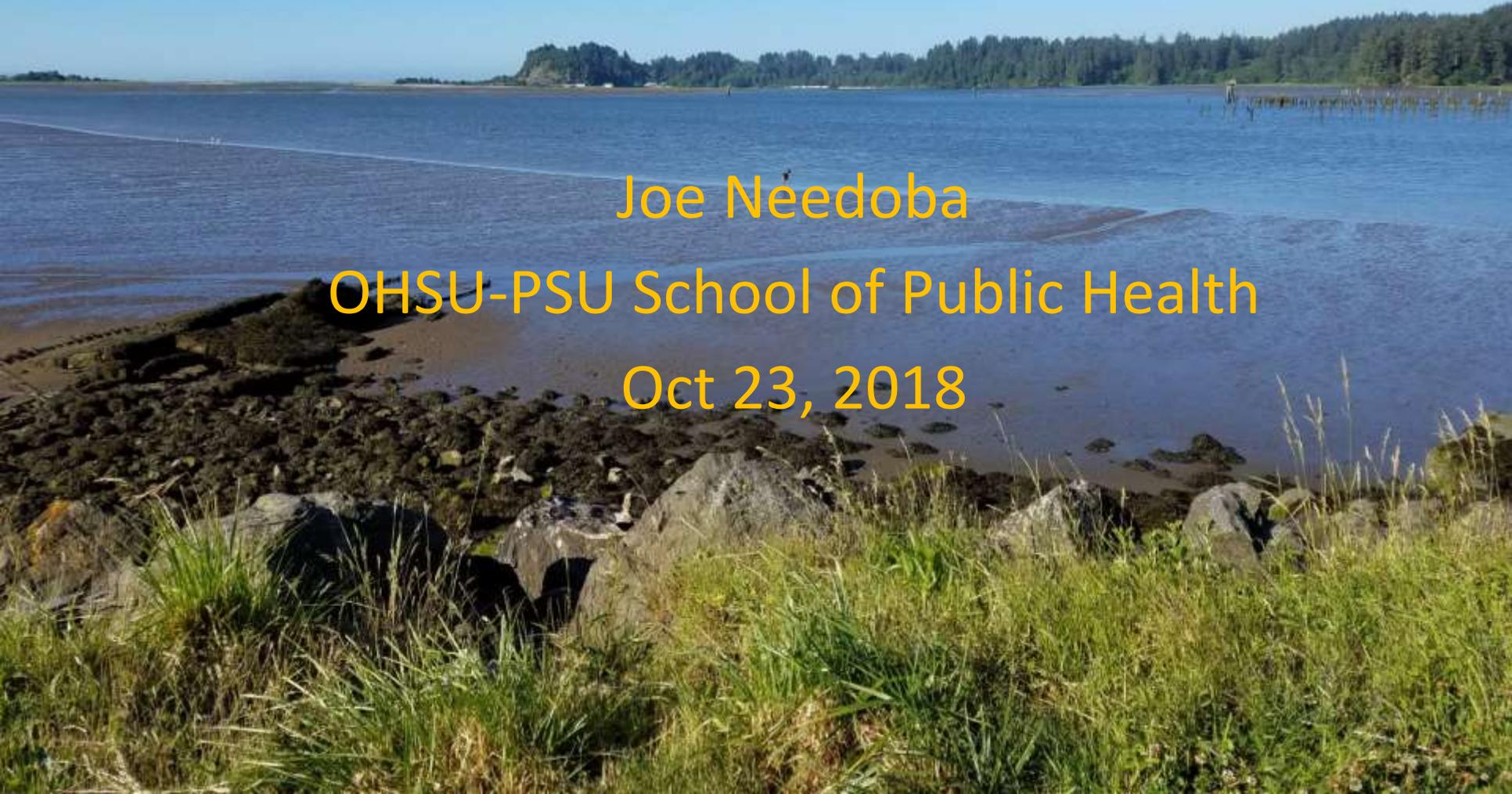


Ecosystem Monitoring Program 2018 – water quality conditions

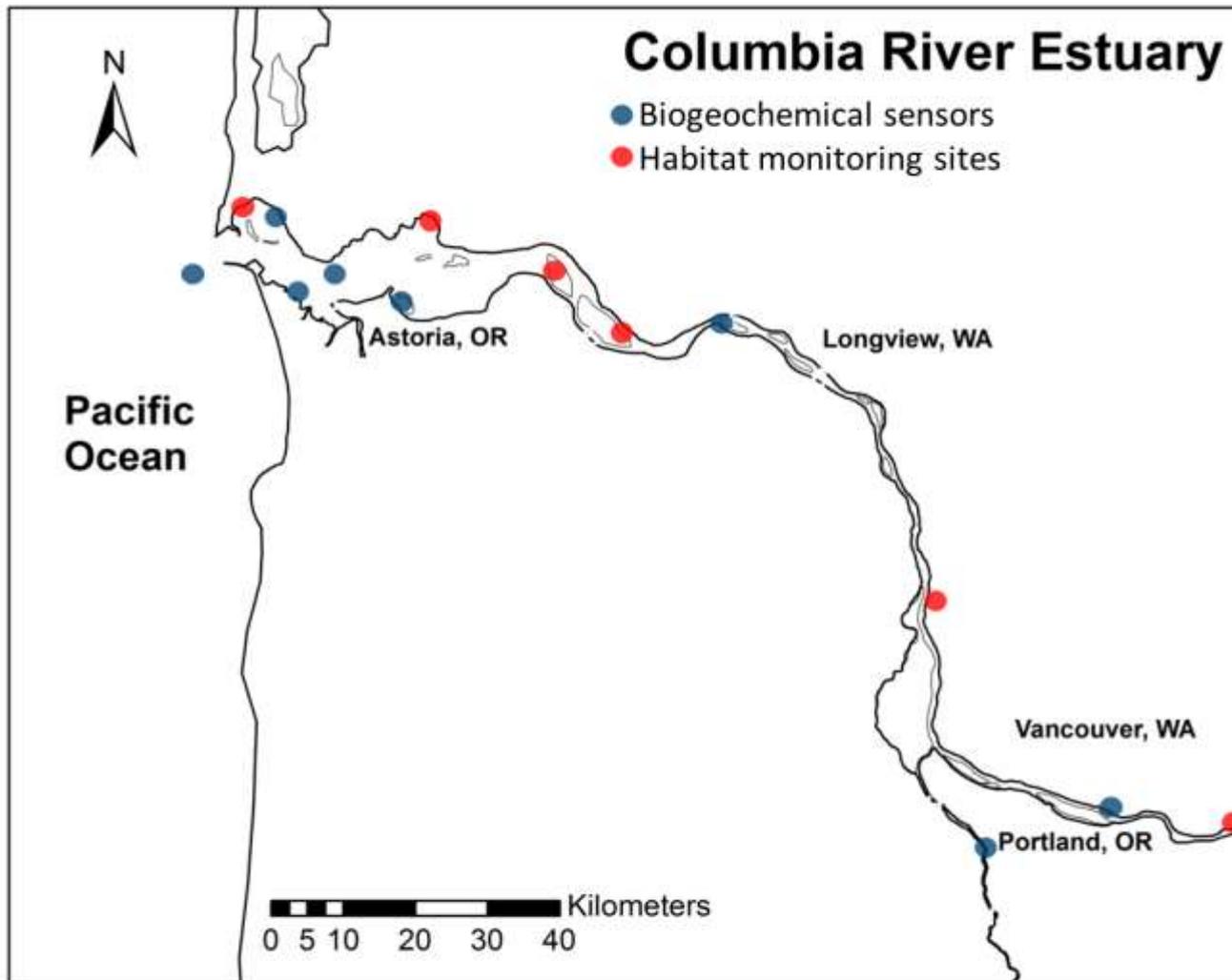
Joe Needoba

OHSU-PSU School of Public Health

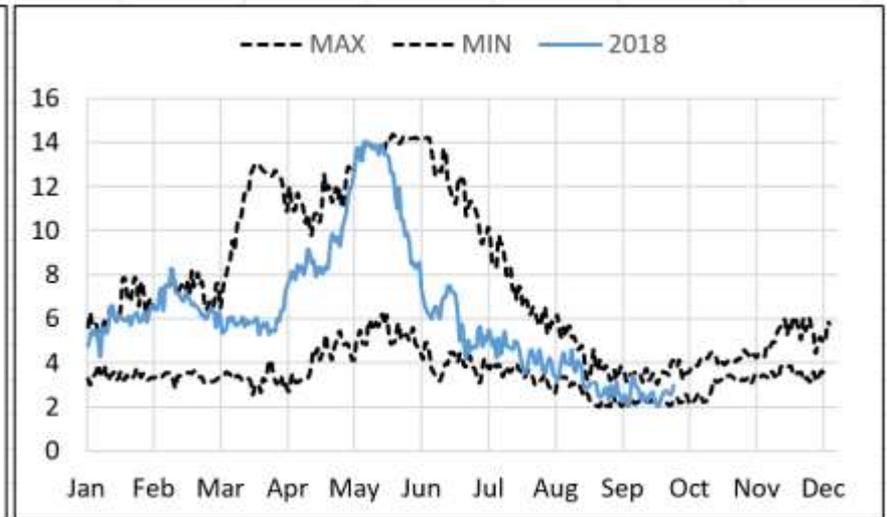
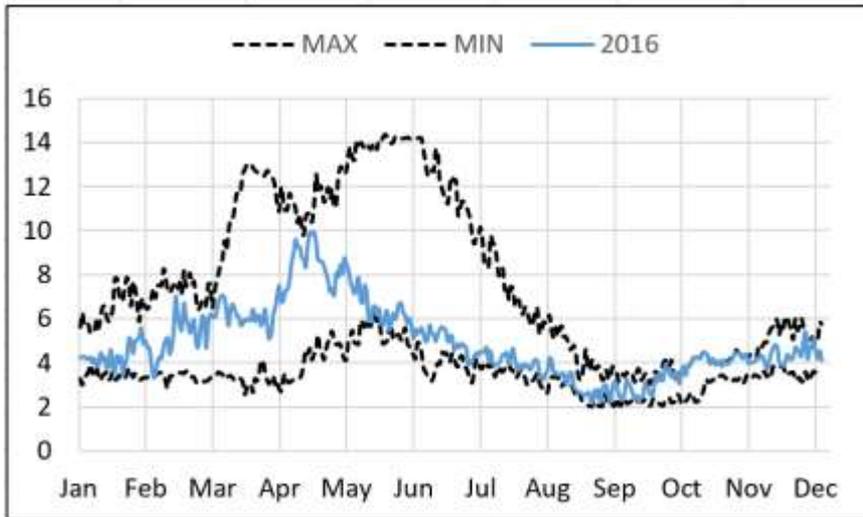
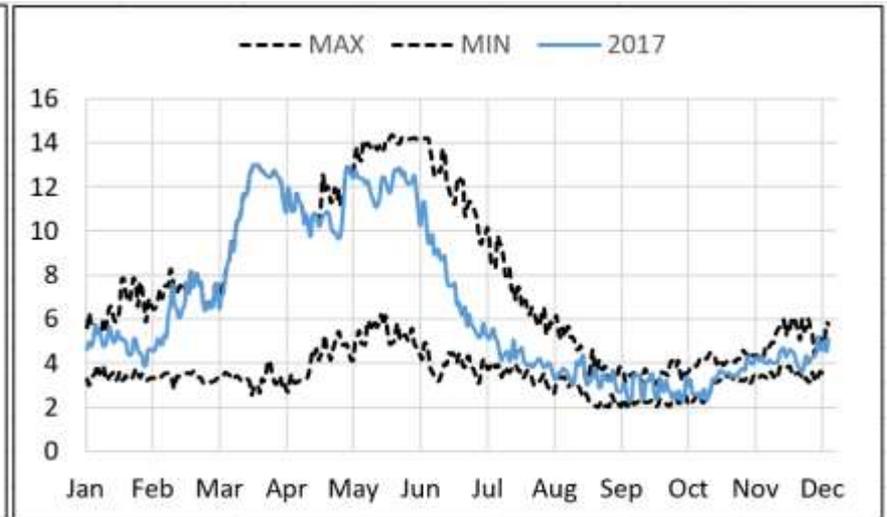
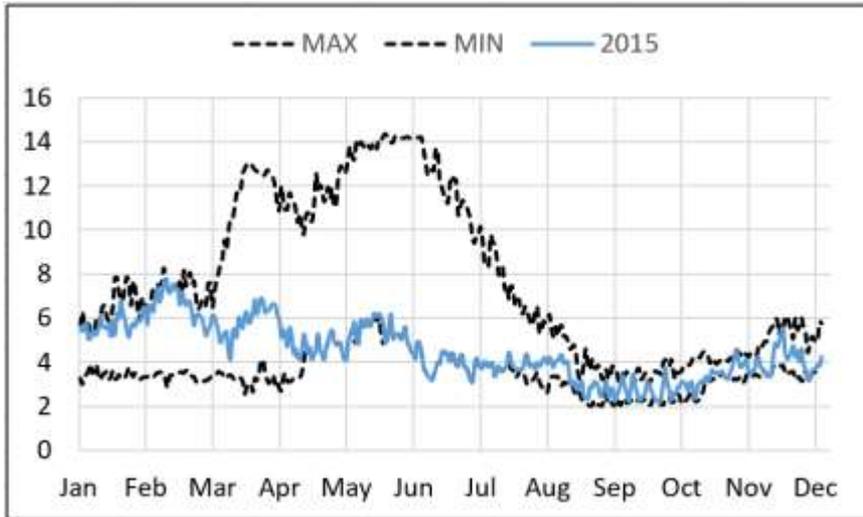
Oct 23, 2018



Sensor Networks in the Columbia River estuary



River Discharge at Bonneville



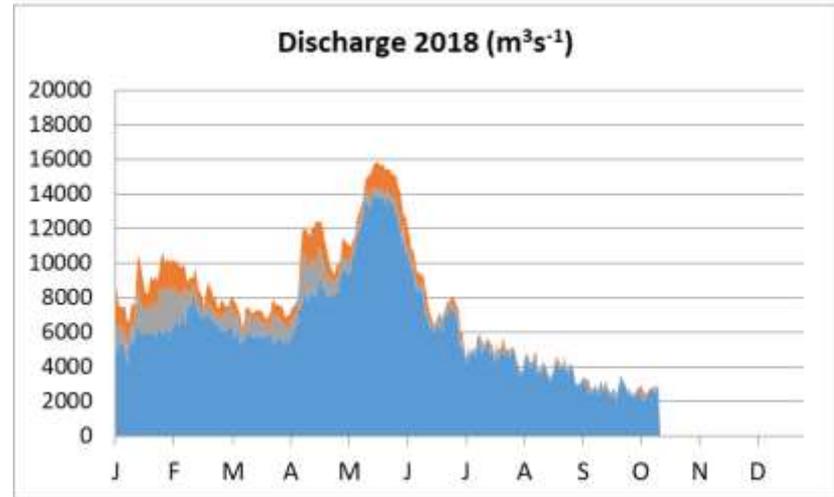
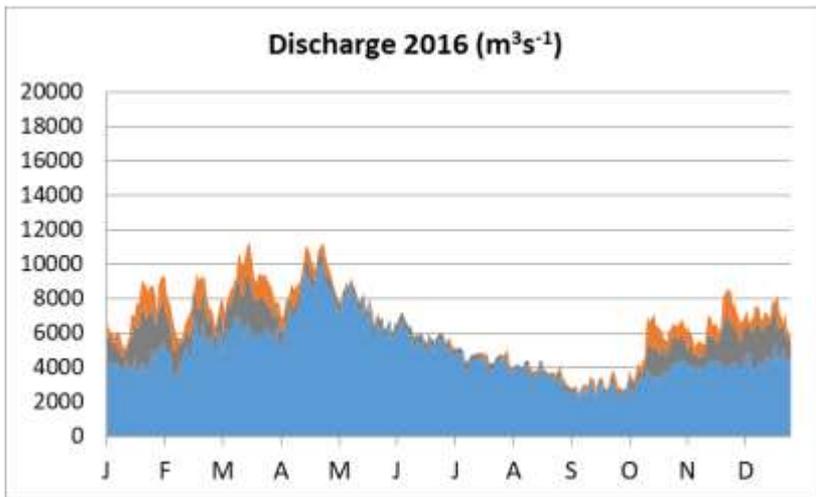
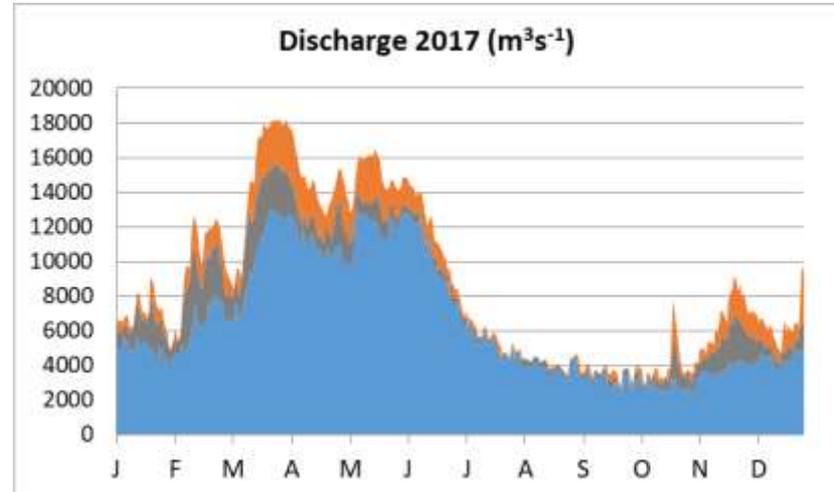
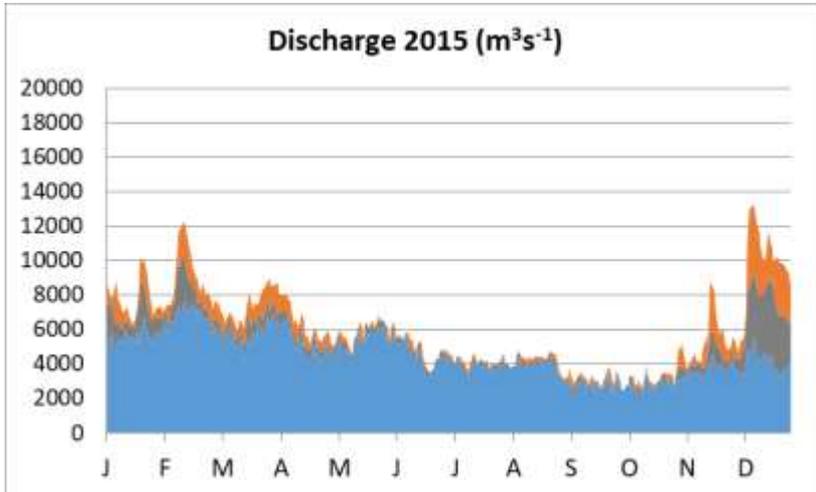
Min/Max time period 2009-2018

Franz lake – March – May – Sept

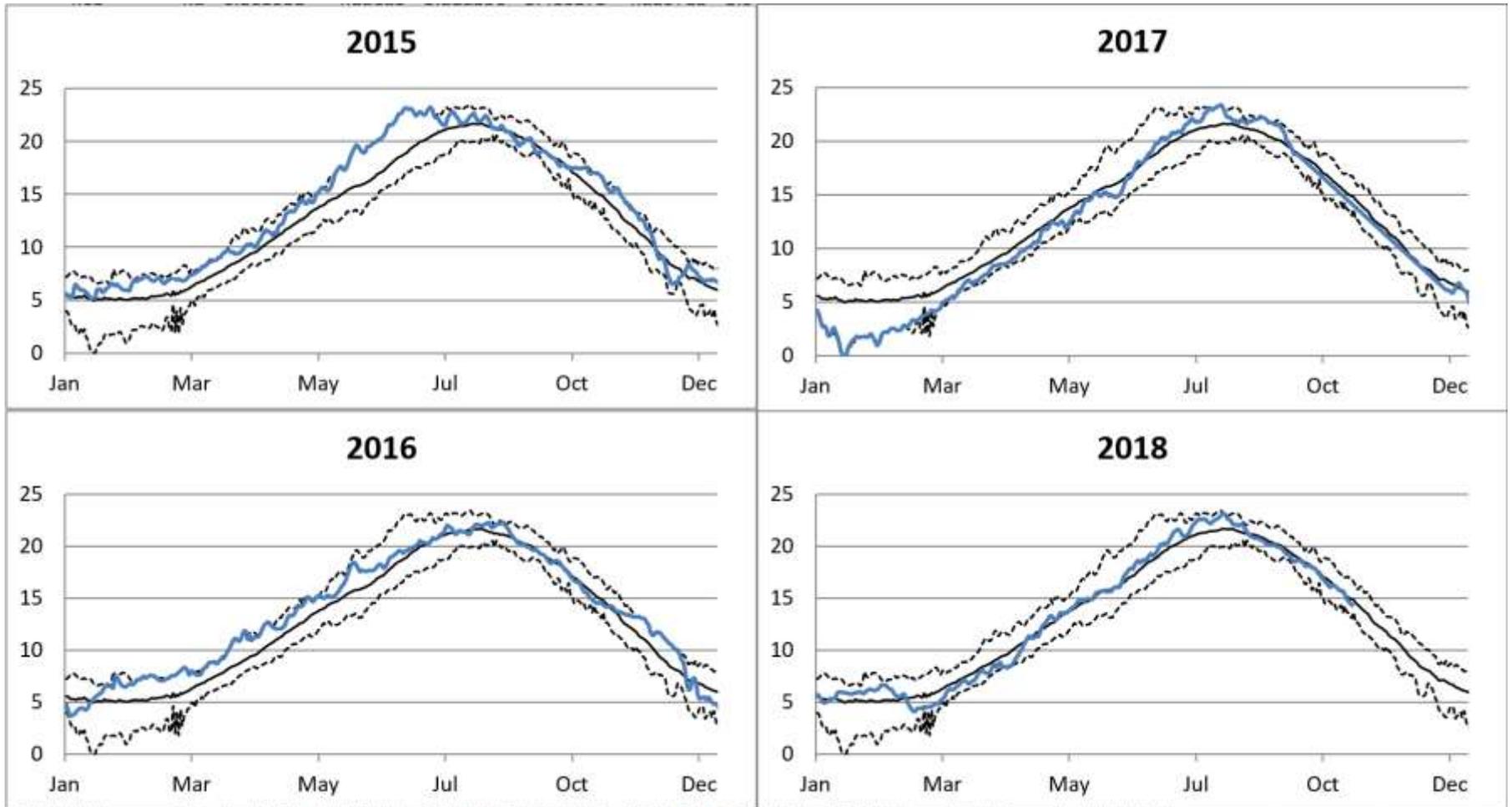


River Discharge at BAT

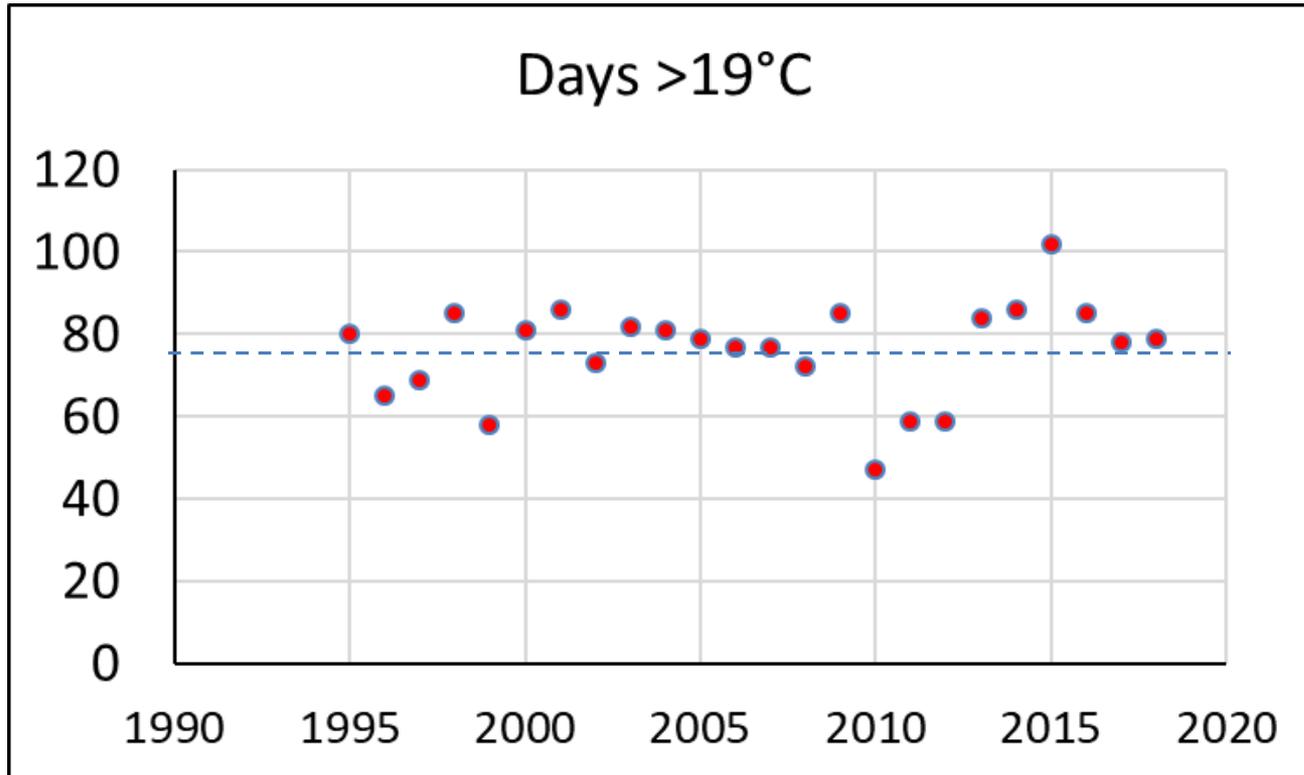
Bonneville – Willamette – Other tributaries



Mainstem Temperature

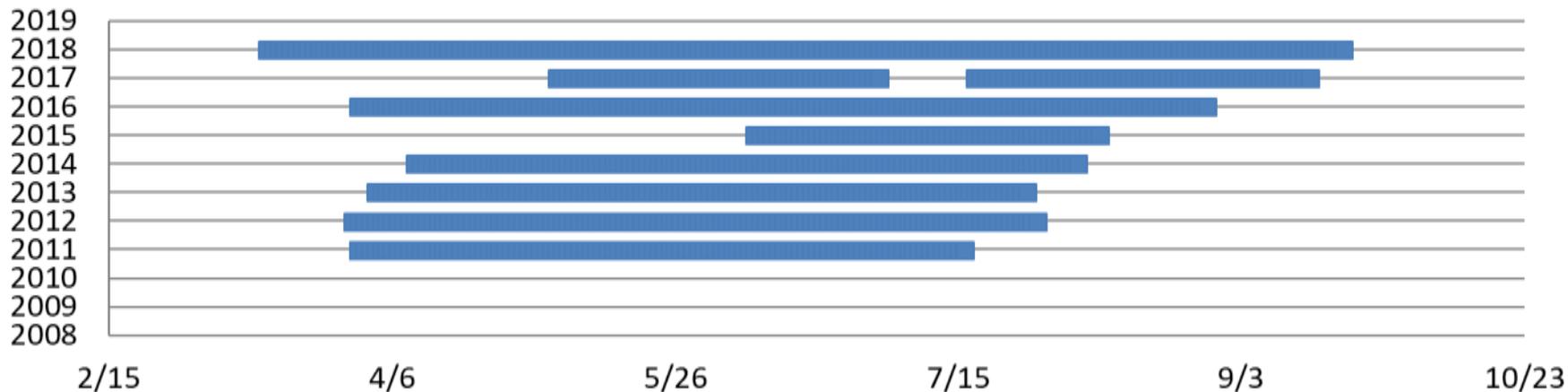


Average # days where river temperature is $> 19^{\circ}\text{C}$

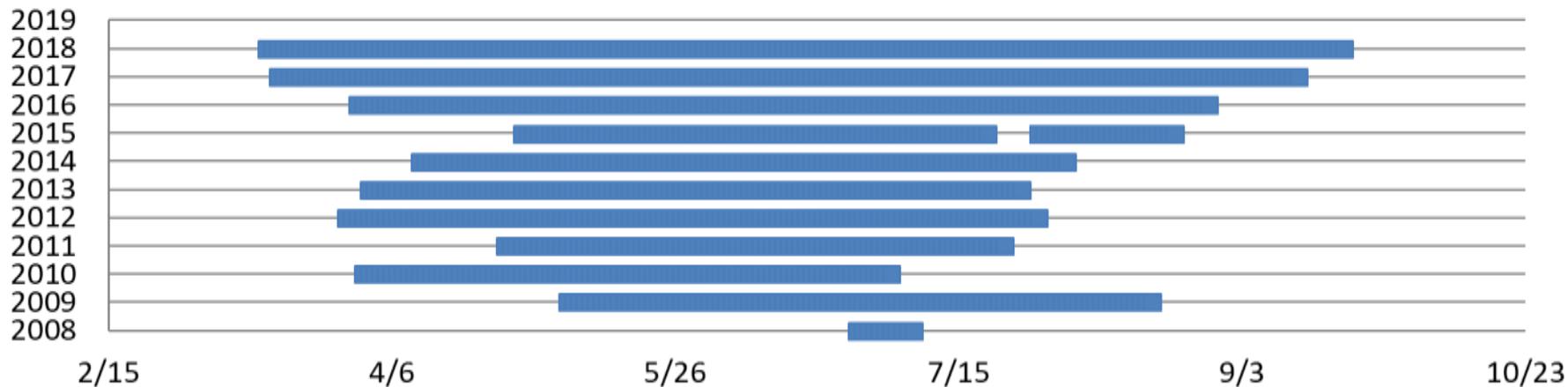


EMP YSI Sonde Deployments

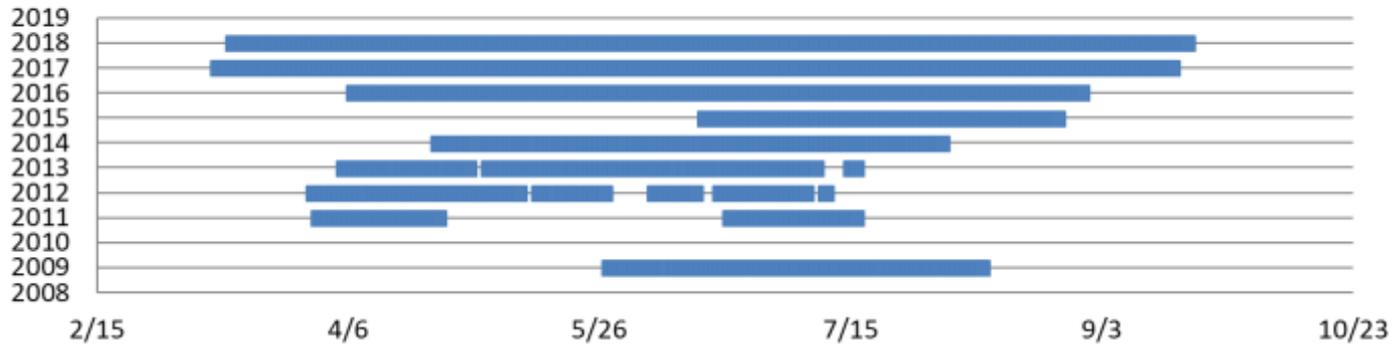
Franz Sonde Deployment Periods



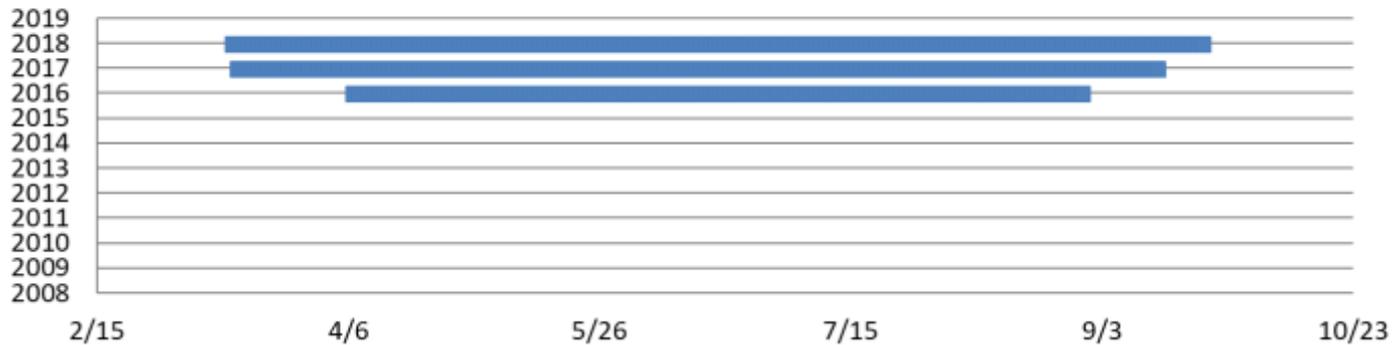
Campbell Sonde Deployment Periods



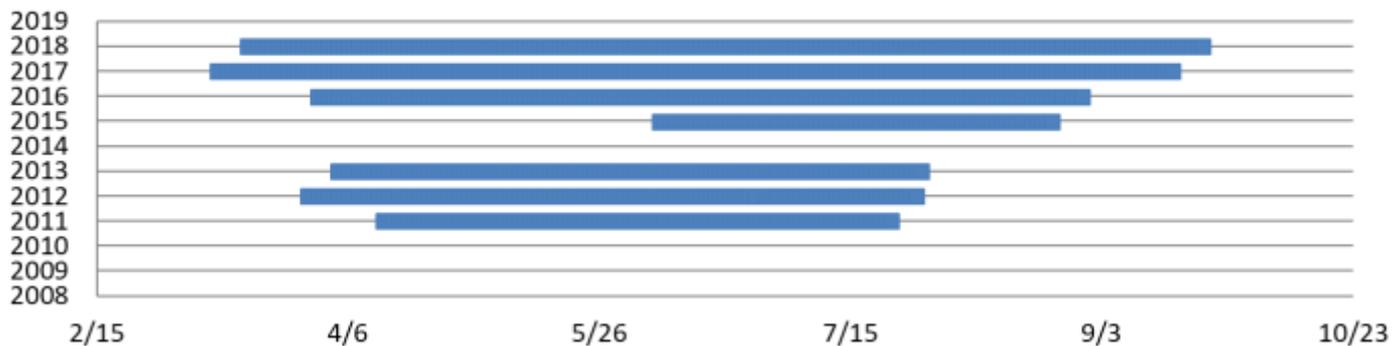
Whites Sonde Deployment Periods



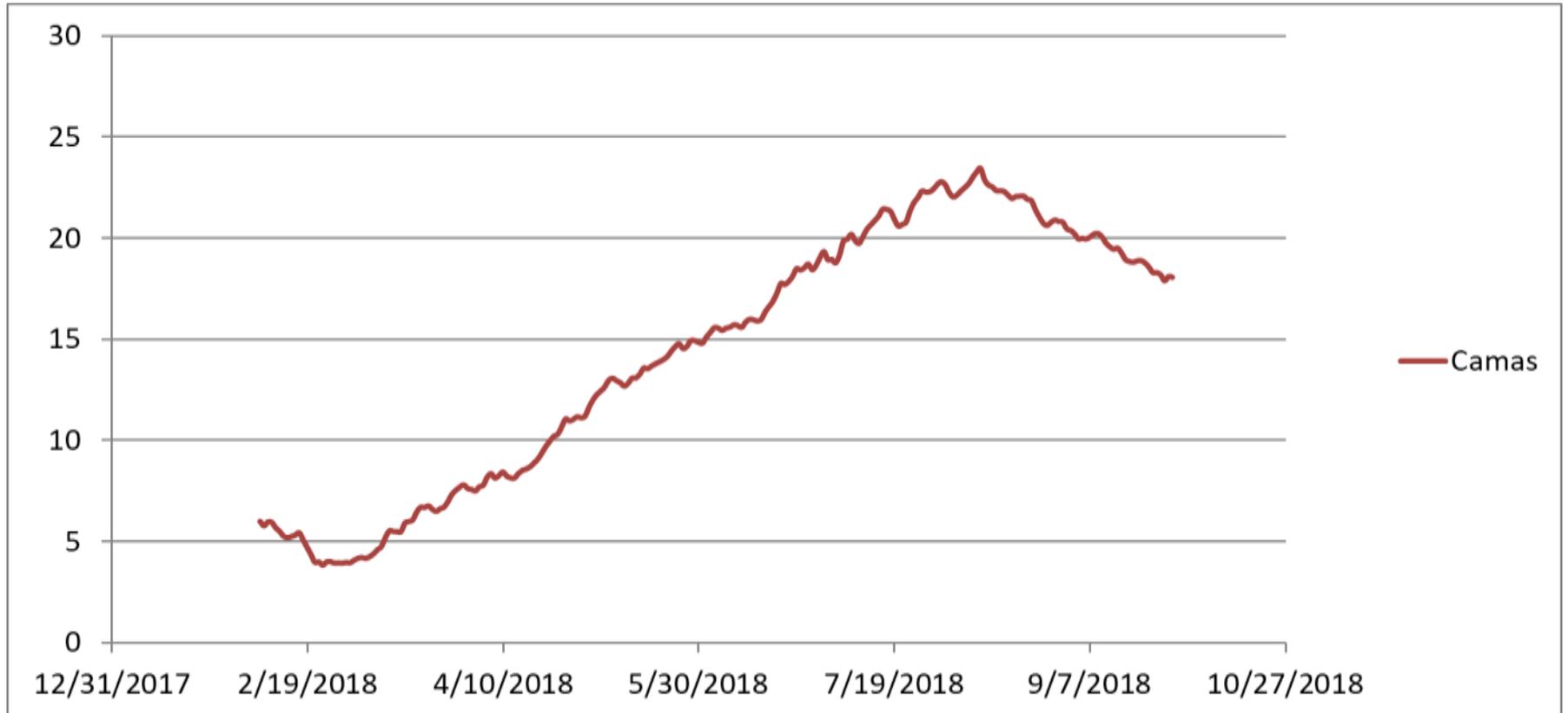
Welch Sonde Deployment Periods



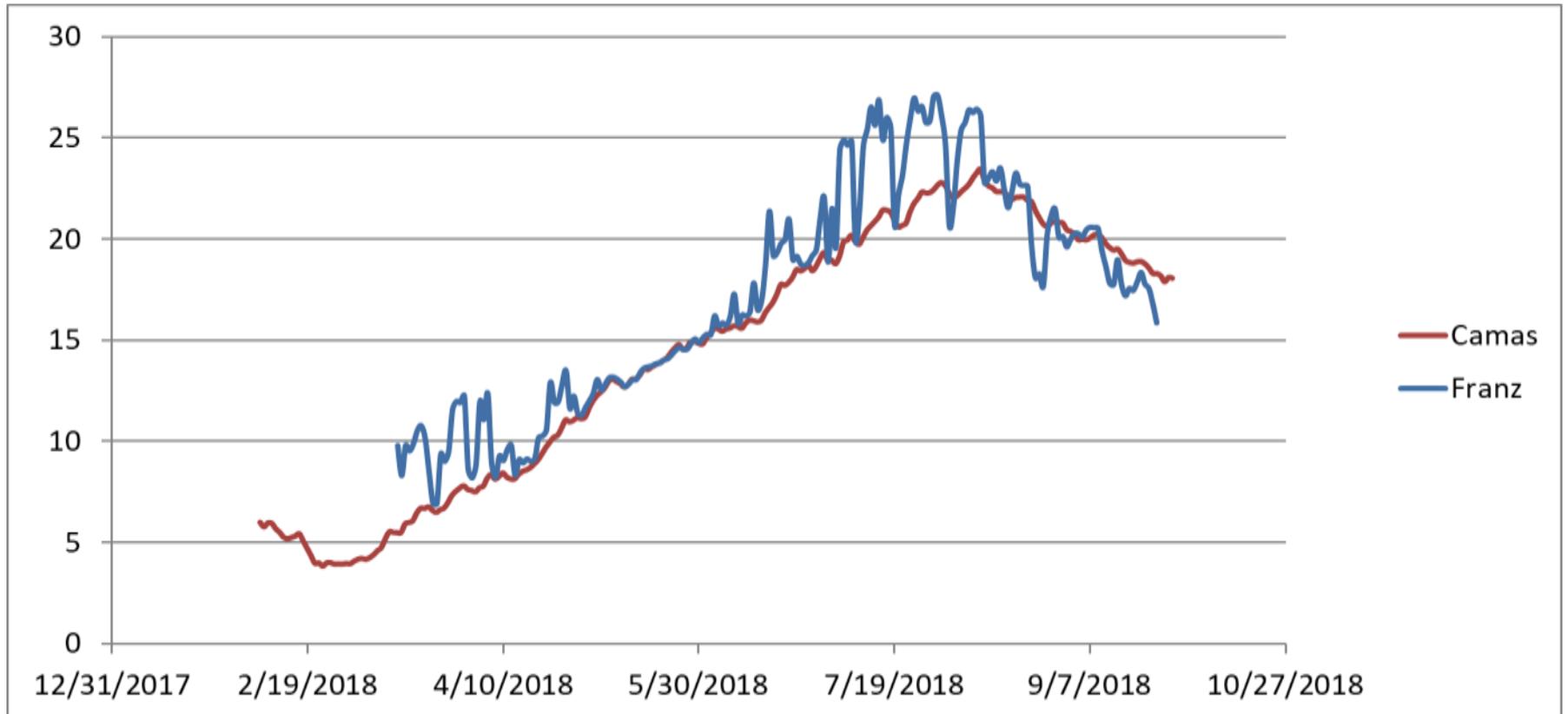
Ilwaco Sonde Deployment Periods



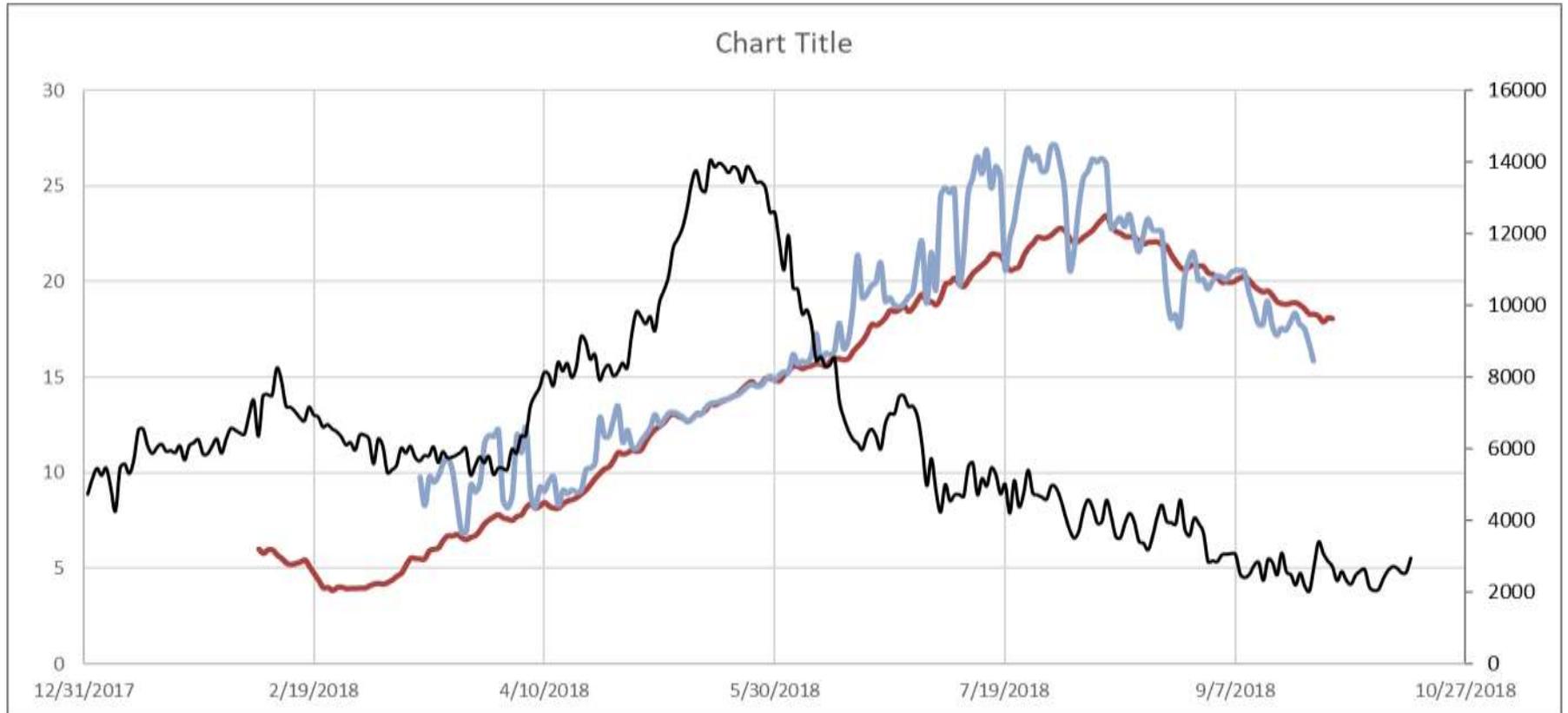
Temperature of EMP sites compared to Mainstem



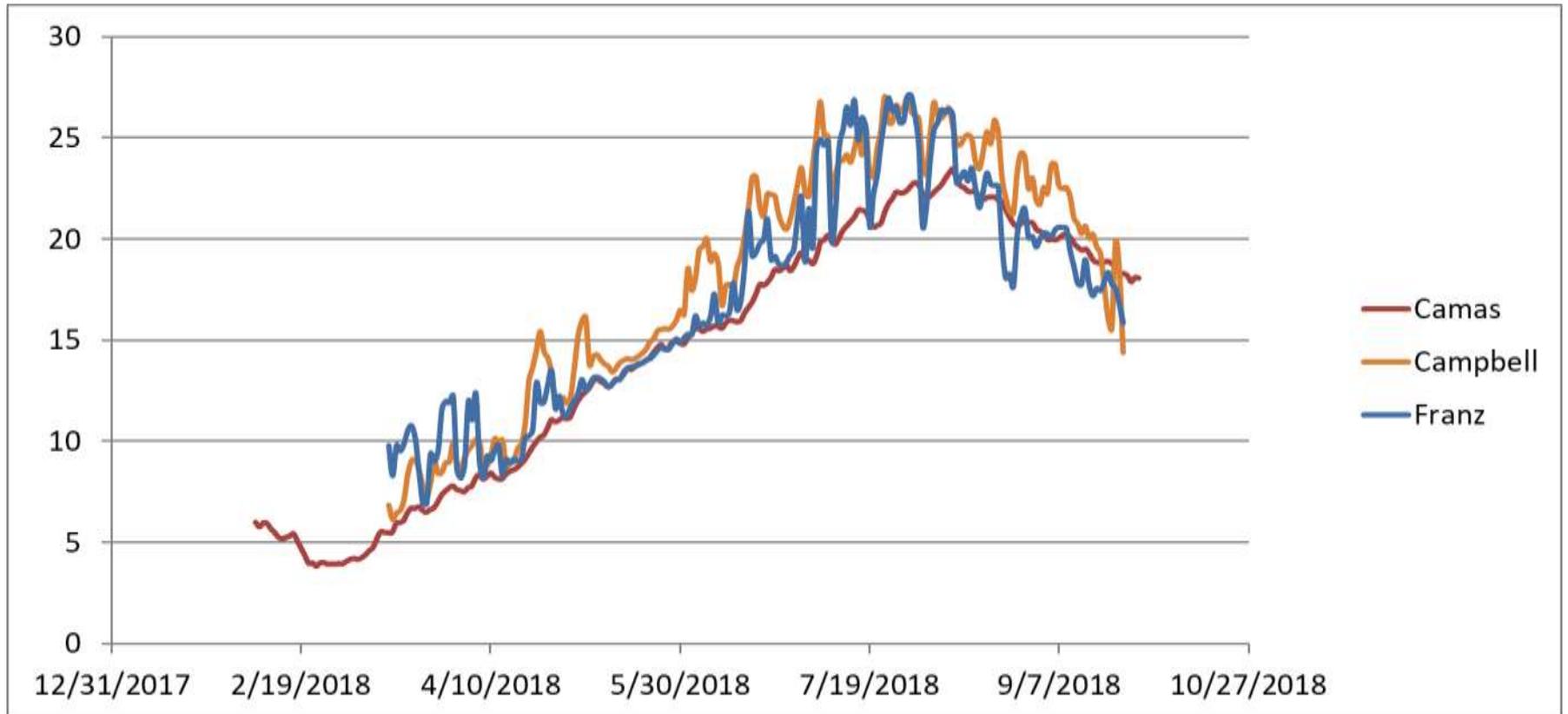
Temperature of EMP sites compared to Mainstem



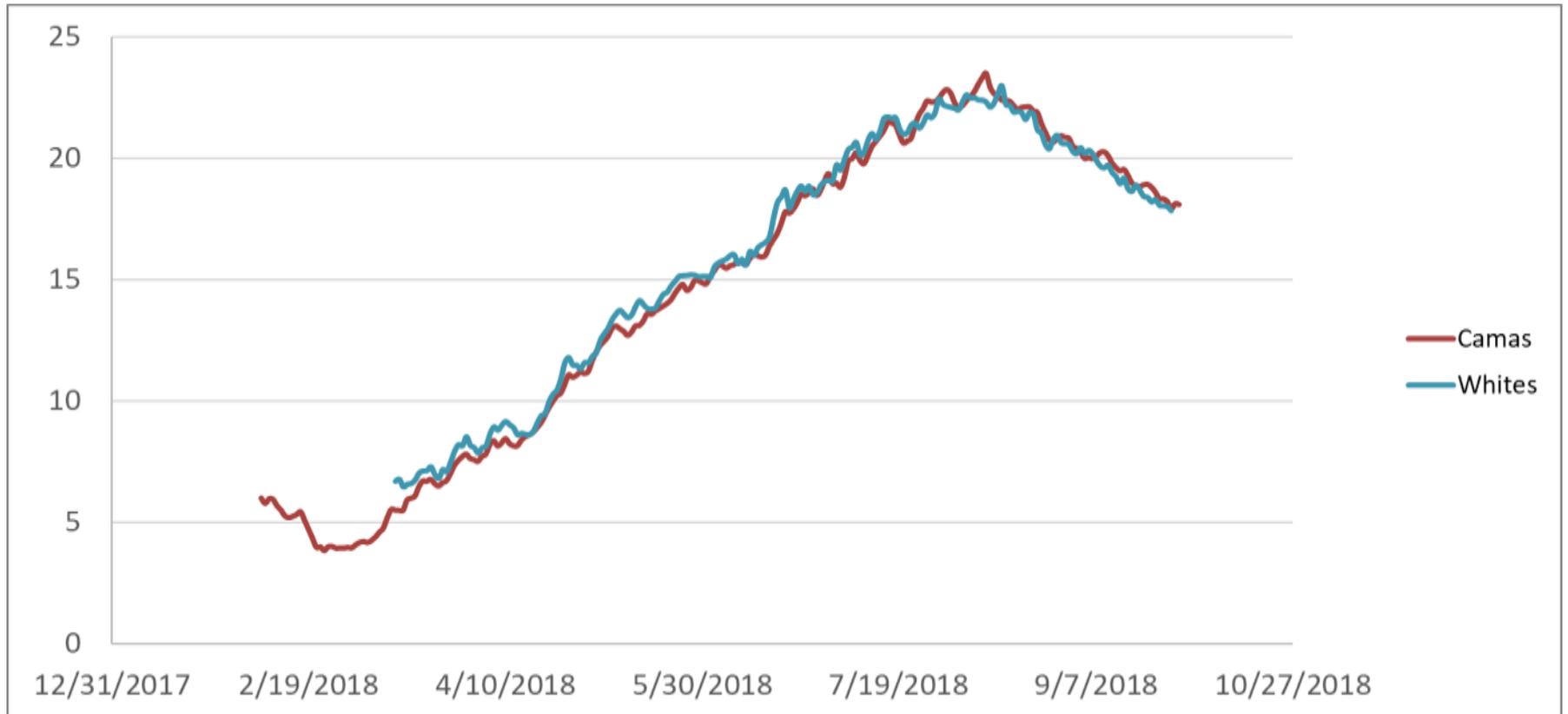
Temperature of EMP sites compared to Mainstem



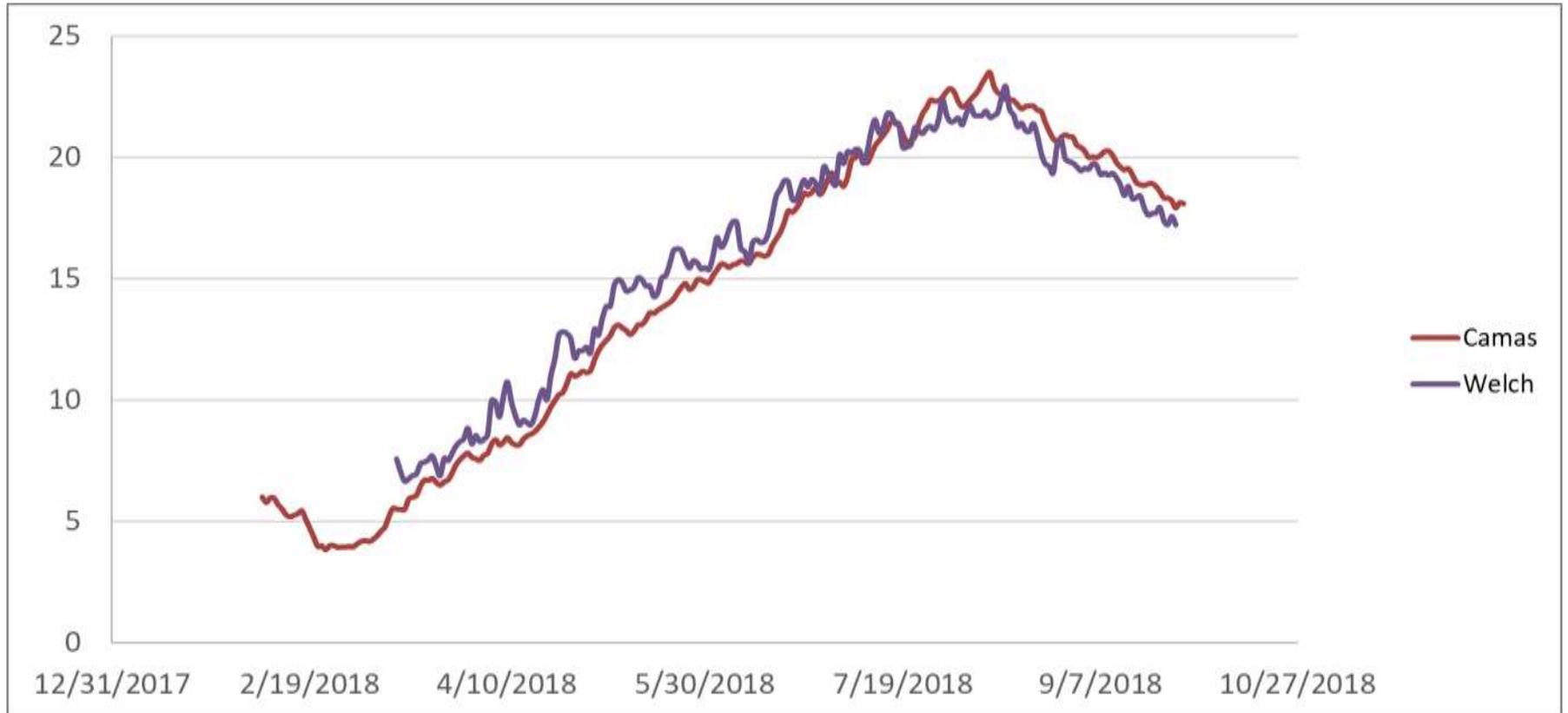
Temperature of EMP sites compared to Mainstem



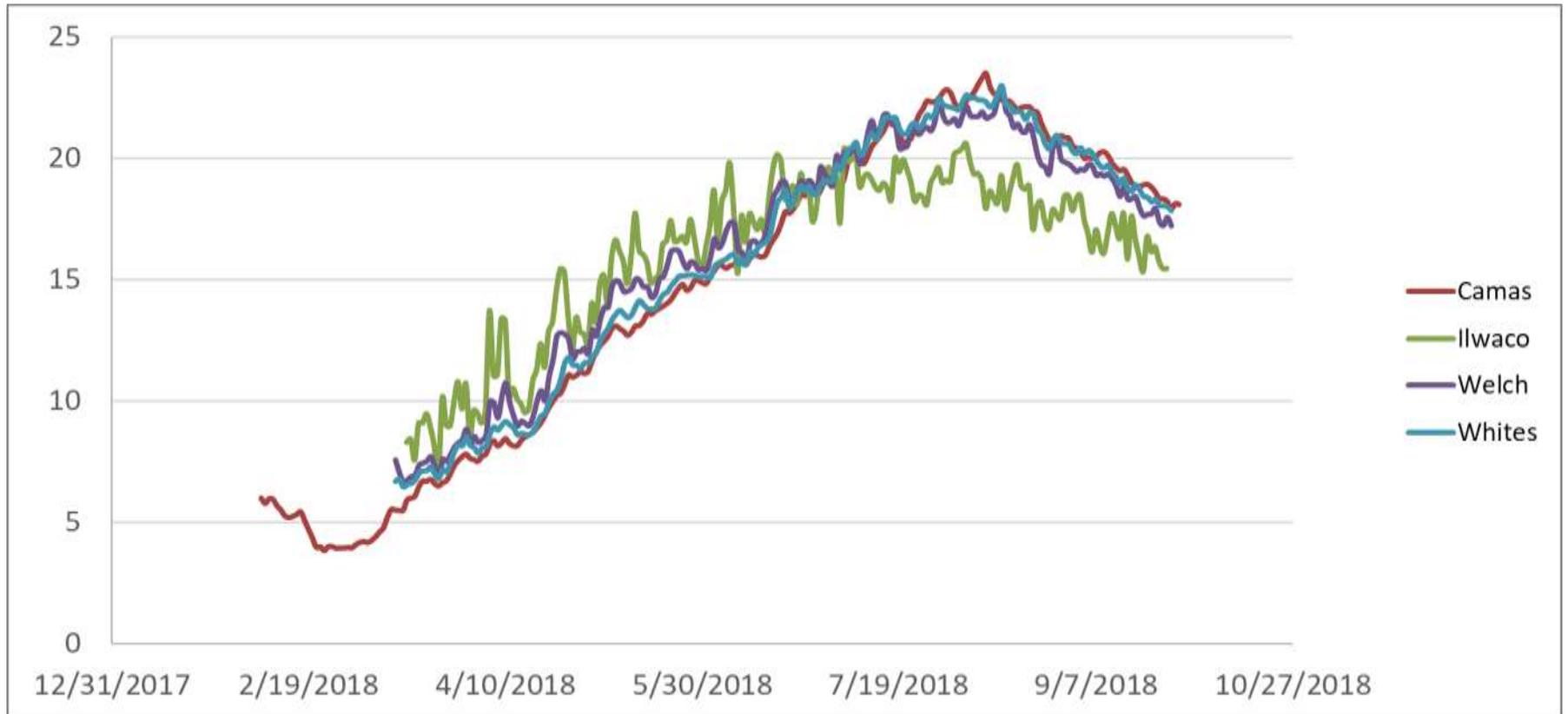
Temperature of EMP sites compared to Mainstem



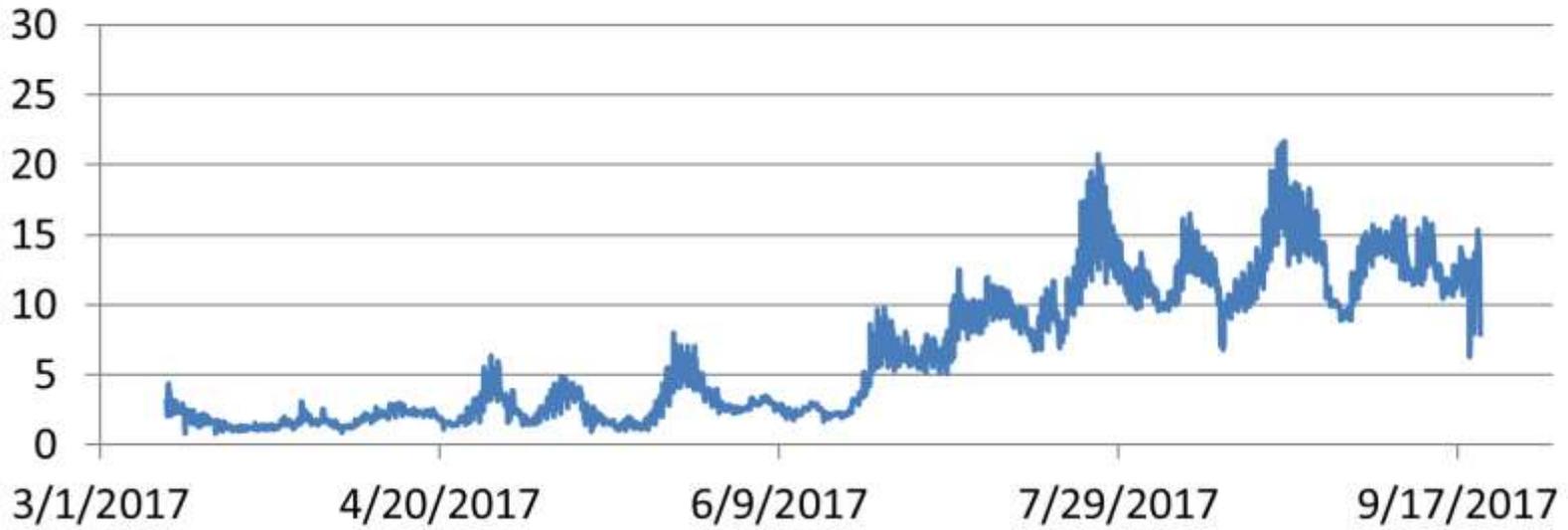
Temperature of EMP sites compared to Mainstem



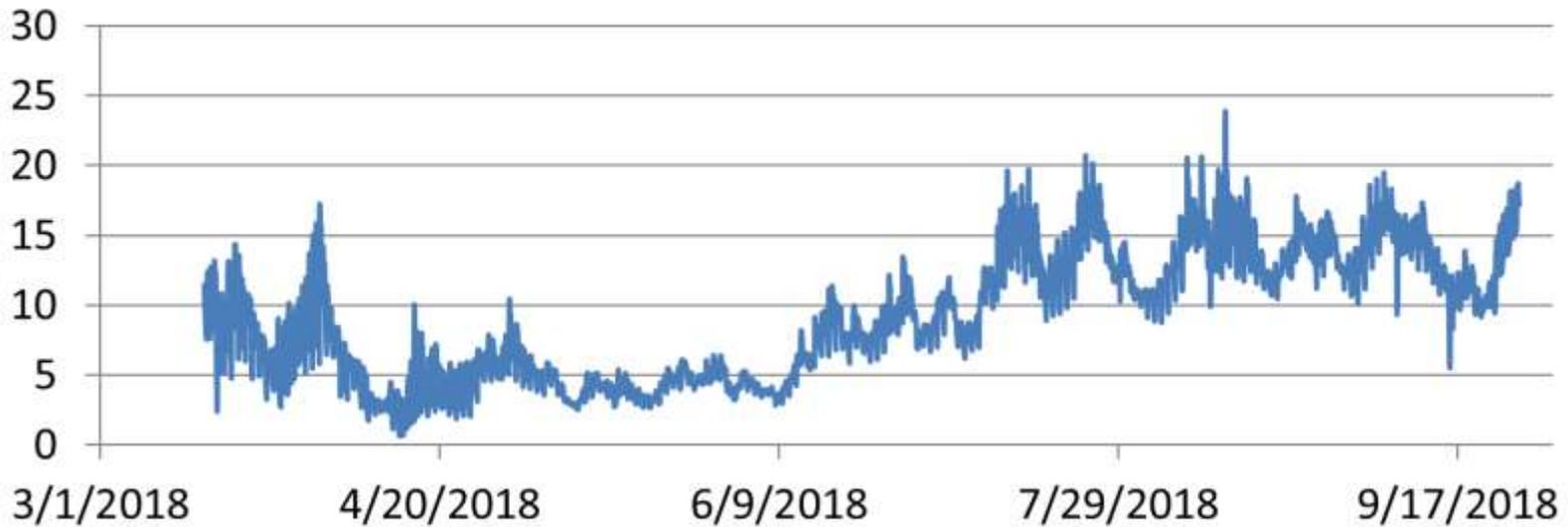
Temperature of EMP sites compared to Mainstem



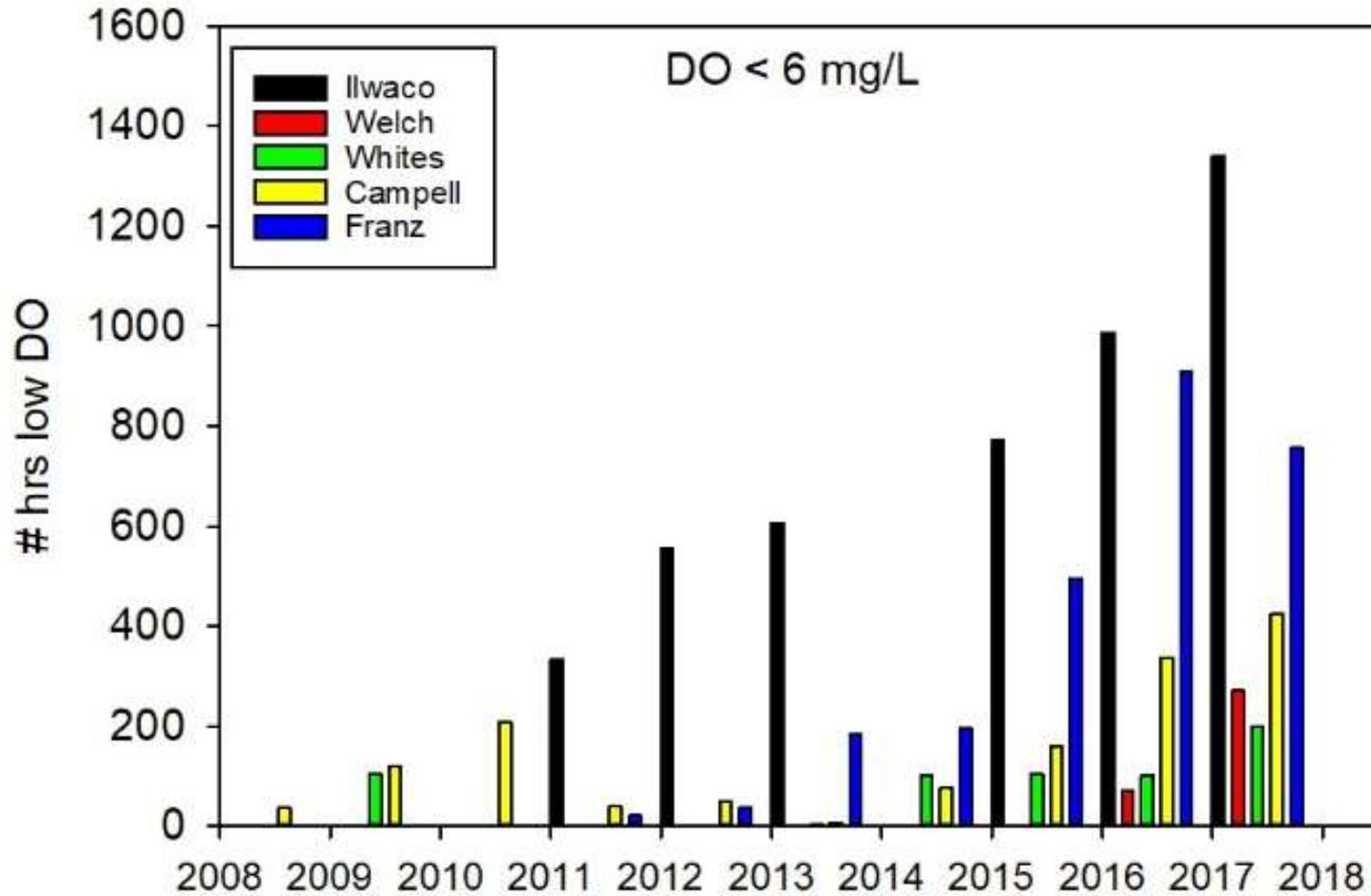
Ilwaco - Salinity



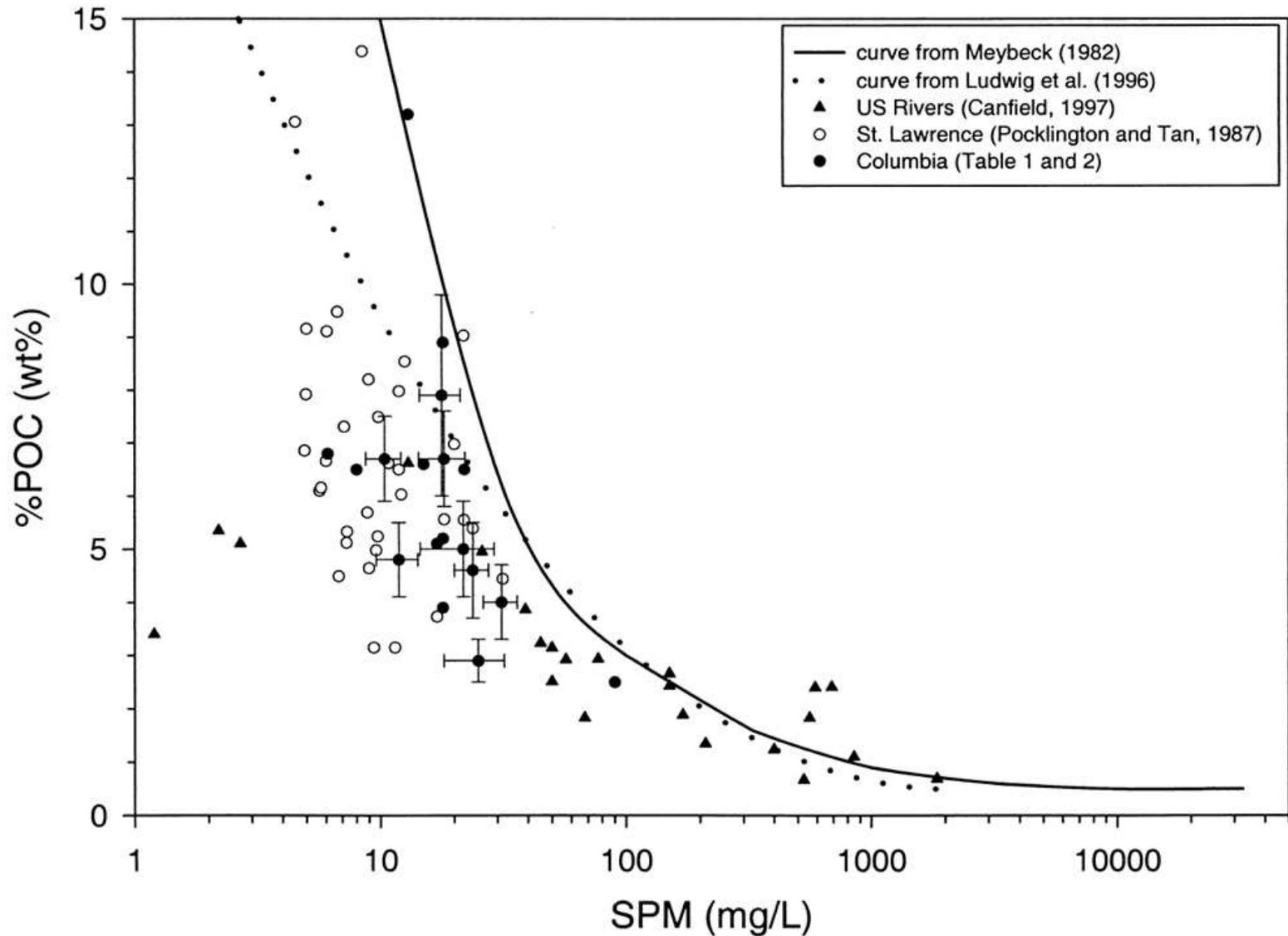
Ilwaco - Salinity



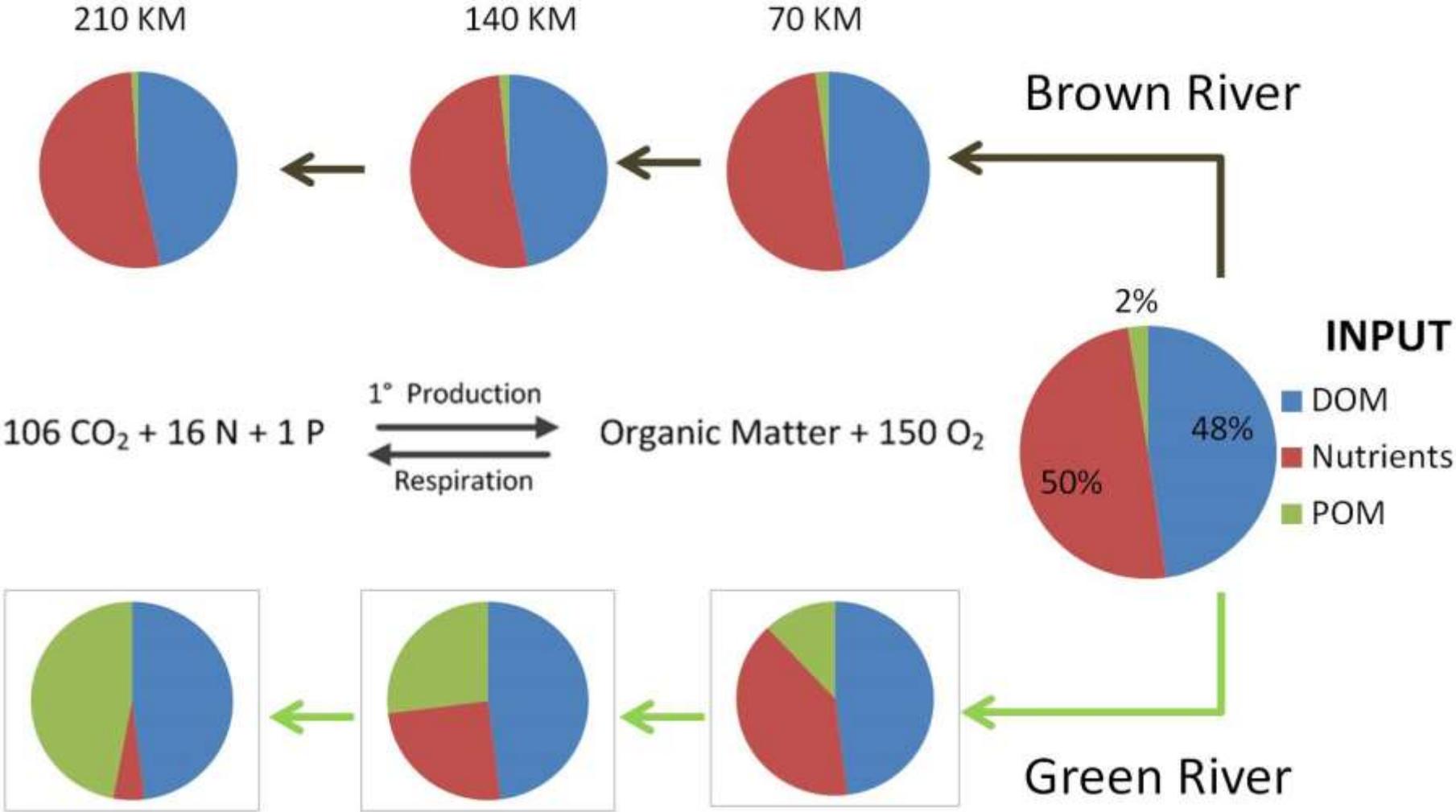
Dissolved Oxygen - potential for hypoxia



“Greening” of the River



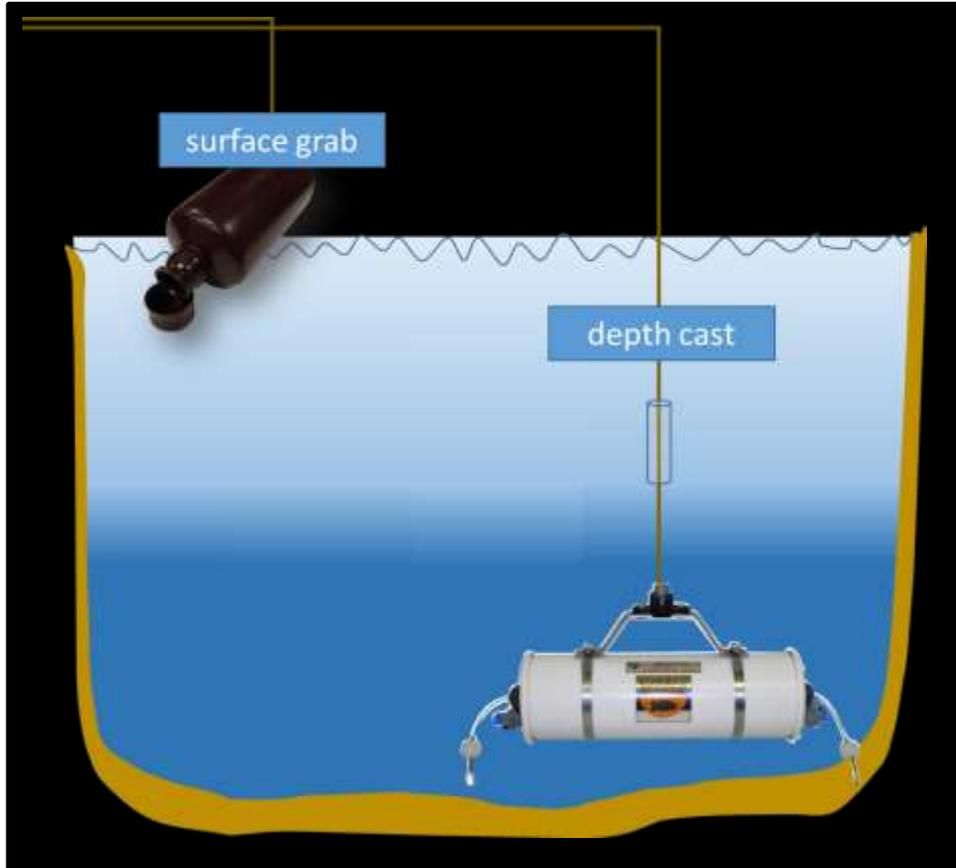
Nutrient Transformation in Two Different Rivers



Water column light and stratification measurements



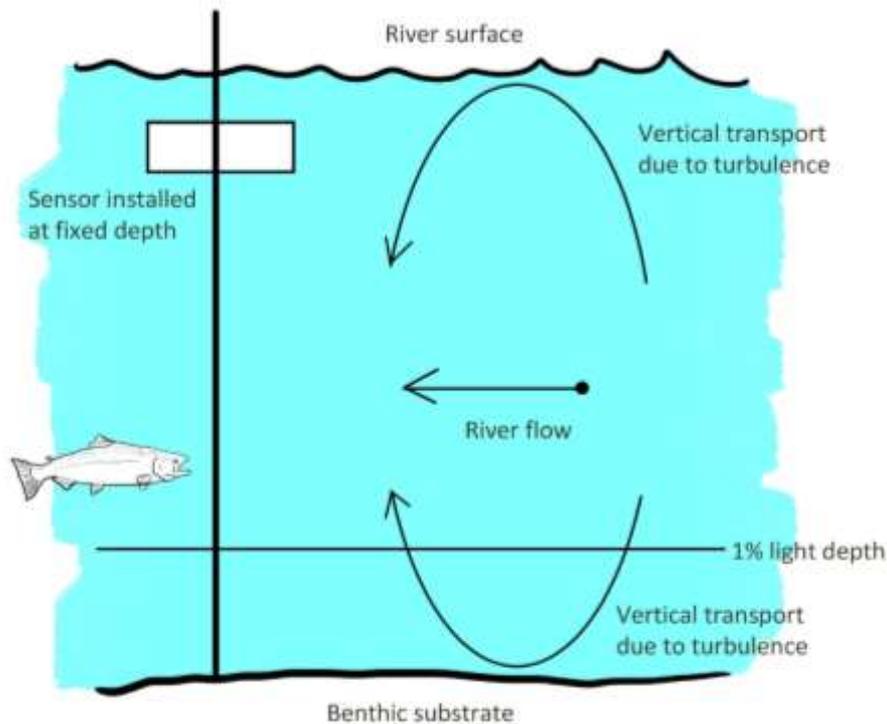
Field work: weekly sampling for one year



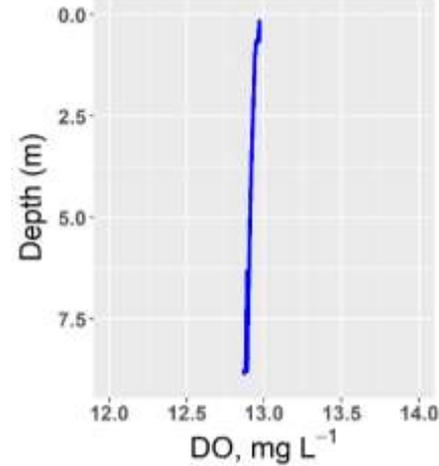
Credit: Stuart Dyer



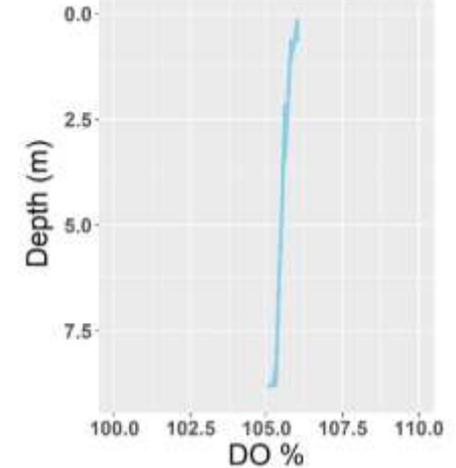
The Water Column is Homogeneously Mixed in Both Rivers: Depth Profiles



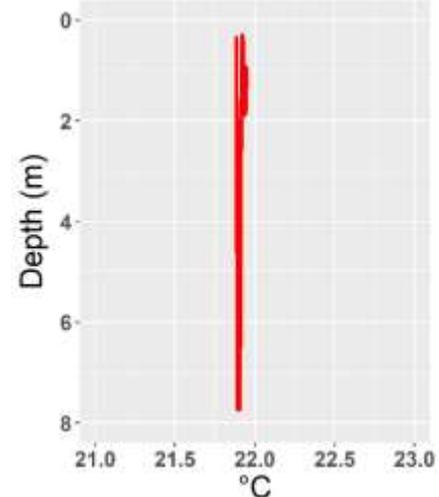
Dissolved oxygen



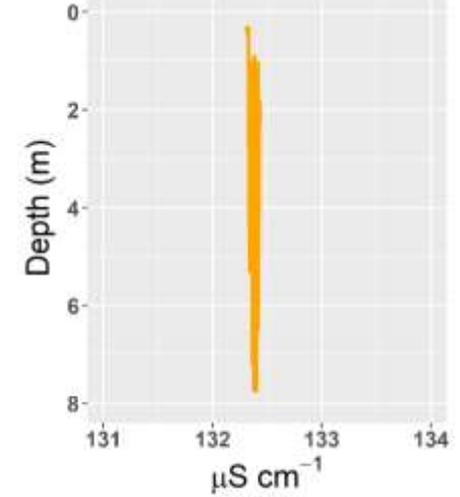
Oxygen saturation



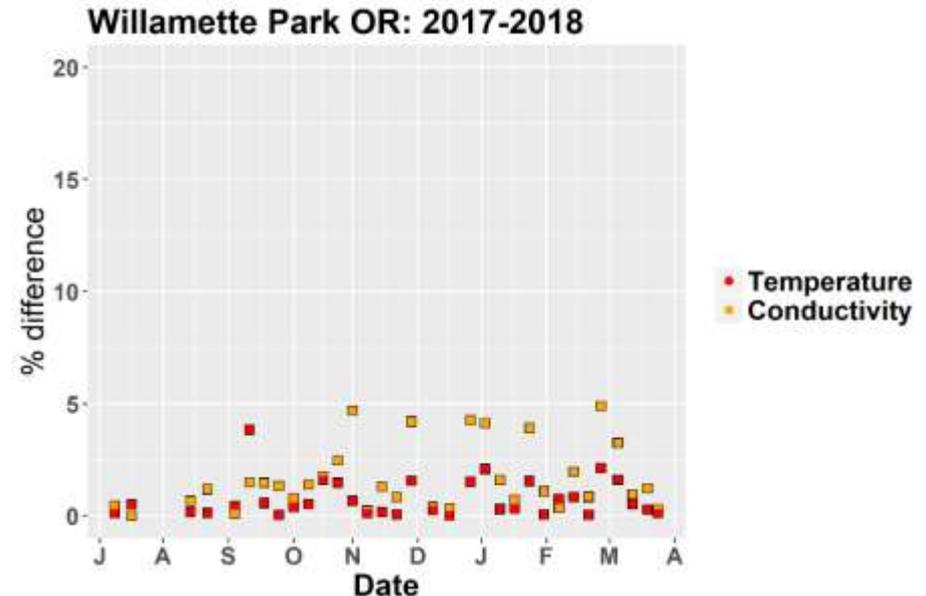
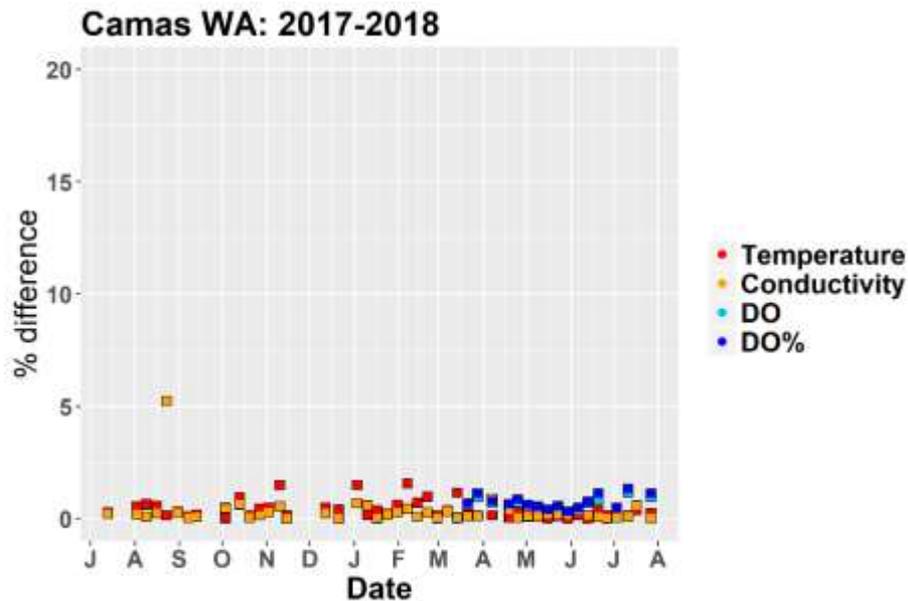
Temperature



Conductivity

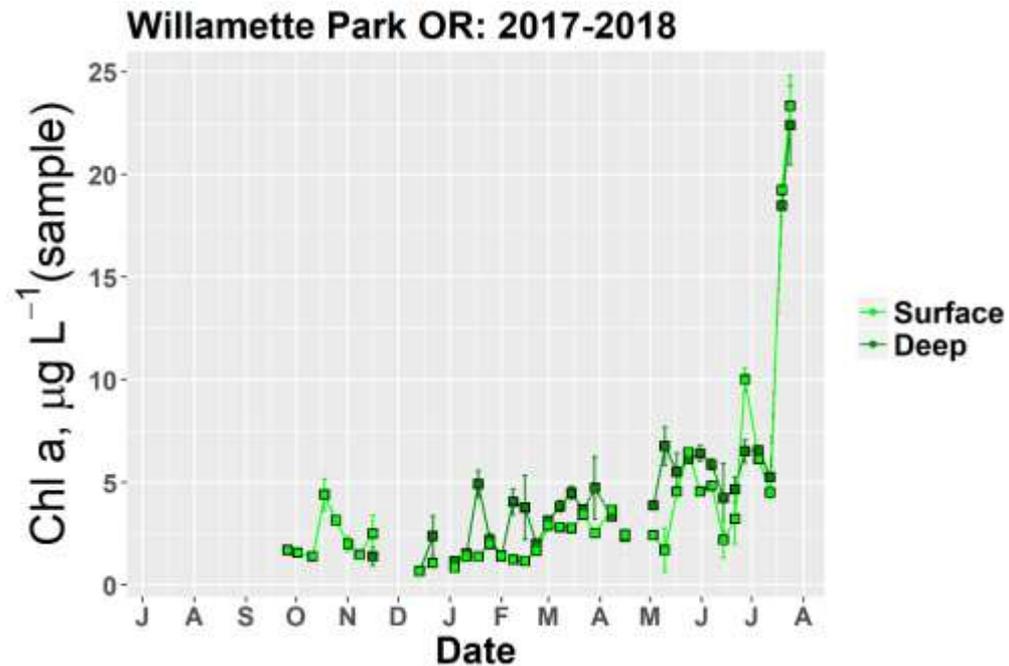
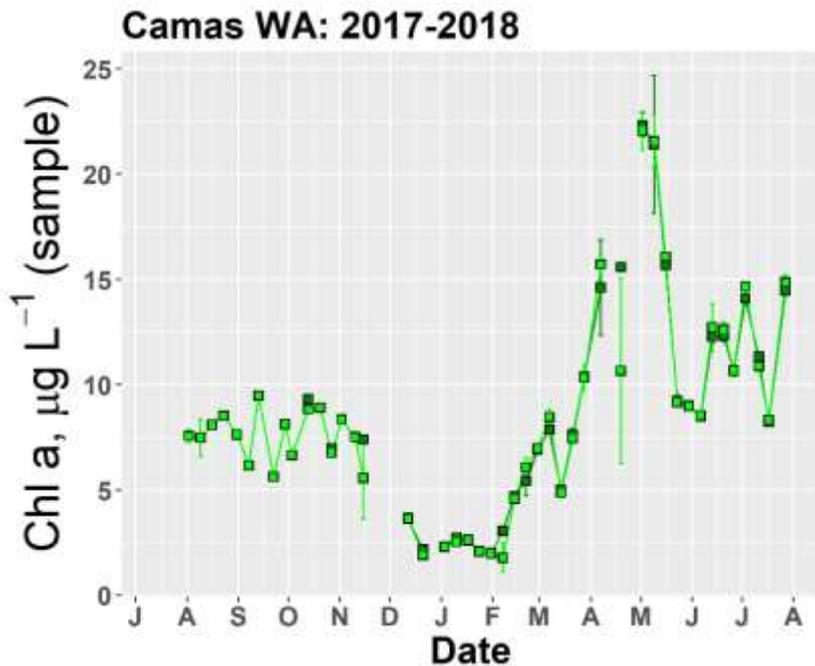


The Water Column is Homogeneously Mixed in Both Rivers: Depth Profiles



- Both rivers usually less than 2% different between surface and photic zone limit
- Occasional variation of up to 5%
- Willamette more irregular
- Comparison: heavily stratified Ross Island Lagoon had 36% temperature difference, 12% conductivity difference

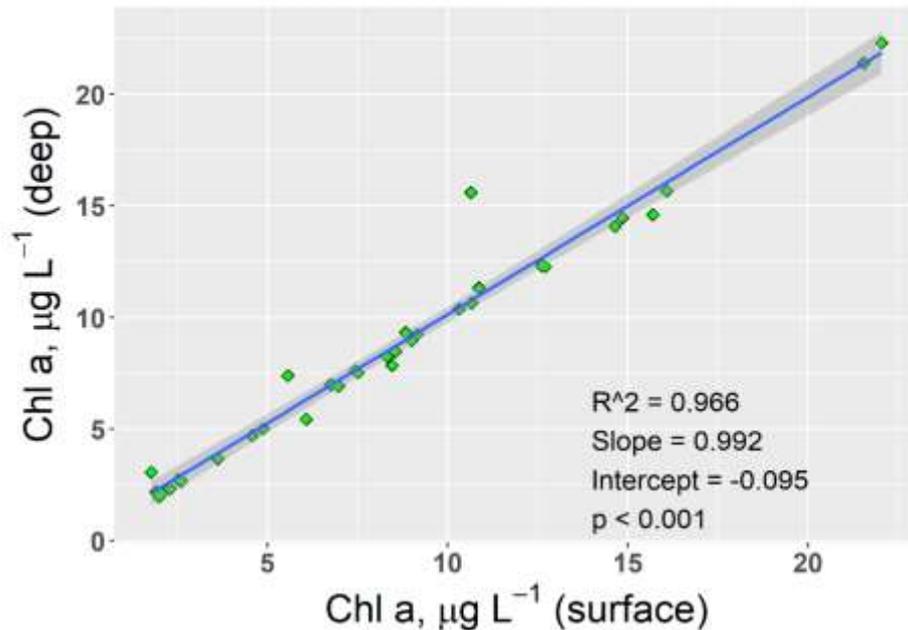
The Water Column *is* Homogeneously Mixed in Both Rivers: Chlorophyll *a*



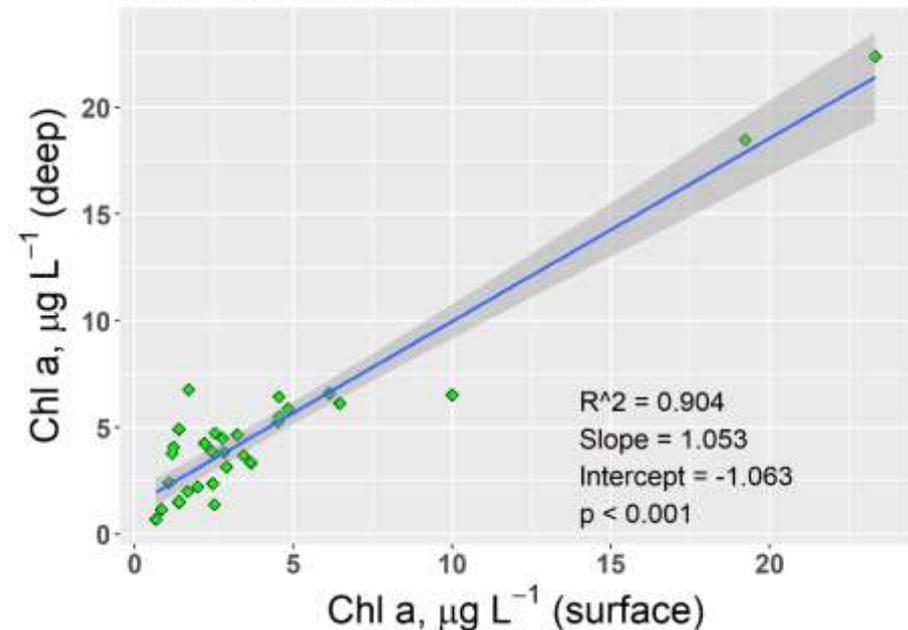
Chlorophyll patterns: early summer phyto bloom in Columbia, late bloom in Willamette

The Water Column *is* Homogeneously Mixed in Both Rivers: Chlorophyll *a*

Columbia River, 2017-2018



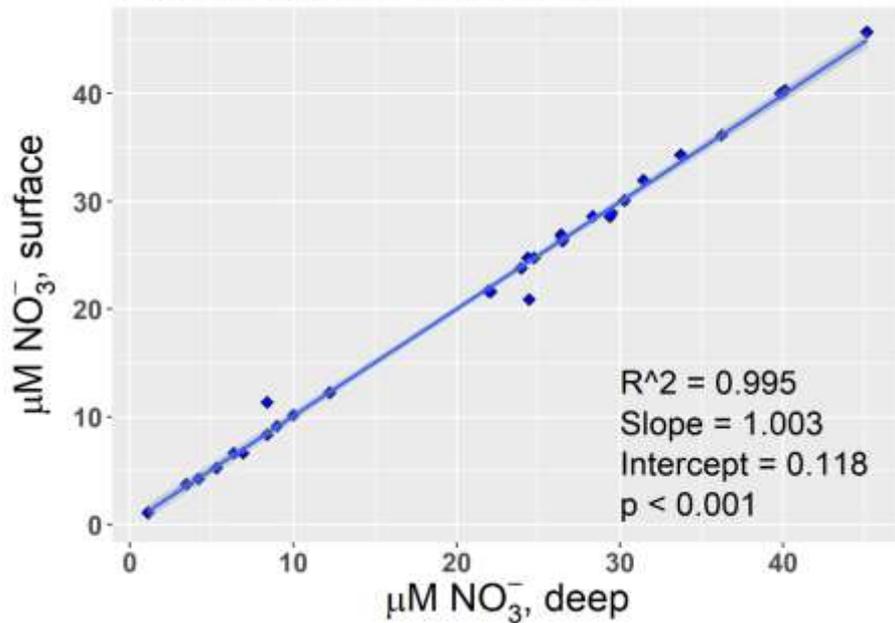
Willamette River, 2017-2018



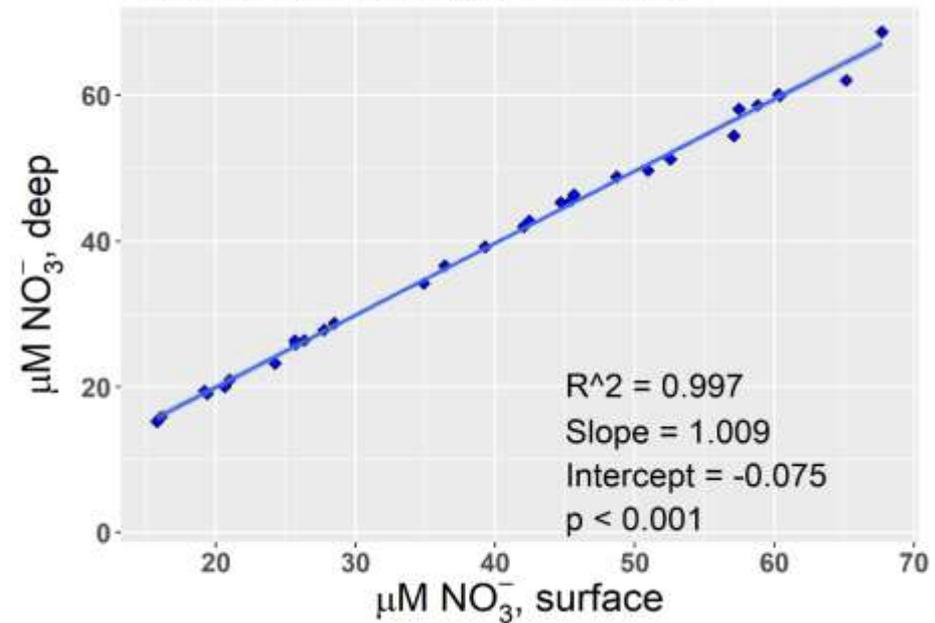
- Chlorophyll concentrations were very close to each other between depths
- Result expected despite differing rates of photosynthesis between depths

The Water Column *is* Homogeneously Mixed in Both Rivers: Nitrate and Ortho-Phosphate

Columbia River, 2017-2018

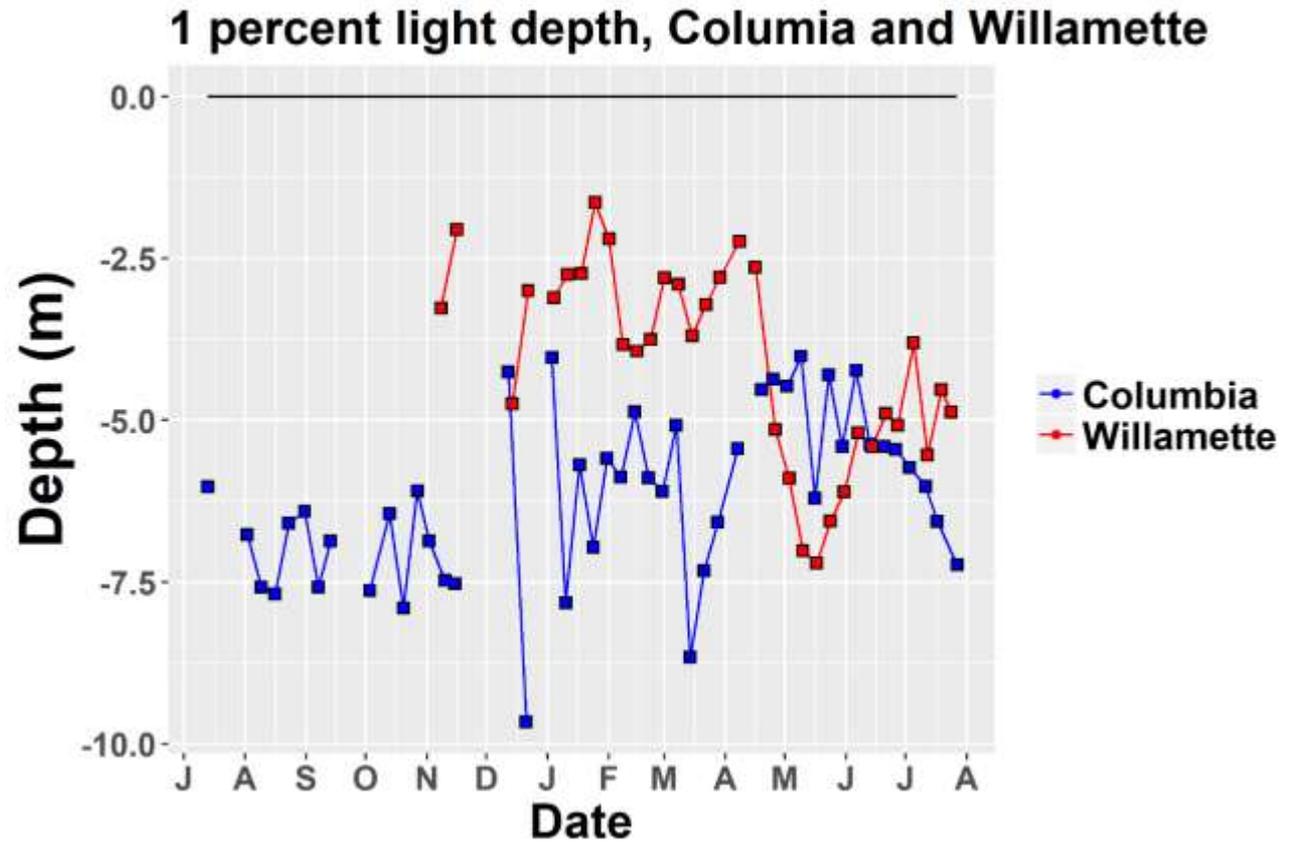
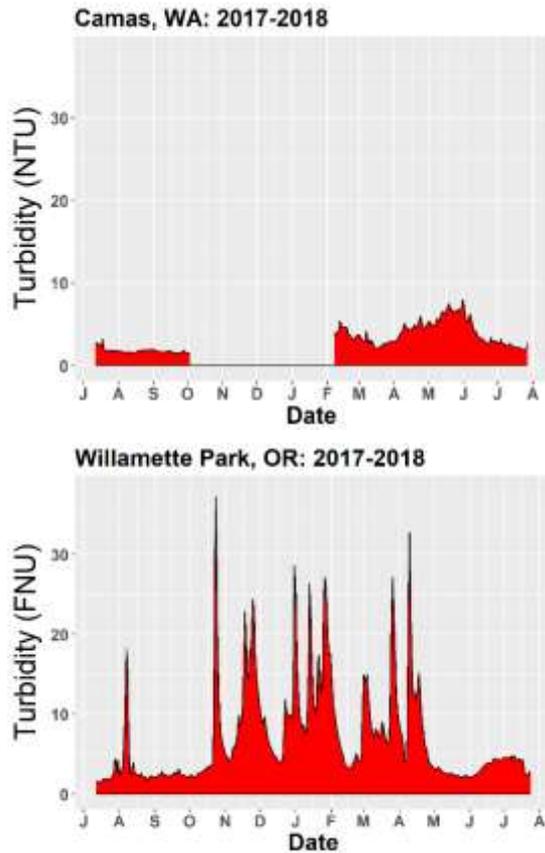


Willamette Park OR, 2017-2018



Nitrate was the same between depths

The Columbia has a deep photic zone most of the year

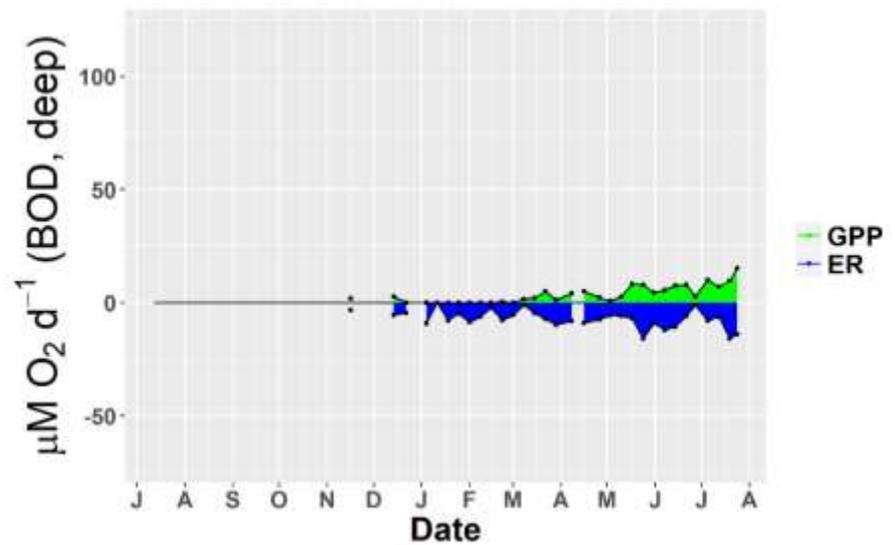
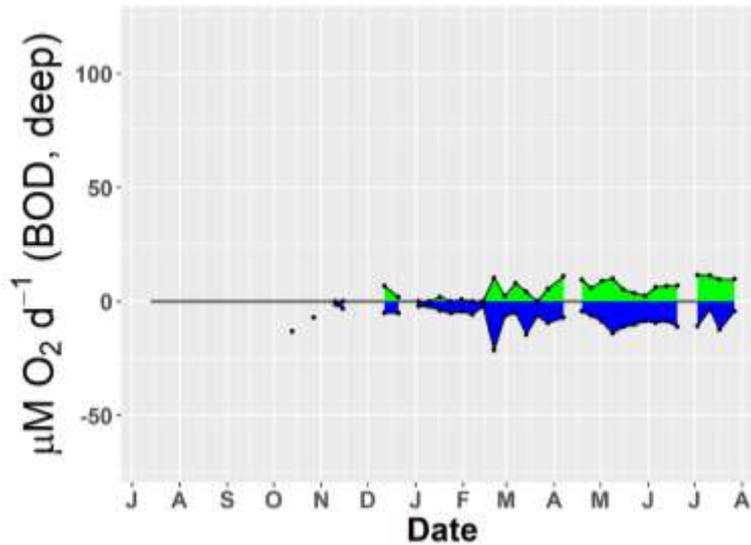
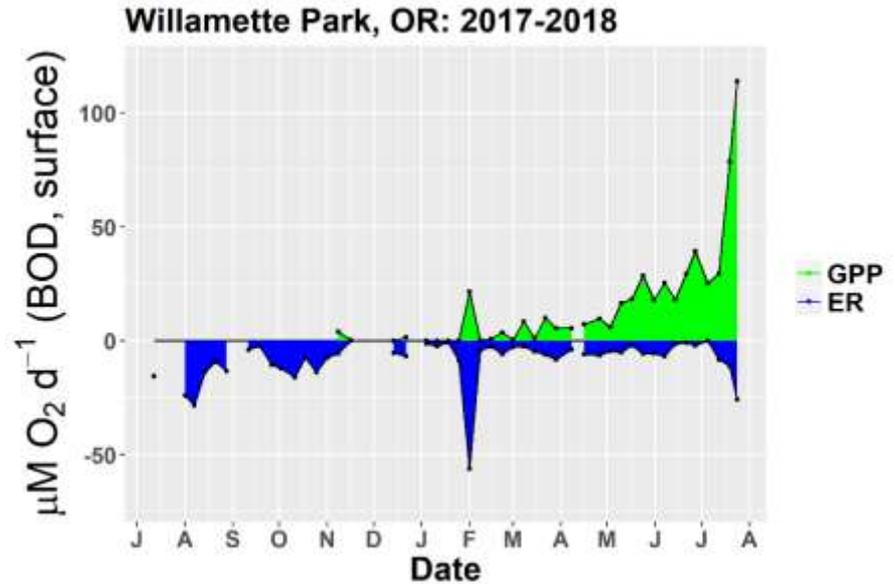
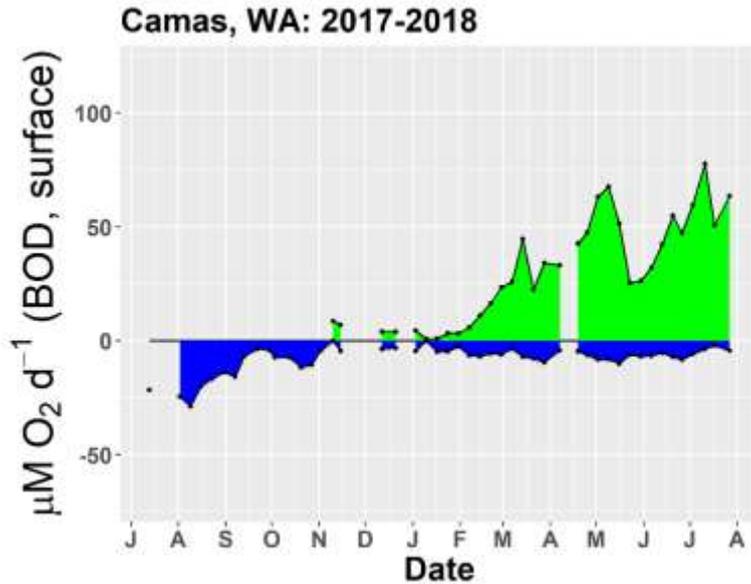


BOD Bottle Incubations Isolate Plankton Production from Different Depths

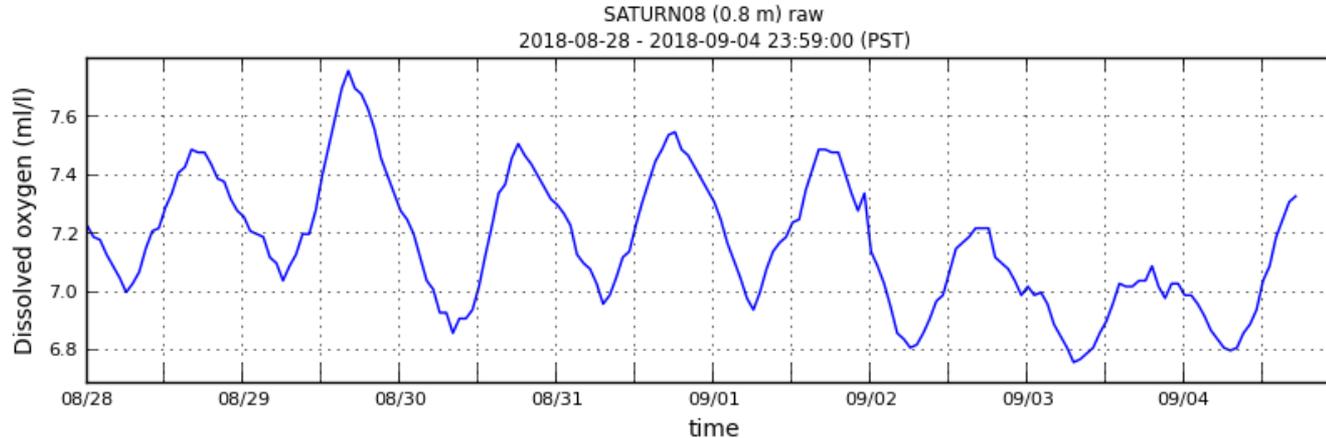
- BOD experiments to measure production and respiration in isolated samples
- Samples divided into two groups, incubated under full spectrum light and in darkness
- Change in dissolved oxygen shows rate of production and respiration



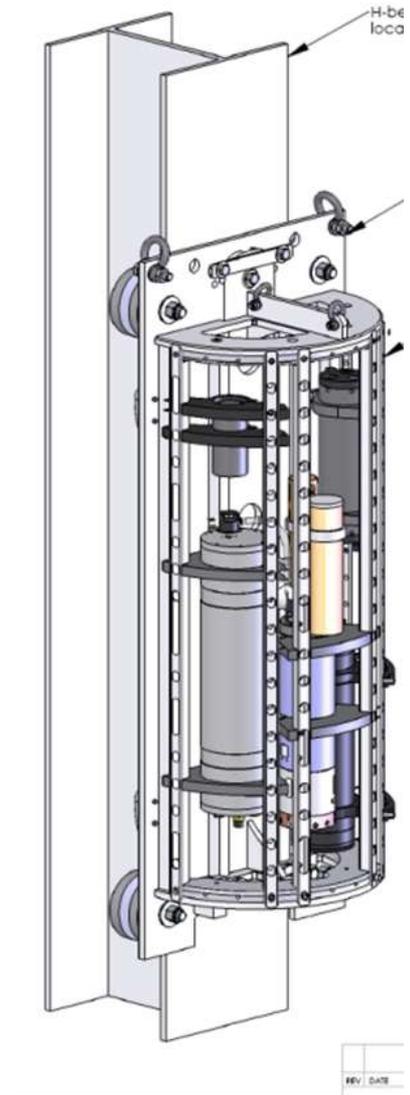
BOD incubations from different depths



NEM Open Water Technique

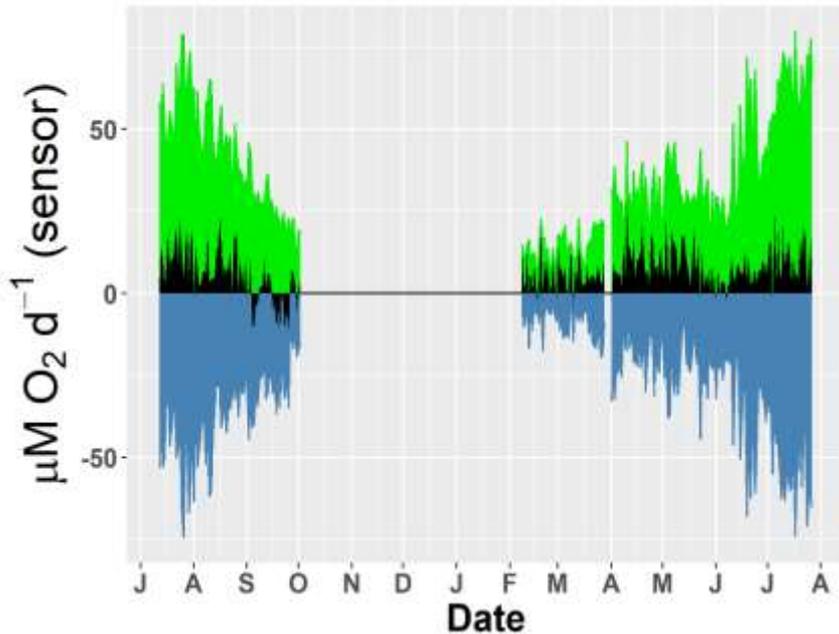


- Use average decrease in dissolved oxygen at night to infer respiration rate
- Increase in oxygen during daytime allows calculation of Net Ecosystem Metabolism and primary production

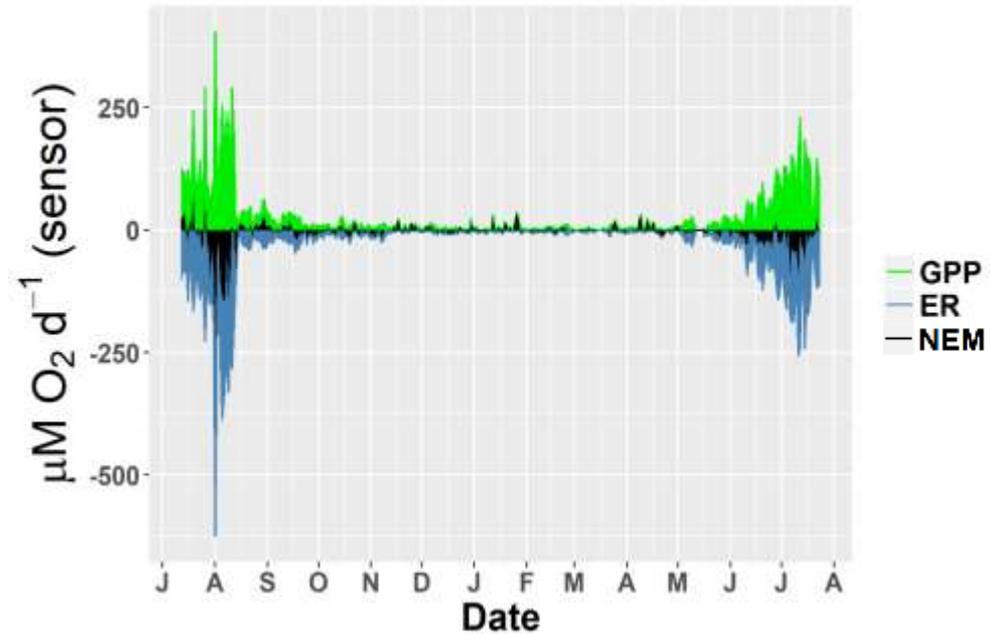


Comparing Sensor and BOD Results

Camas, WA: 2017-2018

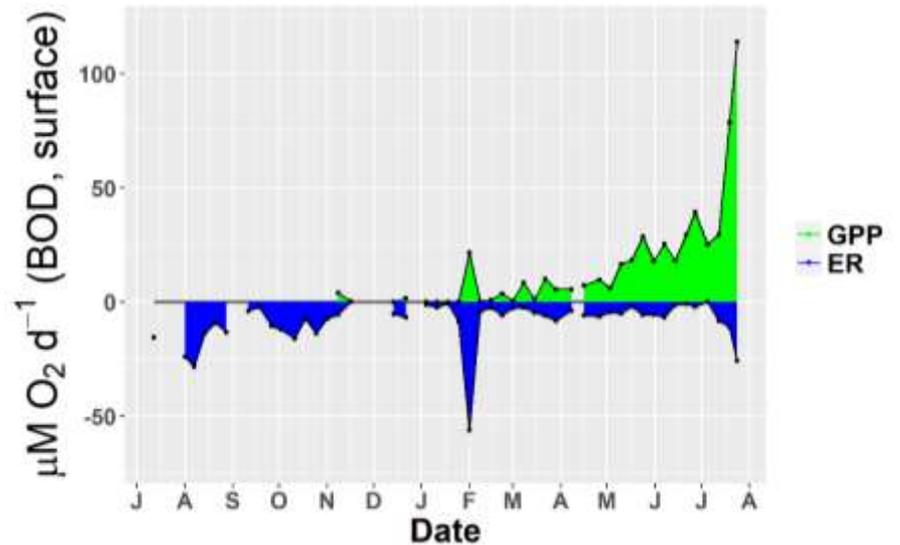
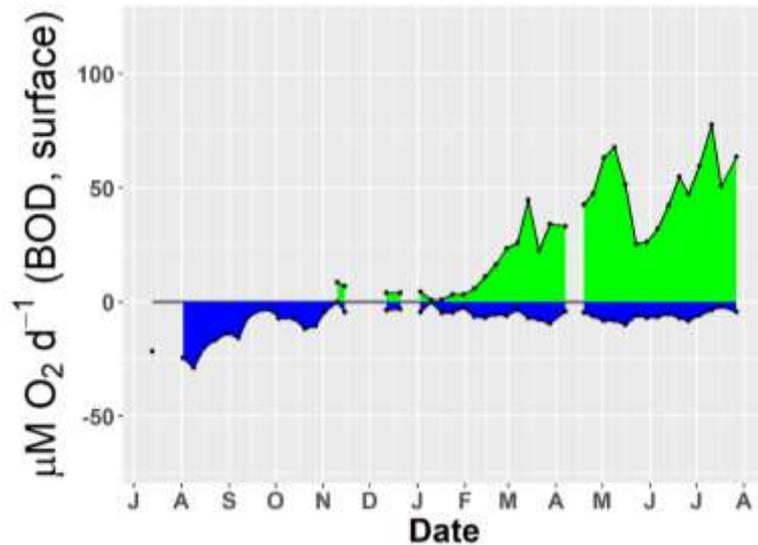
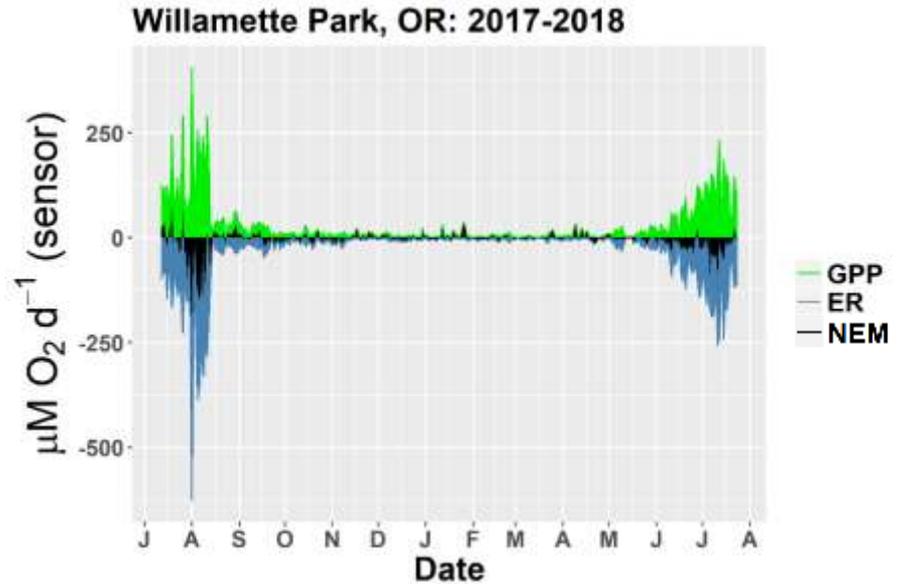
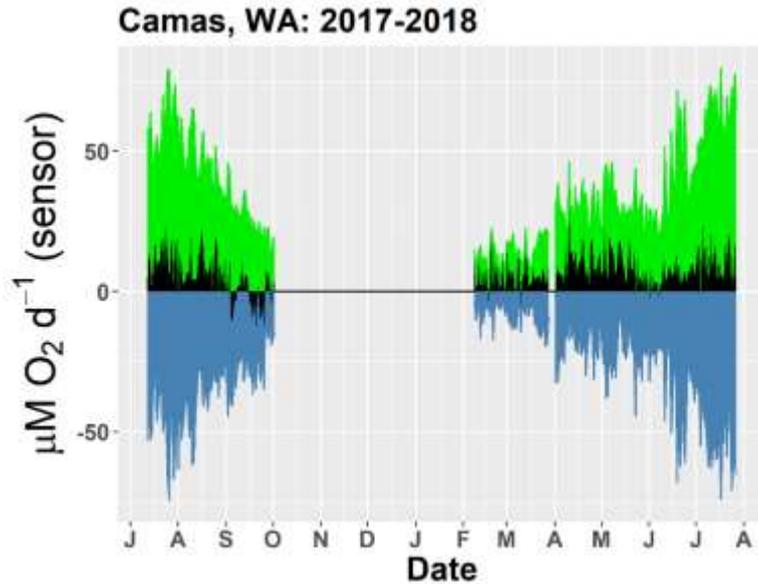


Willamette Park, OR: 2017-2018



- Columbia River is autotrophic most of the year
- Willamette slightly autotrophic, strongly heterotrophic in summer

Comparing Sensor and BOD Results



Trophic State

Columbia River:

Gross: ~631

Net: + ~233

Willamette River:

Gross: 566

Net: - 236

