Studies of fecal indicator bacteria in San Dieguito Lagoon

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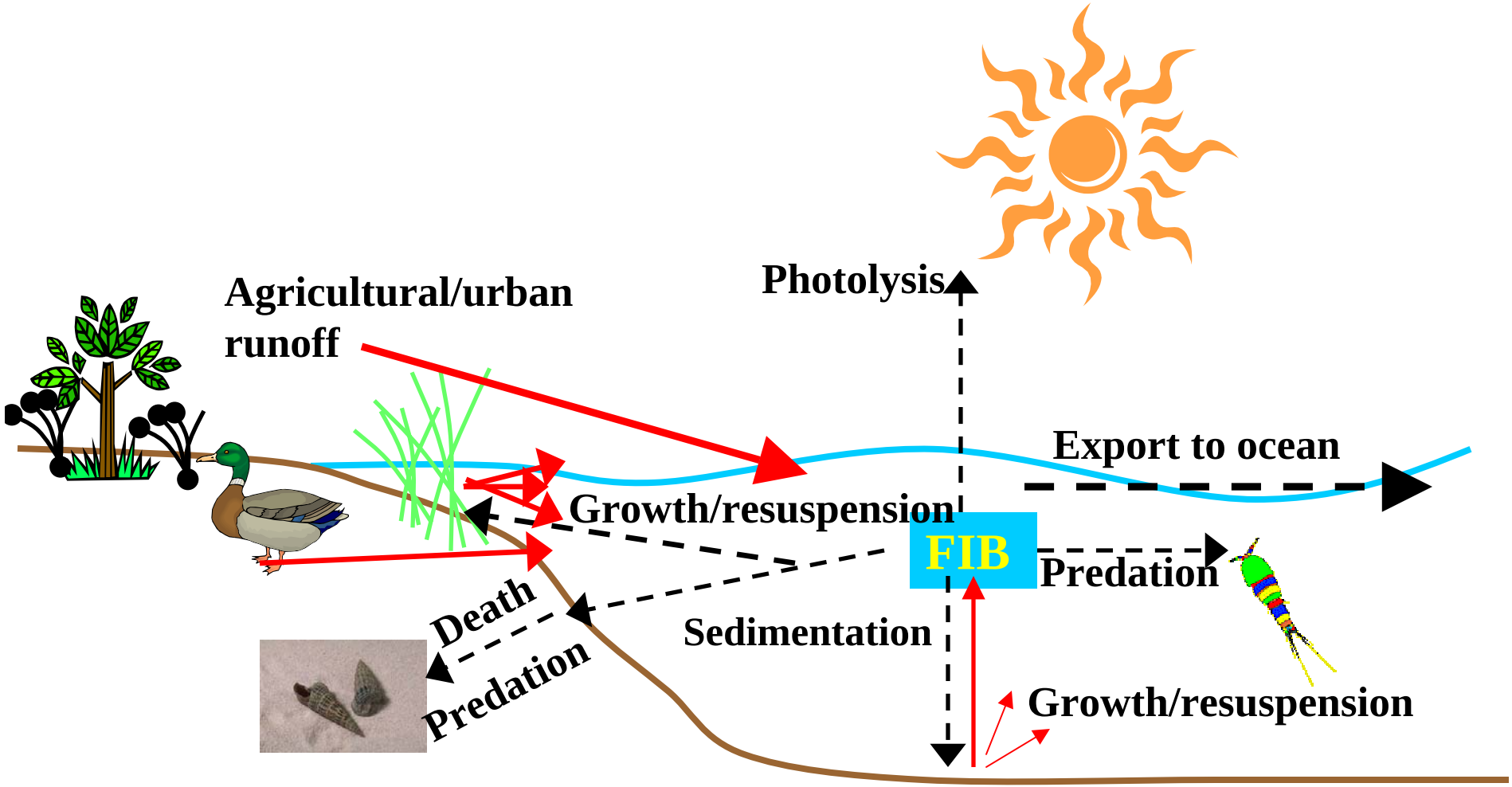
Acknowledgements

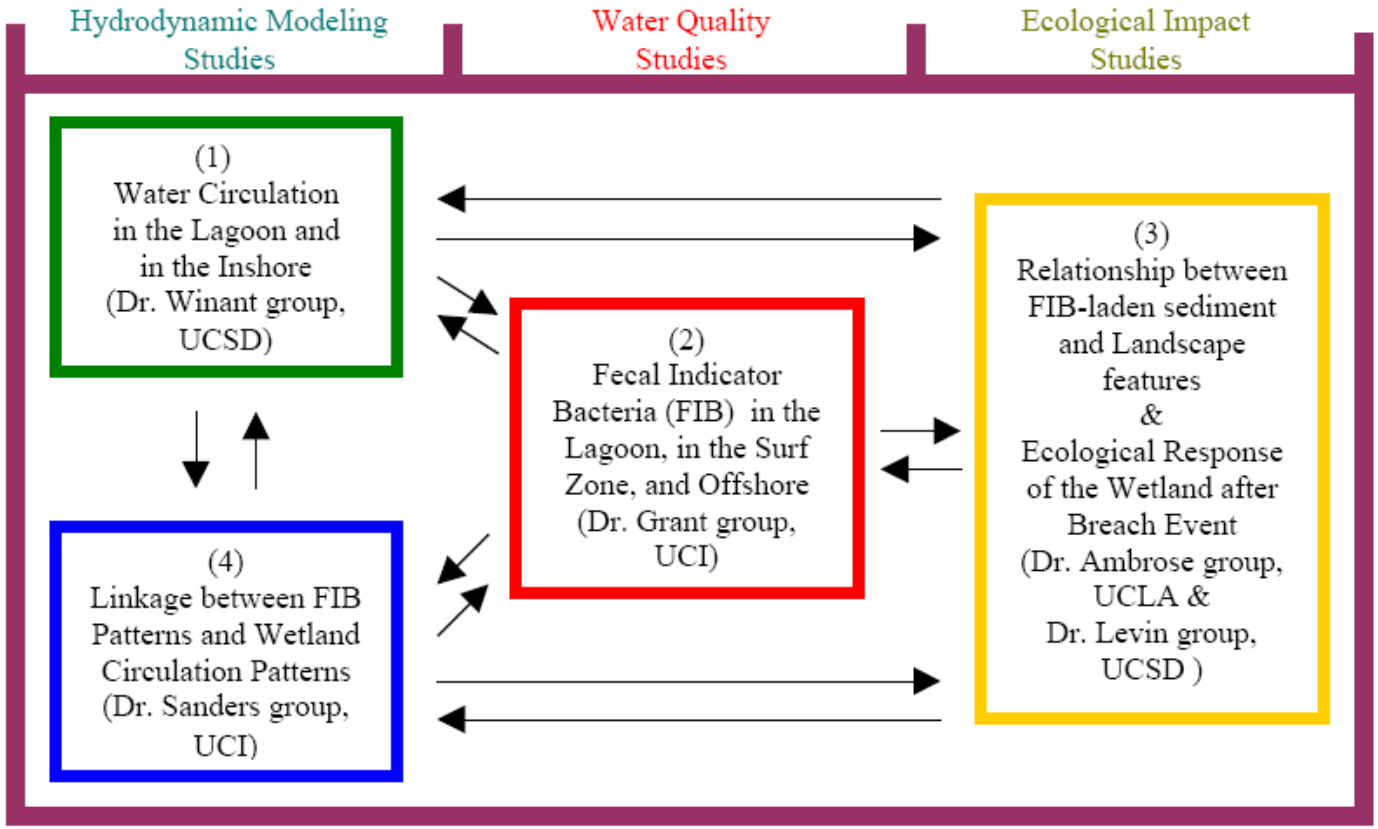
- Funding by the University of California Marine Council, Southern California Edison, Coastal Toxicology Component of the UC Toxic Substances Research and Teaching Program
- Assistance by many, many students, including Mel Evanson and Laurie Ikuta at UCLA

Key Wetland Mass Transport Mechanisms

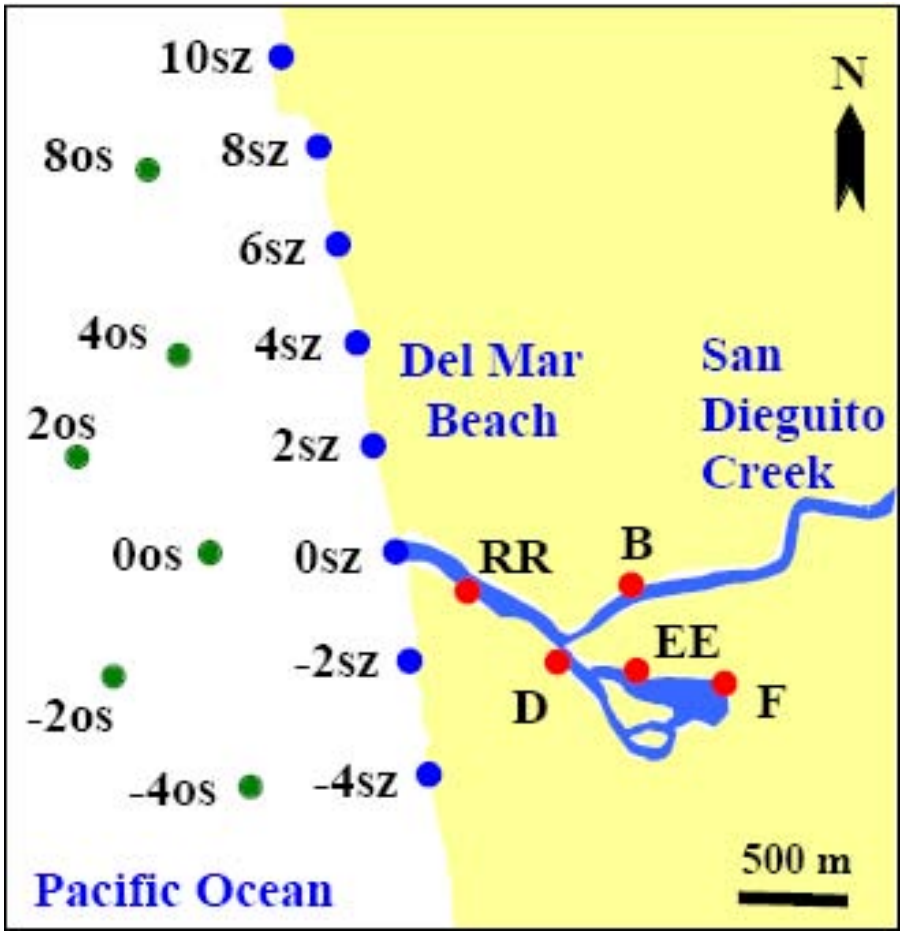


Influence of San Dieguito Lagoon breach on fecal indicator bacteria concentrations

Lagoon Breached October 4, 2002



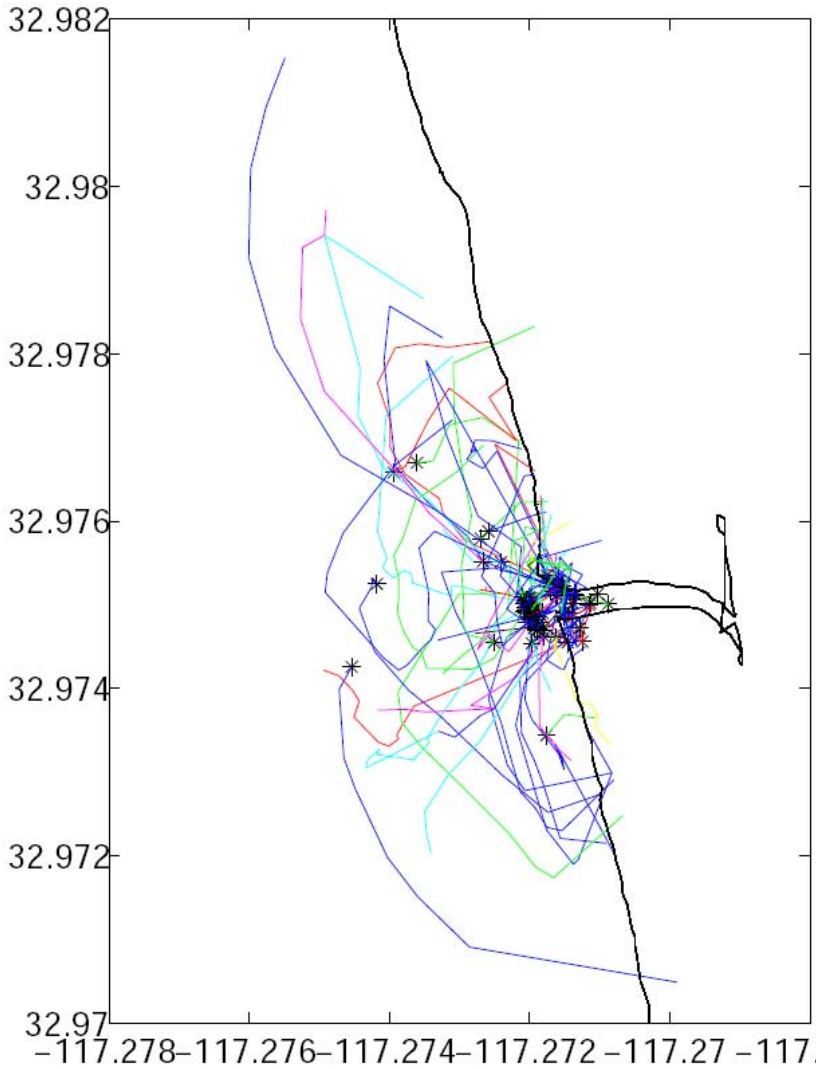
San Dieguito Lagoon and Ocean Sampling Stations



sz = surfzone
os = offshore

Movement of offshore drifters

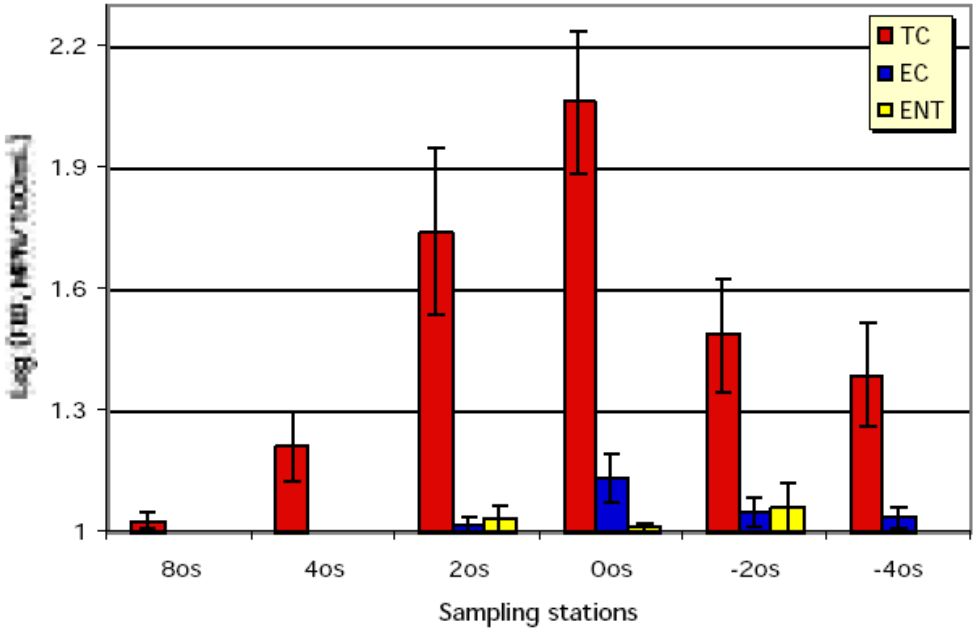
- The breach took place on a day with small waves and weak currents, so little lagoon effluent was directly entrained in the surf zone
- As the outlet was breached, water flowed out of the lagoon, crossed the surf zone, and spread out in a symmetrical pattern offshore.
- Drogues released near the outlet were taken offshore initially, and many returned back to the shoreline within 1 km of their point of release
- It appears that contaminants associated with the lagoon effluent would have been taken offshore initially, and some fraction may have been recycled back into the surf zone by shoreward directed currents



Combined trajectories for all 83 drifter releases. Drifter release positions are marked by asterisks.

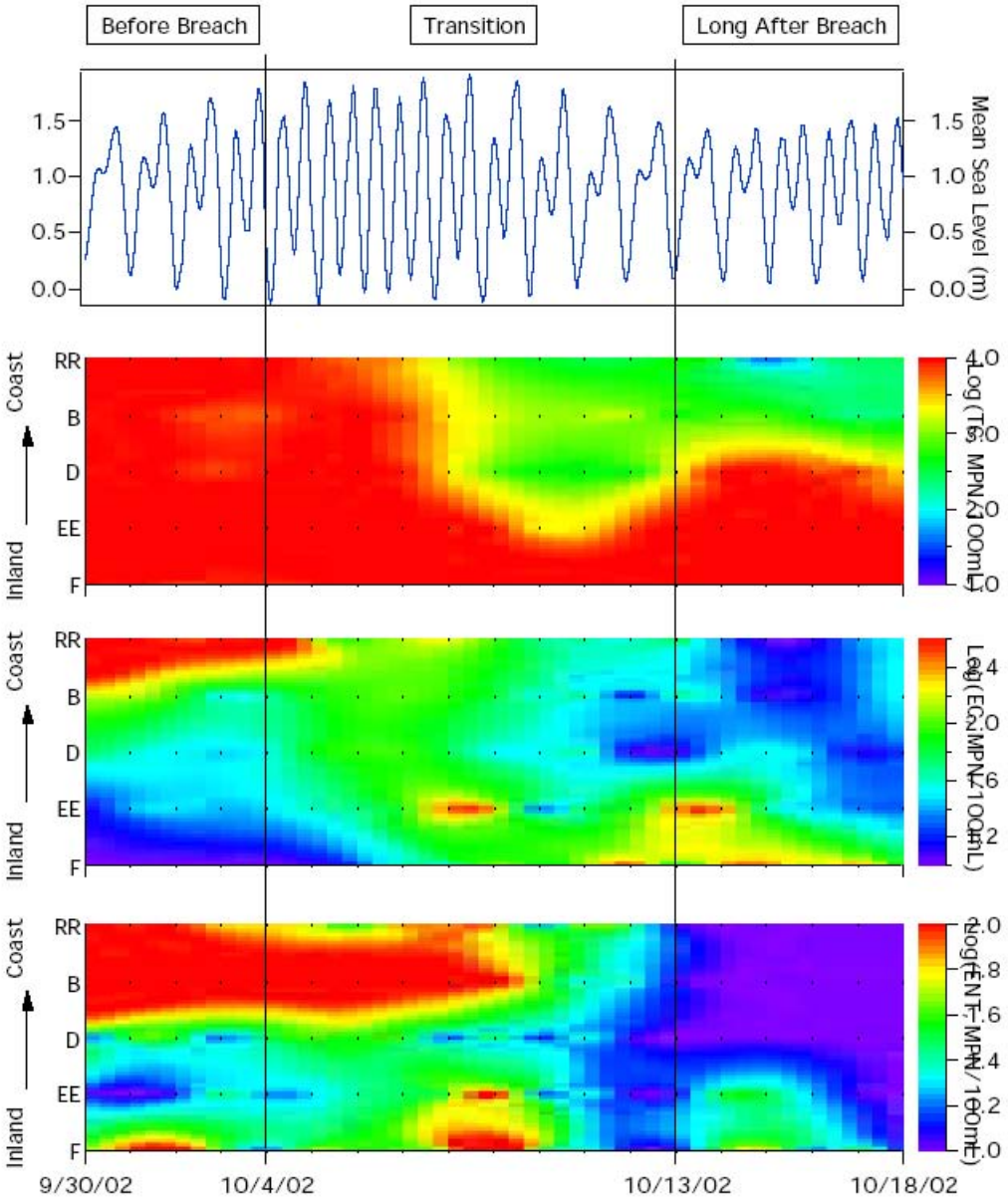
Fecal Indicator Bacteria (FIB) distribution offshore

- The FIB plume was most concentrated directly offshore of the tidal outlet
- Within 24 hours of the breach event, FIB from the lagoon had contaminated a >4 km^2 area offshore, stretching at least 4 km along shore and 1.2 km offshore
- Surprisingly, the breach did not obviously affect FIB concentrations in the surf zone.



FIB distribution in the Lagoon

- Before breach: FIB highest in River (RR, B)
- After breach: FIB highest away from River (D, EE, F)



Total coliform

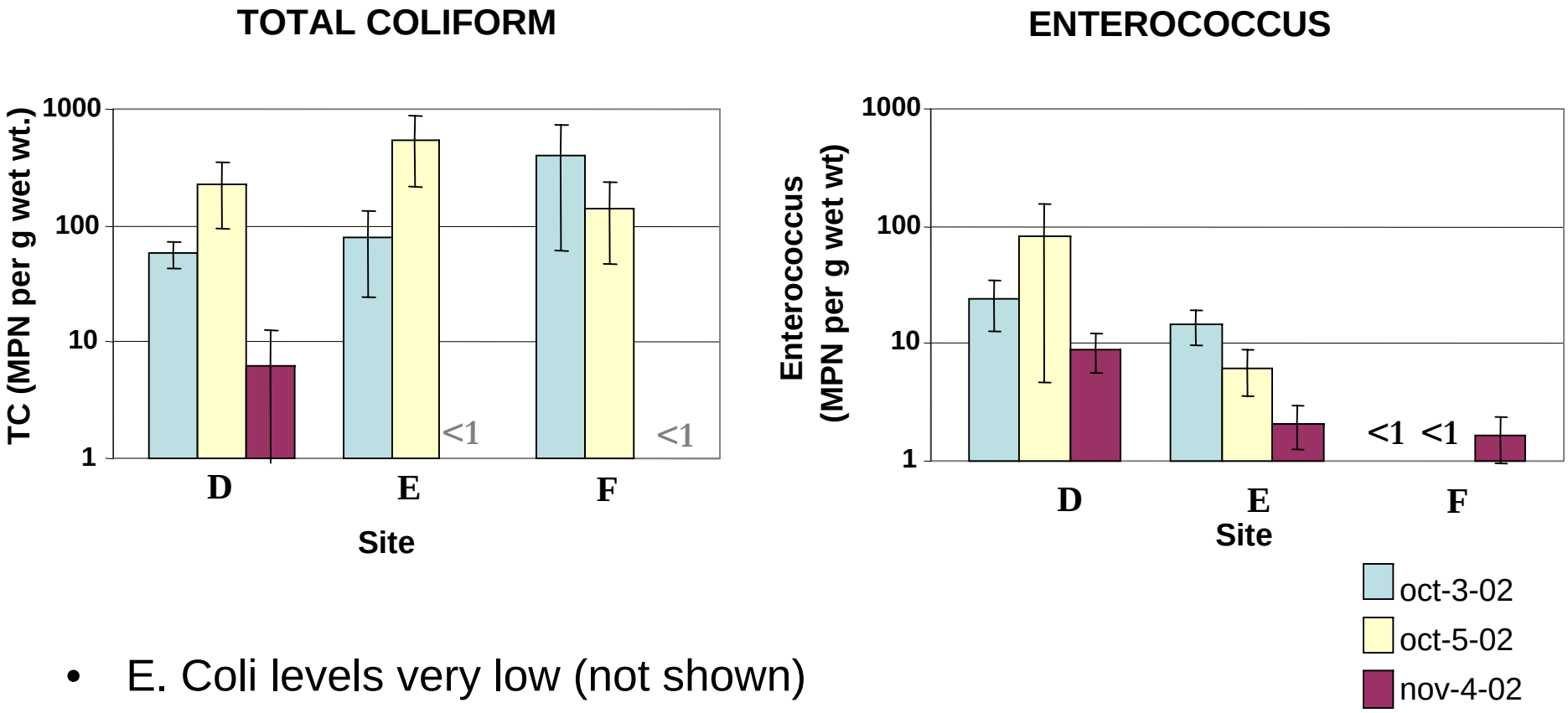
E. coli

Enterococcus

San Dieguito Lagoon Breach Wetland Sediment Study

- Lagoon breached on Oct 4, 2002
- Stations D, E, F sampled immediately pre- and post breach
- Lower and Mid-marsh transects

Changes in sediment FIB after breach Lower Marsh



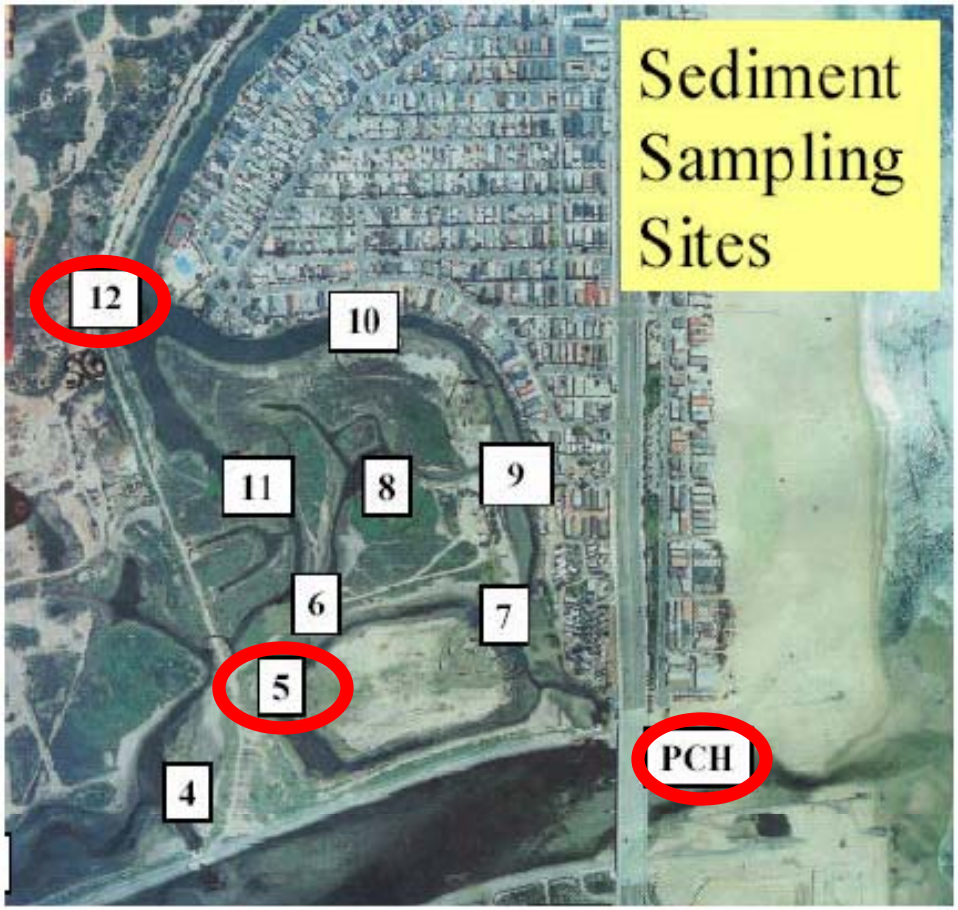
- E. Coli levels very low (not shown)
- Mid-marsh TC, ENT very low (1-8 MPN)
  - No apparent temporal and station difference

Summary: FIB in sediments

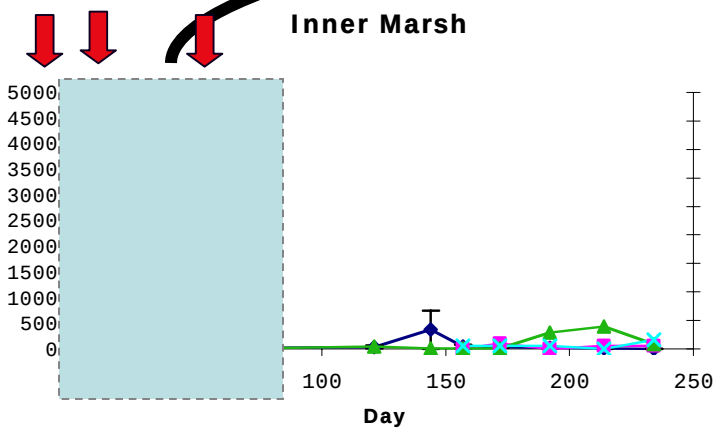
- FIB levels higher in lower (wetter) marsh
- Little change in sediment FIB levels immediately after breach
- Decrease in both TC and ENT after one month of tidal scouring
- Vegetation cover may influence FIB survivorship in sediment
  - ENT levels higher at station with higher vegetation cover
  - High levels of FIB associated with algae

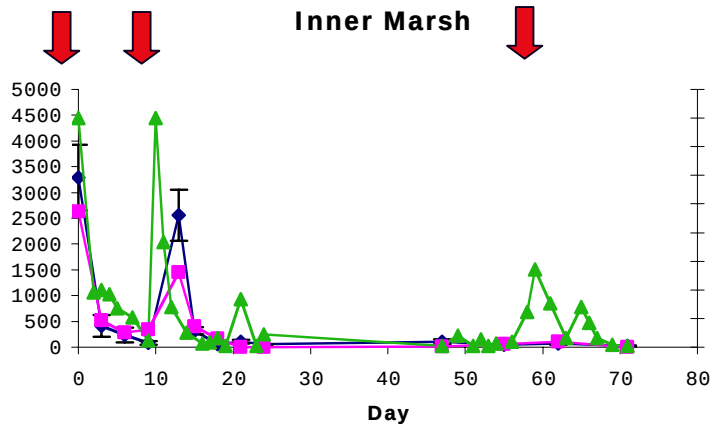
Santa Ana River wetland

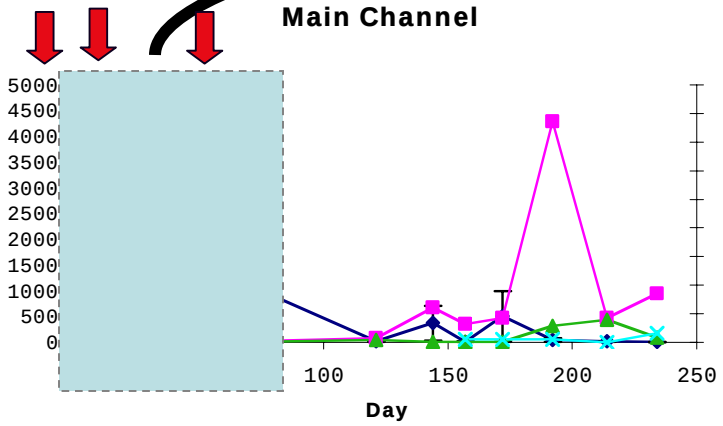
- Sampling sites:
  - one along the main channel
  - one along the inner marsh
  - one near ocean
- Sampled sediment and water
- Sampled for >1 year

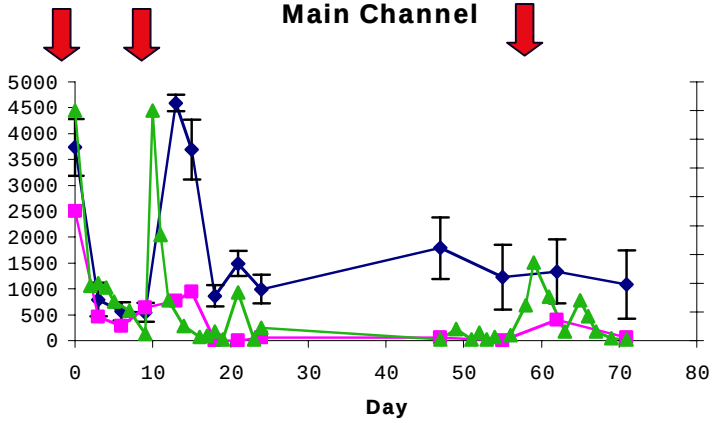


Enterococcus









Wetland Water
Sediment
Beach Water

= rain event

Laboratory mesocosm experiment

- Methods
  - Sediment collected from the main channel site and added to small systems
  - Three salinity treatments: 0, 15, or 35 ppt
  - Samples were collected on days 0, 2, 4, 6, and 10
- Initial results
  - Initially, all FIB increased under all conditions
  - TC and EC more abundant in water, ENT in sediment
  - FIB survived longest in low salinity treatments

Preliminary SAR Conclusions

- Rain events/ winter conditions are the most conducive to high FIB levels
- Elevated FIB levels in wetland waters at SAR apparently not linked to high beach water levels
- FIB can grow within wetland sediments and prefer low salinity conditions
- ENT exhibits different behavior than TC and EC