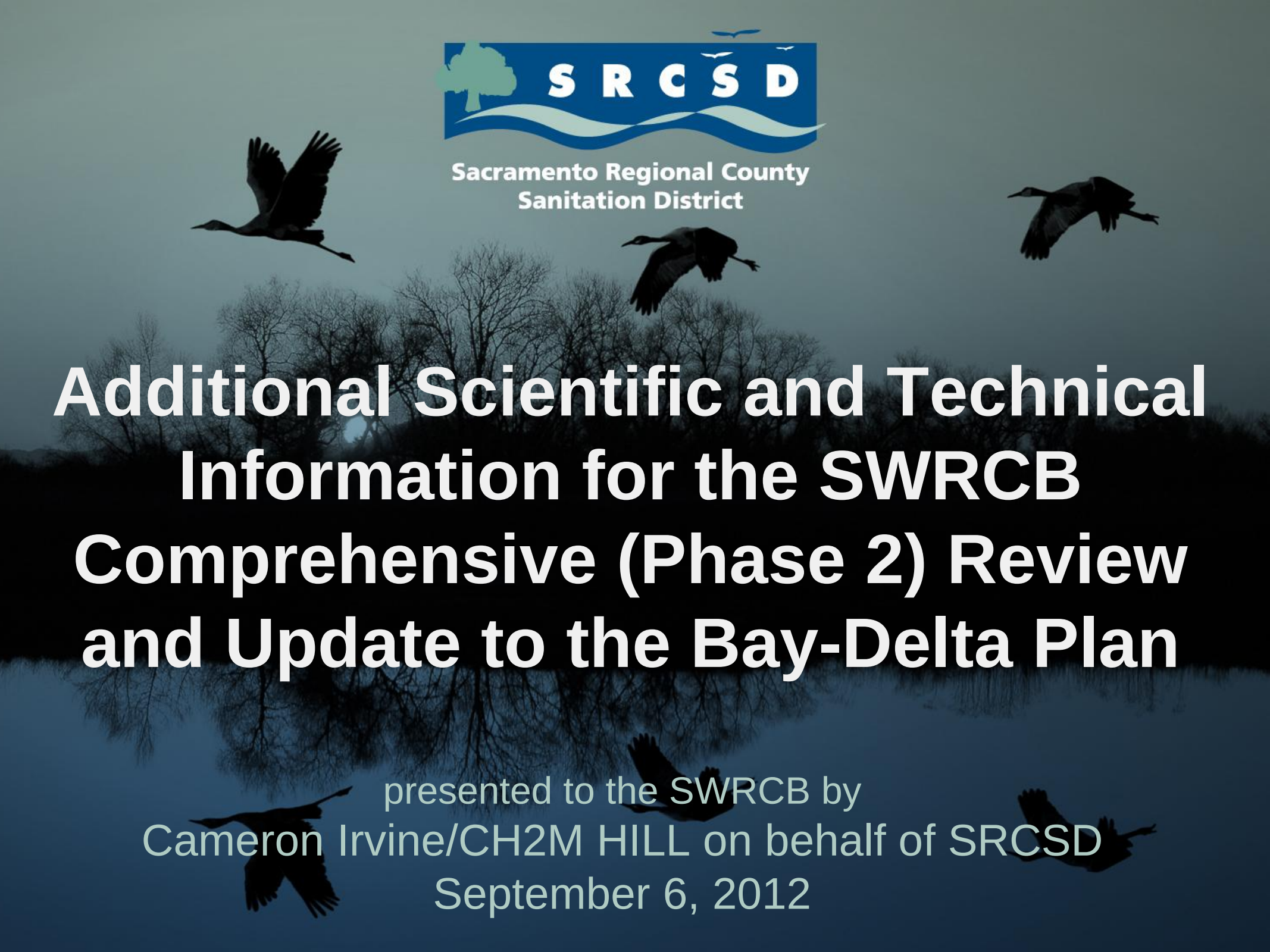


Additional Scientific and Technical Information for the SWRCB Comprehensive (Phase 2) Review and Update to the Bay-Delta Plan

presented to the SWRCB by

Cameron Irvine/CH2M HILL on behalf of SRCSD

September 6, 2012

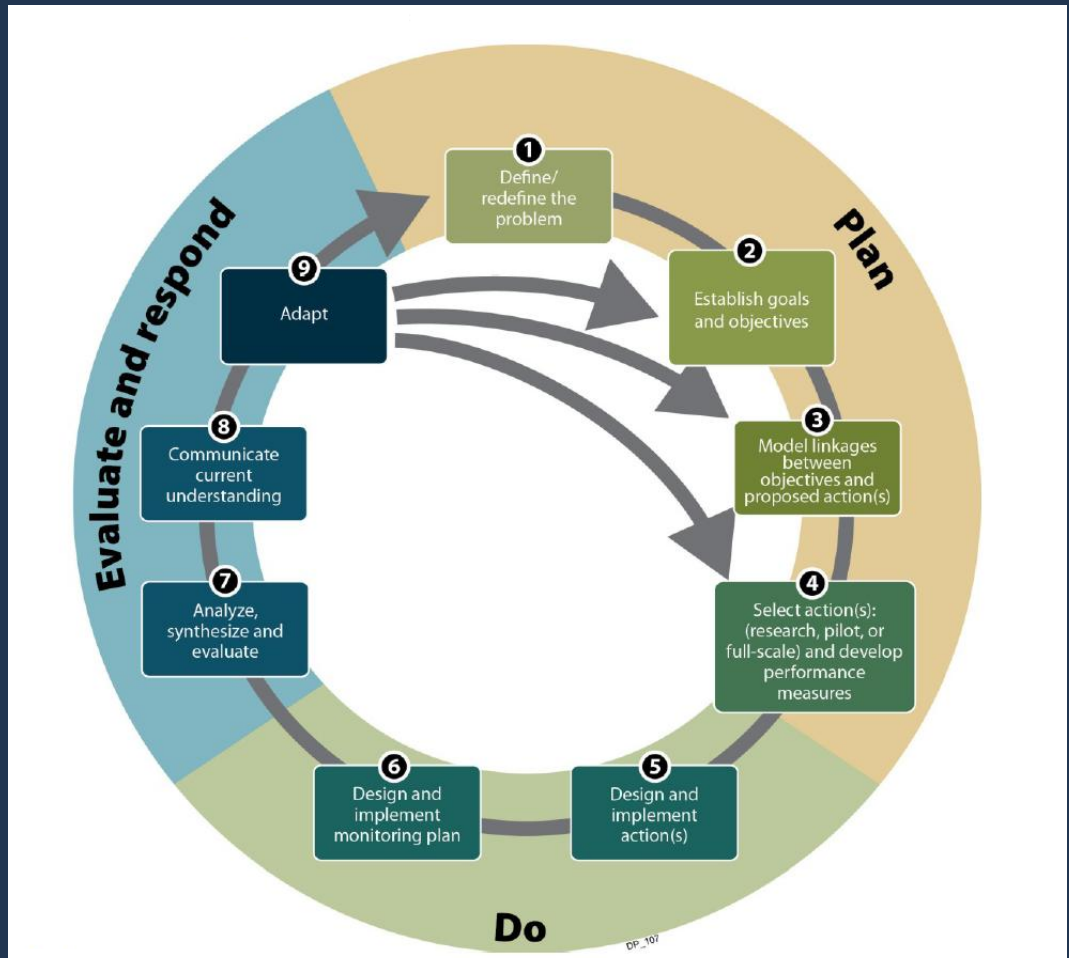
Outline

SWRCB requested two types of information in a public notice to support the Delta Plan Information Review Workshops:

1. Scientific and technical information related to ecosystem changes in the low salinity zone (LSZ) of the Delta along with levels of uncertainty and recommended changes to the Delta Plan supported by the new information; and
2. Comments on how to address uncertainty, change, and how to implement an adaptive management program.

Scientific Uncertainty

- What we do not know
- Always exists
- Variable
- Manageable
- Informs weight / confidence
- Informs adaptive management



Adaptive Management Plan[1]

[1] Delta Stewardship Council. 2012. Proposed Final Draft Delta Plan. http://deltacouncil.ca.gov/delta-plan/current-draft-of-delta-plan

Managing Uncertainty

- **Multi-agency/Stakeholder**
  - IEP and POD Contaminant Work Team
  - Blue Ribbon Expert Panels
  - Workshop Proceedings
    - Framework for ammonia research[2]
    - LSZ workshop[3]
    - DRERIP conceptual models[4]
    - SF Bay NNE[5]
    - Bay-Delta Plan Review Expert Panel

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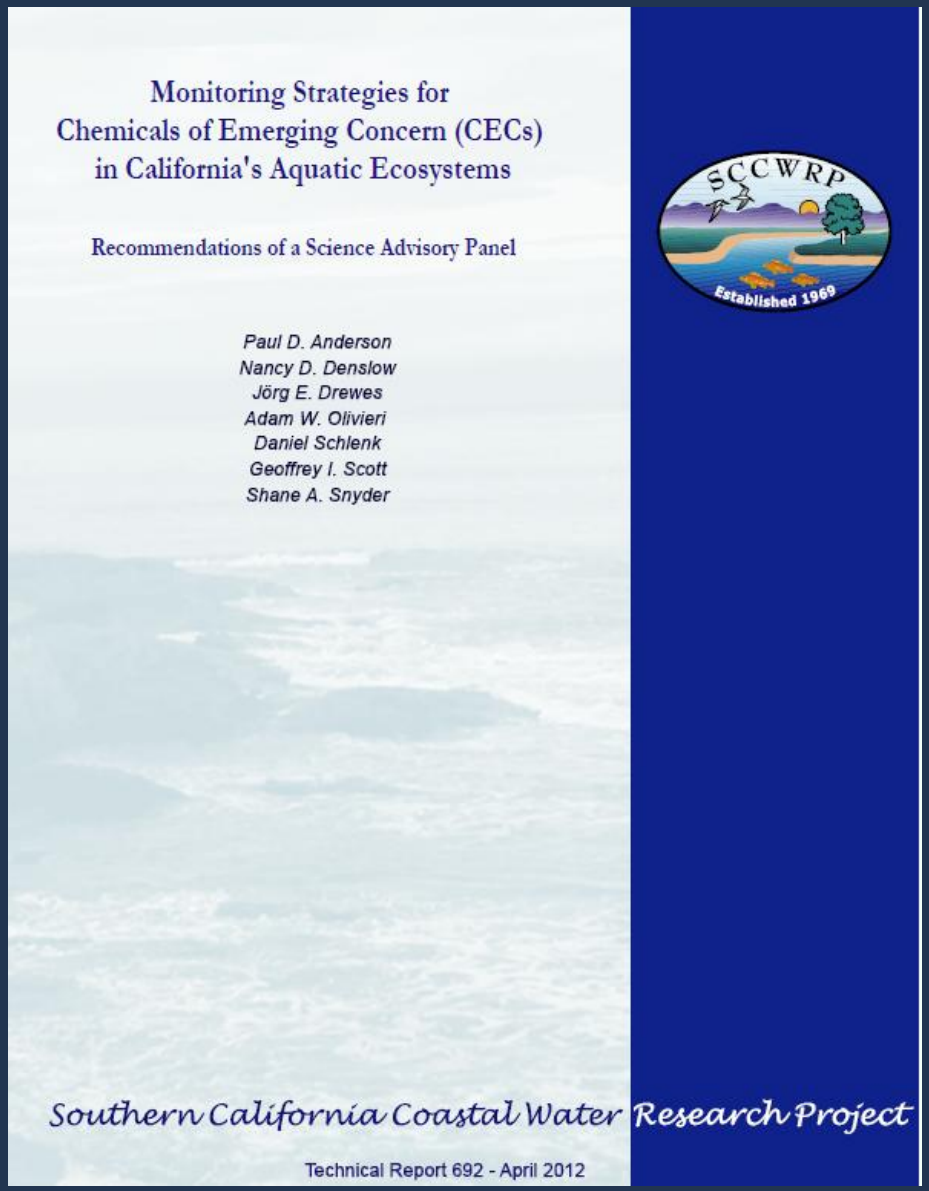
[2] Meyer et al. 2009. A Framework for Research Addressing the Role of Ammonia/Ammonium in the Sacramento-San Joaquin Delta and the San Francisco Bay Estuary Ecosystem. Submitted to the CALFED Science Program. April.
[3] Bernstein. 2012. Workshop Summary: Technical Workshop on Estuarine Habitat in the Bay Delta Estuary Convened by USEPA . Sacramento. March.
[4] http://www.dfg.ca.gov/ERP/conceptual_models.asp
[5] McKee et al. 2011. San Francisco Nutrient Numeric Endpoint (NNE) Development for the San Francisco Bay Estuary: Literature Review and Data Gap Analysis

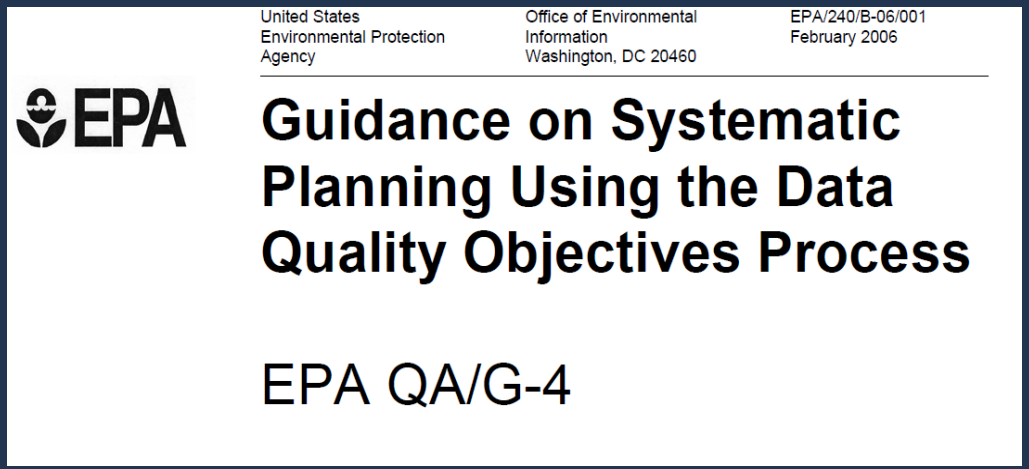
Example: Expert Panels

- Technical Experts: government, consulting, and academia
- Proven risk-based approach
- Recognized uncertainties (e.g., non-point sources excluded)
- ID research needs (e.g., analytical methods)



Managing Uncertainty

- **Validity of scientific studies can be argued when**
  - data are of unknown or poor quality (i.e., lack/fail QA/QC)
  - Scientists/decision makers do not agree on data interpretation
- **A good study plan includes**
  - Data Quality Objectives (DQOs)
  - Quality Assurance/Quality Control (QA/QC)



Managing Uncertainty

- **DQO process:**
  - The problem and a conceptual model
  - Eventual decisions or estimates to be made
  - Type of data needed
  - How the data will be used to draw conclusions
  - Acceptable data quality criteria
  - The investigation design
- **Results in validated data**
- **Reduces uncertainty**
- **Supports management decisions**

Managing Uncertainty

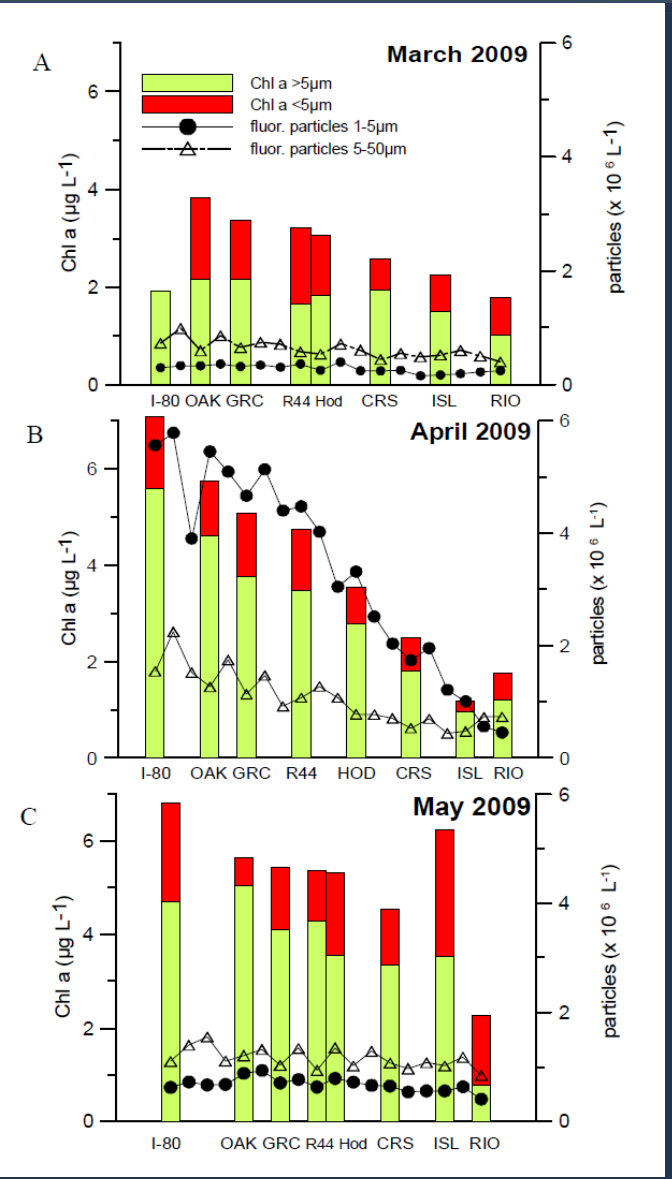
- **Data Validation**
  - Data meet test acceptability criteria
  - Data without adequate QA/QC are questionable
- **Reporting/ Interpretation**
  - Conclusions beyond the scope of collected data are not defensible and should be evaluated with further testing
  - Qualify speculation
  - Qualify uncertainties in the data

"…problems associated with Teh et al.'s experimental methodology … and significant questions regarding the analysis of the resulting data do indicate that the quality of the work should preclude the resulting 'critical threshold' data (i.e., NOECs, LOECs, and point estimates [e.g., ECx, LCx, and ICx values]) from being used for regulatory purposes." [6]

[6] Pacific EcoRisk, Inc . 2011. *A Critical Review of: Full Life-Cycle Bioassay Approach to Assess Chronic Exposure of Pseudodiaptomus forbesi to Ammonia/Ammonium - Final Report . Teh et al. August 31, 2011*.

Managing Uncertainty

- **Peer and Stakeholder Review**
  - Publications vary in quality
  - Uncertainties should be discussed and data qualified
  - Further study recommended to fill new data gaps
  - Comments are adequately addressed

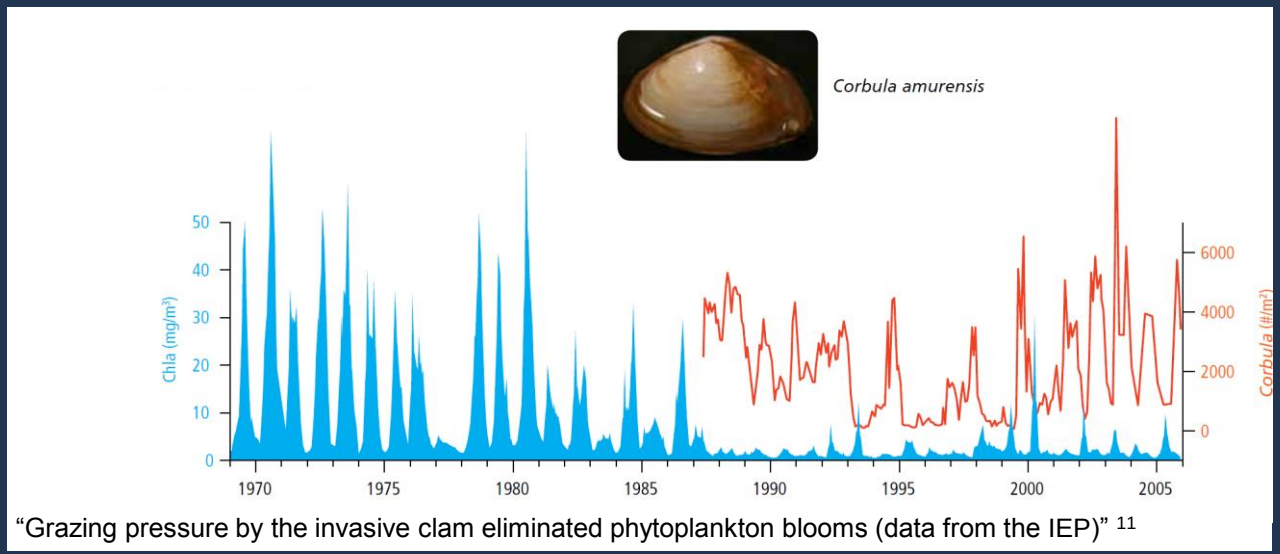


Algae in Sacramento River surface water[7]

[7] Parker et al. 2010. Effect of Ammonium and Wastewater Effluent on Riverine Phytoplankton in the Sacramento River, CA. Report for the SWRCB.

Example: Suisun Bay Algae v. Clams

- **Invasive clams filter the overlying water in <1 to 4 days[8]**
- **Alters food web dynamics[9,10]**
- **Conceptual or empirical models lacking this driver are highly uncertain**

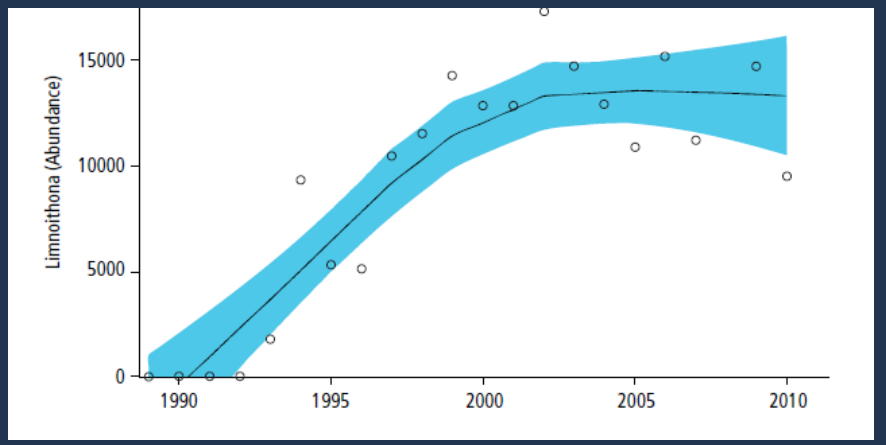


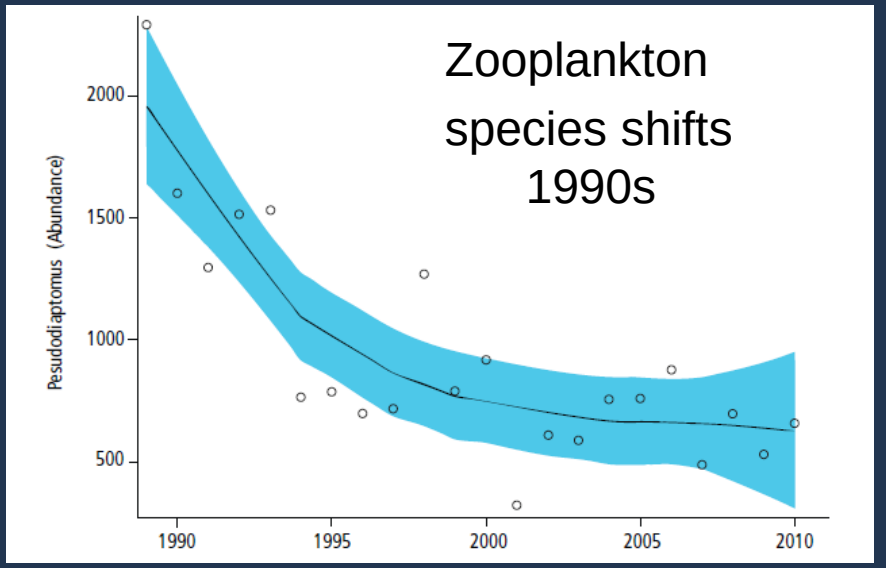
"Grazing pressure by the invasive clam eliminated phytoplankton blooms (data from the IEP)" [11]

[8] Thompson and Parchaso. 2010. Corbula amurensis Conceptual Model . U.S. Geological Survey. DRERIP Conceptual Model. October.
[9] Cloern and Jassby. In prep. Drivers of Change in Estuarine-Coastal Ecosystems: Discoveries from four decades of study in SF Bay.
[10] Winder and Jassby. 2011. Shifts in zooplankton community structure: implications for food web processes in the upper SFE. Estuaries and Coasts
[11] Werme, C. et al. 2011. A Growing Concern: Potential Effects of Nutrients on Bay Phytoplankton. *In.* The Pulse of the Estuary. http://www.sfei.org/documents

Summary

- **Data used by resource managers as a basis for decisions must minimize uncertainties**
  - Data Quality Objectives
  - QA/QC
  - Data Validation
  - Peer and stakeholder review
- **Delta models should consider the relative importance, spatial and temporal variability, and the confidence in data**





Average Annual (March-November) Organisms/m^2 and 95% confidence limits. [12]

[12] Hennessy. A. 2012. Zooplankton in the Delta. in 2012 Pulse of the Delta.