

Anomalous hydrologic and biogeochemical conditions in the Columbia River Estuary during 2014-2015

Joe Needoba, Tawnya Peterson, Charles Seaton,
Sarah F. Riseman, and António M. Baptista



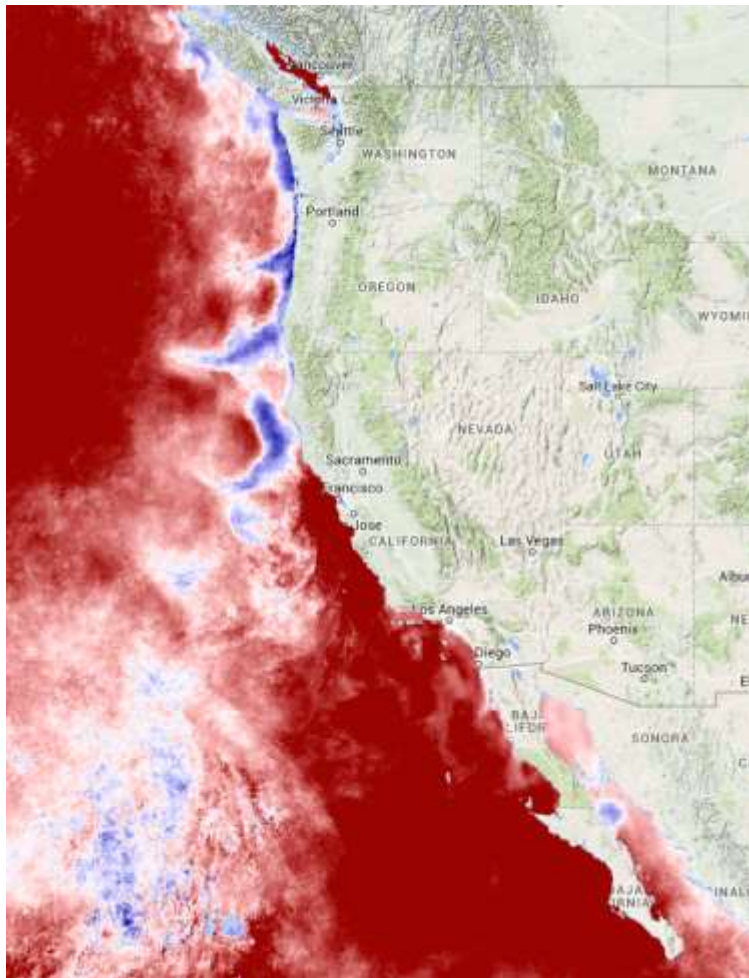
OREGON
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CMOP
Center for Coastal
Margin Observation
& Prediction

How did the Blob influence the CRE?

August 2014



October 2014

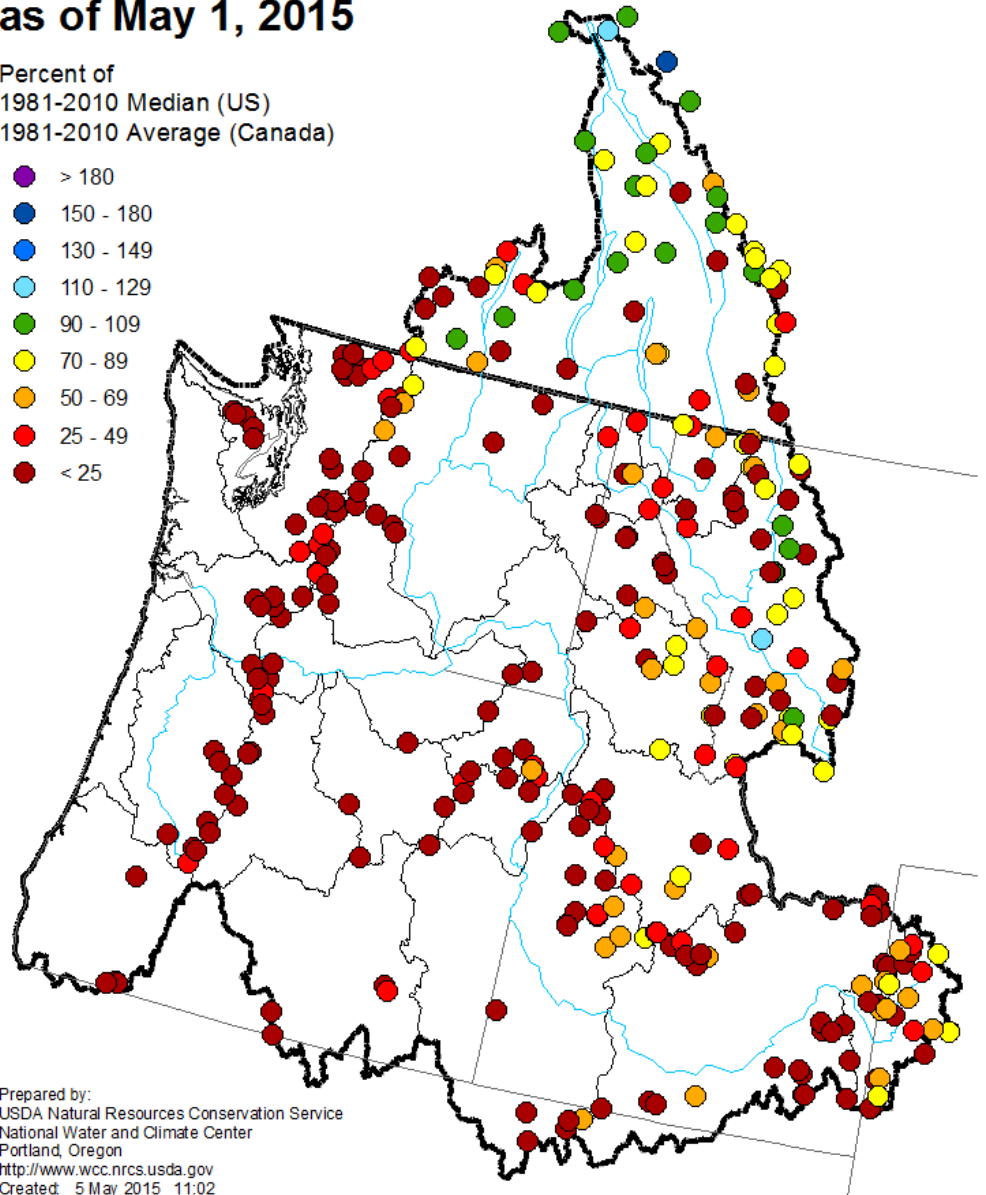


**In 2015 the estuary
was also influenced
by warm river
conditions**

Columbia River and Pacific Coastal Basins Mountain Snowpack as of May 1, 2015

Percent of
1981-2010 Median (US)
1981-2010 Average (Canada)

- > 180
- 150 - 180
- 130 - 149
- 110 - 129
- 90 - 109
- 70 - 89
- 50 - 69
- 25 - 49
- < 25



Prepared by:
USDA Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
<http://www.wcc.nrcs.usda.gov>
Created: 5 May 2015 11:02

For the CRE, how does 2014-2015 compare to previous “anomalous” warm years?

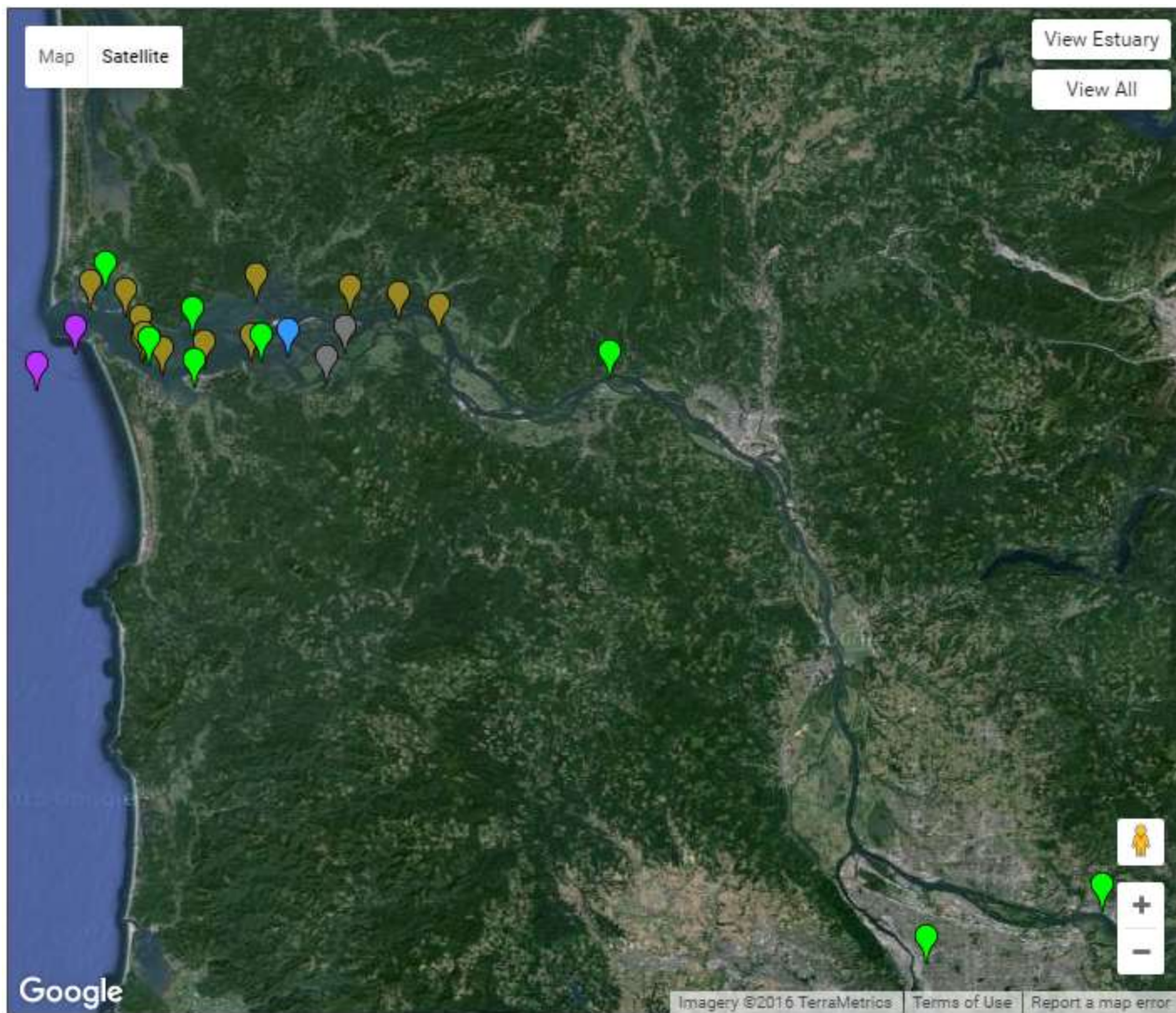
- **1997** Strong El Niño - warm ocean
- **2001** Low snowpack - warm river
- **2005** Delayed upwelling - warm ocean
- **2014-2015** The Blob - **warm ocean and river**



Temp and River Flow Data Sets

CORIE/CMOP
1996 -2016

USGS
NASQAN/NAWQA
1991-2003 (temp)

1992-2015 (flow)

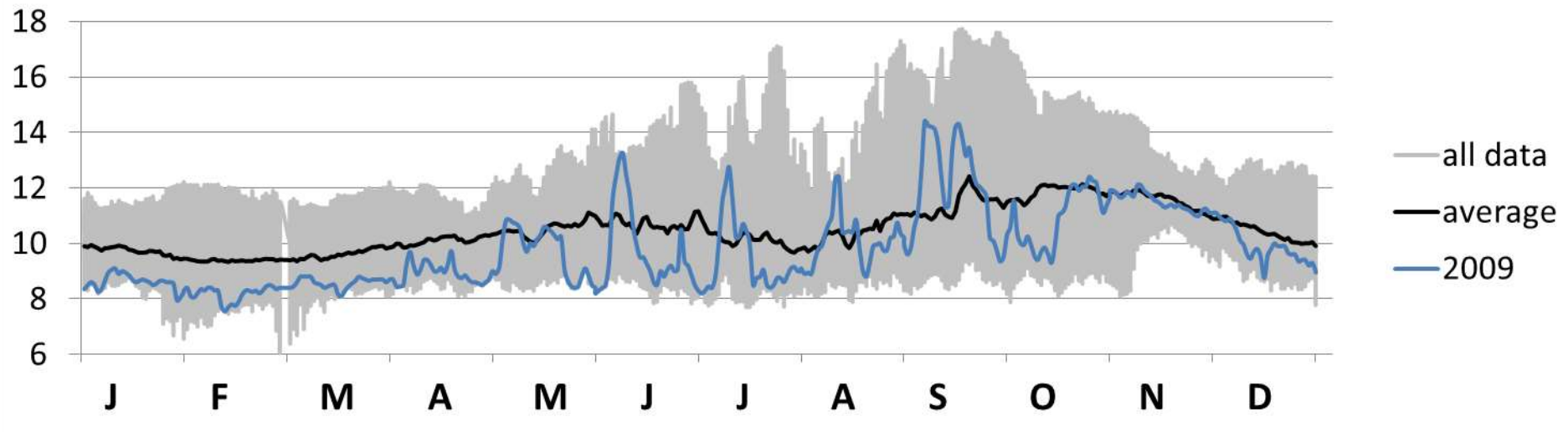


 real-time  offline  self recording  seasonal  low priority  historical

 Display in

Measuring ocean water in the estuary

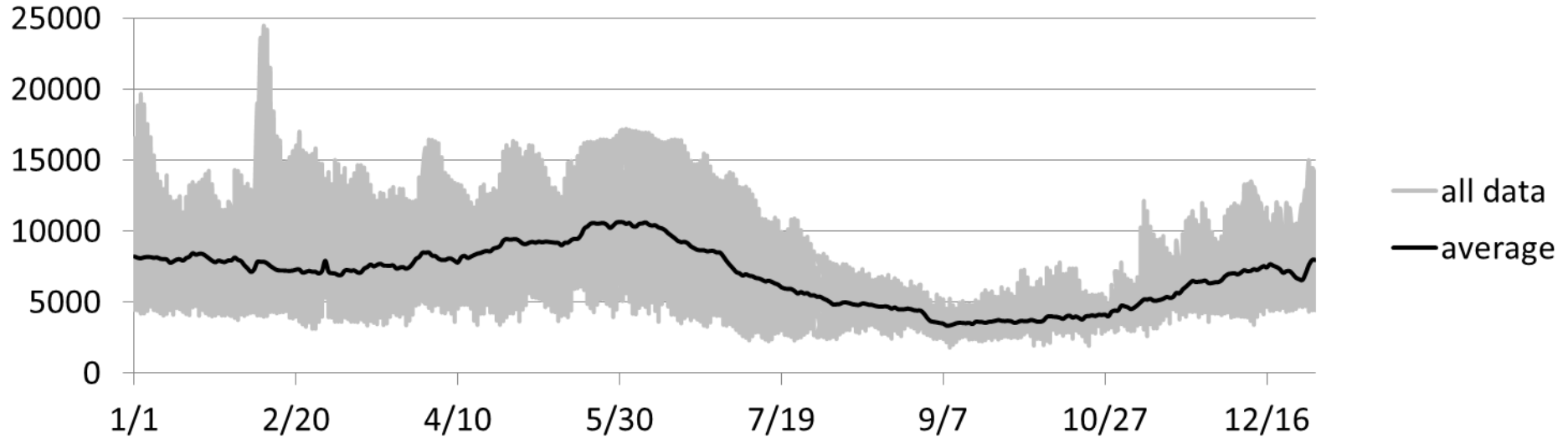
Esturay-Ocean Temp (°C) 2009



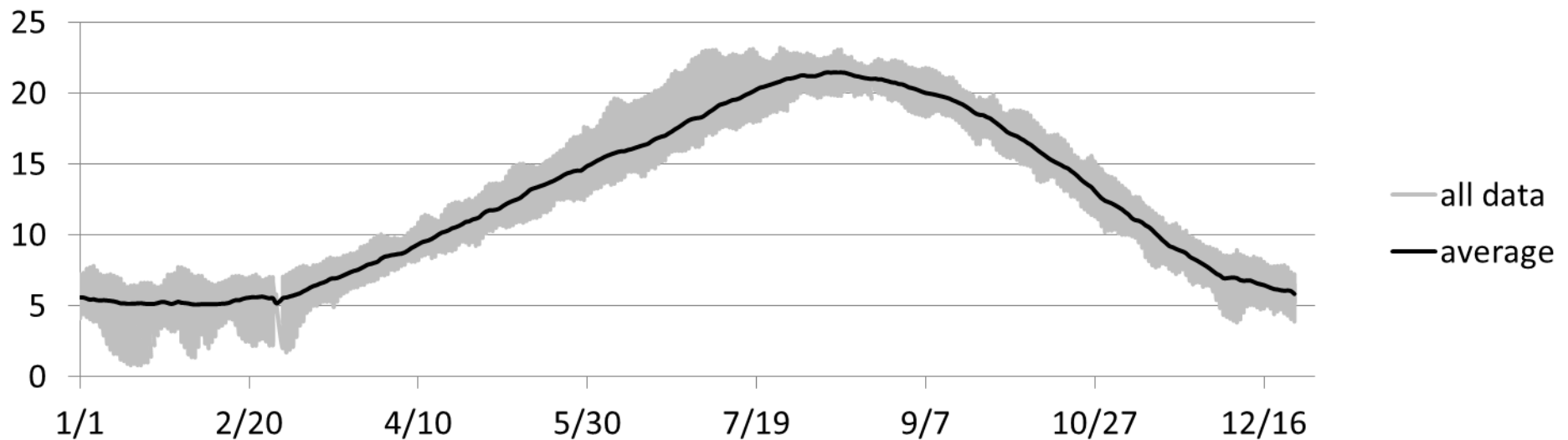
Temperature corresponding to daily highest salinity measurement – 1996-2015

River Flow and Temperature 1992-2015

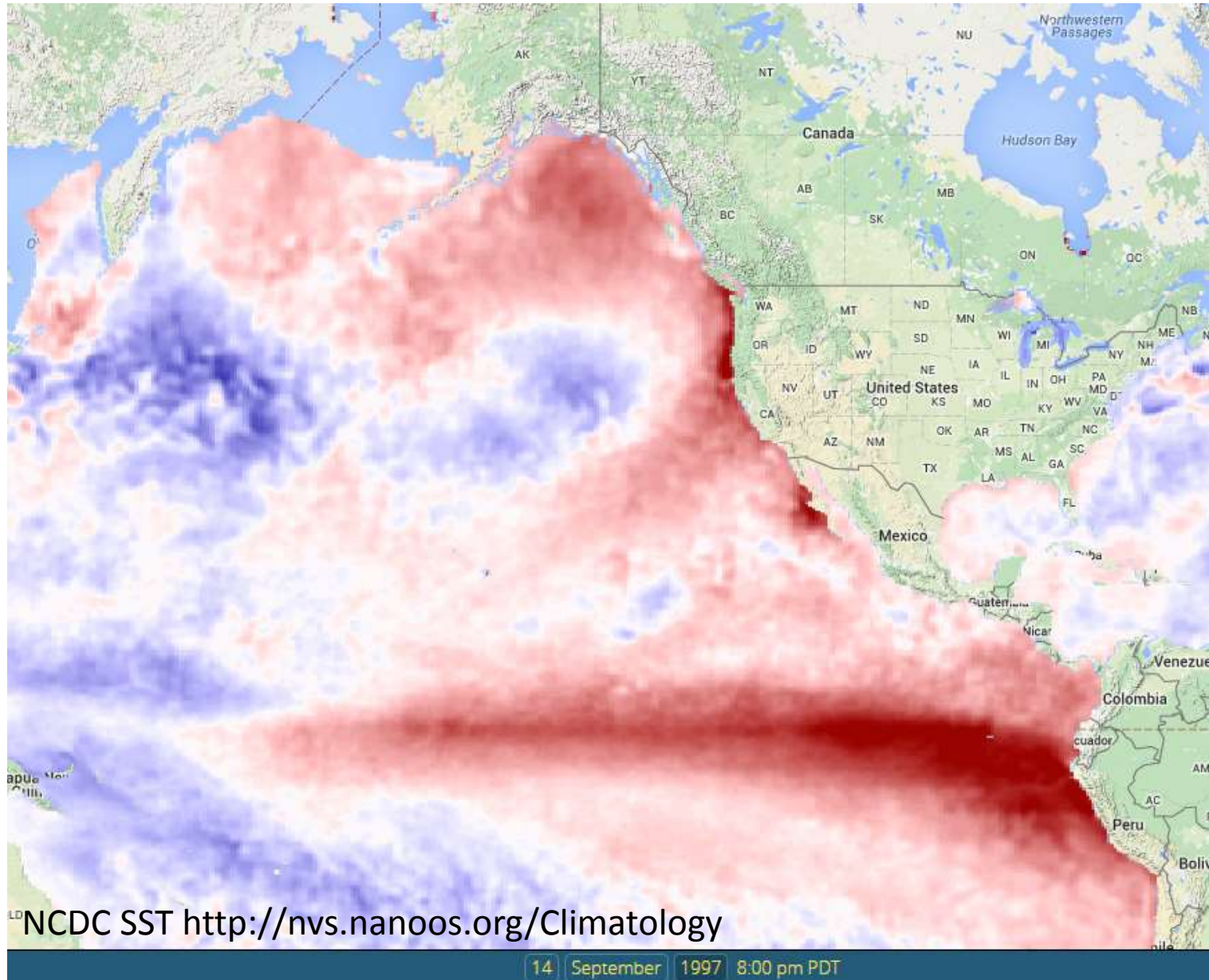
BAT Discharge (m³/s)



Mainstem Temp (°C)

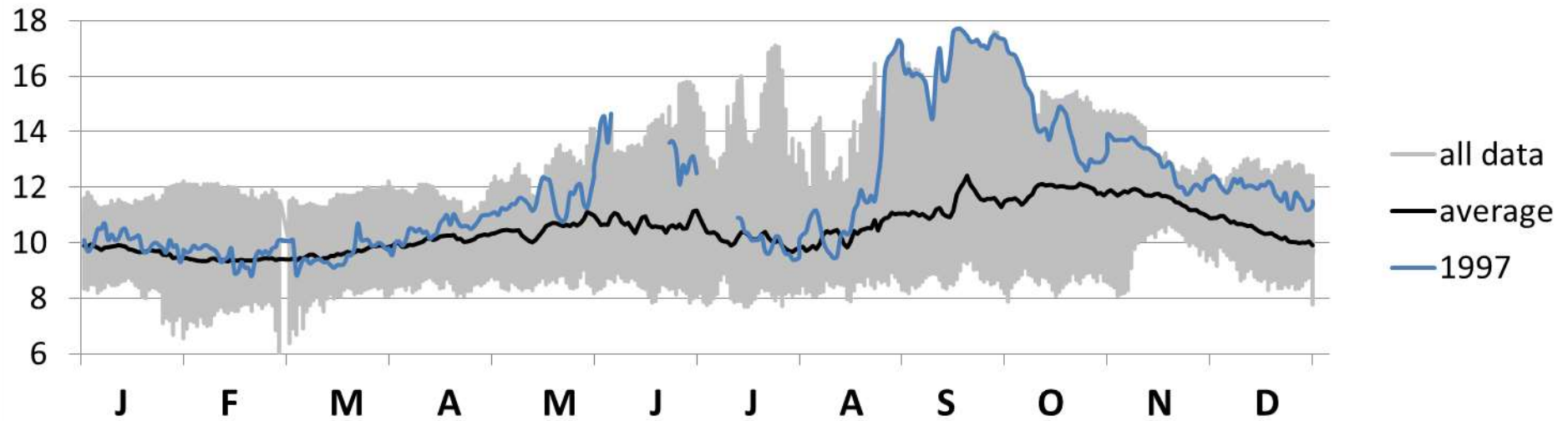


1997 Strong El Niño - warm ocean



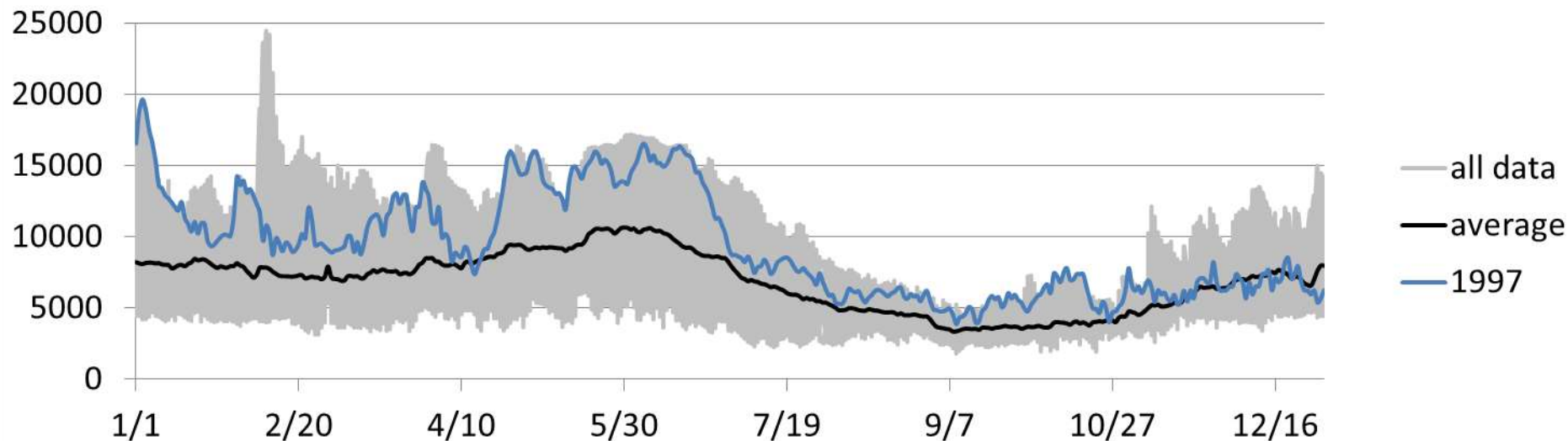
1997 Strong El Niño - warm ocean

Estuary-Ocean Temp (°C) 1997

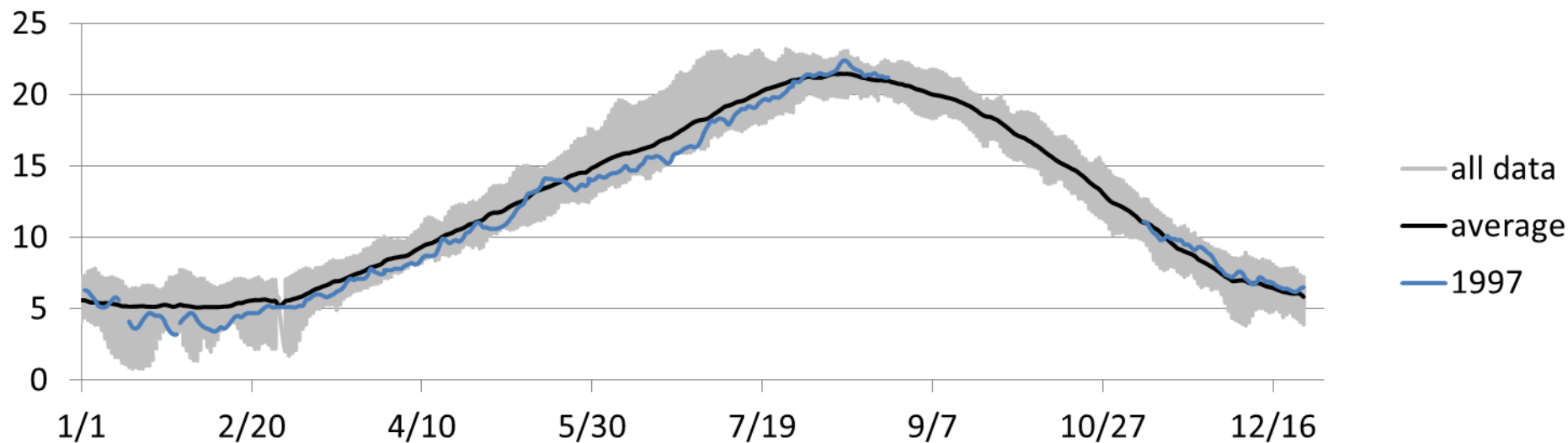


1997 Strong El Niño - warm ocean

BAT Discharge (m³/s) - 1997



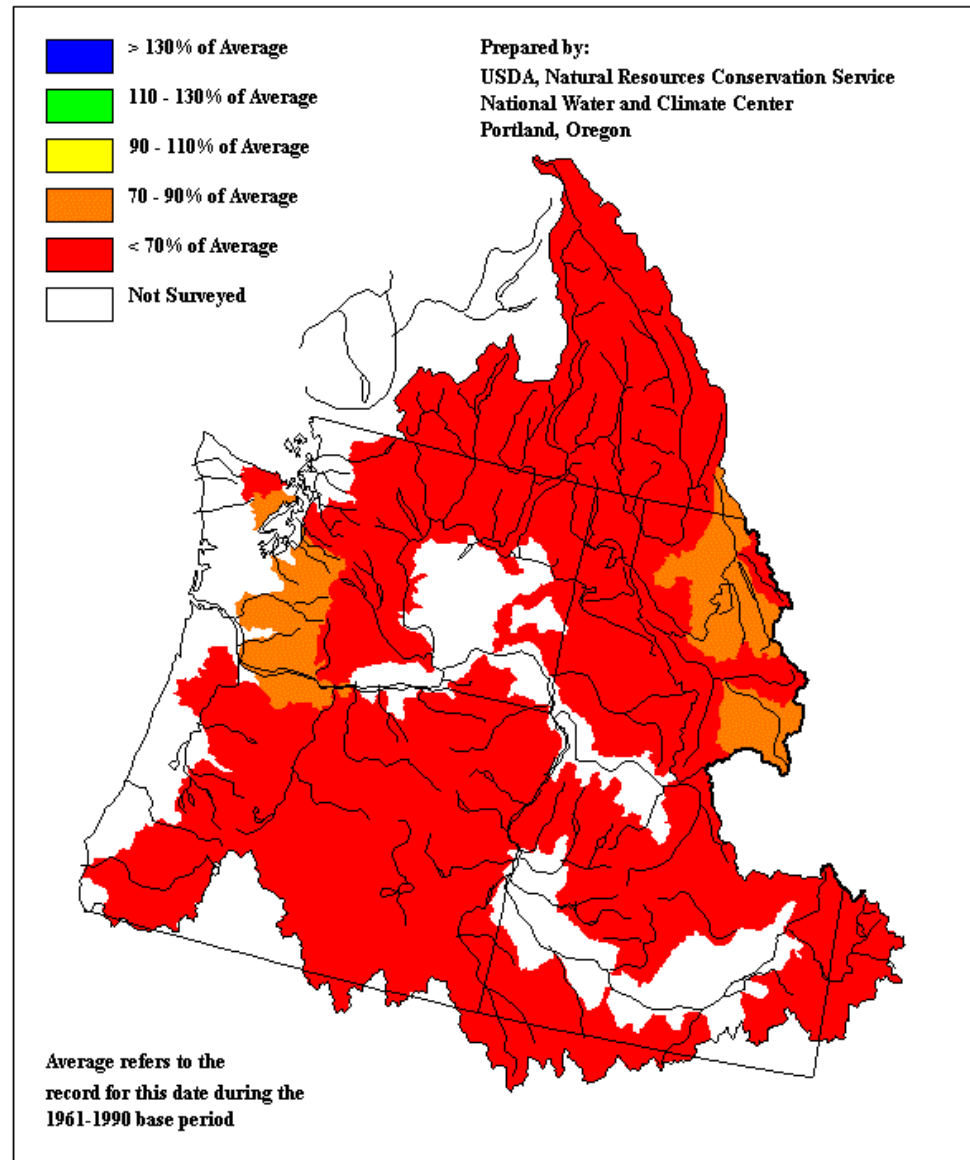
Mainstem Temp (°C) - 1997



Mountain Snow Water Equivalent

as of May 1, 2001 (in relation to the average for this date)

**2001 Low snowpack -
warm river**

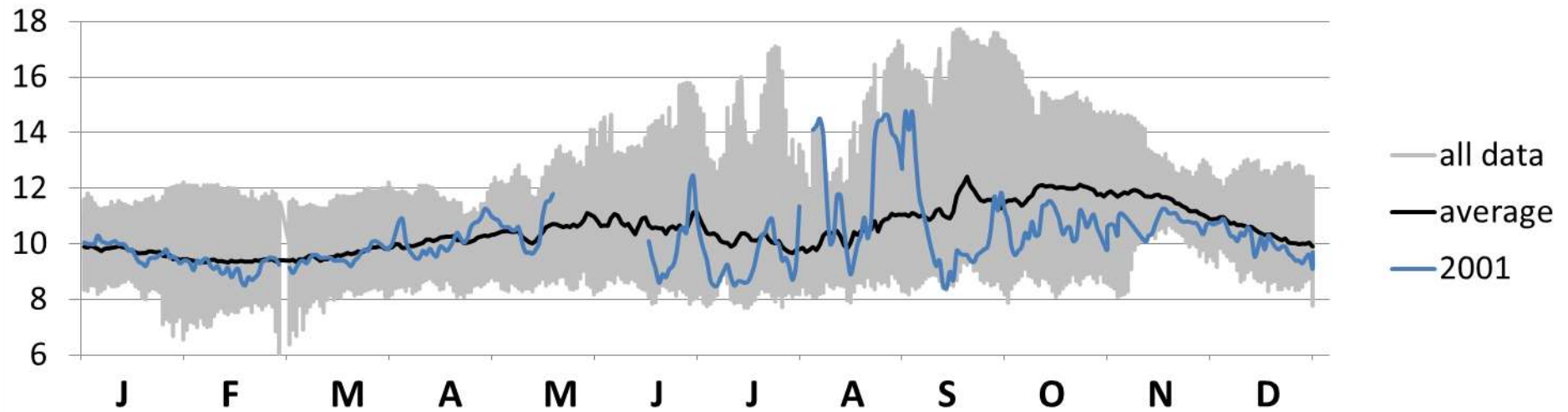


http://www.wcc.nrcs.usda.gov/ftpref/support/snow/snowpack_maps/columbia_river/wy2001/cusn0105.gif

United States Department of Agriculture -- Natural Resources Conservation Service
in cooperation with
The Province of British Columbia -- Ministry of the Environment

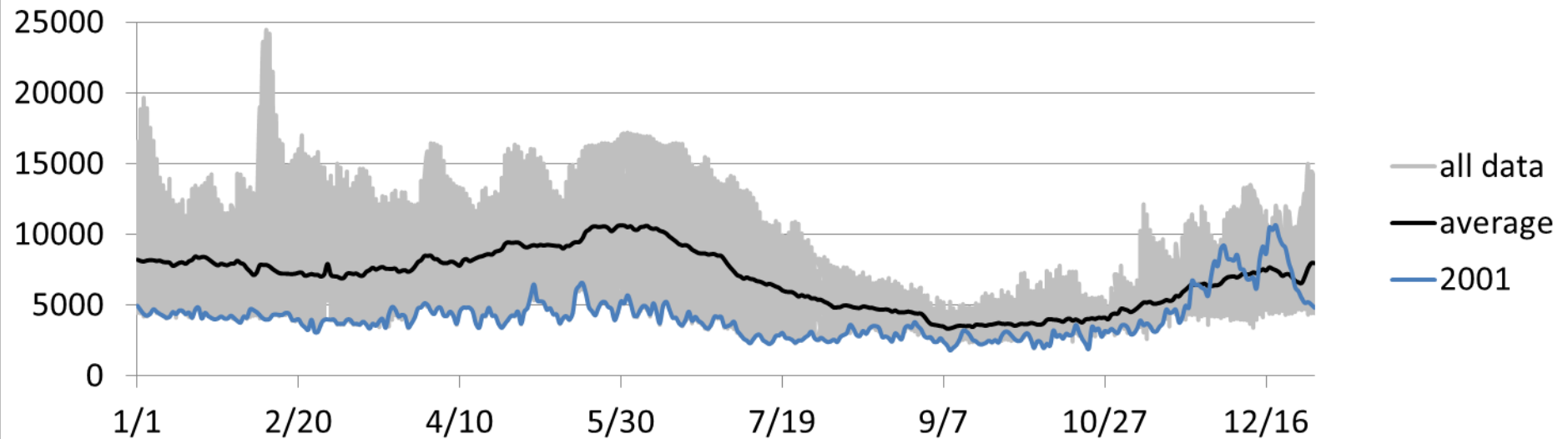
2001 Low snowpack - warm river

Estuary-Ocean Temp (°C) 2001

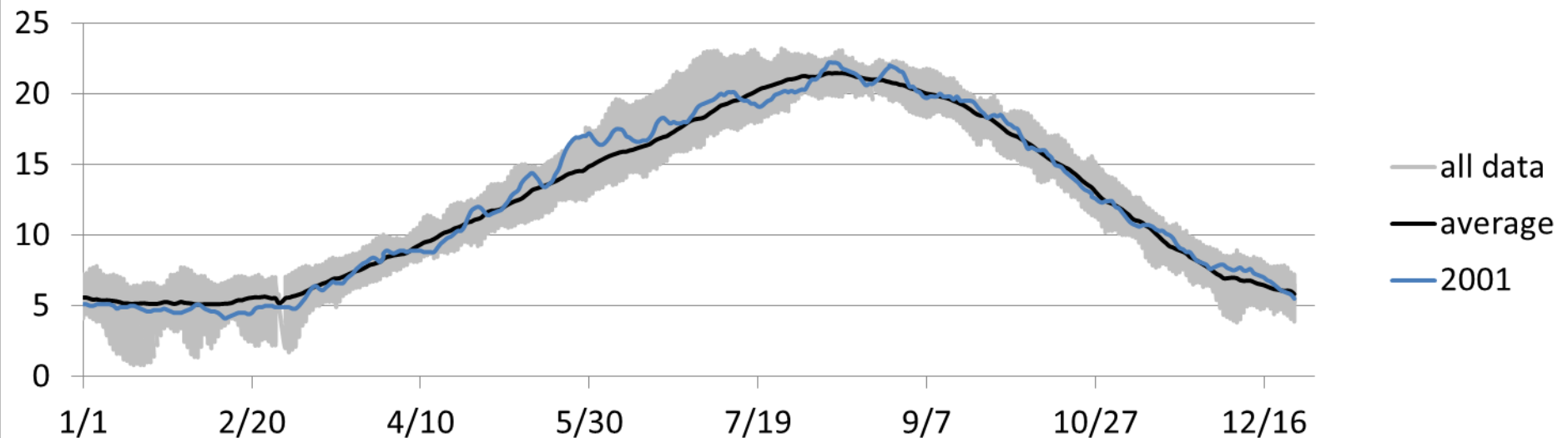


2001 Low snowpack - warm river

BAT Discharge (m³/s) - 2001

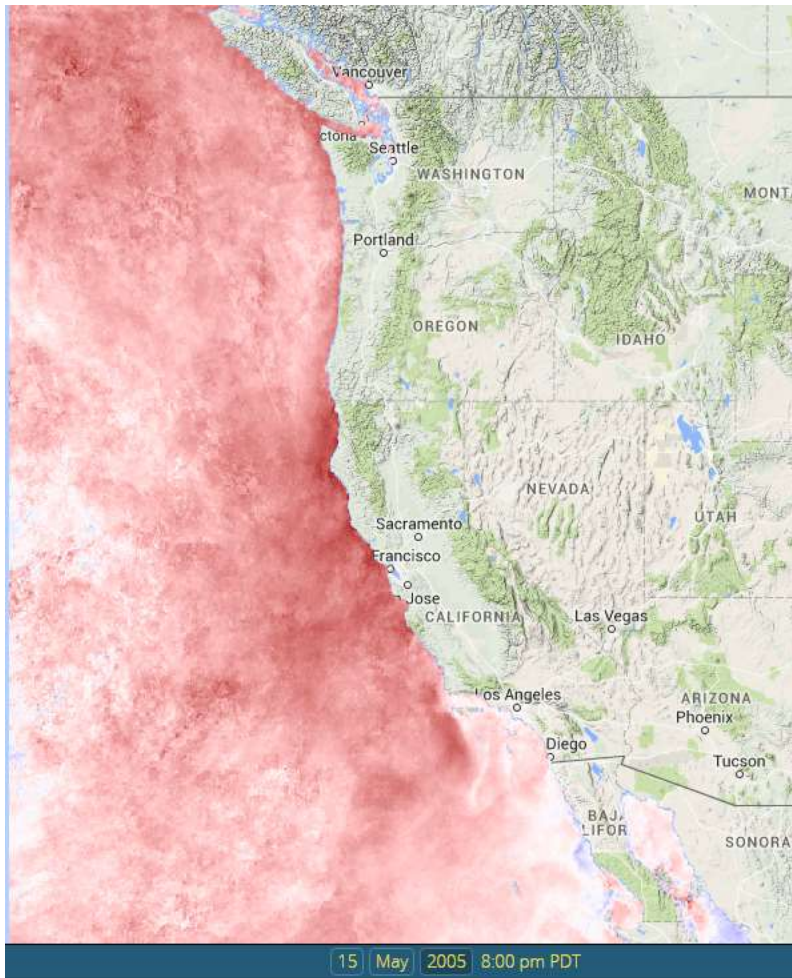


Mainstem Temp (°C) - 2001

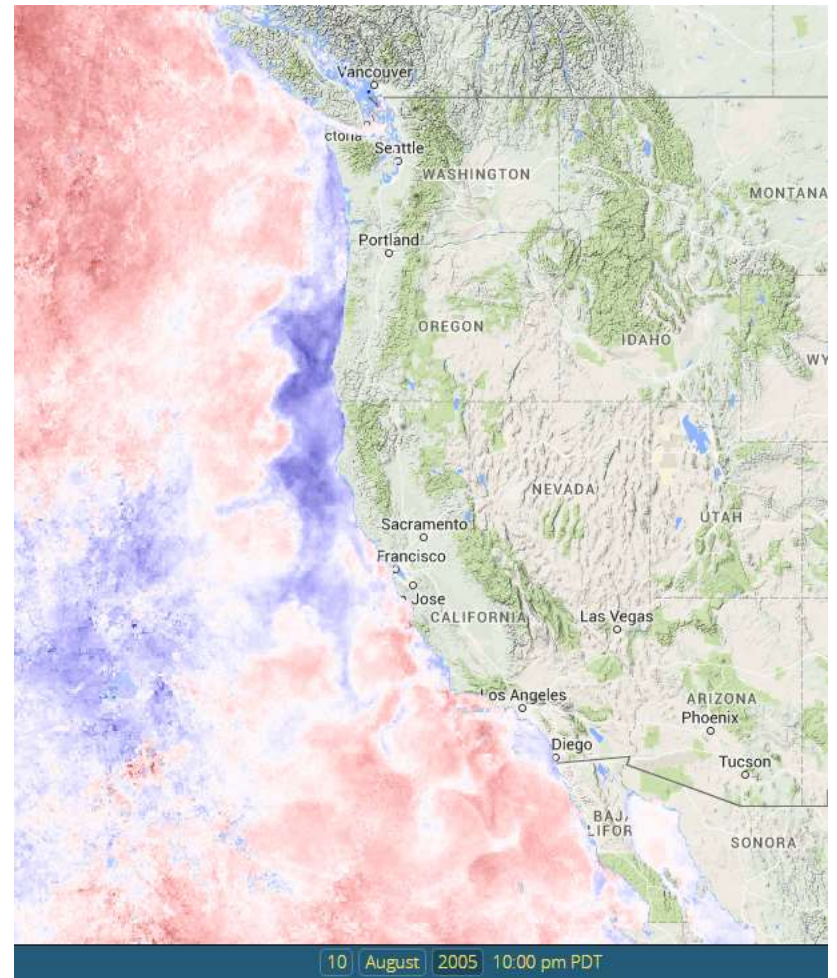


2005 Delayed upwelling - warm ocean

May 2005

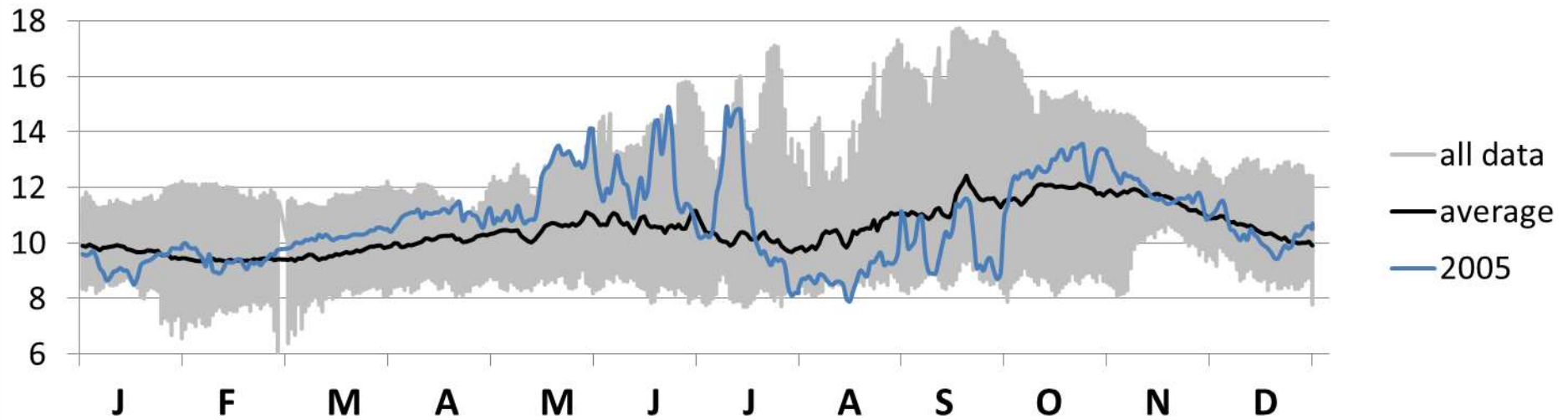


August 2005



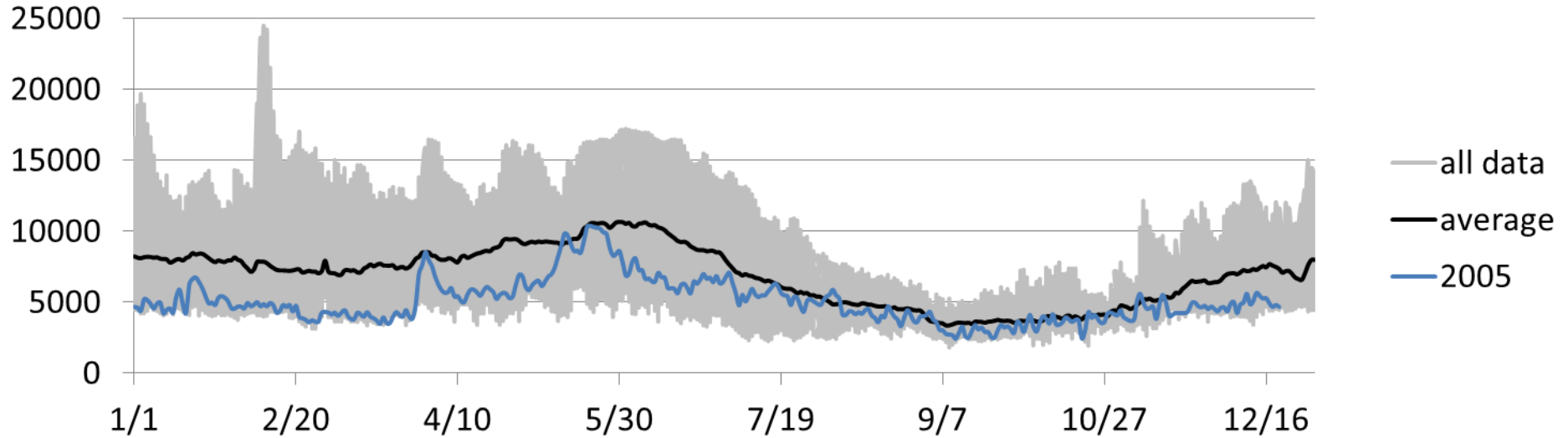
2005 Delayed upwelling - warm ocean

Estuary-Ocean Temp (°C) 2005

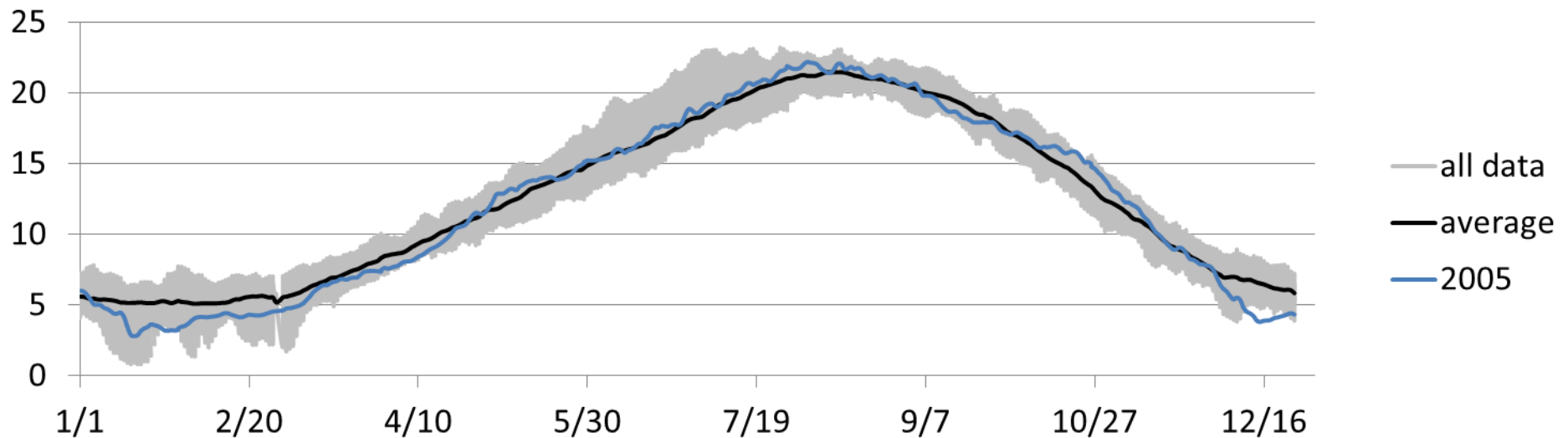


2005 Delayed upwelling - warm ocean

BAT Discharge (m³/s) - 2005



Mainstem Temp (°C) - 2005



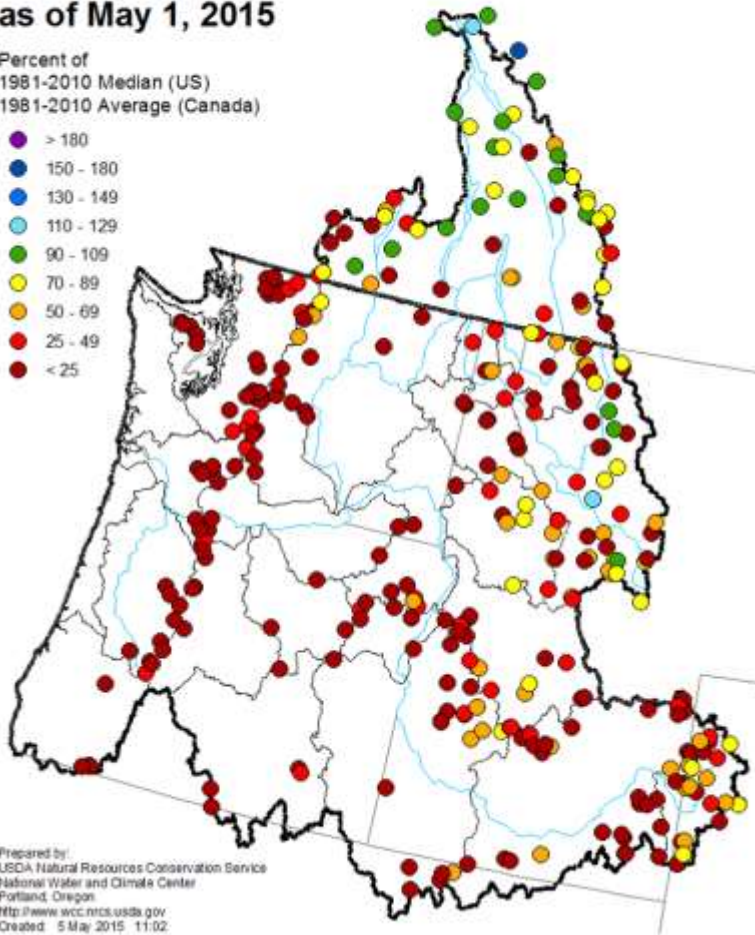
2014-2015 The Blob - warm ocean and river

October 2014

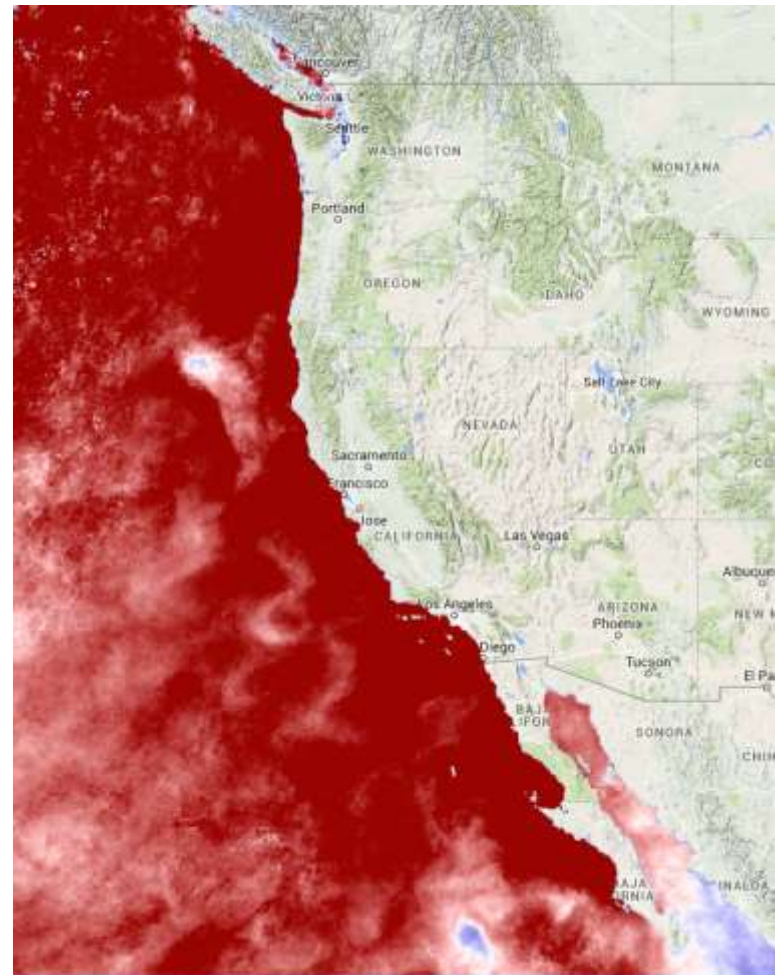
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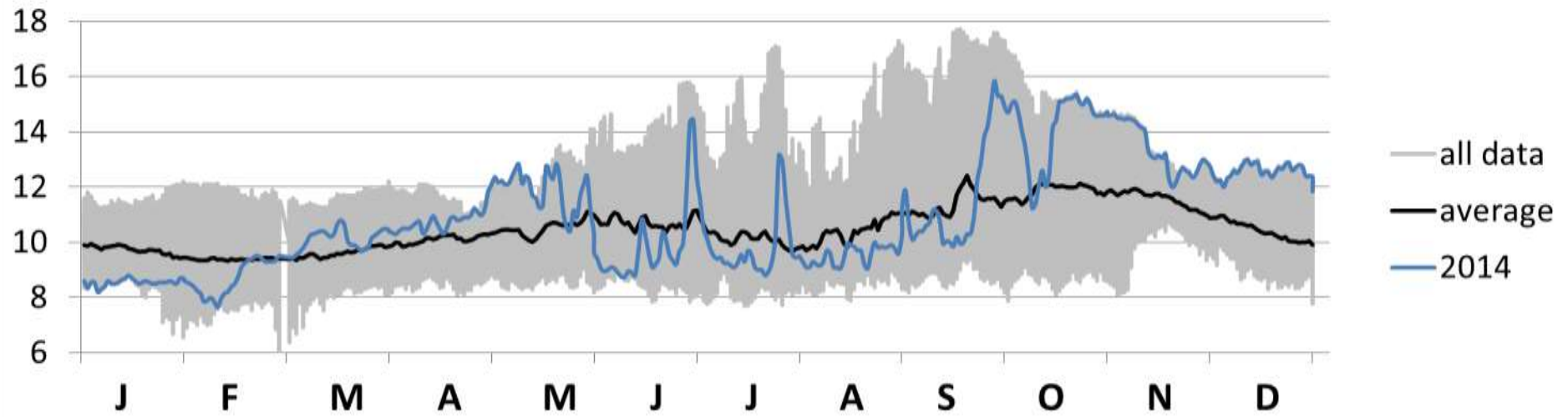


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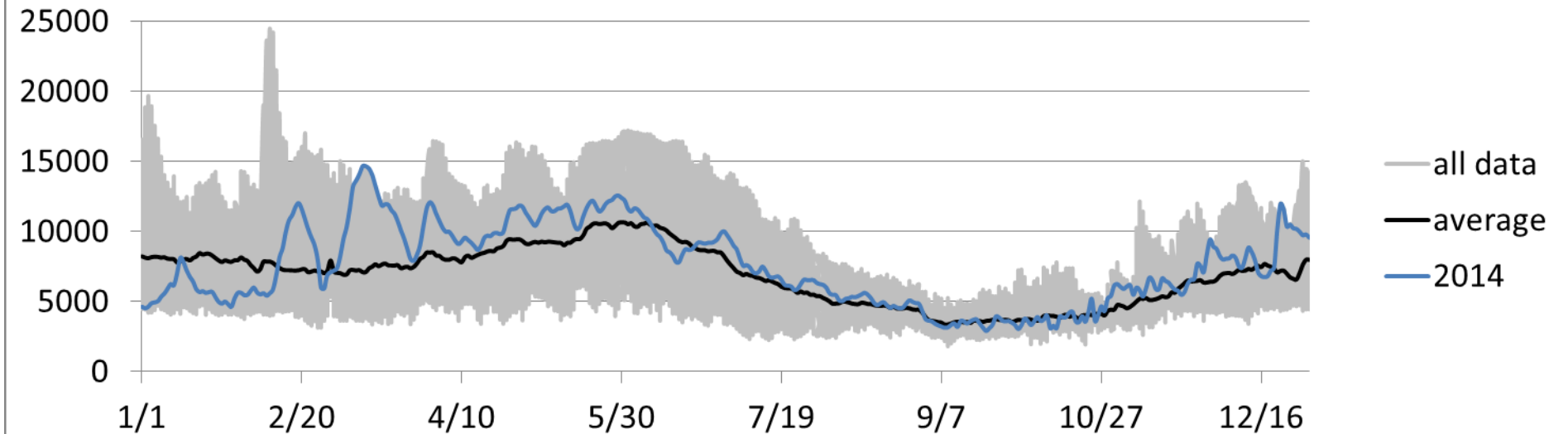
2014-2015 The Blob - warm ocean and river

Estuary-Ocean Temp (°C) 2014

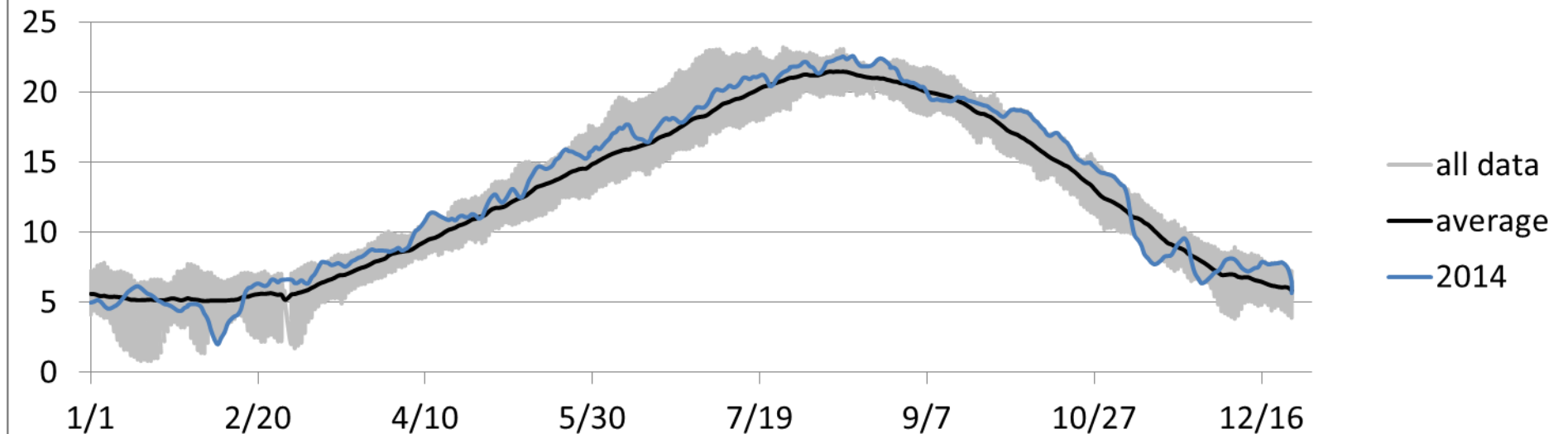


2014-2015 The Blob - warm ocean and river

BAT Discharge (m³/s) - 2014

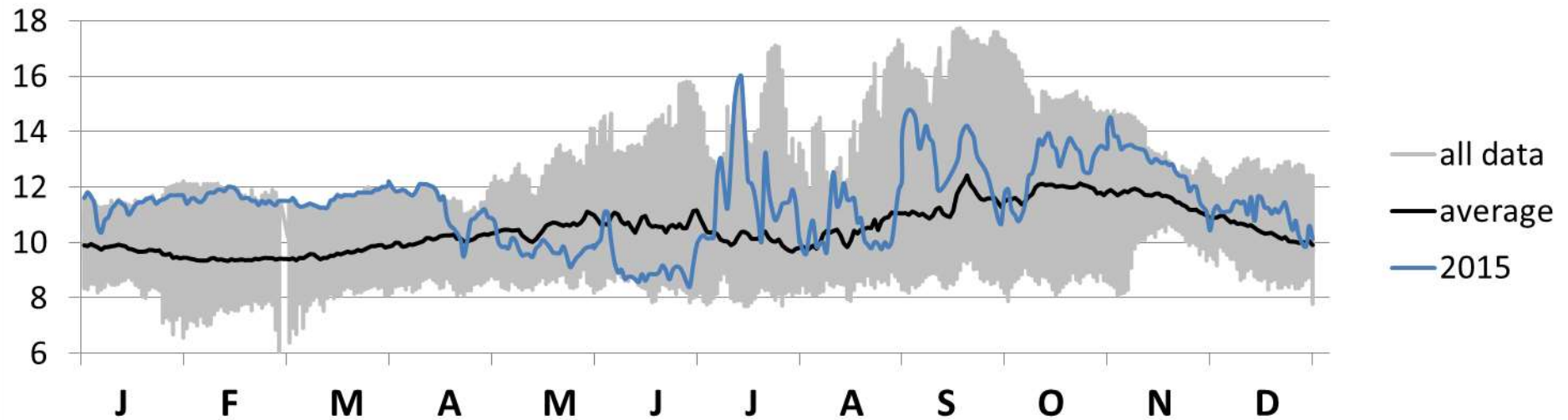


Mainstem Temp (°C) - 2014



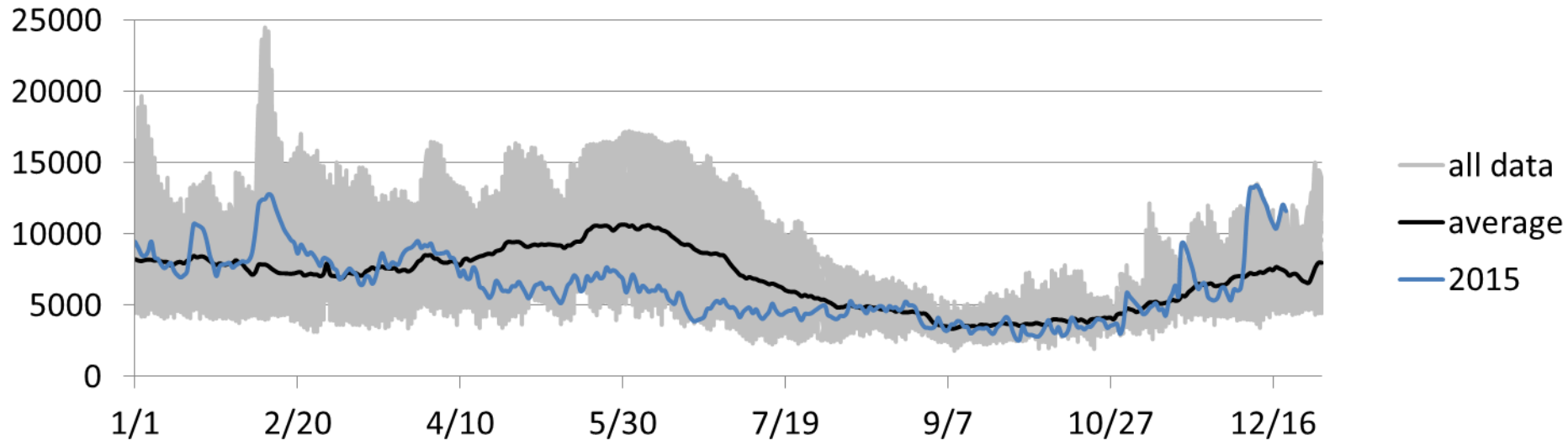
2014-2015 The Blob - warm ocean and river

Estuary-Ocean Temp (°C) 2015

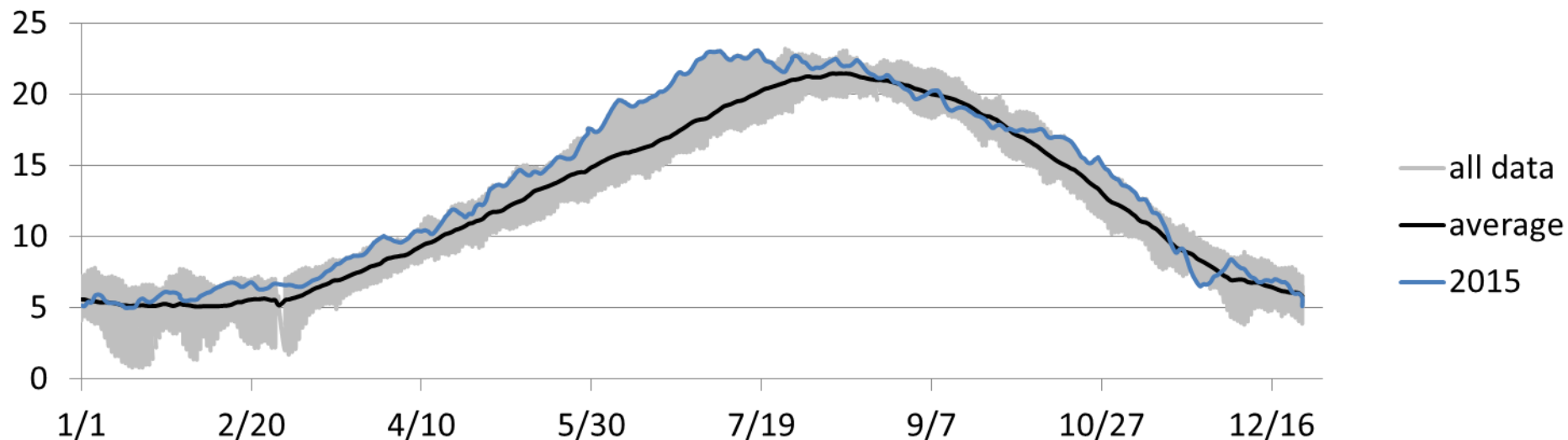


2014-2015 The Blob - warm ocean and river

BAT Discharge (m³/s) - 2015



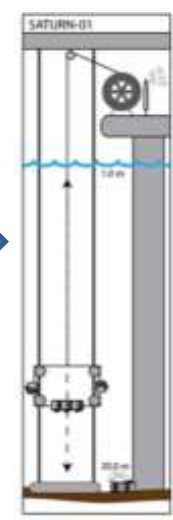
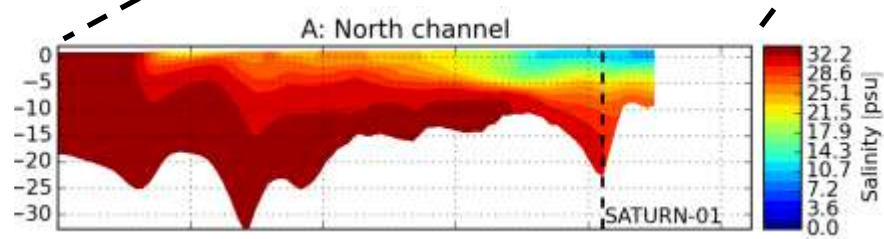
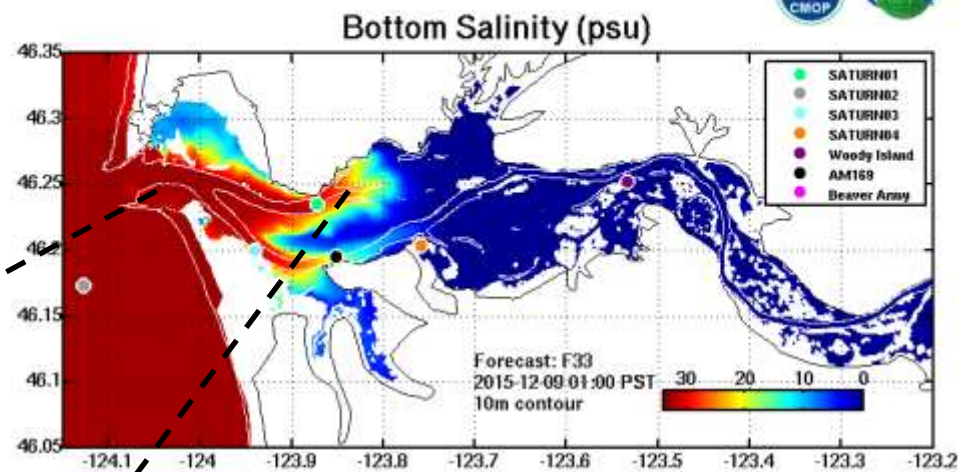
Mainstem Temp (°C) - 2015



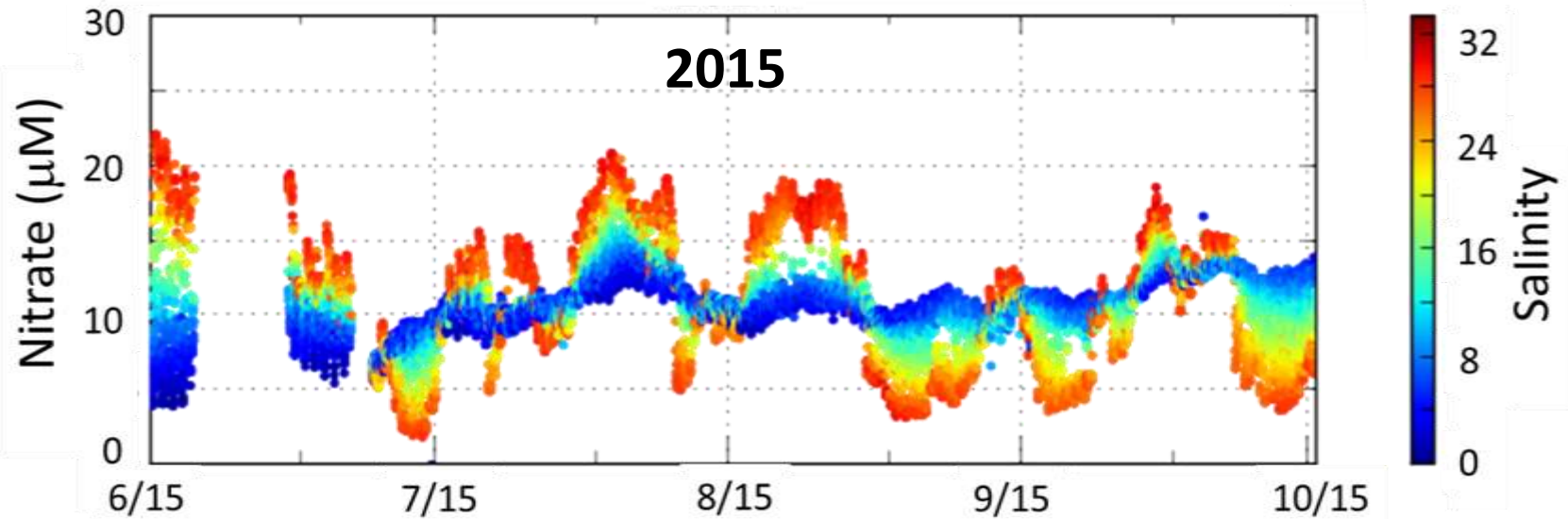
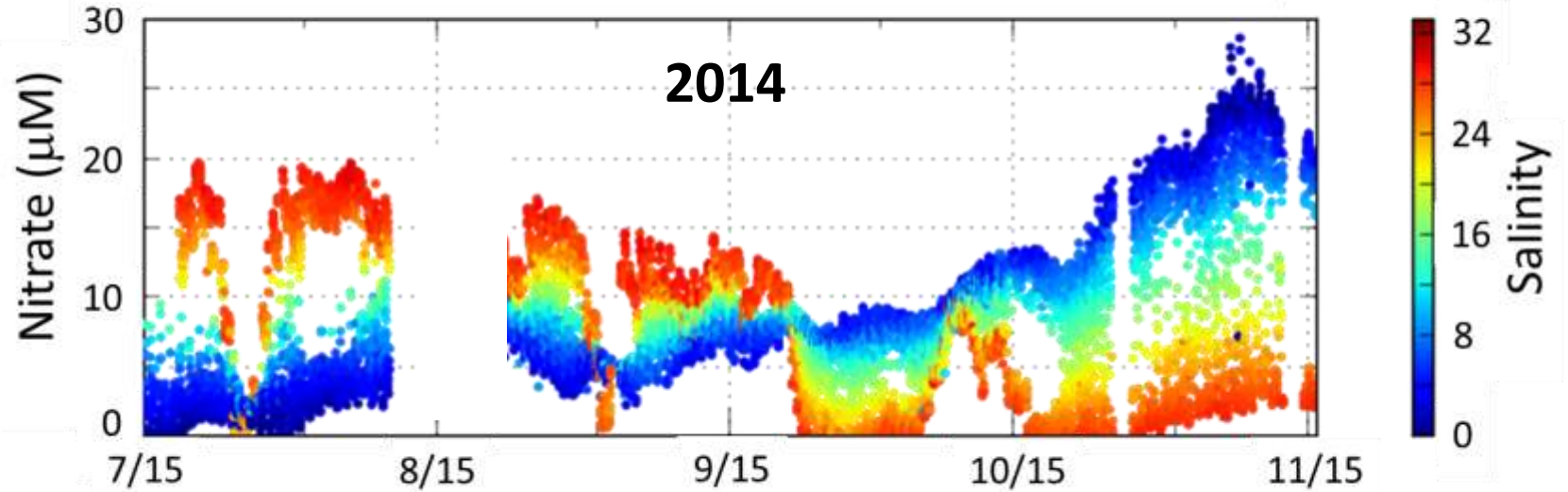
Summary of Estuary Conditions

Year	Event	Ocean end member	River end member
1997	El Nino	Warm	Cold
2001	Small snowpack	Cold	Average
2005	Delayed upwelling	Warm	Average
2014	Upwelling - blob	Cold - Warm	Average
2015	Blob + small snowpack + unusual warm weather in spring	Warm	Warm

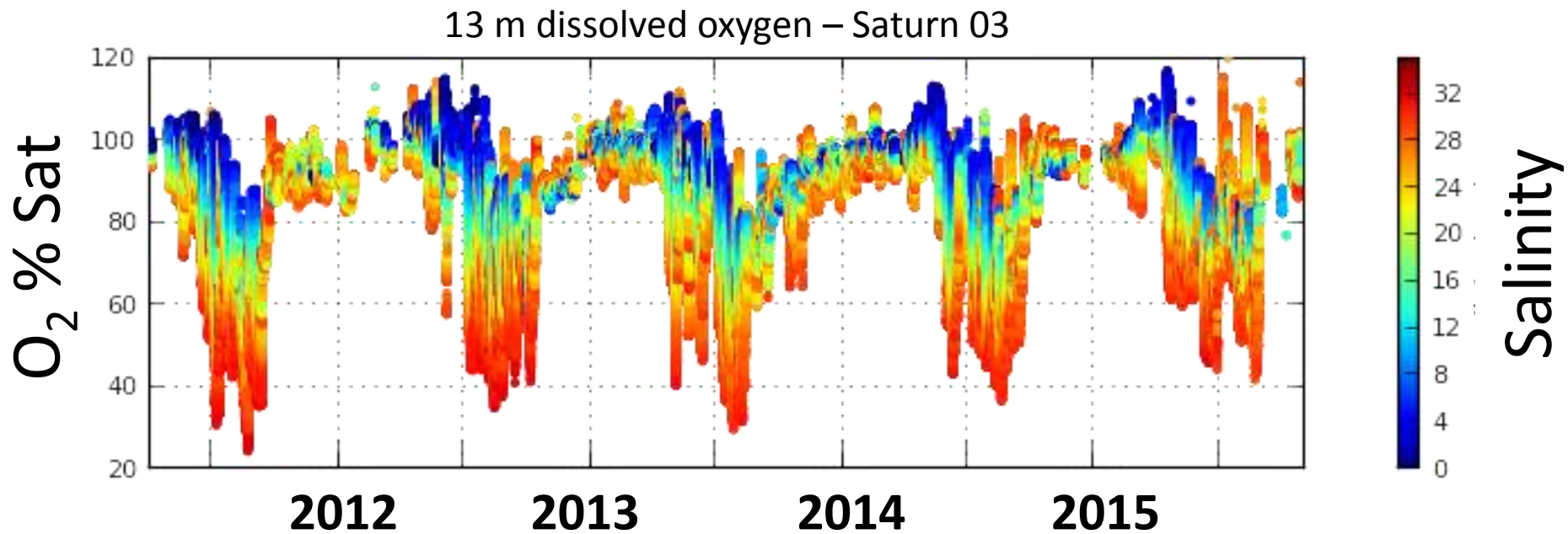
CMOP Biogeochemical Data



Nitrate (colored by salinity)



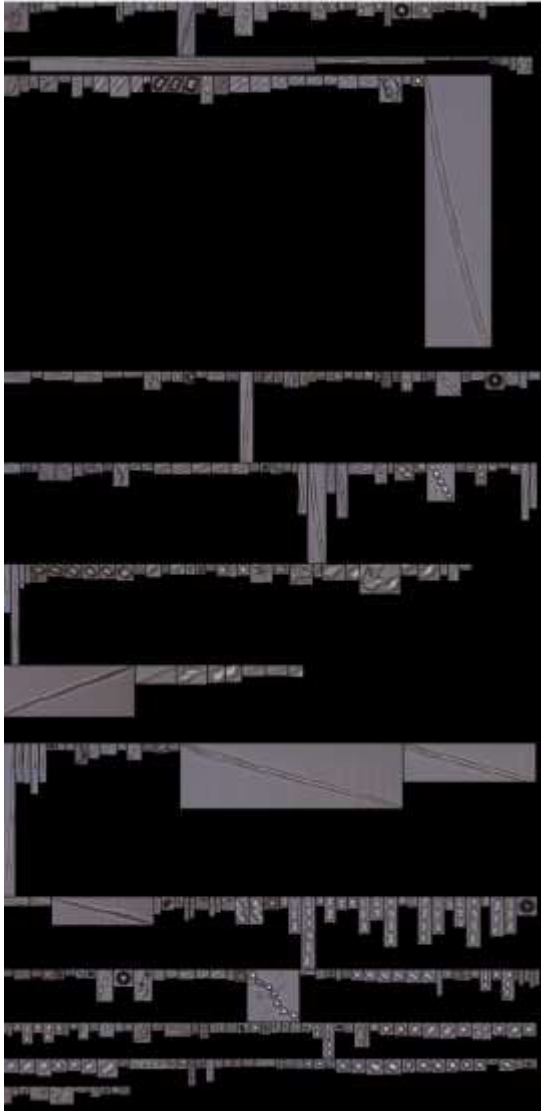
SATURN-03 Dissolved Oxygen Time Series



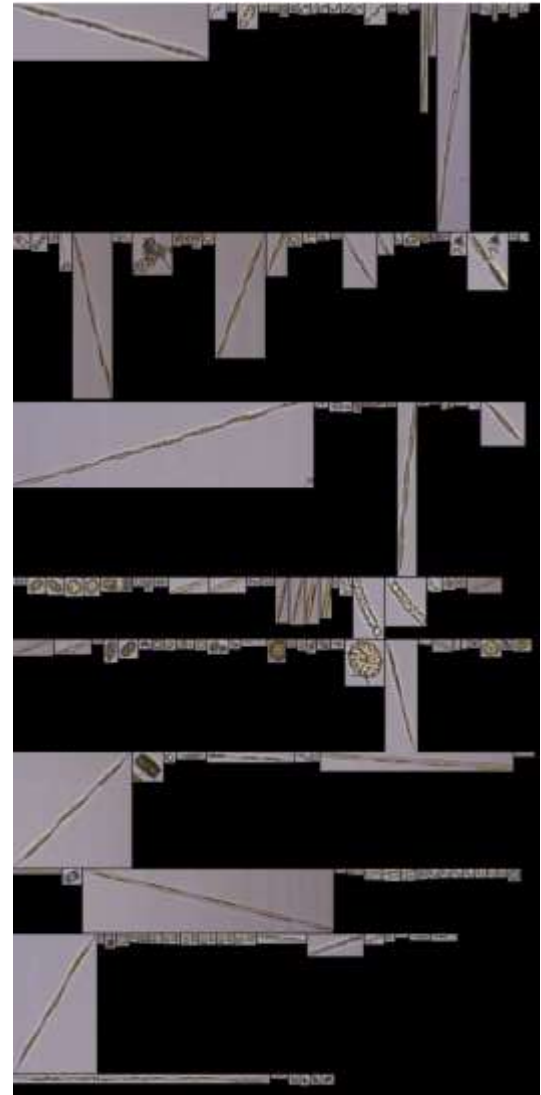
No evidence for strong hypoxia formation associated with the blob

Remnants of persistent bloom of *Pseudo-nitzschia* spp. in NE Pacific were seen in the CR estuary

Offshore sample (surface, CR-40)



Estuary sample (surface, SAT-03)



Biogeochemical consequences of warm waters in the Columbia River (ongoing research)

No significant hypoxia detected in estuary

Summer-Fall: Nutrient supply depends on strength of upwelling

HAB blooms widespread in river and ocean end-members

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5 Facts About The Willamette's Green Slime

By Amelia Templeton, Dave Miller, and Phoebe Flanigan | 08/11/2015 12:00pm | Updated: Aug. 14, 2015 10:02am | 19 Reads

OPEN THIS OUT LOUD
Who's On Algae Duty...


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Dr. Jennifer L. Graham (2011)

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Wait, Can I Swim In That River Dividing Portland?

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FOCUS

Last month, the Oregon Health Authority released a health advisory for the Ross Island Lagoon in the Willamette River, due to an algae bloom that has produced low but detectible levels of toxins.