

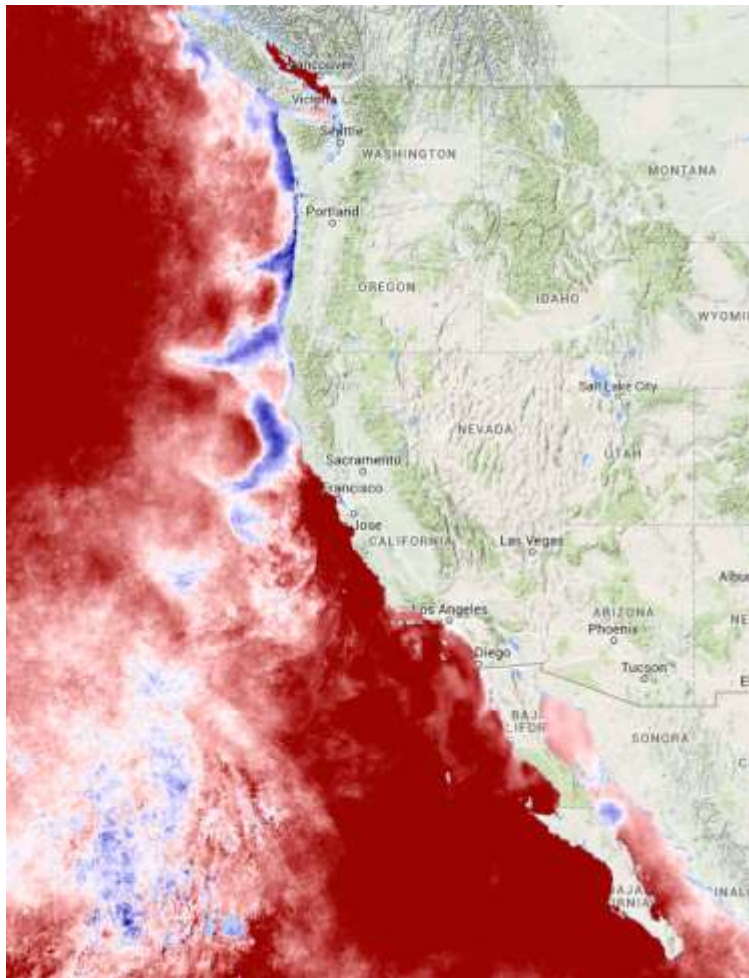
Science Workgroup Meeting Estuary Monitoring Program

Joe Needoba

10/25/2016

How did the Blob influence the CRE?

August 2014



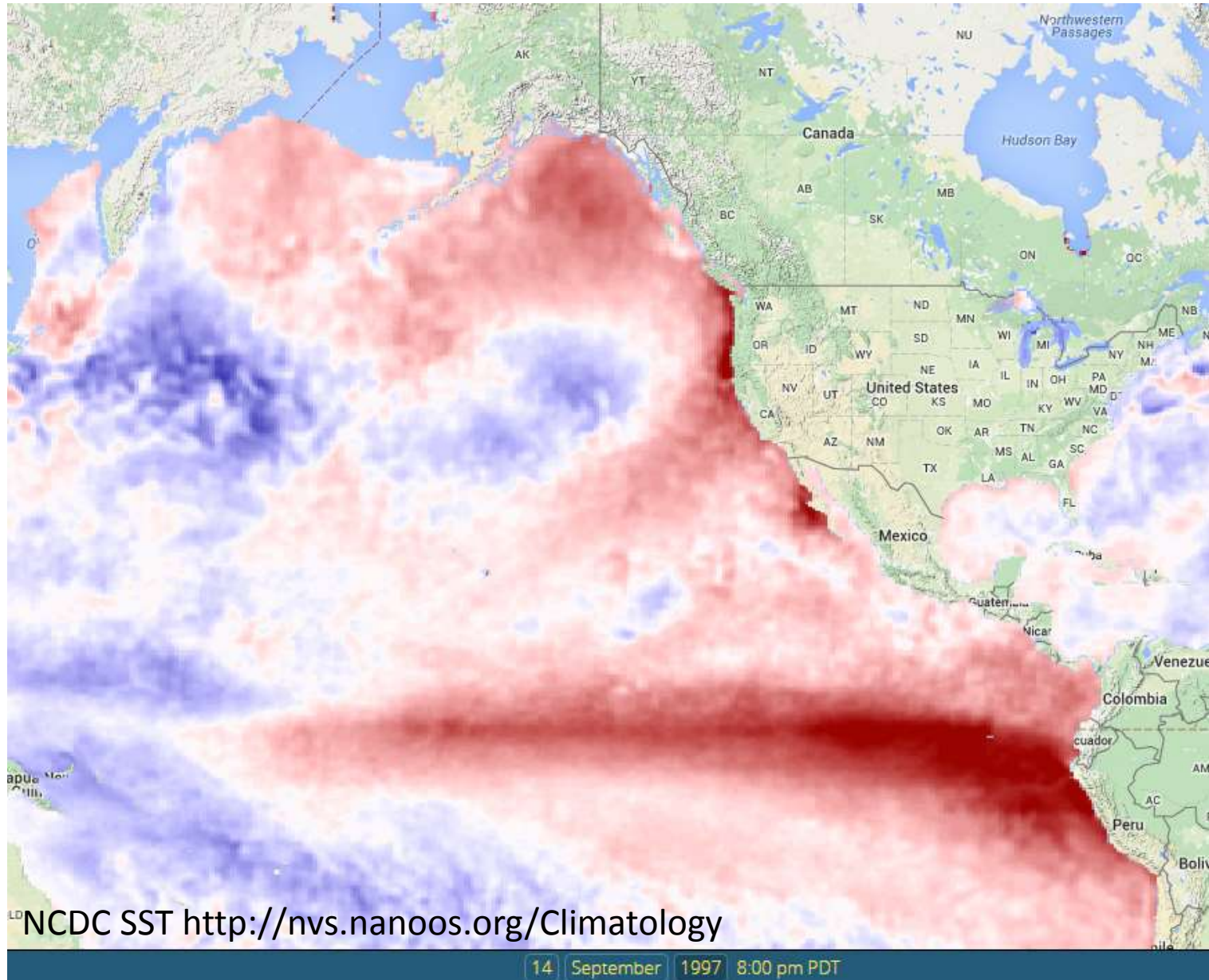
October 2014



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**
- **2016** – Strong El Niño - warm ocean

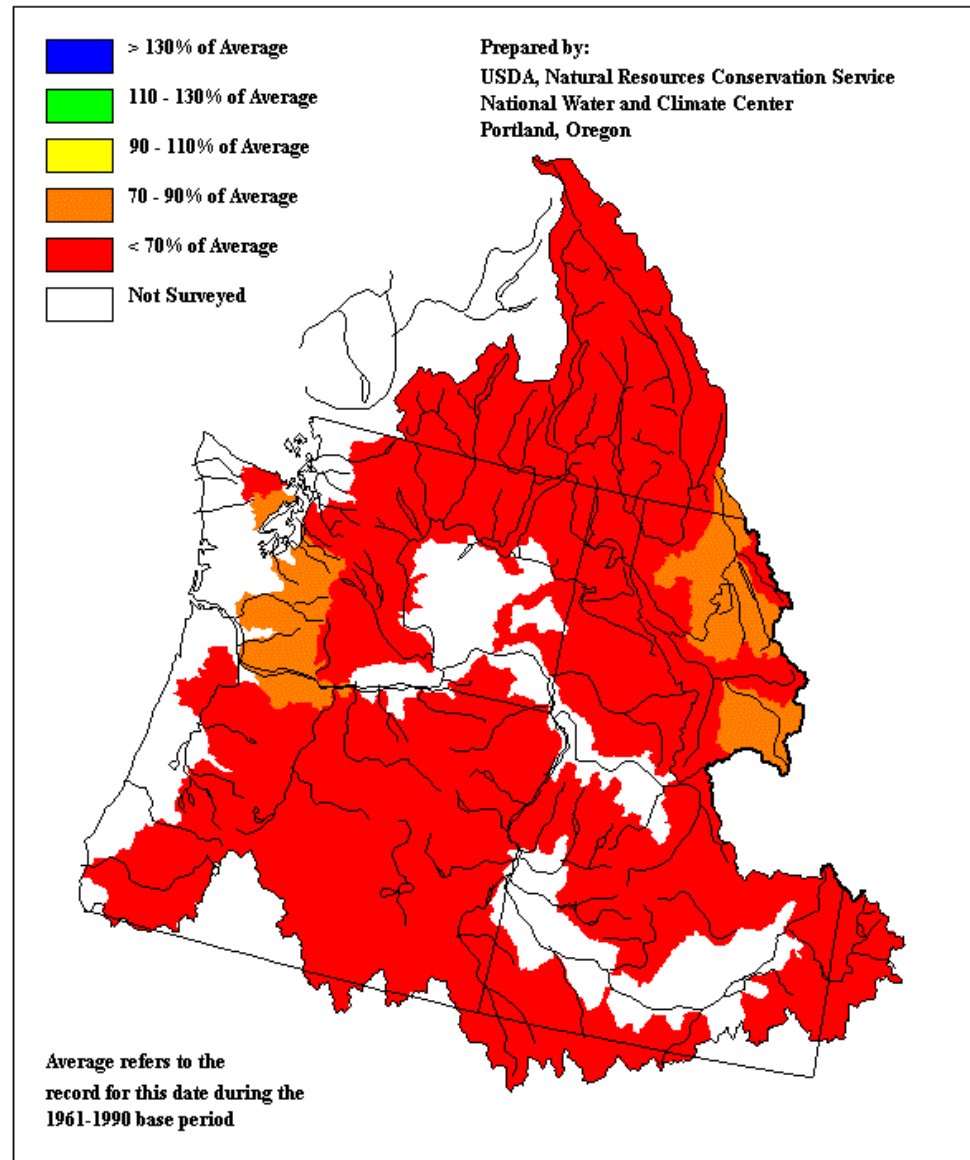
1997 Strong El Niño - warm ocean



Mountain Snow Water Equivalent

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

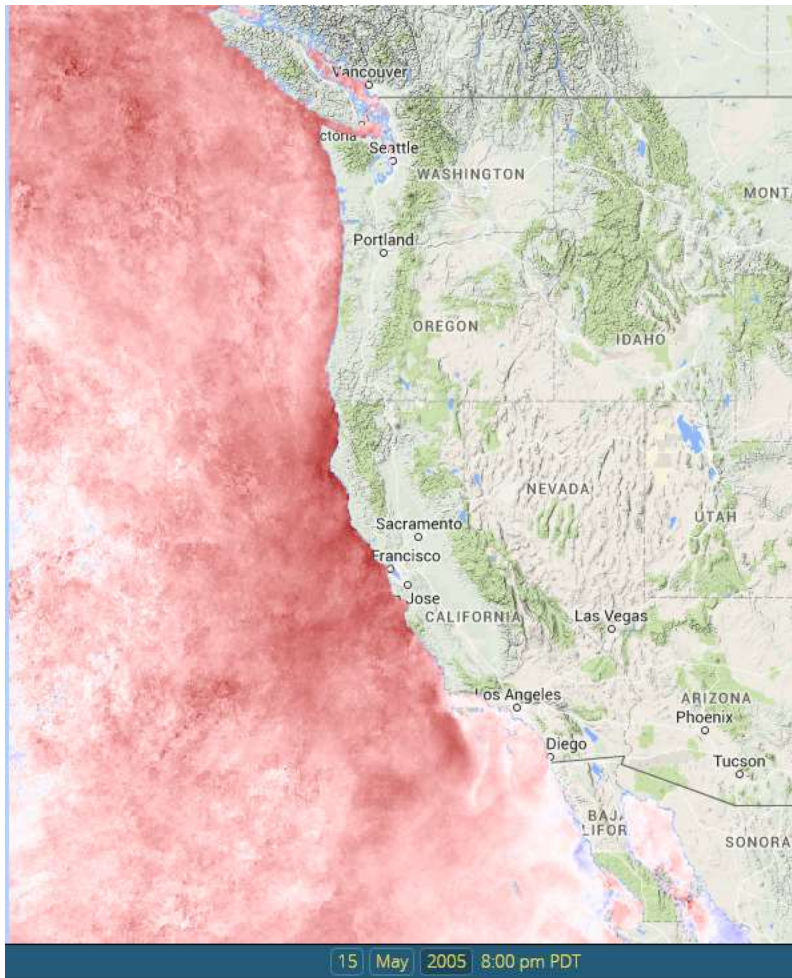
**2001 Low snowpack -
warm river**



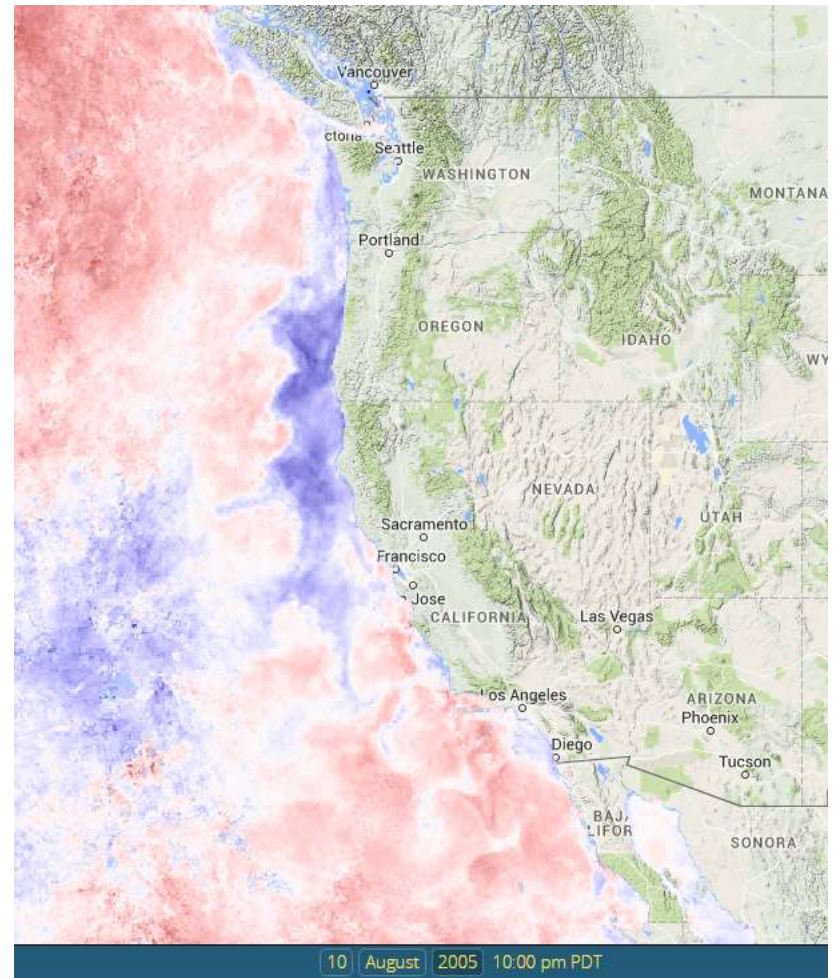
http://www.wcc.nrcs.usda.gov/ftpref/support/snow/snowpack_maps/columbia_river/wy2001/cusn0105.gif

2005 Delayed upwelling - warm ocean

May 2005



August 2005



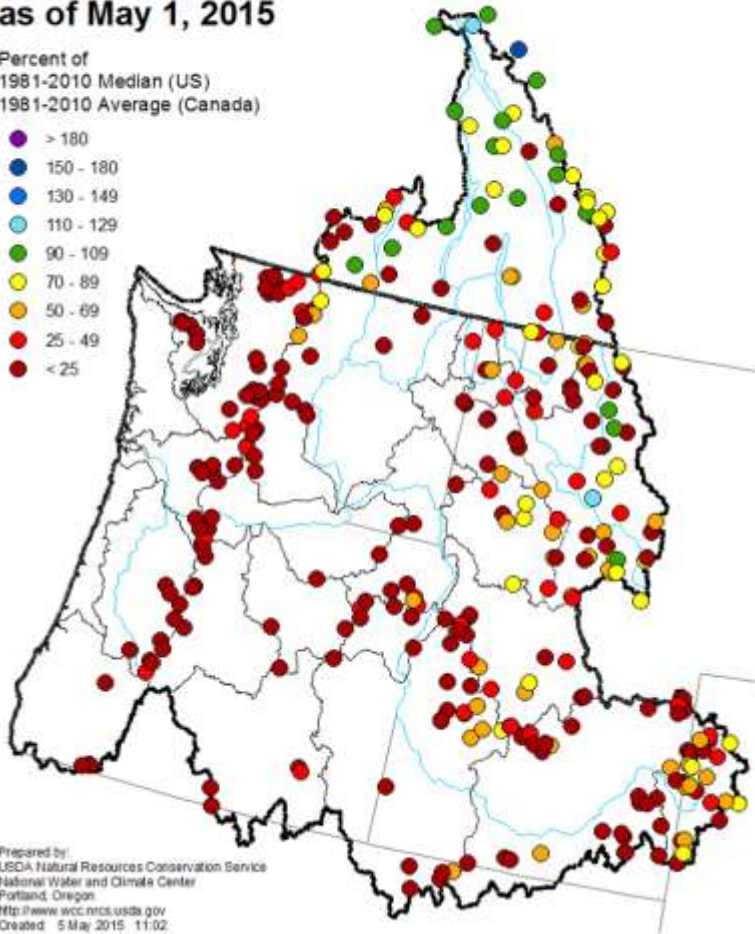
2014-2015 The Blob - warm ocean and river

October 2014

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

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

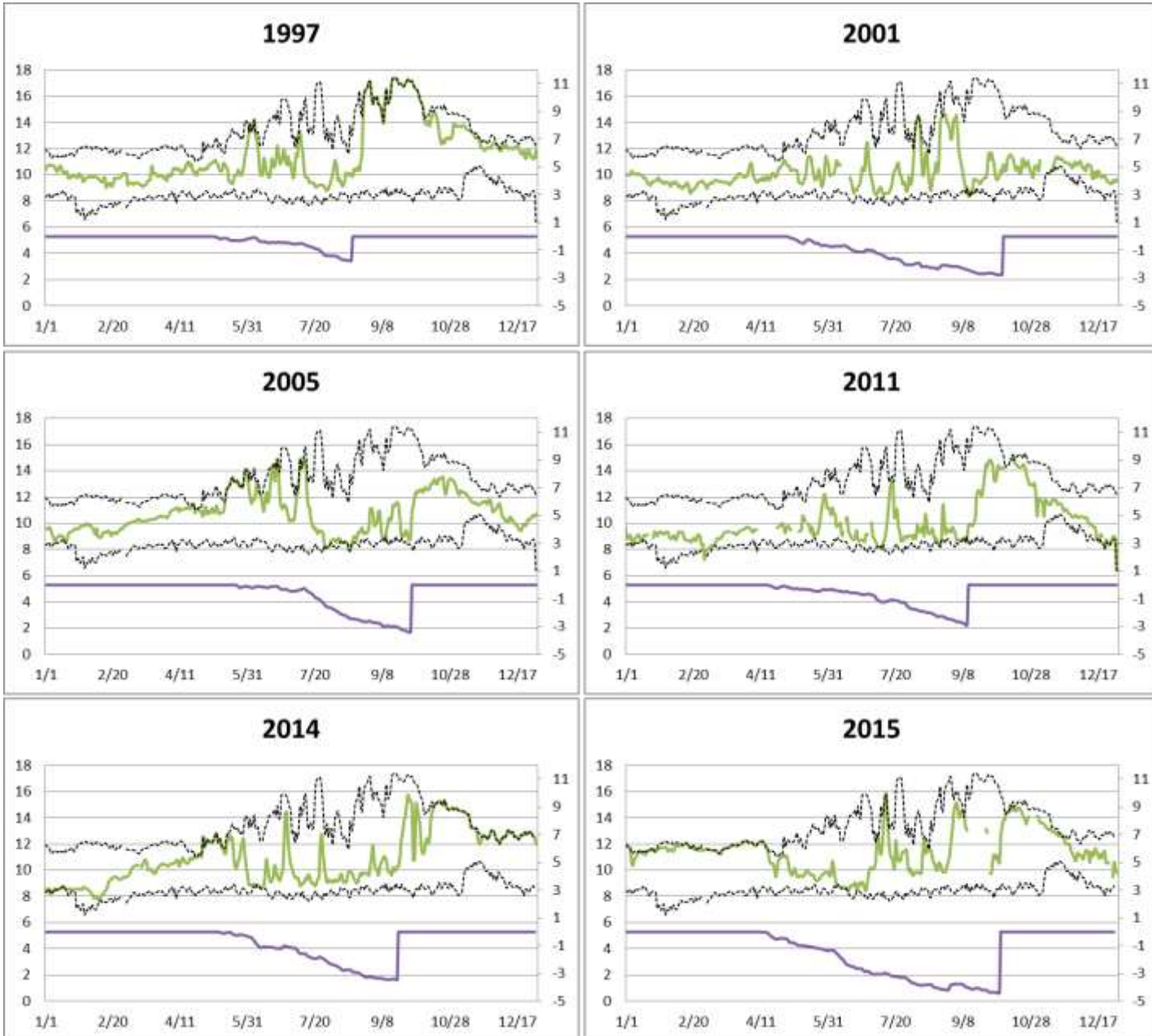
- > 180
- 150 - 180
- 130 - 149
- 110 - 129
- 90 - 109
- 70 - 89
- 50 - 69
- 25 - 49
- < 25



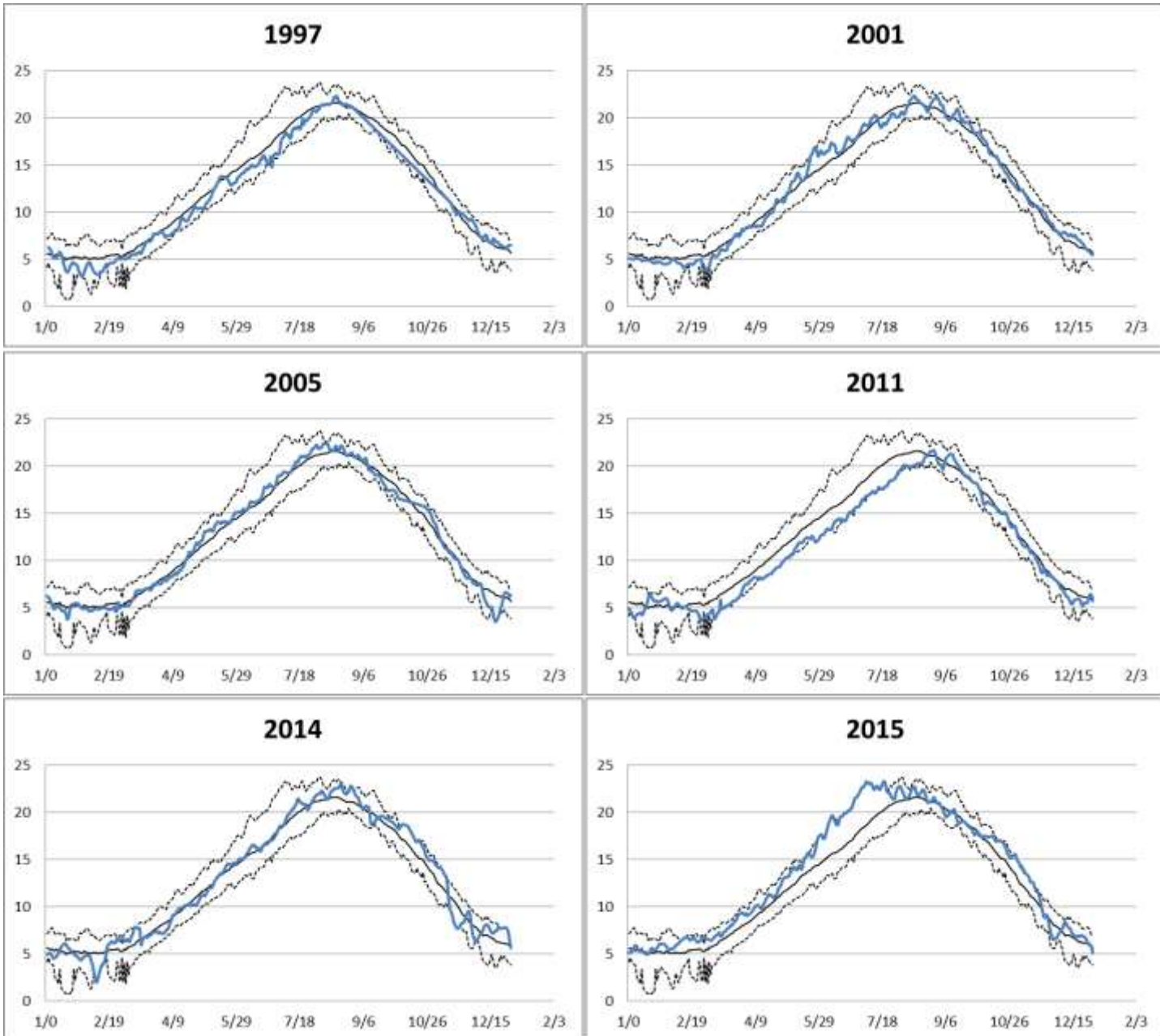
Prepared by:
USDA Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
<http://www.wcc.nrcs.usda.gov>
Created: 5 May 2015 11:02



Estuary – Ocean temperature



Main-stem River temperature



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 |

Table Headings

Heading descriptions:

EOT-US: # days during upwelling season (May-Sept) the estuary-ocean temp was > 1 STD warmer than average for 1997-2015

EOT-DS: # days during downwelling season (Oct-Apr) the estuary-ocean temp was > 1 STD warmer than average for 1997-2015

Upwelling: a measure of seasonal upwelling inferred from cumulative wind stress on Oregon coast (1985-2015) (Pierce and Barth)

R-temp: # days that the river temp was >19 C May –Sep (data 1992-2015)

Freshet: cumulative river discharge ($\text{m}^3 \times 10^{10}$) for May – Aug (1964-2015)

April CRB SWE: % of median (1981-2010) snow water equivalent across all Columbia River sub-basins (1981-2010)

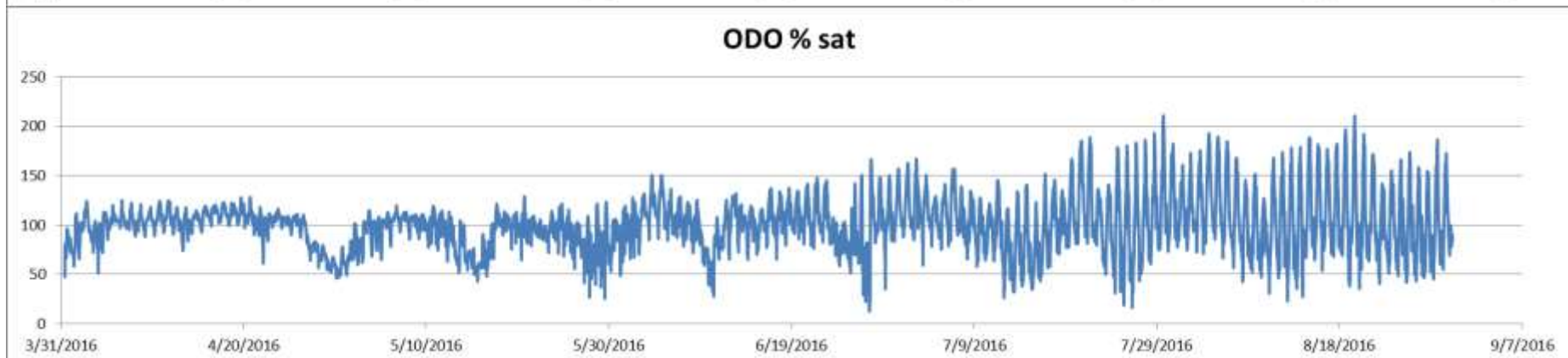
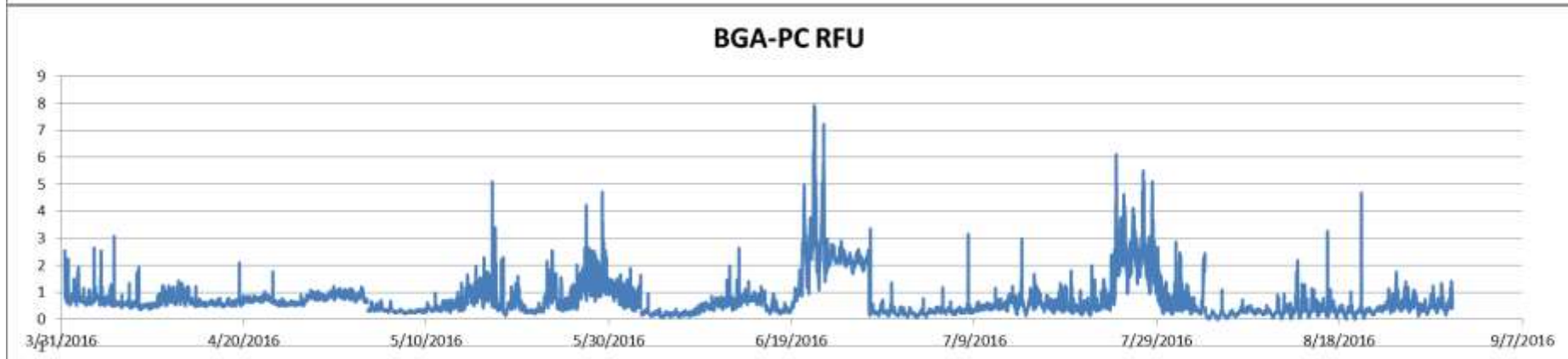
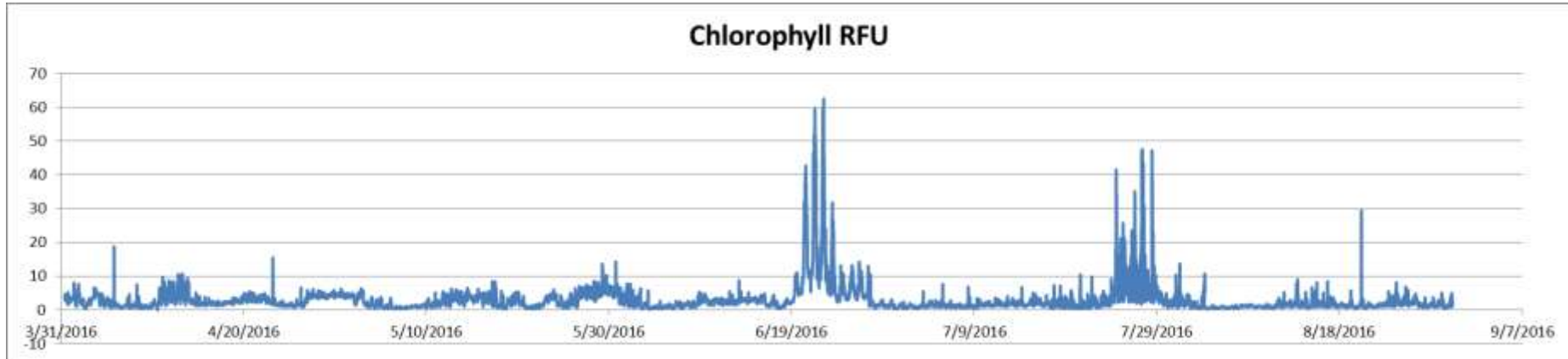
April CRB Precip: % of median (1981-2010) cumulative precipitation across all Columbia River sub-basins

PDX air: # of days daily minimum air temperature > 58 F (1981-2015)

Sonde Data

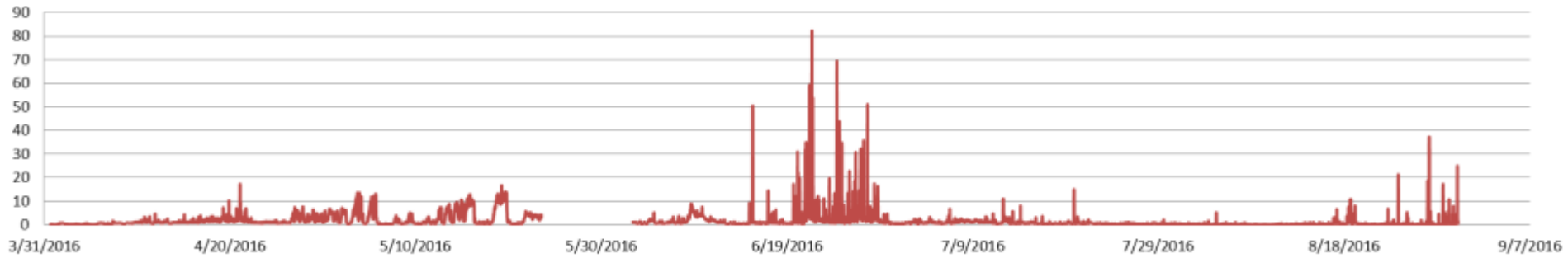


Campbell 2016

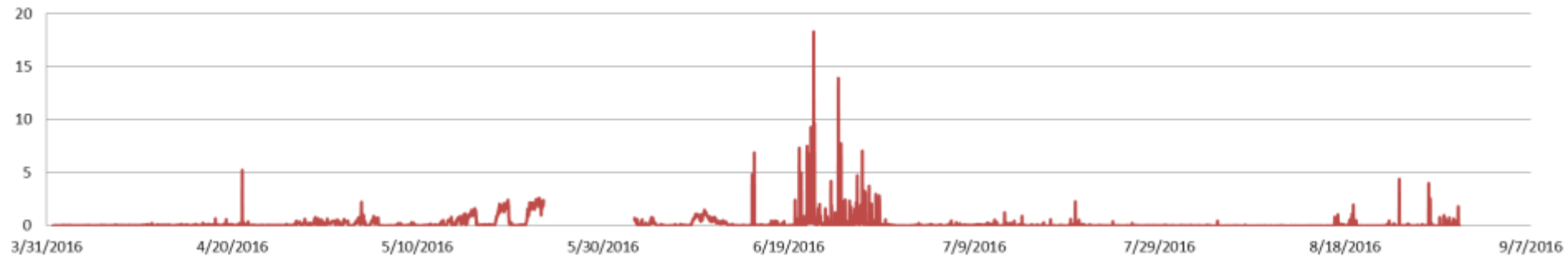


Franz 2016

Chlorophyll RFU



BGA-PC RFU

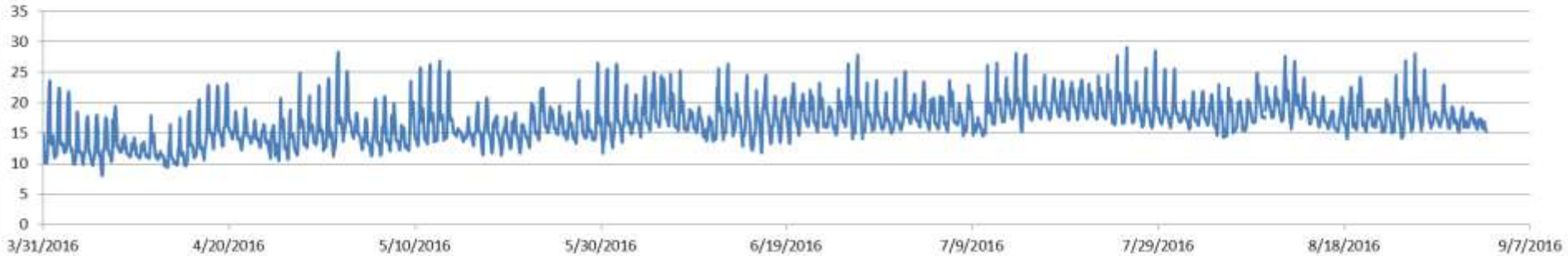


ODO % sat



Ilwaco 2016

Temp



Salinity



ODOsat

