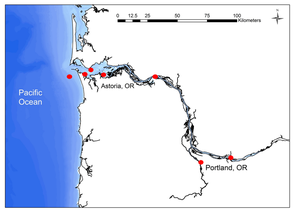
Observations of Biogeochemical Conditions in the Columbia River Estuary Associated with the 2014-2015 North Pacific Temperature Anomaly

Joseph A. Needoba*, Tawnya D. Peterson, Sarah Riseman, Michael Wilkin, and António M. Baptista

OHSU Institute of Environmental Health, Portland, Oregon *email: needobaj@ohsu.edu

Summary

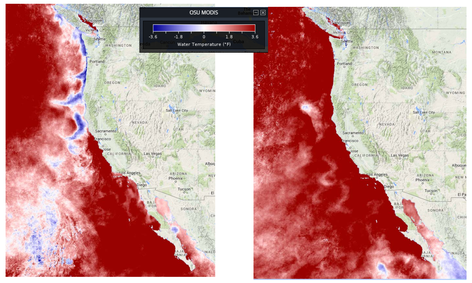
- Water masses from 'the Blob' were detected in the Columbia River estuary on multiple occasions in 2014 and 2015.
- Coastal upwelling forced the Blob offshore during the upwelling season.
- Low Columbia Basin snowpack levels in 2015 led to very warm river temperatures during spring and summer 2015.



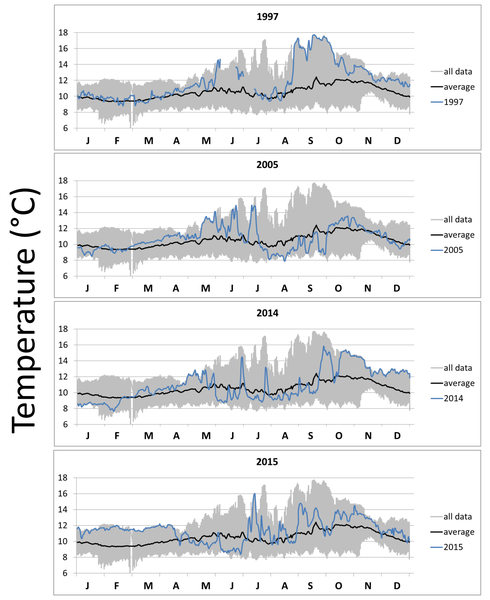
Right: Locations of in situ observatory platforms operated by the NSF Science and Technology Center for Coastal Margin Observation and Prediction (CMOP). Data presented in this poster is available at www.stccmop.org. Additional temperature and discharge data from USGS waterdata.usgs.gov/usa/nwis/uv?site_no=14246900

Ocean Temperature

Nearshore ocean water transported into the estuary was indicative of regional coastal ocean conditions and was dominated by upwelling in 2014 and 2015. When upwelling winds relaxed, waters originating from the blob were transported into the estuary.

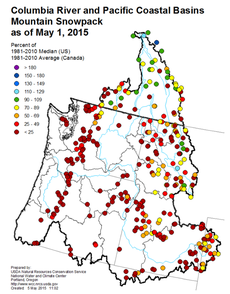


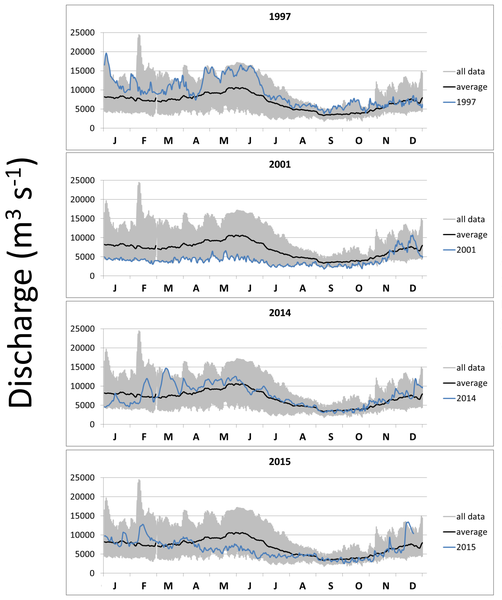
Above: MODIS satellite images of sea surface temperature anomalies in August 2014 (left and October 2014 (right). From http://nvs.nanoos.org/Climatology.
Right: Water temperature measured at high tide inside the mouth of the Columbia River (CMOP station Jetty A). Date range 1997 – 2015.



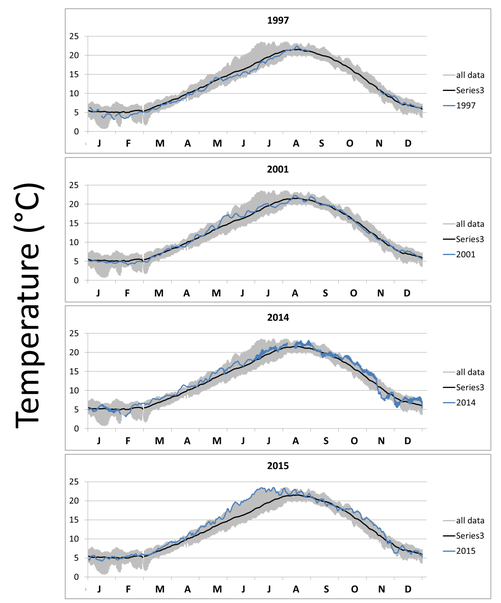
River Flow and Temperature

Low discharge and high river temperatures persisted during the summer of 2015 as a result of low winter snowpack and subsequent low freshwater inputs to the estuary.





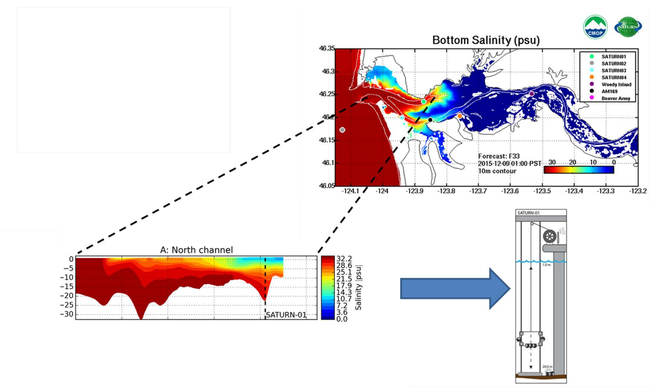
Left: Columbia River discharge at Beaver Army Terminal (USGS 14246900). Date range: 1996 – 2015. Source: waterdata.usgs.gove



Left: Columbia River temperature. Date range: 1993 – 2003, and 2009 – 2015. Source: waterdata.usgs.gov and www.stccmop.org

Estuarine Temperature, Dissolved O_2, and Nitrate

Biogeochemical observations from observatory platforms within the estuary demonstrated that warm, low nutrient seawater was transported into the estuary in September 2014 when upwelling winds diminished. Warm water persisted intermittently through April 2015. In May 2015 coastal upwelling resulted in the replacement of these warm waters with colder, nutrient replete waters. Intermittent intrusion of warm waters continued through fall 2015.



Above: Model output of salinity in the Columbia River estuary and the location of a vertical profiling platform that records biogeochemical observations in the salt water region of the North Channel.
http://www.stccmop.org/datamart/virtualcolumbiariver/forecasts