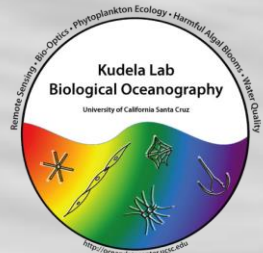
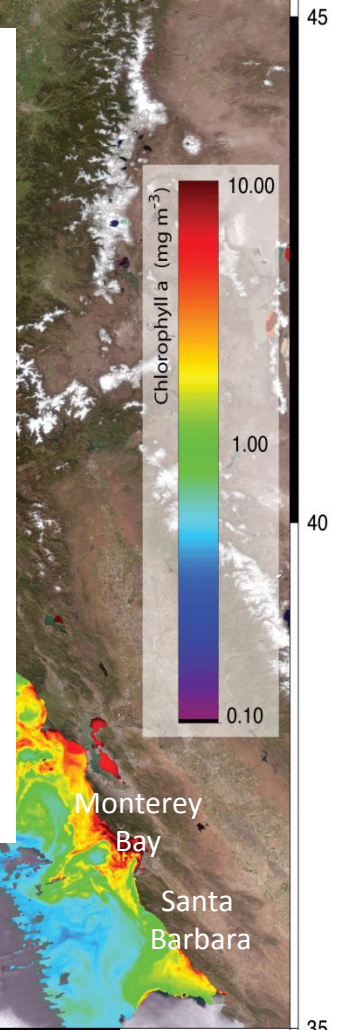
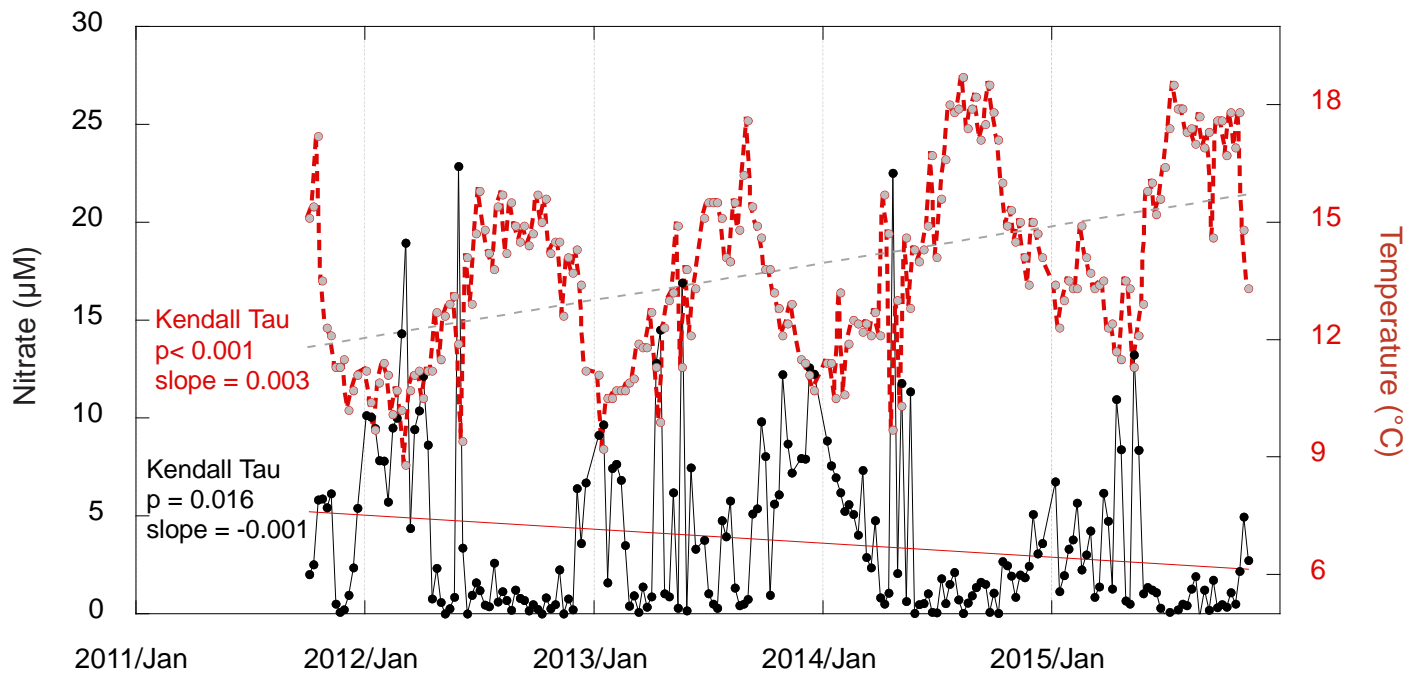
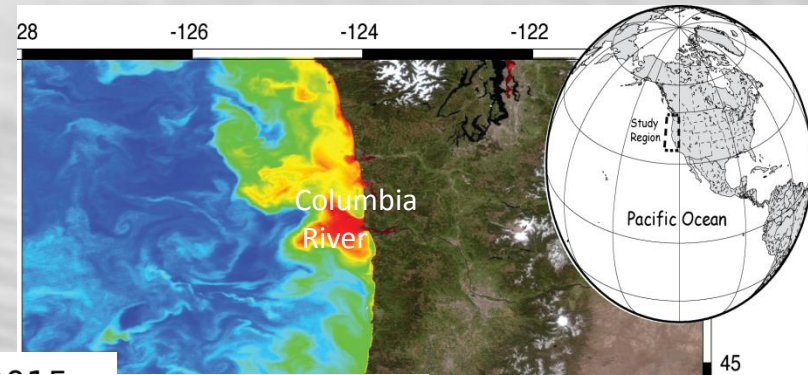


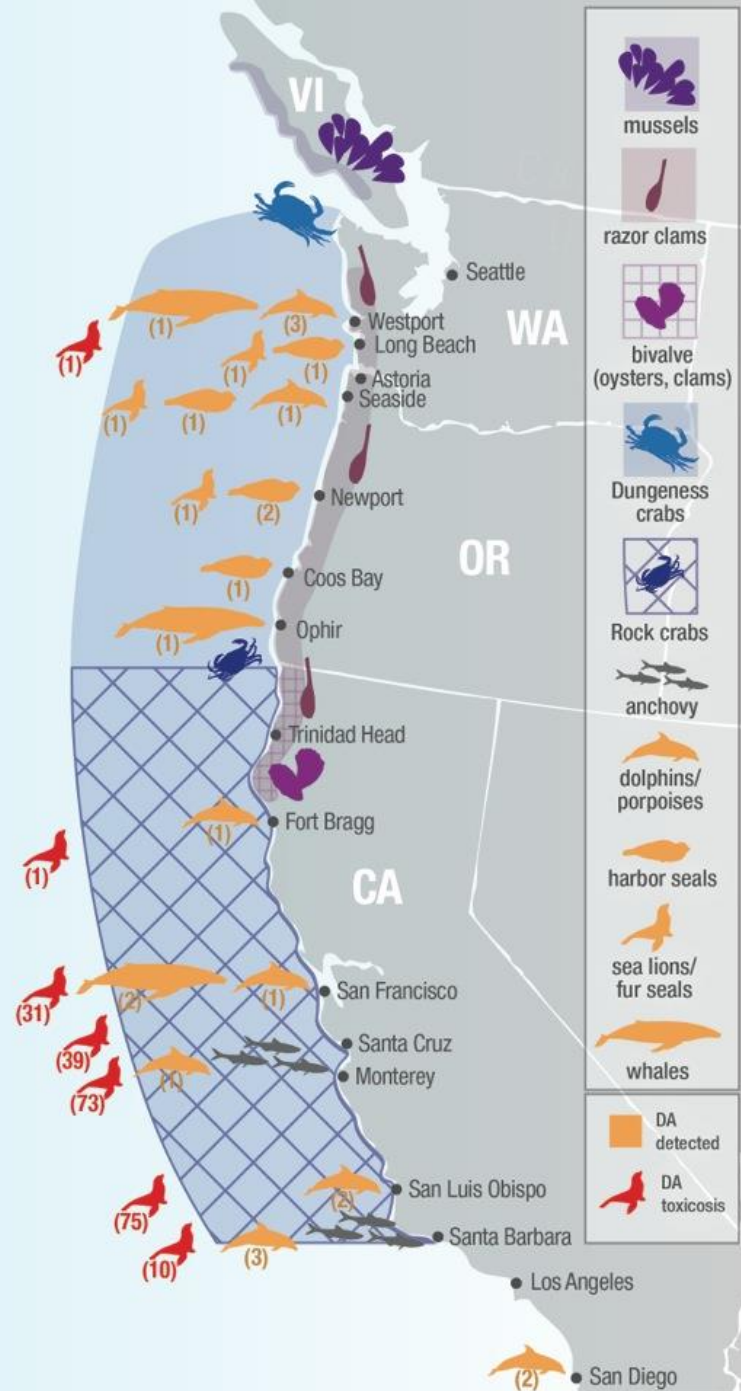
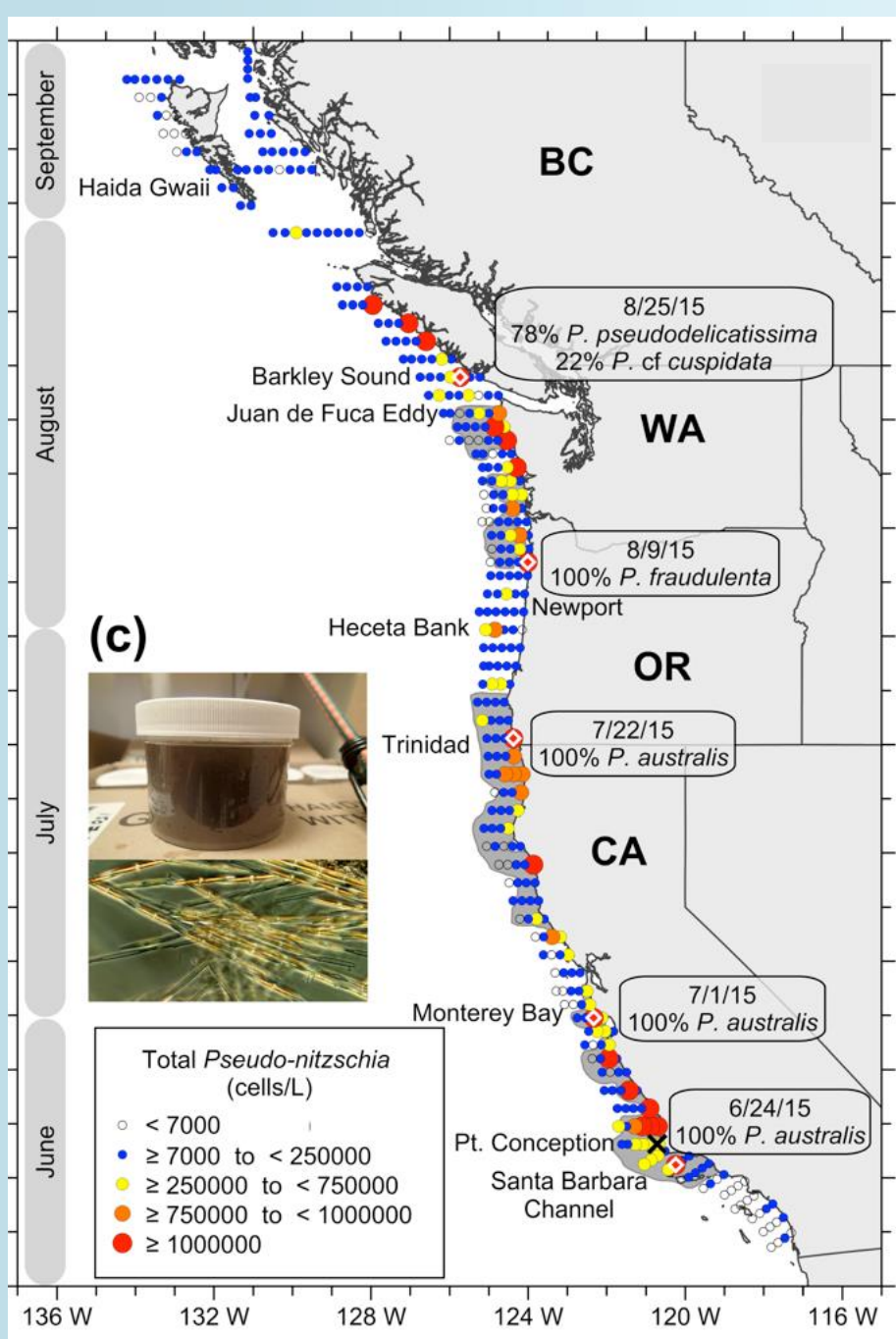
The West Coast Bloom and Domoic Acid: Lessons Learned, Future Prognosis

Raphael Kudela & Clarissa Anderson
University of California Santa Cruz



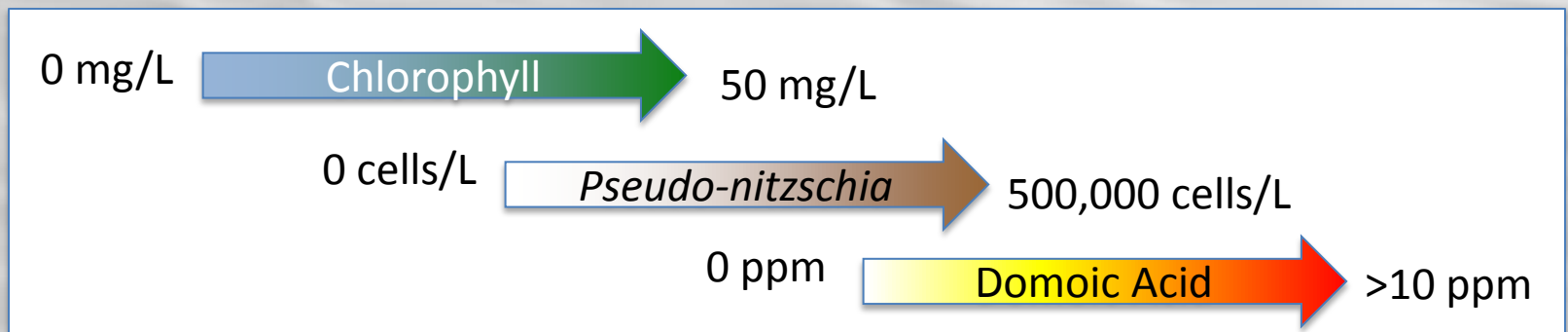
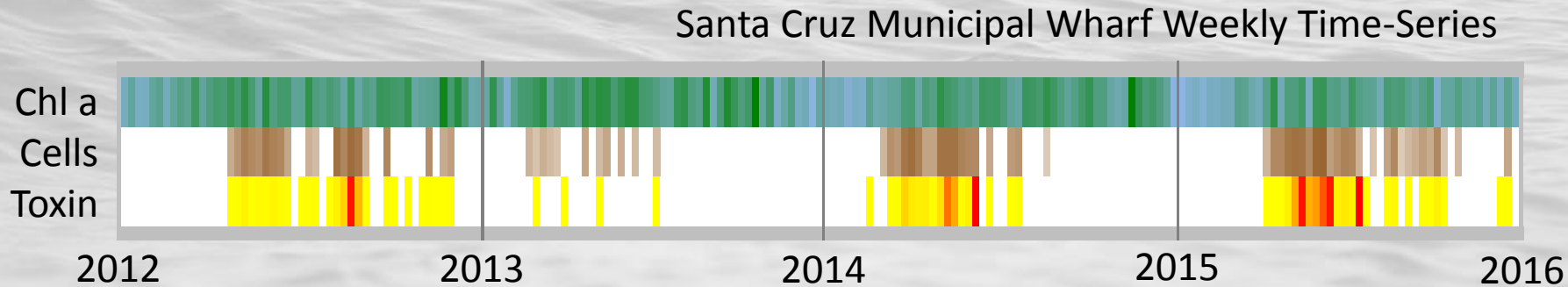
Upwelling Drives Abundance & Diversity





What Happened in 2015?

Blooms occur most years, but the combination of the warm blob and El Niño set up perfect conditions along the entire west coast....



Toxin Saturated the Food Web



Rockfish
Market Squid
Ling Cod
Halibut



King Salmon
Coho Salmon
Mackerel
Sardinops

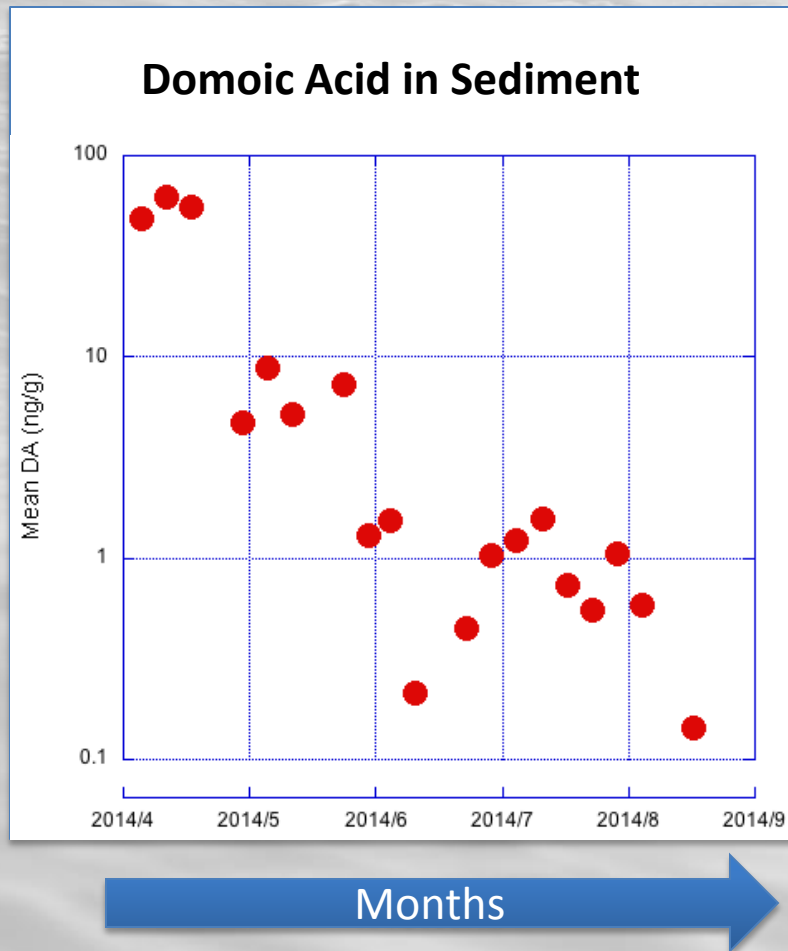


0.03 - 15 ppm



Anchovy = 100 – 600 ppm
Razor Clam = 340 ppm
Mussels = 200 ppm

Toxins Accumulated in the Benthos



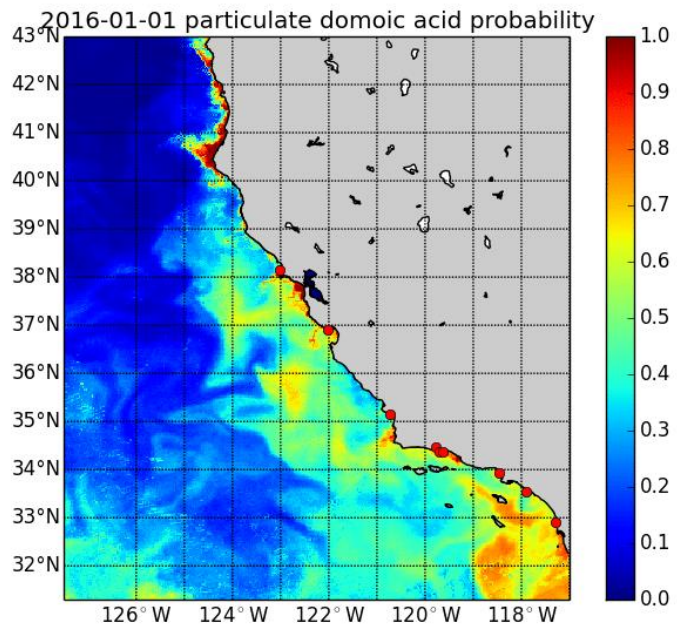
Rock Crab = 1000 ppm

Dungeness = 270 ppm

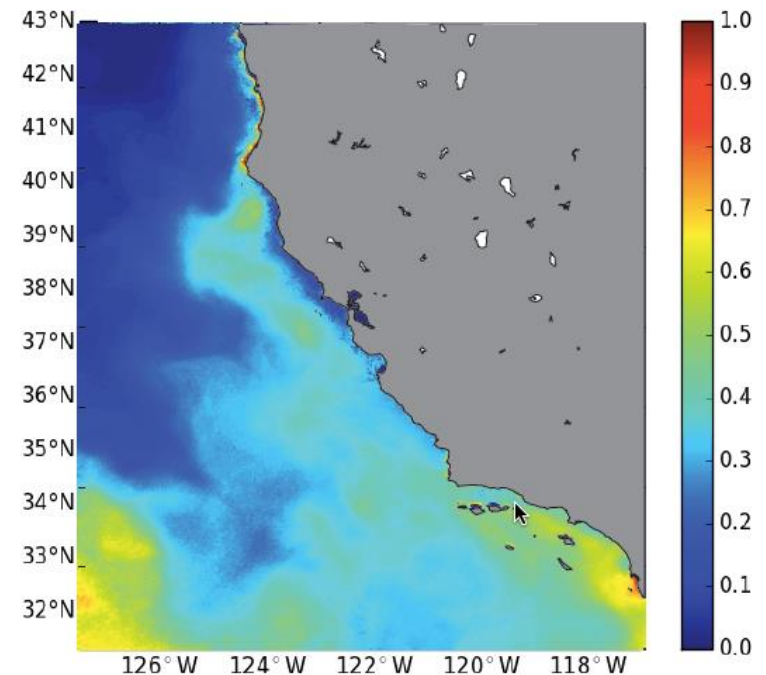
Toxin concentrations continued to increase months after the bloom dissipated....

Model Predictions Track Closures

Real-Time Model

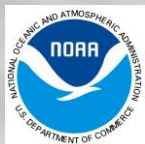


Time-Averaged

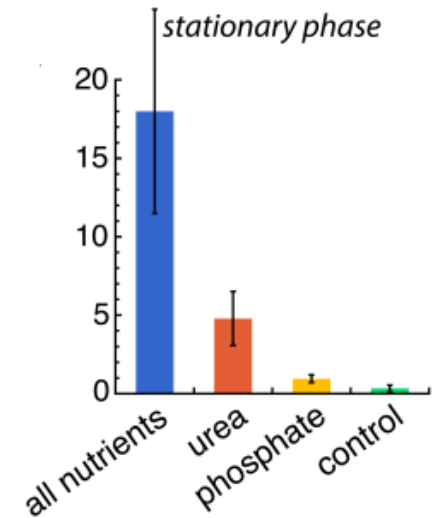
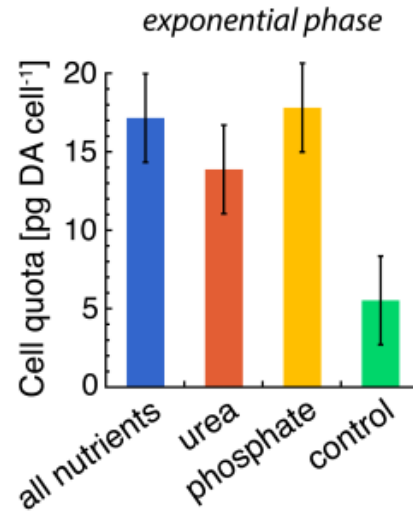
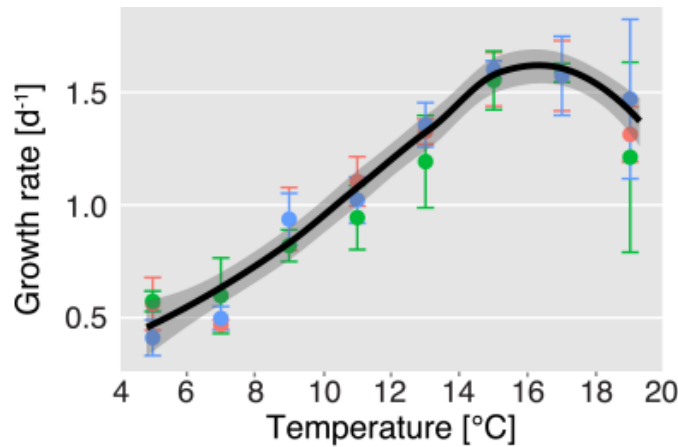


<http://www.cencoos.org/data/models/habs>

Toxin Probability, Oct-Nov 2015



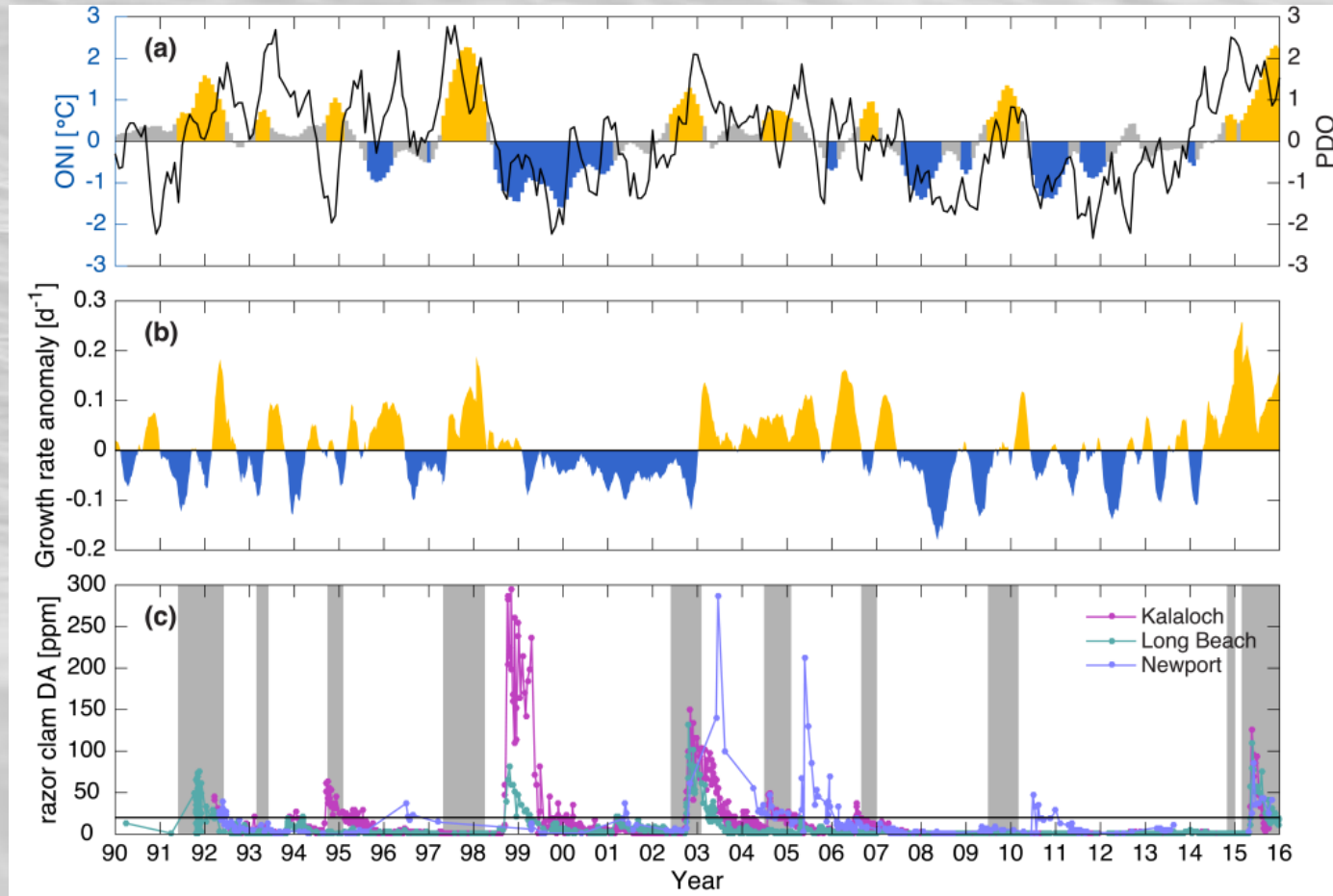
Prediction for 2016 and Beyond



Pseudo-nitzschia does VERY WELL in warm water...

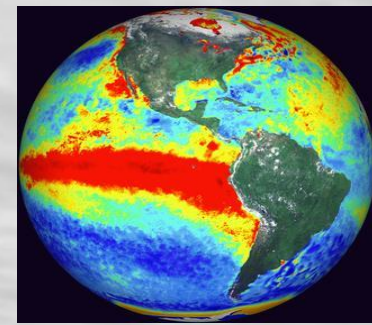
... and becomes MORE TOXIC when given excess nutrients.

Prediction for 2016 and Beyond



Toxic Events track warm anomalies
(El Niño, Pacific Decadal Oscillation, Warm Blob)

Living With a Warmer Ocean



- The 2015 “super bloom” was set up by unusually warm conditions and injection of nutrients from upwelling
- Toxin accumulates in the environment and can persist for months after a bloom
- La Niña would probably dampen the blooms, but runoff could provide a source of nutrients, making blooms more toxic
- A warmer Eastern Pacific with localized upwelling would (statistically) increase the chance of more large-scale bloom events in the future

Thank You

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