



Ecosystem Monitoring Program: Water quality monitoring, 2008—2011

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Water-quality monitoring to support salmonid-habitat characterization

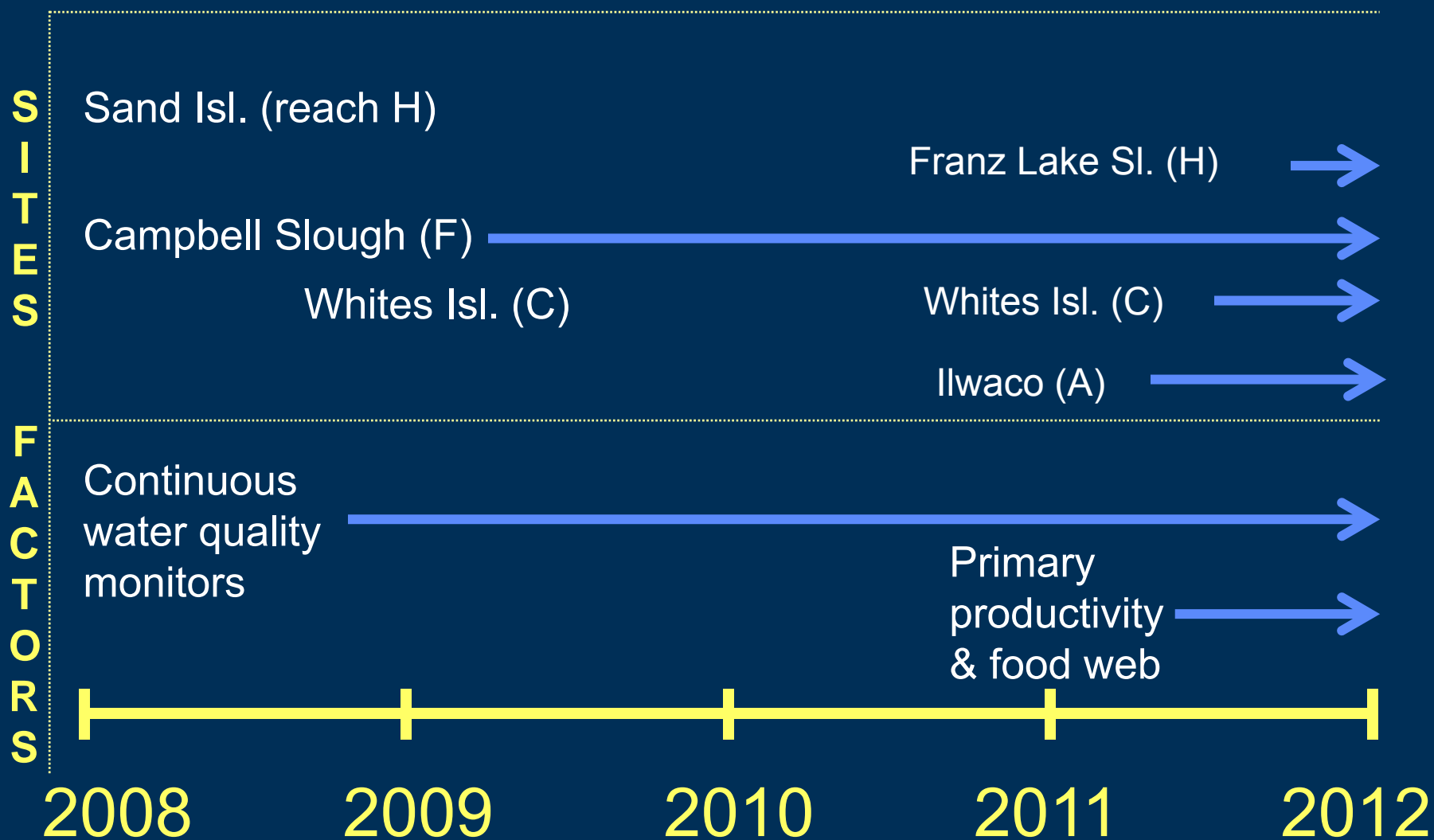
■ Background

- Changes to Columbia R. estuary habitats and food web have changed its capacity to support juvenile salmonids
- Need long-term monitoring of habitat conditions and use by juvenile salmonids for appropriate restoration planning

■ USGS work plan

- Assess trends at 4 fixed sites
- Measure WQ during period when juvenile salmonids are using the sites

Overview



Water-Quality Monitors

- Parameters:
 - Temperature
 - pH
 - Dissolved oxygen
 - Specific conductance
 - Turbidity (2008—09)
 - Sonde depth
- 15/30 minute logging
 - May – August (2008—2010)
 - April – July (2011 – present)

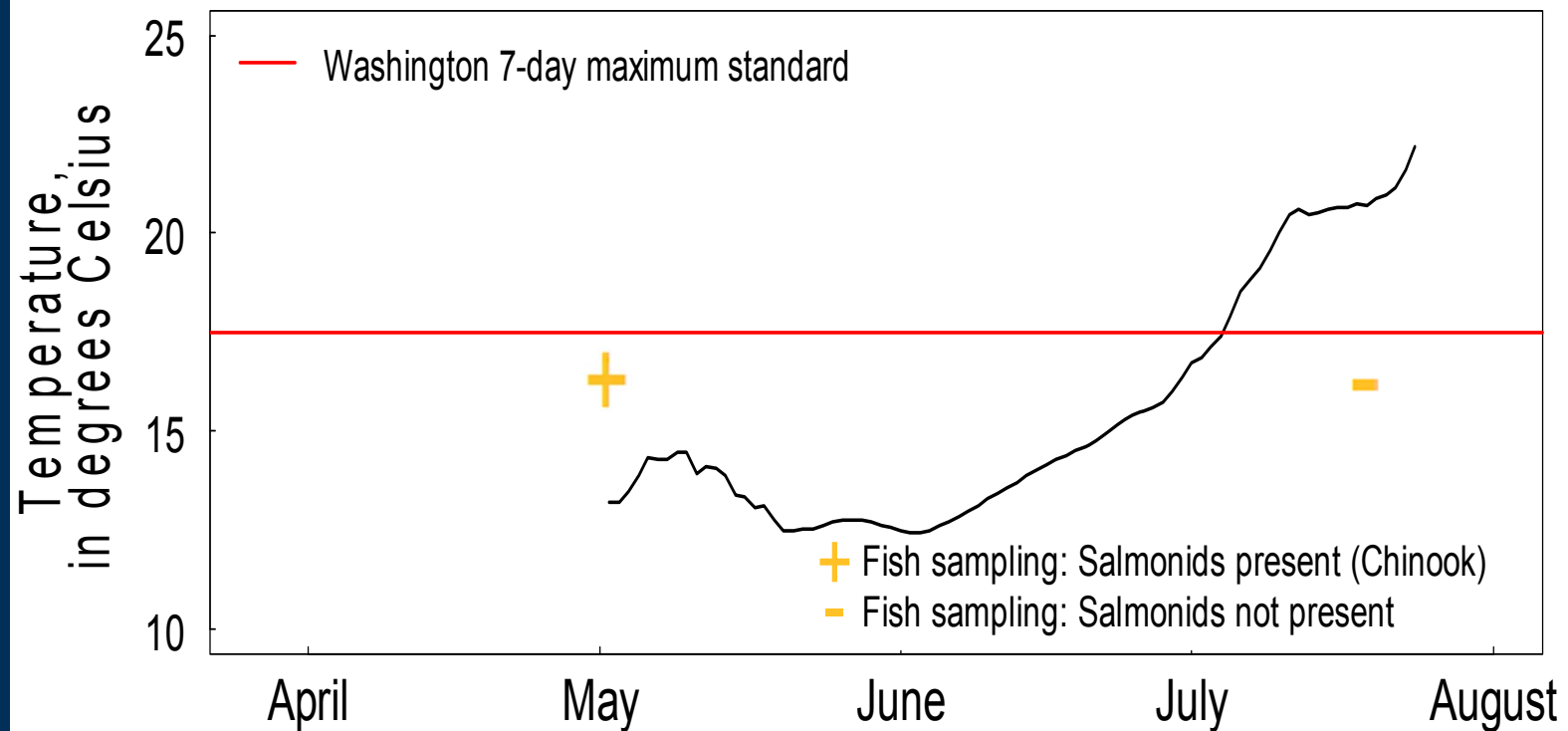


Washington Water-Quality Standards

- Thresholds set to protect salmonid spawning, rearing, and migration in the Columbia River
- 7-day average maximum temperature: **17.5° C**
- Daily minimum dissolved oxygen: **8.0 mg/L**
- pH acceptable range: **6.5 – 8.5**

Example

A. Seven-day maximum temperature at Campbell Slough, 2011



Water-Quality Monitoring Sites

Ilwaco
(reach A)



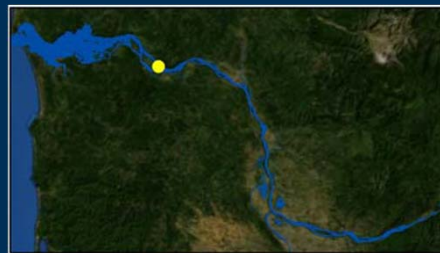
rkm
5



Whites
Island (C)



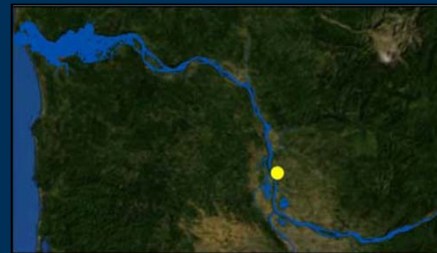
rkm
72



Campbell Slough,
Ridgefield (F)



rkm
149



Franz Lake
Slough (H)



rkm
221

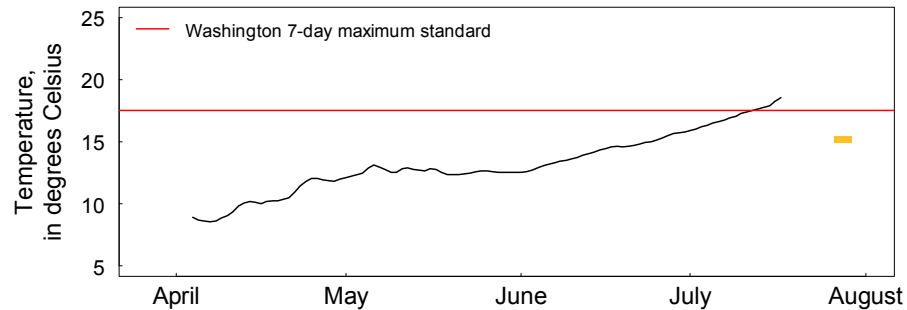


Franz Lake Slough (2011)

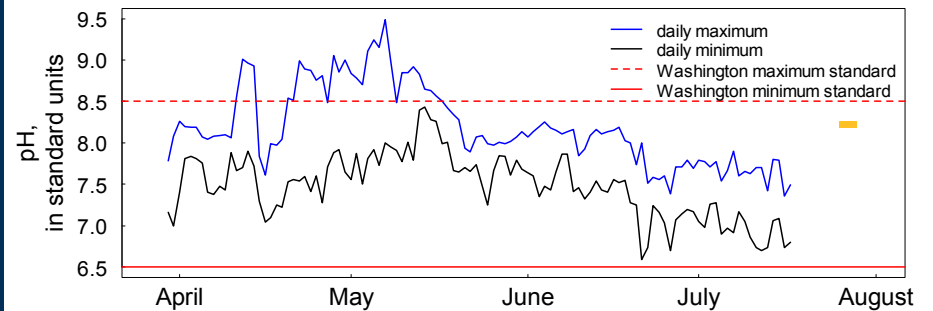


Franz Lake Slough (2011)

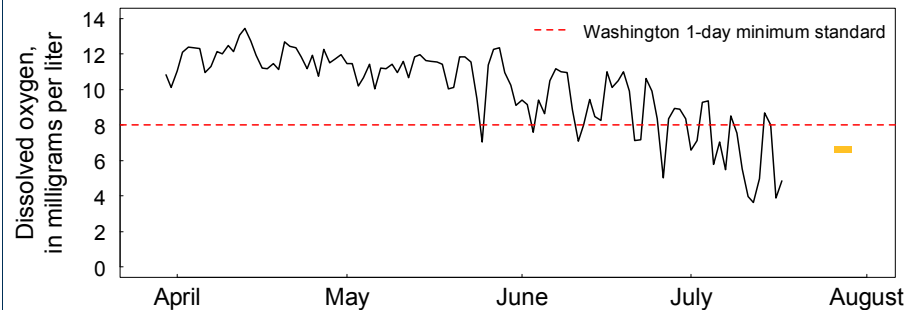
A. Seven-day maximum temperature at Franz Lake Slough, 2011



B. Daily pH at Franz Lake Slough, 2011



C. Daily minimum dissolved oxygen at Franz Lake Slough, 2011

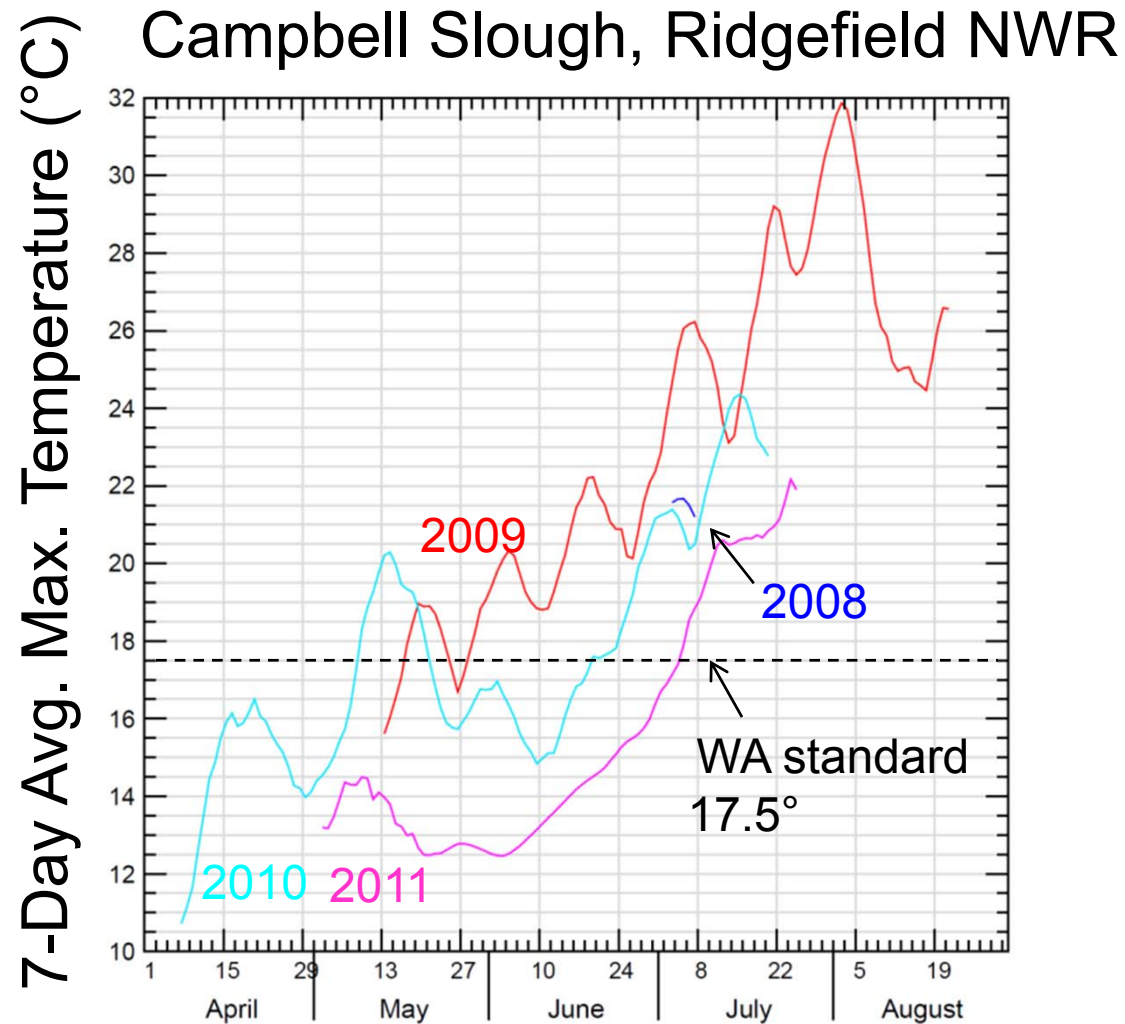


— Salmonids not present during fish sampling

Campbell Slough (2008-2011)

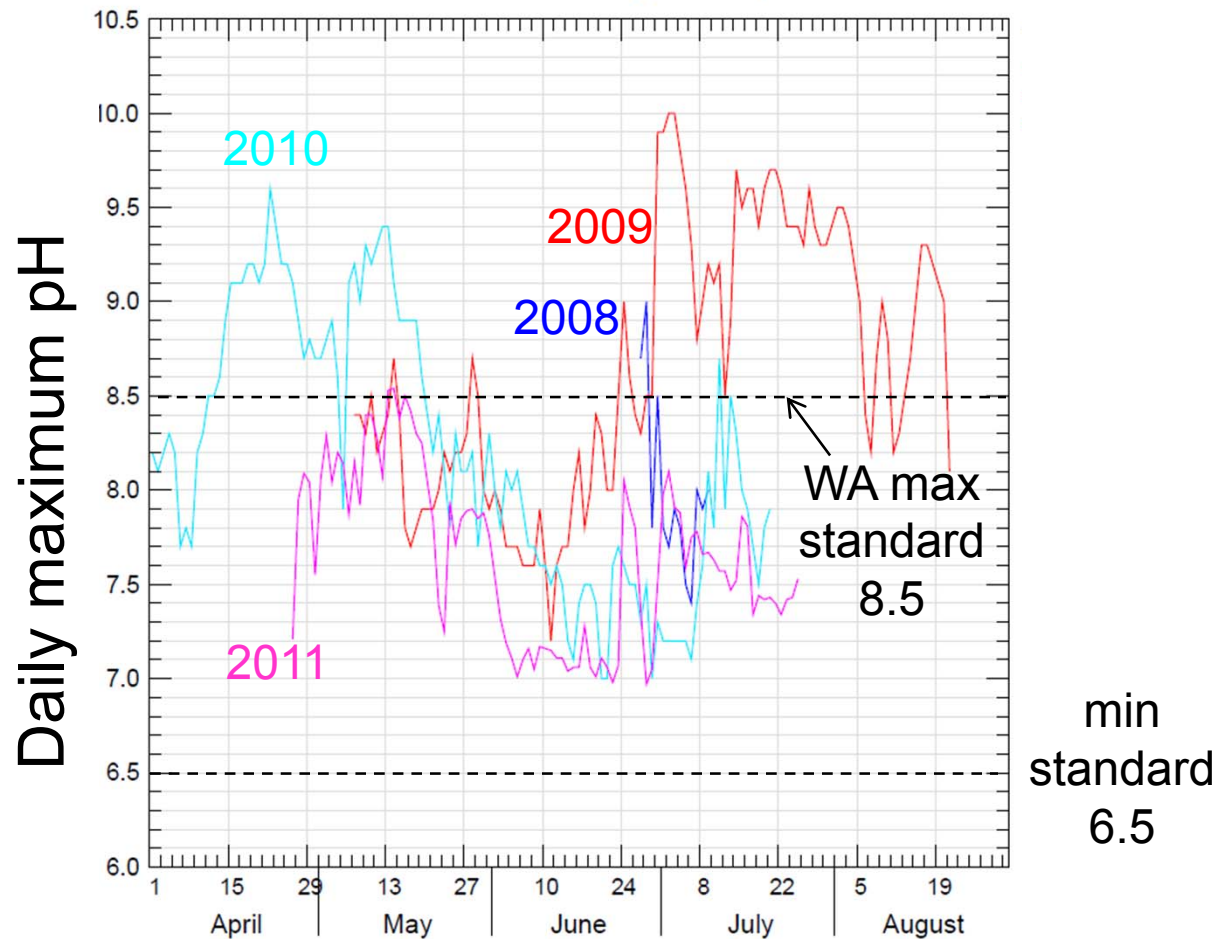


Campbell Slough: Temperature

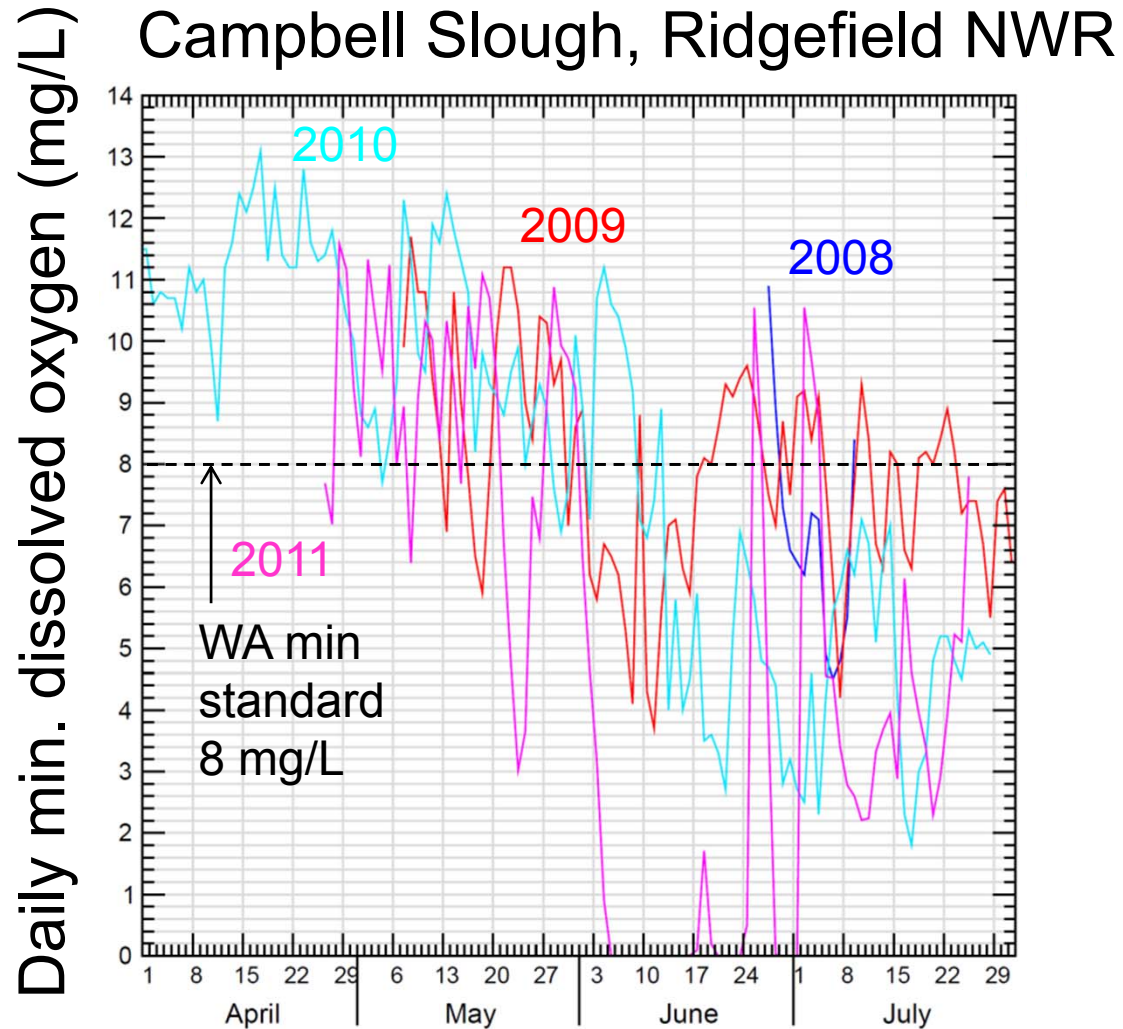


Campbell Slough: pH

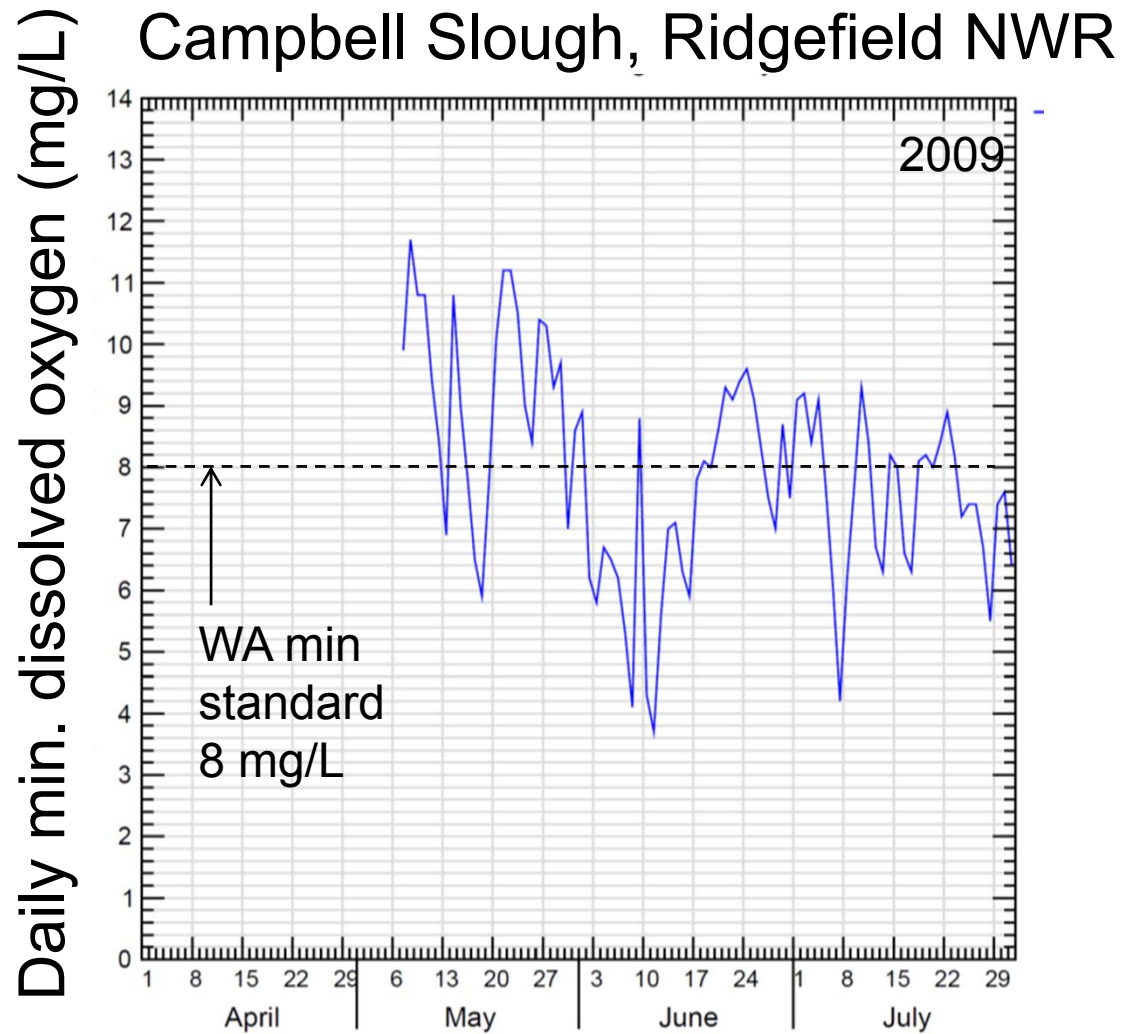
Campbell Slough, Ridgefield NWR



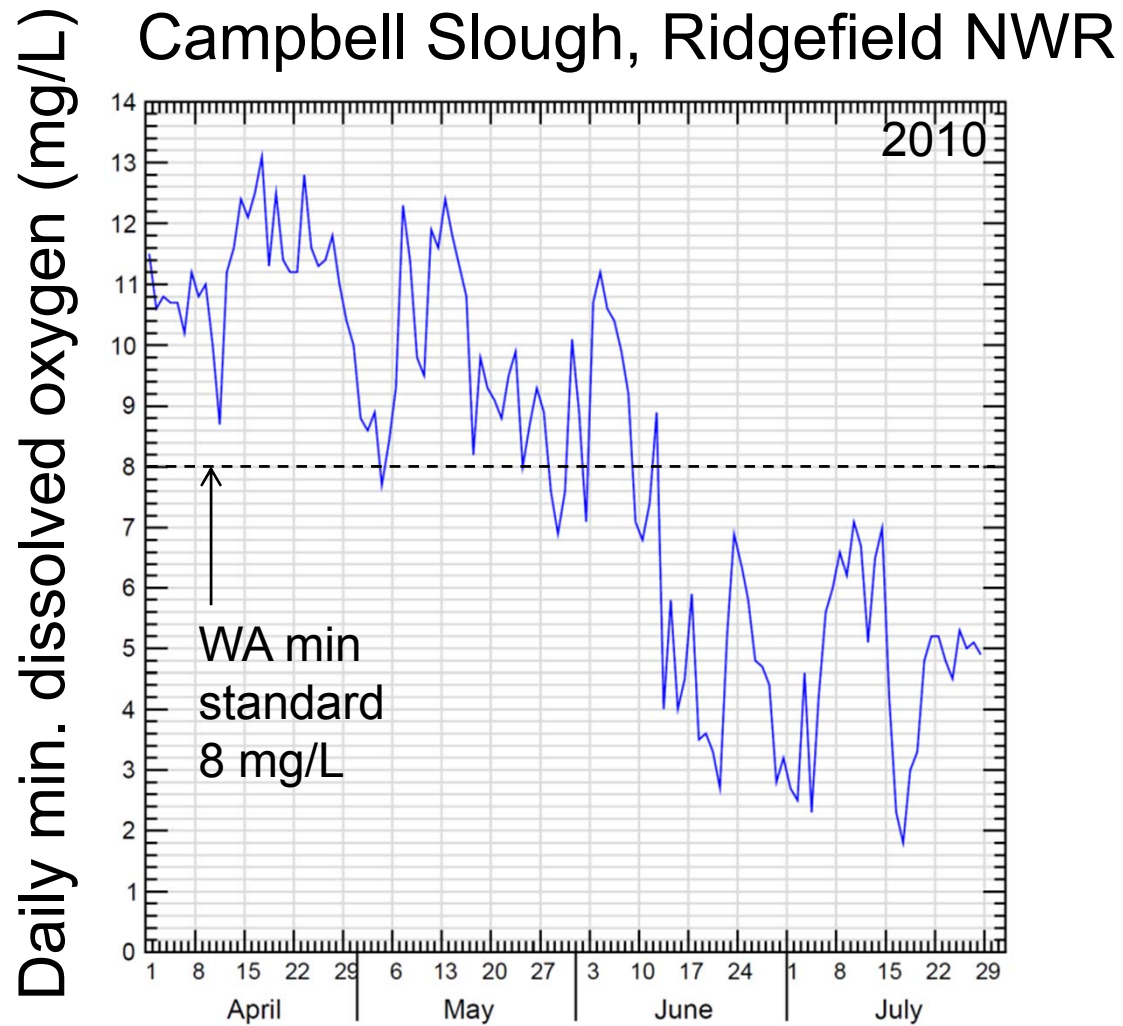
Campbell Slough: Dissolved Oxygen



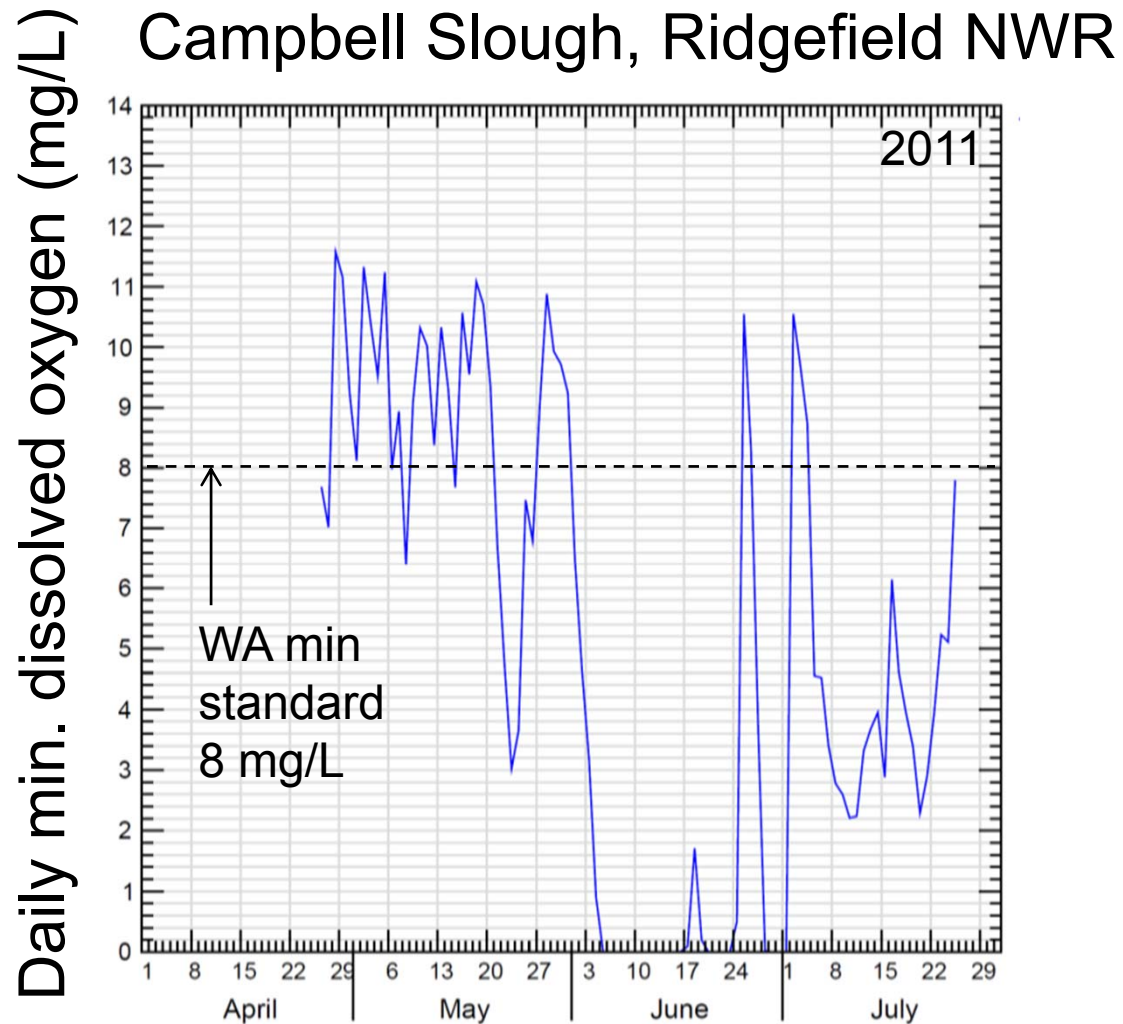
Campbell Slough: Dissolved Oxygen



Campbell Slough: Dissolved Oxygen



Campbell Slough: Dissolved Oxygen

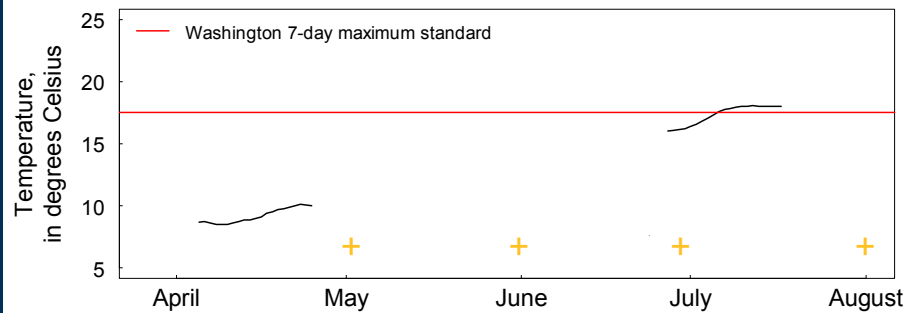


Whites Island (2009, 2011)

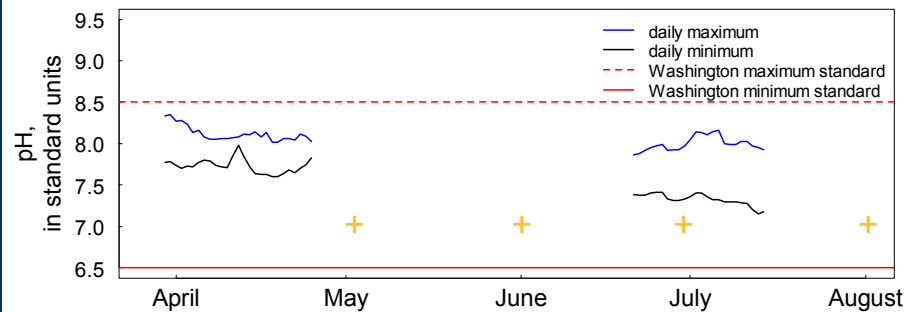


Whites Island (2009, 2011)

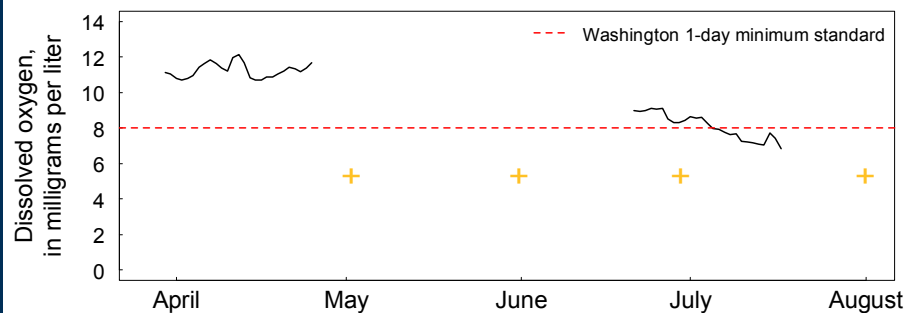
A. Seven-day maximum temperature at Whites Island, 2011



B. Daily pH at Whites Island, 2011

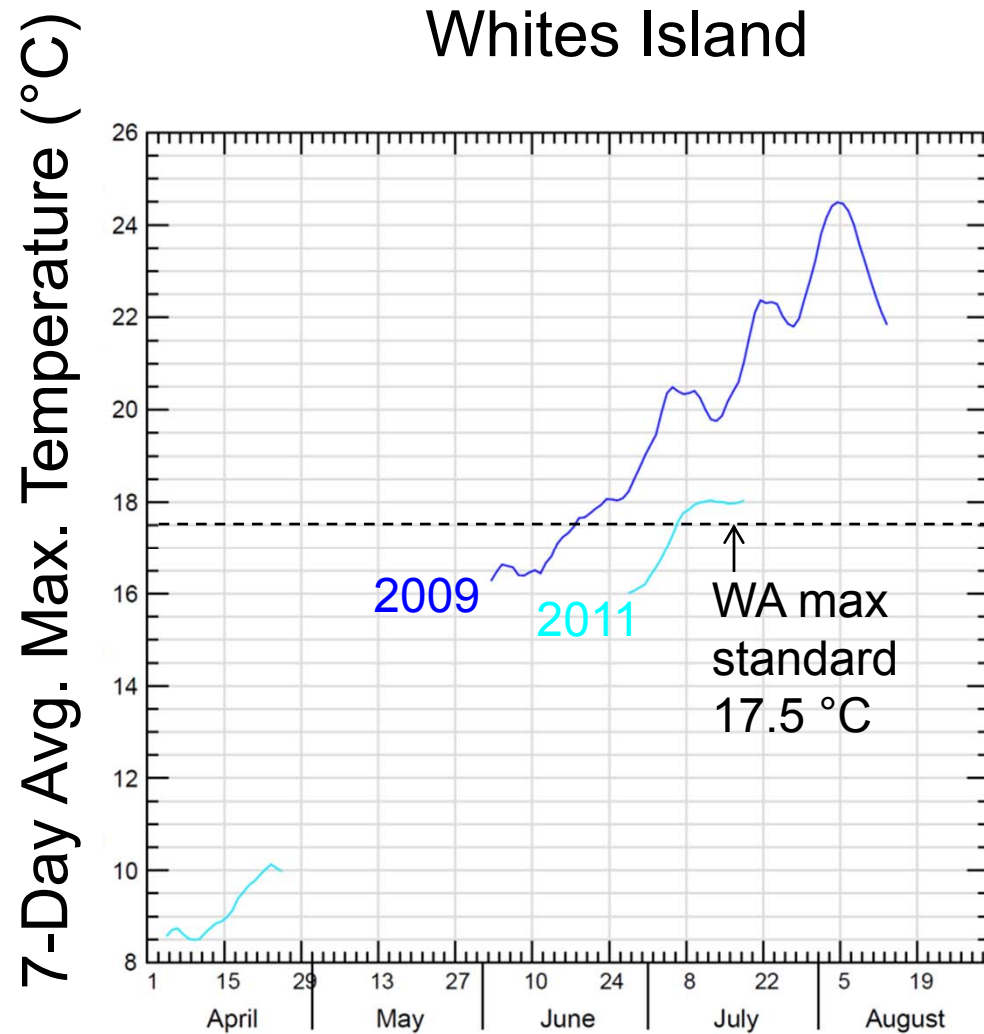


C. Daily minimum dissolved oxygen at Whites Island, 2011

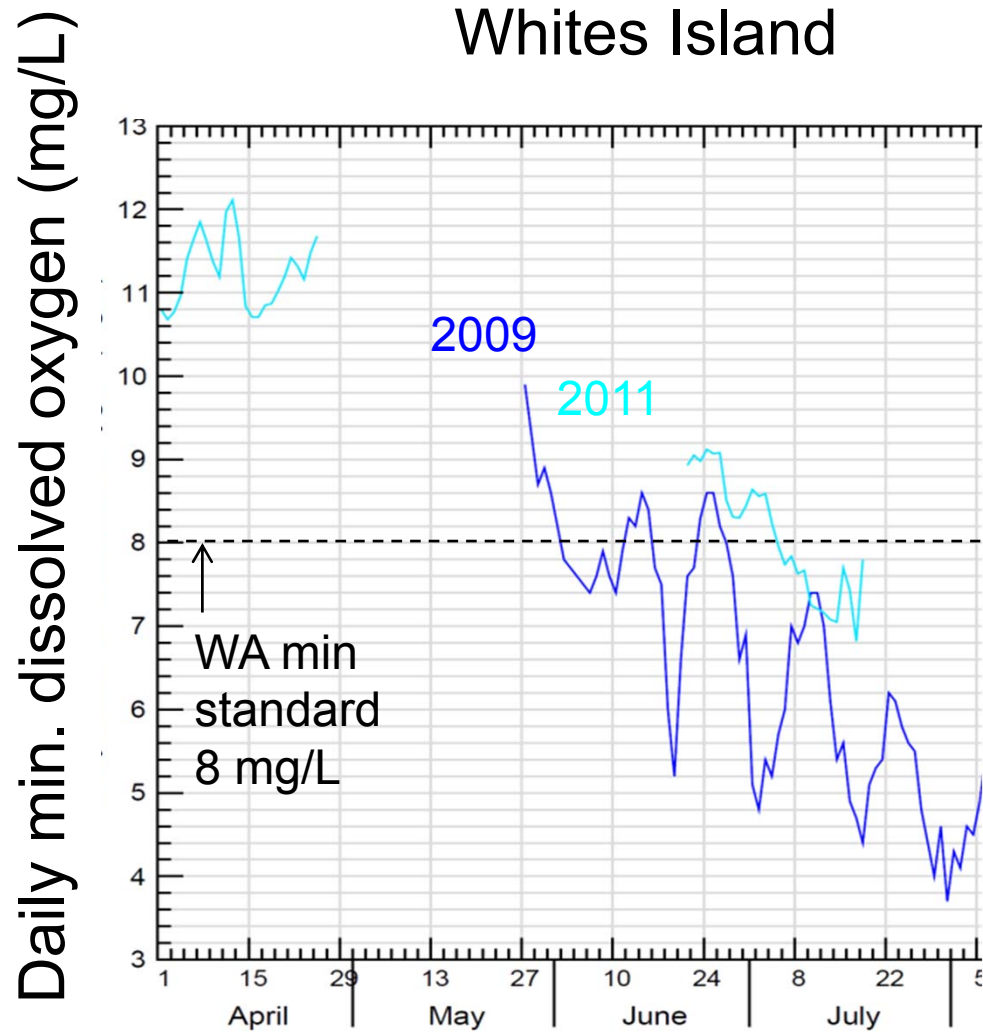


+ Fish sampling: Salmonids present (Chinook)

Whites Island (2009, 2011)



Whites Island (2009, 2011)

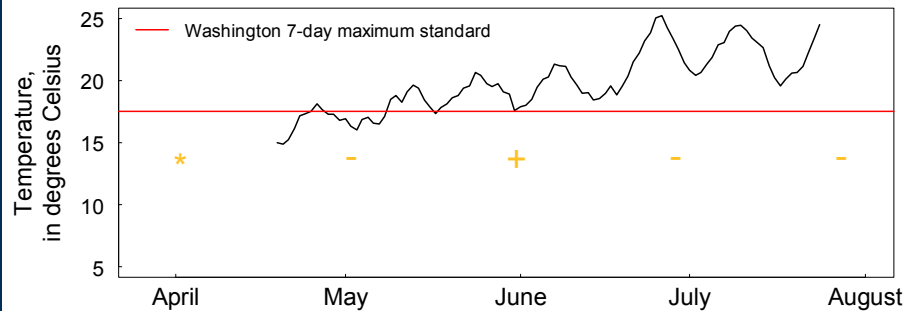


Ilwaco (2011)

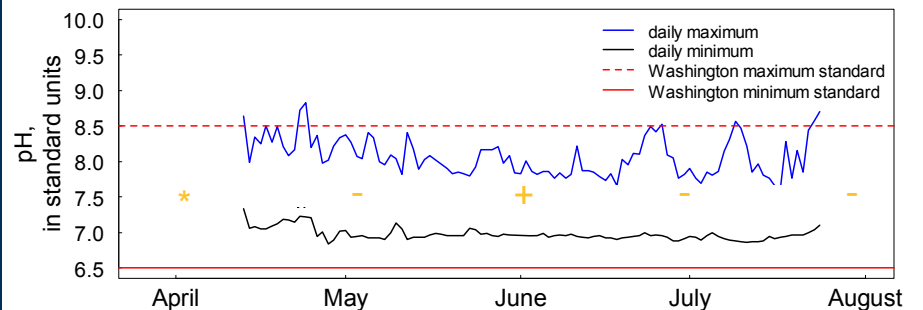


Ilwaco (2011)

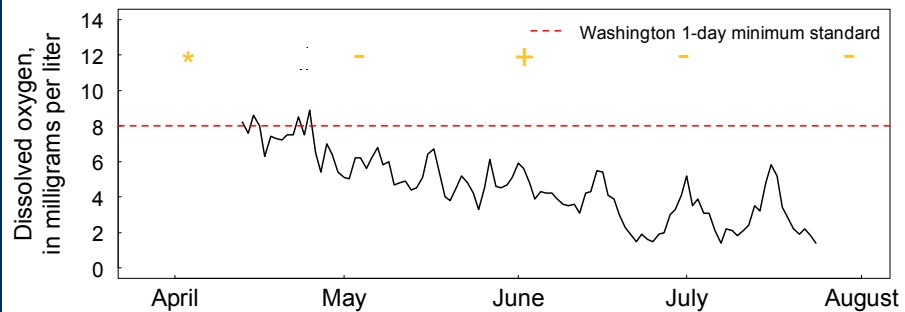
A. Seven-day maximum temperature at Ilwaco, 2011



B. Daily pH at Ilwaco, 2011

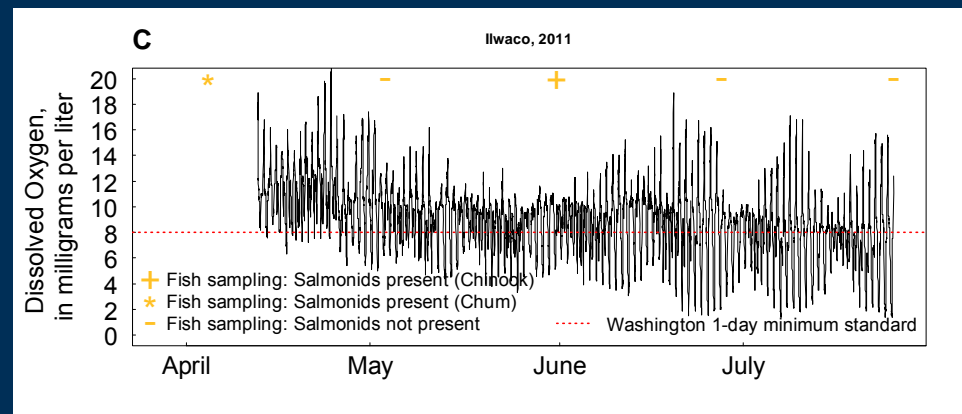
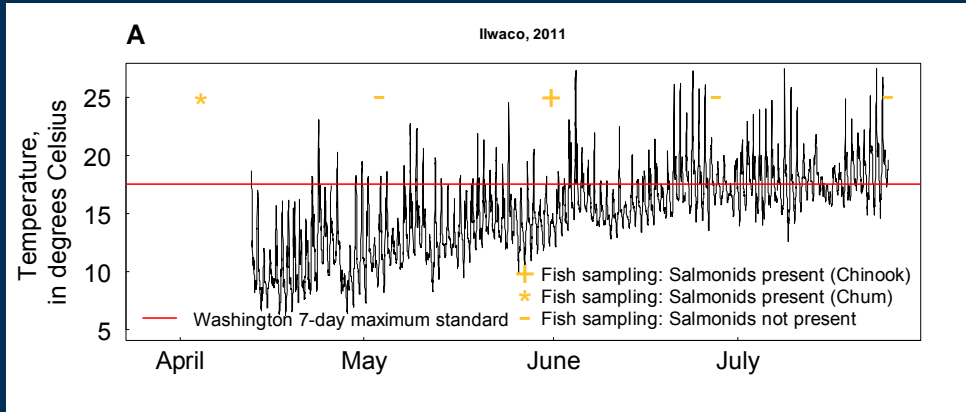


C. Daily minimum dissolved oxygen at Ilwaco, 2011

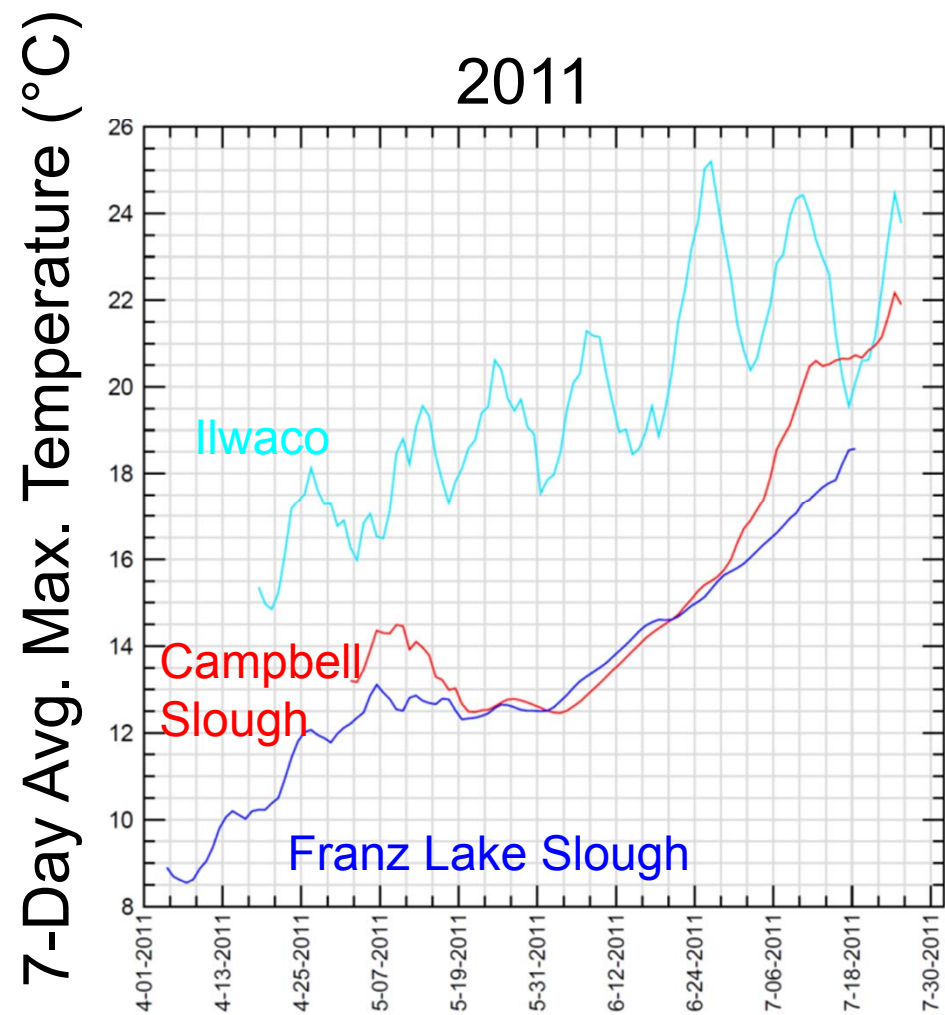


- + Fish sampling: Salmonids present (Chinook)
- * Fish sampling: Salmonids present (Chum)
- Fish sampling: Salmonids not present

Ilwaco (2011)



Inter-site variability



Water-Quality Summary

- All sites had periods of suitable conditions and of poor conditions for salmonids
- The extent and timing of stressful periods varied across sites and years
- With a few exceptions, juvenile salmon were found at the sites during periods of low temperature, moderate pH, and high DO

Primary Productivity & Food Web



Water-column nutrients (N,P) and light (PAR)

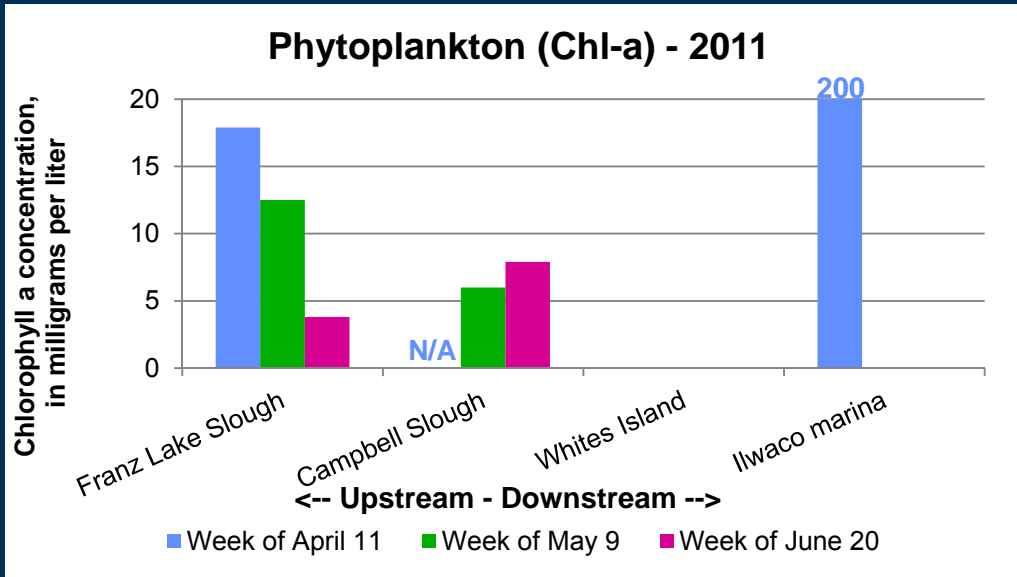


Algal abundance and productivity rates



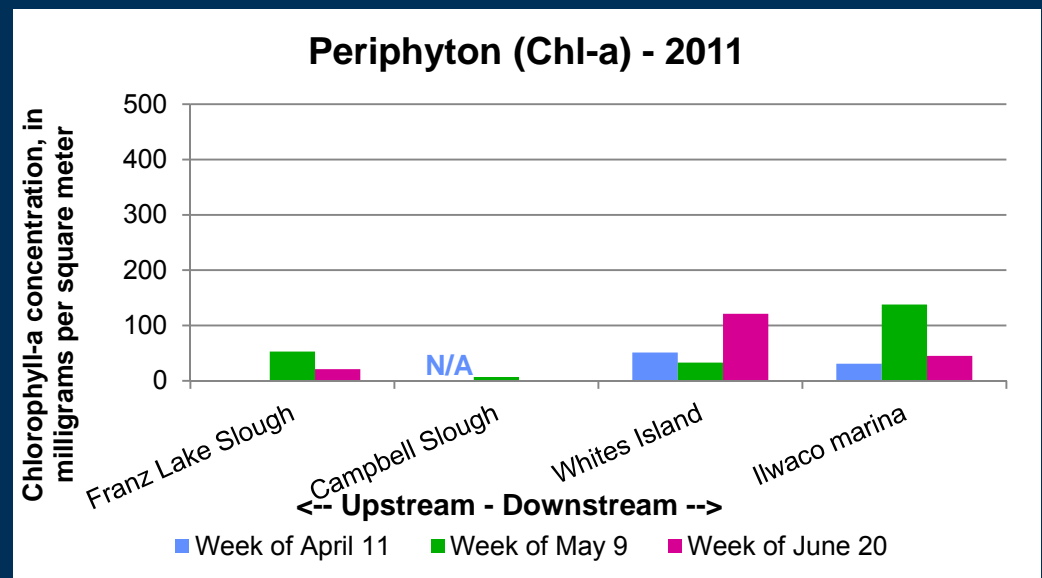
Stable isotope analysis of $\delta^{15}\text{N}$ / $\delta^{13}\text{C}$ in juvenile salmon and food web components

Ambient algal abundance: 2011



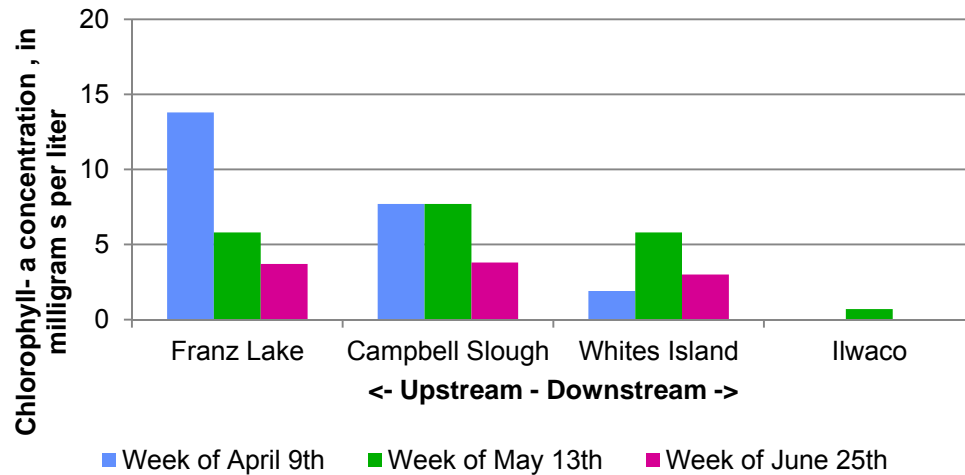
N/A = no sample

Otherwise, no bar = less than detection limit



Ambient algal abundance: 2012

Phytoplankton (Chl-a) - 2012

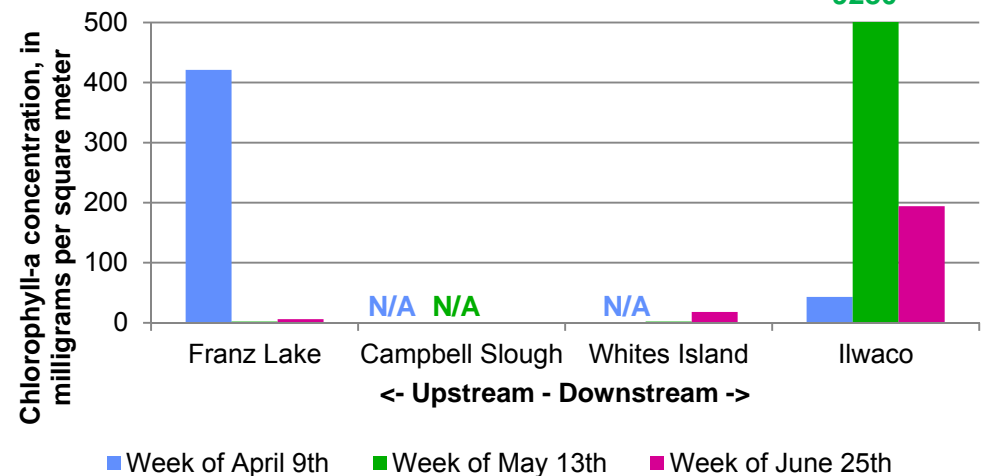


N/A = no sample

Otherwise, no bar = less than detection limit

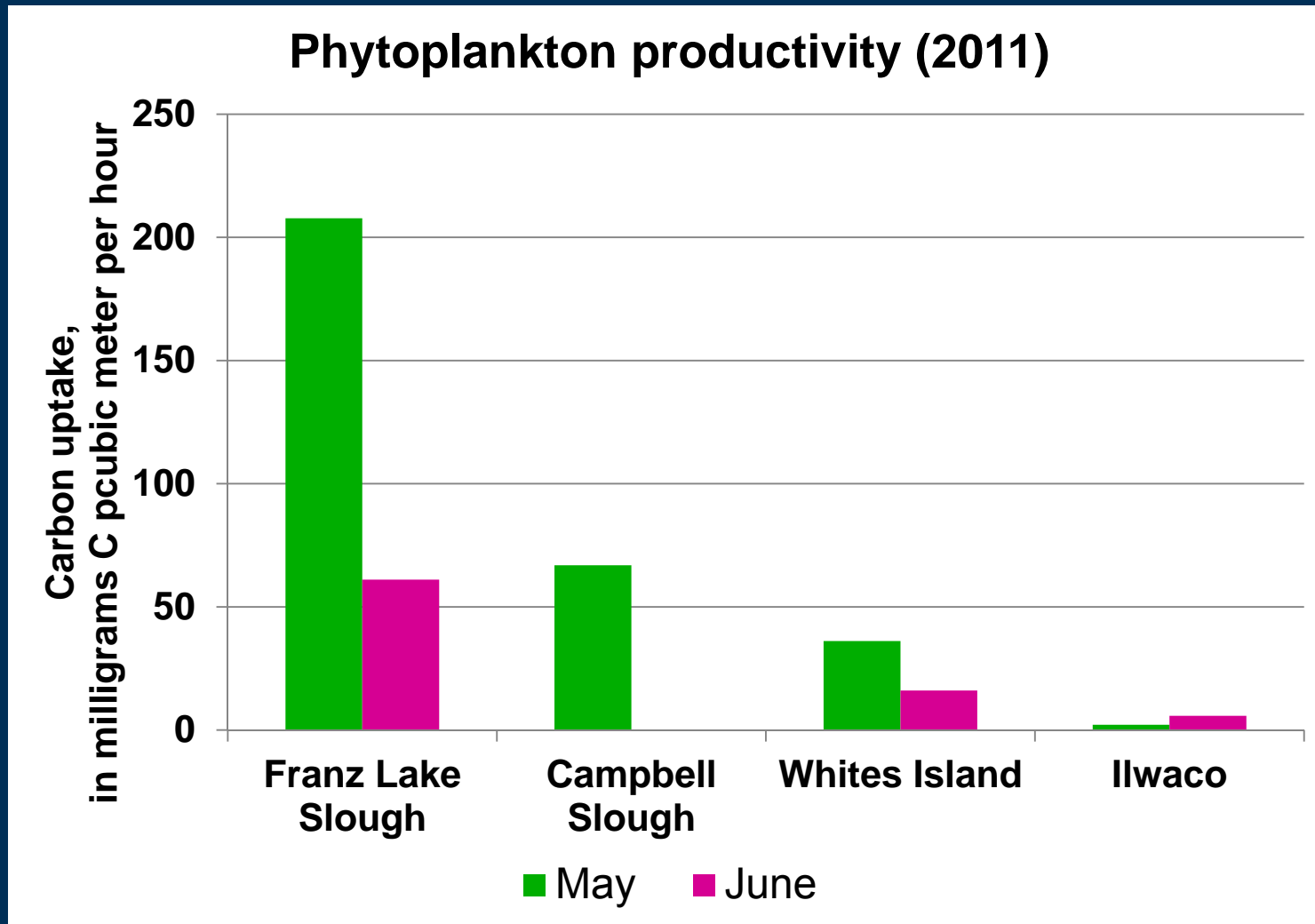


Periphyton (Chl-a) - 2012



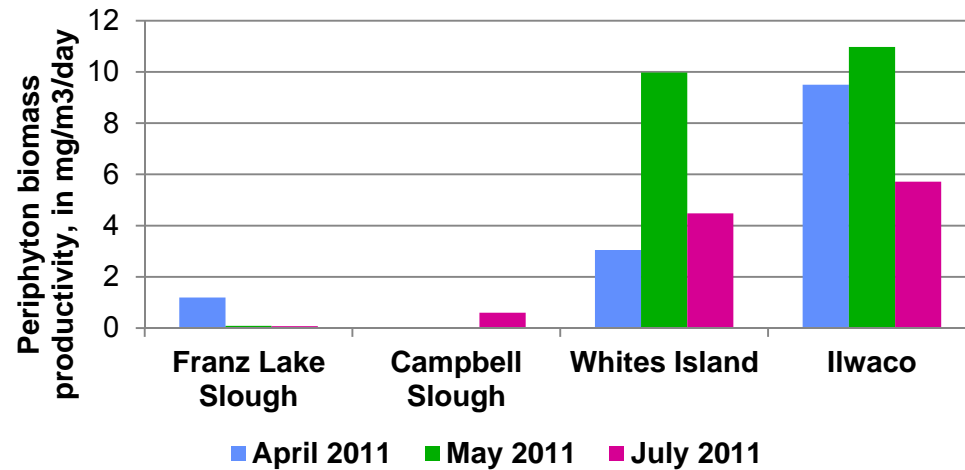
Phytoplankton productivity rates: 2011

¹⁴C uptake method

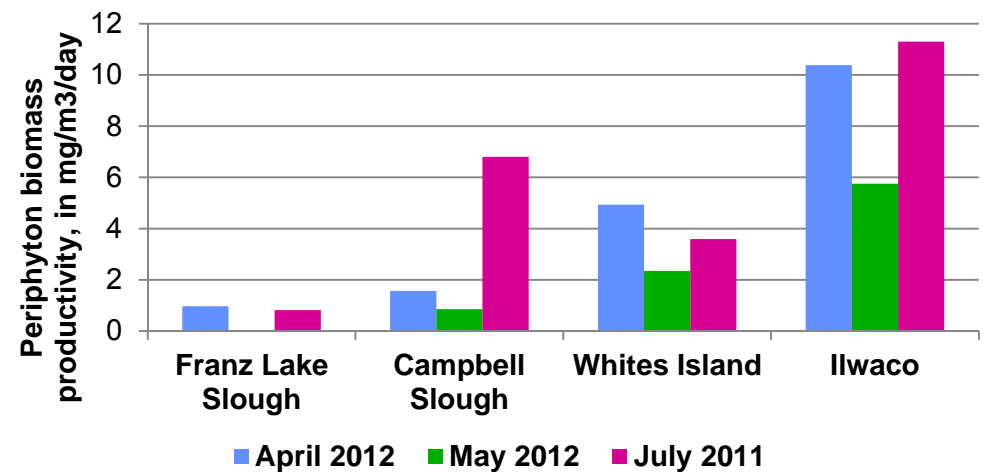


Periphyton Productivity: 2011—2012

Periphyton Productivity Rates - 2011



Periphyton Productivity Rates - 2012



Primary Productivity Summary

- Higher phytoplankton ambient abundance and productivity rates upstream
- Higher periphyton ambient abundance and productivity rates downstream
- Seasonal patterns in water-quality and productivity are consistent at sites
- Bulk of data analysis yet to be completed

Questions?

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