Discharger Perspectives
Delta Inflow Workshop Presentation
4/17/2010

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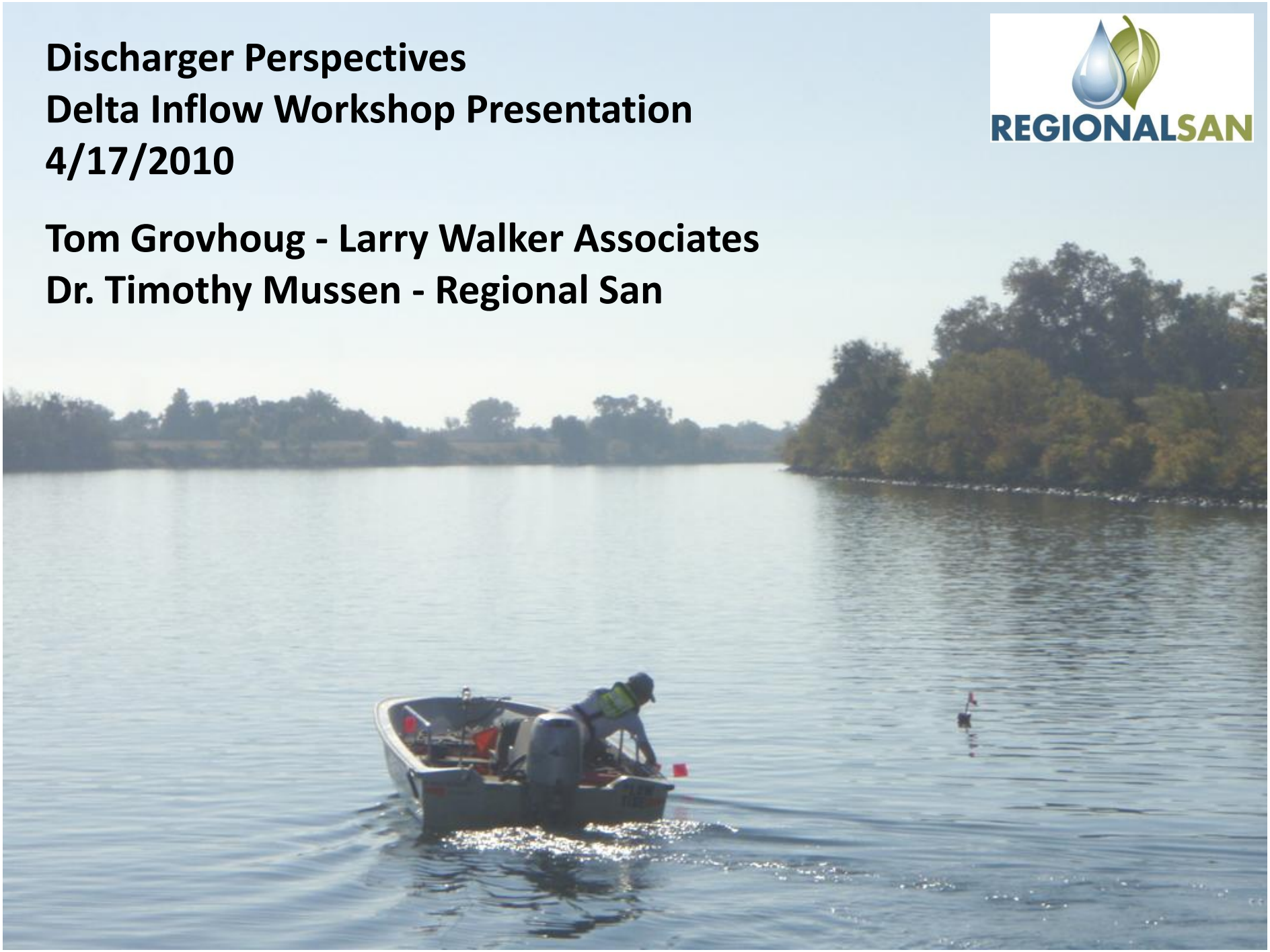
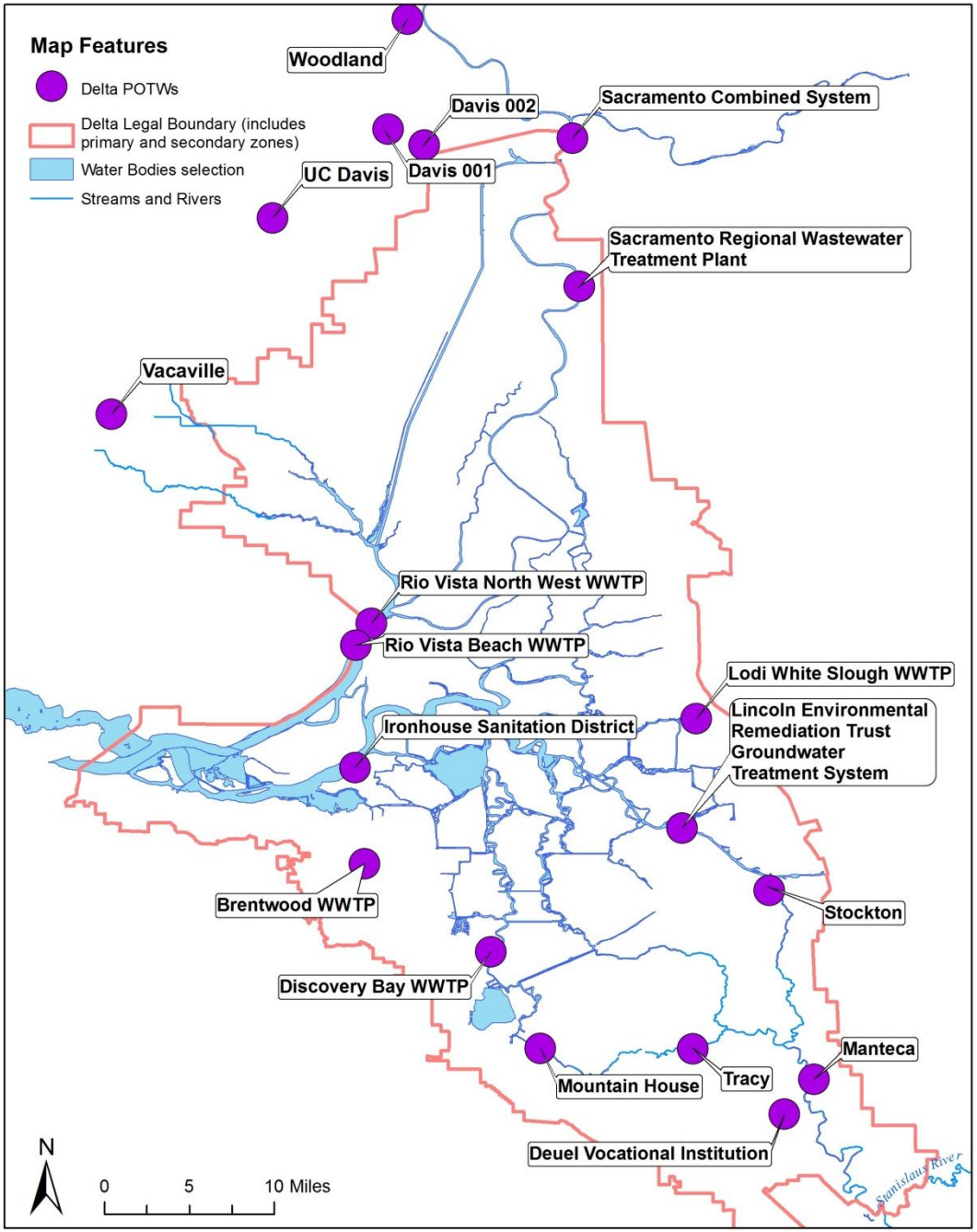
Dr. Timothy Mussen - Regional San



Publicly Owned Treatment Works Discharging to the Delta



Outline

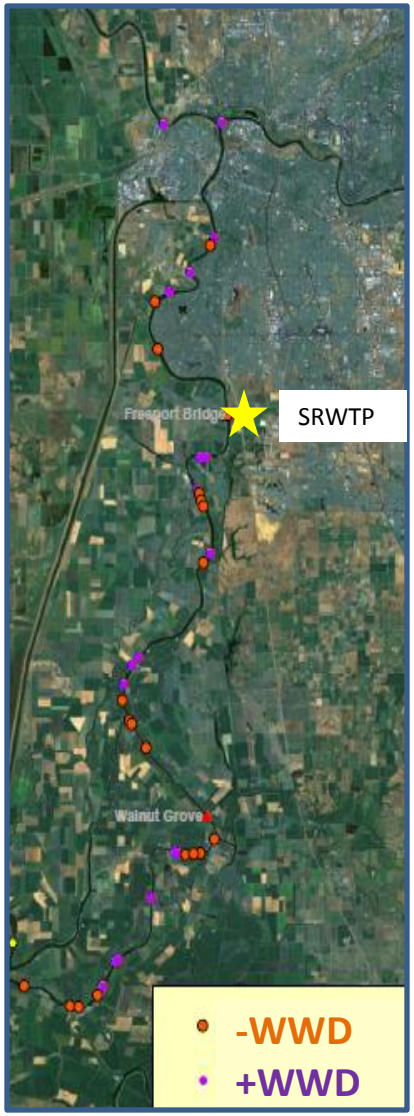
USGS experiment investigating phytoplankton growth in the Sacramento River in the presence and absence of wastewater effluent

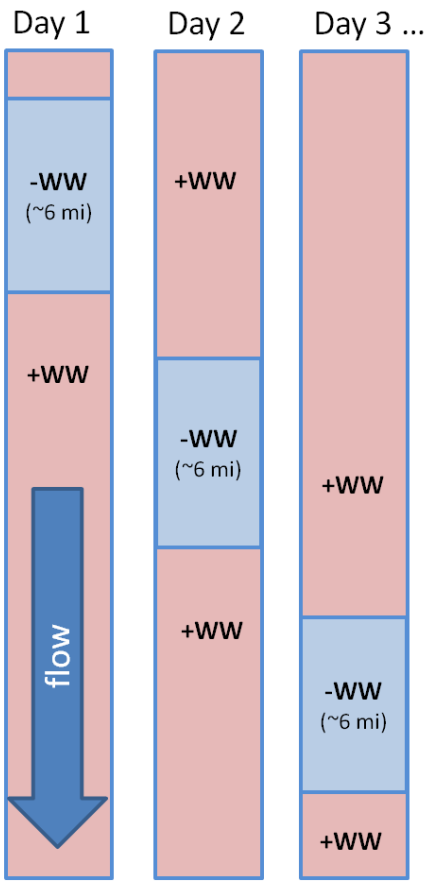
Pyrethroid removal at Sacramento Regional Wastewater Treatment Plant

Phytoplankton light limitation and grazing losses

River management to support native fish survival and food abundance

USGS Lagrangian Transect Study (preliminary results)
Tracking Wastewater-Free Water Parcels in the Sac. River

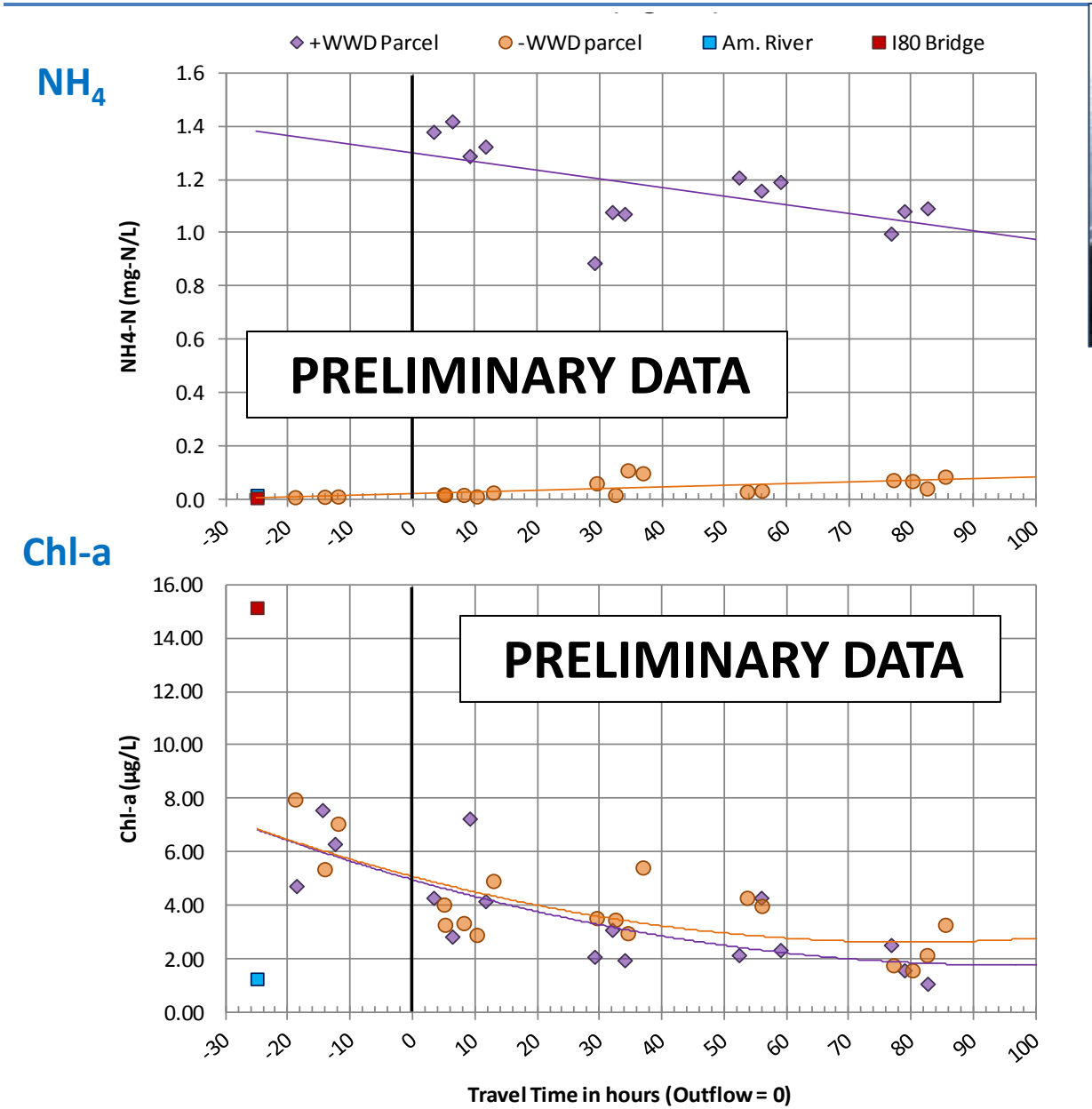




- 17-h wastewater hold
- ~6 mi. wastewater-free parcel
- 5-d tracking +WW and –WW
- measure phytoplankton and nutrient dynamics

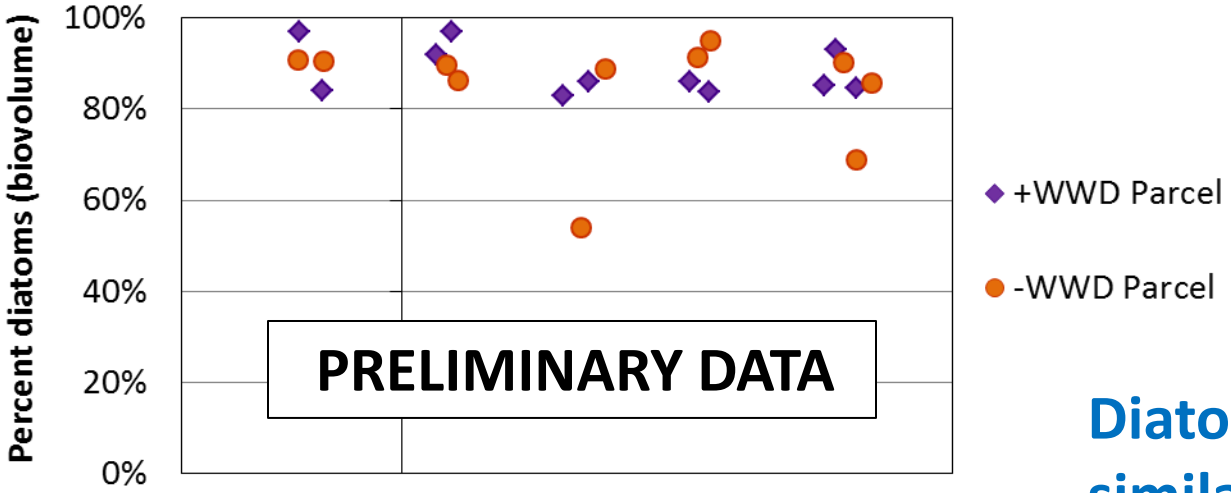
P.I. Dr. Tamara Kraus - USGS

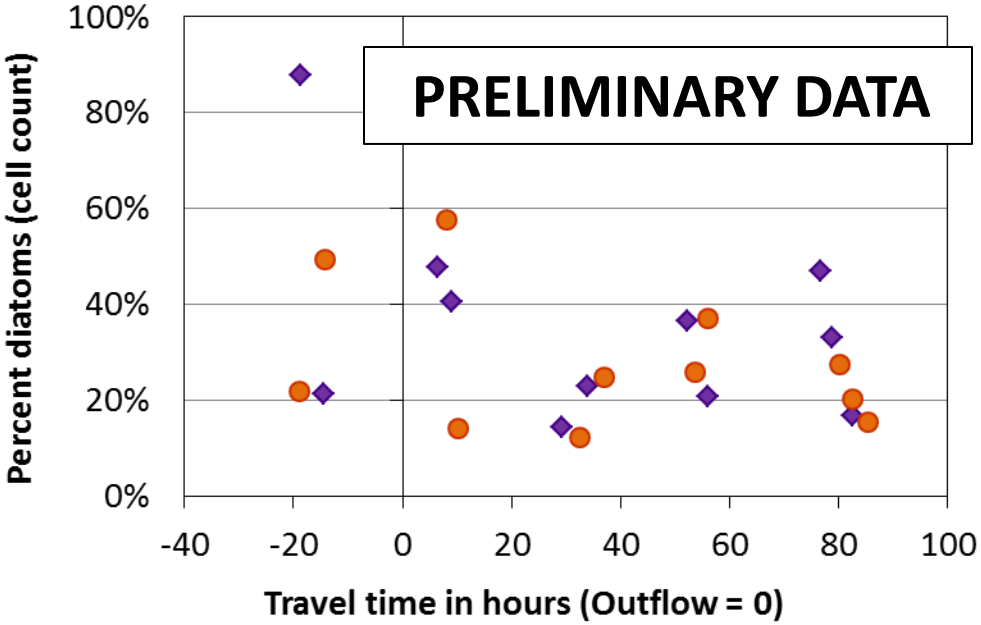
Ammonia and Chlorophyll-a Concentrations



Chlorophyll-a concentrations declined in <u>both</u> the presence and absence of wastewater effluent.

Diatom Abundance in the Sacramento River





Diatom abundance was similar between parcels and over time

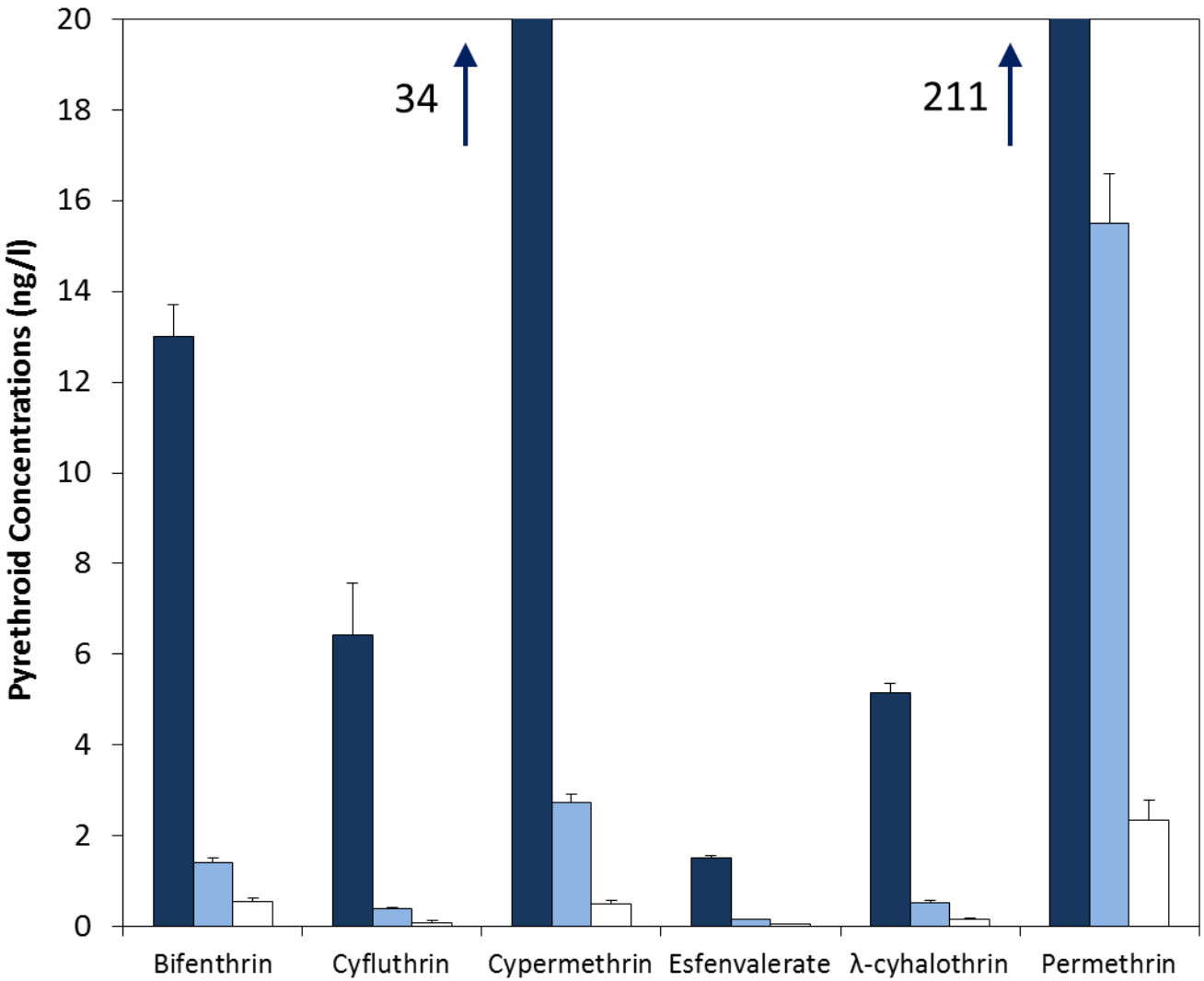
Wastewater enriched
- **88% of biovolume**
- **35% of cell count**

Wastewater free
- **85% of biovolume**
- **28% of cell count**

Enumerated by BSA Environmental Services, Inc.

Wastewater Treatment Removes Pyrethroid Pesticides

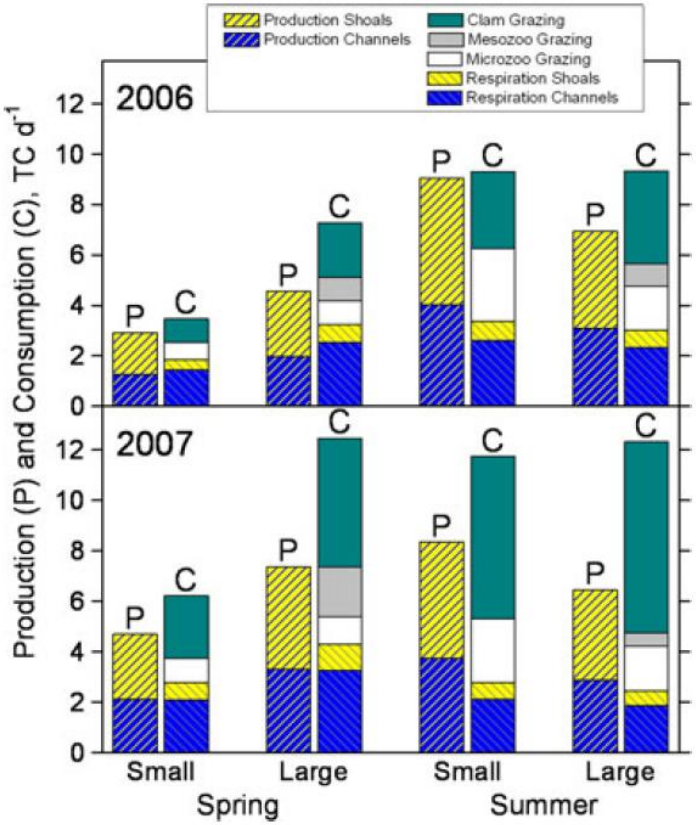
Source control is the optimal method for pyrethroid reduction



- SRWTP influent
- SRWTP effluent (91% reduction)
- Pilot BNR effluent (98% reduction)

BNR = Biological Nutrient Removal

Phytoplankton Abundance is Limited by Grazing in the Low Salinity Zone



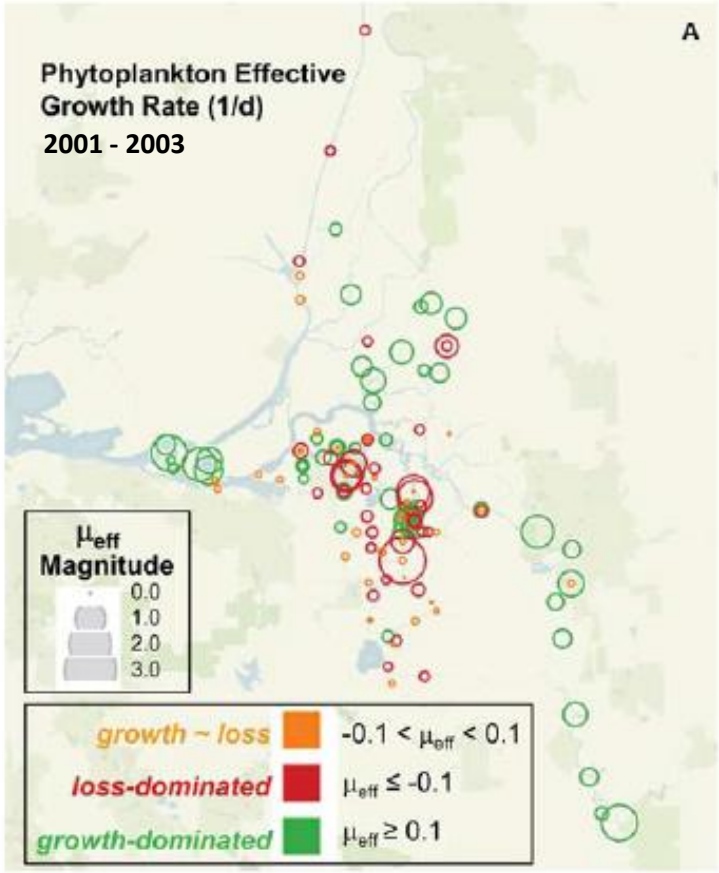
Clams and microzooplankton can consume phytoplankton faster than it can be produced

Grazing can control phytoplankton growth in Spring and Summer

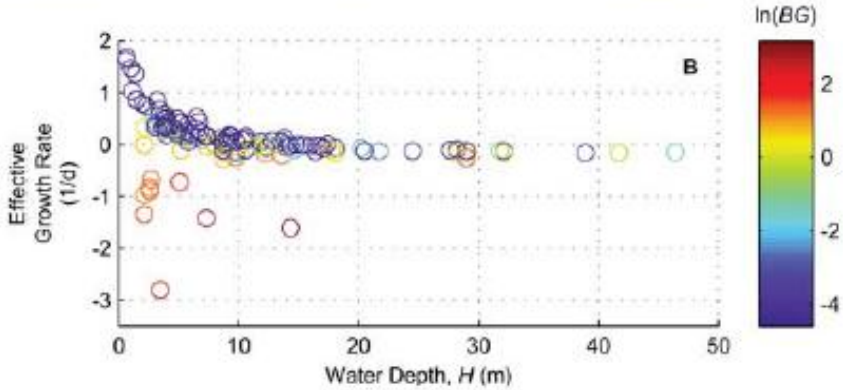
Figure 3 from Kimmerer and Thompson (2014) Estuaries and Coasts.

P = Production, C = Consumption

Invasive Clams are Widespread in the Bay-Delta System



Including the Sacramento River



Phytoplankton growth and clam grazing increase in shallow water with longer residence times

Figure 3 from Lucas and Thompson (2012), Ecosphere

Yolo Bypass (Floodplain) Productivity

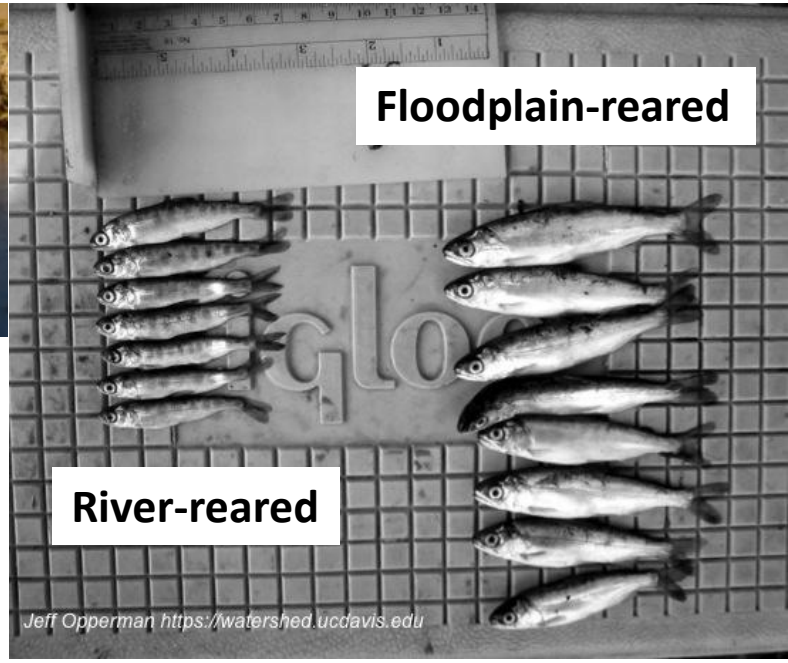


Figure 7. from Jeffres et al. (2008), Environmental Biology of Fishes

Phytoplankton and zooplankton production can be high in floodplains

- **Shallow water**
- **Long residence time**
- **No clams**

Native fish evolved to utilize floodplains (less stranding)
Floodplains promote salmon life history diversity (migration timing)
Native fish are more prevalent in the northern Delta (Yolo Bypass)
Floodplains need some refuge from avian predators

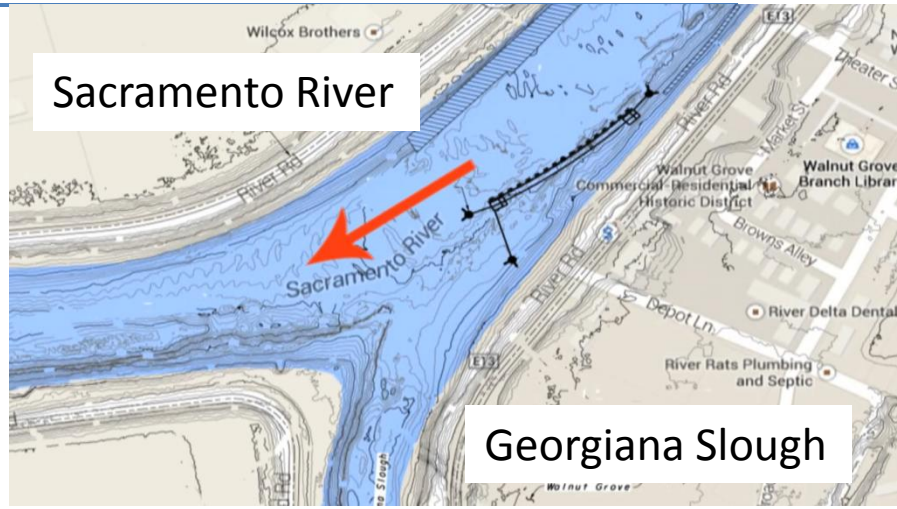
Behavioral Fish-Guidance Devices

Chinook salmon may be guided past entrances to the central Delta or into restored Floodplains

Outmigration survival is higher when salmon remain in the Sacramento River main stem

Perry et al. (2012) Environmental Biology of Fishes

CA DWR is currently testing a floating boom at Georgiana Slough with 5,500 tagged salmon



http://www.youtube.com/watch?v=937bXx9QMn8&list=PLCEB7BD6E44B91309

Main Messages

Sacramento River phytoplankton growth is similar in the presence and absence of wastewater effluent

Diatoms dominate phytoplankton biovolume, but are low in cell counts

Source control is the preferred method to reduce pyrethroids, but Regional San's wastewater treatment removes ~90% of certain pyrethroids and further reductions are expected with treatment upgrades

Light limitation and grazing losses can limit phytoplankton abundance

Floodplain inundation and behavioral guidance devices may increase native fish food abundance and survival

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