A detailed map of the Sacramento-San Joaquin River Delta and Suisun Bay ecosystem. The map shows a complex network of waterways, including the Sacramento River, San Joaquin River, and various tracts and islands. Key locations labeled include Pittsburg, Antioch, Stockton, and Manteca. The map also shows various tracts such as the Delta Cross Channel, New Hope Tract, and many others. The text is overlaid on the map in a large, bold, black font.

New Questions and Monitoring Needed in Assessing the Role of Ammonia in the Delta and Suisun Bay Ecosystem

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Ammonia Summit:

Assessing the Role of Ammonia in the Delta and Suisun Bay Ecosystem

http://www.waterboards.ca.gov/centralvalley/water_issues/delta_water_quality/ambient_ammonia_concentrations/index.shtml



Primary Questions

- **Does ammonia cause beneficial use impairments in the Delta?**
- **Are additional studies needed to answer the above question?**

Food Web Dynamics

Tools used:



Light attenuation
salinity

ADCP



Flow cytometer
fluoroprobe



$\text{NO}_3 + \text{NO}_2, \text{NH}_4$,

Urea,

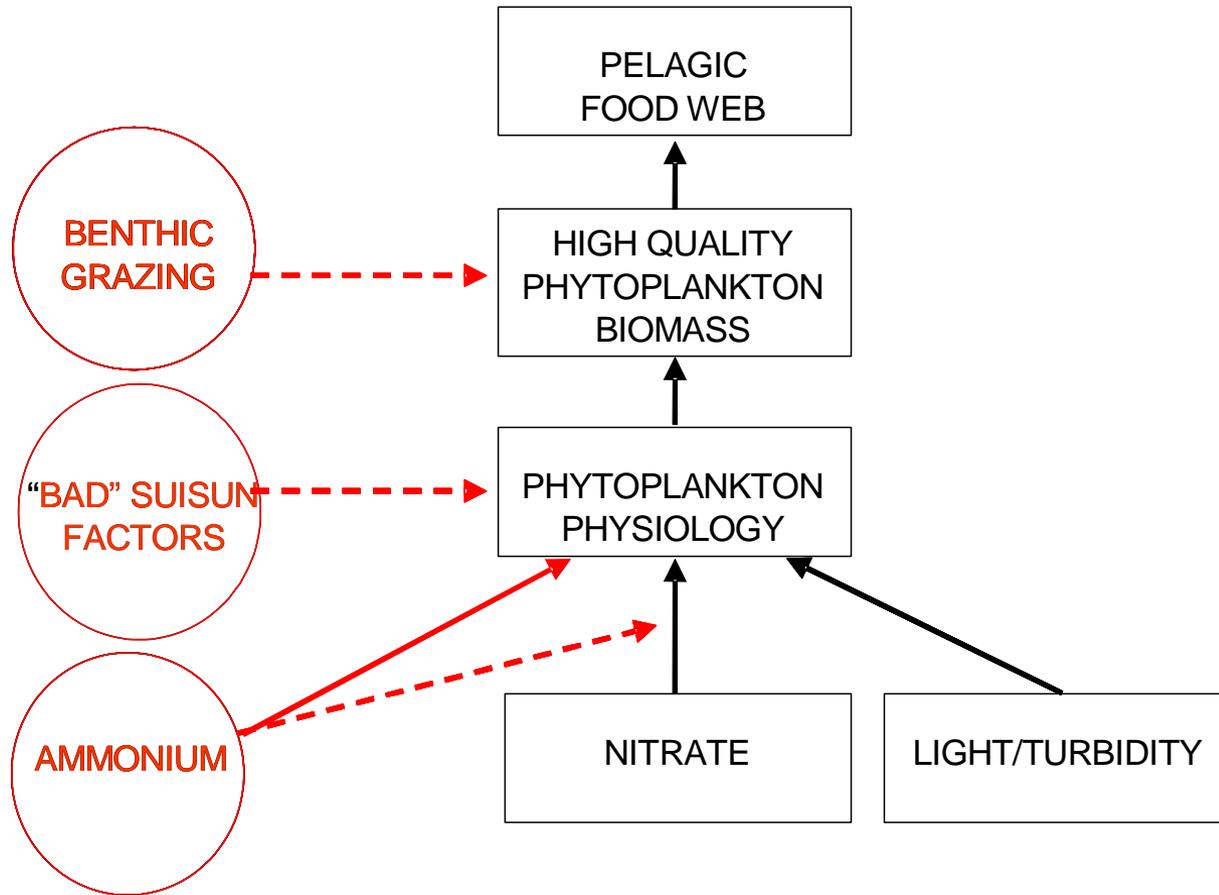
PO_4 , Si.

chl-a, POC/PON



$^{13}\text{C}, ^{15}\text{NO}_3, ^{15}\text{NH}_4$

Food Web Dynamics



Food Web Dynamics



Food Web Dynamics

- Increasing *Microcystis* cell densities were positively correlated with increasing ammonia concentrations, but *Microcystin* levels were not (Mioni)



Toxicity testing



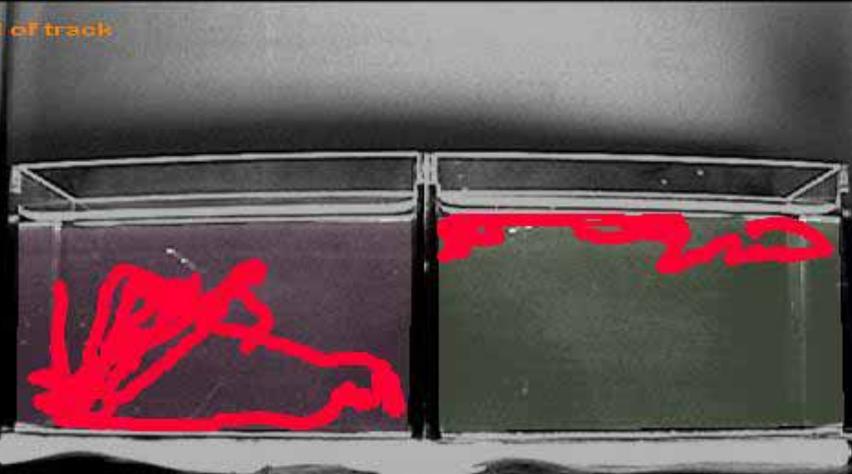
Delta Smelt Swimming Behavior



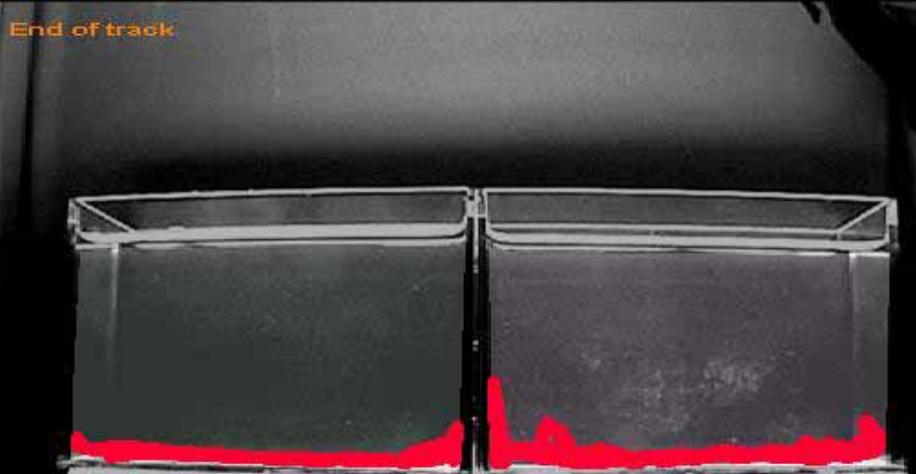
Garcia Bend



2 mg/L SRWTP

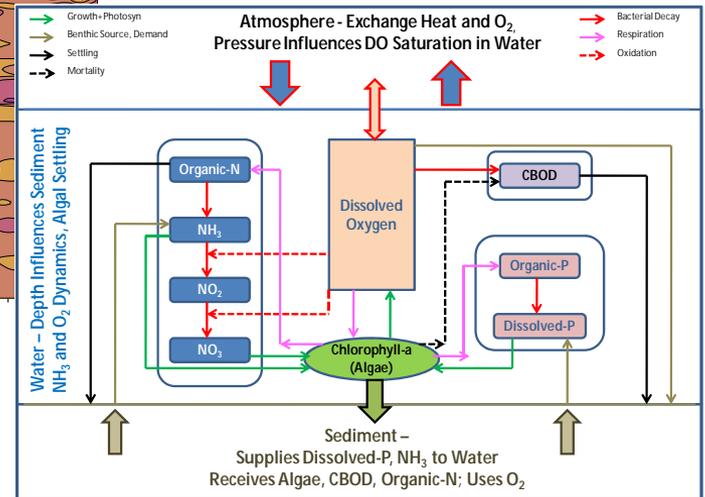
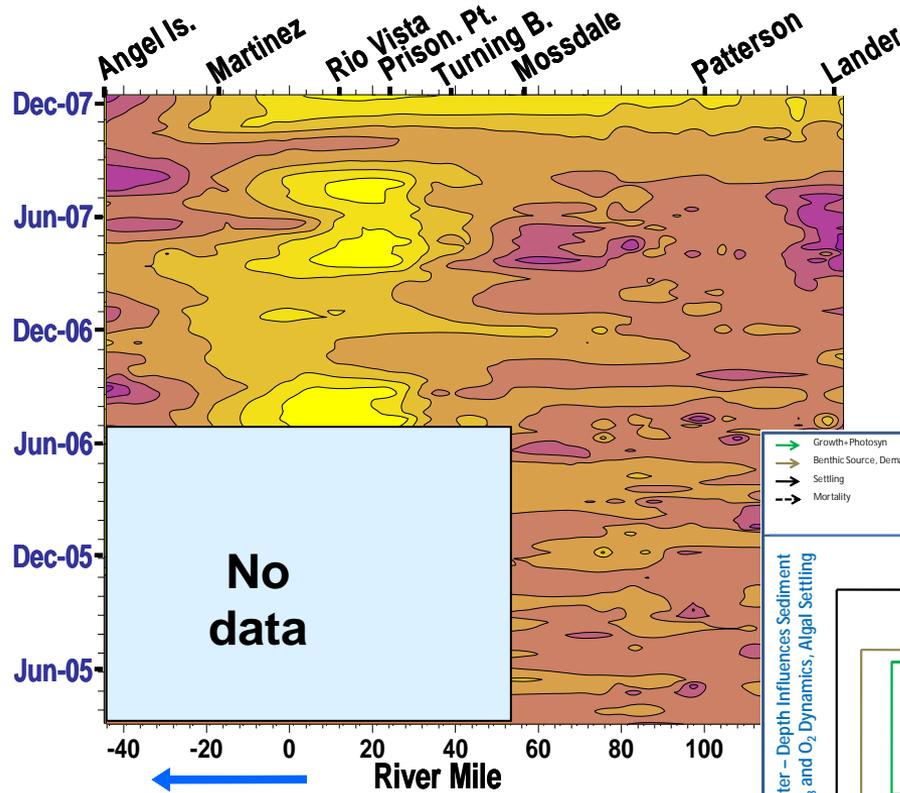


4 mg/L SRWTP



6 mg/L SRWTP

Measurements & Models



Syntheses

- **Ambient concentrations are below EPA criteria (Engle)**
- **ACR analyses indicate river concentrations may be high enough to cause chronic toxicity, and EPA criteria may not be protective (Werner, Teh, and Johnson)**

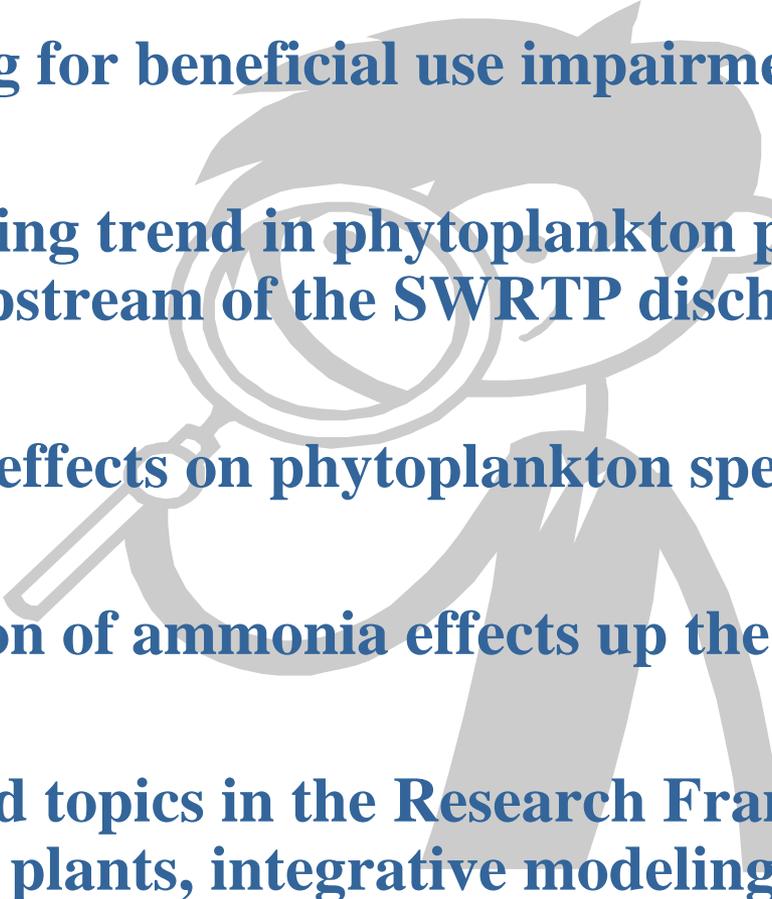
Bottom-line

- **Study results are preliminary**
- **No beneficial use impairments have been identified yet**
- **Acute fish and invertebrate toxicity from ammonia appear unlikely**
- **Impacts of ammonia on phytoplankton and the food web needs further assessment**

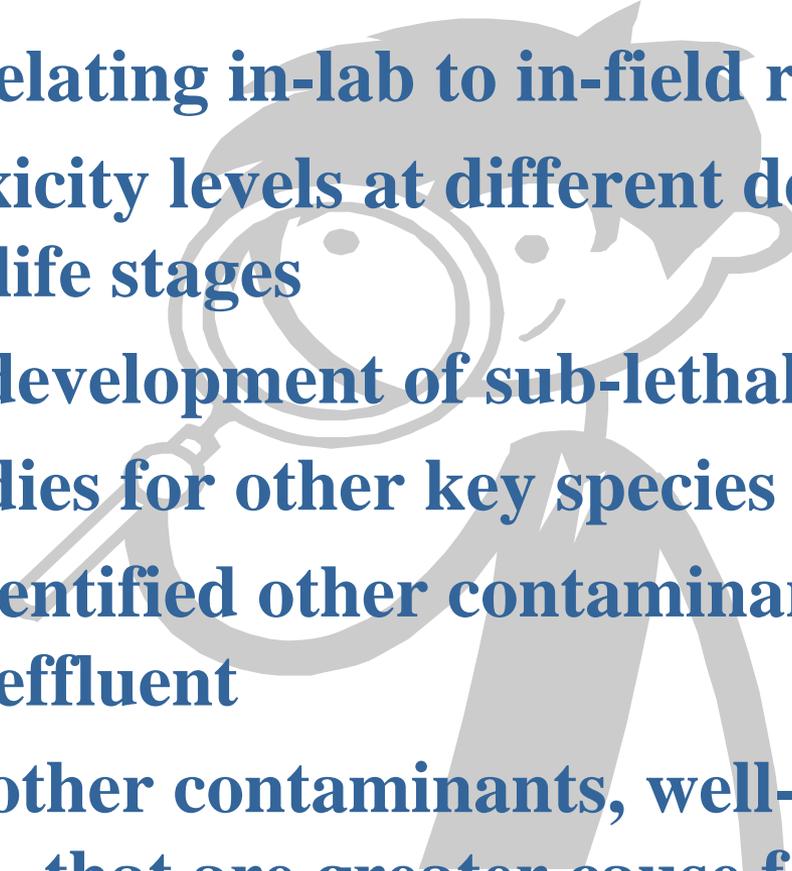
Additional Research Findings

- **The Sacramento Regional Wastewater Treatment Plant (SRWTP) is a major source of ammonia to the estuary**
- **Ammonia discharge from the SRWTP affects the way algae in the Sacramento River take up nitrogen, but the effects on algal production and biomass are varied**
- **Algal biomass in the Sacramento River is generally low and decreases from Sacramento to Rio Vista.**
- **Tests suggest that additional toxic contaminant(s) present in the SRWTP effluent effect delta smelt survival and algal production**

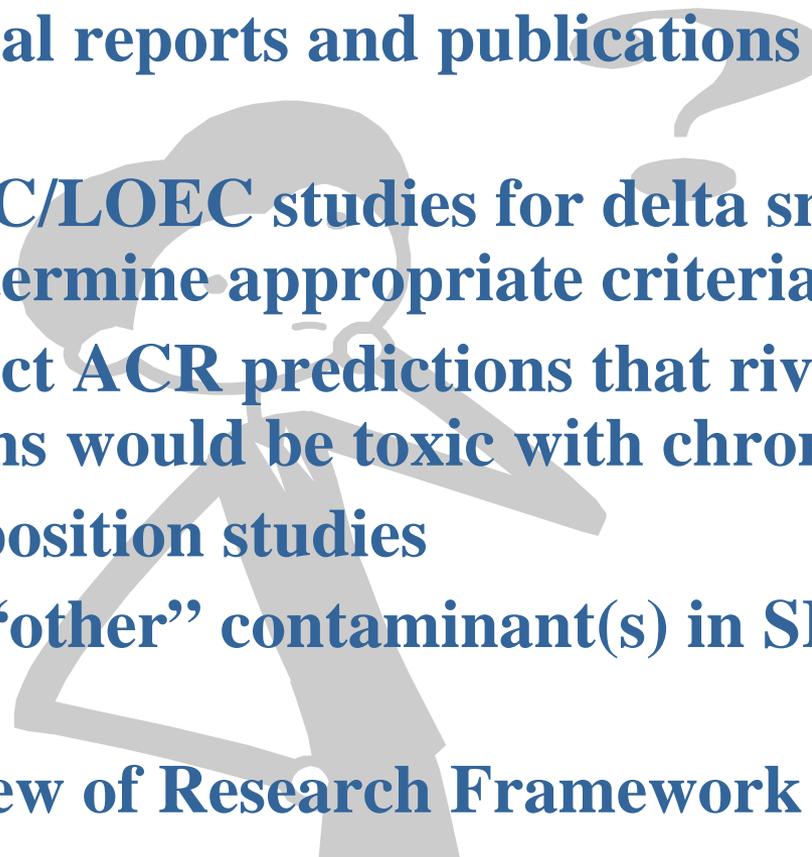
Future Research Topics

- **Monitoring for beneficial use impairments**
 - **The declining trend in phytoplankton production and biomass upstream of the SWRTP discharge**
 - **Ammonia effects on phytoplankton species composition**
 - **Propagation of ammonia effects up the food chain**
 - **Unexplored topics in the Research Framework, e.g. effects on aquatic plants, integrative modeling.**
- 

Research Topics (cont)

- **Studies relating in-lab to in-field results**
 - **Acute toxicity levels at different delta smelt and copepod life stages**
 - **Method development of sub-lethal endpoints**
 - **LC₅₀ studies for other key species**
 - **The unidentified other contaminant(s) in the SRWTP effluent**
 - **Possible other contaminants, well-correlated with ammonia, that are greater cause for concern**
- 

What's Next?

- **Review of final reports and publications from these studies**
 - **Repeat NOEC/LOEC studies for delta smelt and other species to determine appropriate criteria**
 - **Confirm/reject ACR predictions that river concentrations would be toxic with chronic exposures**
 - **Species composition studies**
 - **Identify the “other” contaminant(s) in SRWTP effluent**
 - **Regular review of Research Framework and DaSGA maintenance**
- 

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