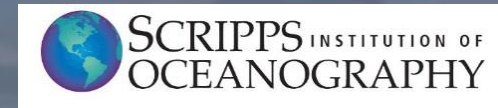


Evolution of a NPDES Permit- Novel Implementation Strategies for Storm Water Compliance Monitoring at Scripps Institution of Oceanography in San Diego, CA



SoCal SETAC Annual Meeting, San Diego, CA

May 6, 2019



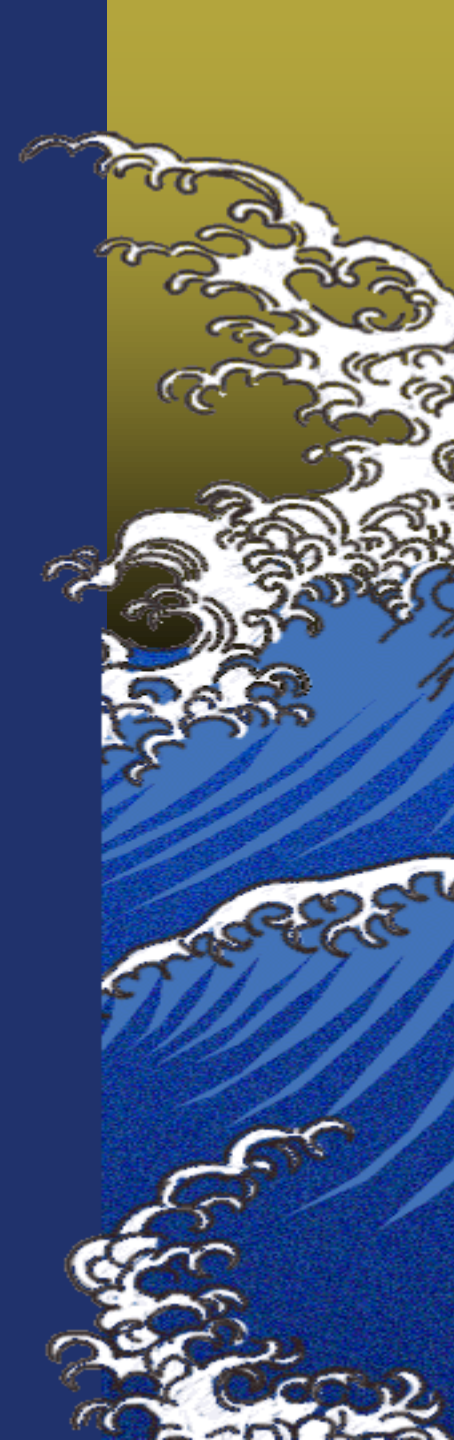
Rolf Schottle, Chris Stransky, Wood Environment and Infrastructure Solutions
Kimberly O'Connell, UCSD

wood.

UC San Diego

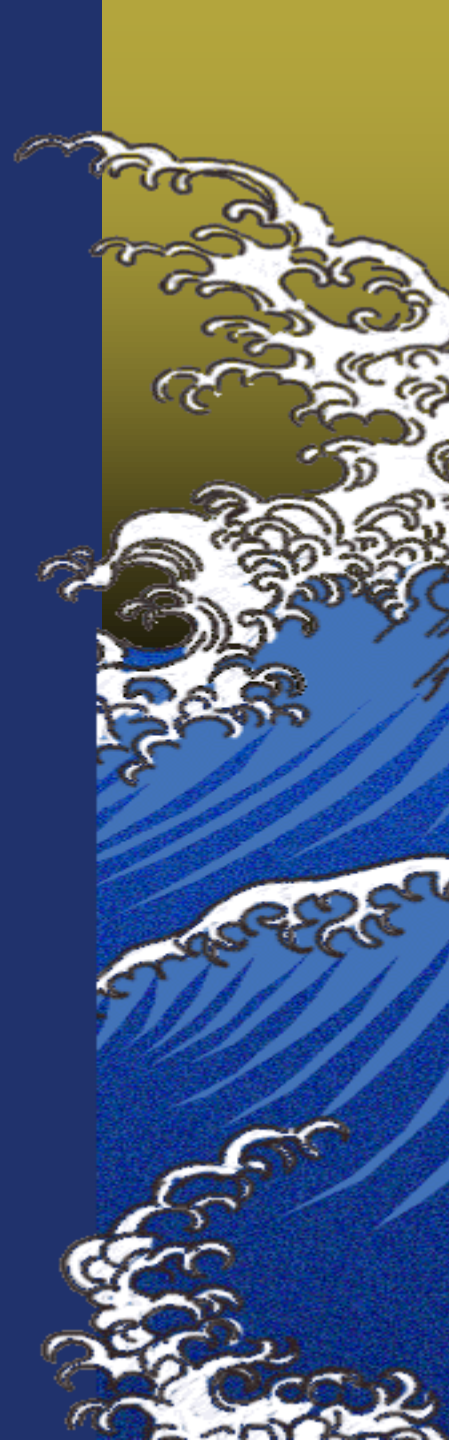
Overview

- Regulatory Background and Implementation
- Seawater System and Outfall Tour
- Significant Special Studies and Permit Monitoring Outcomes
- Ongoing Innovative Studies



San Diego Marine Life Refuge - ASBS

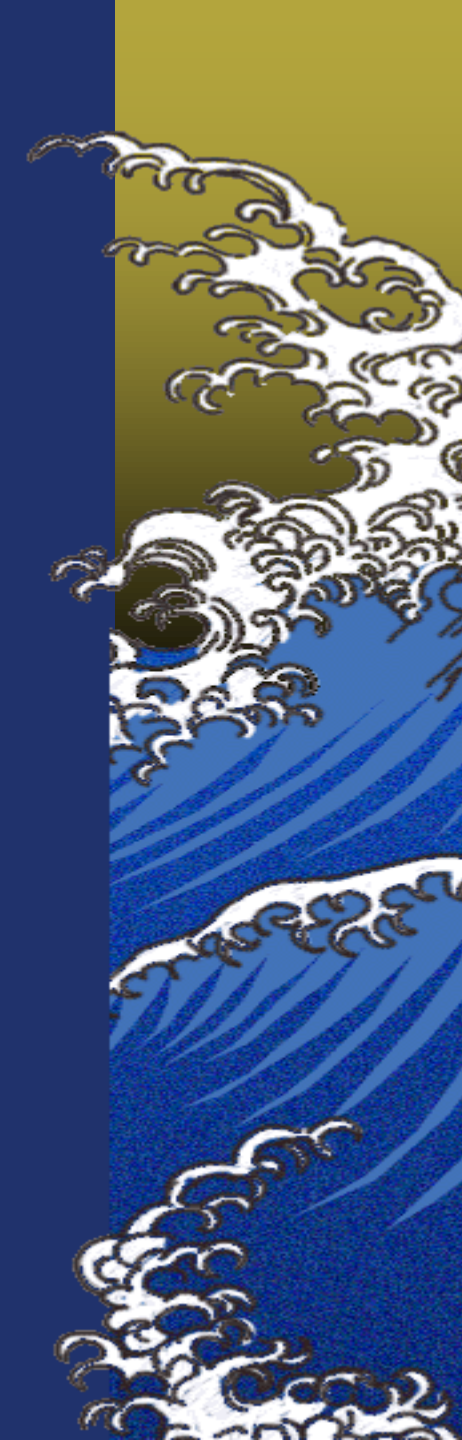
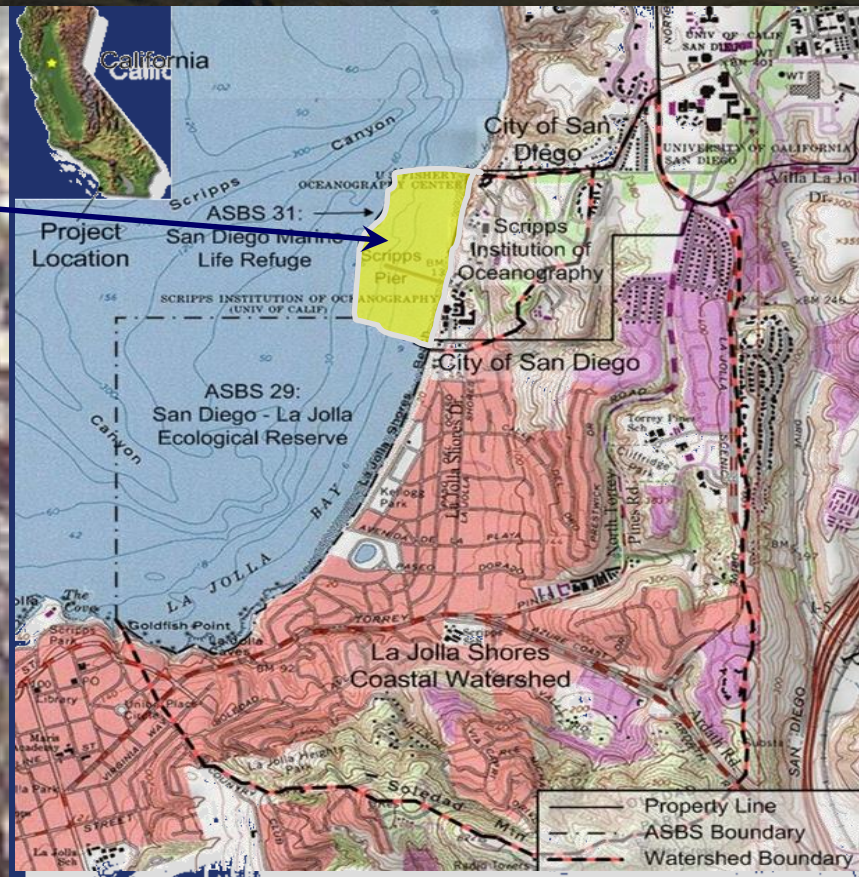
- ▶ 1929 - San Diego Marine Life Refuge established by SIO
- ▶ 1974 - Designated SDMLR and ASBS No.31
- ▶ 2002 - SIO submitted a request for an exception to the 2001 California Ocean Plan prohibition against waste discharges into ASBS
- ▶ 2004 - SWRCB granted exception with 19 conditions
- ▶ 2005 - SIO's NPDES Permit revised, incorporating the 19 exception conditions
- ▶ 2008 & 2015 - NPDES Permit modified



San Diego-Scripps ASBS No. 31 Location

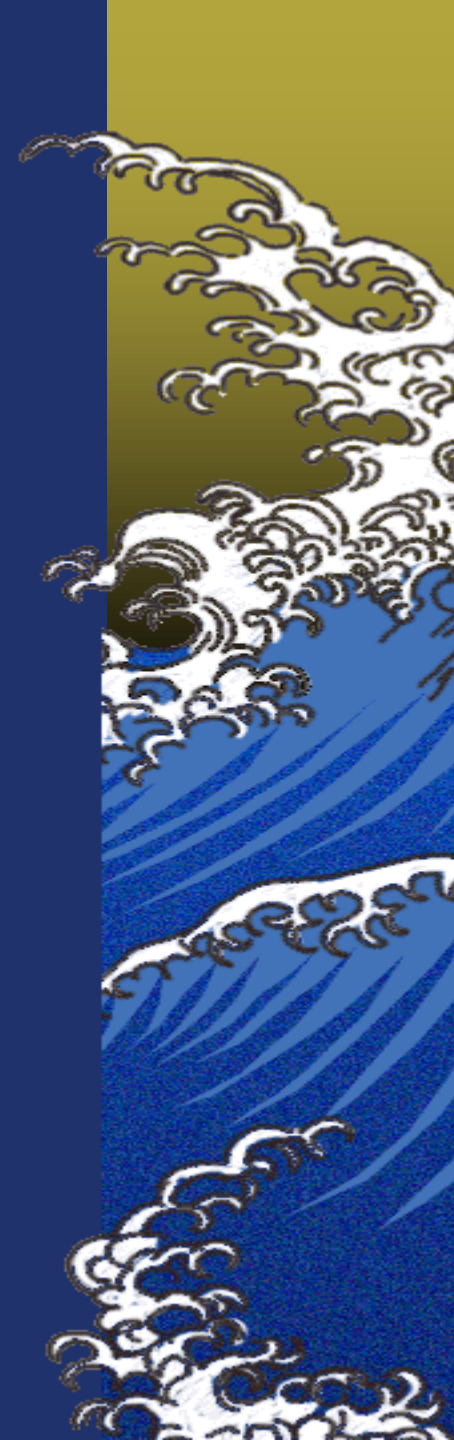
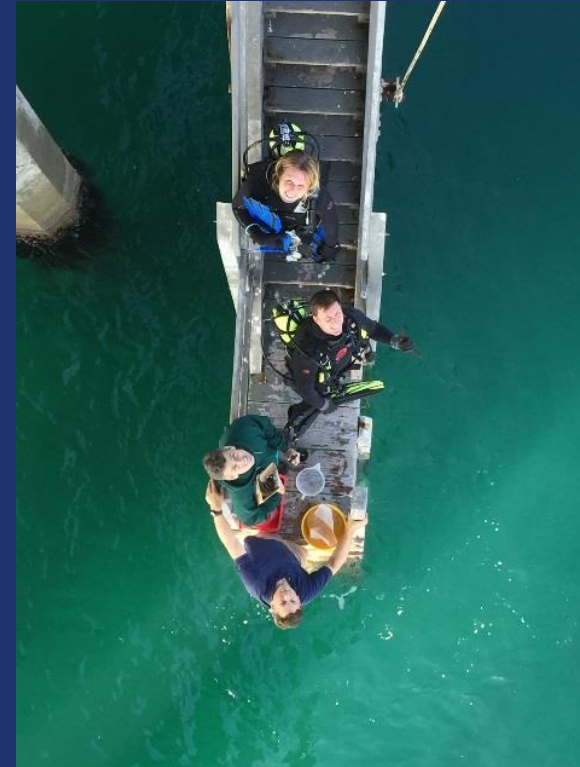


San Diego-Scripps
Area of Special
Biological
Significance No.31

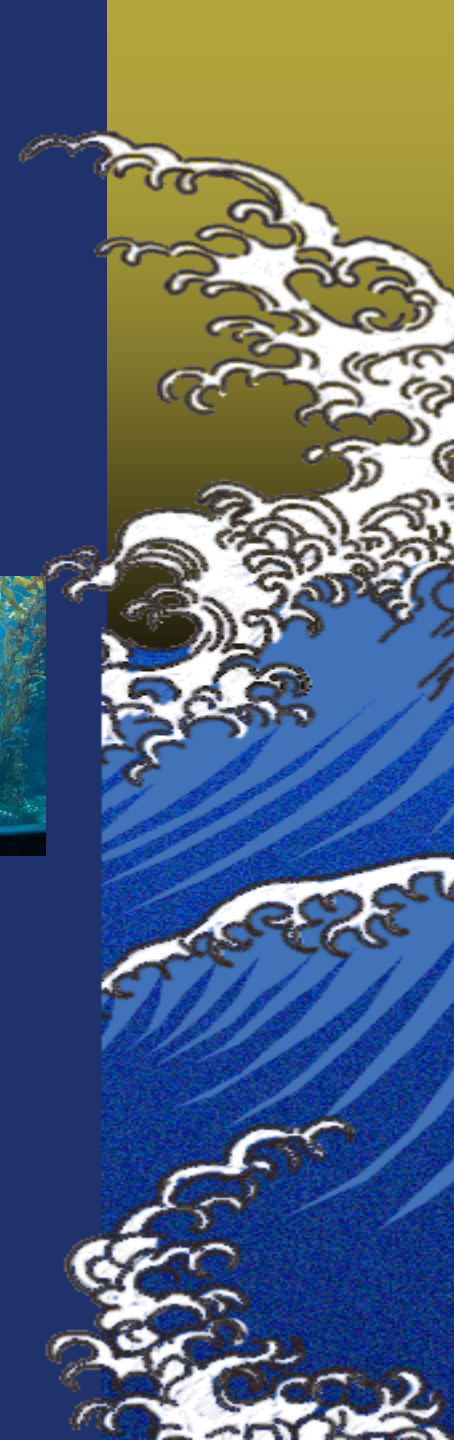
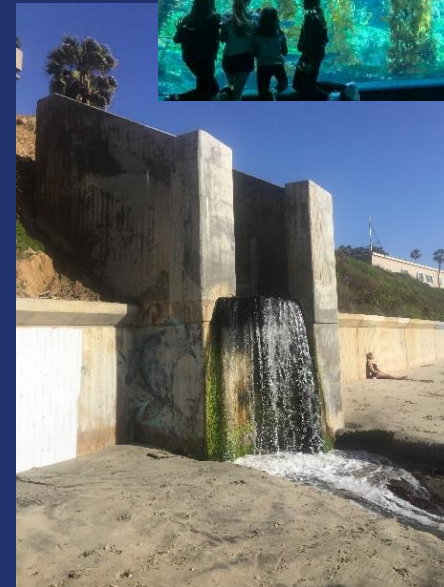


Regulatory Background

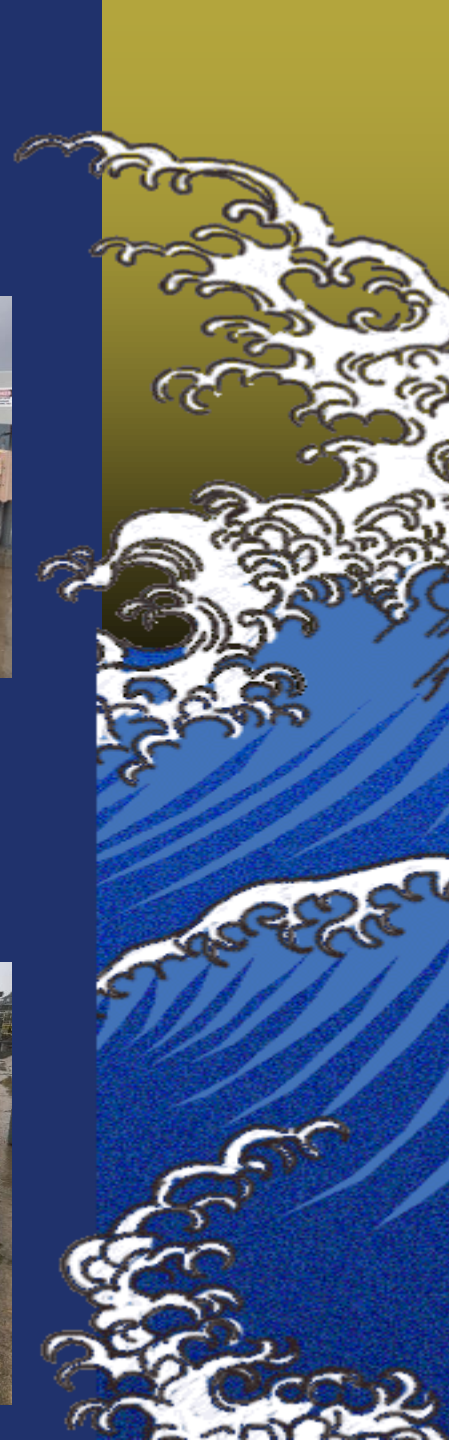
- ▲ 2005 NPDES Permit, 19 Conditions
 - ▲ Definition of “Natural Water Quality”
 - ▲ Dilution and Dispersion Study
 - ▲ Toxicity Testing
 - ▲ Revised WET TU to TST reporting
 - ▲ Outfall and Receiving Water Monitoring
 - ▲ Other Special Studies
 - ▲ Surf zone bacteriological study
 - ▲ Benthic marine life survey
 - ▲ Bioaccumulation study (Mussels and Sand Crabs)
 - ▲ Controls to prevent the discharge of chemicals or the release of exotic species



Seawater System and Outfalls

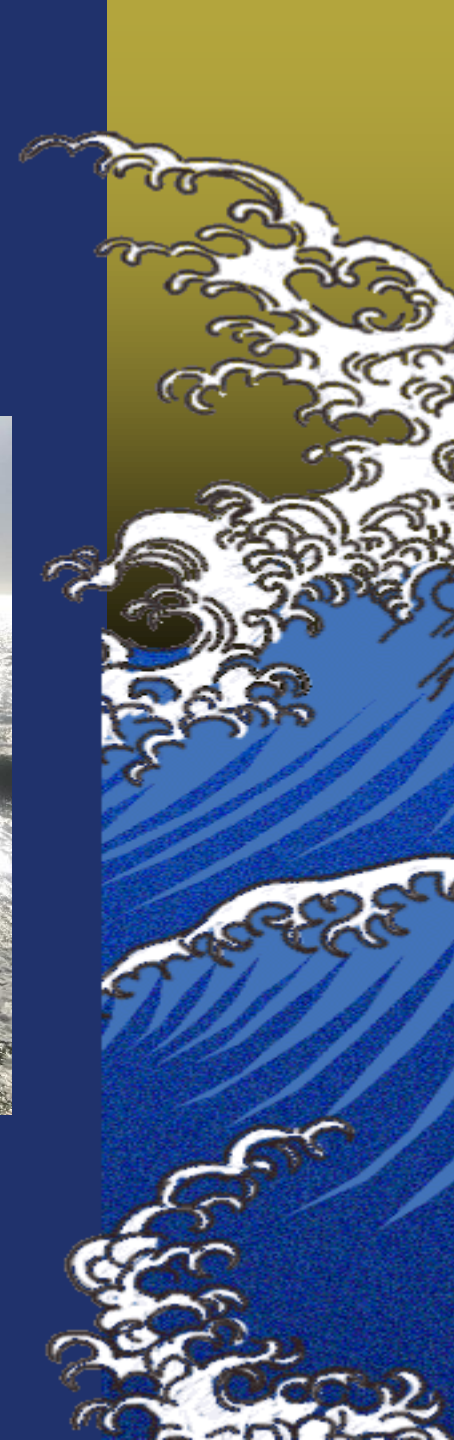


NPDES Dry and Wet Weather Sampling



Natural Water Quality

- ▲ “Natural water quality” within ASBS must not be altered as a result of discharges
- ▲ An advisory committee established by the SWRCB to define and evaluate “natural water quality”, includes:
 - ▲ State and Regional Board staff
 - ▲ Marine scientists, including an SIO representative
- ▲ Committee reviewed SIO monitoring data and marine studies from 2006-2009, SCCWRP findings report in 2010



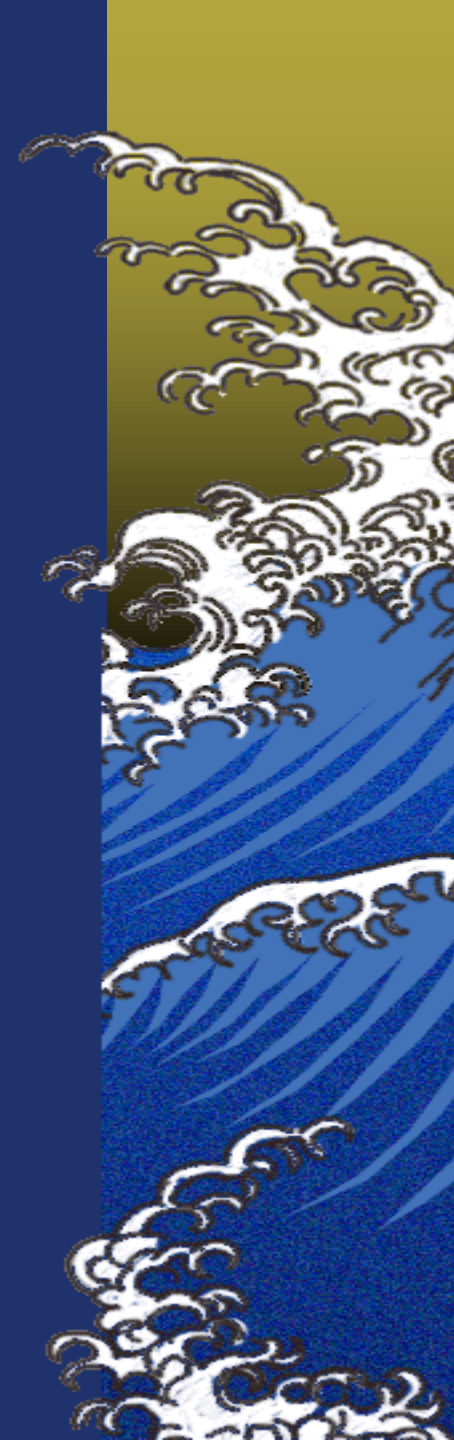
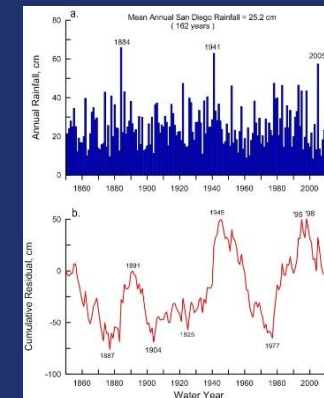
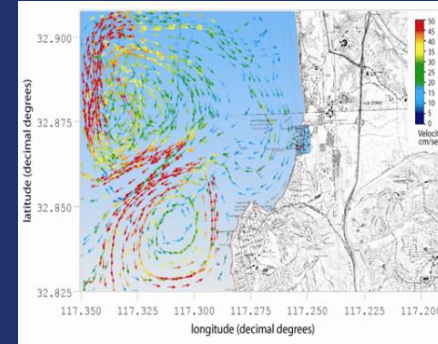
NWQC Summation of Findings

- ▶ Definition of NWQ: Sustains marine ecosystem, free from man-made constituents and non-indigenous species
- ▶ Establishes Reference conditions vs. Discharge for NWQ determination
- ▶ 3 Questions: OP Limits met for SIO, Biological Community, and Water Quality (informed Bight '08, 85th percentile for post-storm reference)
- ▶ TCDDs ubiquitous, discharges outside ASBS, other method limitations: Total Residual Chlorine, Toxicity



Dilution & Dispersion Model

- ▶ Quantitative dilution assessment developed by Dr. Scott Jenkins, SIO, using the SEDXPOR hydrodynamic modeling system
- ▶ Model incorporates water mass and boundary properties (bathymetry, salinity, temperature, ocean level/tides) and forcing functions (waves, currents, and winds)
- ▶ Modeled outcomes during peak storm water discharge and stagnant to storm sea conditions
- ▶ Submitted to SWRCB and RWQCB; UCSD first permit to receive a dilution credit



Dilution & Dispersion Model

Based on the results of this study (model generated 7,523 separate simulations of dilution fields), the dilution factor in the NPDES permit was revised from 2:1 to 7:1

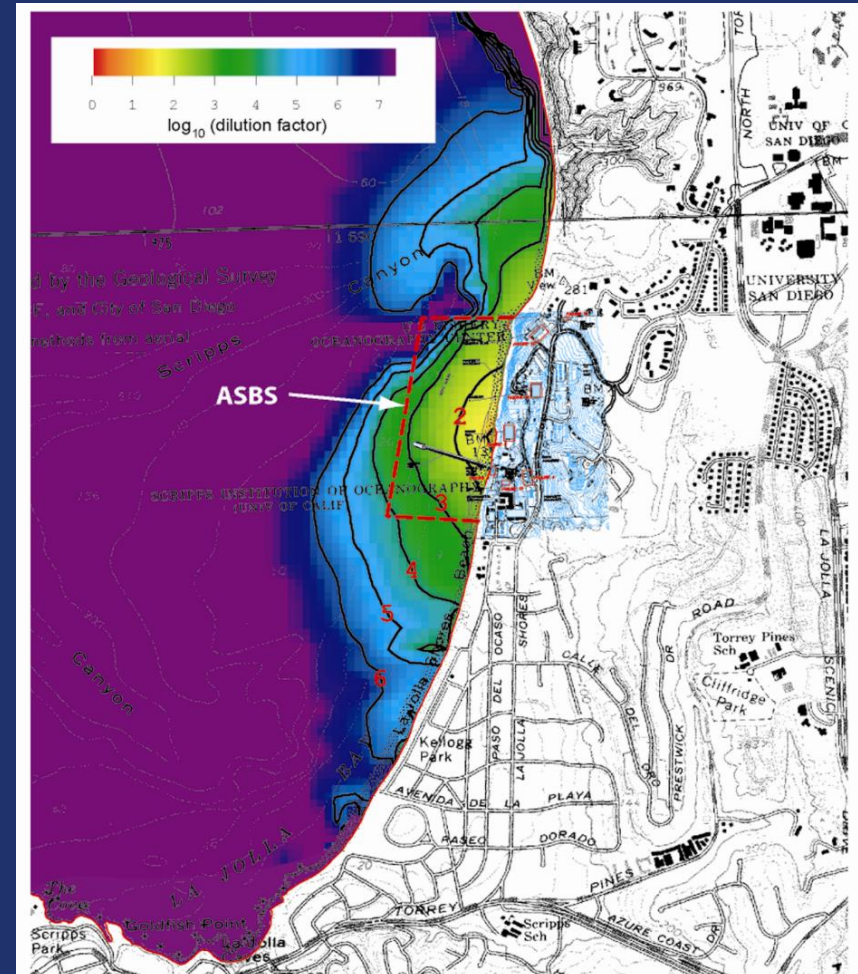
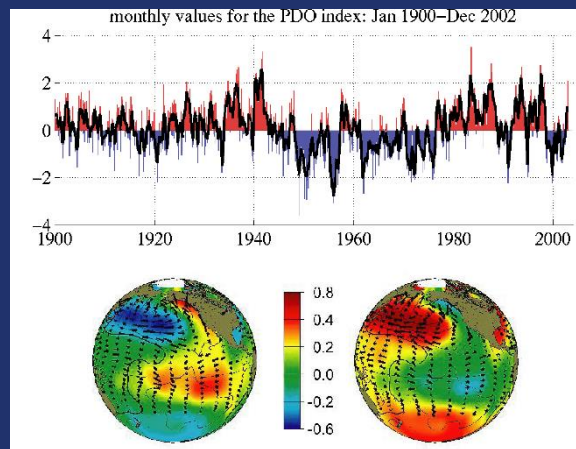
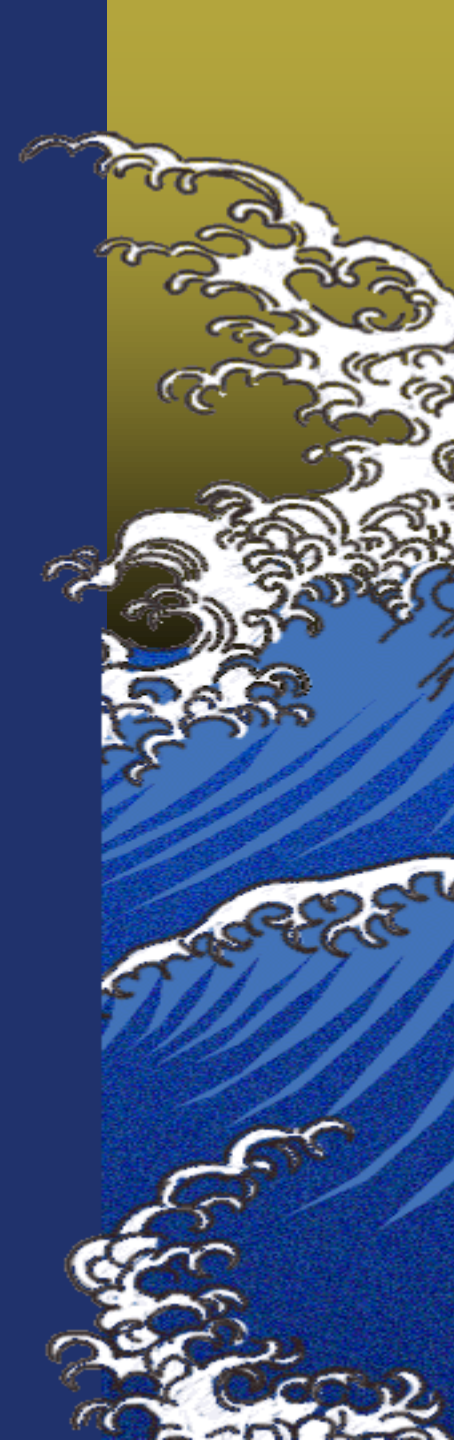


Figure . Wet weather worst-case: Outfall-001 = 5700 gpm stormwater, 486 gpm seawater. Outfall-002 = 200 gpm stormwater. Outfall-003 = 139 gpm seawater, Outfall-004a/b = 97 gpm seawater. Waves: $H = 2$ m; $T = 15$ s; $\alpha = 285^\circ$. Wind = 18 kts.



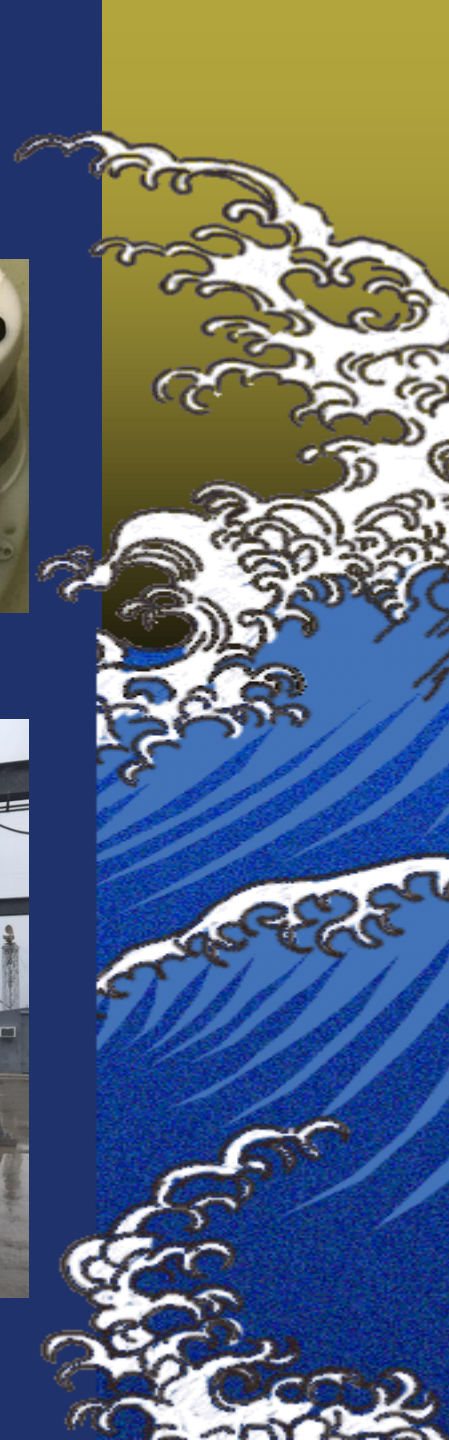
Toxicity Method Revisions

- ▶ Whole Effluent Toxicity (WET) and Toxic Unit reporting
 - ▶ Earlier method reporting did not accurately take into account control variability
 - ▶ Giant kelp (germination and fertilization)
 - ▶ Purple sea urchin (fertilization) bioassays
- ▶ Toxicity Statistical Test (TST)
 - ▶ The EPA TST method in the latest NPDES Permit provides more statistical relevance
 - ▶ Dilution study revised the in-stream waste concentration (IWC) to 14% effluent and TST method requires a “pass” with no greater than a 50% effect relative to the control



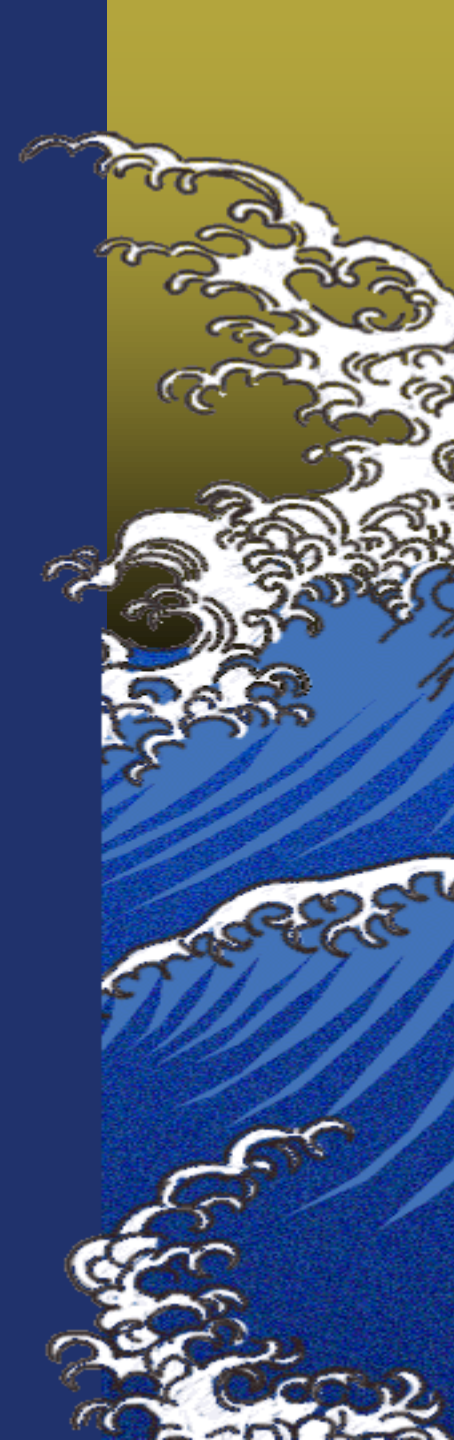
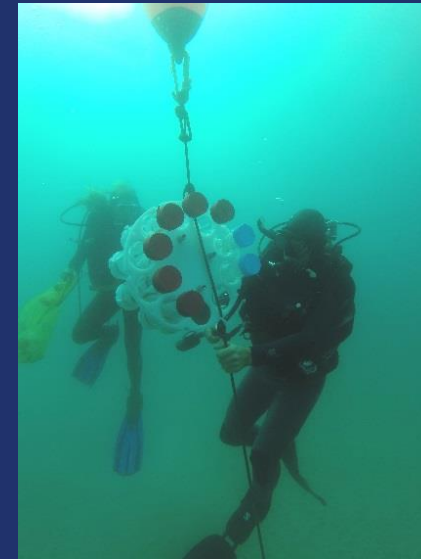
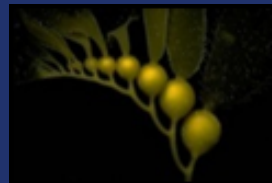
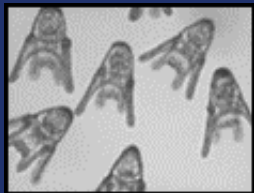
Ongoing Innovative Monitoring

- ▶ SEA-Ring™ In situ Testing
- ▶ Pulsed Studies
- ▶ Salinity mapping
- ▶ Harmful Algal Blooms
- ▶ Regional Monitoring
 - ▶ Bight '18 Program

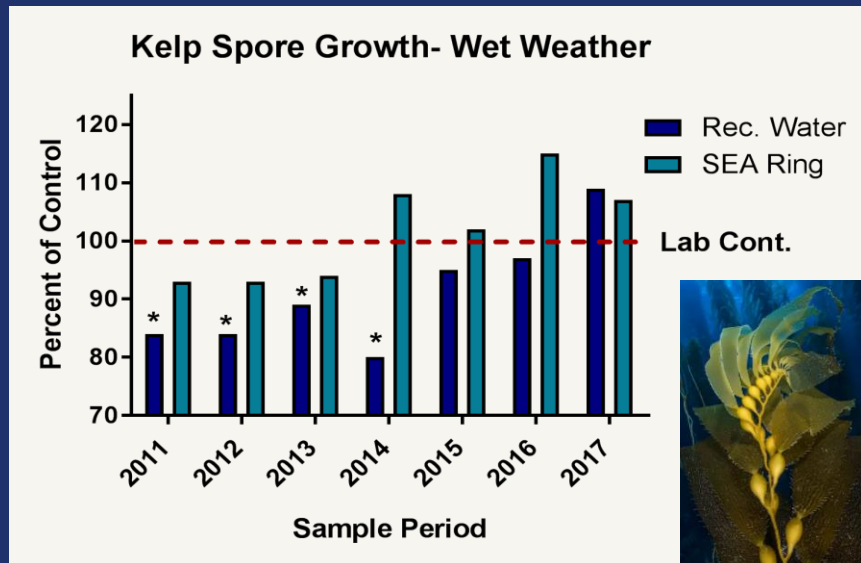


SEA-Ring™ In-Situ Testing

- Exposes animals to natural site conditions
- Incorporates stressors impossible to mimic in a lab
- No sample storage effects
- Challenges include exposure to confounding factors (HABs, physical disturbance, predation, salinity, temperature)



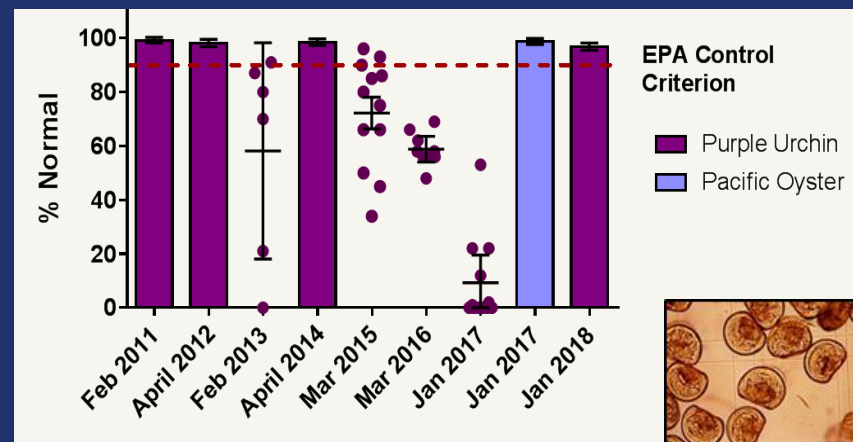
SEA-Ring™ In-Situ Results



Kelp growth *in situ* is typically greater than laboratory receiving water tests

Pacific oyster and purple urchin in-situ testing has been subject to physical disturbance, algal blooms, and predation

Purple Sea Urchin and Pacific Oyster Embryo Development



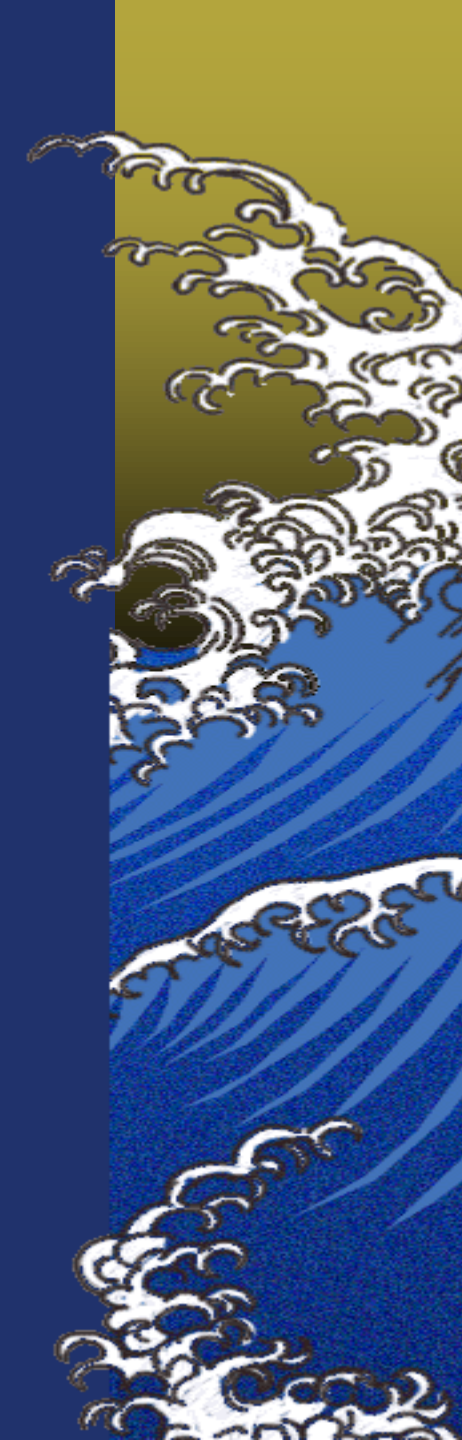
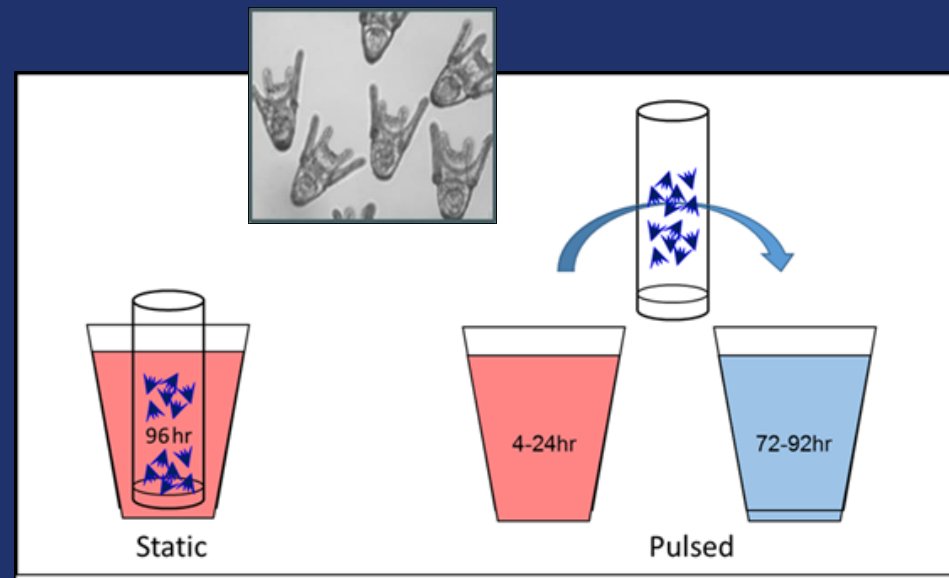


Pulsed Studies



- UCSD-SIO NPDES permit requires standard Whole Effluent Toxicity (WET) Testing for storm water discharges
 - 72-96 hour exposure during most sensitive period of development

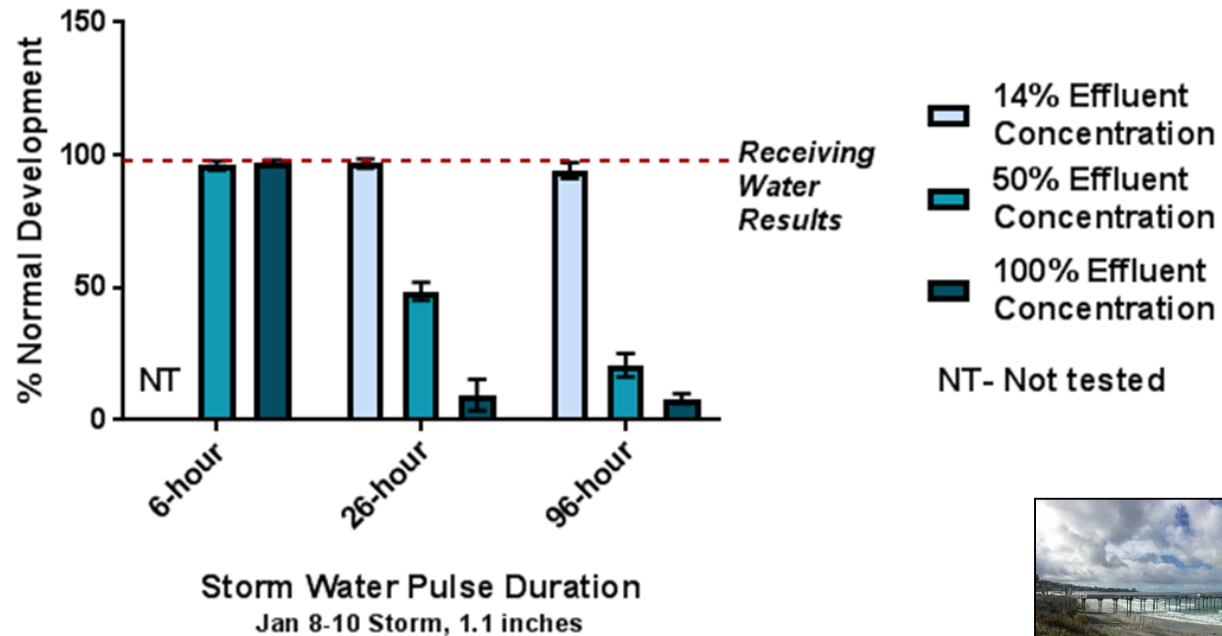
Pulsed study method designed to mimic episodic exposure to storm water



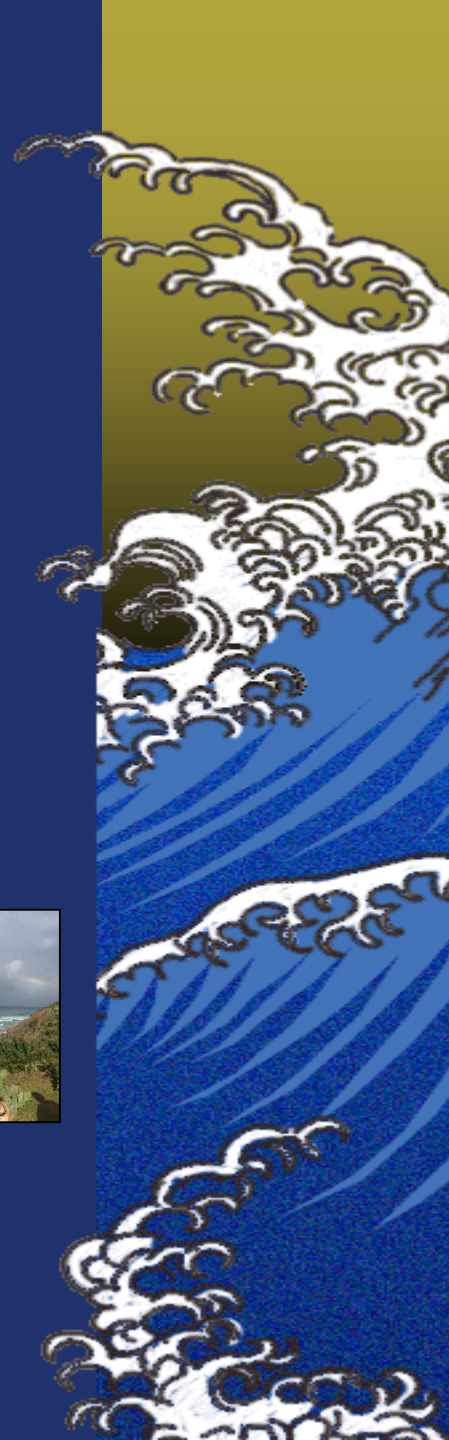
Pulsed Studies



Pulsed Study: Purple Sea Urchin Embryo Development



A greater incidence of abnormal embryo development was observed with increasing effluent exposure in both duration and concentration



Conclusions

- ▶ Natural Water Quality Committee findings applicable to other ASBS permittees
- ▶ Quantitative site-specific dilution study revised permit limits and guided BMP implementation
- ▶ Toxicity Statistical Test provides more statistically-relevant outcomes
- ▶ Ongoing Special Studies aid regulatory acceptance and permit renewal, and supports regional monitoring efforts



