine vessels were obtained from the database developed for Naval Sea Systems Command by John J. McMullen Associates, Inc. (John J. McMullen Associates 2001). Emission factors were provided for each marine vessel type and power level. The resulting calculations provided information on the time spent at each power level in each part of the Study Area, emission factors for that power level (in pounds of pollutant per hour), and total emissions for each marine vessel for each operational type and mode.

The pollutants for which calculations are made include exhaust total hydrocarbons, CO, NO_x, PM, CO_2, and SO_2. For non-road engines, all particulate matter emissions are assumed to be smaller than PM_{10}, and 92 percent of the particulate matter from gasoline and diesel-fueled engines is assumed to be smaller than $PM_{2.5}$. For gaseous-fueled engines (liquefied petroleum gas/compressed natural gas), 100 percent of the particulate matter emissions are assumed to be smaller than $PM_{2.5}$.

The emissions calculations for each alternative conservatively assume that each vessel activity is separately conducted and separately produces vessel emissions. In practice, one or more testing activities may take advantage of an opportunity to travel at sea aboard and test from a vessel conducting a related or unrelated training activity. It is also probable that two or more training activities may be conducted during one training vessel movement (e.g., a ship may conduct large-, medium-, and small-caliber surface-to-surface gunnery exercises during one vessel movement). Furthermore, multiple unit level training activities may be conducted during a larger composite training unit exercise. Using conservative assumptions may produce elevated vessel emissions estimates, but accounts for the possibility (however remote) that each training or testing activity is separately conducted.

Figure D.5-5: Conformity Analysis, San Diego Air Basin (continued)

Naval Gunfire, Missiles, Bombs, Other Munitions and Military Expended Material

Naval gunfire, missiles, bombs, and other types of munitions used in training and testing activities emit air pollutants. To estimate the amounts of air pollutants emitted by ordnance during their use, the numbers and types of munitions used during training or testing activities are first totaled. Then generally accepted emissions factors (AP-42, Compilation of Air Pollutant Emission Factors, Chapter 15: Ordnance Detonation ([USEPA 1995]) for criteria air pollutants are applied to the total amounts. Finally, the total amounts of air pollutants emitted by each munition type are summed to produce total amounts of each criteria air pollutant under each alternative.

The average annual operational emissions for the No Action Alternative and Preferred Alternative are presented in Table 2. Annual emissions are expected to increase from the No Action Alternative levels to the Preferred Alternative levels over several years. All annual Preferred Alternative emissions would be below General Conformity *de minimis* levels.

Table 2: Estimated Air Pollutant Emissions Under the Proposed Action

Parameter	Emissions by Air Pollutant (TPY)		
	CO	NO_X	VOC
No Action Alternative	177	547	175
Preferred Alternative	254	581	185
Net Change	**77**	**34**	**10**
De Minimis Threshold	100	100	100
Exceeds Threshold?	No	No	No

Notes: Table includes criteria pollutant precursors (e.g., VOC). Individual values may not add exactly to total values due to rounding. CO = carbon monoxide; NO_X = nitrogen oxides; TPY = tons per year; VOC = volatile organic compounds

EMISSIONS EVALUATION CONCLUSION

The U.S. Navy concludes that the *de minimis* thresholds for applicable criteria pollutants would not be exceeded by implementation of the Proposed Action. The emissions data supporting that conclusion are shown in Table 2, which summarizes the calculated estimates and *de minimis* limits. Therefore, the U.S. Navy concludes that further formal Conformity Determination procedures are not required, resulting in this record of Non-Applicability.

Figure D.5-5: Conformity Analysis, San Diego Air Basin (continued)

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APPENDIX E PUBLIC PARTICIPATION

This appendix includes information about the public's participation in the development of the Hawaii-Southern California Training and Testing Activities (HSTT) Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS).

E.1 PROJECT WEBSITE

A public website was established specifically for this project, http://www.HSTTEIS.com/. This website address was published in the *Notice of Intent to Prepare an Environmental Impact Statement and Overseas Impact Statement* (Notice of Intent) and has subsequently been re-printed in all newspaper advertisements, agency letters, and public postcards. The Scoping Meeting Fact Sheets and various other materials will be available on the project website throughout the course of the project.

E.2 GENERAL SUMMARY OF THE SCOPING PERIOD

The public scoping period began with the issuance of the Notice of Intent in the *Federal Register* on 15 July 2010. This notice included a project description and scoping meeting dates and locations. The scoping period lasted 60 days, concluding on 14 September 2010. Section E.2.1 describes the United States (U.S.) Department of the Navy's (Navy's) notification efforts during scoping. The scoping period allowed a variety of opportunities for the public to comment on the scope of the EIS/OEIS.

E.2.1 PUBLIC SCOPING NOTIFICATION

The Navy made significant efforts at notifying the public to ensure maximum public participation during the scoping process. A summary of these efforts follows.

E.2.1.1 Scoping Notification Letters

Notice of Intent/Notice of Scoping Meeting Letters were distributed on 14 July 2010, to 230 federal, state, and local elected officials and government agencies. Recipients included:

<u>Federal</u>
U.S. Senators (Hawaii, California)
U.S. Representatives (California Districts 35, 36, 37, 44, 46, 48, 49, 50, 52, and Hawaii Districts 1 and 2)
Federal Aviation Administration
- Washington, D.C., Headquarters
- Western Pacific Region

U.S. Army Corps of Engineers
- Pacific Ocean Division
  - Honolulu District
- South Pacific Division
  - Los Angeles District

U.S. Department of Commerce
- National Oceanic and Atmospheric Administration
  - National Marine Fisheries Service
    - Washington, D.C., Headquarters
    - Southwest Regional Offices
    - Southwest Fisheries Science Center
    - Pacific Islands Regional Office
    - Pacific Islands Fisheries Science Center

- Office of Habitat Conservation
  - Southwest Regional Office
  - Pacific Islands Regional Habitat Conservation Division
- Office of Protected Resources
  - Headquarters and Pacific Islands Region

Channel Islands National Marine Sanctuary
Hawaiian Islands Humpback Whale National Marine Sanctuary
Papahanaumokuakea Marine National Monument

U.S. Department of Homeland Security
- U.S. Coast Guard
  - District 11
  - District 14
  - Office of Operating and Environmental Standards

U.S. Department of the Interior
- Bureau of Indian Affairs
  - Pacific Regional Office
  - Southern California Agency
- Bureau of Land Management
  - California Coastal National Monument
- Bureau of Ocean Energy Management, Regulation, and Enforcement
  - National Offshore Office
  - Pacific Outer Continental Shelf Region
- Channel Islands National Park
- National Park Service
  - Pacific West Region
- Office of Environmental Policy and Compliance
  - Oakland Region

U.S. Environmental Protection Agency
- National Environmental Policy Act Compliance Division
- Region IX (San Francisco)
- Washington, D.C., Headquarters

U.S. Fish and Wildlife Service
- Carlsbad Office
- Pacific Regional Office
- Pacific Southwest Regional Office
- Ventura Office
- San Diego Bay National Wildlife Refuge
- San Diego National Wildlife Refuge
- Hanalei National Wildlife Refuge
- Huleia National Wildlife Refuge
- James Campbell National Wildlife Refuge
- Kealia Pond National Wildlife Refuge
- Kilauea Point National Wildlife Refuge
- Pearl Harbor National Wildlife Refuge

Marine Mammal Commission

U.S. Geological Survey
- Western Region Offices
  - California Water Science Center

Pacific Islands Water Science Center
Western Fisheries Research Center

State of California
Office of the Governor
Office of Planning and Research, Military Affairs
State Senators (Districts 27, 33, 35, 38, and 39)
State Assembly members (Districts 54, 55, 74, 75, 76, 77, 78, and 79)
California Coastal Commission
Department of Conservation
Division of Land Resource Protection
Department of Fish and Game
Marine Life Protection Act Blue Ribbon Task Force
Marine Region 7
South Coast Region 5
Wildlife Branch
Department of Parks and Recreation
Department of Public Health
Department of Transportation
Division of Aeronautics, Office of Airports
Department of Toxic Substance Control
Region 4
Department of Veterans Affairs
Environmental Protection Agency
Air Resources Board
Office of Environmental Health Hazard Assessment
Office of the Secretary
Natural Resources Agency
Office of Historic Preservation
State Lands Commission
State Water Resources Control Board
Los Angeles Regional Water Quality Control Board
San Diego Regional Water Quality Control Board
Santa Ana Regional Water Quality Control Board
Wildlife Conservation Board

State of Hawaii
Office of the Governor
State Senators (all)
State Representatives (all)
Department of Business, Economic Development, and Tourism
Hawaii Coastal Zone Management Program
State Land Use Commission
Department of Hawaiian Home Lands, Office of the Chairman
Department of Health
Department of Land and Natural Resources
Division of Aquatic Resources
Division of Conservation and Resource Enforcement
Division of Forestry and Wildlife

Division of State Parks
Historic Preservation Division
Island Burial Councils (Hawaii, Kauai/Niihau, Maui/Lanai, Molokai, and Oahu)
Office of Conservation and Coastal Lands
Department of Transportation
Airports Division
Harbors Division
Office of Hawaiian Affairs

Local - California

City of Avalon
City of Coronado
City of Dana Point
City of Huntington Beach
City of Imperial Beach
City of Laguna Beach
City of Long Beach
City of Los Angeles
City of Malibu
City of Newport Beach
City of Oceanside
City of San Diego
County of Los Angeles
County of Orange
County of San Diego
Port of Long Beach
Port of Los Angeles
San Diego Unified Port District

Local - Hawaii
City and County of Honolulu
County of Hawaii
County of Kauai
County of Maui

E.2.1.2 Postcard Mailers

On 21 July 2010 postcards were mailed to 1,288 organizations and individuals on the HSTT project mailing list, which was compiled from previous Hawaii and Southern California Navy NEPA project mailing lists, with the scoping meeting dates, locations, and times.

E.2.1.3 Press Releases

Press releases to announce the Notice of Intent were distributed on 15 July 2010.

E.2.1.4 Newspaper Display Advertisements

Advertisements were made to announce the scoping meetings in the following cities and newspapers on the dates indicated below:

San Diego
Union Tribune
Saturday, July 17, 2010
Sunday, July 18, 2010
Monday, July 19, 2010
Wednesday, July 21, 2010
Wednesday, July 28, 2010
Monday, August 2, 2010
Tuesday, August 3, 2010
Wednesday, August 4, 2010

Long Beach
Long Beach Press-Telegram
Saturday, July 17, 2010
Tuesday, July 20, 2010
Wednesday, July 21, 2010
Thursday, July 22, 2010
Friday, July 30, 2010
Tuesday, August 3, 2010
Wednesday, August 4, 2010
Thursday, August 5, 2010

Maui
Maui News
Saturday, July 17, 2010
Sunday, July 18, 2010
Monday, July 19, 2010
Thursday, August 12, 2010
Sunday, August 22, 2010
Wednesday, August 25, 2010
Thursday, August 26, 2010
Friday, August 27, 2010

Honolulu/Oahu
Honolulu Star-Advertiser
Saturday, July 17, 2010
Sunday, July 18, 2010
Monday, July 19, 2010
Tuesday, August 10, 2010
Wednesday, August 18, 2010
Monday, August 23, 2010
Tuesday, August 24, 2010
Wednesday, August 25, 2010

Lihue/Kauai
The Garden Island
Saturday, July 17, 2010
Sunday, July 18, 2010
Monday, July 19, 2010
Monday, August 9, 2010
Thursday, August 19, 2010
Sunday, August 22, 2010
Monday, August 23, 2010
Tuesday, August 24, 2010

Hilo/Big Island
Hawaii Tribune-Herald
Saturday, July 17, 2010
Sunday, July 18, 2010
Monday, July 19, 2010
Wednesday, August 11, 2010
Thursday, August 19, 2010
Tuesday, August 24, 2010
Wednesday, August 25, 2010
Thursday, August 26, 2010

E.2.2 Scoping Meetings

Six scoping meetings were held on August 4, 5, 24, 25, 26 and 27 in the cities of San Diego, CA; Lakewood, CA; Lihue, HI; Honolulu, HI; Hilo, HI; and Kahului, HI, respectively. At each scoping meeting, staffers at the welcome station greeted guests and encouraged them to sign in to be added to the project mailing list to receive future notifications. In total, 131 people signed in at the welcome table. The meetings were held in an open house format, presenting informational posters and written information, with Navy staff and project experts available to answer participants' questions. Additionally, a digital voice recorder was available to record participants' oral comments. The interaction during the information sessions was productive and helpful to the Navy.

What is a scoping meeting?

The scoping period determines the extent of the EIS in terms of significant issues. Scoping meetings allow the face-to-face exchange of information and ideas to ensure relevant topics are identified and properly studied and that the Draft EIS is thorough and balanced.

E.2.3 Public Scoping Comments

Scoping participants submitted comments in five ways:

- Oral statements at the public meetings (as recorded by the tape recorder)
- Written comments at the public meetings
- Written letters (received any time during the public comment period)

- Electronic mail (received any time during the public comment period)
- Comments submitted directly on the project website (received any time during the public comment period)

In total, the Navy received comments from 72 individuals and groups. Because many of the comments addressed more than one issue, 228 total comments resulted. Table E-1 provides a breakdown of areas of concern based on comments received during scoping. The summary following Table E-1 provides an overview of comments and is organized by area of concern.

Table E-1: Public Scoping Comment Summary

Area of Concern	Count	Percent of Total
Sonar/Underwater Detonations	44	19.3%
Marine Mammals	43	18.9%
Other	30	13.2%
Fish/Marine Habitat	29	12.7%
Meeting/NEPA Process	11	4.8%
Alternatives	10	4.4%
Regional Economy	9	3.9%
Noise	9	3.9%
Threatened and Endangered Species	8	3.5%
Proposed Action	7	3.1%
Water Quality	6	2.6%
Air Quality	5	2.2%
Depleted Uranium	5	2.2%
Public Health and Safety	4	1.8%
Cumulative Impacts	4	1.8%
Terrestrial/Birds	3	1.3%
Recreation	1	0.4%
TOTAL	**228**	

E.2.3.1 Sonar and Underwater Detonations

Many comments mentioned concerns about the effect of Navy sonar on marine life, such as marine mammals, fish, sea turtles, and sea invertebrates. Participants frequently requested that the EIS/OEIS consider alternative technologies to mid-frequency active sonar.

E.2.3.2 Biological Resources-Marine Mammals

A significant number of participants expressed concerns about impacts to marine mammals, primarily from the use of Navy sonar. It was frequently requested that the EIS/OEIS consider alternative technologies to mid-frequency active sonar.

E.2.3.3 Other

This category of comments expressed the desire to close all military bases, that all military activities should cease, and the land be returned to the native Hawaiian people. There were several comments expressing that activities be performed elsewhere.

E.2.3.4 Biological Resources-Fish and Marine Habitat

A significant number of participants expressed concerns about impacts to fish and marine habitat.

E.2.3.5 Meetings/National Environmental Policy Act Process

Comments on the National Environmental Policy Act (NEPA) process included several that felt the information available during the scoping process was inadequate to provide informed comments. There was one comment stating that the Navy HSTT informational video was too basic. There was also concern about allowing more active public participation in regards to public speaking at the scoping meetings.

E.2.3.6 Alternatives

Most comments regarding alternatives were in opposition to the current training and testing activities of the Navy. Many expressed concerns about the perceived expansion of the training and testing activities area that now includes an expanded Study Area and a transit corridor between Hawaii and California.

E.2.3.7 Regional Economy

There were several comments regarding regional economic concerns, including questions about the effects on commercial shipping and commercial fishing.

E.2.3.8 Noise

Many participants in the commenting process wanted to know what the noise impacts would be to cetaceans and how they would be protected from acoustic trauma.

E.2.3.9 Threatened and Endangered Species

Concerns in this area were about ensuring that endangered marine mammals and other species would not be harmed during Navy activities.

E.2.3.10 Proposed Action

The comments pertaining to the Proposed Action requested more details on the website regarding the planned activities and request for a timeline to be presented for the use of the HSTT area.

E.2.3.11 Biological Resources-Onshore

Terrestrial issues mentioned were concerns about habitat fragmentation and potential damage to intertidal, inland, or upland resources.

E.2.3.12 Water Quality

Water quality comments included general concerns about the potential contaminants in the water.

E.2.3.13 Air Quality

Comments in this category expressed concern about the effects of military activities on air quality, including off-shore emissions.

E.2.3.14 Depleted Uranium

The concern with depleted uranium was the effect of its use on the environment in general.

E.2.3.15 Public Health and Safety

One comment was made regarding the safety challenge of military ship transits through San Diego Bay. Another participant expressed concern over the effect on people of sonar testing.

E.2.3.16 Cumulative Impacts

Comments in this category expressed concern about the overall impact of military activity in the HSTT Study Area.

E.2.3.17 Terrestrial/Birds

Comments in this area addressed the impact of training activities on birds and the land.

E.2.3.18 Recreation

One comment regarding recreation was concerned about how all levels of Navy sonar use would impact recreational activities.

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APPENDIX F TRAINING AND TESTING ACTIVITIES MATRICES

F.1 STRESSORS BY TRAINING ACTIVITY

Table F-1: Stressors by Training Activity

Hawaii-Southern California Training Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosions	In-air Explosions	Weapons Firing Noise	Aircraft Noise	Vessel and Simulated Vessel Noise	Electromagnetic	Lasers	Aircraft and Aerial Target Strikes	Vessel and In-water Device Strikes	Military Expended Materials	Seafloor Devices	Cables and Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives	Metals	Chemicals	Other Materials	Acoustics [1]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
ANTI-AIR WARFARE (AAW)																														
Air Combat Maneuver (ACM)						✔				✔						✔	✔	✔		✔		✔	✔			✔	✔			
Air Defense Exercise (ADEX)						✔	✔	✔		✔	✔						✔	✔								✔	✔			
Gunnery Exercise (Air-to-Air)				✔	✔	✔				✔		✔				✔	✔	✔		✔				✔	✔	✔	✔			✔
Missile Exercise (Air-to-Air)				✔		✔				✔		✔			✔	✔	✔	✔	✔	✔	✔			✔	✔	✔	✔			✔
Gunnery Exercise (Surface-to-Air)				✔	✔	✔	✔	✔		✔	✔	✔				✔	✔	✔	✔	✔				✔	✔	✔	✔			✔
Missile Exercise (Surface-to-Air)				✔		✔	✔	✔		✔	✔	✔				✔	✔	✔	✔	✔	✔			✔	✔	✔	✔			✔
Missile Exercise - Man-portable Air Defense System				✔		✔				✔		✔				✔	✔	✔	✔	✔	✔			✔	✔	✔	✔			✔
AMPHIBIOUS WARFARE (AMW)																														
Fire Support Exercise – Land-Based Target					✔		✔				✔						✔	✔							✔	✔				✔
Fire Support Exercise – At Sea			✔		✔		✔				✔	✔				✔	✔	✔	✔	✔			✔	✔	✔	✔	✔	✔		✔
Amphibious Assault						✔	✔			✔	✔						✔	✔						✔	✔		✔			✔
Amphibious Assault – Battalion Landing						✔	✔			✔	✔						✔	✔						✔	✔		✔			✔
Amphibious Raid							✔				✔						✔	✔						✔	✔		✔			✔
Expeditionary Fires Exercise / Supporting Arms Coordination Exercise					✔		✔				✔						✔	✔							✔	✔				✔
Humanitarian Assistance Operations						✔	✔			✔	✔						✔	✔						✔	✔		✔			✔
STRIKE WARFARE (STW)																														
Bombing Exercise (Air-to-Ground)						✔				✔		✔					✔	✔		✔			✔	✔		✔				
Gunnery Exercise (Air-to-Ground)						✔				✔		✔					✔	✔		✔			✔	✔		✔				

Note: A check indicates events that take place for all alternatives; ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor

Table F-1: Stressors by Training Activity (continued)

Hawaii-Southern California Training Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosions	In-air Explosions	Weapons Firing Noise	Aircraft Noise	Vessel and Simulated Vessel Noise	Electromagnetic	Lasers	Aircraft and Aerial Target Strikes	Vessel and In-water Device Strikes	Military Expended Materials	Seafloor Devices	Cables and Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives	Metals	Chemicals	Other Materials	Acoustics [1]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
ANTI-SURFACE WARFARE (ASUW)																														
Maritime Security Operations						✓	✓			✓	✓	✓				✓	✓	✓							✓	✓	✓			✓
Gunnery Exercise (Surface-to-Surface) Ship – Small-Caliber							✓				✓	✓				✓	✓	✓		✓					✓	✓	✓			✓
Gunnery Exercise (Surface-to-Surface) Ship – Medium and Large Caliber			✓		✓		✓				✓	✓				✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Gunnery Exercise (Surface-to-Surface) Boat – Small-Caliber							✓				✓	✓				✓	✓	✓		✓				✓	✓	✓	✓			✓
Gunnery Exercise (Surface-to-Surface) Boat – Medium-Caliber			✓		✓		✓				✓	✓				✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Missile Exercise (Surface-to-Surface)			✓		✓		✓				✓	✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
Gunnery Exercise (Air-to-Surface) – Small-Caliber						✓				✓		✓				✓	✓	✓		✓				✓	✓	✓	✓			✓
Gunnery Exercise (Air-to-Surface) – Medium-Caliber			✓			✓				✓	✓	✓				✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		✓
Missile Exercise (Air-to-Surface) Rocket			✓			✓				✓	✓	✓				✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Missile Exercise (Air-to-Surface)			✓			✓				✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
Bombing Exercise (Air-to-Surface)			✓			✓				✓		✓				✓	✓	✓	✓	✓			✓	✓	✓		✓	✓	✓	✓
Laser Targeting						✓	✓			✓	✓						✓	✓							✓		✓		✓	✓
Sinking Exercise (SINKEX)			✓		✓	✓	✓			✓	✓	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓
ANTI-SUBMARINE WARFARE (ASW)																														
Tracking Exercise/Torpedo Exercise – Submarine	✓					✓	✓			✓	✓	✓		✓						✓				✓			✓	✓		✓
Tracking Exercise/Torpedo Exercise – Surface	✓						✓				✓	✓					✓	✓						✓	✓		✓	✓		✓
Tracking Exercise/Torpedo Exercise – Helicopter	✓					✓	✓			✓	✓	✓			✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft	✓					✓	✓			✓	✓	✓			✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓

Note: A check indicates events that take place for all alternatives. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor

Table F-1: Stressors by Training Activity (continued)

Hawaii-Southern California Training Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosions	In-air Explosions	Weapons Firing Noise	Aircraft Noise	Vessel and Simulated Vessel Noise	Electromagnetic	Lasers	Aircraft and Aerial Target Strikes	Vessel and In-water Device Strikes	Military Expended Materials	Seafloor Devices	Cables and Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives	Metals	Chemicals	Other Materials	Acoustics [1]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
ANTI-SUBMARINE WARFARE (ASW) (Continued)																														
Tracking Exercise/Torpedo Exercise – Maritime Patrol Aircraft Extended Echo Ranging Sonobuoys	✔		✔			✔				✔		✔			✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔
KILO Dip - Helicopter	✔					✔				✔							✔	✔	✔					✔	✔	✔	✔	✔		✔
Submarine Command Course (SCC) Operations	✔	✔				✔	✔			✔	✔	✔		✔	✔		✔	✔	✔		✔	✔		✔	✔	✔	✔	✔		✔
MAJOR TRAINING EVENTS																														
ASW for Composite Training Unit Exercise (COMPTUEX)	✔	✔	✔			✔	✔			✔	✔	✔			✔	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔		✔
ASW for Joint Task Force Exercise (JTFEX)/Sustainment Exercise (SUSTAINEX)	✔	✔	✔			✔	✔			✔	✔	✔			✔	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔		✔
Rim of the Pacific (RIMPAC) Exercise	✔	✔	✔			✔	✔			✔	✔	✔			✔	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔		✔
Multi-Strike Group Exercise	✔	✔	✔			✔	✔			✔	✔	✔			✔	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔		✔
Integrated Anti-Submarine Warfare Course (IAC)	✔	✔				✔	✔			✔	✔	✔			✔	✔	✔	✔		✔	✔			✔	✔	✔	✔	✔		✔
Group Sail	✔	✔	✔			✔	✔			✔	✔	✔			✔		✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔		✔
Undersea Warfare Exercise (USWEX)	✔	✔	✔			✔	✔			✔	✔	✔			✔	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔		✔
Ship ASW Readiness and Evaluation Measuring (SHAREM)	✔	✔	✔			✔	✔			✔	✔	✔			✔	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔		✔
ELECTRONIC WARFARE (EW)																														
Electronic Warfare Operations (EW Ops)						✔	✔			✔	✔						✔	✔							✔	✔	✔			✔
Counter Targeting Flare Exercise						✔				✔						✔	✔	✔		✔		✔		✔	✔	✔	✔			✔
Counter Targeting Chaff Exercise – Ship							✔				✔					✔	✔	✔				✔			✔					✔
Counter Targeting Chaff Exercise – Aircraft						✔				✔						✔	✔	✔				✔				✔				✔

Note: A check indicates events that take place for all alternatives; ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor

Table F-1: Stressors by Training Activity (continued)

Hawaii-Southern California Training Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosions	In-air Explosions	Weapons Firing Noise	Aircraft Noise	Vessel and Simulated Vessel Noise	Electromagnetic	Lasers	Aircraft and Aerial Target Strikes	Vessel and In-water Device Strikes	Military Expended Materials	Seafloor Devices	Cables and Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives	Metals	Chemicals	Other Materials	Acoustics [1]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
MINE WARFARE (MIW)																														
Mine Countermeasure Exercise (MCM) – Ship Sonar	✔						✔				✔		✔				✔	✔							✔			✔		✔
Mine Countermeasure Exercise – Surface (SMCMEX)	✔						✔				✔		✔				✔	✔							✔			✔		✔
Mine Neutralization – Explosive Ordnance Disposal (EOD)			✔			✔	✔			✔	✔	✔	✔			✔	✔	✔	✔				✔	✔	✔	✔	✔	✔		✔
Mine Countermeasure (MCM) – Towed Mine Neutralization						✔	✔	✔		✔	✔		✔				✔	✔						✔	✔	✔	✔	✔		✔
Mine Countermeasure (MCM) – Mine Detection	✔					✔	✔			✔	✔		✔				✔	✔						✔	✔	✔	✔	✔	✔	✔
Mine Countermeasure (MCM) – Mine Neutralization					✔	✔	✔			✔	✔	✔	✔			✔	✔	✔		✔				✔	✔	✔	✔		✔	✔
Mine Neutralization – Remotely Operated Vehicle			✔			✔	✔			✔	✔	✔	✔	✔		✔	✔	✔	✔	✔			✔	✔	✔	✔	✔	✔		✔
Mine Laying**						✔				✔		✔					✔	✔		✔				✔	✔	✔	✔			✔
Marine Mammal System			✔														✔	✔	✔	✔				✔	✔	✔	✔	✔		✔
Shock Wave Generator			✔													✔				✔				✔	✔	✔	✔	✔		✔
Surf Zone Test Detachment/ Equipment Test and Evaluation			✔																									✔		
Submarine Mine Exercise											✔	✔	✔															✔		✔
Maritime Homeland Defense/Security Mine Countermeasures	✔		✔			✔	✔	✔		✔	✔		✔				✔	✔	✔				✔	✔	✔	✔	✔	✔		✔
NAVAL SPECIAL WARFARE (NSW)																														
Personnel Insertion/ Extraction - Submarine											✔																			
Personnel Insertion/ Extraction – Non-submarine						✔				✔							✔	✔	✔											
Underwater Demo Multiple Charge – Mat Weave & Obstacle Loading			✔									✔	✔			✔	✔	✔	✔				✔	✔	✔	✔	✔	✔		✔
Underwater Demolition Qualification / Certification			✔									✔	✔			✔	✔	✔	✔				✔	✔	✔	✔	✔	✔		✔

Note: A check indicates events that take place for all alternatives; ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor

Table F-1: Stressors by Training Activity (continued)

Hawaii-Southern California Training Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosions	In-air Explosions	Weapons Firing Noise	Aircraft Noise	Vessel and Simulated Vessel Noise	Electromagnetic	Lasers	Aircraft and Aerial Target Strikes	Vessel and In-water Device Strikes	Military Expended Materials	Seafloor Devices	Cables and Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives	Metals	Chemicals	Other Materials	Acoustics [1]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
OTHER TRAINING EXERCISES																														
Precision Anchoring							✓				✓		✓				✓	✓			✓	✓		✓	✓		✓			✓
Small Boat Attack					✓		✓				✓					✓	✓	✓		✓										
Offshore Petroleum Discharge System (OPDS)																	✓	✓												
Elevated Causeway System (ELCAS)		✓																							✓			✓		
Submarine Navigation	✓										✓																✓	✓		✓
Submarine Under Ice Certification	✓										✓													✓			✓	✓		✓
Salvage Operations													✓				✓	✓	✓					✓			✓			✓
Surface Ship Sonar Maintenance	✓						✓				✓																	✓		
Submarine Sonar Maintenance	✓										✓																	✓		

Note: A check indicates events that take place for all alternatives; ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor

F.2 STRESSORS BY TESTING ACTIVITY

Table F-2: Stressors by Testing Activity

Hawaii-Southern California Testing Activity	Biological Resources																	Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors										
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosions	In-air Explosions	Weapons Firing Noise	Aircraft Noise	Vessel and Simulated Vessel Noise	Electromagnetic	Lasers	Aircraft and Aerial Target Strikes	Vessel and In-water Device Strikes	Military Expended Materials	Seafloor Devices	Cables and Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives	Metals	Chemicals	Other Materials	Acoustics [1]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
Naval Air Systems Command																														
ANTI-AIR WARFARE (AAW)																														
Air Combat Maneuver (ACM)						✔				✔							✔	✔								✔	✔			✔
Air Platform/Vehicle Test						✔				✔		✔					✔	✔		✔						✔	✔		✔	✔
Air Platform Weapons Integration Test						✔				✔		✔				✔	✔	✔	✔	✔					✔	✔	✔			✔
Intelligence, Surveillance, and Reconnaissance Test						✔				✔							✔	✔								✔	✔			✔
ANTI-SURFACE WARFARE (ASUW)																														
Air-to-Surface Missile Test			✔			✔				✔		✔				✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔			✔
Air-to-Surface Gunnery Test			✔			✔				✔		✔				✔	✔	✔	✔	✔			✔	✔	✔	✔	✔	✔		✔
Rocket Test			✔			✔				✔		✔				✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Laser Targeting Test						✔				✔							✔	✔								✔	✔		✔	✔
ELECTRONIC WARFARE (EW)																														
Electronic System Evaluation						✔				✔							✔	✔								✔	✔			✔
ANTI-SUBMARINE WARFARE (ASW)																														
ASW Torpedo Test	✔					✔				✔	✔	✔		✔	✔	✔	✔	✔		✔	✔	✔		✔	✔	✔	✔	✔		✔
Kilo Dip	✔					✔				✔							✔	✔							✔	✔	✔	✔		✔
Sonobuoy Lot Acceptance Test**	✔		✔			✔	✔			✔	✔	✔			✔	✔	✔	✔	✔				✔	✔	✔	✔	✔	✔		✔
ASW Tracking Test – Helicopter	✔		✔			✔				✔		✔			✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔
ASW Tracking Test – Maritime Patrol Aircraft	✔		✔			✔				✔	✔	✔			✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔

Note: A check indicates events that take place for all alternatives; 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor

Table F-2: Stressors by Testing Activity (continued)

Hawaii-Southern California Testing Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosions	In-air Explosions	Weapons Firing Noise	Aircraft Noise	Vessel and Simulated Vessel Noise	Electromagnetic	Lasers	Aircraft and Aerial Target Strikes	Vessel and In-water Device Strikes	Military Expended Materials	Seafloor Devices	Cables and Wires,	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives	Metals	Chemicals	Other Materials	Acoustics [1]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
MINE WARFARE (MIW)																														
Airborne Mine Neutralization Systems (AMNS)Test – ASQ-235			✓			✓				✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Airborne Towed Minehunting Sonar System Test – AN/AQS-20A	✓					✓				✓	✓						✓	✓							✓	✓	✓	✓		✓
Airborne Towed Minesweeping System Test – AN/ALQ-220 (OASIS)			✓			✓		✓		✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Airborne Laser-Based Mine Detection System Test – ALMDS						✓				✓							✓	✓							✓	✓	✓		✓	✓
Airborne Projectile-based Mine Clearance System Test			✓			✓				✓		✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
OTHER TESTING ACTIVITIES																														
Test and Evaluation (T&E) Catapult Launch						✓	✓			✓	✓						✓	✓							✓	✓	✓			✓
Air Platform Shipboard Integrate Test						✓				✓							✓	✓							✓	✓	✓			✓
Shipboard Electronic Systems Evaluation						✓				✓							✓	✓								✓	✓			✓
NAVAL SEA SYSTEMS COMMAND																														
NEW SHIP CONSTRUCTION																														
Surface Combatant Sea Trials – Pierside Sonar Testing**	✓	✓																										✓		
Surface Combatant Sea Trials – Propulsion Testing							✓				✓						✓	✓							✓		✓			✓
Surface Combatant Sea Trials – Gun Testing, Large-Caliber					✓		✓				✓	✓					✓	✓		✓				✓	✓	✓	✓			✓
Surface Combatant Sea Trials – Missile Testing					✓		✓			✓	✓	✓					✓	✓		✓				✓	✓		✓			✓
Surface Combatant Sea Trials – Decoy Testing							✓				✓					✓	✓	✓				✓			✓		✓			✓
Surface Combatant Sea Trials – Surface Warfare Testing- Large-Caliber					✓		✓				✓	✓					✓	✓		✓				✓	✓	✓	✓			✓

Note: A check indicates events that take place for all alternatives; ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor

Table F-2: Stressors by Testing Activity (continued)

Hawaii-Southern California Testing Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosions	In-air Explosions	Weapons Firing Noise	Aircraft Noise	Vessel and Simulated Vessel Noise	Electromagnetic	Lasers	Aircraft and Aerial Target Strikes	Vessel and In-water Device Strikes	Military Expended Materials	Seafloor Devices	Cables and Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives	Metals	Chemicals	Other Materials	Acoustics [1]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
NEW SHIP CONSTRUCTION (Continued)																														
Surface Combatant Sea Trials – Anti-Submarine Warfare Testing	✓	✓					✓				✓						✓	✓		✓	✓	✓			✓		✓	✓		✓
Other Class Ship Sea Trials – Propulsion Testing							✓				✓						✓	✓							✓		✓			✓
Other Class Ship Sea Trials – Gun Testing – Small-Caliber							✓				✓	✓				✓	✓	✓							✓	✓	✓			✓
ASW Mission Package Testing - Shipboard**	✓					✓	✓			✓	✓	✓			✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓
ASW Mission Package Testing – Airborne**	✓					✓				✓							✓	✓								✓	✓	✓		✓
ASUW Mission Package Testing – Gun Testing					✓		✓				✓	✓					✓	✓		✓				✓	✓	✓	✓			✓
ASUW Mission Package Testing – Missile/Rocket Testing			✓		✓	✓	✓			✓	✓	✓				✓	✓	✓					✓	✓	✓	✓	✓	✓		✓
MCM Mission Package Testing**	✓		✓			✓	✓			✓	✓					✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓
Post-Homeporting Testing (All Classes)**							✓				✓						✓	✓							✓		✓			✓
LIFECYCLE ACTIVITIES																														
Ship Signature Testing**							✓				✓						✓	✓									✓	✓		✓
Surface Ship Sonar Testing/Maintenance (in OPAREAs and Ports)**	✓	✓					✓				✓						✓	✓									✓	✓		✓
Submarine Sonar Testing/Maintenance (in OPAREAs and Ports)**	✓	✓									✓																✓	✓		✓
Combat System Ship Qualification Trial (CSSQT) – In-port Maintenance Period**	✓																											✓		
Combat System Ship Qualification Trial (CSSQT) – Air Defense**				✓	✓		✓			✓	✓	✓				✓	✓	✓		✓		✓		✓		✓	✓			✓
Combat System Ship Qualification Trial (CSSQT) – Anti-Surface Warfare**				✓	✓		✓				✓	✓				✓	✓	✓		✓		✓		✓		✓	✓			✓
Combat System Ship Qualification Trial (CSSQT) – Anti-Submarine Warfare**	✓					✓	✓			✓	✓	✓			✓	✓	✓	✓		✓		✓		✓		✓	✓	✓		✓

Note: A check indicates events that take place for all alternatives; ** Alternative 1 and Alternative 2 only. 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor

Table F-2: Stressors by Testing Activity (continued)

Hawaii-Southern California Testing Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosions	In-air Explosions	Weapons Firing Noise	Aircraft Noise	Vessel and Simulated Vessel Noise	Electromagnetic	Lasers	Aircraft and Aerial Target Strikes	Vessel and In-water Device Strikes	Military Expended Materials	Seafloor Devices	Cables and Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives	Metals	Chemicals	Other Materials	Acoustics [1]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
ANTI-SURFACE WARFARE/ANTI-SUBMARINE WARFARE TESTING																														
Missile Testing**					✓		✓			✓	✓	✓					✓	✓	✓	✓	✓			✓	✓	✓	✓			✓
Kinetic Energy Weapon Testing**					✓		✓				✓	✓					✓	✓	✓	✓	✓			✓	✓	✓	✓			✓
Electronic Warfare Testing**											✓																✓			✓
Torpedo (Non-Explosive) Testing	✓	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓
Torpedo (Explosive) Testing	✓		✓			✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Countermeasure Testing – Acoustic System Testing**	✓	✓					✓				✓						✓	✓						✓			✓	✓		✓
Countermeasure Testing – Anti-Torpedo Torpedo Defense System Testing**	✓						✓				✓				✓	✓	✓	✓							✓		✓	✓		✓
Pierside Sonar Testing	✓																											✓		
At-sea Sonar Testing	✓	✓					✓				✓	✓					✓	✓									✓	✓		✓
MINE WARFARE TESTING																														
Mine Detection and Classification Testing**	✓					✓	✓			✓	✓						✓	✓							✓	✓	✓	✓		✓
Mine Countermeasure/Neutralization Testing**	✓		✓			✓	✓	✓		✓	✓			✓		✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓		✓
Pierside Systems Health Checks	✓	✓																												
SHIPBOARD PROTECTION SYSTEMS AND SWIMMER DEFENSE TESTING																														
Pierside Integrated Swimmer Defense	✓	✓				✓					✓		✓											✓			✓	✓		✓
Shipboard Protection Systems Testing							✓				✓	✓				✓	✓	✓		✓						✓	✓	✓		✓
Chemical/Biological Simulant Testing						✓	✓			✓	✓						✓	✓			✓	✓			✓	✓	✓			✓

Note: A check indicates events that take place for all alternatives; 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor

Table F-2: Stressors by Testing Activity (continued)

Hawaii-Southern California Testing Activity	Biological Resources																Physical Resources						Human Resources							
	Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
	Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosions	In-air Explosions	Weapons Firing Noise	Aircraft Noise	Vessel and Simulated Vessel Noise	Electromagnetic	Lasers	Aircraft and Aerial Target Strikes	Vessel and In-water Device Strikes	Military Expended Materials	Seafloor Devices	Cables and Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives	Metals	Chemicals	Other Materials	Acoustics [1]	Physical Disturbance [1]	Accessibility [2]	Airborne Acoustics [2]	Physical Disturbance and Strikes [2]	Underwater Energy [3]	In-Air Energy [3]	Physical Interactions [3]
UNMANNED VEHICLE TESTING																														
Underwater Deployed Unmanned Aerial System Testing**										✔	✔	✔								✔				✔	✔		✔			✔
Unmanned Vehicle Development and Payload Testing**	✔						✔				✔		✔											✔	✔		✔	✔		✔
OTHER TESTING																														
Special Warfare	✔	✔					✔				✔																✔	✔		✔
Acoustic Communications Testing**							✔				✔																✔			✔
SPACE AND NAVAL WARFARE SYSTEMS COMMAND																														
Autonomous Undersea Vehicle (AUV) Anti-Terrorism/Force Protection (AT/FP) Mine Countermeasures		✔									✔																			
AUV Underwater Communications		✔									✔																			
Fixed System Underwater Communications		✔							✔		✔		✔	✔																
AUV Autonomous Oceanographic Research and Meteorology and Oceanography (METOC)		✔																												
Fixed Autonomous Oceanographic Research and METOC		✔											✔																	
Passive Mobile Intelligence, Surveillance, and Reconnaissance Sensor Systems		✔					✔				✔																			
Fixed Intelligence, Surveillance, and Reconnaissance Sensor Systems		✔					✔				✔		✔	✔																
Anti-Terrorism/Force Protection (AT/FP) Fixed Sensor Systems		✔																												
OFFICE OF NAVAL RESEARCH																														
Kauai Acoustic Communications Experiment (Coastal)																														

Note: A check indicates events that take place for all alternatives; ** Alternative 1 and Alternative 2 only; 1: cultural resources stressor; 2: socioeconomics stressor; 3: public health and safety stressor

F.3 STRESSORS BY RESOURCE

Table F-3: Stressors by Resource

Stressors vs. Resources		Biological Resources																Physical Resources						Human Resources							
		Acoustic Stressors							Energy Stressors		Physical Stressors				Entanglement Stressors		Ingestion Stressors	Air Quality Stressors		Sediment and Water Quality Stressors											
		Tactical Acoustic Sonar	Other Acoustic Devices	Underwater Explosions	In-air Explosions	Weapons Firing Noise	Aircraft Noise	Vessel and Simulated Vessel Noise	Electromagnetic	Lasers	Aircraft and Aerial Target Strikes	Vessel and In-water Device Strikes	Military Expended Materials	Seafloor Devices	Cables and Wires	Parachutes	Military Expended Materials	Criteria Air Pollutants	Hazardous Air Pollutants	Explosives and Explosive Hyproducts	Metals	Chemicals Other than Explosives	Other Materials	Acoustics	Physical Disturbance	Accessibility	Airborne Acoustics	Physical Disturbance and Strikes	Underwater Energy	In-Air Energy	Physical Interactions
Physical	Sediments and Water Quality																			✓	✓	✓	✓								
	Air Quality																	✓	✓												
Biological	Marine Habitats			✓								✓	✓	✓																	
	Marine Mammals	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓								
	Sea Turtles	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓								
	Birds	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓				✓	✓	✓												
	Marine Vegetation			✓								✓	✓	✓						✓	✓	✓	✓								
	Marine Invertebrates	✓	✓	✓					✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓								
	Fish	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓	✓	✓			✓	✓	✓	✓								
Human	Cultural Resources			✓			✓						✓	✓										✓	✓						
	Socioeconomic Resources		✓	✓	✓	✓	✓	✓				✓	✓		✓	✓				✓	✓	✓	✓			✓	✓	✓			
	Public Health and Safety	✓	✓	✓	✓	✓				✓	✓	✓	✓																✓	✓	✓

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APPENDIX G STATISTICAL PROBABILITY ANALYSIS FOR ESTIMATING DIRECT STRIKE IMPACT AND NUMBER OF POTENTIAL EXPOSURES

This appendix discusses the methods and results for calculating the probability of a direct strike of an animal from any military items from the proposed training and testing activities falling toward (or directed at) the sea surface. For the purposes of this appendix, military items include non-explosive practice munitions, sonobuoys, acoustic countermeasures, and targets. Only marine mammals and sea turtles will be analyzed using these methods because animal densities are necessary to complete the calculations, and density estimates are currently only available for marine mammals and sea turtles within the Hawaii-Southern California Training and Testing (HSTT) Study Area (Study Area). Furthermore, the analysis conducted here does not account for explosive munitions because impacts from explosives are analyzed within the United States (U.S.) Department of the Navy (Navy) Acoustic Effects Model.

G-1 DIRECT IMPACT ANALYSIS

A statistical probability was calculated to estimate the impact probability (P) and number of exposures (T) associated with direct impact of military items on marine animals on the sea surface within the specified training or testing area (R) in which the activities are occurring. The statistical probability analysis is based on probability theory and modified Venn diagrams with rectangular "footprint" areas for the individual animal (A) and total impact (I) inscribed inside the training or testing area (R). The analysis assumes: (1) that all animals would be at or near the surface 100 percent of the time, when in fact, marine mammals spend the majority of their time underwater, and (2) that the animals are stationary, which does not account for any movement or any potential avoidance of the training or testing activity.

1. A = length*width, where the individual animal's width (breadth) is assumed to be 20 percent of its length for marine mammals and 112 percent of its length for sea turtles. This product for A is multiplied by the number of animals N_a in the specified training or testing area (i.e., product of the highest average seasonal animal density [D] and training or testing area [R]: $N_a = D*R$) to obtain the total animal footprint area ($A*N_a = A*D*R$) in the training or testing area. As a worst case scenario, the total animal footprint area is calculated for the species with the highest average seasonal density in the training or testing area with the highest use of military items within the entire Study Area.

2. $I = N_{mun}$*length*diameter, where N_{mun} = total annual number of military items for each type, and "length" and "diameter" refer to the individual military equipment dimensions. For each type, the individual impact footprint area is multiplied by the total annual number of military items to obtain the type-specific impact footprint area ($I = N_{mun}$*length*diameter). Each training or testing activity uses one or more different types of military items, each with a specific number and dimensions, and several training and testing activities occur in a given year. When integrating over the number of military items types for the given activity (and then over the number of activities in a year), these calculations are repeated (accounting for differences in dimensions and numbers) for all military items types used, to obtain the type-specific impact footprint area (I). These impact footprint areas are summed over all military items types for the given activity, and then summed (integrated) over all activities to obtain the total impact footprint area resulting from all activities occurring in the training or testing area in a given year. As a worst case scenario, the total impact footprint area is calculated for the training or testing area with the highest use of military items within the entire Study Area.

Though marine mammals and sea turtles are not randomly distributed in the environment, a random point calculation was chosen due to the intensive data needs that would be required for a calculation that incorporated more detailed information on an animal's or military item's spatial occurrence.

The analysis is expected to provide an overestimation of the probability of a strike for the following reasons: (1) it calculates the probability of a single military item (of all the items expended over the course of the year) hitting a single animal at its species' highest seasonal density, (2) it does not take into account the possibility that an animal may avoid military activities, (3) it does not take into account the possibility that an animal may not be at the water surface, (4) it does not take into account that most projectiles fired during training and testing activities are fired at targets, and so only a very small portion of those projectiles that miss the target would hit the water with their maximum velocity and force, and (5) it does not quantitatively take into account the Navy avoiding animals that are sighted through the implementation of mitigation measures.

The likelihood of an impact is calculated as the probability (P) that the animal footprint (A) and the impact footprint (I) will intersect within the training or testing area (R). This is calculated as the area ratio A/R or I/R, respectively. Note that A (referring to an **individual** animal footprint) and I (referring to the impact footprint resulting from the **total** number of military items N_{mun}) are the relevant quantities used in the following calculations of single-animal impact probability [P], which is then multiplied by the number of animals to obtain the number of exposures (T). The probability that the random point in the training or testing area is within both types of footprints (i.e., A and I) depends on the degree of overlap of A and I. The probability that I overlaps A is calculated by adding a buffer distance around A based on one-half of the impact area (i.e., 0.5*I), such that an impact (center) occurring anywhere within the combined (overlapping) area would impact the animal. Thus, if L_i and W_i are the length and width of the impact footprint such that $L_i*W_i = 0.5*I$ and $W_i/L_i = L_a/W_a$ (i.e., similar geometry between the animal footprint and impact footprint), and if L_a and W_a are the length and width (breadth) of the individual animal such that $L_a*W_a = A$ (= individual animal footprint area), then, assuming a purely static, rectangular scenario (Scenario 1), the total area $A_{tot} = (L_a + 2*L_i)*(W_a + 2*W_i)$, and the buffer area $A_{buffer} = A_{tot} – L_a*W_a$.

Four scenarios were examined with respect to defining and setting up the overlapping combined areas of A and I:

1. **Scenario 1**: Purely static, rectangular scenario. Impact is assumed to be static (i.e., direct impact effects only; non-dynamic; no explosions or scattering of military items after the initial impact). Hence the impact footprint area (I) is assumed to be rectangular and given by the product of military items length and width (multiplied by the number of military items). $A_{tot} = (L_a + 2*L_i)*(W_a + 2*W_i)$ and $A_{buffer} = A_{tot} – L_a*W_a$.

2. **Scenario2**: Dynamic scenario with end-on collision, in which the length of the impact footprint (Li) is enhanced by Rn = 5 military items lengths to reflect forward momentum. $A_{tot} = (L_a + (1 + R_n)*L_i)*(W_a + 2*W_i)$ and $A_{buffer} = A_{tot} – L_a*W_a$.

3. **Scenario 3**: Dynamic scenario with broadside collision, in which the width of the impact footprint (W_i) is enhanced by R_n = 5 military items lengths to reflect forward momentum. Atot = $(L_a + 2*W_i)*(W_a + (1 + R_n)*L_i)$ and $A_{buffer} = A_{tot} – L_a*W_a$.

4. **Scenario 4**: Purely static, radial scenario, in which the rectangular animal and impact footprints are replaced with circular footprints while conserving area. Define the radius (R_a) of the circular

individual animal footprint such that $\pi * R_a^2 = L_a * W_a$, and define the radius (R_i) of the circular impact footprint such that $\pi * R_i^2 = 0.5 * L_i * W_i = 0.5 * I$. Then $A_{tot} = \pi * (R_a + R_i)^2$ and $A_{buffer} = A_{tot} - \pi * R_a^2$ (where $\pi = 3.1415927$).

Static impacts (Scenarios 1 and 4) assume no additional areal coverage effects of scattered military items beyond the initial impact. For dynamic impacts (Scenarios 2 and 3), the distance of any scattered military items must be considered by increasing the length (Scenario 2) or width (Scenario 3), depending on orientation (broadside versus end-on collision), of the impact footprint to account for the forward horizontal momentum of the falling object. Forward momentum typically accounts for five object lengths, resulting in a corresponding increase in impact area. Significantly different values may result from these two types of orientation. Both of these types of collision conditions can be calculated each with 50 percent likelihood (i.e., equal weighting between Scenarios 2 and 3, to average these potentially different values).

Impact probability P is the probability of impacting one animal with the given number, type, and dimensions of all military items used in training or testing activities occurring in the area per year, and is given by the ratio of total area (A_{tot}) to training or testing area (R): $P = A_{tot}/R$. Number of exposures is $T = N*P = N*A_{tot}/R$, where N = number of animals in the training or testing area per year (given as the product of the animal density [D] and range size [R]). Thus, $N = D*R$ and hence $T = N*P = N*A_{tot}/R = D*A_{tot}$. Using this procedure, P and T were calculated for each of the four scenarios, for Endangered Species Act (ESA)-listed marine mammals and the marine mammal and sea turtle species with the highest average seasonal density (used as the annual density value) and for each military item type. The scenario -specific P and T values were averaged over the four scenarios (using equal weighting) to obtain a single scenario -averaged annual estimate of P and T.

G-2 PARAMETERS FOR ANALYSIS

Impact probabilities (P) and number of exposures (T) were estimated by the analysis for the following parameters:

1. **Three proposed alternatives**: No Action Alternative, Alternative 1, and Alternative 2. Animal densities, animal dimensions, and military item dimensions are the same for the three alternatives.

2. **Two Training or Testing Areas**: Hawaii (HRC) and Southern California (SOCAL) Operating Areas (OPAREA). Areas are 235,000 square nautical miles (nm^2) (807,058 square kilometers [km]^2) and 120,000 nm^2 (590,025 km^2), respectively. These two training areas were chosen because they constitute the areas with the highest estimated numbers and concentrations of military expended materials for each alternative, and would, thus, provide a reasonable comparison for all other areas with fewer expended materials.

3. **The following types of munitions or other items**:

   a) **Small-caliber projectiles:** up to and including 0.50 caliber rounds
   b) **Medium-caliber projectiles:** larger than 0.50 caliber rounds but smaller than 57 millimeters (mm) projectiles
   c) **Large-caliber projectiles:** includes projectiles greater than or equal to a 57 mm projectile
   d) **Missiles:** includes rockets and jet-propelled munitions

e) **Bombs:** Non-explosive practice bombs and mine shapes, ranging from 10 to 2,000 pounds (lb.) (4.5 to 907.2 kilograms [kg])
f) **Torpedoes:** includes aircraft deployed torpedoes
g) **Sonobuoys:** includes aircraft deployed sonobuoys

4. **Animal species of interest:** the six species of ESA-listed marine mammals and the non-ESA listed marine mammal species with the highest average seasonal density in the training and testing areas of interest. The sea turtle species with the highest average seasonal density in the training and testing areas of interest.

G-3 INPUT DATA

Input data for the direct strike analysis include animal species likely to be in the area and military items proposed for use under each of the three alternatives. Animal species data include: (1) species ID and status (i.e., threatened, endangered, or neither), (2) highest average seasonal density estimate for the species of interest, and (3) adult animal dimensions (length and width) for the species with the highest density. The animal's dimensions are used to calculate individual animal footprint areas (A = length*width), and animal densities are used to calculate the number of exposures (T) from the impact probability (P): T = N*P. Military items data include: (1) military items category (e.g., projectile, bomb, rocket, target), (2) military items dimensions (length and width), and (3) total number of military items used annually.

Military items input data, specifically the quantity (e.g., numbers of guns, bombs, and rockets), are different in magnitude among the three proposed alternatives (No Action Alternative, Alternative 1, and Alternative 2). All animal species input data, the military items identification and category, and military items dimensions, are the same for the three alternatives, only the quantities (i.e., total number of military items) are different.

G-4 OUTPUT DATA

Estimates of impact probability (P) and number of exposures (T) for a given species of interest, were made for the specified training or testing area with the highest annual number of military items used for each of the three alternatives. The calculations derived P and T from the highest annual number of military items used in the Study Area for the given alternative. Differences in P and T among the alternatives arise from different numbers of events (and therefore military items) for the three alternatives.

Results for marine mammals and sea turtles are presented in Table G-1 and Table G-2.

Table G-1: Estimated Marine Mammal Exposures from Direct Strike of Munitions and Other Items by Area and Alternative

Pacific Marine Ecosystem						
HAWAII OPAREA						
Species	**Training**			**Testing**		
	No Action	**Alternative 1**	**Alternative 2**	**No Action**	**Alternative 1**	**Alternative 2**
Humpback Whale	0.00011	0.00015	0.00015	0.00000	0.00003	0.00003
Blue Whale	0.00000	0.00001	0.00001	0.00000	0.00000	0.00000
Fin Whale	0.00000	0.00001	0.00001	0.00000	0.00000	0.00000
Sei Whale	0.00000	0.00001	0.00001	0.00000	0.00000	0.00000
Sperm Whale	0.00015	0.00028	0.00028	0.00001	0.00000	0.00000
Hawaiian Monk Seal	0.00001	0.00001	0.00001	0.00000	0.00000	0.00000
Southwest Coast United States Continental Shelf Large Marine Ecosystem						
SOUTHERN CALIFORNIA OPAREA						
Species	**Training**			**Testing**		
	No Action	**Alternative 1**	**Alternative 2**	**No Action**	**Alternative 1**	**Alternative 2**
Humpback Whale	0.00032	0.00060	0.00060	0.00001	0.00001	0.00001
Blue Whale	0.00001	0.00002	0.00002	0.00000	0.00000	0.00000
Fin Whale	0.00001	0.00002	0.00002	0.00000	0.00000	0.00000
Sei Whale	0.00001	0.00003	0.00003	0.00000	0.00000	0.00000
Sperm Whale	0.00044	0.00082	0.00082	0.00001	0.00001	0.00008
Guadalupe Fur Seal	0.00001	0.00006	0.00006	0.00000	0.00001	0.00001

Table G-2: Estimated Sea Turtle Exposures from Direct Strike of Military Expended Materials by Area and Alternative

Pacific Marine Ecosystem						
HAWAII OPAREA						
Species	**Training**			**Testing**		
	No Action	**Alternative 1**	**Alternative 2**	**No Action**	**Alternative 1**	**Alternative 2**
Pacific Sea Turtle Guild	0.01361	0.02011	0.01937	0.00049	0.00432	0.00457

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