

Plankton dynamics of flood plain lakes in the lower Columbia River

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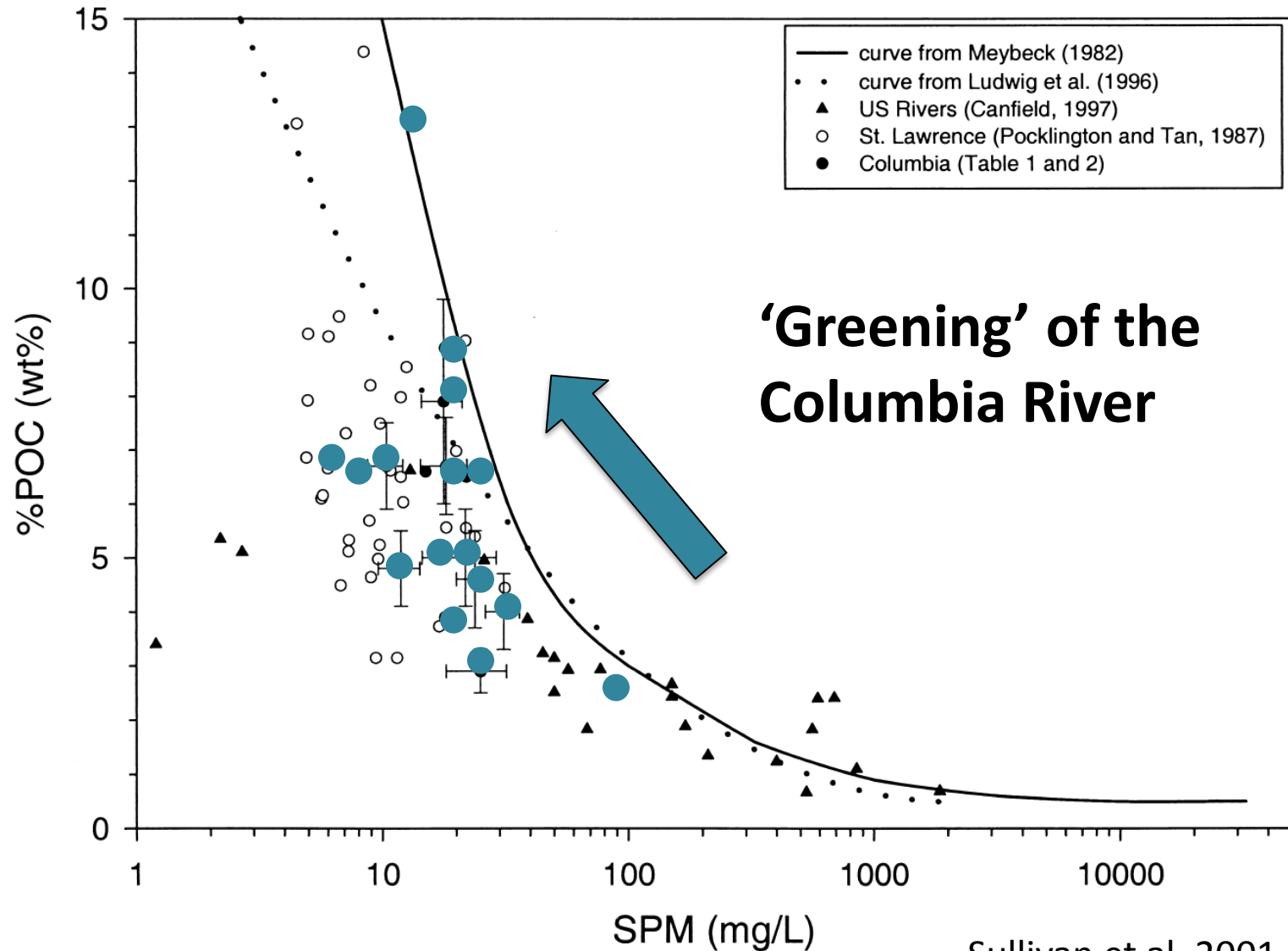


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Topics

- Context
 - Greening of the Columbia River
 - Contribution of plankton to juvenile salmon diet
- Observations from Columbia River Ecosystem Monitoring Program
 - Phytoplankton
 - zooplankton
- Seasonal changes in water quality and organic matter production in shallow water habitats

Impoundments behind dams have increased fluvial phytoplankton production

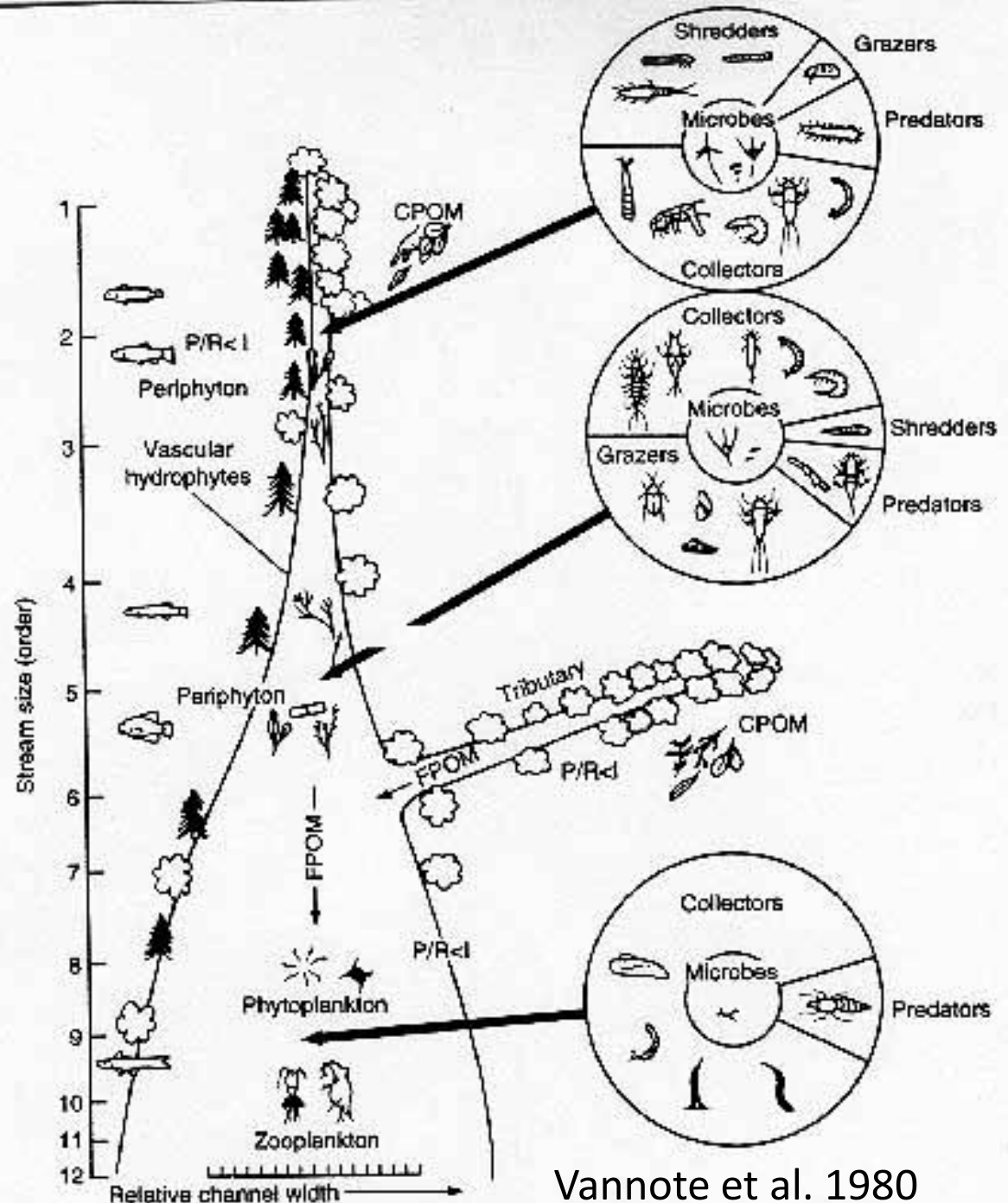


Sullivan et al. 2001

The River Continuum Concept

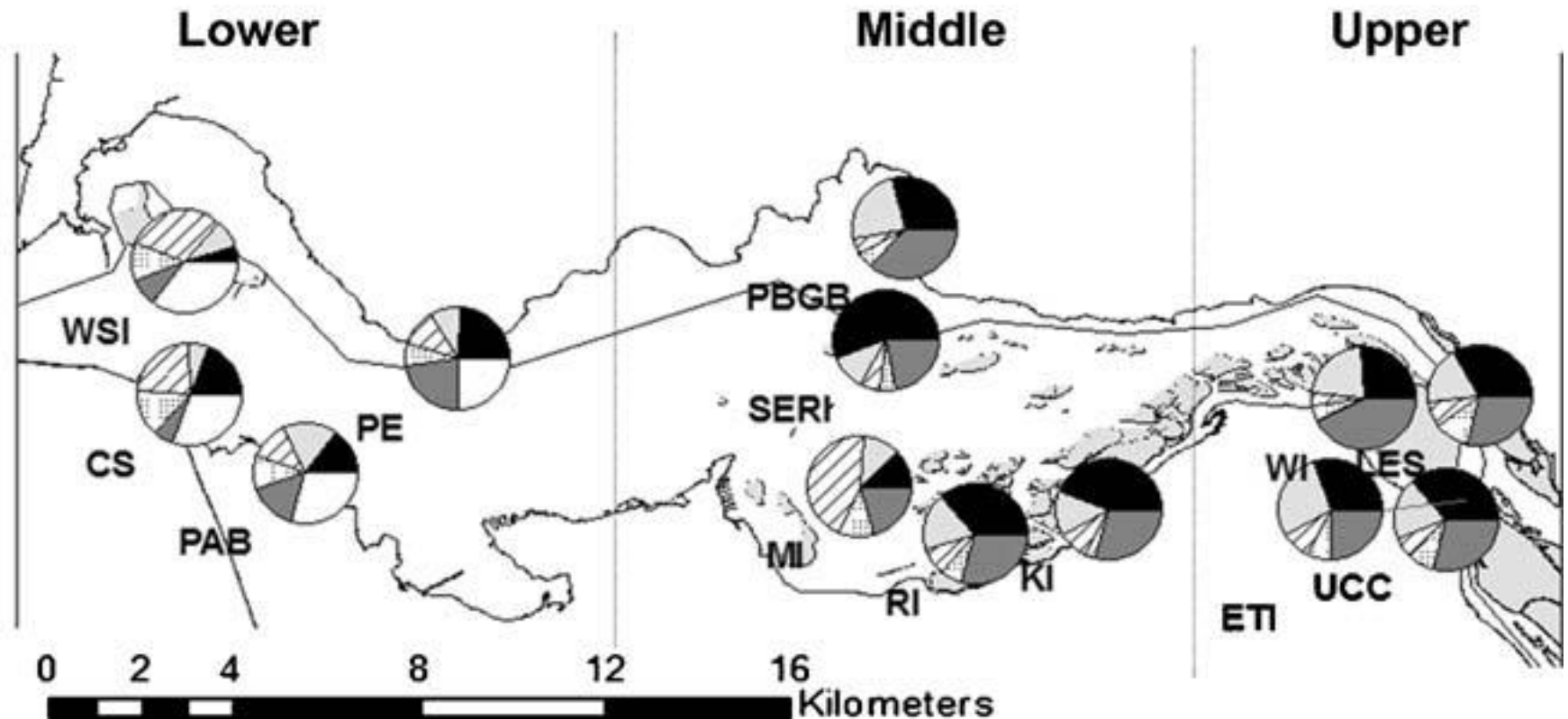
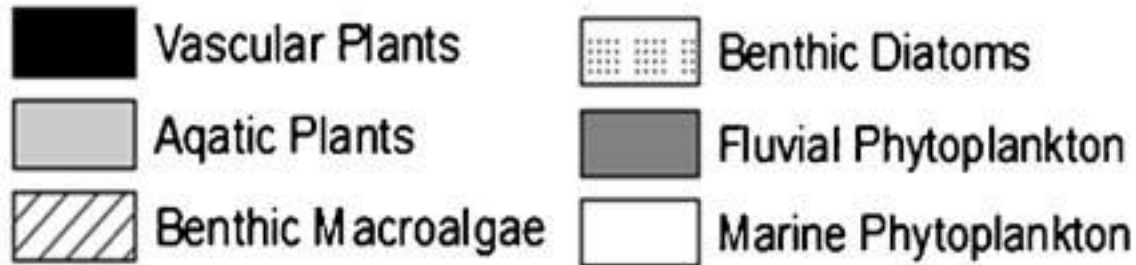
Fluvial
phytoplankton =
single celled
primary
producers

- Organic matter production → food webs
- Water quality → DO, pH

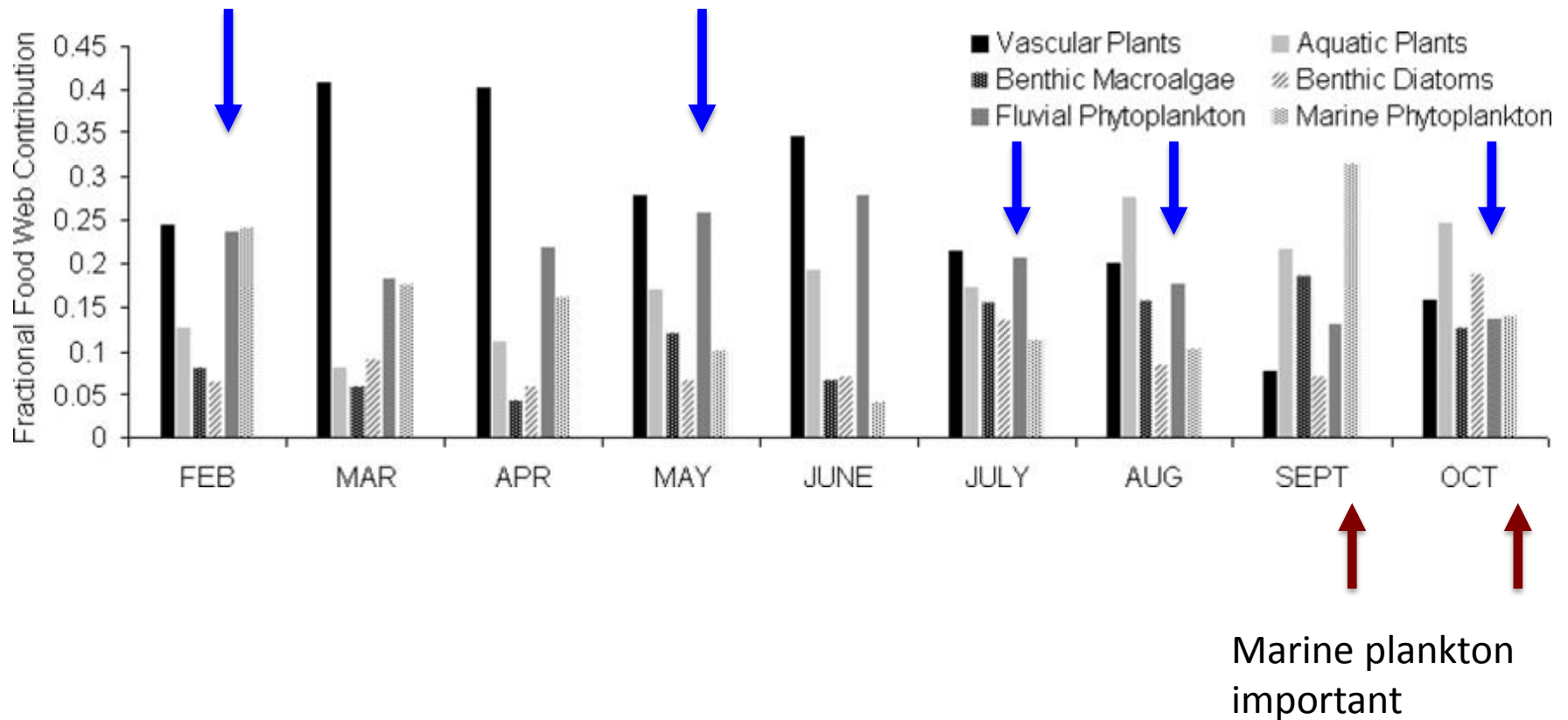


Vannote et al. 1980

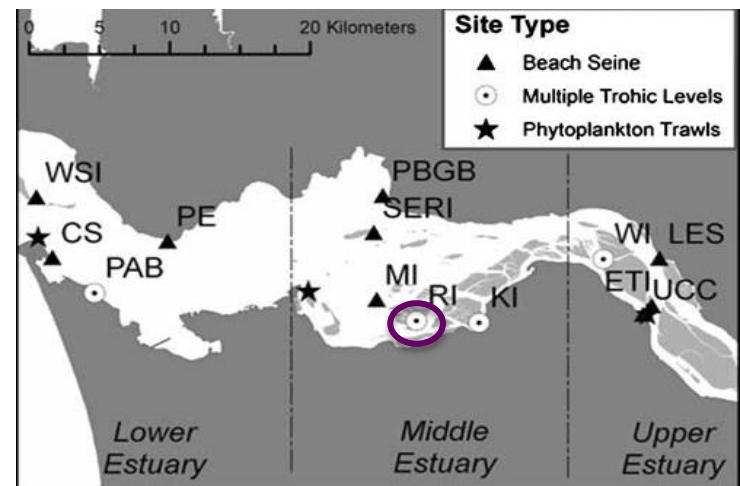
Detrital Sources



Contribution of detrital sources assimilated by juvenile Chinook salmon

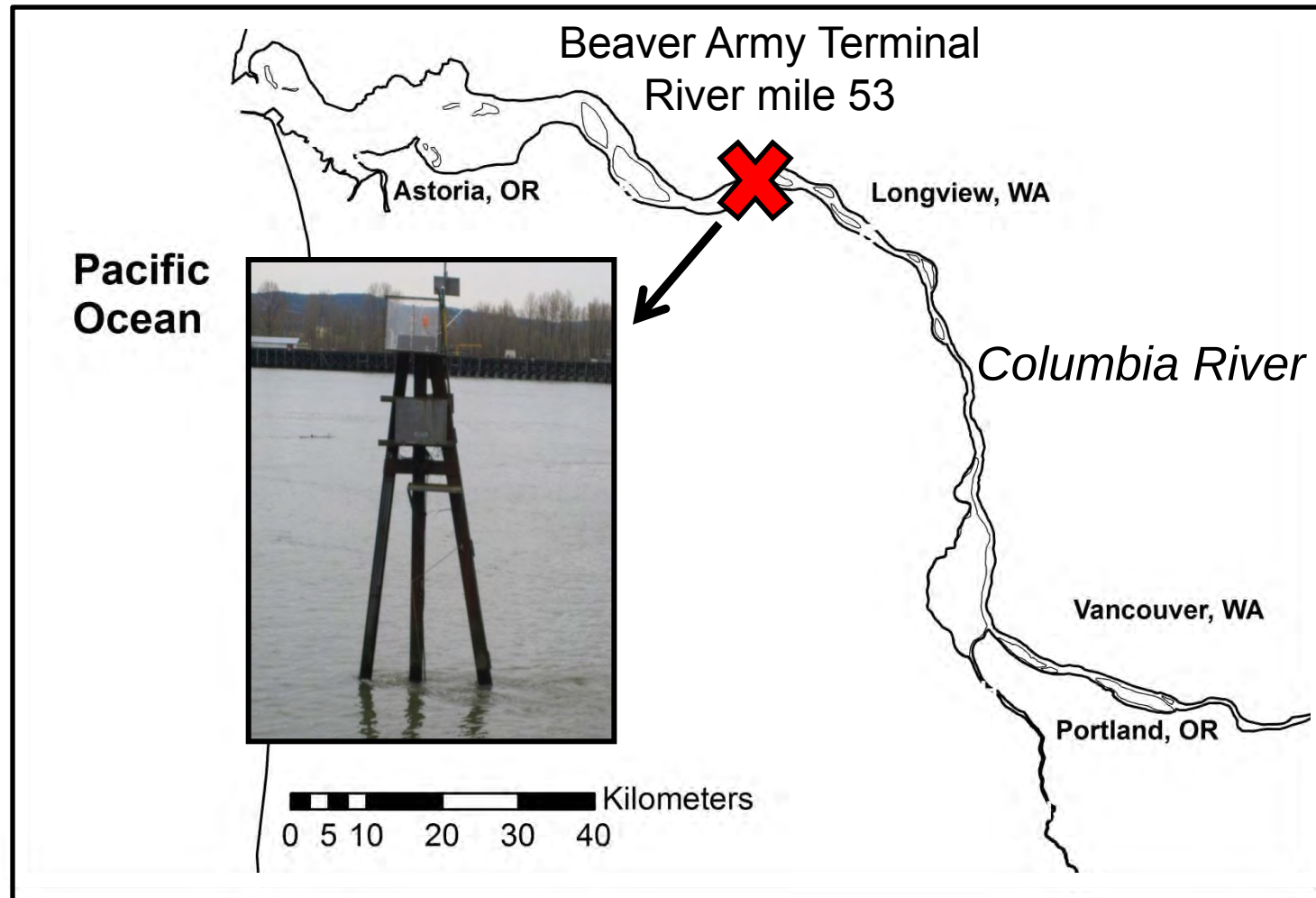


Based on stable isotope model, salmon **prey** depend on fluvial phytoplankton in early-mid spring

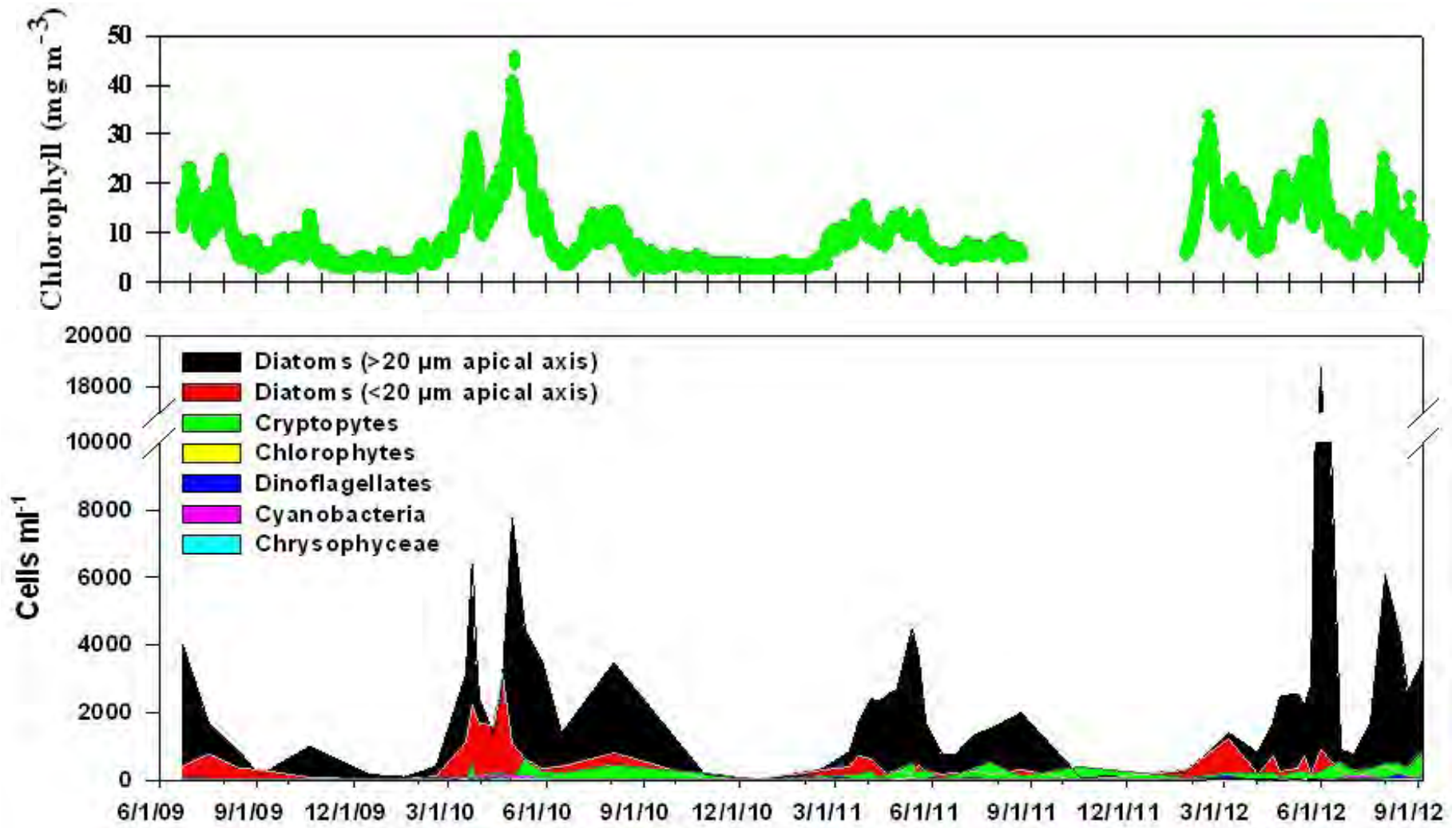


		Vascular plants	Aquatic plants	Benthic diatoms	Fluvial phytoplankton
<i>Chrionomidae</i> spp.	April	7	14	7	60
	May	14	66	5	12
	June	60	11	6	19
	July	20	0	83	0
<i>Corophium salmonis</i>	April	60	3	4	31
	May	65	0	0	39
	June	83	6	4	5
	July	41	37	6	2

In situ sensors in the lower Columbia reveal high-resolution changes in biogeochemical properties



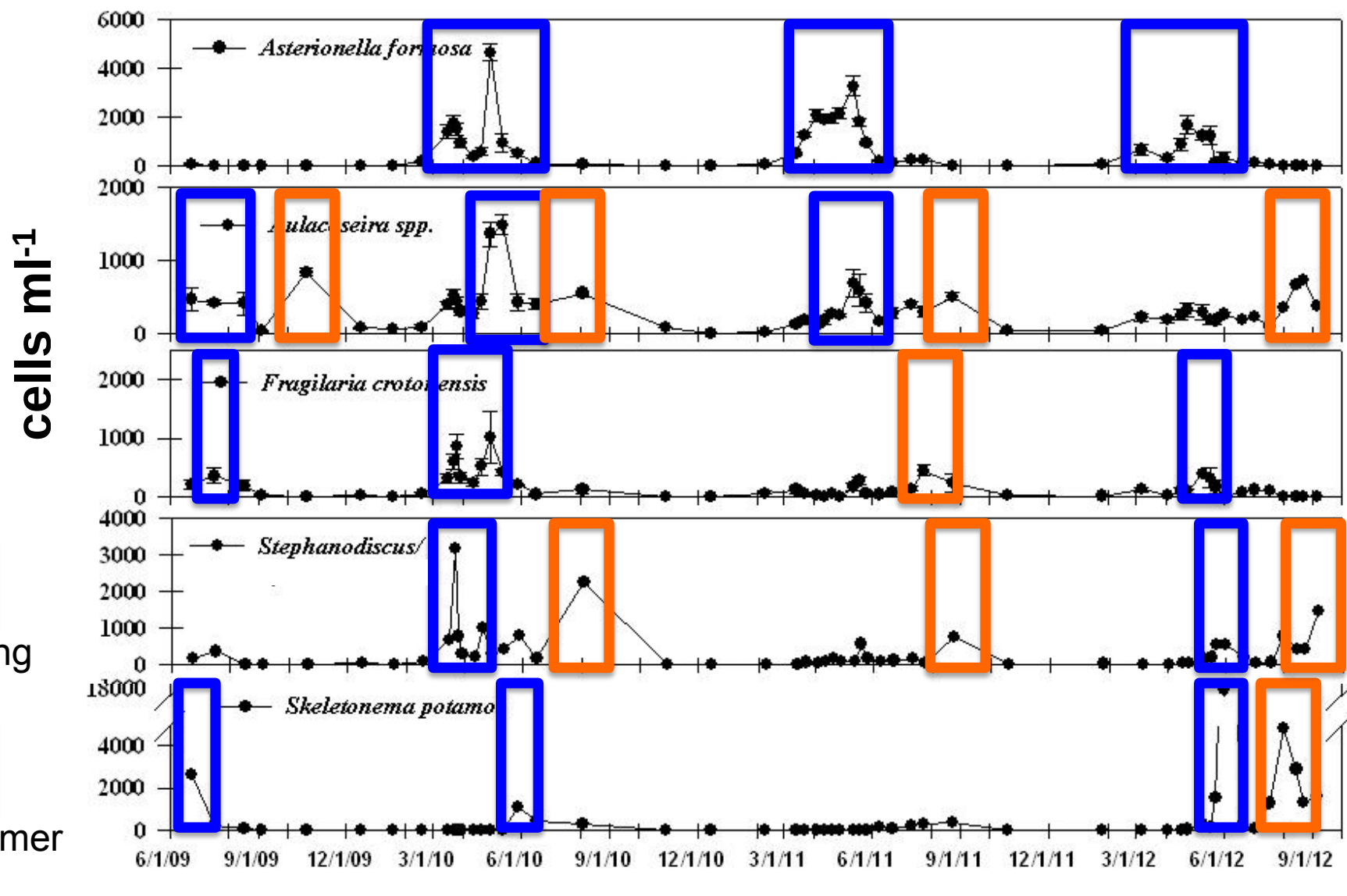
Multiple chlorophyll peaks in mainstem dominated by diatoms

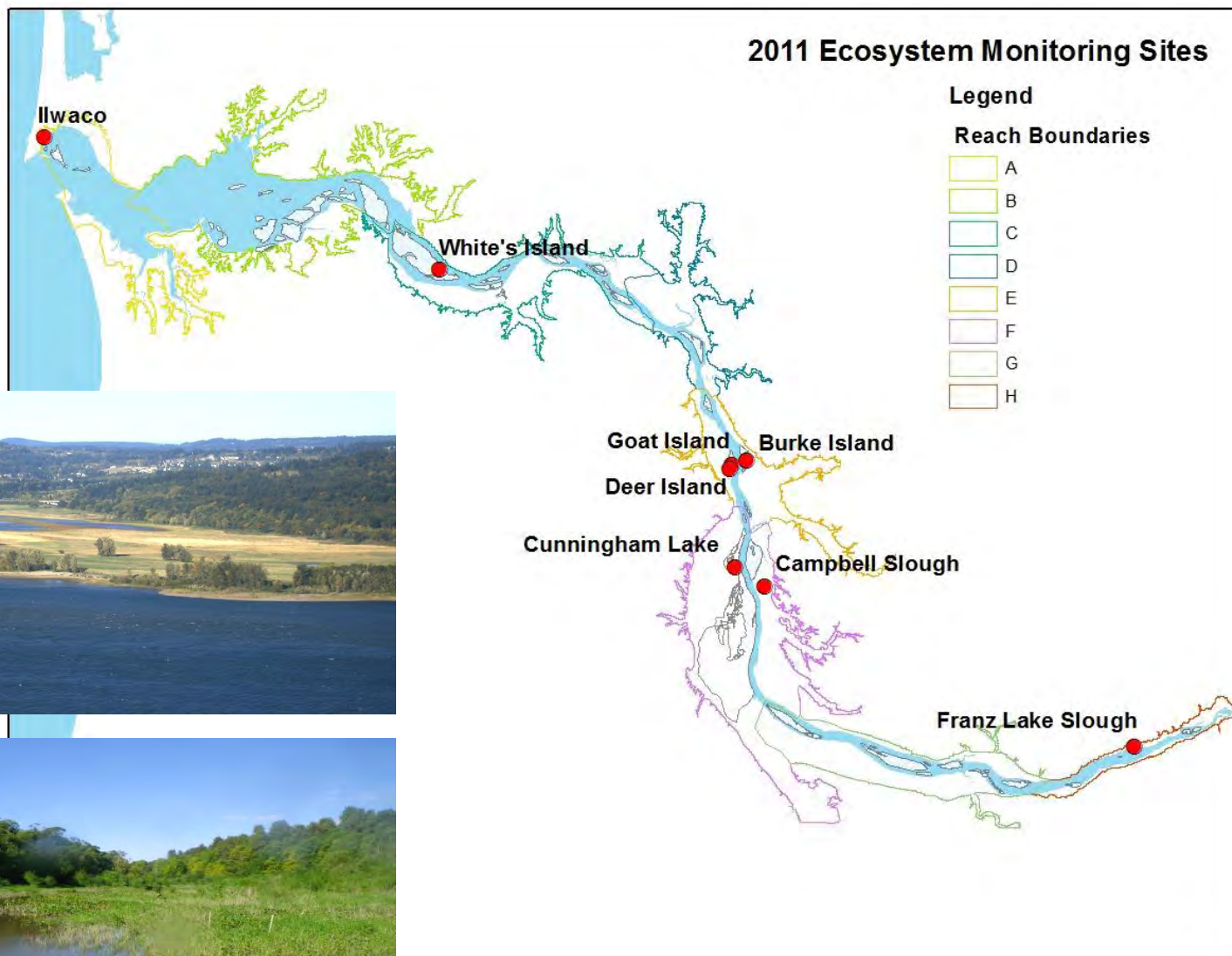


Date

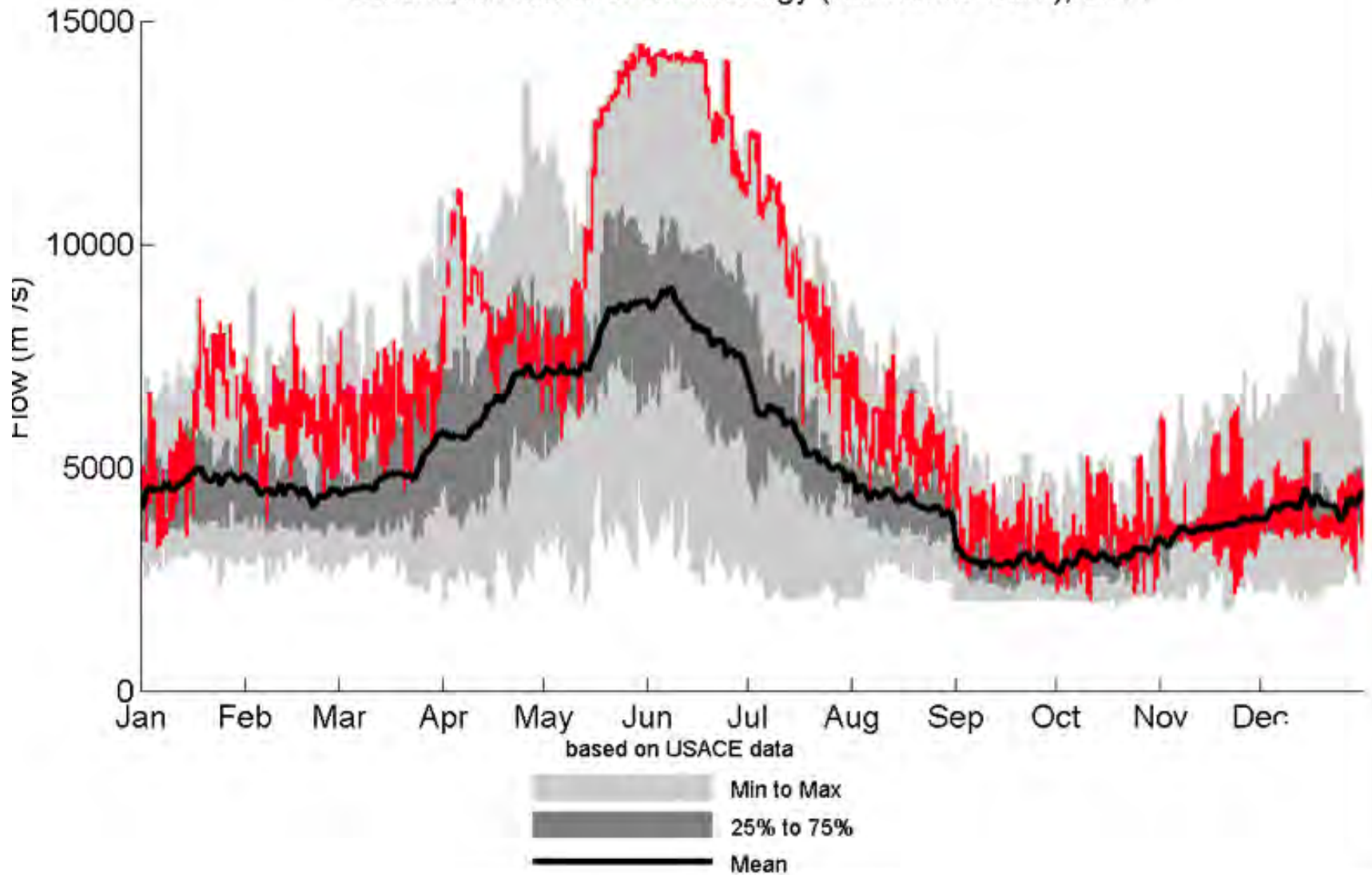
Michelle Maier, OHSU

Mainstem diatom species exhibit seasonal patterns

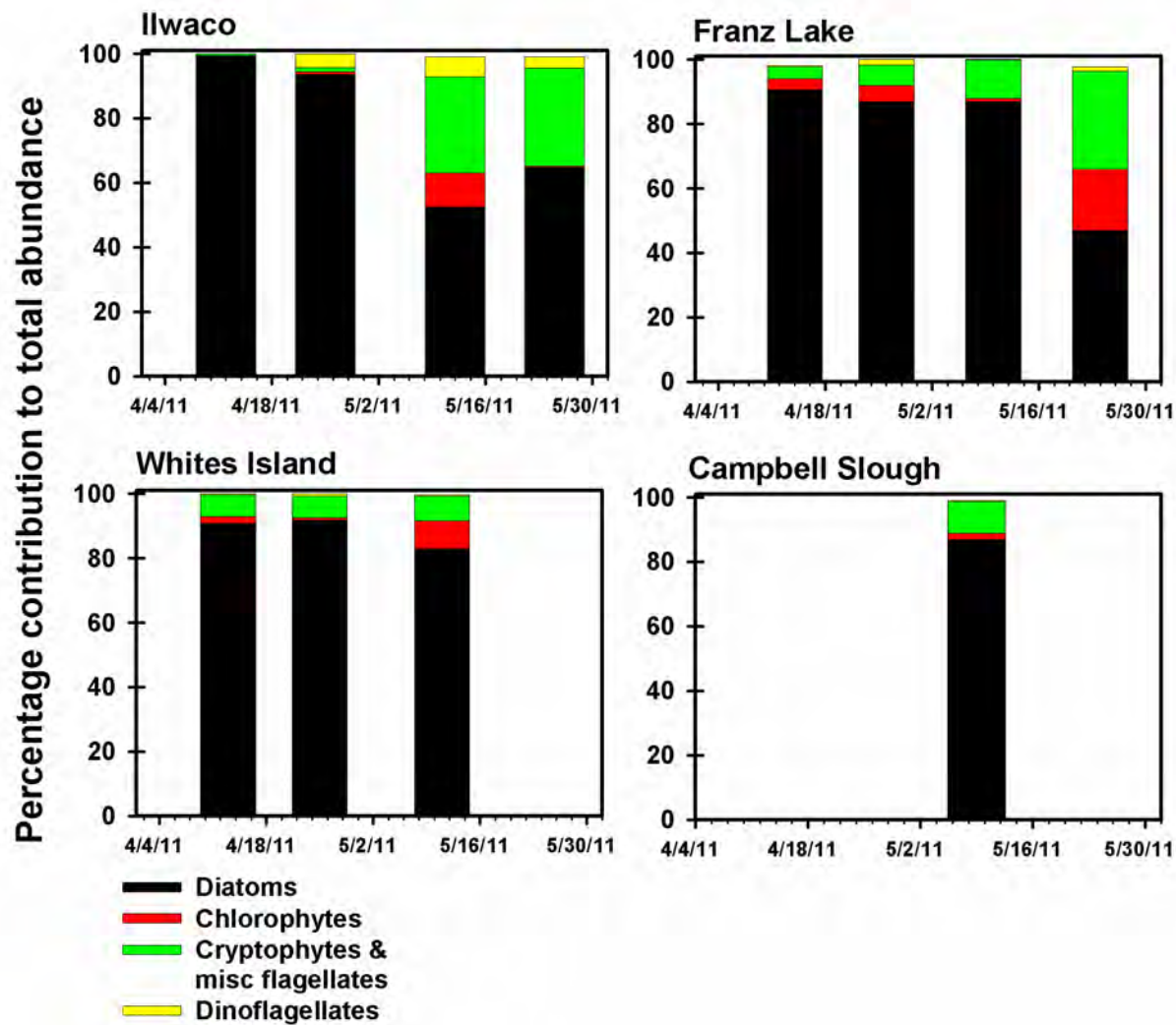




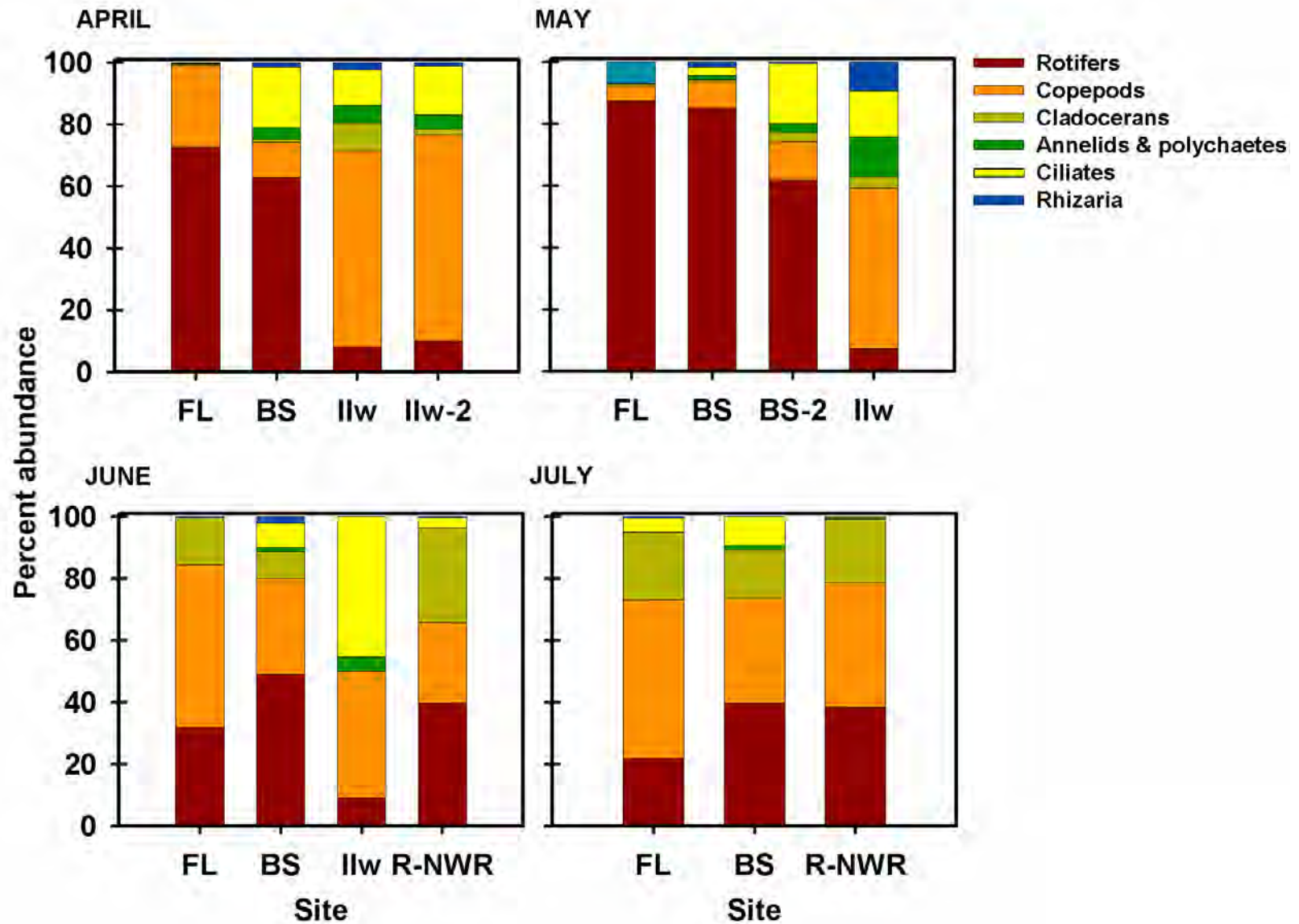
Columbia Flow over Climatology (Bonneville Dam), 2011



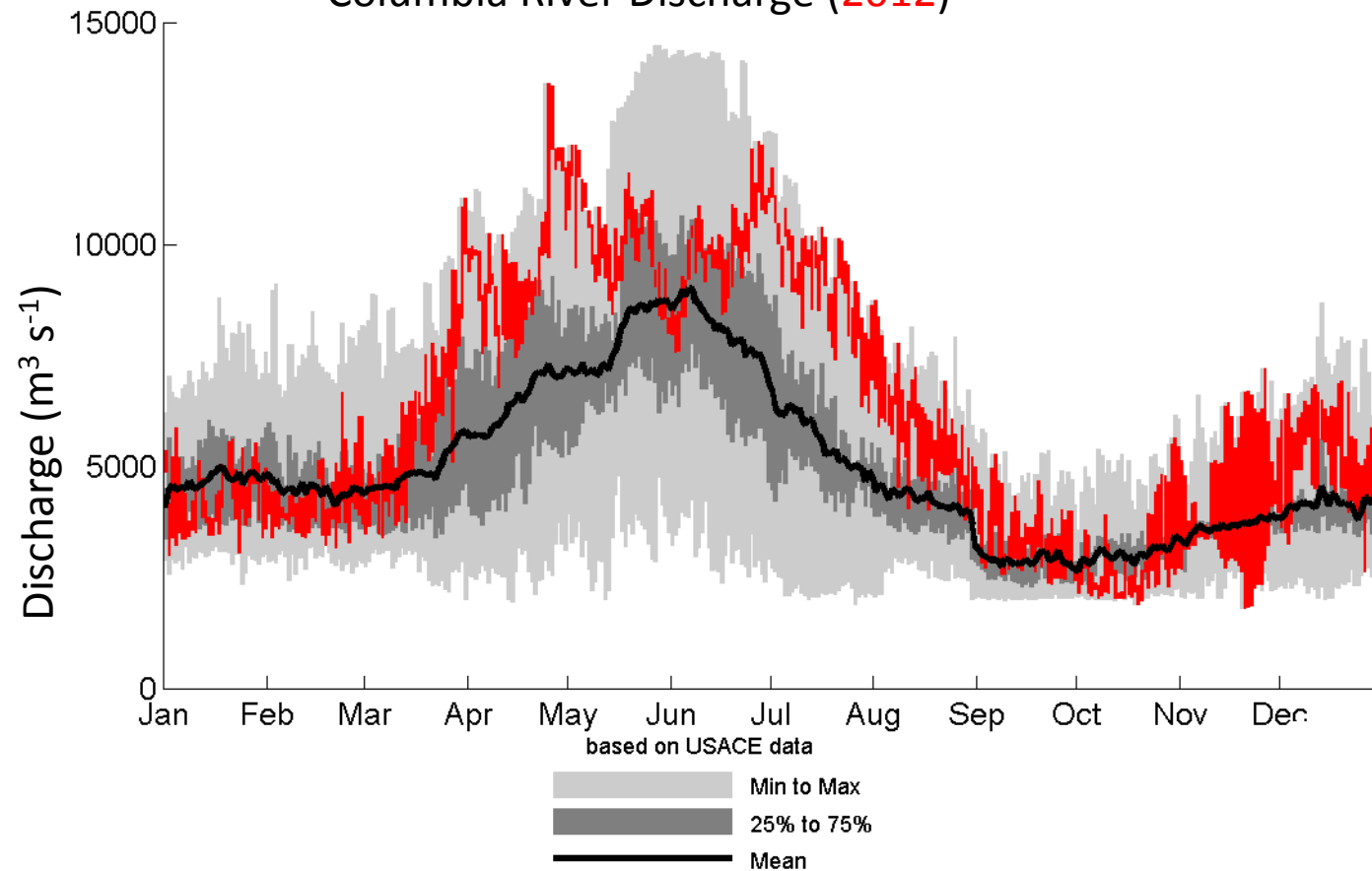
2011



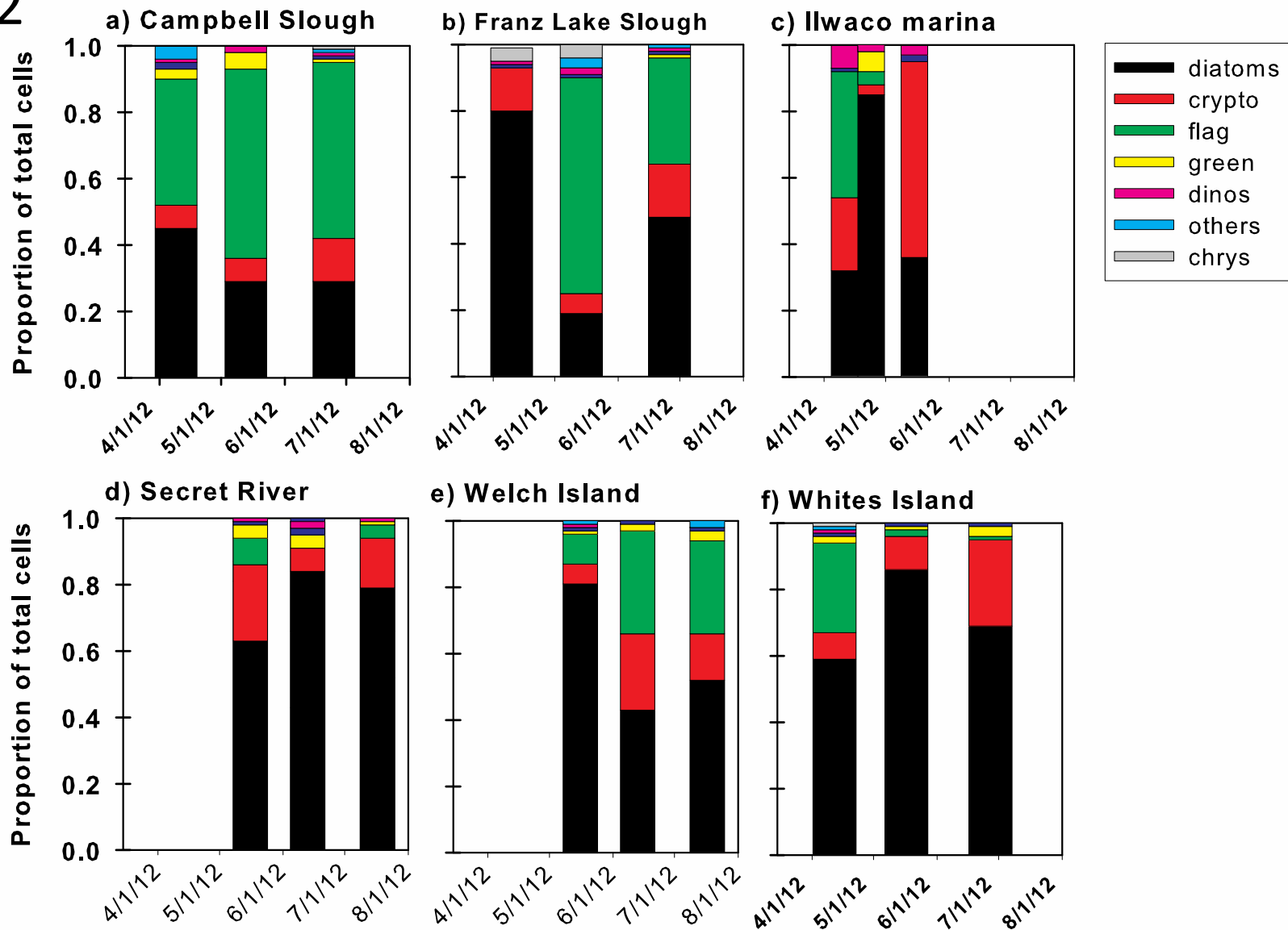
2011

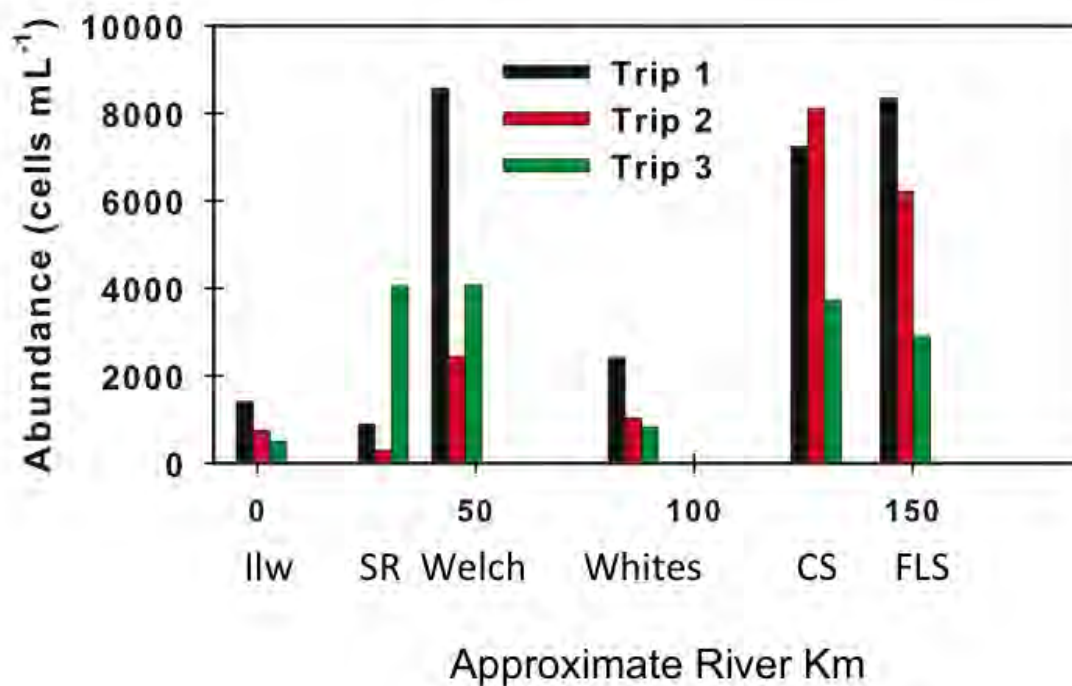
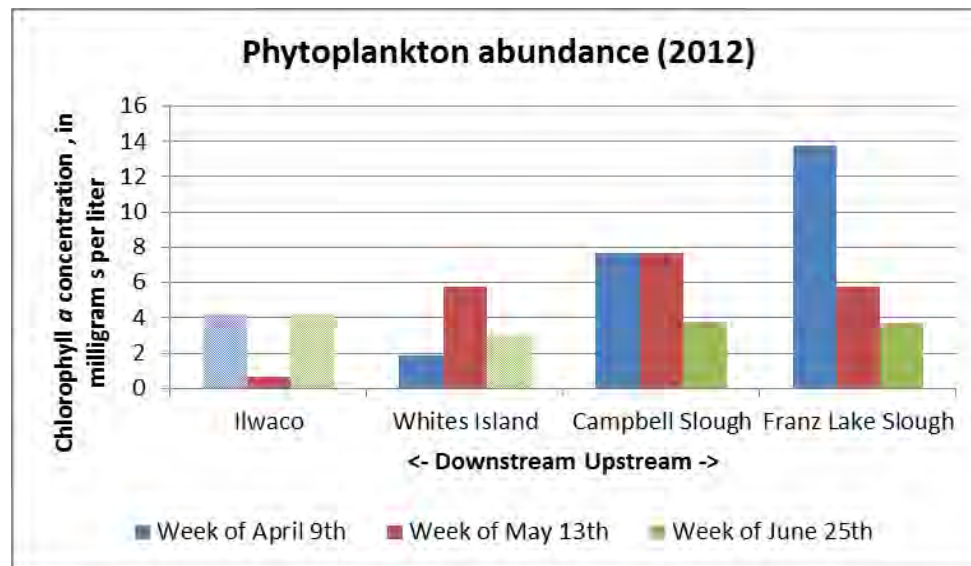


Columbia River Discharge (2012)

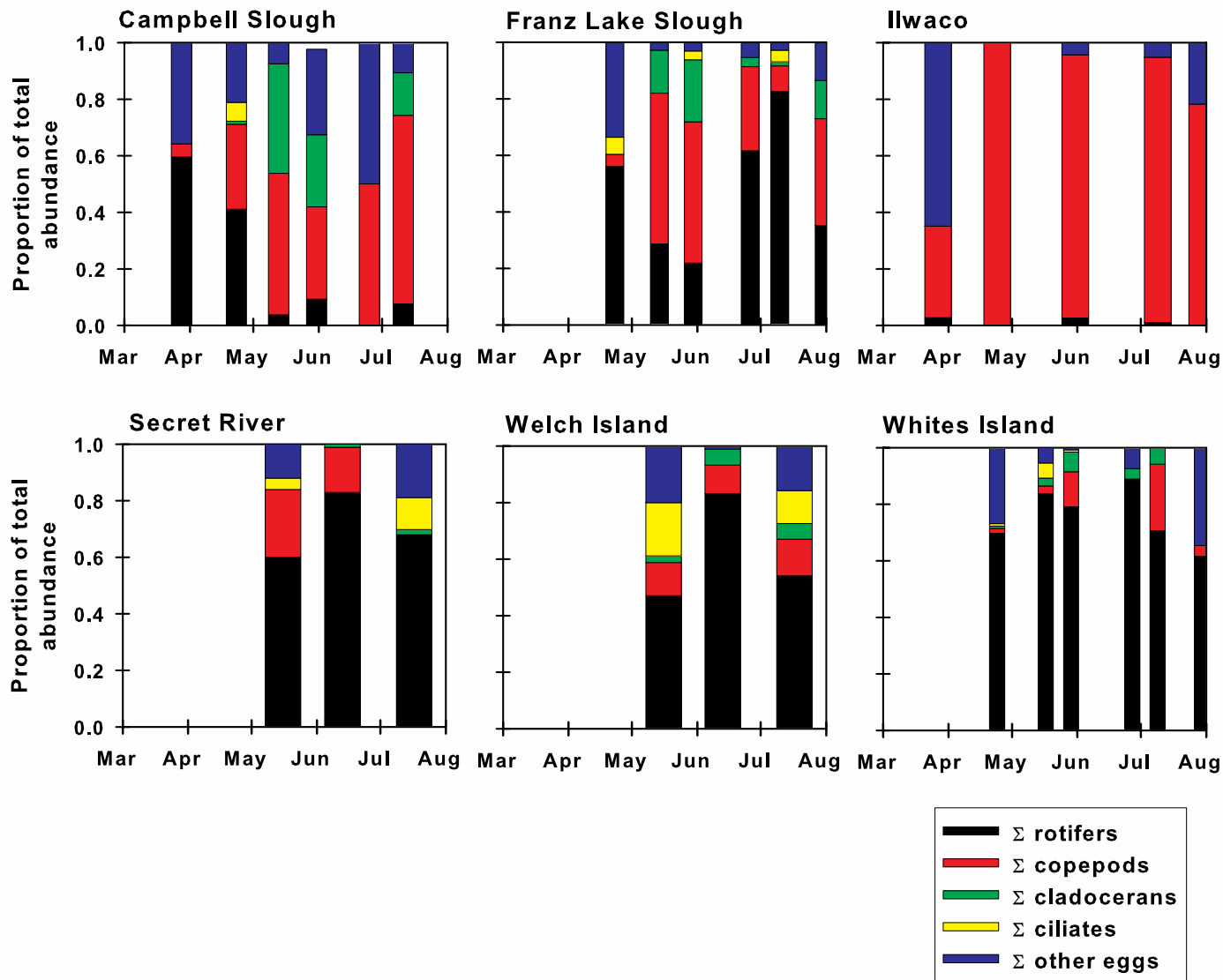


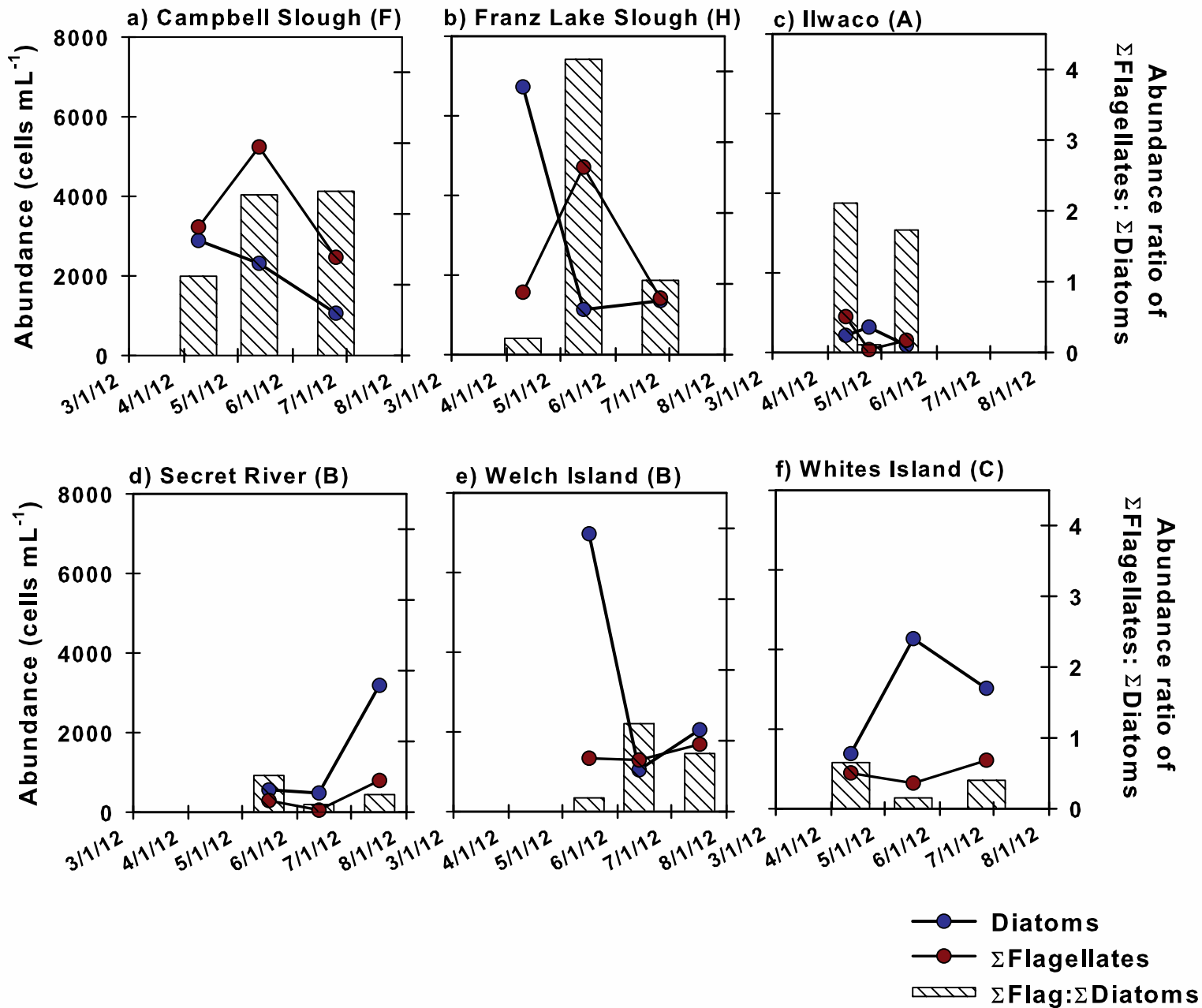
2012

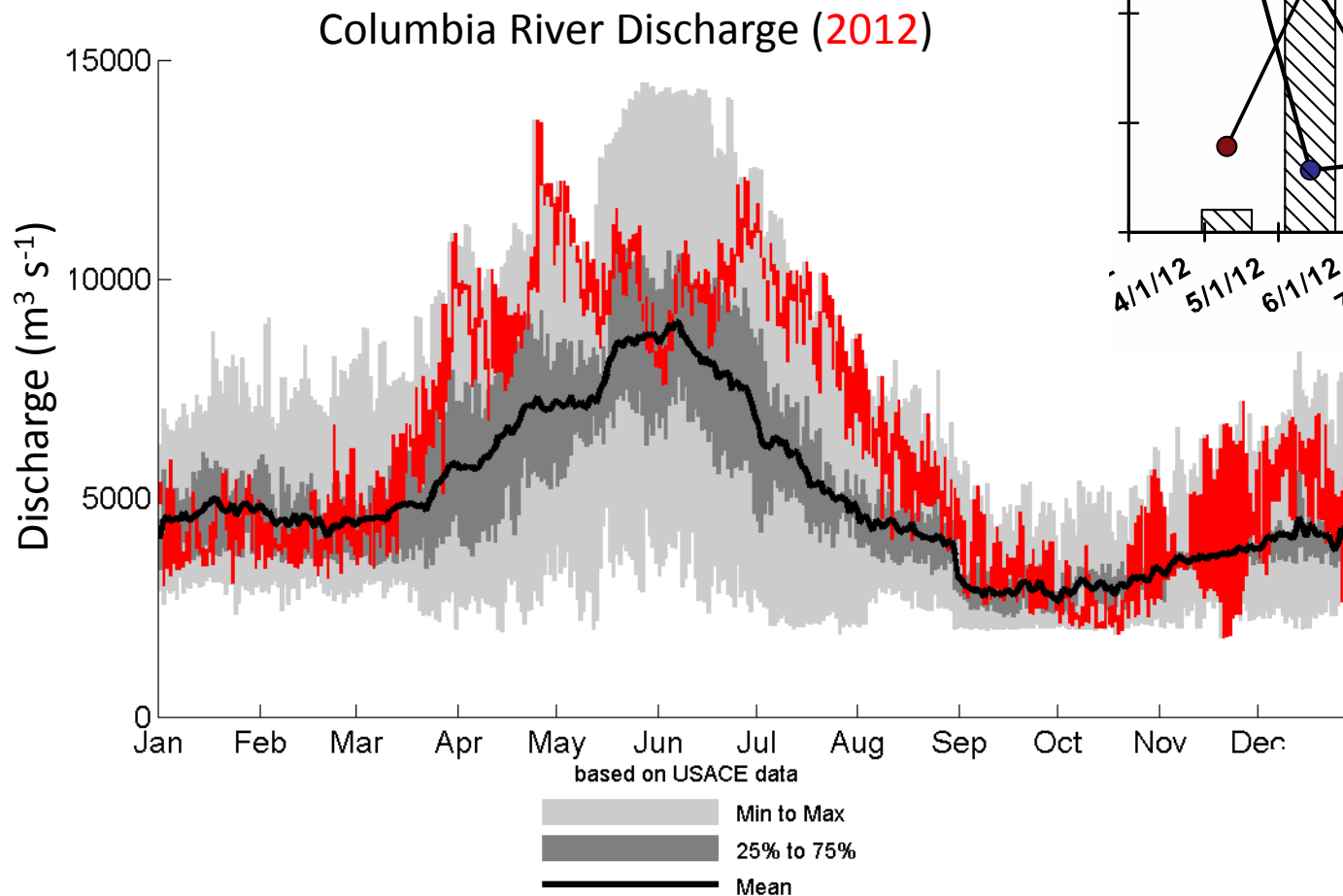




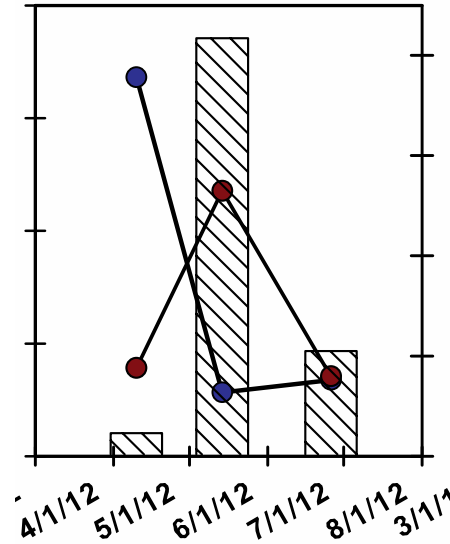
2012



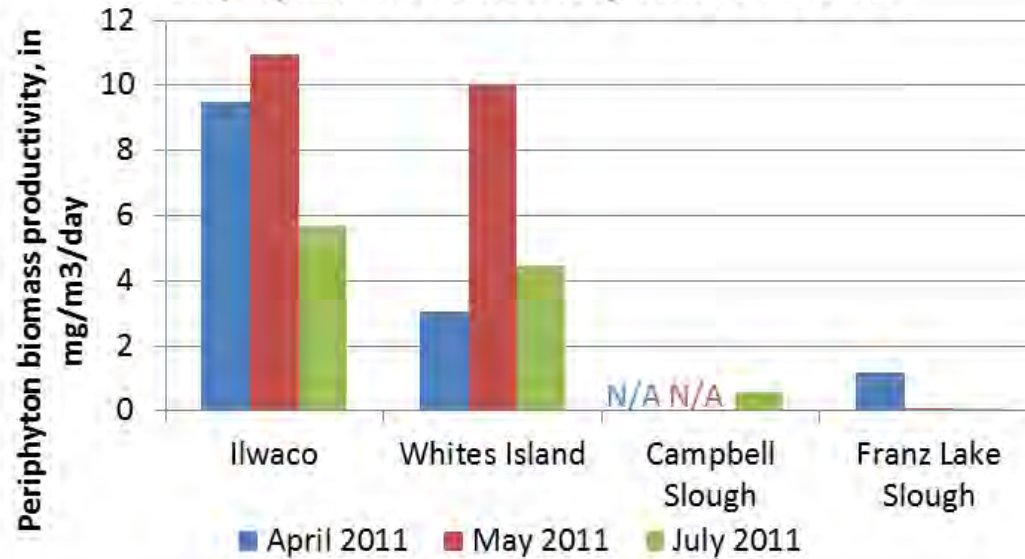




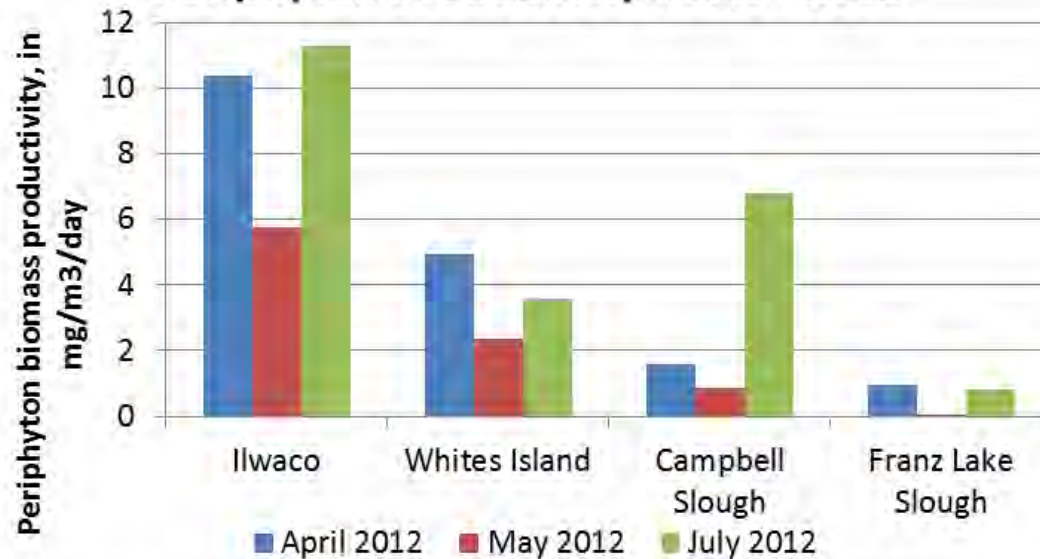
b) Franz Lake Slough (H)



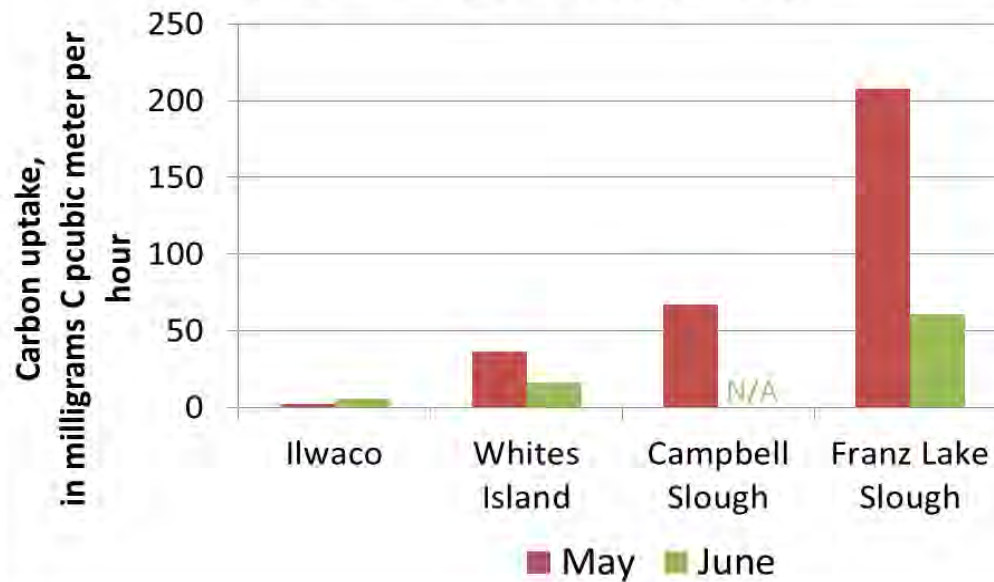
Periphyton Productivity Rates - 2011



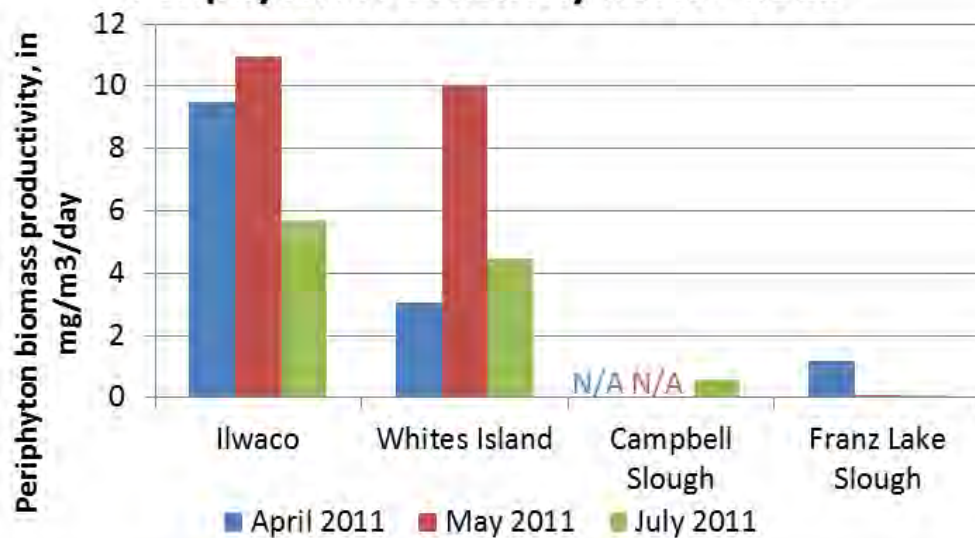
Periphyton Productivity Rates - 2012



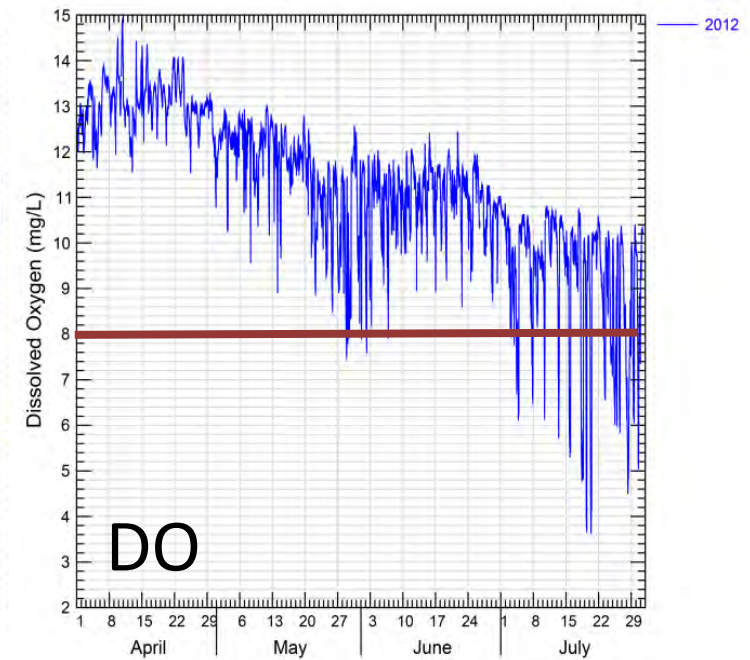
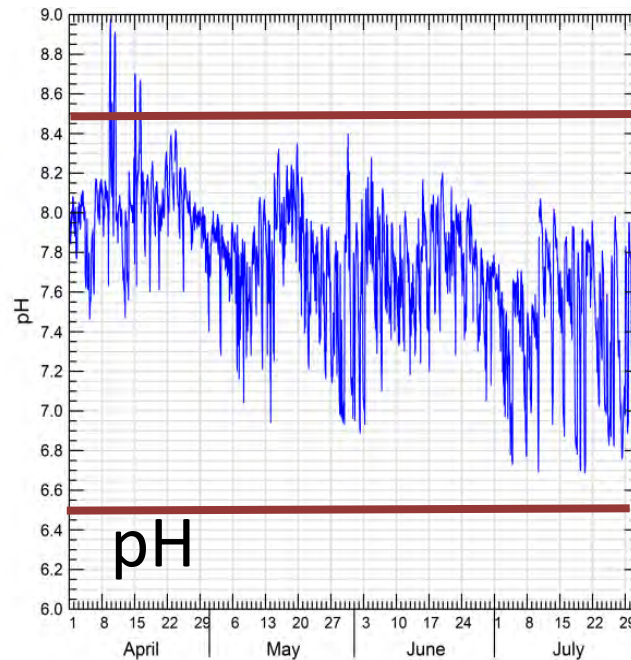
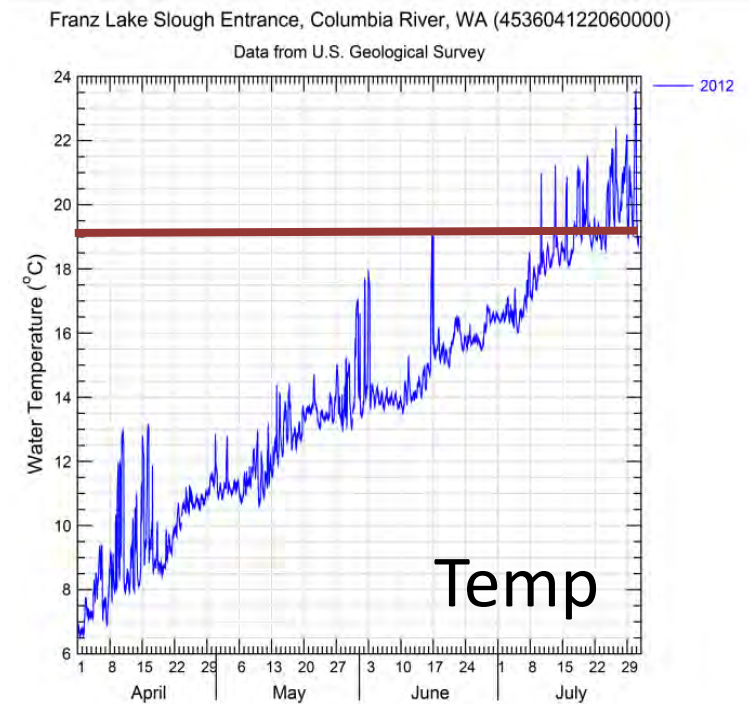
Phytoplankton productivity (2011)



Periphyton Productivity Rates - 2011



Acceptable ranges for water quality
exceeded in July 2012 (Temperature, DO)

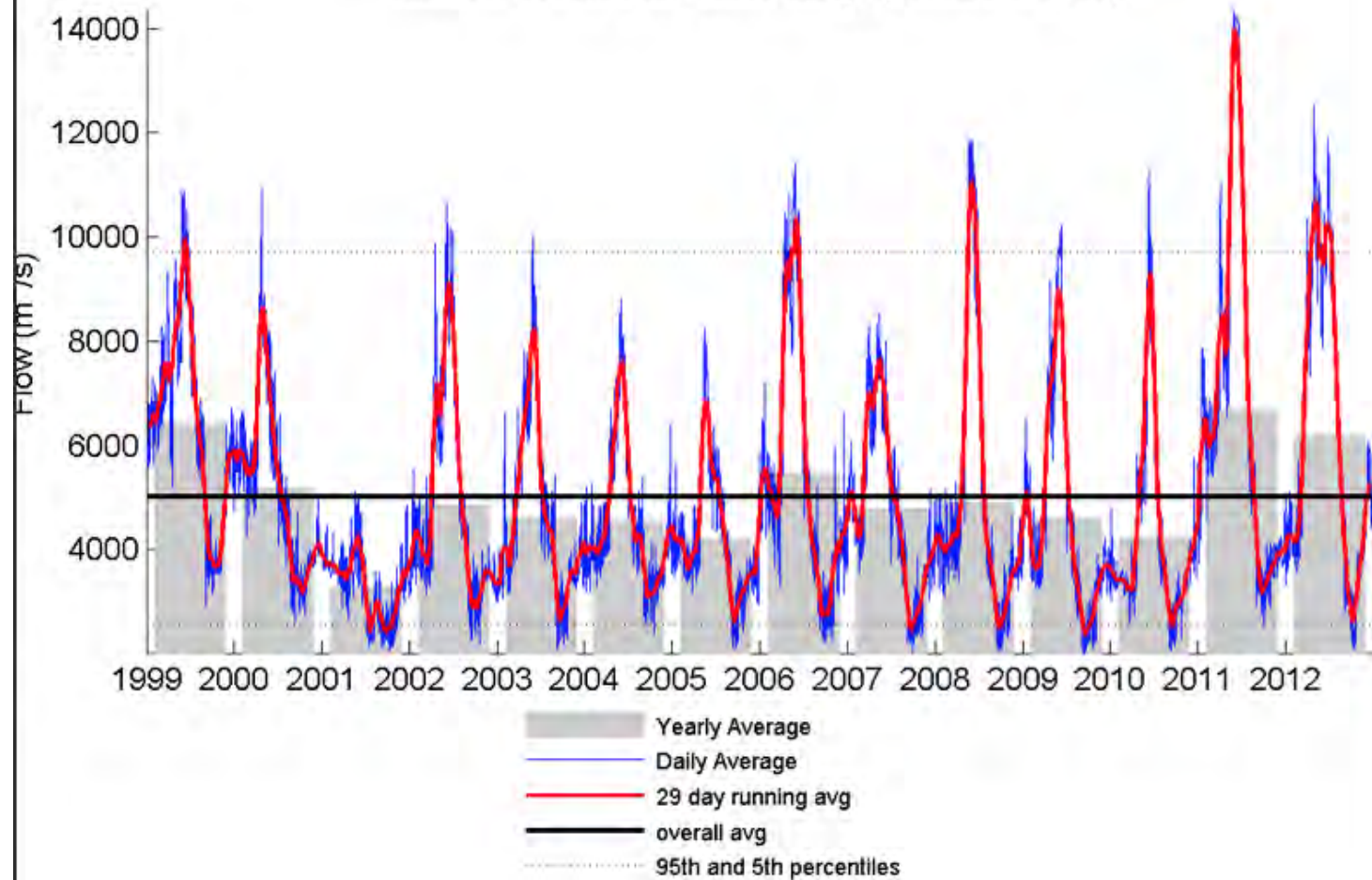


Whitney Temple &
Jennifer Morace,
USGS

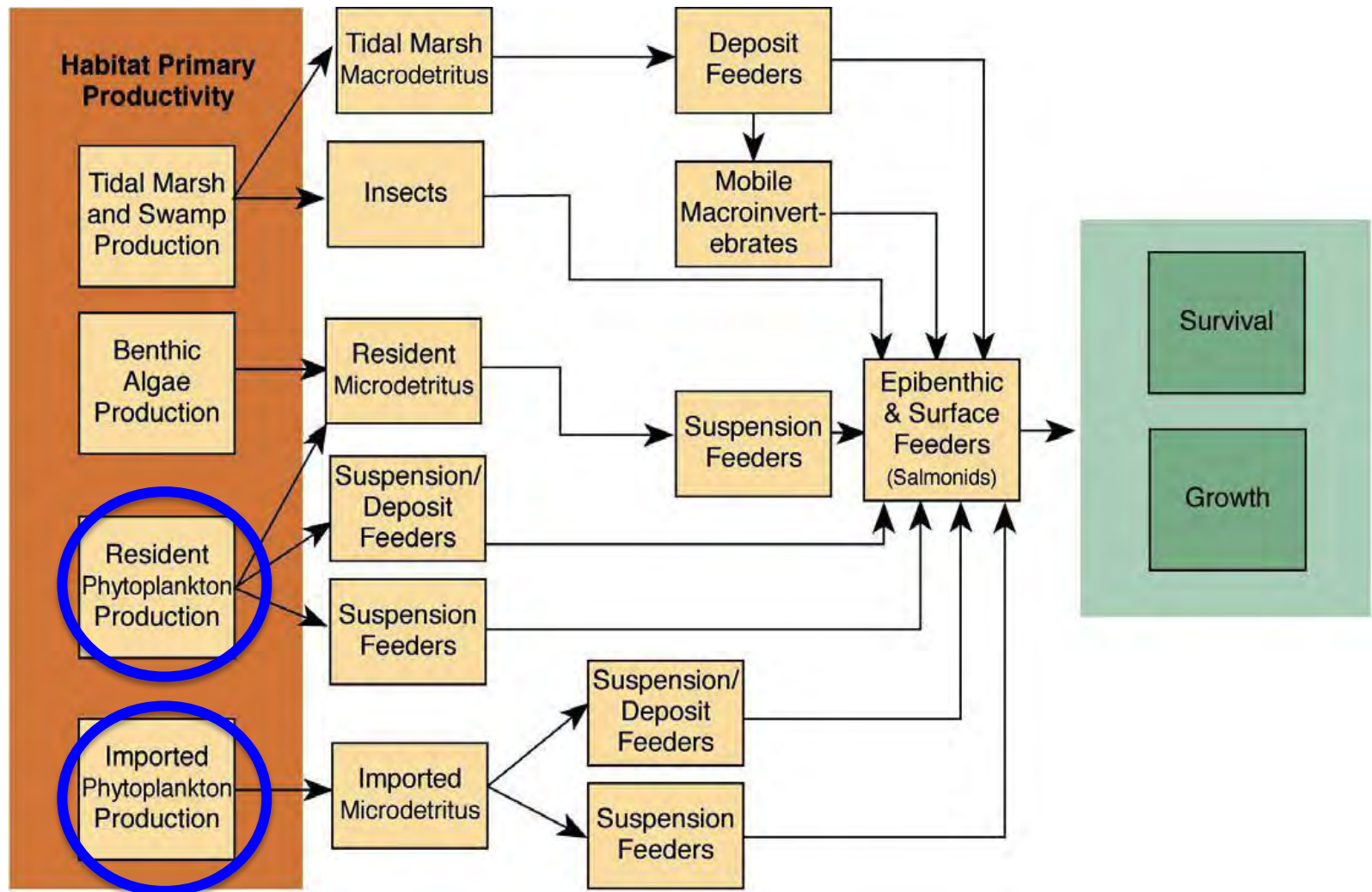
Considerations

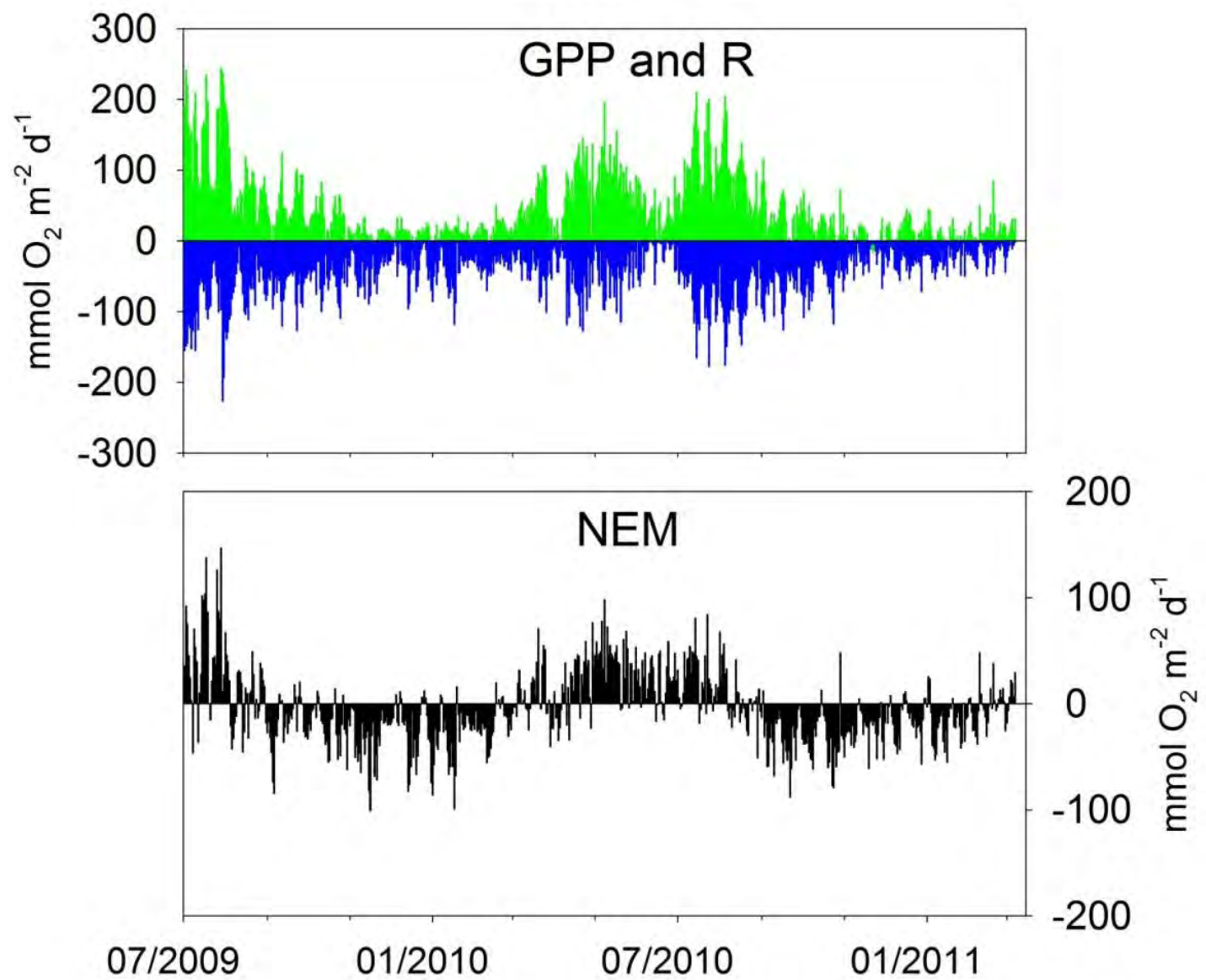
- Change in area of lake → concentration of plankton
- Grazing removal of phytoplankton
 - Types of grazers influence phytoplankton assemblages (rotifers vs. cladocerans or copepods)
- Nutrient sources & speciation
- Noxious species (e.g. cyanobacteria)
- Species successions & disturbance
- How much organic matter is exported from FPL

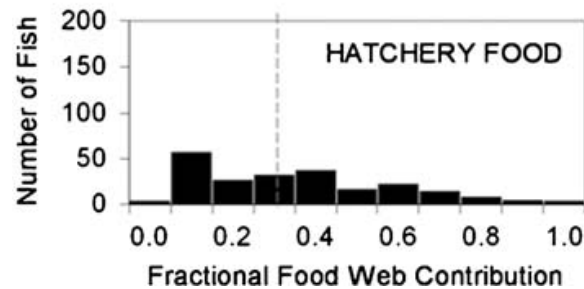
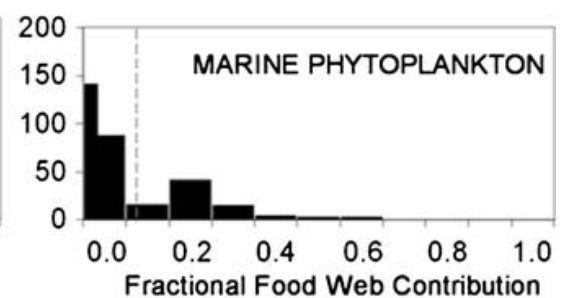
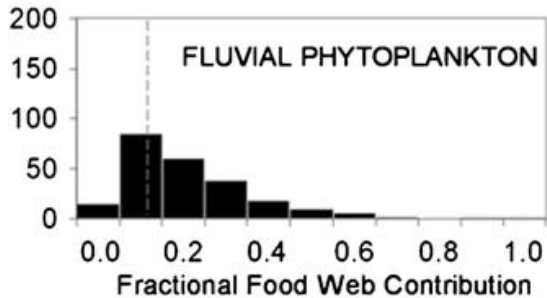
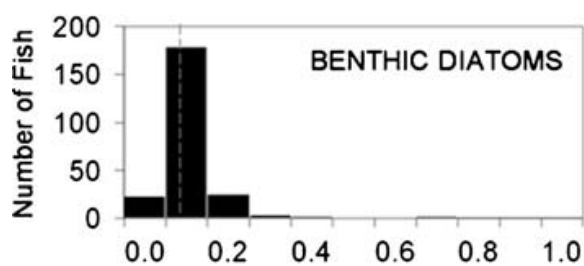
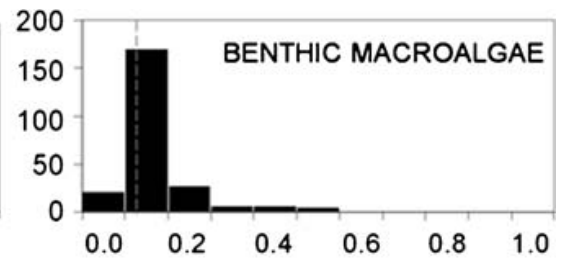
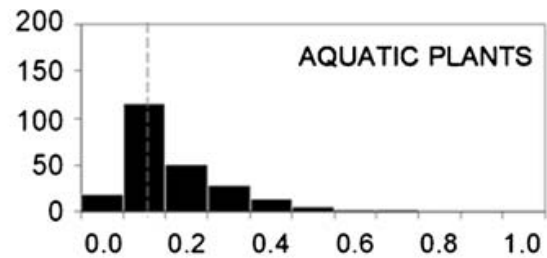
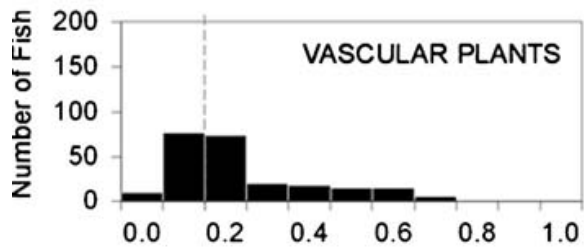
Columbia River Flow Climatology (Bonneville Dam)



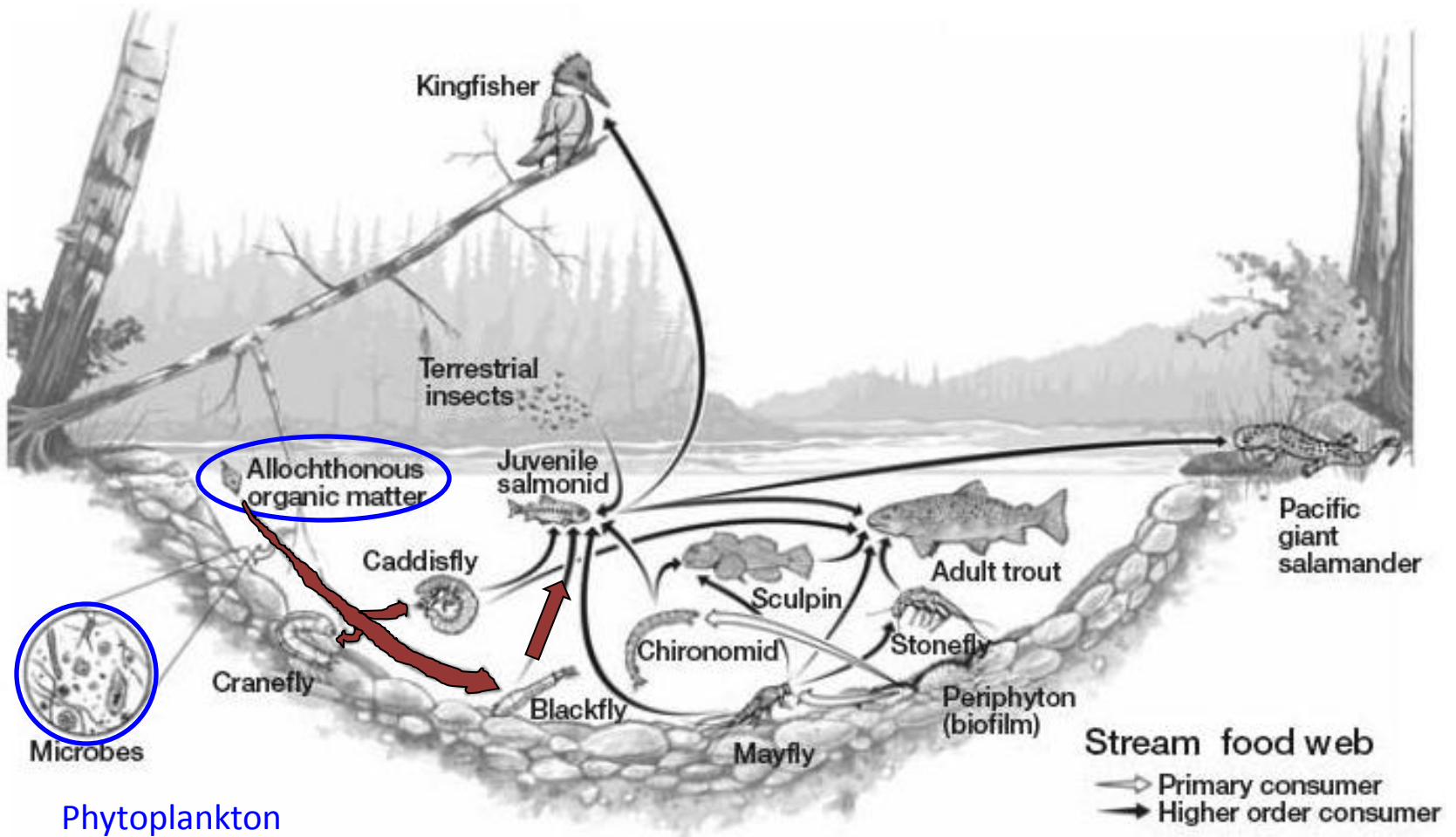
Lower Columbia River food web components







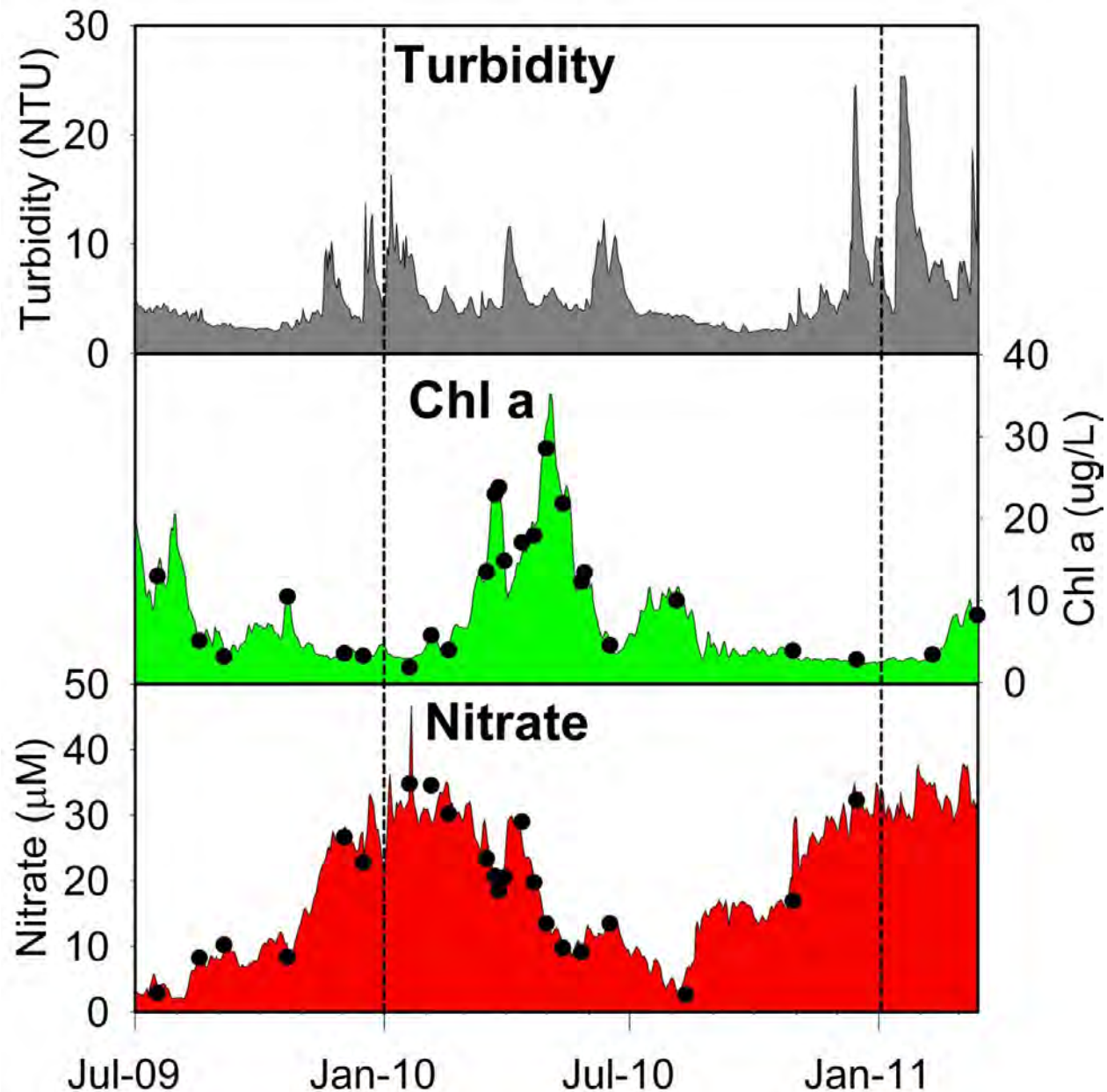
Stream food web



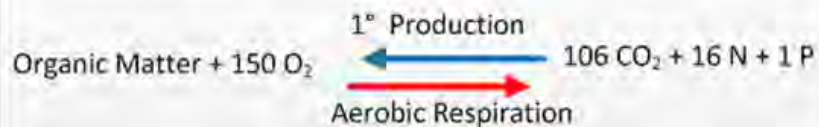
High turbidity
associated with
episodic storm
events

Chlorophyll a
biomass
characteristic of
temperate latitude
phytoplankton
blooms

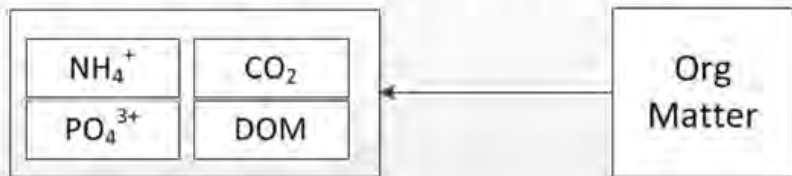
Nitrate highest
during winter



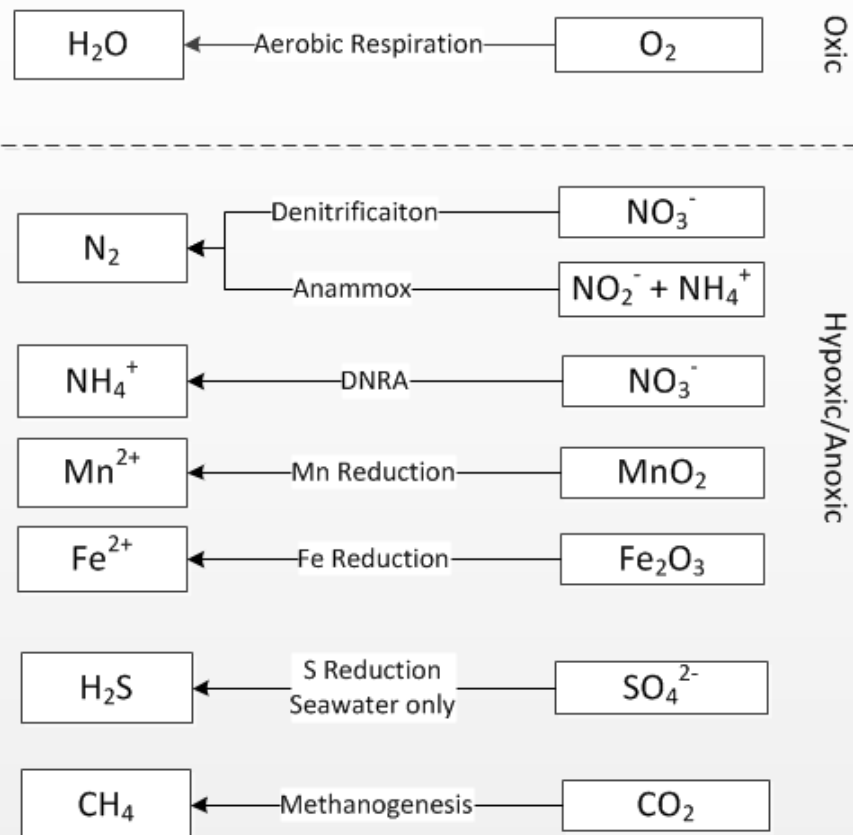
Lateral Bay Primary Production and Food Web



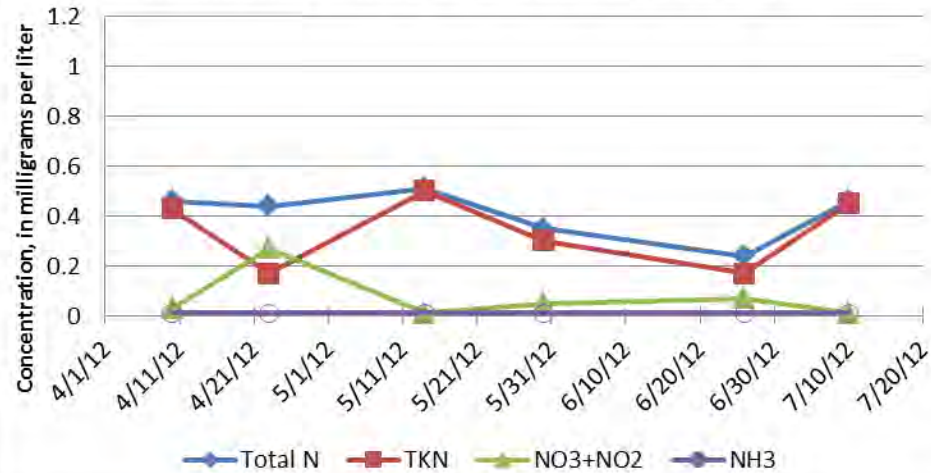
Lateral Bay Org Matter Decomposition Products



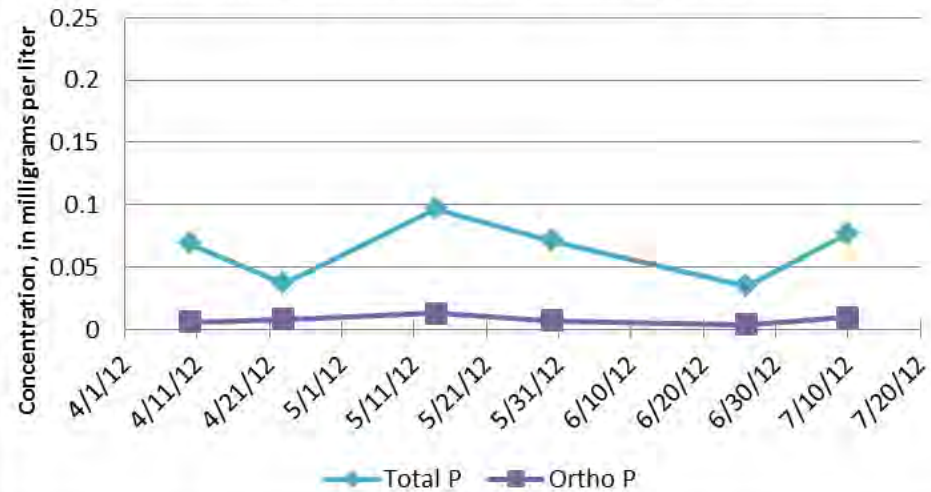
Lateral Bay Org Matter Redox Reactant/Products

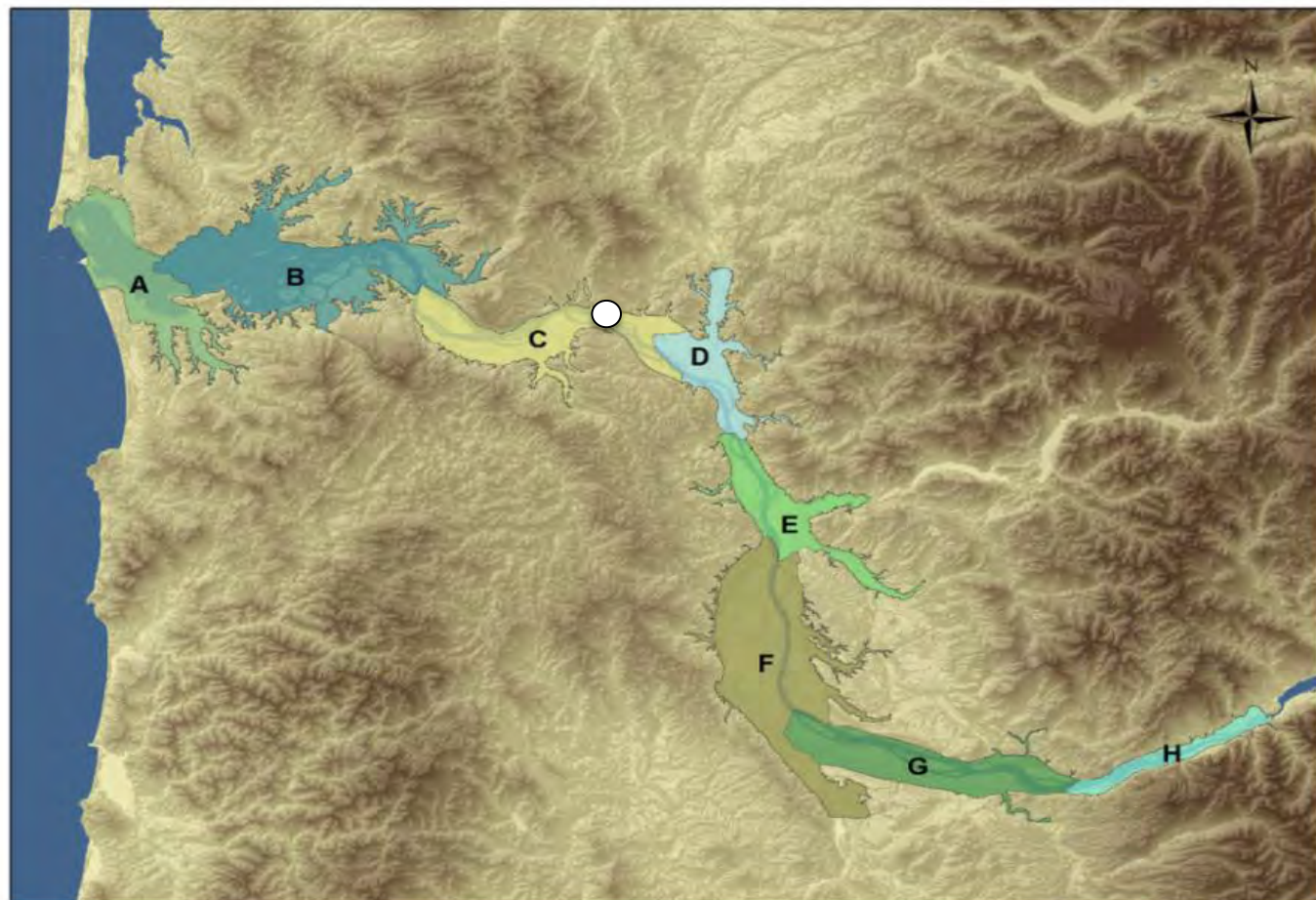


Concentration of Nitrogen at Franz Lake Slough, 2012



Concentration of Phosphorus at Franz Lake Slough, 2012





Hydrogeomorphic Reach

- A - Coastal Lowlands Entrance-Mixing
- B - Coastal Uplands Salinity Gradient
- C - Volcanics Current Reversal
- D - Western Cascades Tributary Confluences
- E - Tidal Flood Plain Basin Constriction
- F - Middle Tidal Flood Plain Basin
- G - Upper Tidal Flood Plain Basin
- H - Western Gorge

0 10 20 40 Kilometers

Columbia River Estuary Ecosystem Classification Level 3 Hydrogeomorphic Reaches

Map created by M.F. Ramirez and C.A. Simenstad,
University of Washington, School of Aquatic and Fishery Sciences,
Data Source: Digital elevation model courtesy of USGS.
Outline boundary courtesy of Earth Design Consultants, Inc.

'Greening' results in increased POM, decreased nutrients

