
Nutrients in San Francisco Bay: A Regulatory Overview

BACWA Annual Meeting
January 27, 2011

Thomas Grovhoug, LWA



Eutrophication

“The enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned.” European Union, 1991

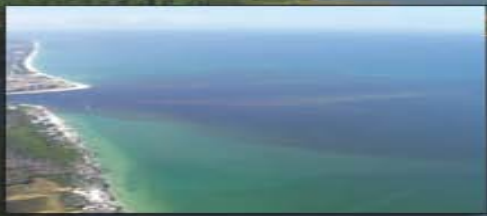


What are potential effects of Eutrophication in estuaries?

- Aesthetic impairment
- Dissolved oxygen depressions
- Fish kills
- Toxicity
- Harmful Algae/Toxins
- Degraded biological communities
- Food web disruption
- Drinking water concerns – taste and odors

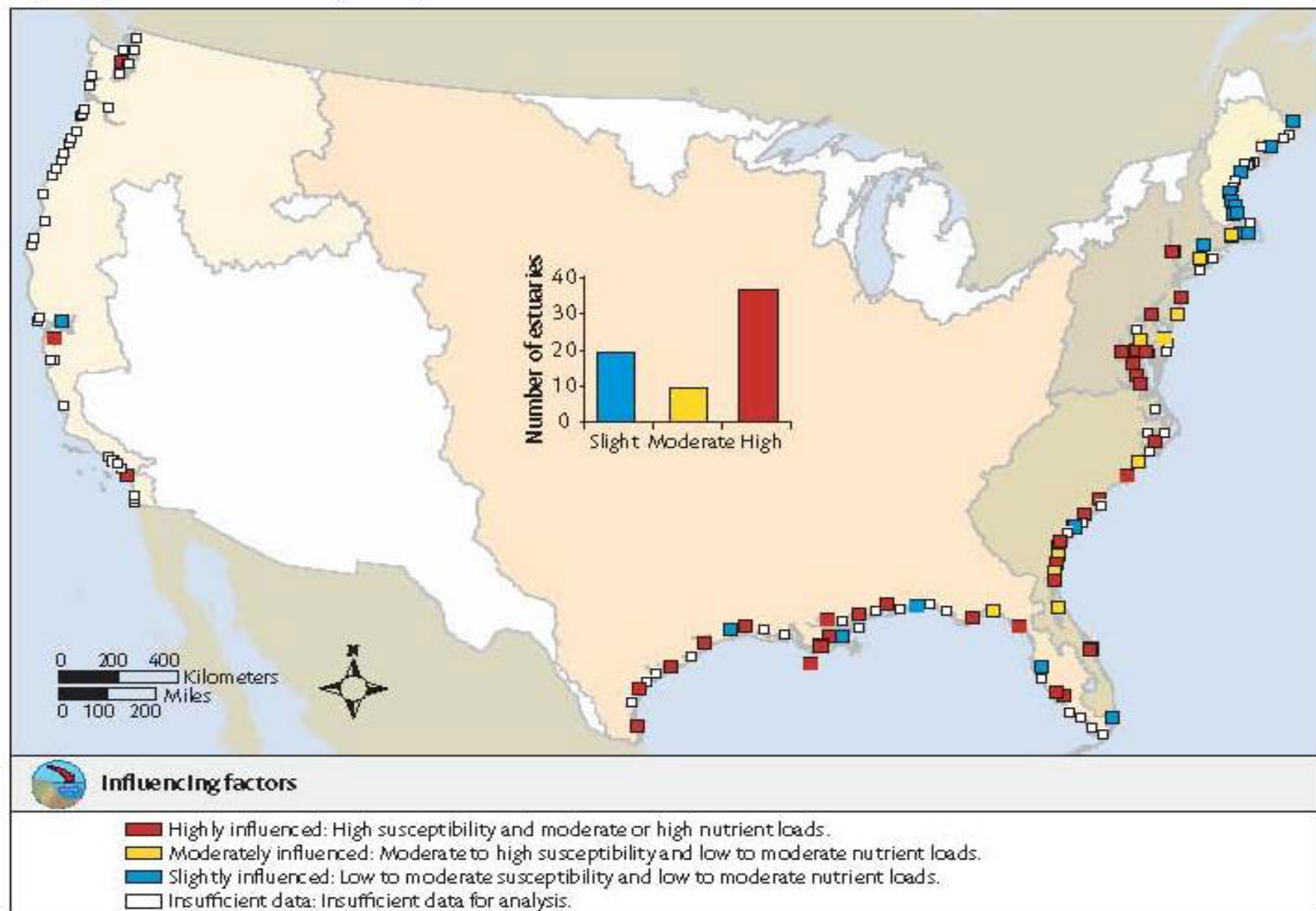


EFFECTS OF NUTRIENT ENRICHMENT IN THE NATION'S ESTUARIES: *A Decade of Change*



**National Estuarine Eutrophication
Assessment Update**

Figure 3.7. Factors influencing eutrophication on a national scale.



NOAA (2007): National Results

Figure 3.1. Number of estuaries in each of the overall eutrophic condition categories.

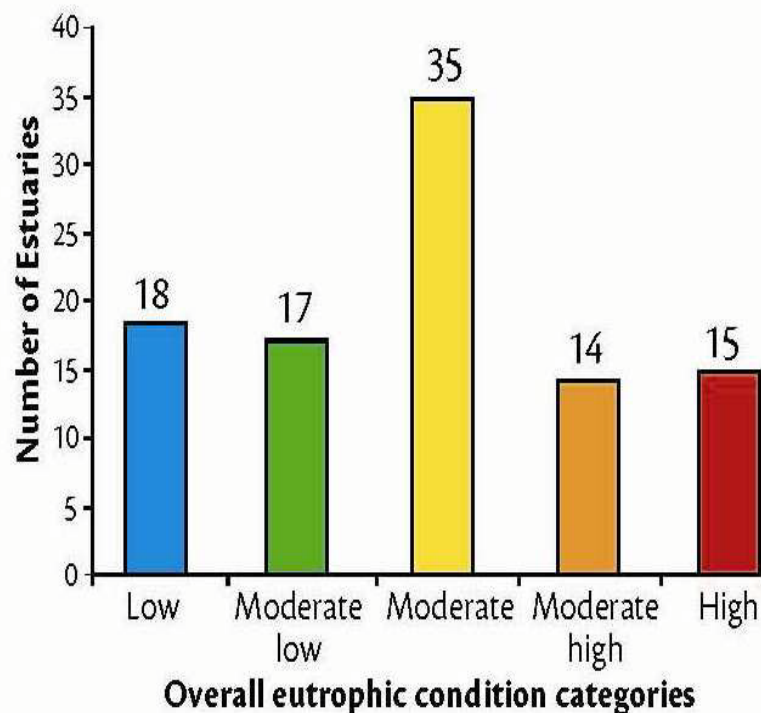
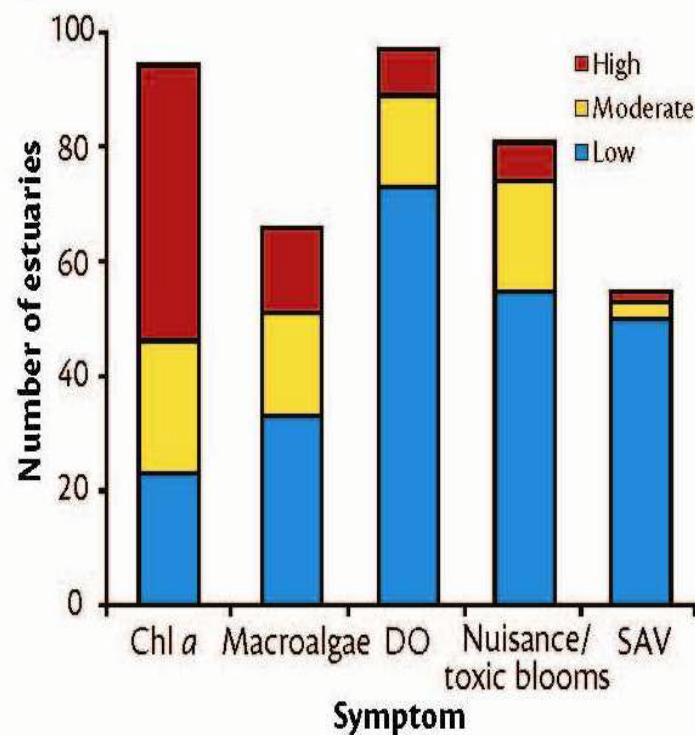


Figure 3.2. Distribution of symptoms and symptom expressions.



Nutrients: USEPA policy direction

- 1998: National strategy for development of regional nutrient standards
- 2001: National Action plan, recommended “ecoregional” criteria for estuaries and coastal waters
- 2007: Memo encouraging all States to adopt numeric nutrient standards

Current Initiatives from USEPA

- Federal Rulemaking (2010): Numeric Nutrient Standards for State of Florida – Lakes and Streams
- Federal Rulemaking (2012): Proposed Nutrient Standards for State of Florida – Estuaries
- Legal actions pending in other states

Redefinition of Secondary Treatment under Clean Water Act

- 2007 petition filed by NRDC with USEPA

Asks USEPA to amend the secondary treatment requirement to impose effluent limits of 0.3 mg/l total phosphorus (Total P) and 3 mg/l total nitrogen (Total N)

- Under review by USEPA

SWRCB Nutrient Guidance

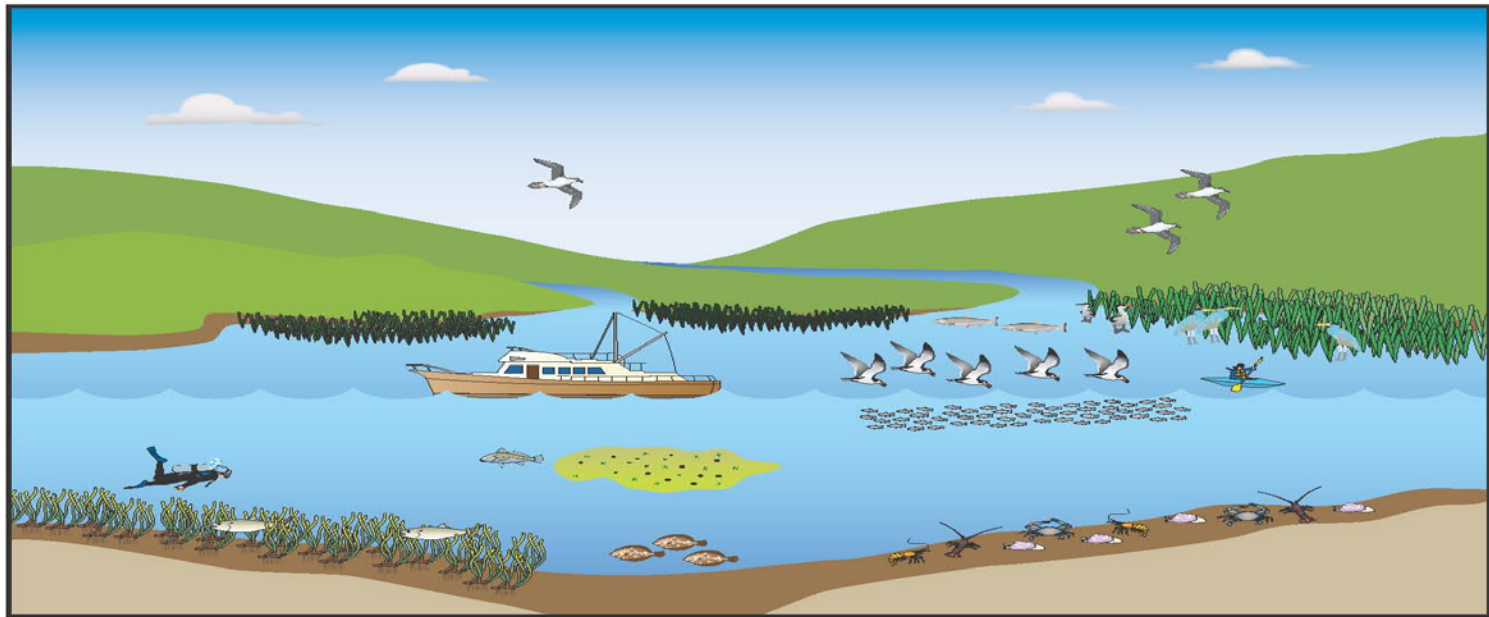
Nutrient Numeric Endpoints (NNE)

Purpose: Provide scientifically defensible framework that can serve as guidance for adopting numeric nutrient criteria.

- Coastal Estuaries (2006)
- SF Bay (2010)

TECHNICAL APPROACH TO DEVELOP NUTRIENT NUMERIC ENDPOINTS FOR CALIFORNIA ESTUARIES

FINAL
MARCH 2007



Prepared for:
US EPA Region IX
(Contract No. 68-C-02-108)

California State Water Resources Control Board
Planning and Standards Implementation Unit

Prepared by:



Lafayette, CA

**Southern California Coastal Water
Research Project**

SWRCB NNE Approach

- Focus on biological response indicators [e.g. chlorophyll-a, DO, harmful algae]
- Weight-of-evidence approach based on multiple indicators
- Relies on models to translate “target thresholds” to numeric criteria

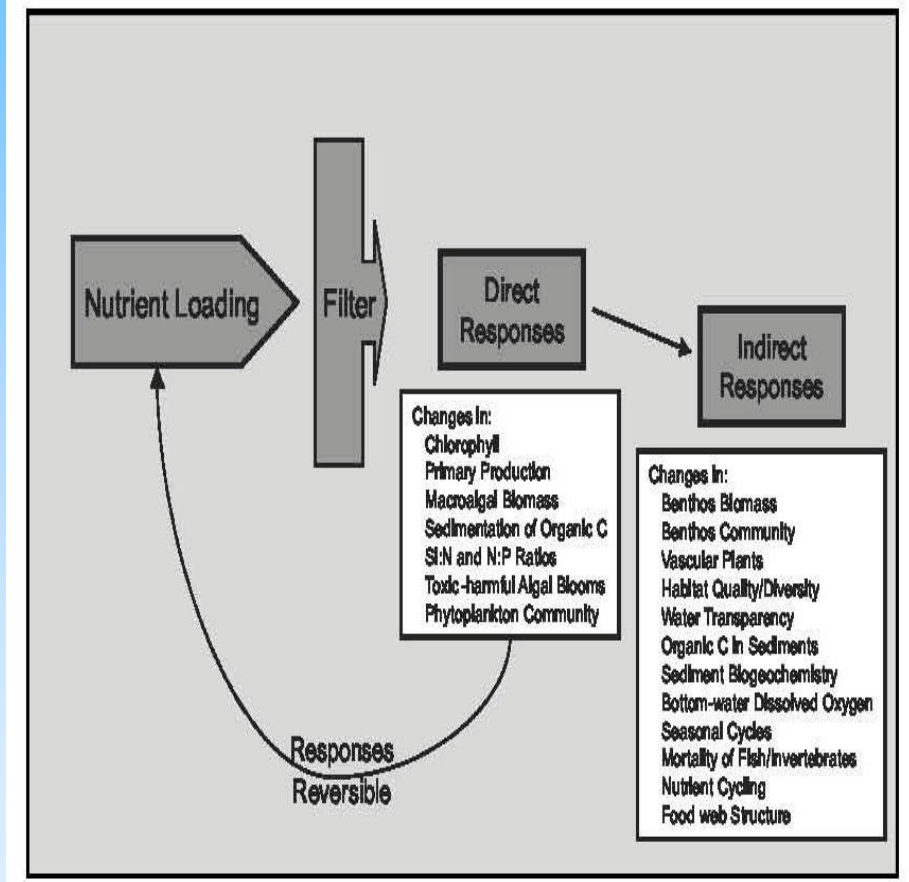
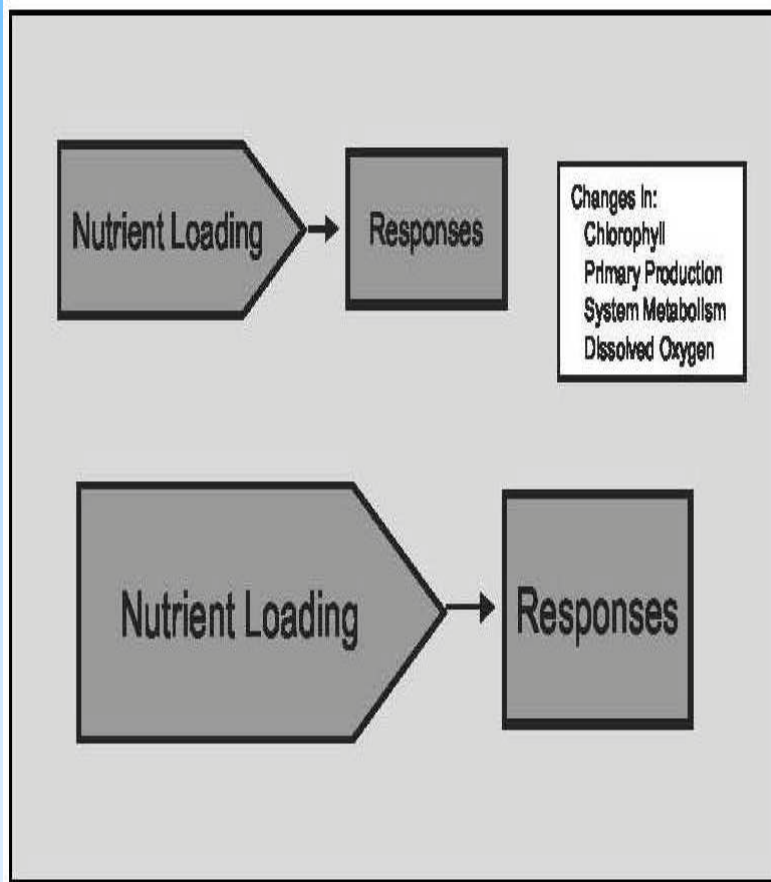
Ongoing Nutrient Activities in Bay/Delta

- USEPA Advanced Notice of Proposed Rulemaking (ANPR) in the Delta
- National Academy of Science panel on Delta stressors
- Delta Stewardship Council – Independent Science Board – Delta stressors
- Regional Board studies in Suisun Bay and Delta – impacts of ammonium on phytoplankton blooms

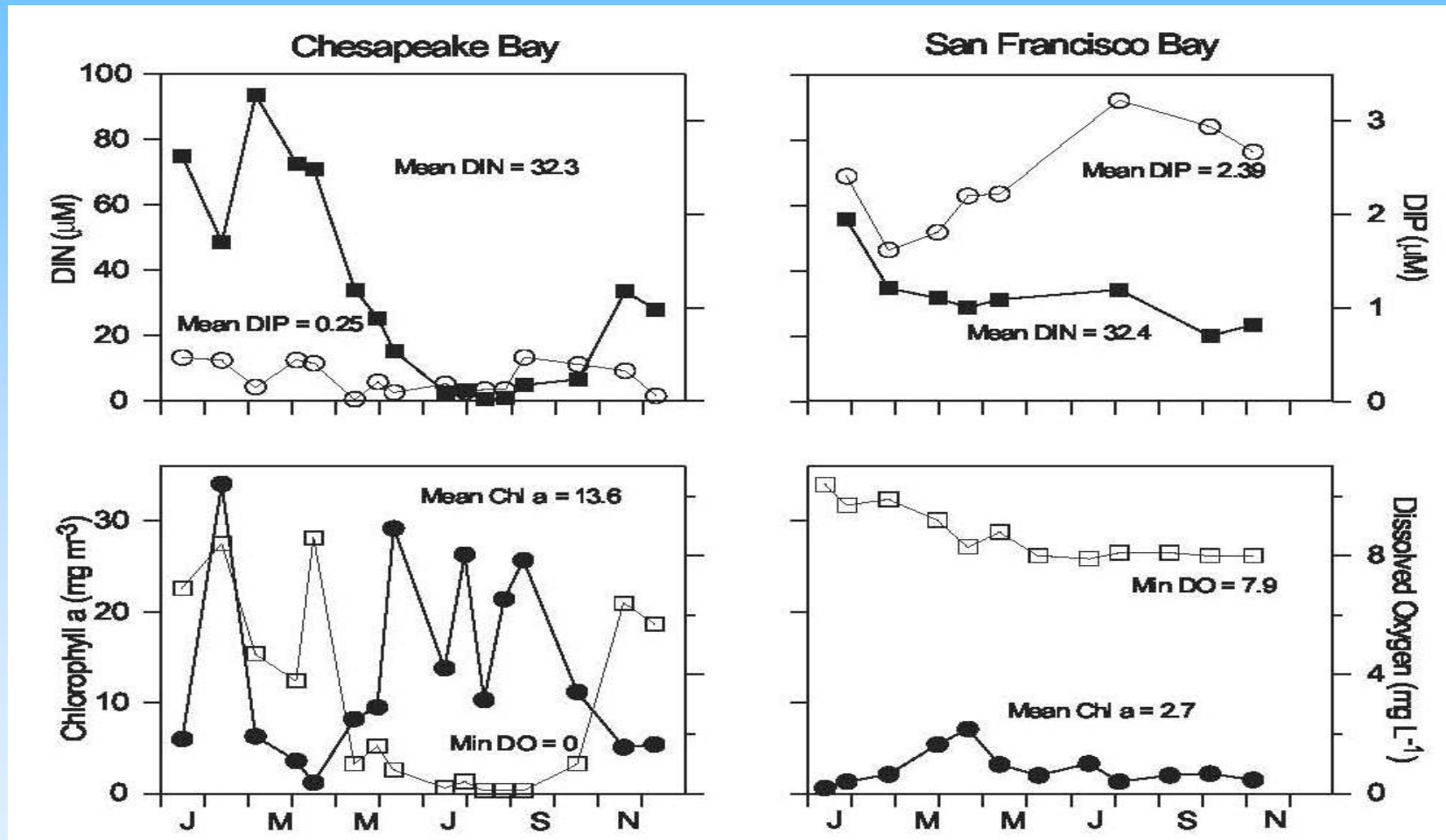
Nutrient effects in San Francisco Bay

- Long record of data collection by USGS and others (IEP, SFEI, DWR, etc)
- 2001 – James Cloern (USGS) conceptual model
- 2007 NOAA assessment – SFB case studies
- SFSU studies
- 2010 USGS – Lessons Learned from Four Decades...

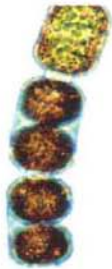
Estuaries respond differently to nutrient loadings



Nutrient Effects: Chesapeake Bay vs San Francisco Bay



San Francisco Bay Water Quality: Lessons Learned from Four Decades of USGS Observations



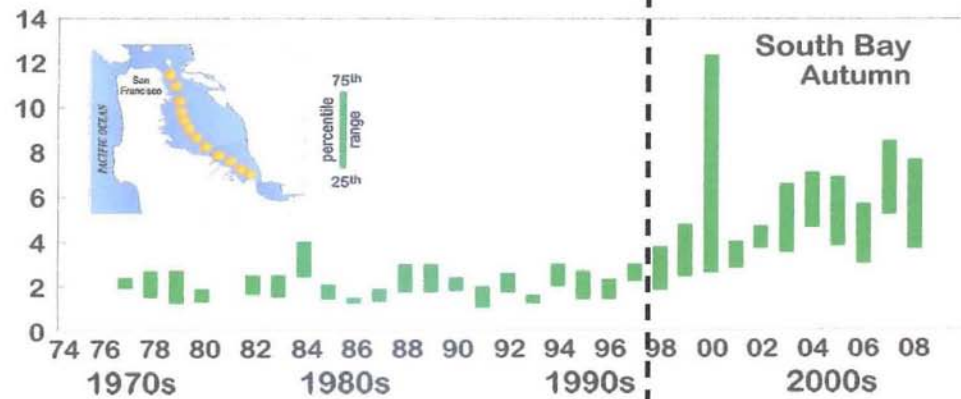
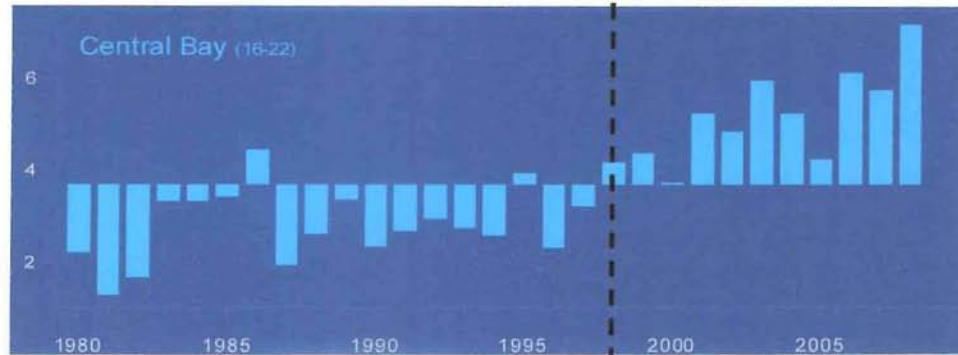
Tara Schraga, James Cloern, Sarah Foster, Caitrin Phillips

U.S. Geological Survey, Menlo Park, California

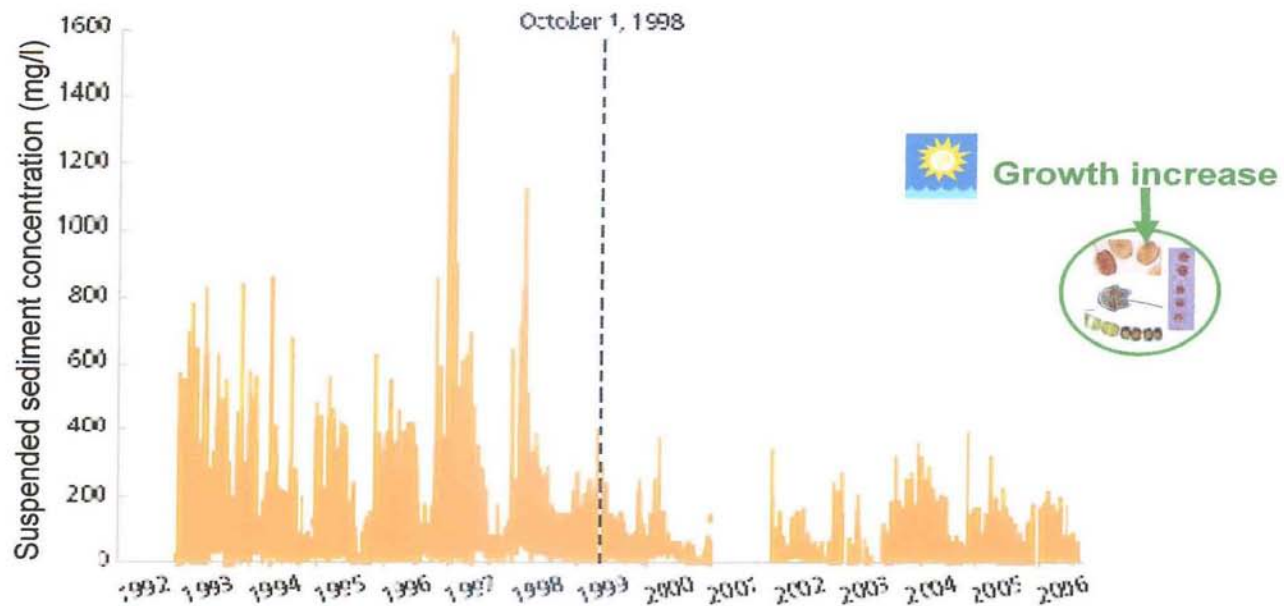


Chl-a increasing since 1998-99!

Annual Chlorophyll a (ug/l)



Water clarity increased due to the 40% decrease in suspended sediments

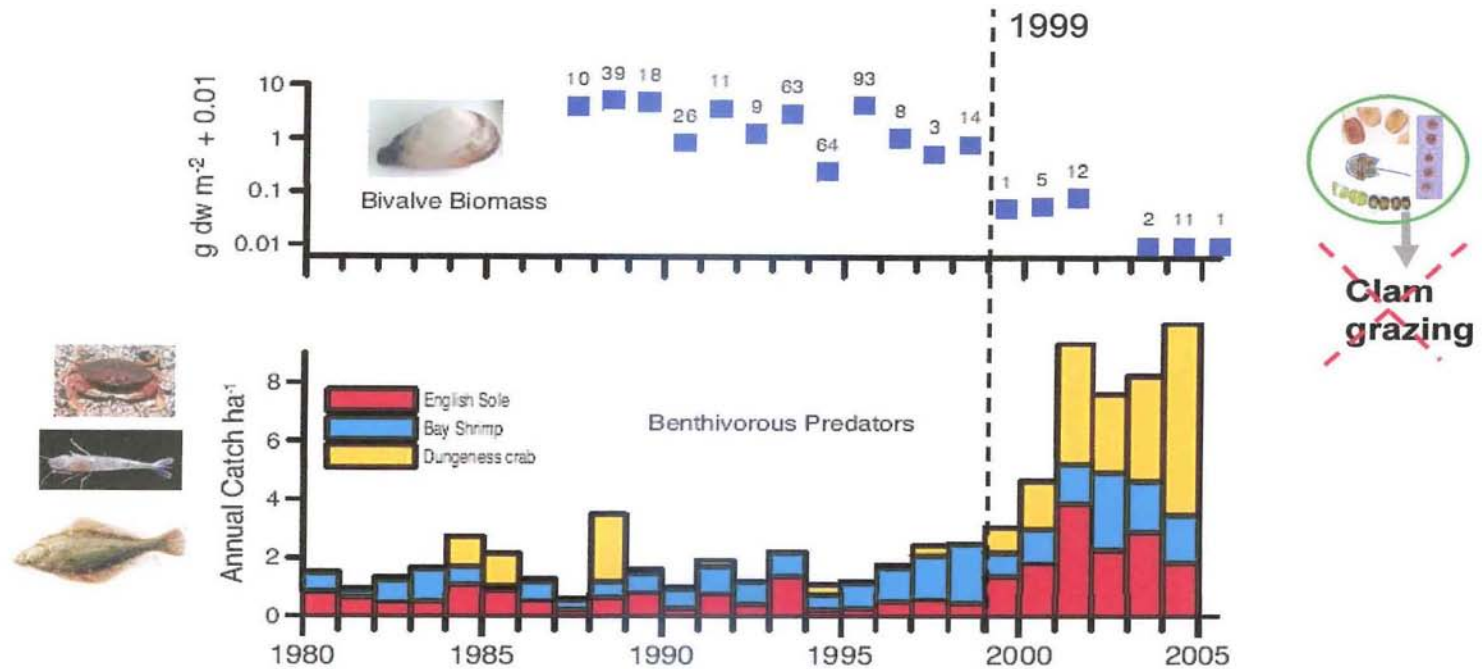


Dave is also funded by the NMN, see his talk today at 1:25pm room 17

"The increase in Bay water clarity is likely to persist"

From: Schoellhamer, D.H., 2009, Suspended Sediment in the Bay: Past a Tipping Point. 2009 The Pulse of the Estuary. San Francisco Estuary Institute. <http://www.sfei.org/rmp/pulse/2006/index.html>

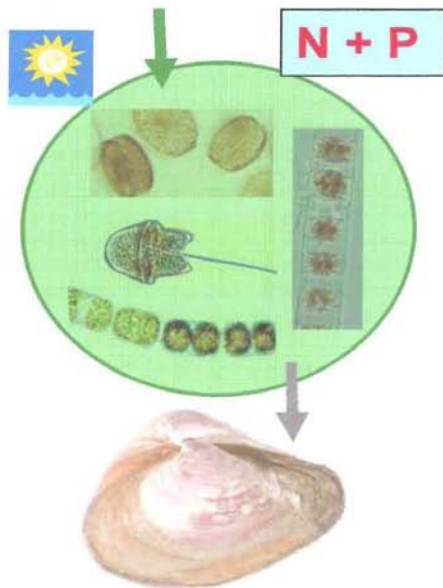
Decreased Clam Grazing (ie, the predator of my consumer is my ally)



From: Cloern, J.E., A.D. Jassby, J.K. Thompson, K. Hieb. 2007. A cold phase of the East Pacific triggers new phytoplankton blooms in San Francisco Bay. *Proceedings of the National Academy of Sciences of the United States of America* 104(47):18561-18566. <http://www.pnas.org/content/104/47/18561.full.pdf+html>

Then

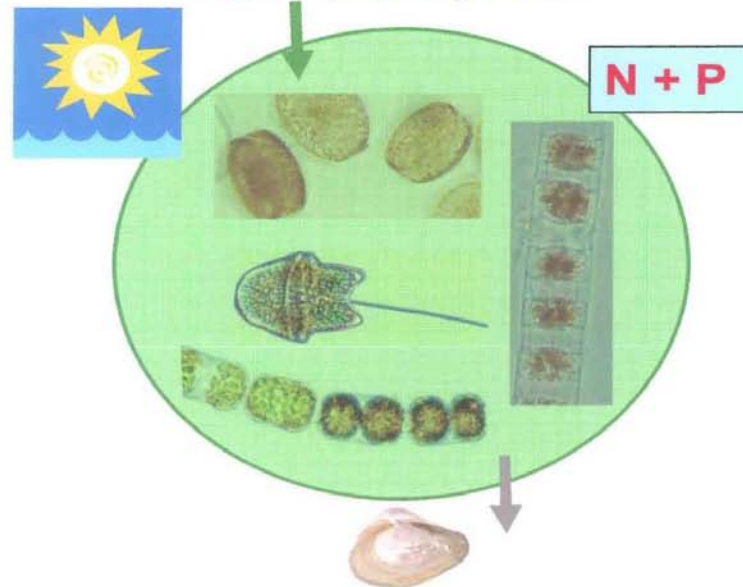
Higher turbidity/less light,
lower phyto growth



Higher clam grazing rates,
lower phyto growth

Now

Lower turbidity/ more light,
higher phyto growth



Lower clam grazing rates,
higher phyto growth

Factors influencing eutrophication in San Francisco Bay

- Nutrient levels, composition
- Turbidity, light availability
- Benthic grazing, introduced bivalves
- Benthic predators - demersal fish, crabs, shrimp (Pacific Decadal Oscillation, Northern Pacific Gyre Oscillation)
- Delta outflows, residence time
- Tidal energy, amplitude, stratification
- Climate change

Going Forward on Nutrient Issues for SF Bay/Delta

Needs

- Integrate ongoing activities
- Develop overarching scientific and regulatory strategies
- Develop appropriate tools and information
- Work collaboratively
- Consider innovative approaches

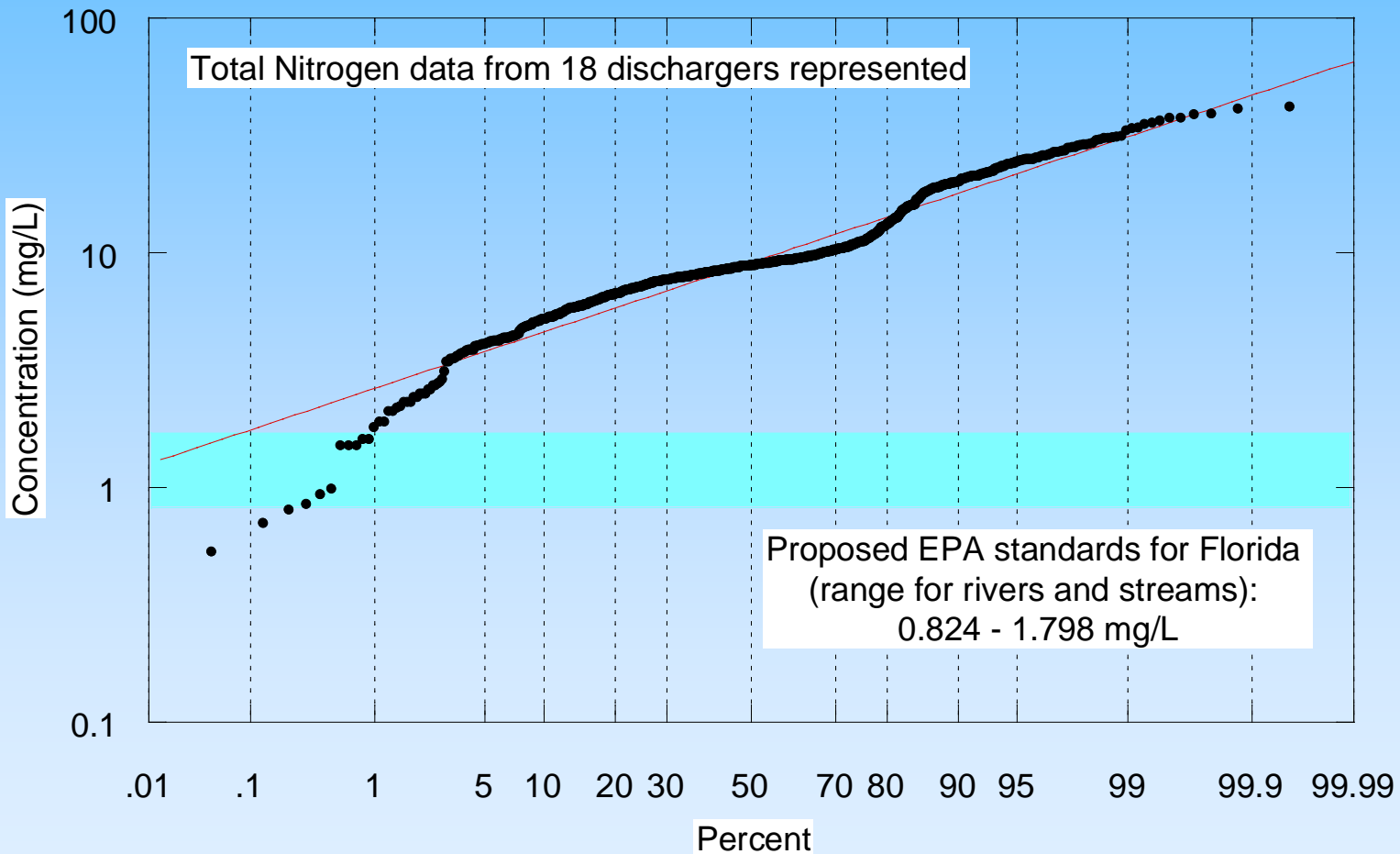
Thank You

Questions?

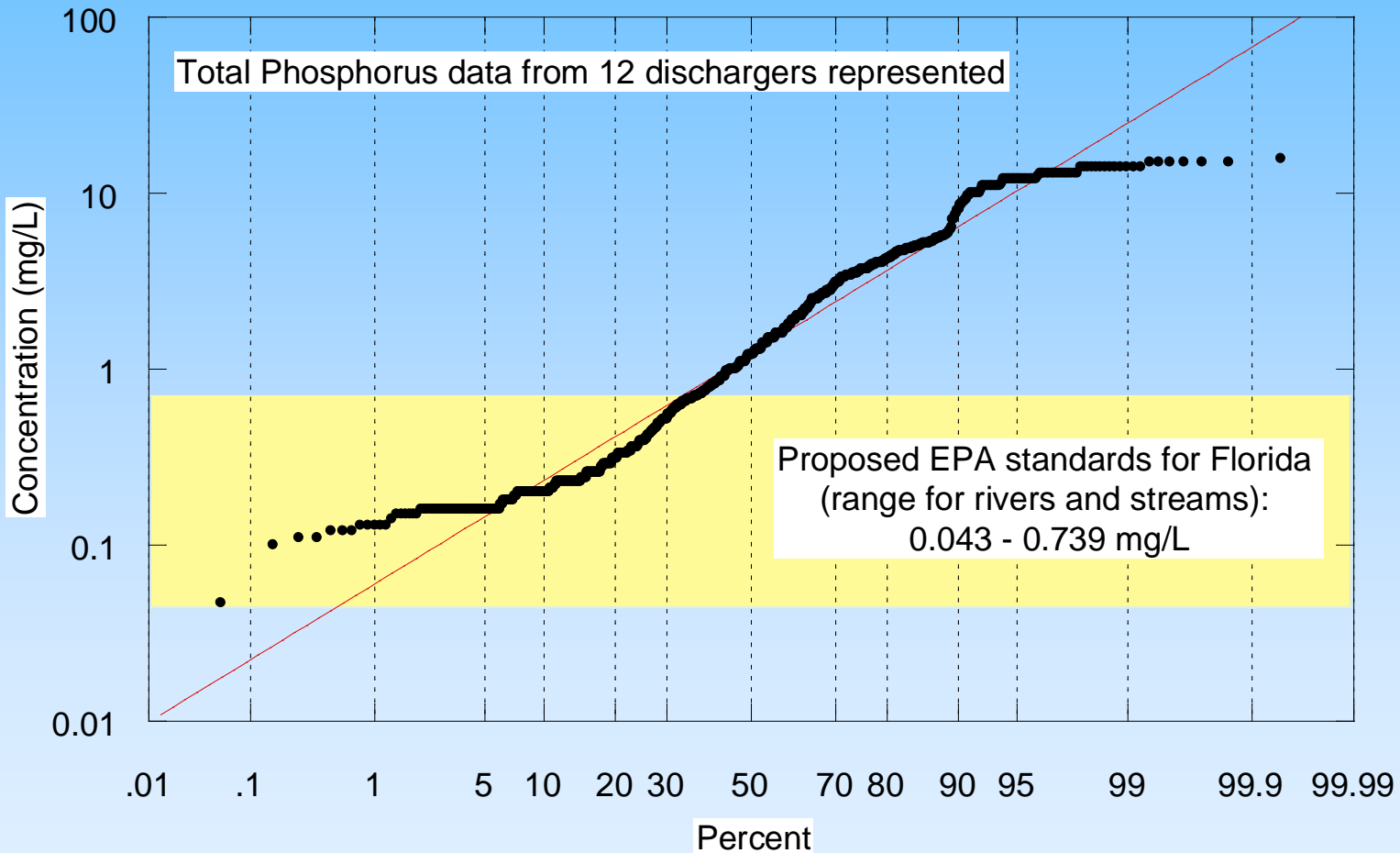
Backup slides

- As needed

Total Nitrogen Effluent Concentrations from 18 California POTWs: Percent Compliance With Projected Effluent Limits

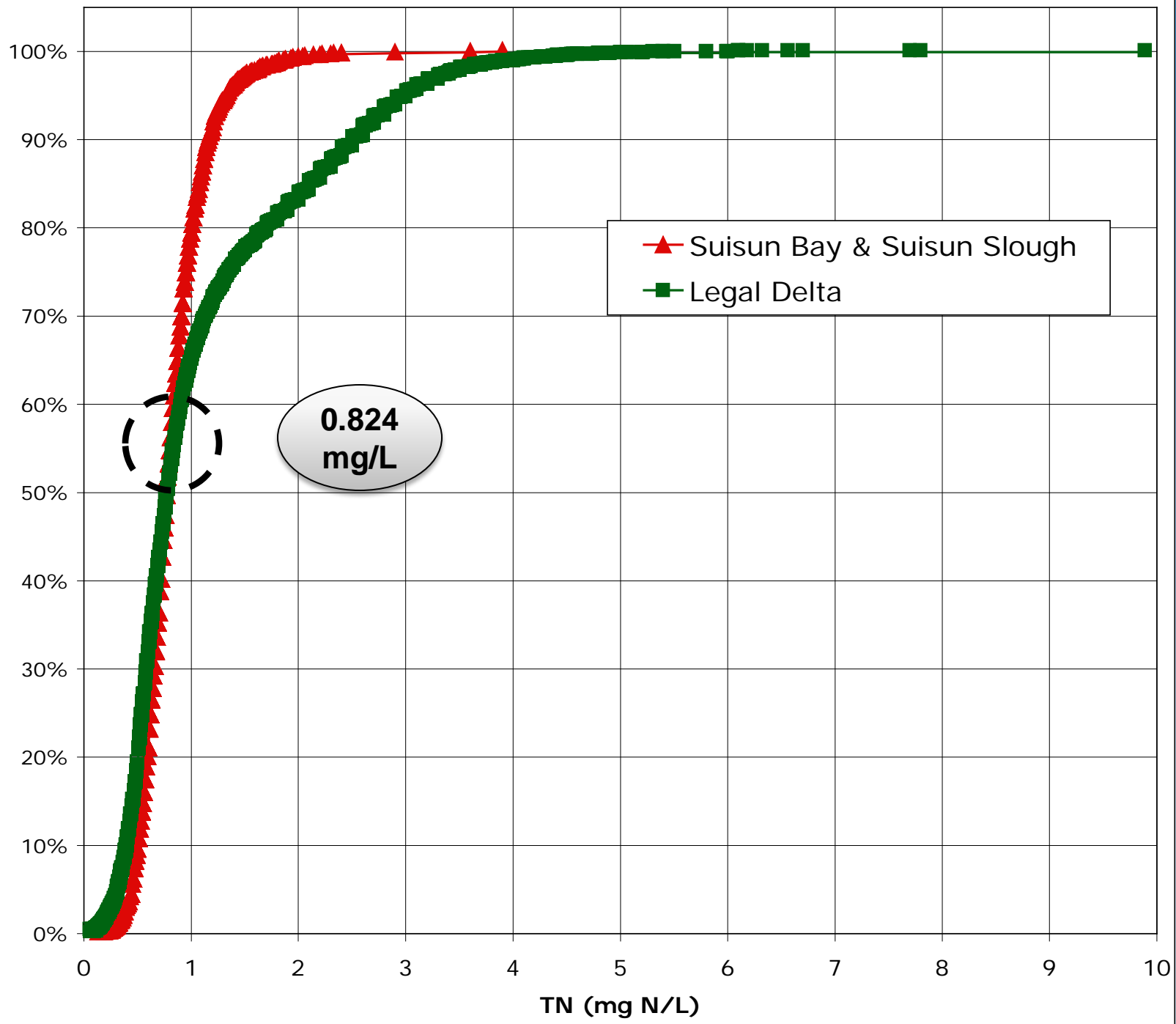


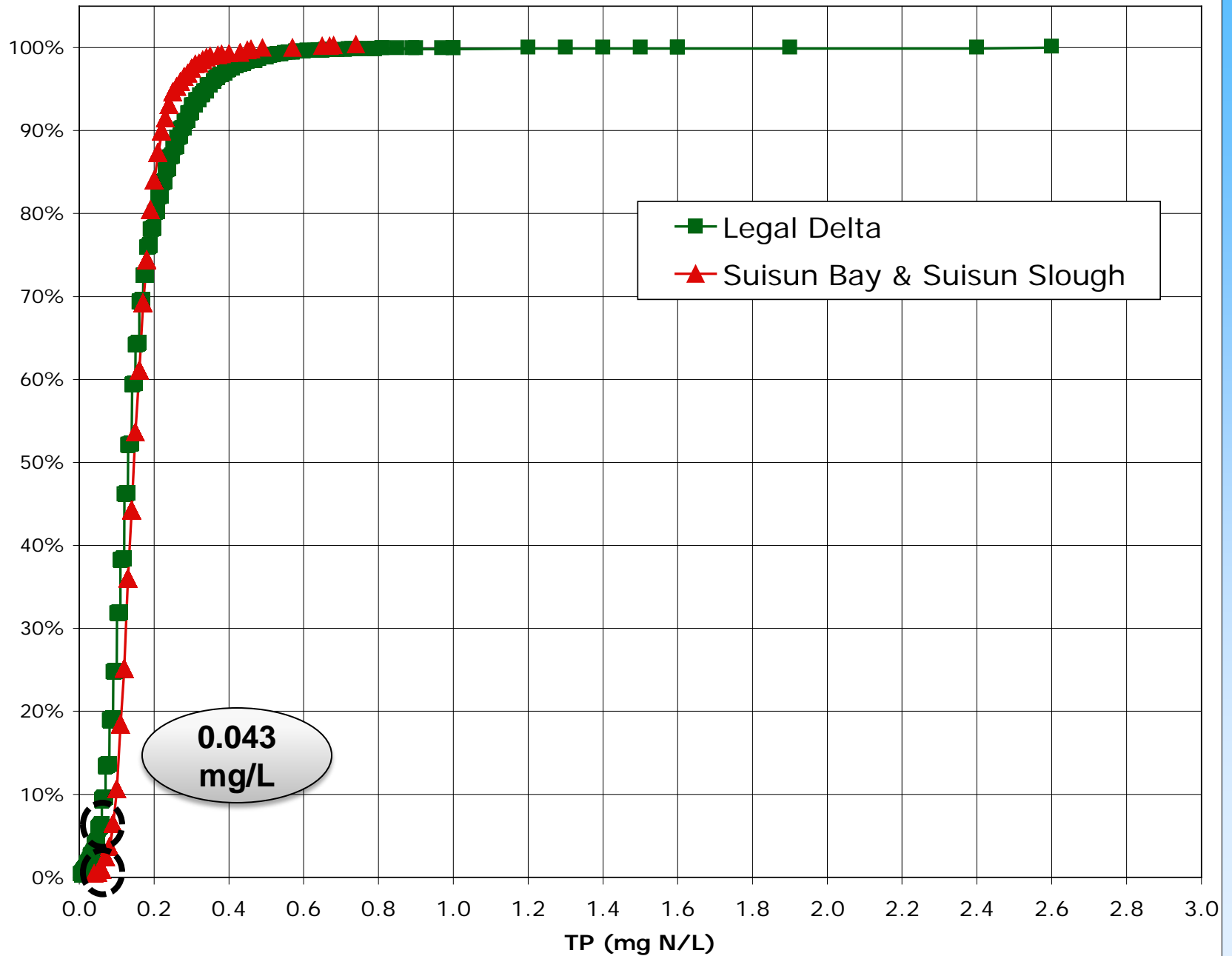
Total Phosphorus Effluent Concentrations from 12 California POTWs: Percent Compliance With Projected Effluent Limits



Science Advisory Board Input (Jan, 2010)

“Without a mechanistic understanding and a clear causative link between nutrient levels and impairment, there is no assurance that managing to specific nutrient levels will lead to the desired outcome.”





Common Themes in Reaction to Proposed Florida Standards

- Disagreement with “Reference Stream” approach
- EPA was unable to establish cause and effect between nutrient levels and in-stream conditions
- Standards are so low that they pose unreasonable requirements and costs on communities
- Concern for rigid precedent