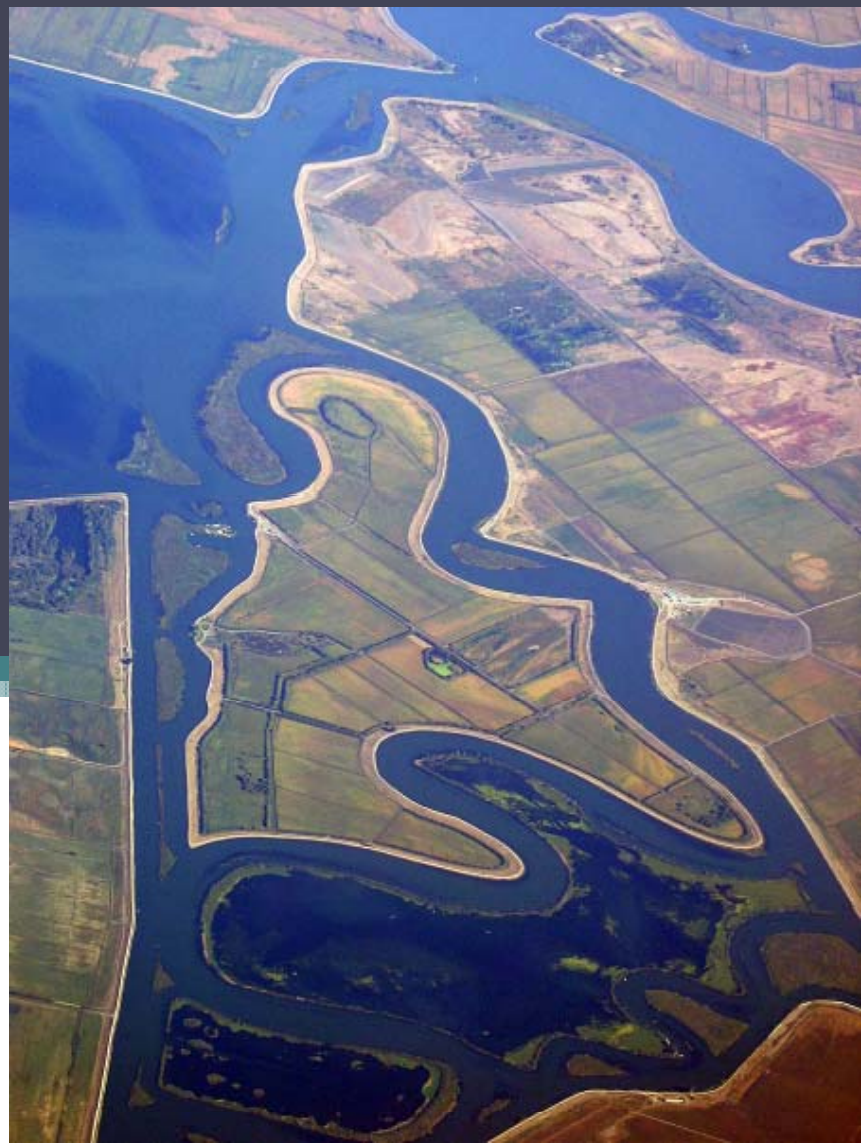
Nutrient-driven food web alterations in the San Francisco Bay Estuary



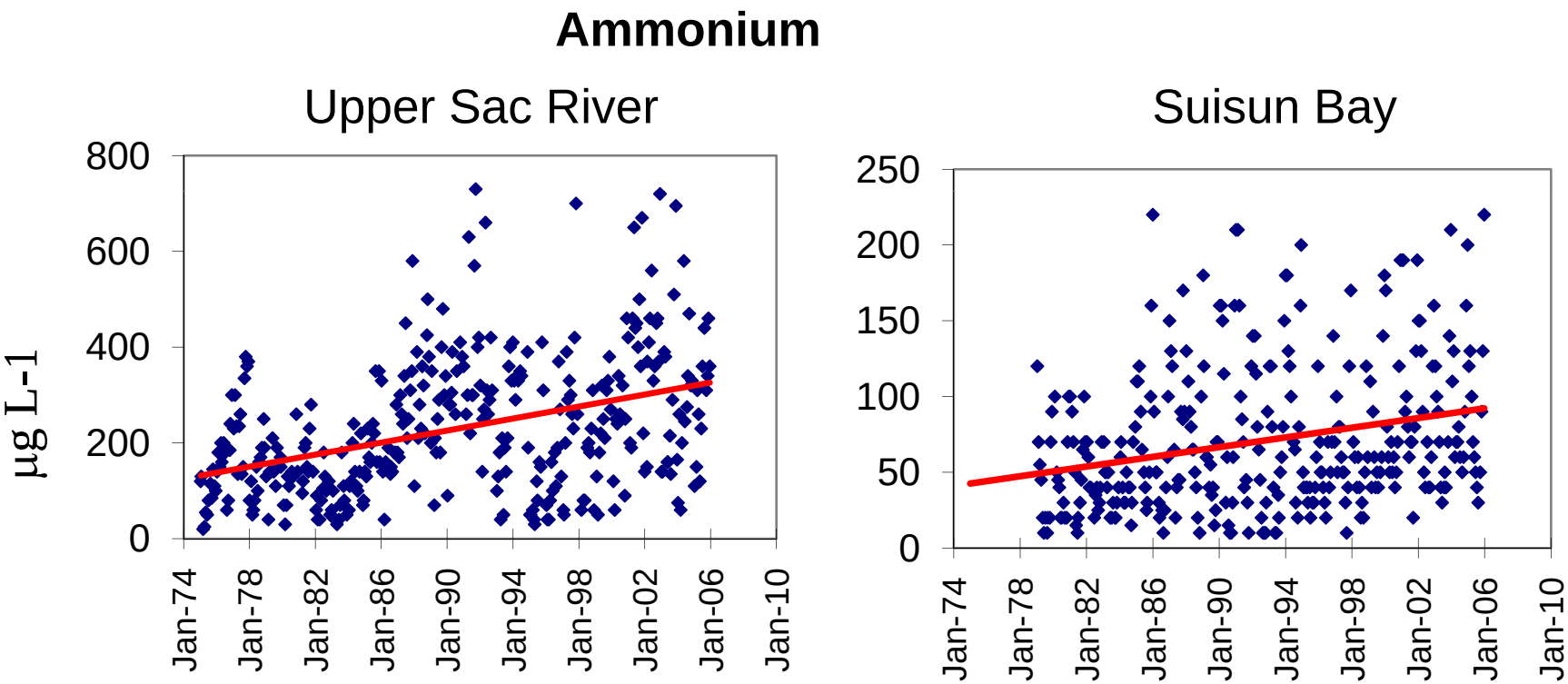
Patricia M. Glibert

University of Maryland
Center for
Environmental Science
Horn Point Laboratory

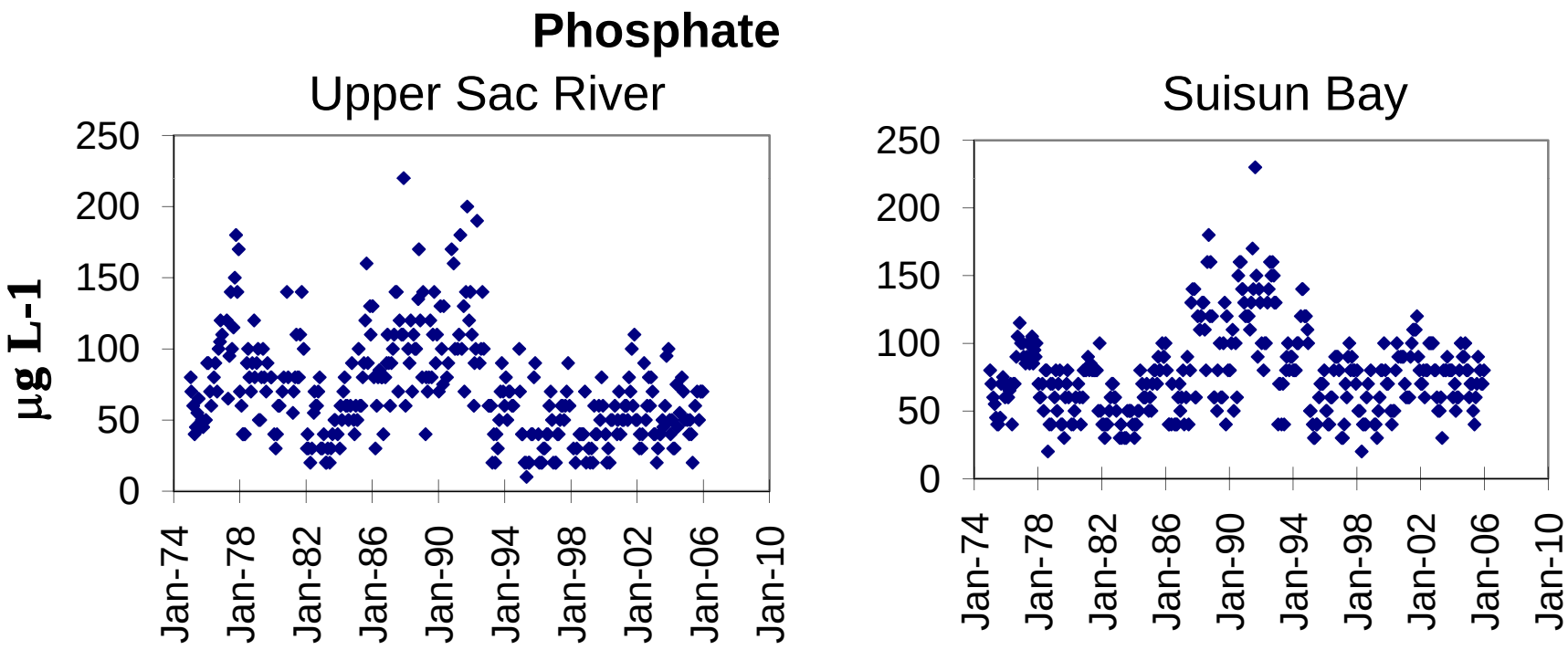
Funded by: State and Federal water contractors & NSF

Are there relationships between changes in nutrients over time and changes in the food web?

Nutrients have changed over time

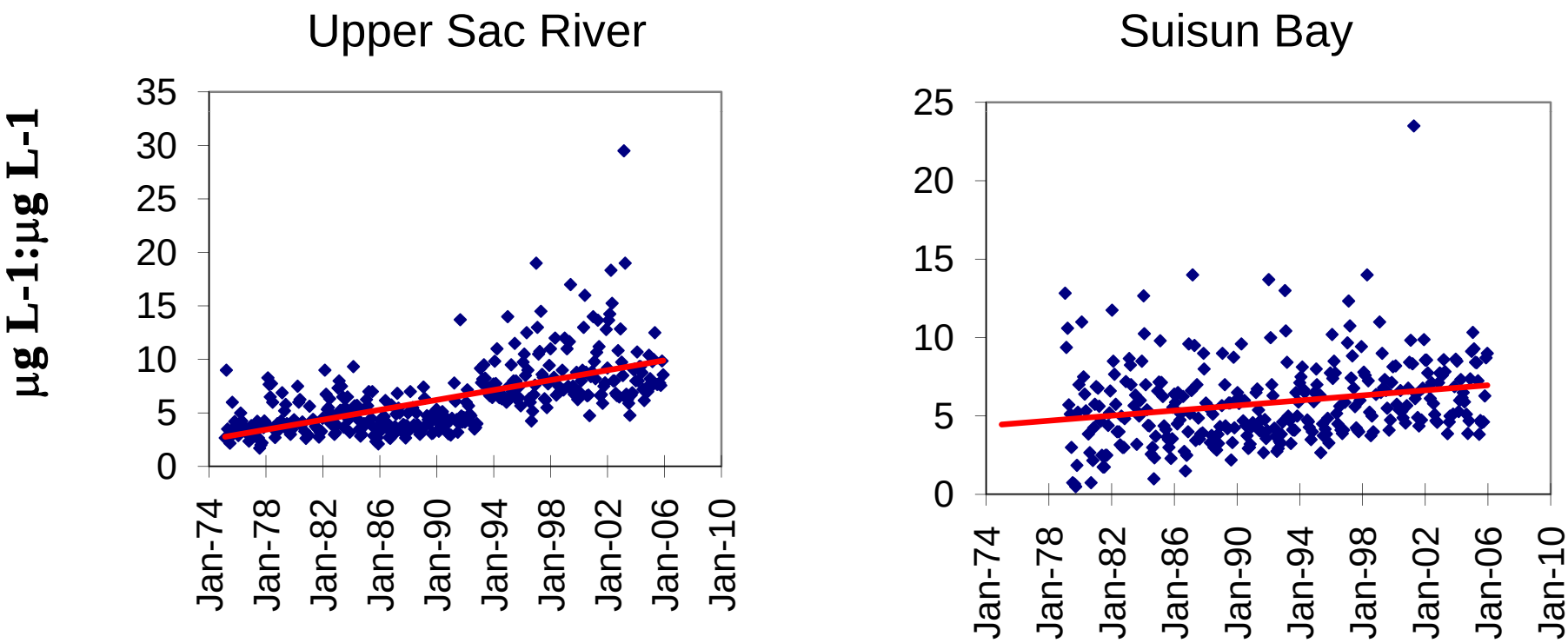


Nutrients have changed over time

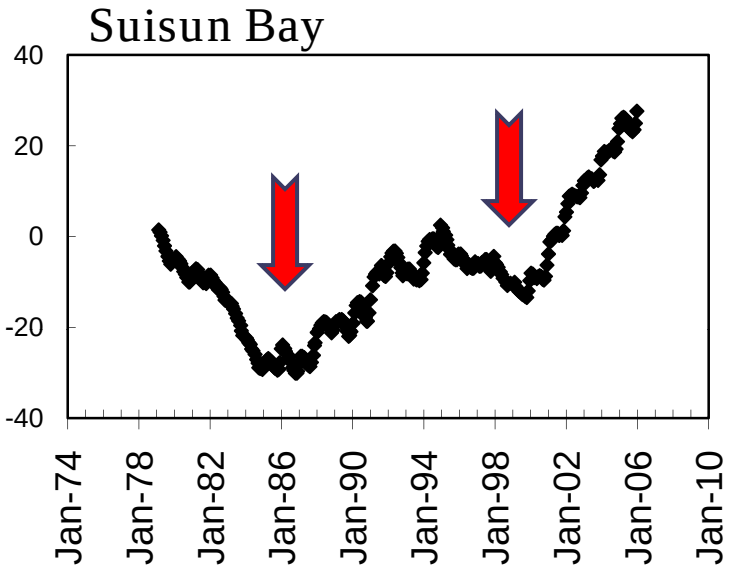


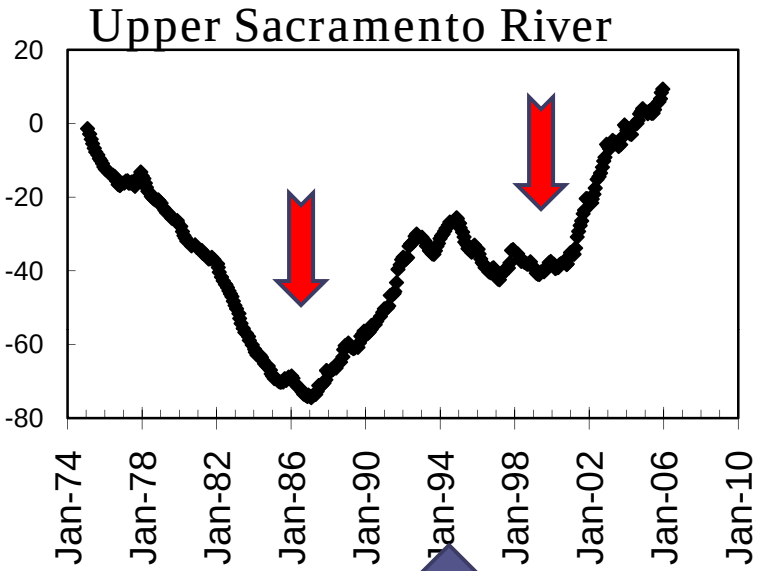
Nutrient ratios have changed over time

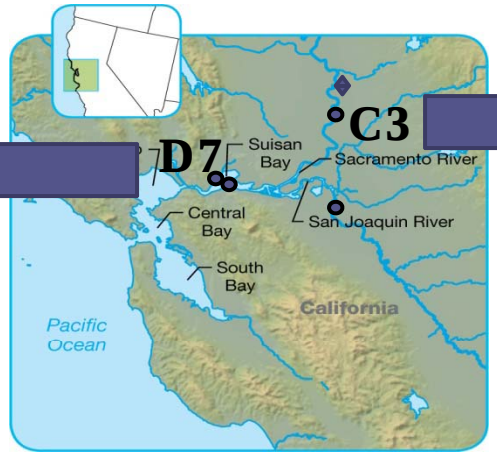
Inorganic Nitrogen:Inorganic Phosphorus



Comparing CUSUMs: Ammonium

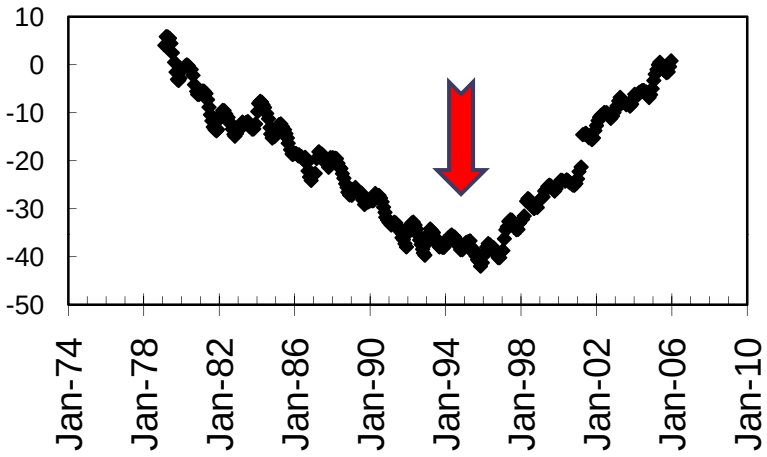




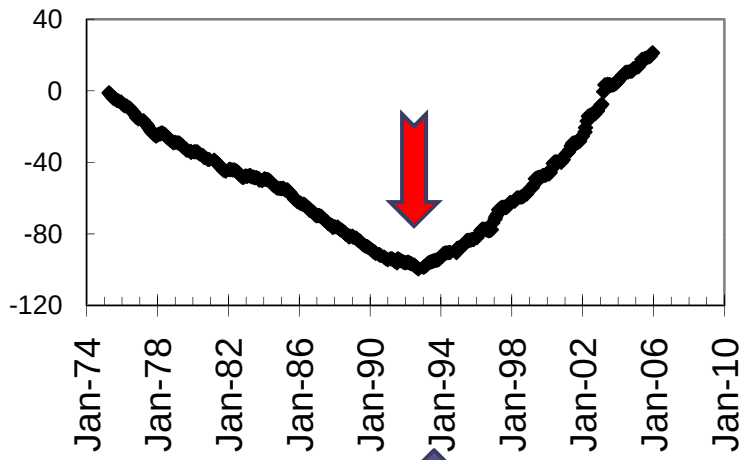


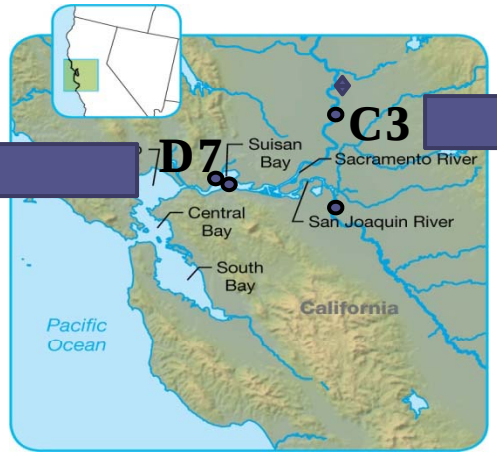
Comparing CUSUMs: DIN:DIP

Suisun Bay

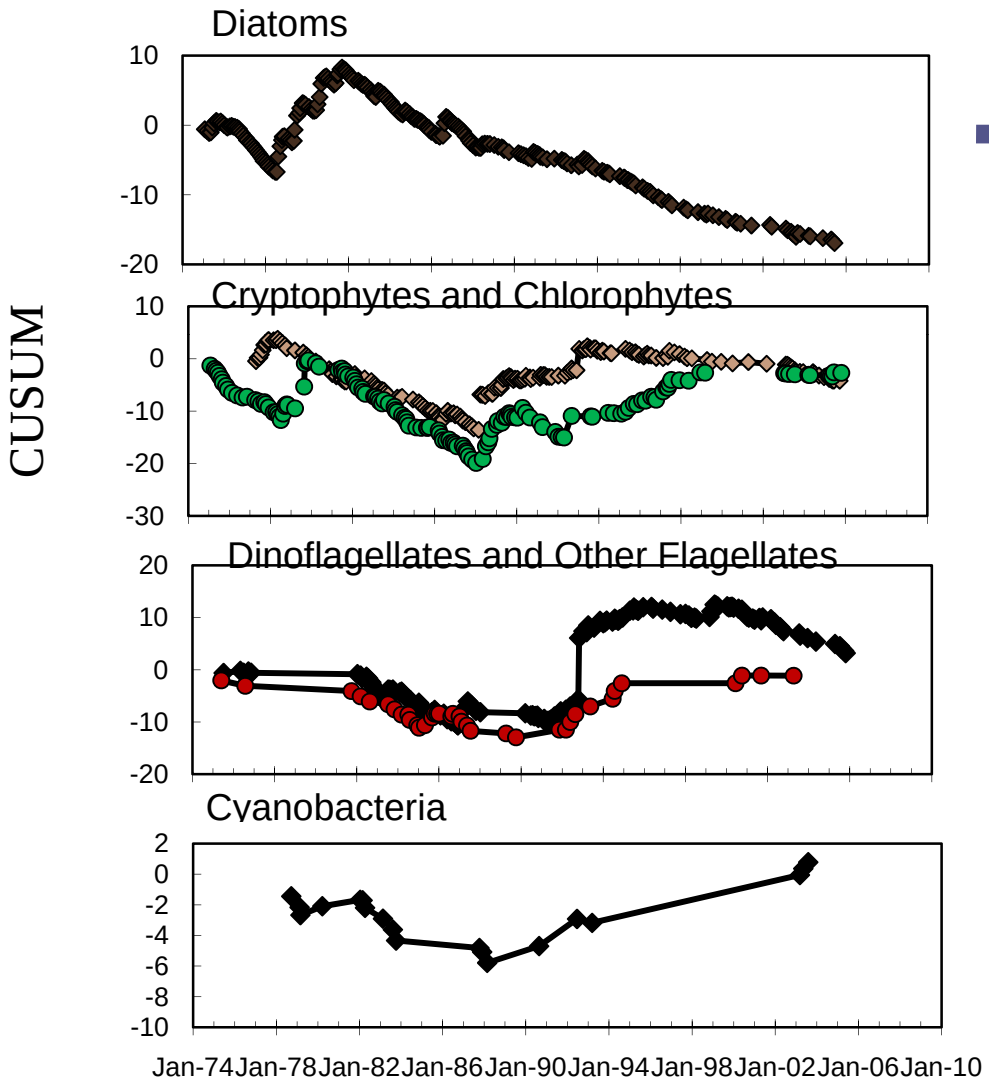


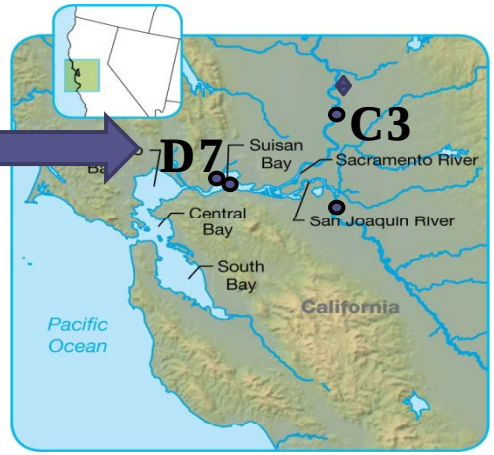
Upper Sacramento River



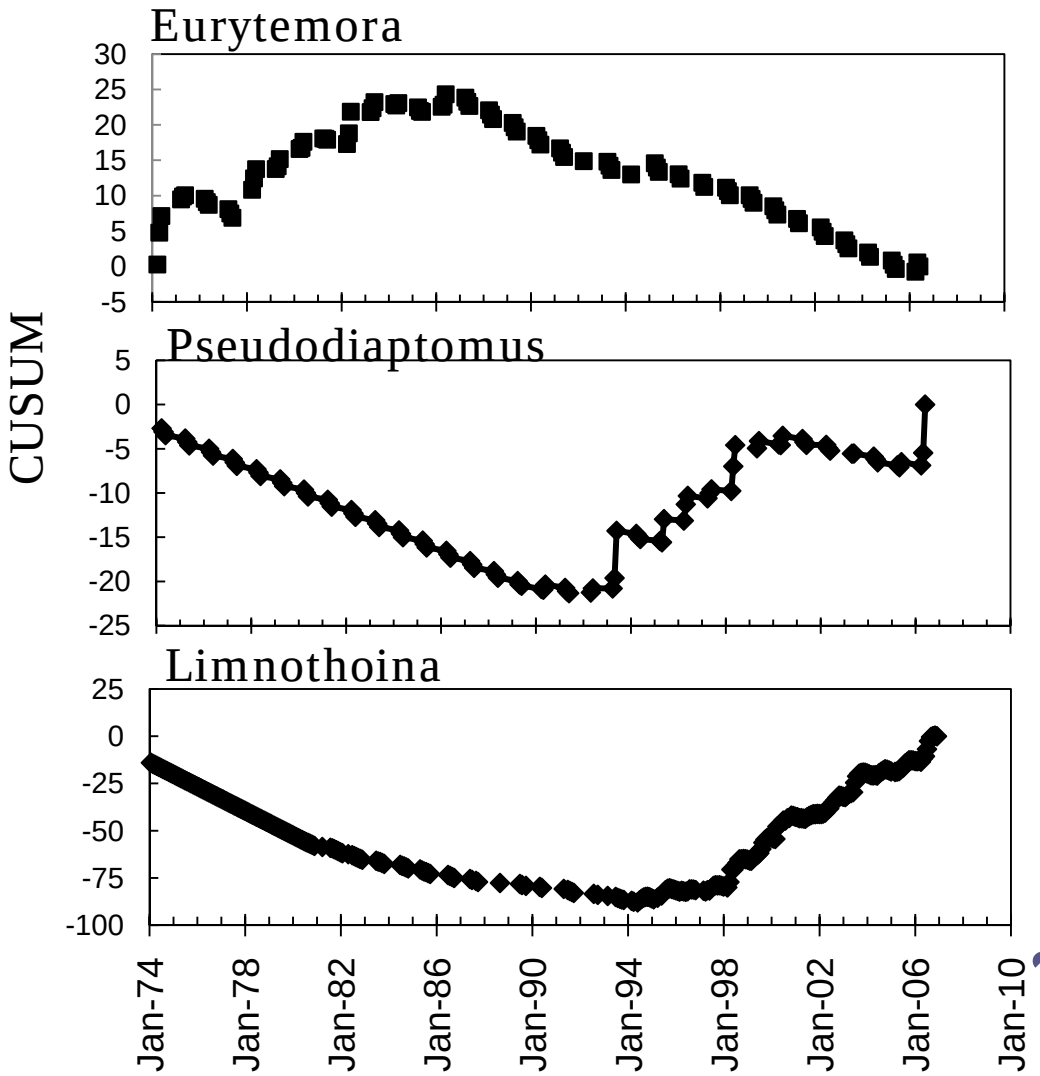


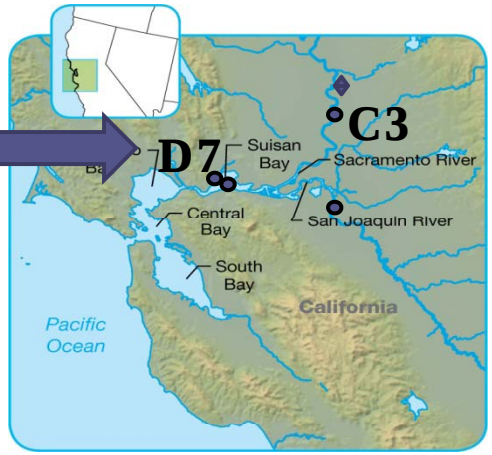
Comparing CUSUMs: Phytoplankton



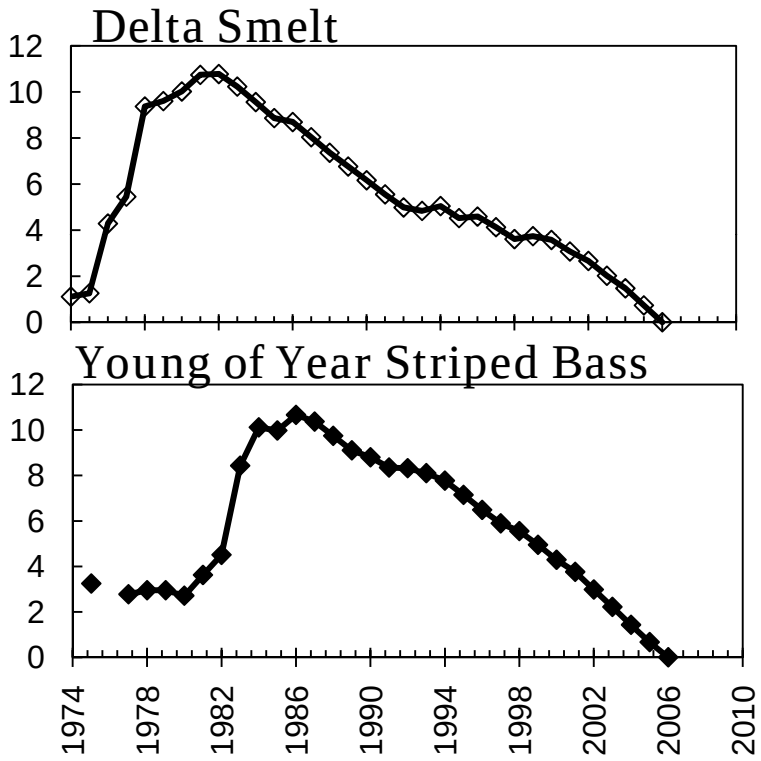


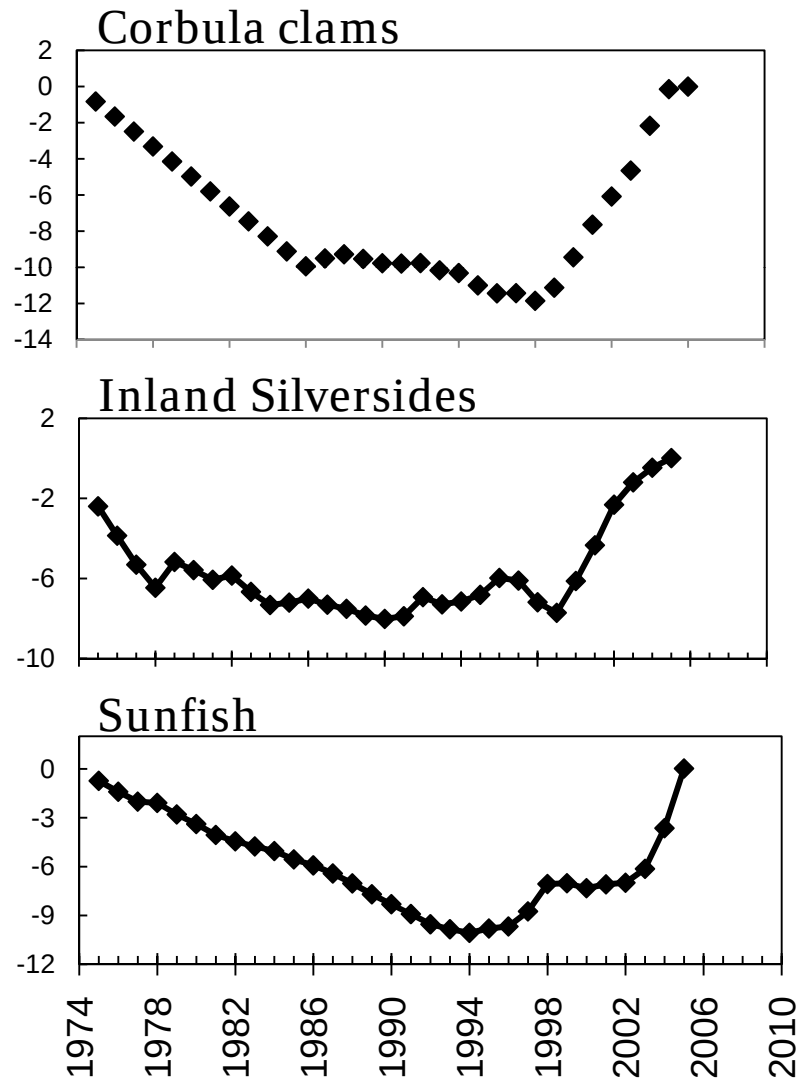
Comparing CUSUMs: Zooplankton



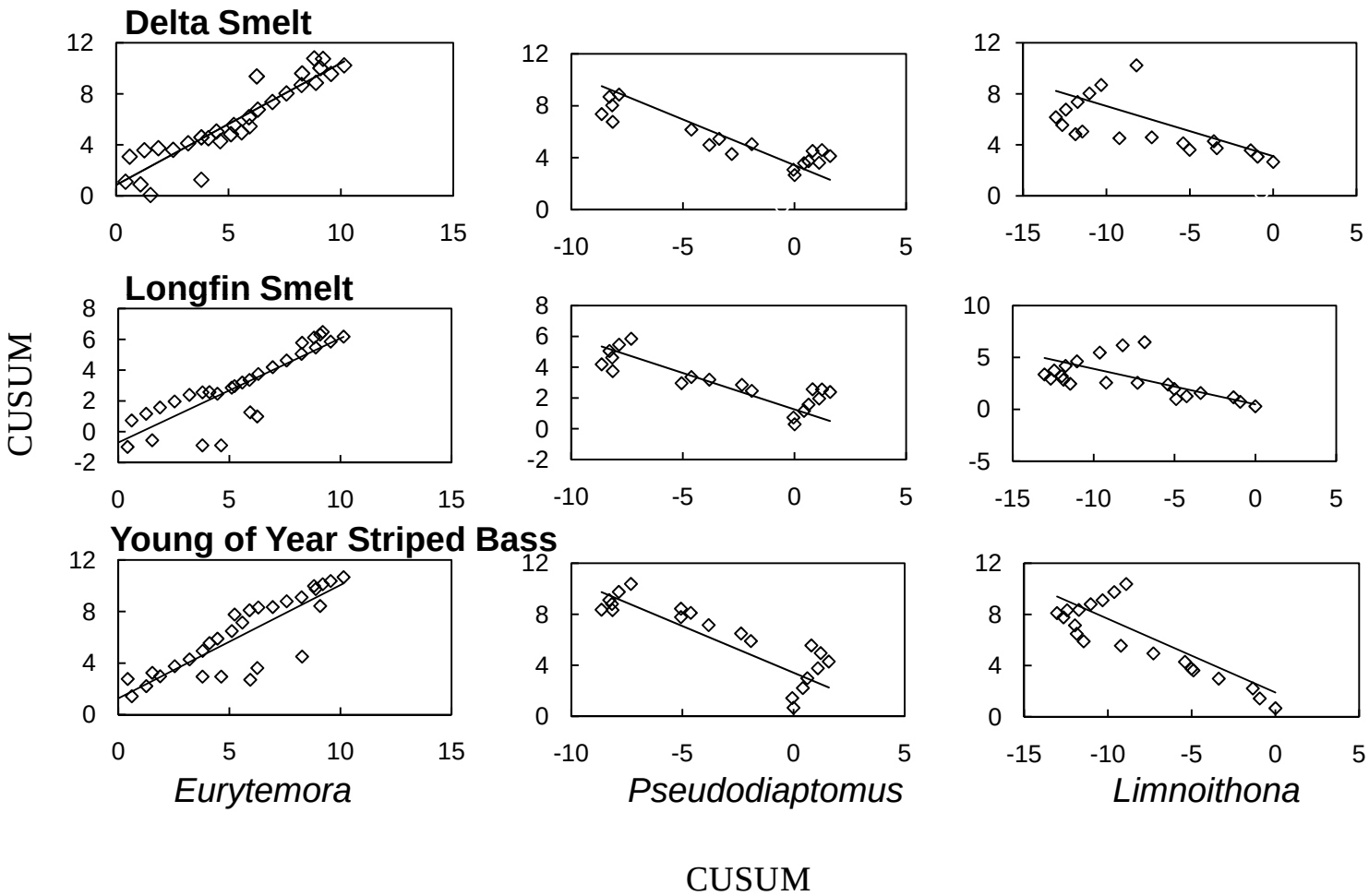


Comparing CUSUMs: Clams and Fish

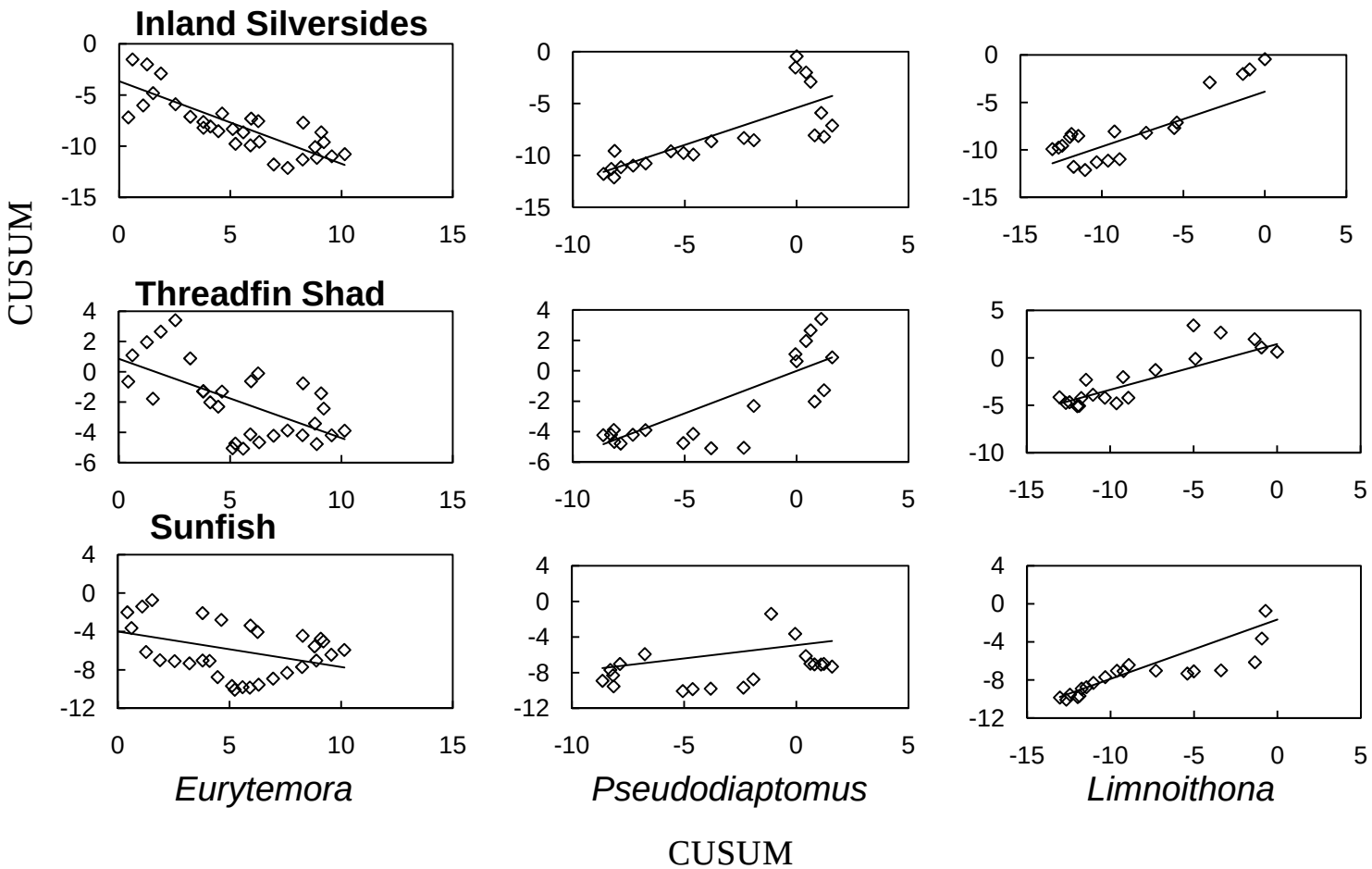




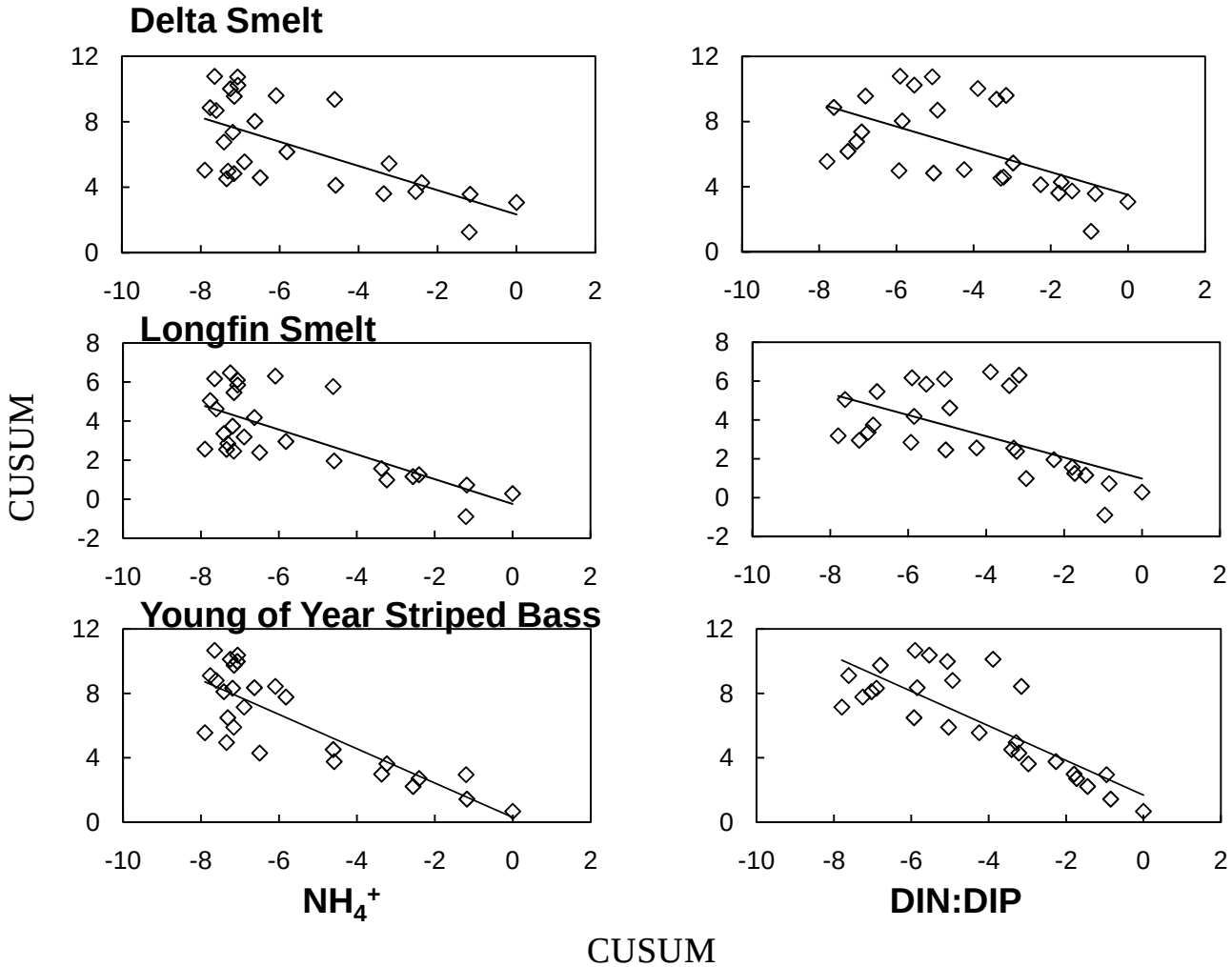
Relating CUSUMs: Fish and Zooplankton



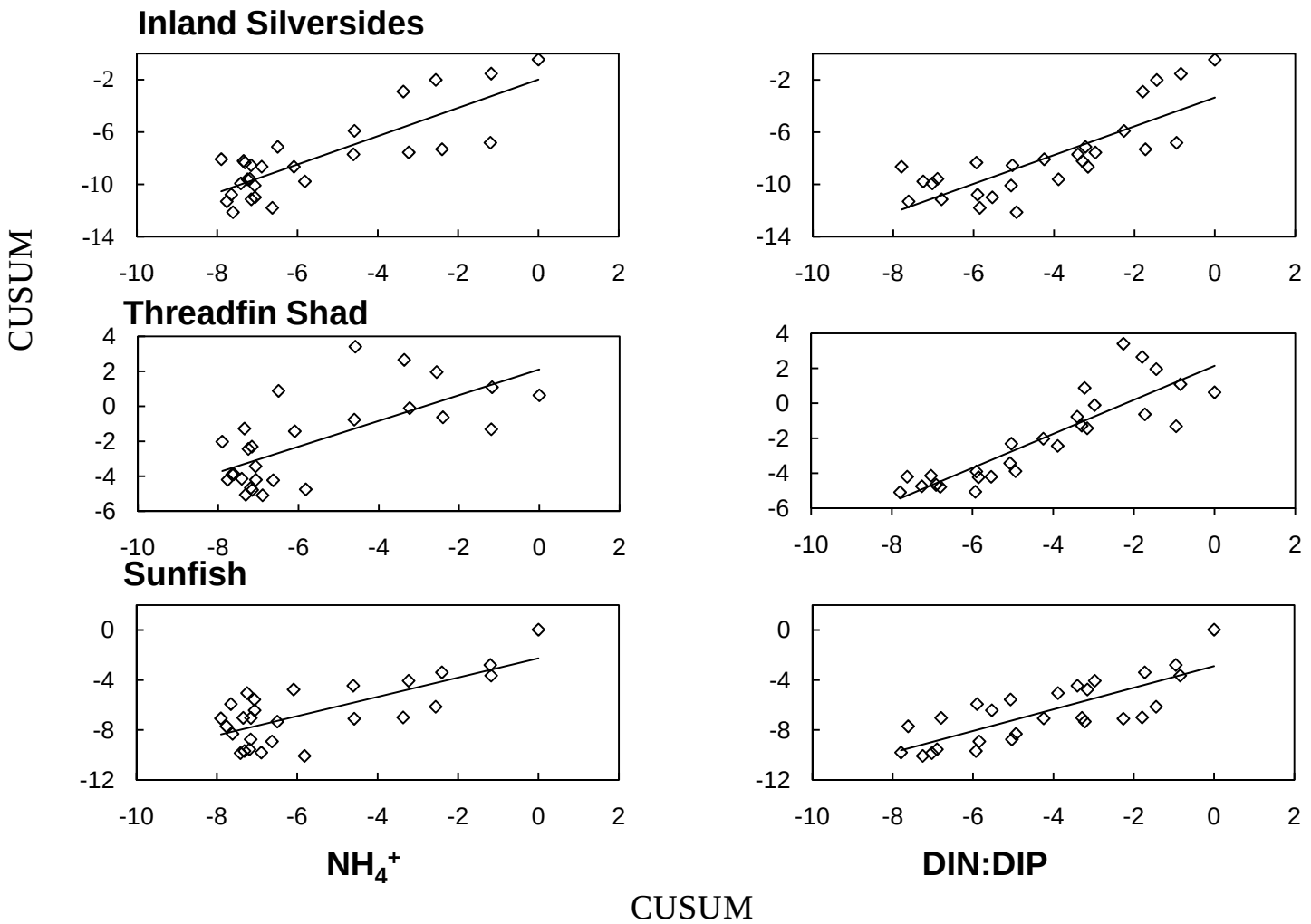
Relating CUSUMs: Fish and Zooplankton



Relating CUSUMs: Fish and Nutrients

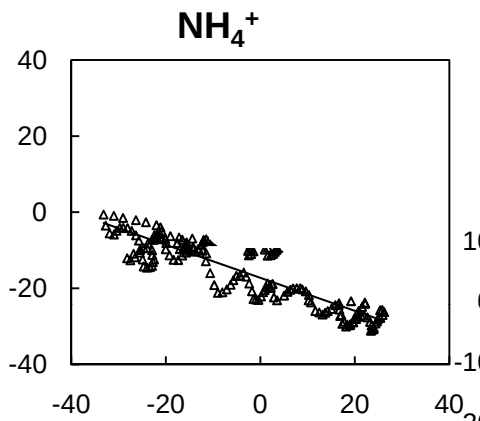


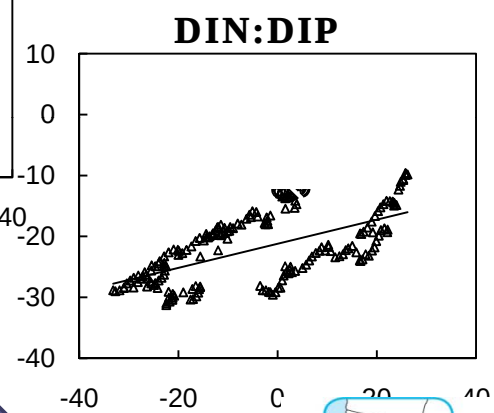
Relating CUSUMs: Fish and Nutrients

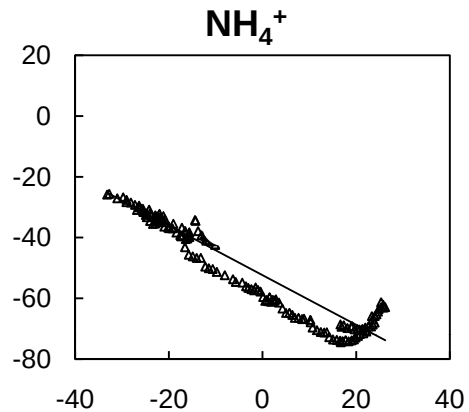


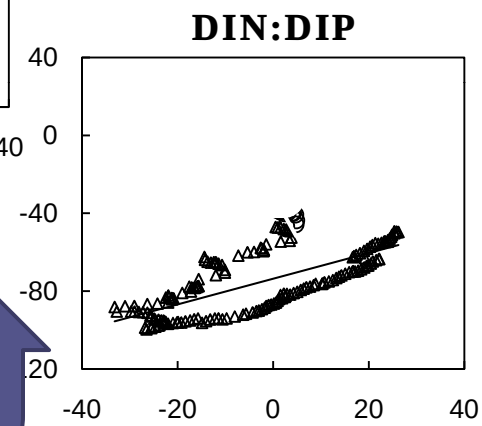
Relating CUSUMs: Nutrients and Dayflow

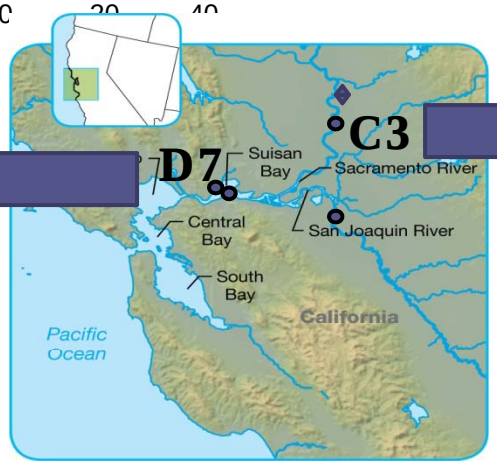
1984-1999 only





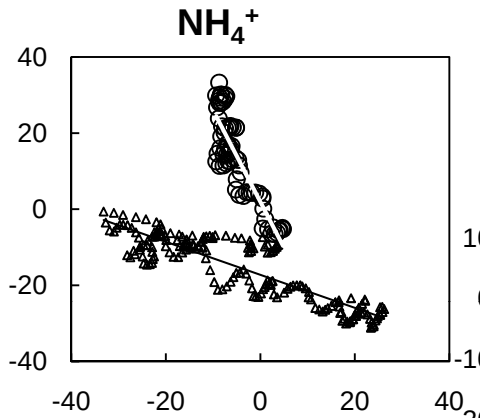


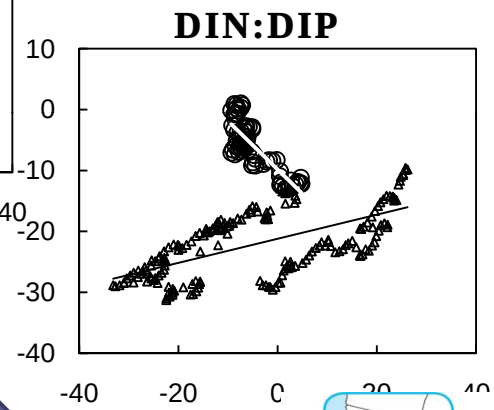


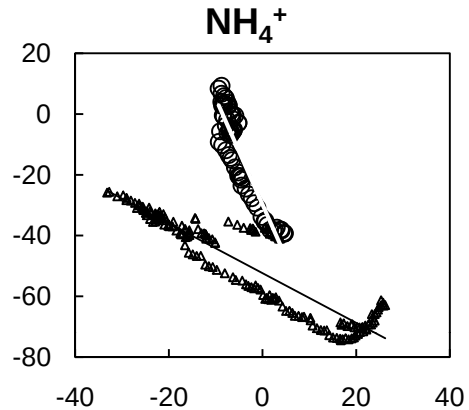


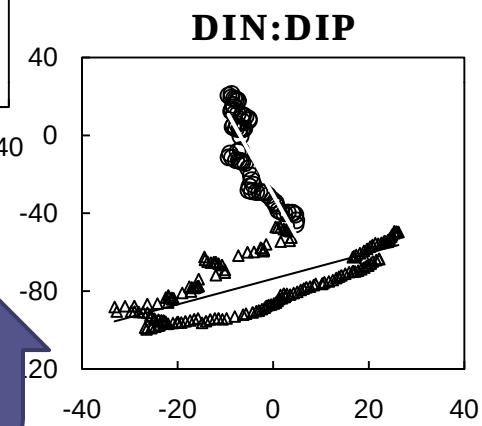
Relating CUSUMs: Nutrients and Dayflow

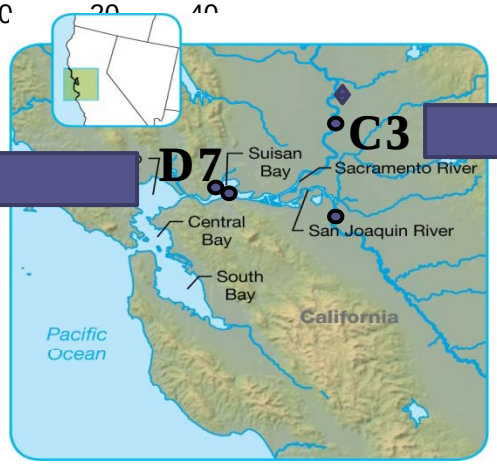
1984-2005











Summary and Conclusions

- Nutrients have changed significantly over time, in terms of total load, nitrogen form and ratios of nitrogen:phosphorus

- Phytoplankton and zooplankton changed significantly over time, with timing of changes coincident with timing of changes in nutrient loads and forms

- Changes in fish tracked changes in zooplankton and nutrient loads and forms, but fell into distinct groups that tracked positively or negatively

- Nutrient changes did not track changes in flow for the entire period, but did relate for specific year periods. The relationships changed when loadings changed.