Yolo Bypass as a source of Delta Phytoplankton:
Not just a legend of the Fall?

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2013 Study Collaboration

Special thanks to:

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Louise Conrad – DWR – *Program Manager II – Office of Water Quality*

Naoaki Ikemiyagi – *DWR – Aquatic Ecology - Yolo Bypass Lead Scientist*

Jasmine Shen & Haley Carlson – DWR – *Fish and Wildlife Sci-Aides*

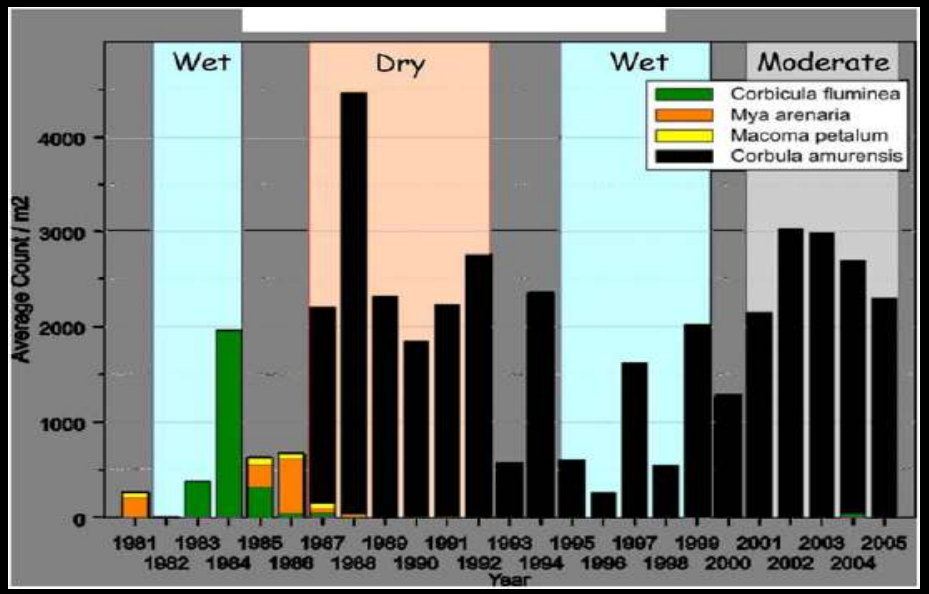
Bryte Lab – Sid Fong, Allan Wong, Marilyn Caroll, Gary Munoz, etc.

Why do we care?

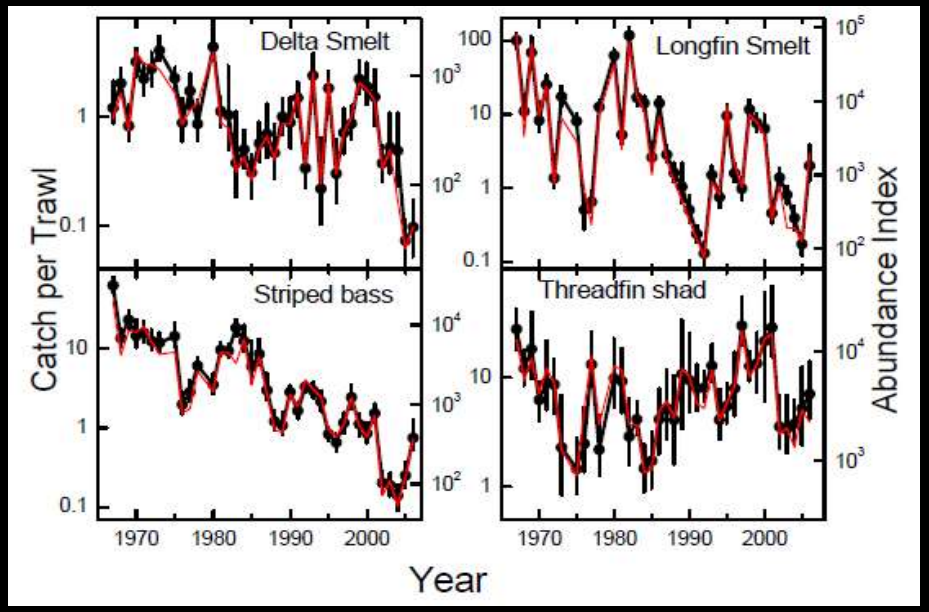
Corbula & Corbicula

Zooplankton

POD Species

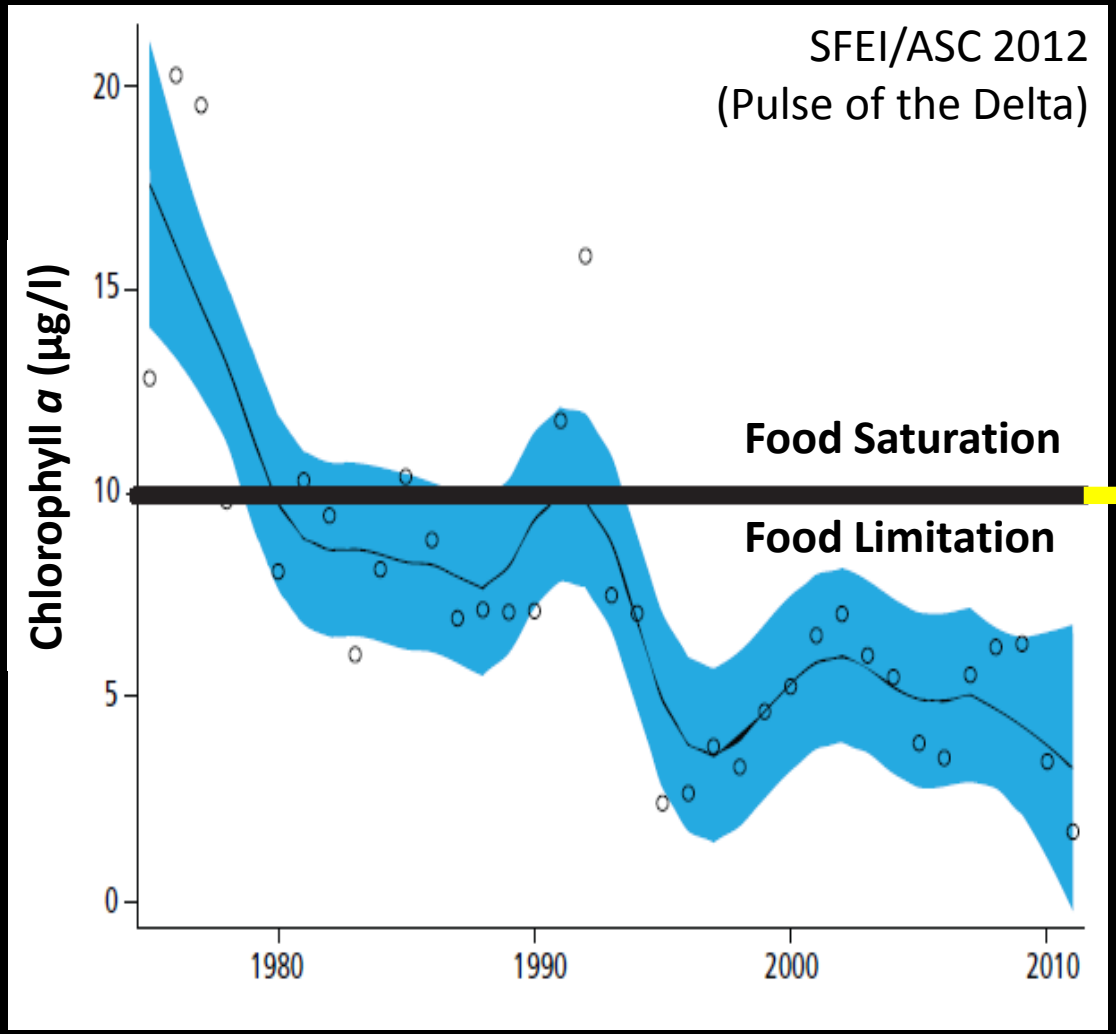


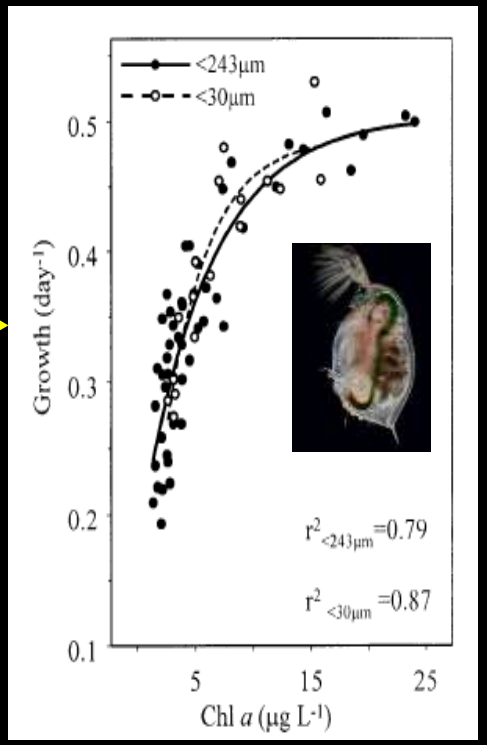
Peterson et al. 2005



Sommer et al. 2007

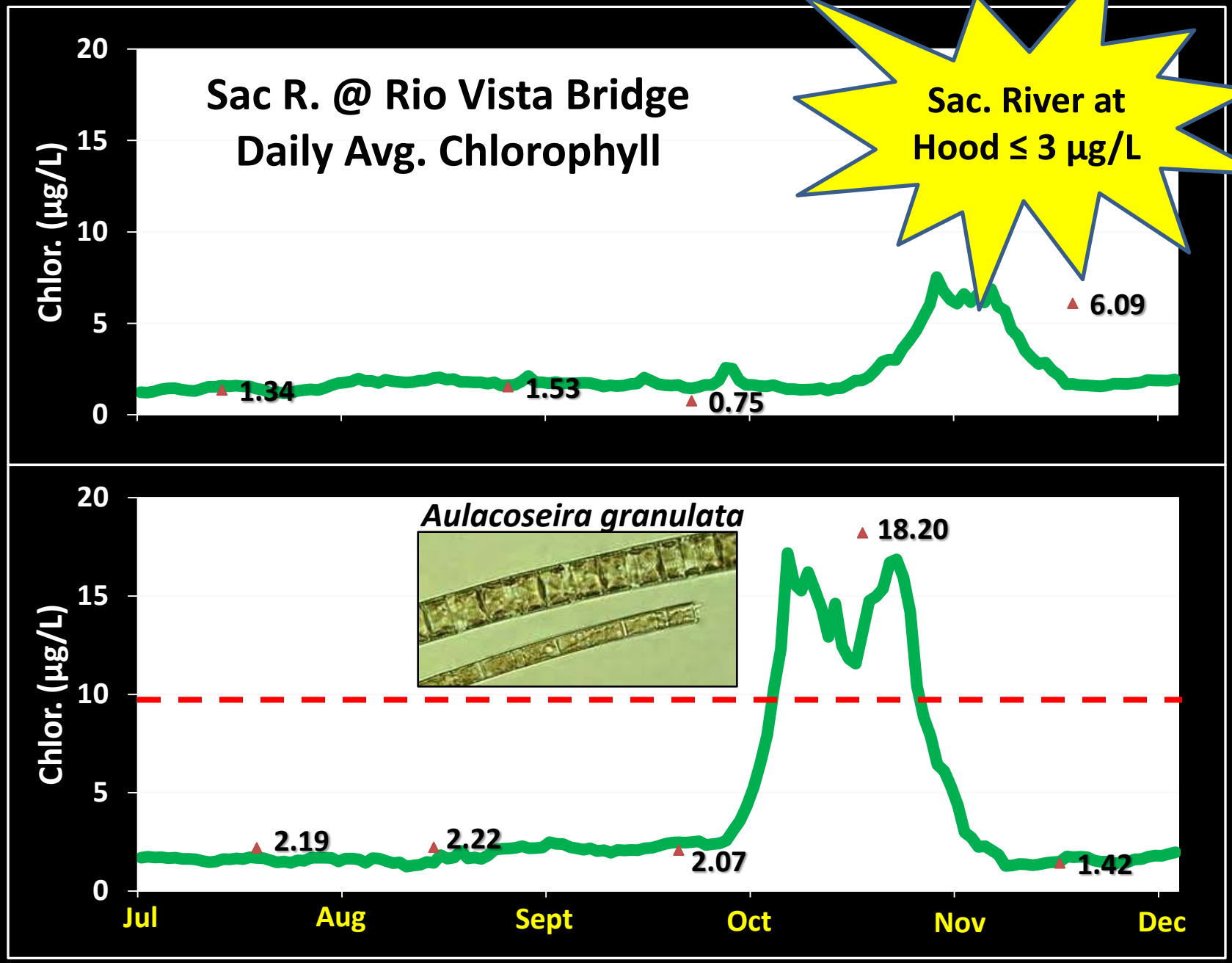
No comparable Delta bloom for over 20 years!



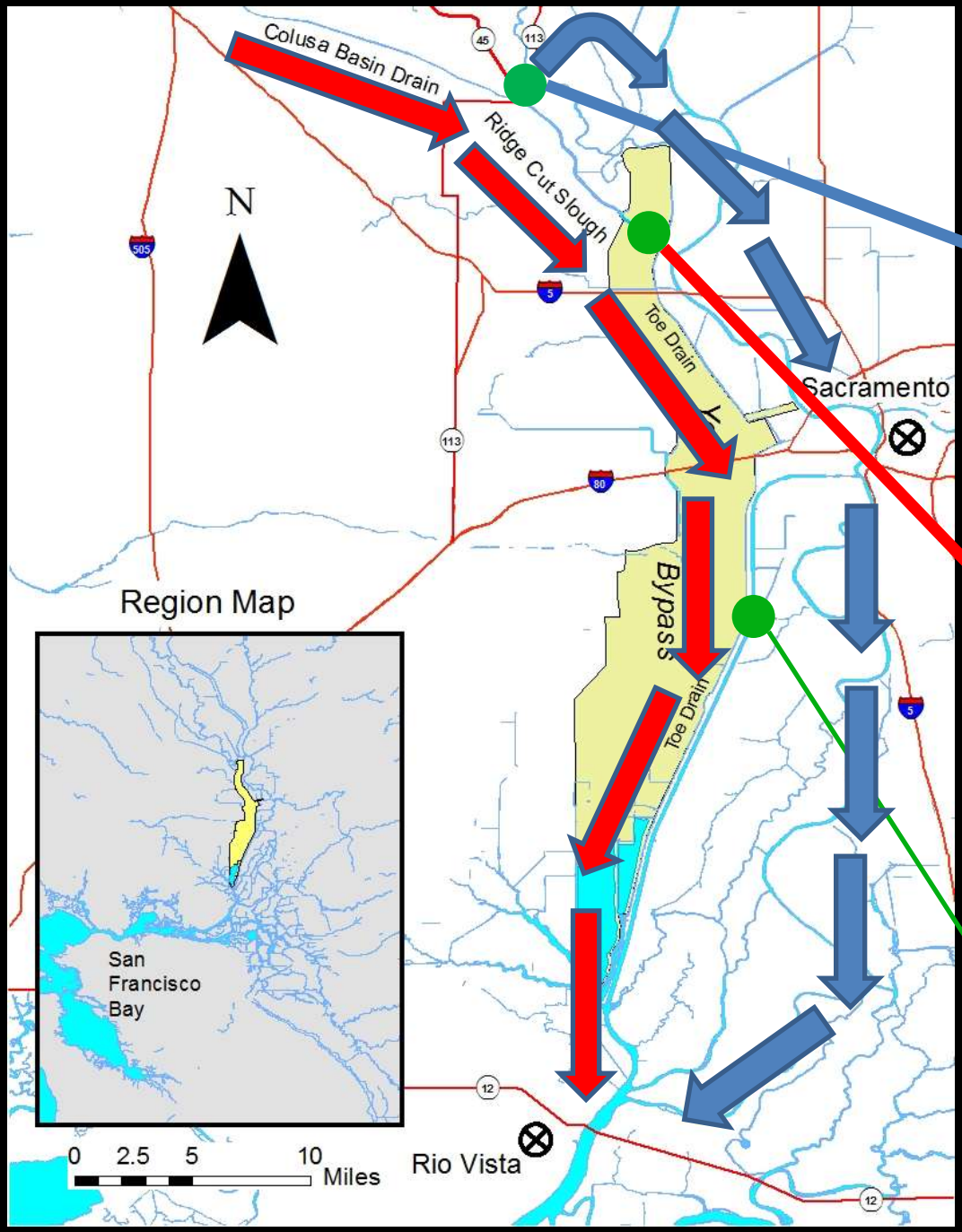


Mueller-Solger et al. 2002

2011 and 2012 Fall Bloom in North Delta



Where?...Yolo Bypass?



1

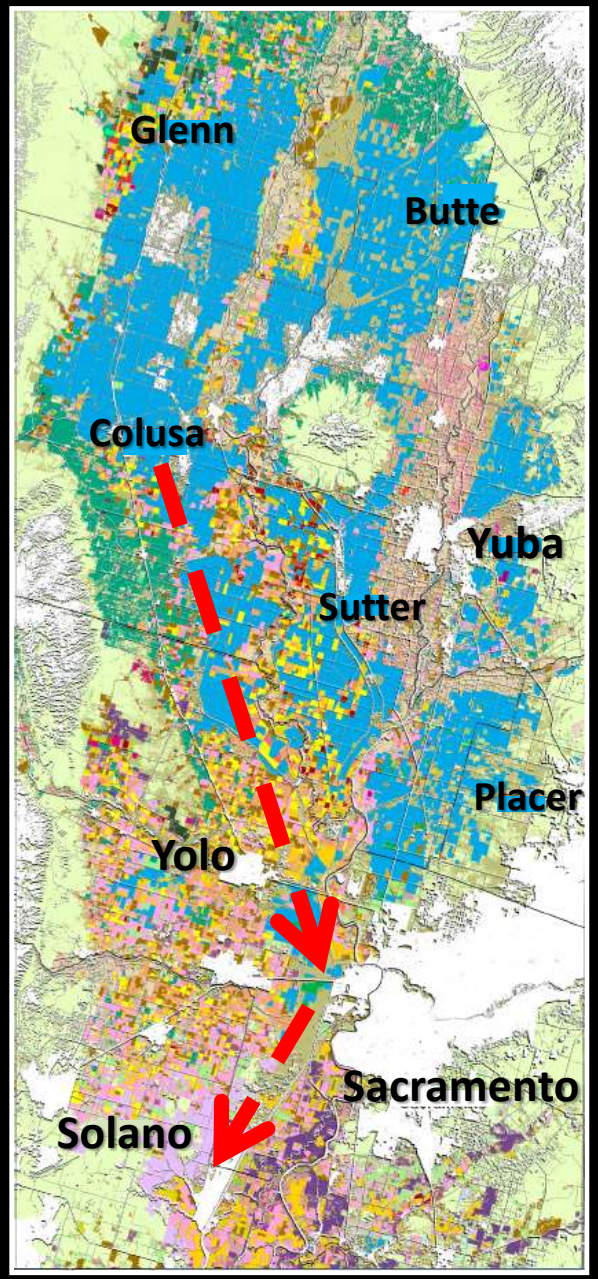
Knight's Landing Outfall Gates

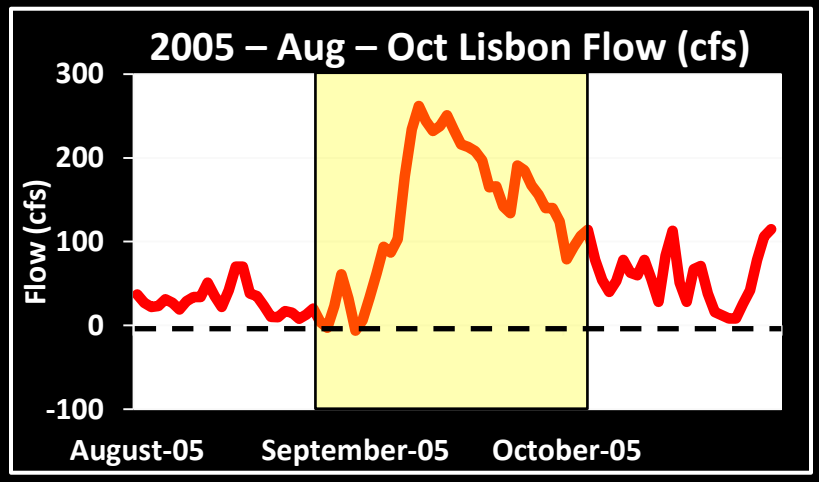
2

Wallace Weir

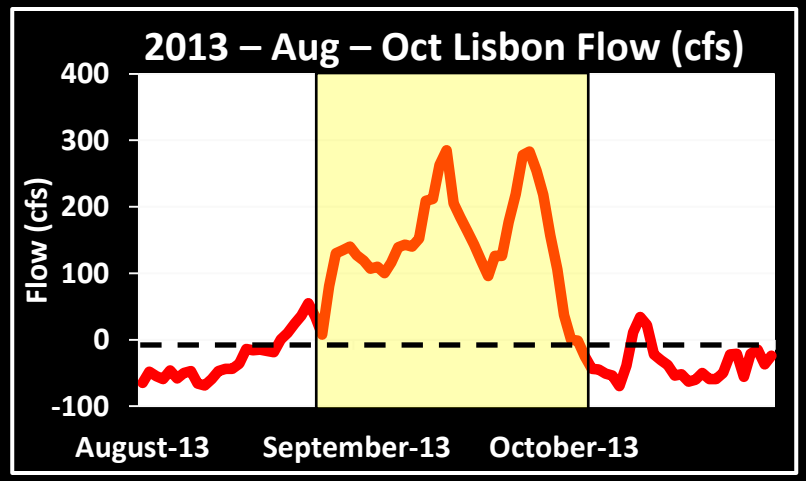
Lisbon Weir

Rice fields and phytoplankton blooms….What's the connection?



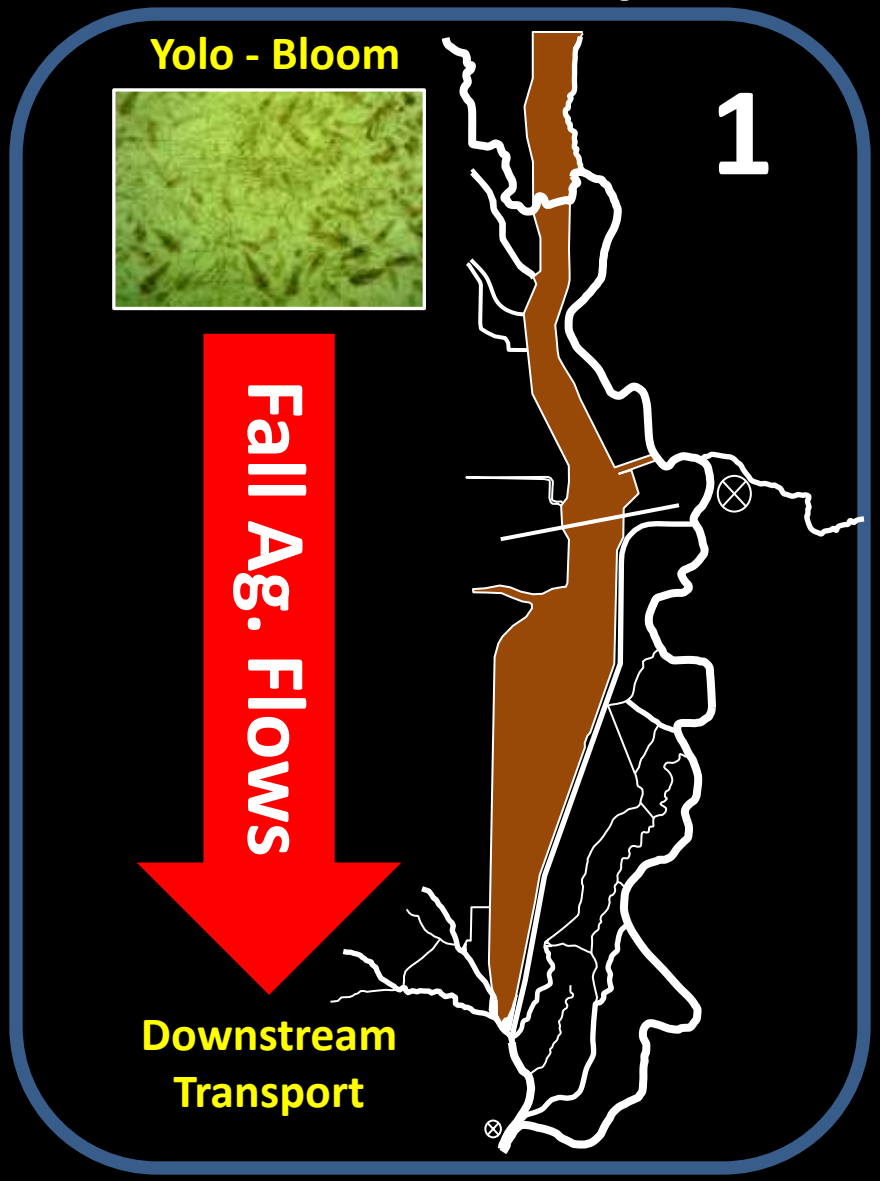


Rice Field Drainage = Fall Flow Pulses

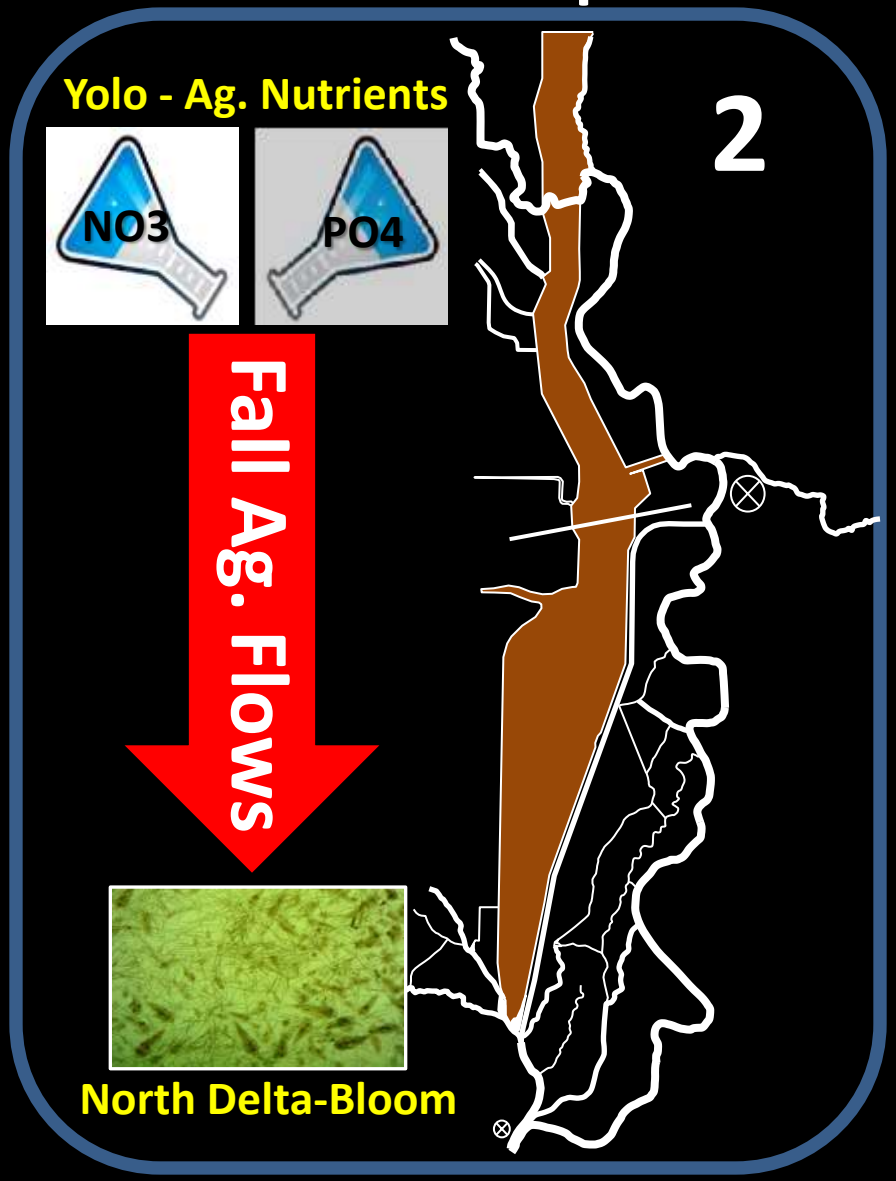


What causes fall blooms downstream at Rio Vista?

Biomass Transport ?



Nutrient Input ?



Methods

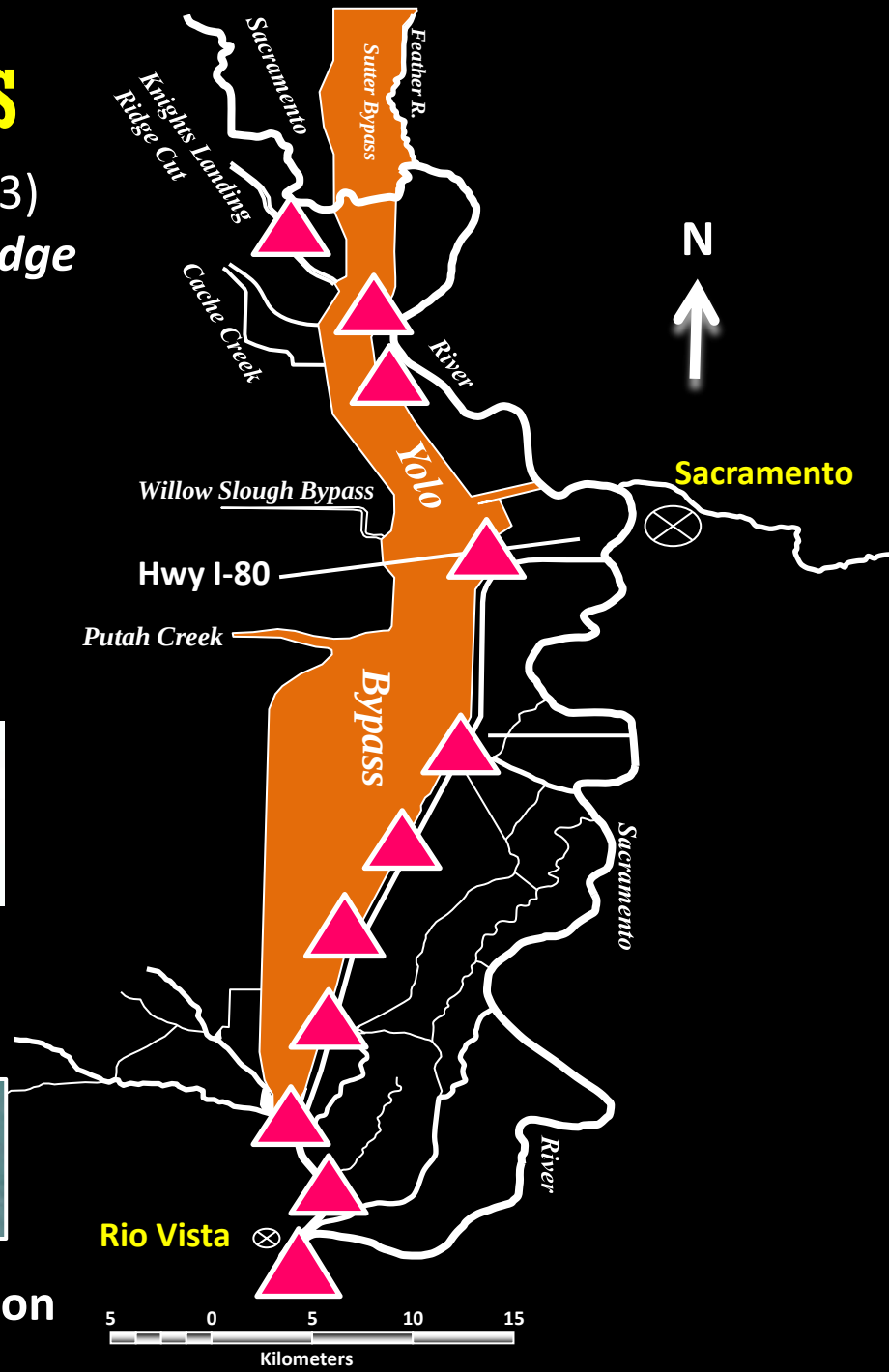
- **11** sampling sites (July 2013 – October 2013)

Ridge Cut Slough* south to *Rio Vista Bridge

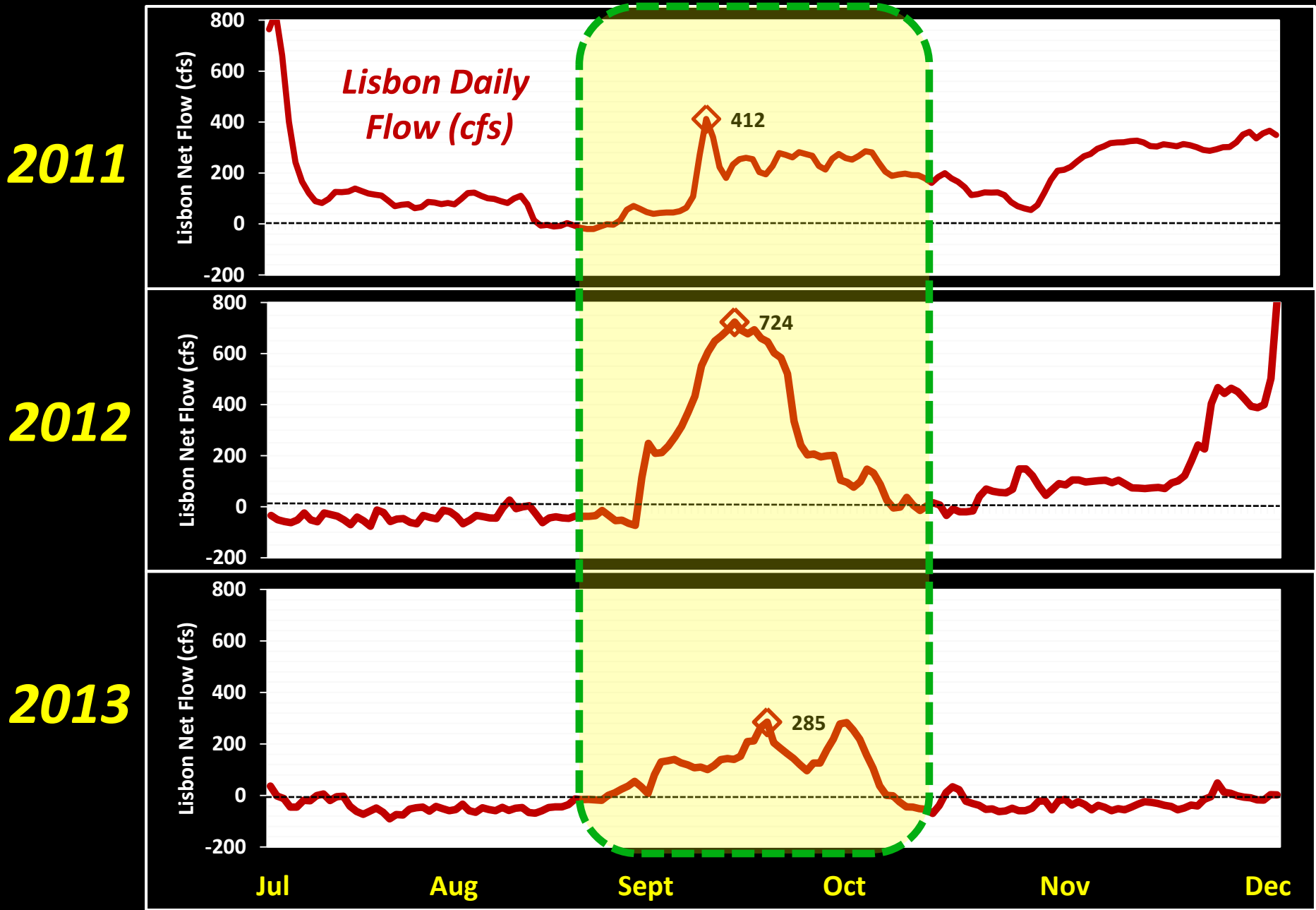
Continuous WQ Monitoring

Nutrient / Chlorophyll-a

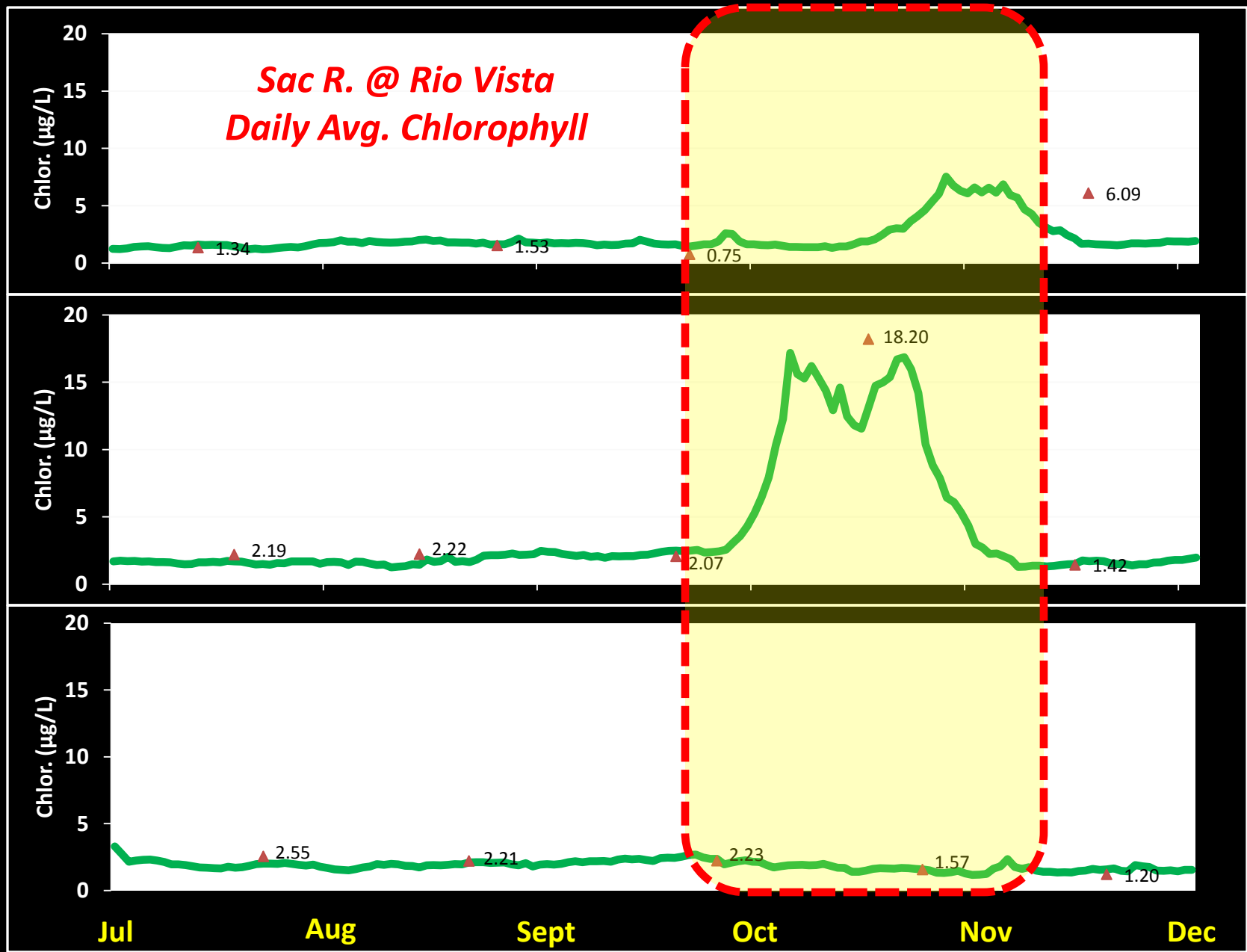
Phyto / Zooplankton



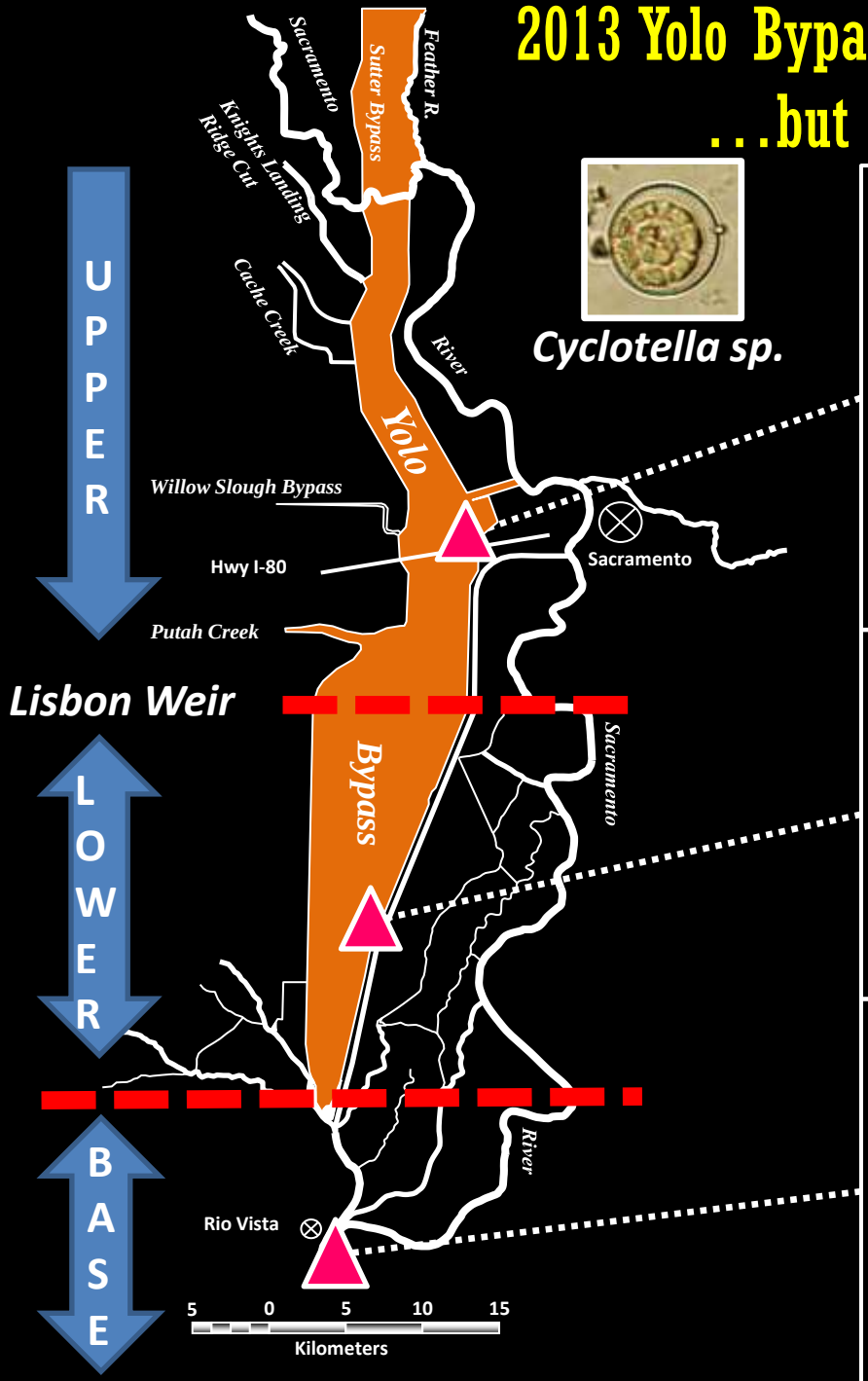
Results: Weak flow pulse in 2013!



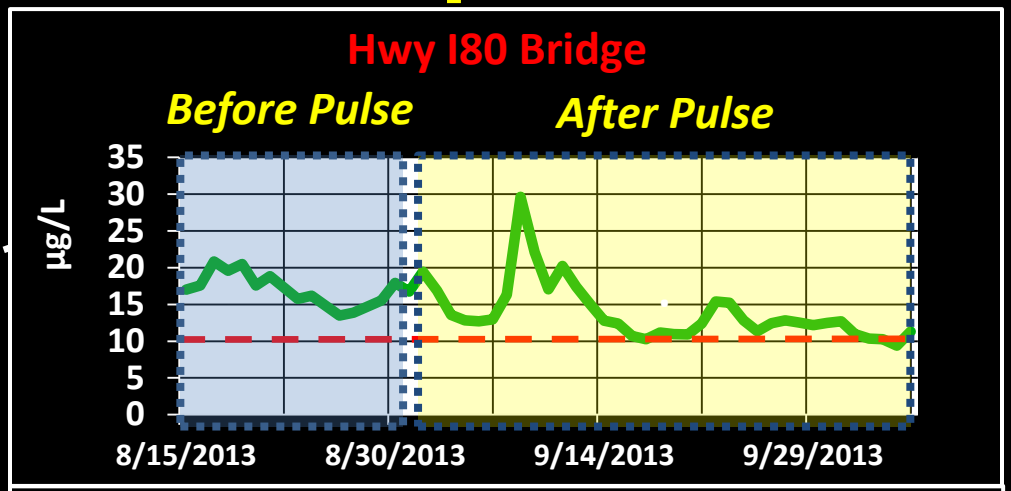
NO Fall bloom at Rio Vista in 2013…#$%@!

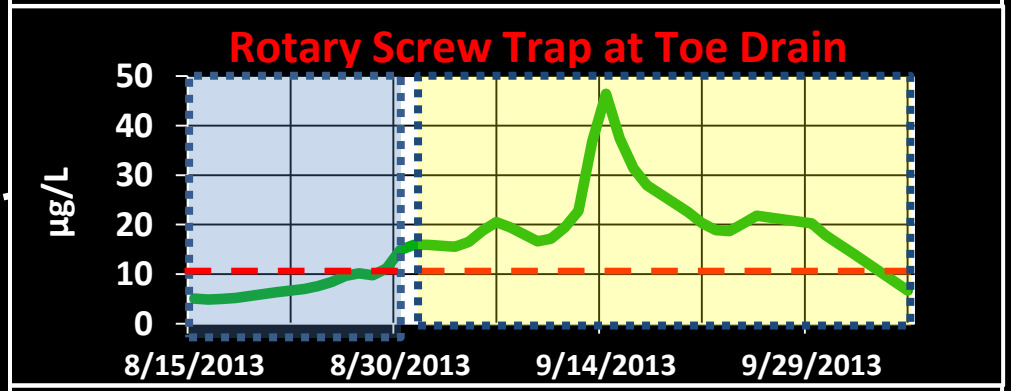


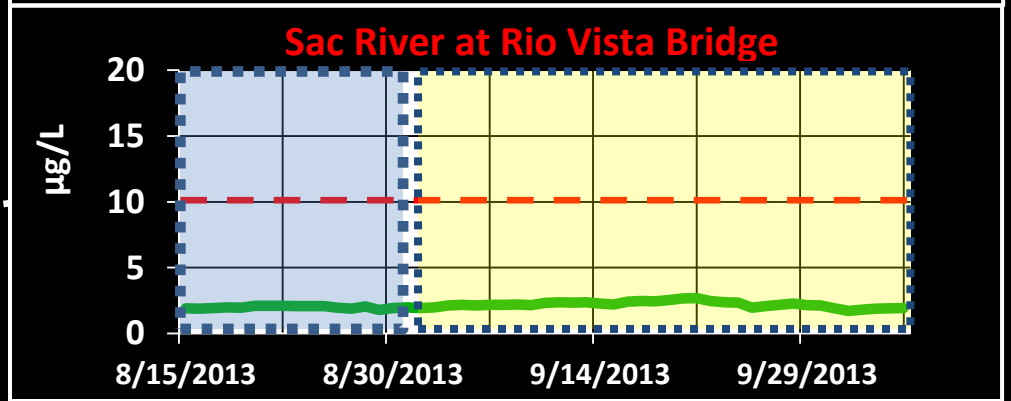
2013 Yolo Bypass…Chlorophyll – YES
…but NO biomass transport to Rio Vista



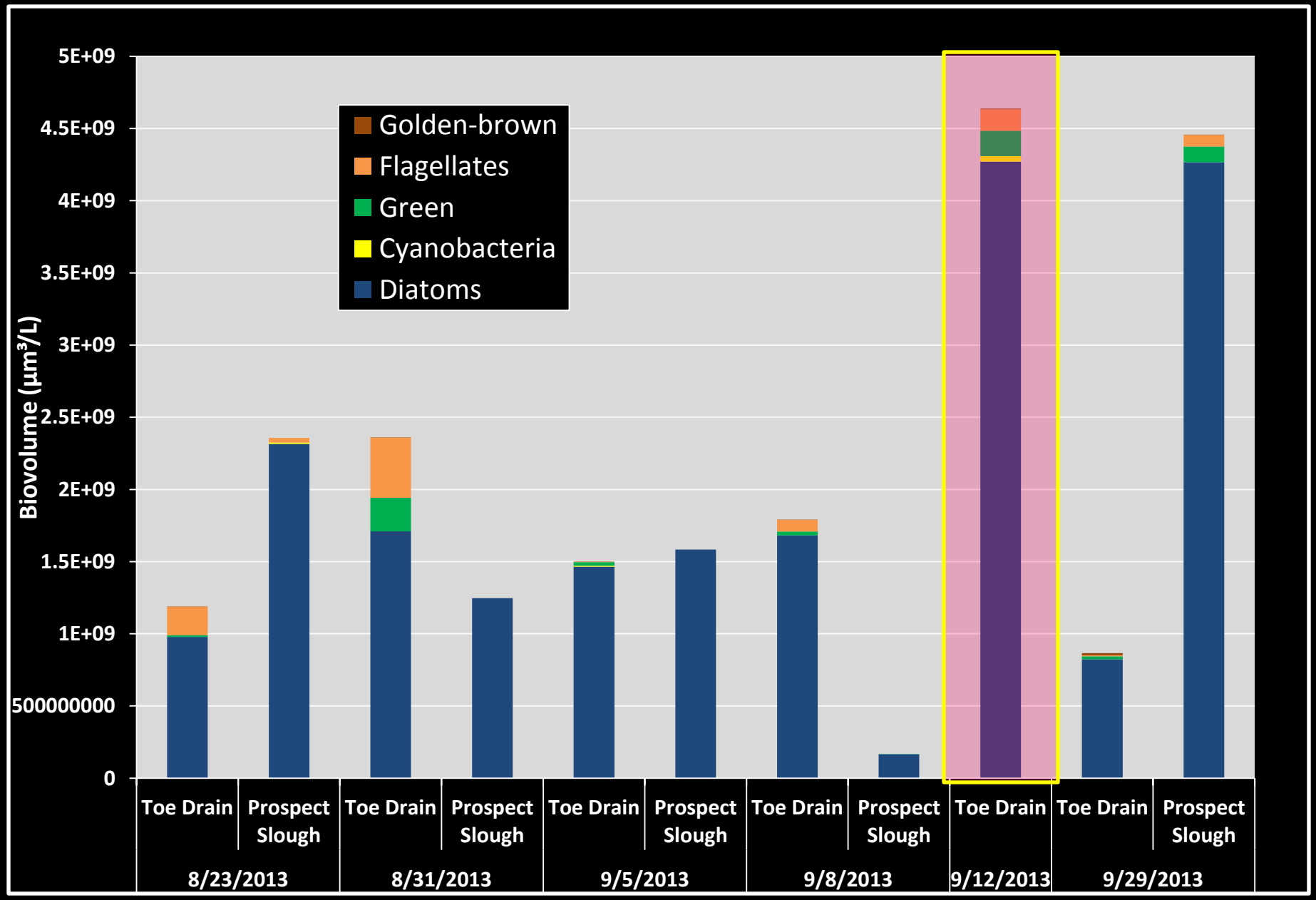
Cyclotella sp.





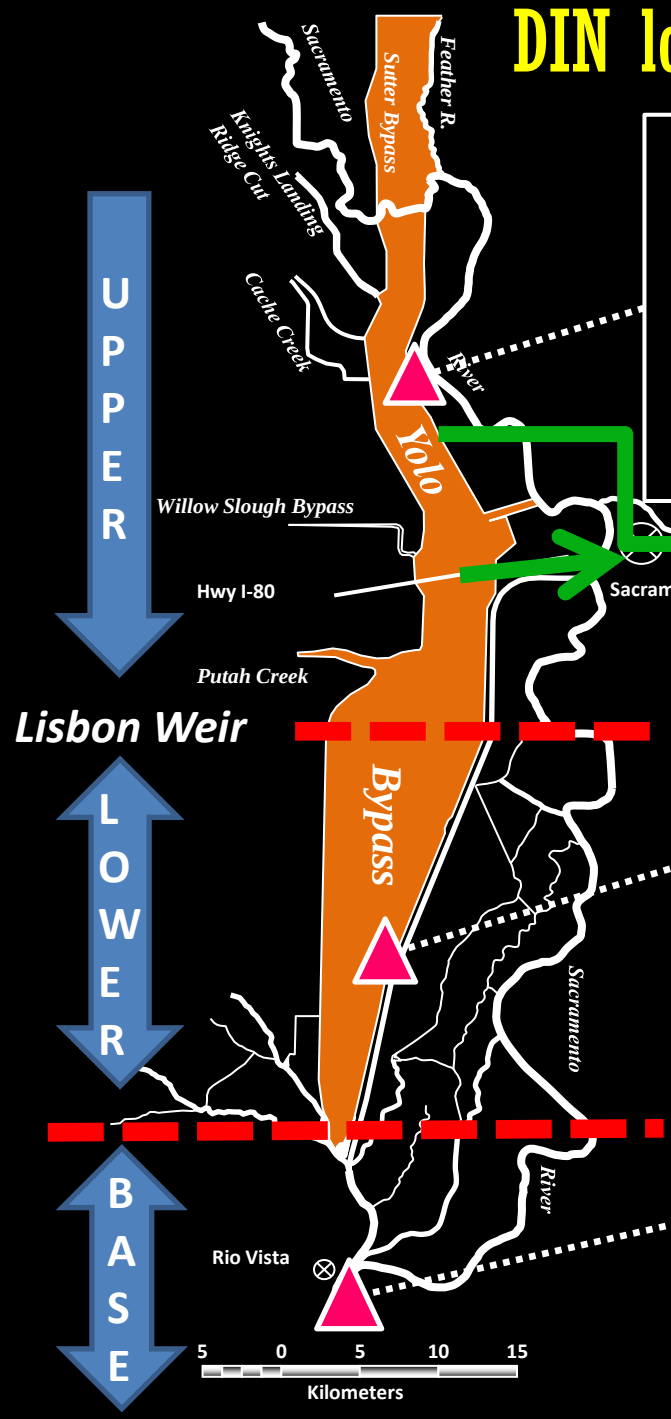


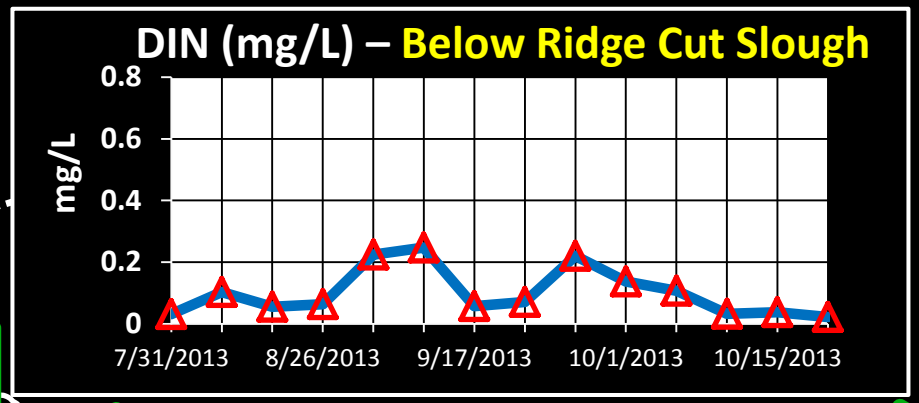
Summer/Fall 2013 Phytoplankton – Diatom Dominated



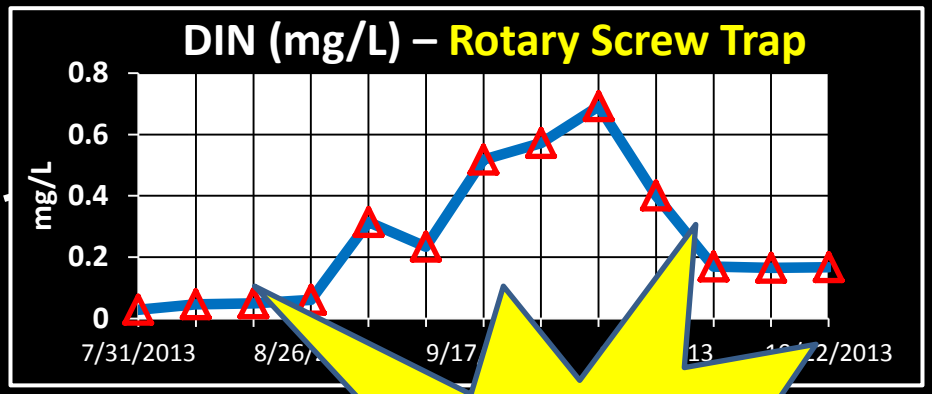
Chris Foe and Randy Dahlgren, 2013 – Berg, M. Applied Marine Sciences

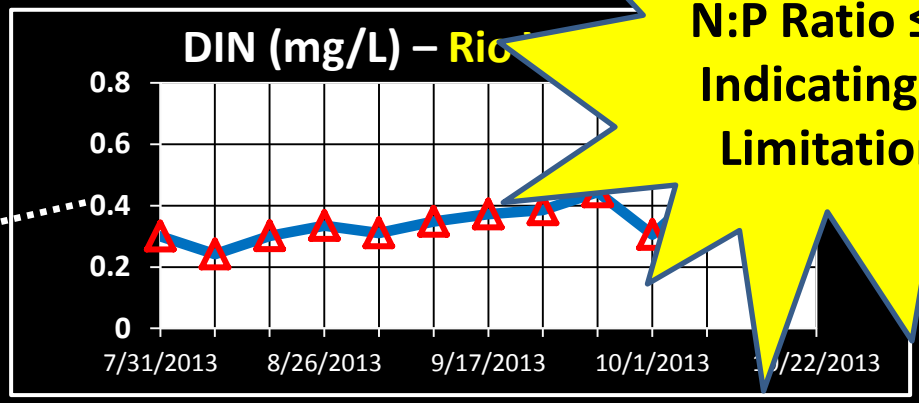
DIN low in rice drainage…low nutrient input



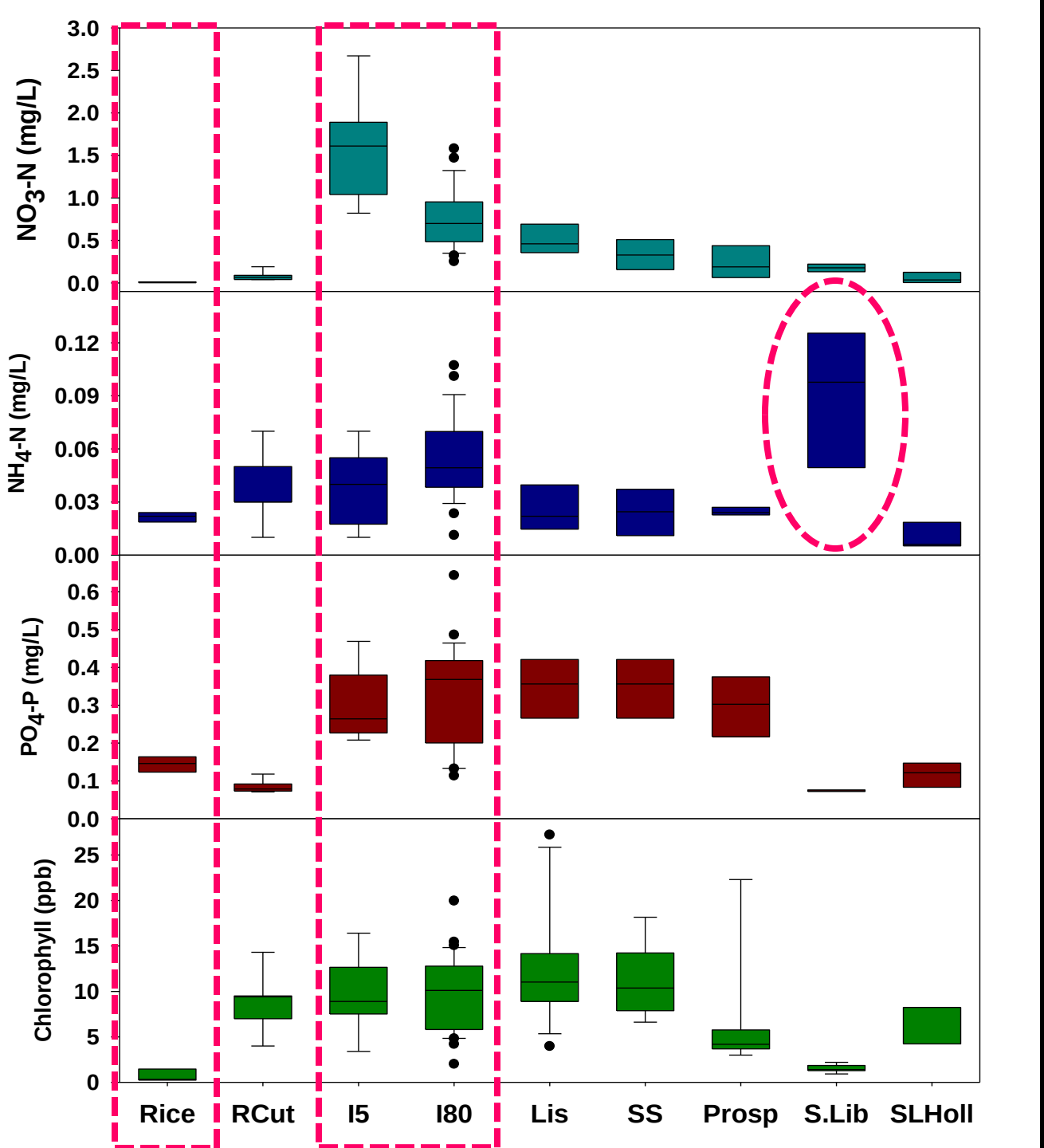


Woodland & Davis WWTP





N:P Ratio ≤ 8 Indicating N Limitation



Sum/Fall 2013

Nitrate

Ammonium

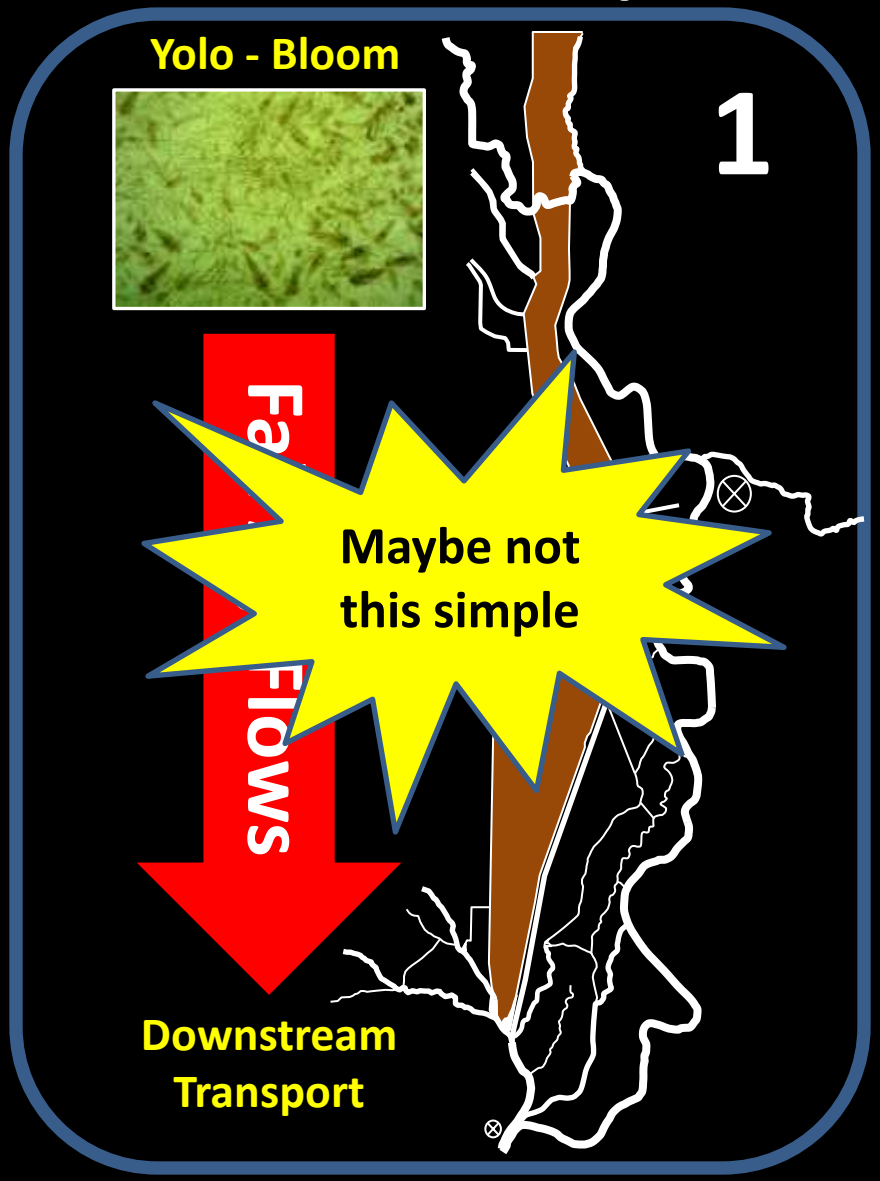
Phosphate

Chlorophyll-a

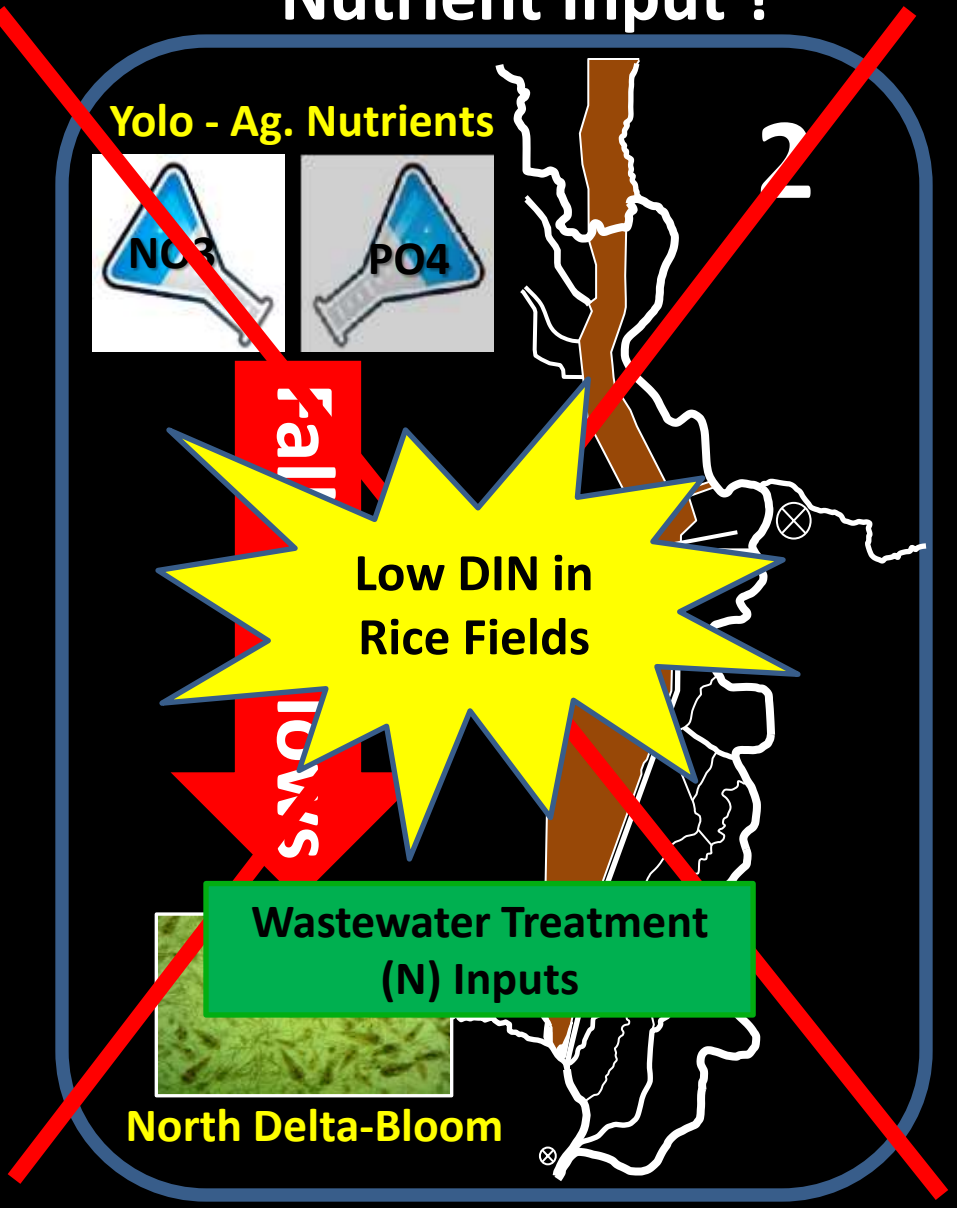
Randy Dahlgren, 2013

What causes fall blooms downstream at Rio Vista?

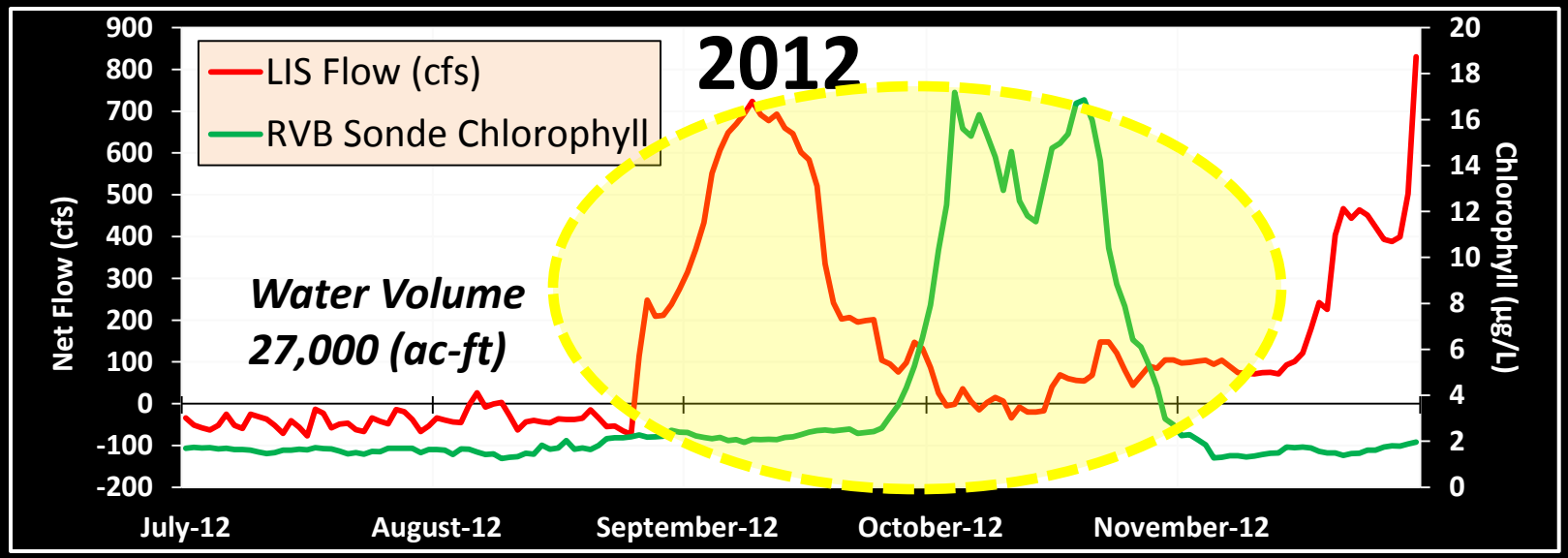
Biomass Transport ?



Nutrient Input ?



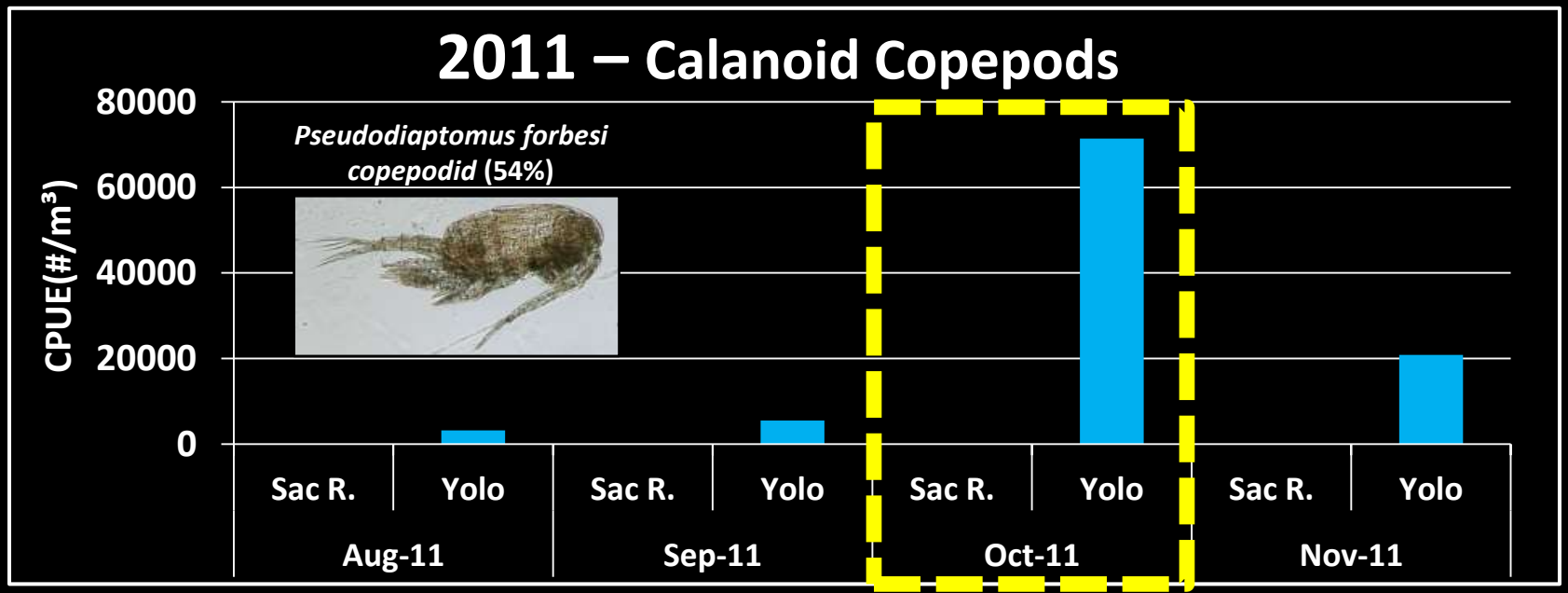
Why no bloom in 2013?....Is there a flow threshold?

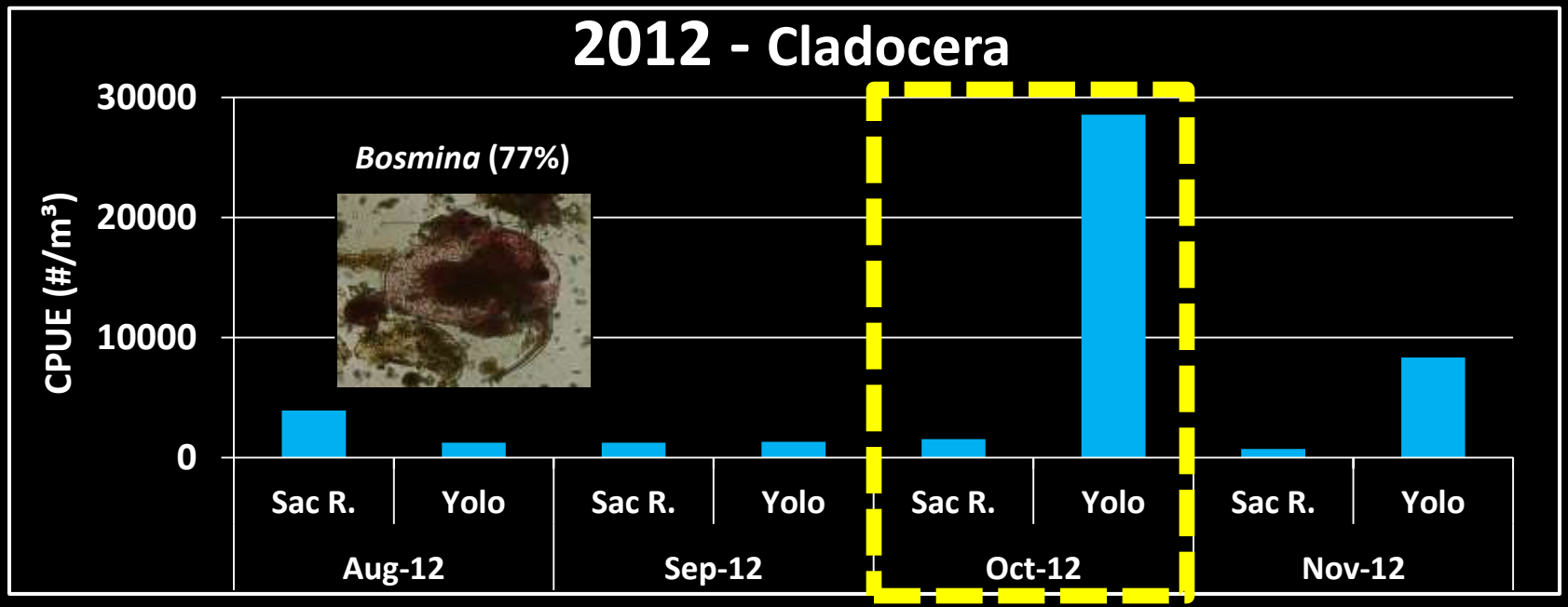


Year	Max Chlorophyll at Rio Vista (µg/L)	Max Flow at Lisbon (cfs)	Water Volume at Lisbon (ac-ft)
2013		284	10,800
2012	17	724	27,000
2011	8	400	21,400
2010		423	9,000
2009	7	183	3,000
2008		111	3,500

Chris Foe, 2013

What about top down effects? . . . Zooplankton Response





What's next?

More analysis of 2013 Data

Phytoplankton

⇕

Water Quality

⇕

Nutrients

⇕

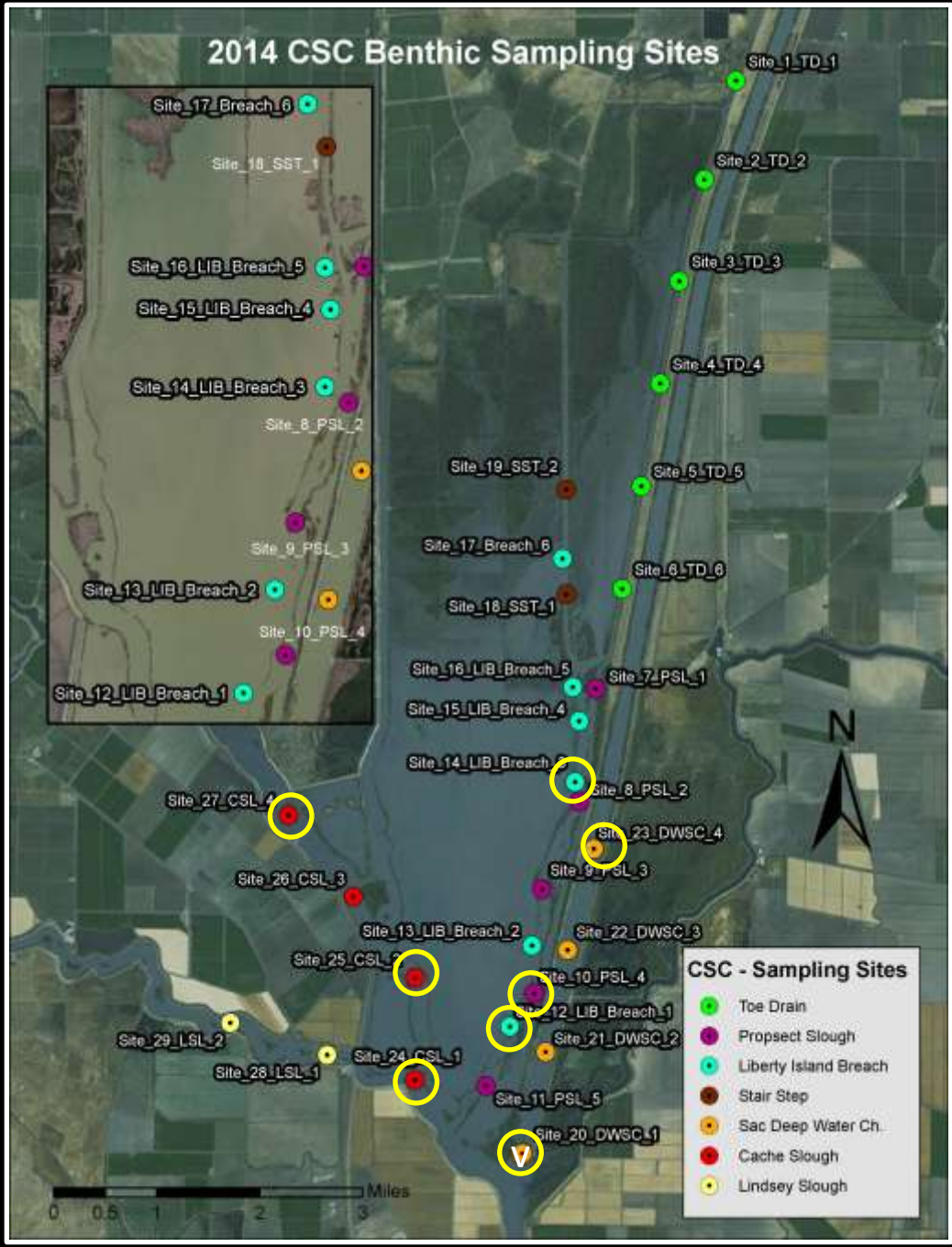
Flow and Tide

TOP DOWN

Larger effort in 2014

Hydro & + Biological Modeling

Possible experimental manipulations…Can we replicate 2012?



2014 Sneak Peek CSC Clam Hotspots

DWR+USGS :
29 Sites/93 Ponar grabs

Largest numbers and sizes of *Corbicula* are found in Southern end of CSC:

- ***Sac Deep Water Ship Channel***
- ***Cache Slough***

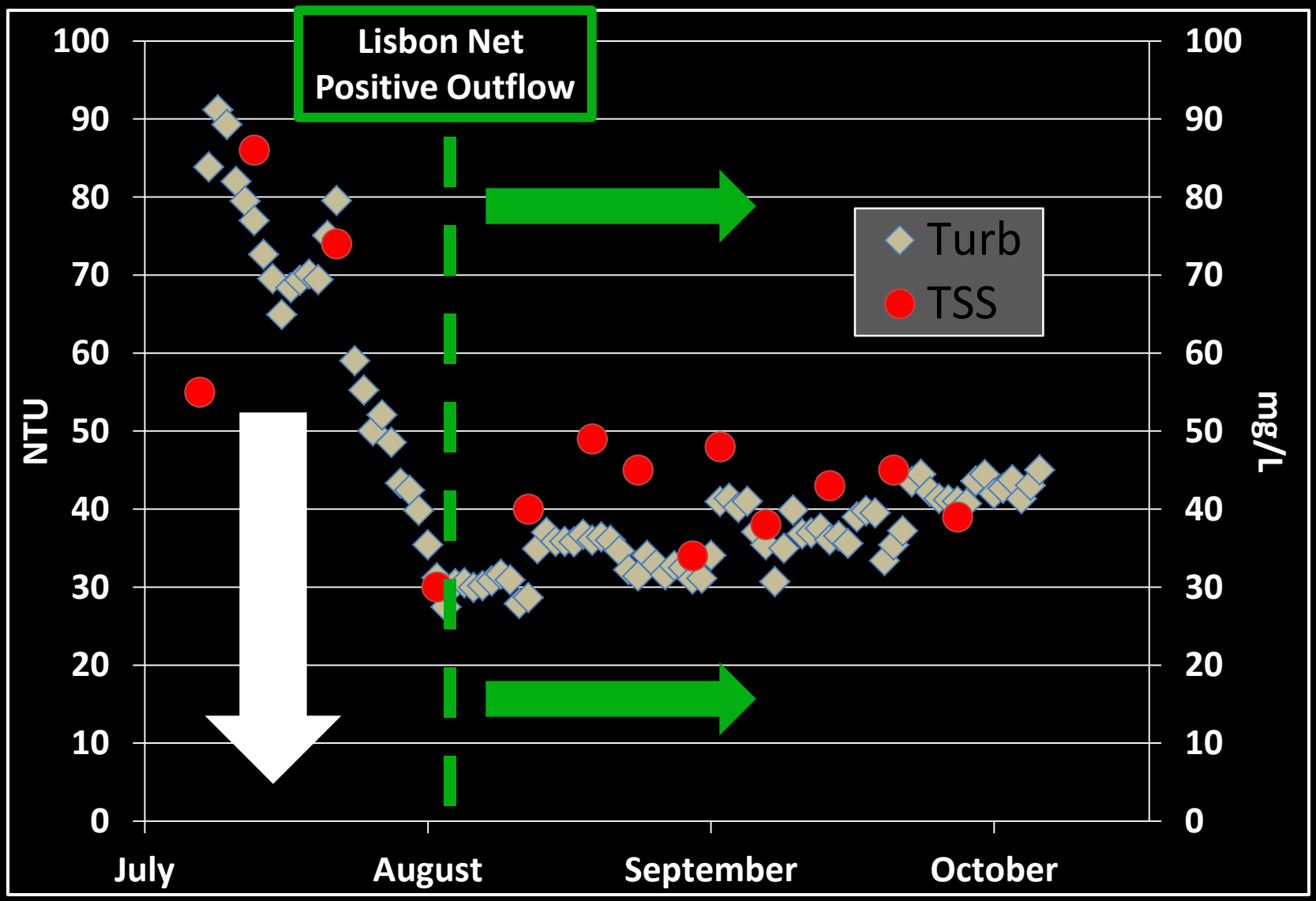
Biomass = 10-30 g/m²

Est. Grazing Rate = 1 – 3 $m^3m^{-2}d^{-1}$

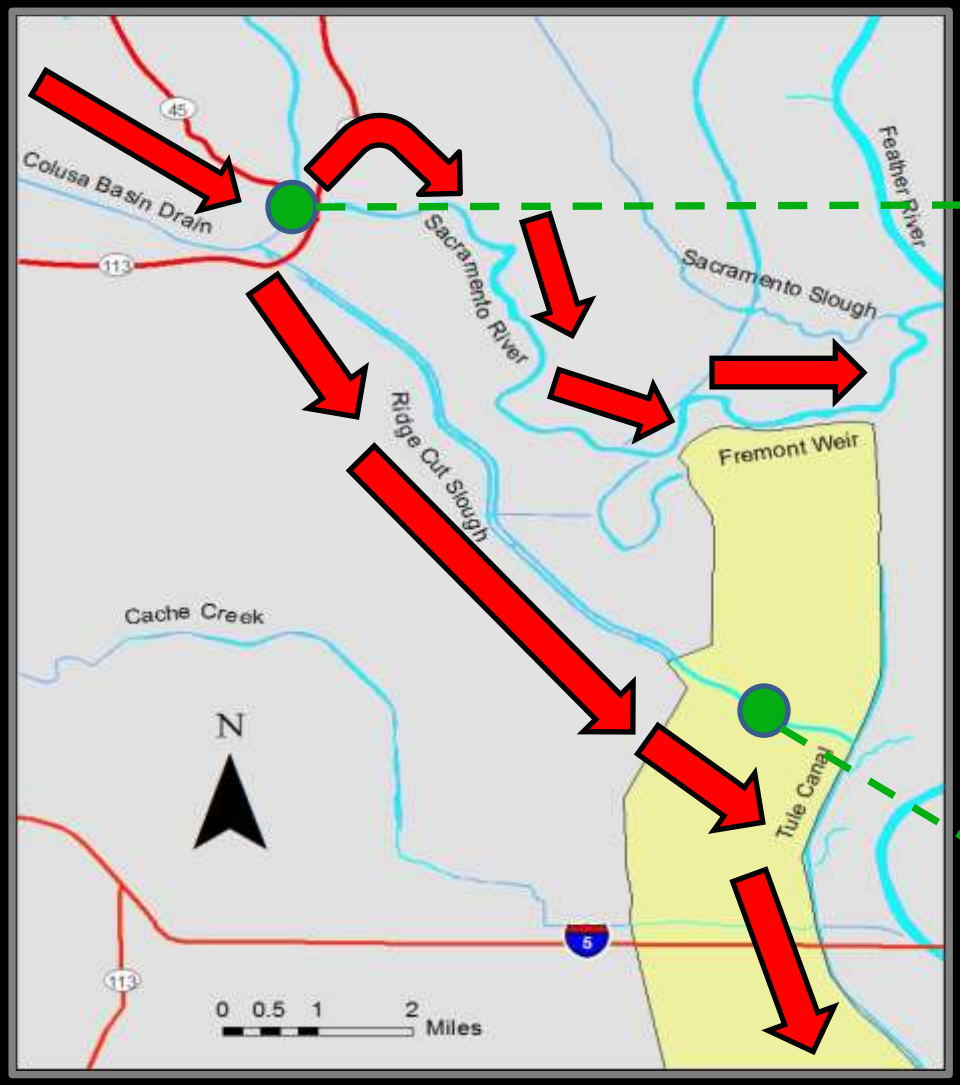
Janet Thompson USGS, 2014

Questions?

Rice field drainage improved water clarity…benefiting phytoplankton growth?



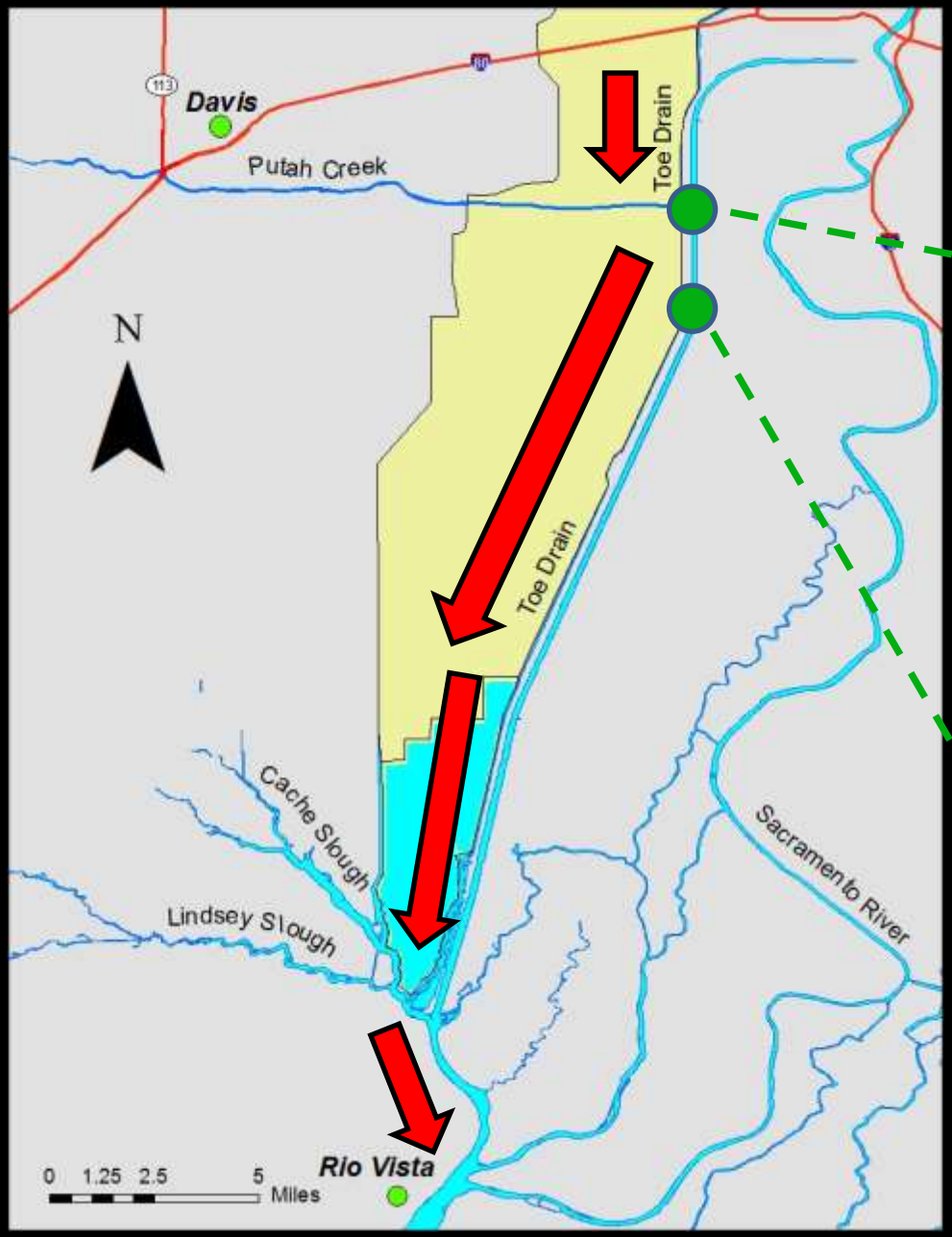
Northern Yolo Bypass - Plumbing



Knight's Landing Outfall Gates

Wallace Weir

Southern Yolo Bypass - Plumbing



Putah Creek

Lisbon Weir