

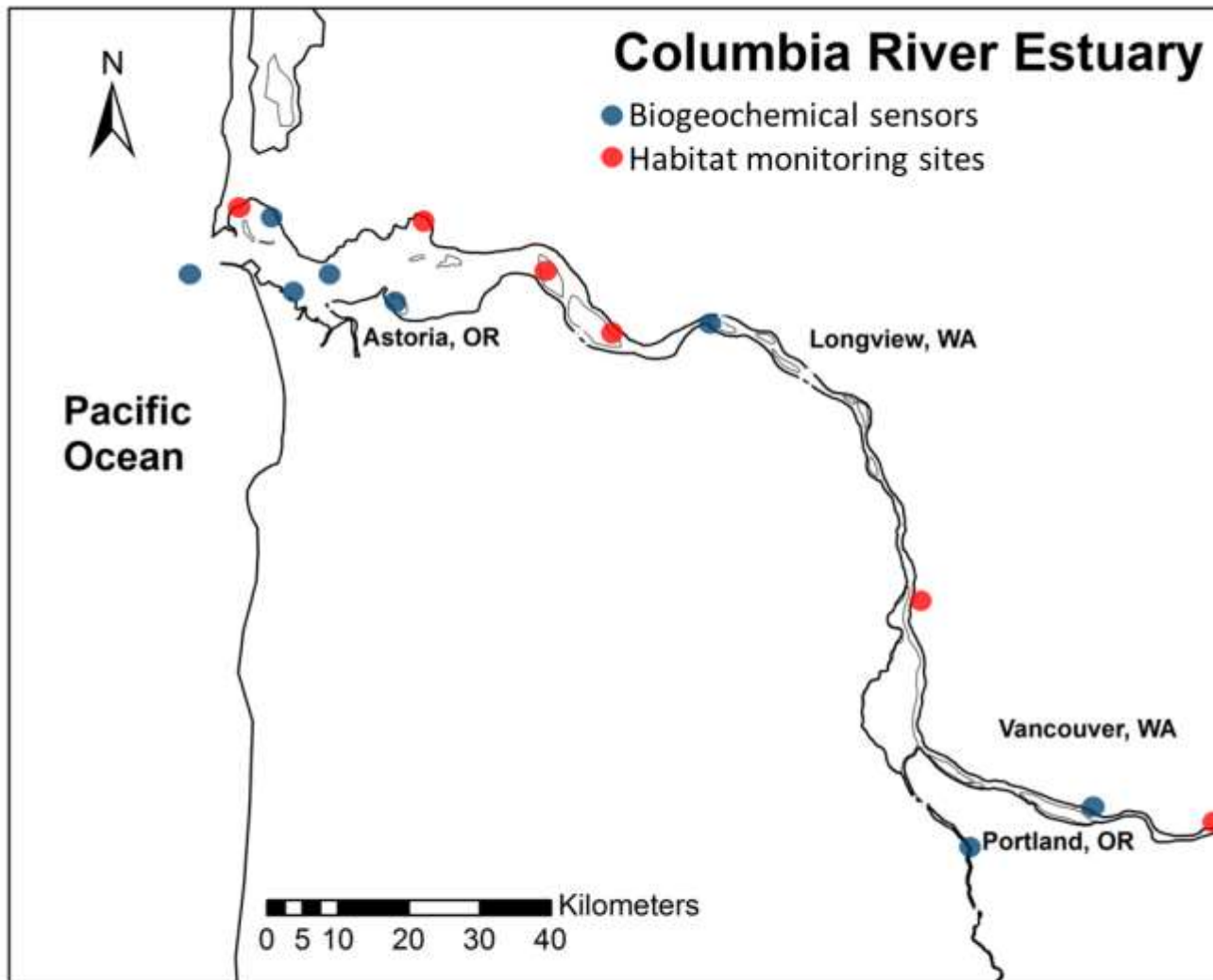
Instream Conditions for Mainstem and Off-channel Habitats

Joe Needoba

OHSU-PSU School of Public Health

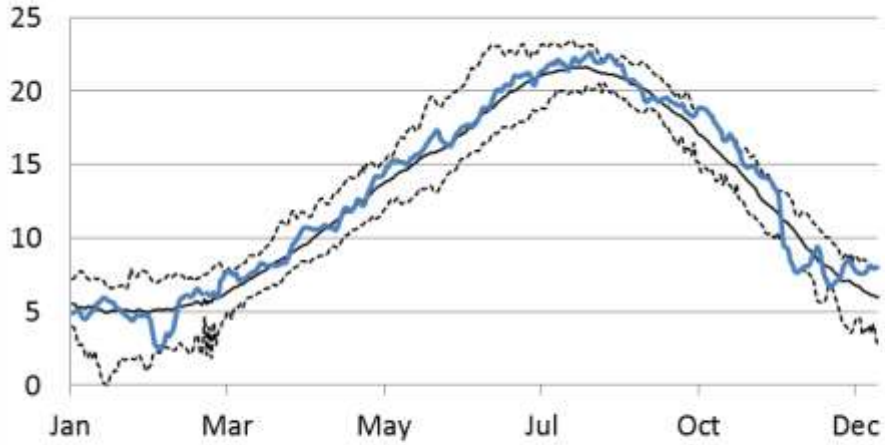
Sept 26, 2017

Sensor Networks in the Columbia River estuary

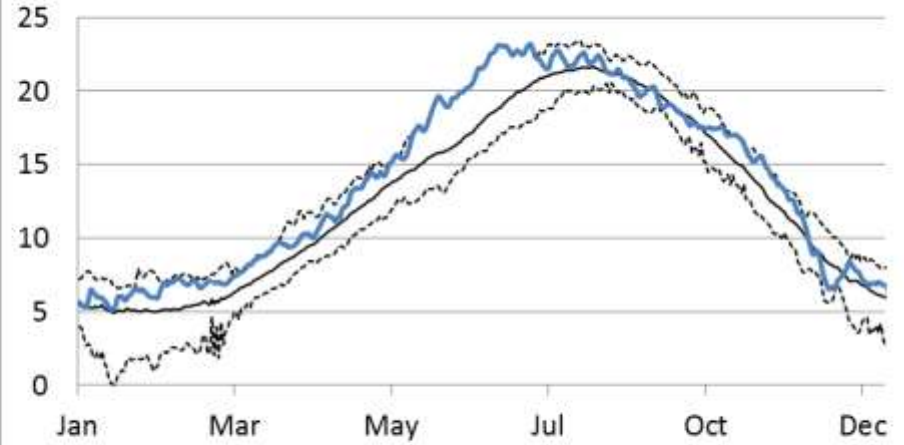


Mainstem Temperature

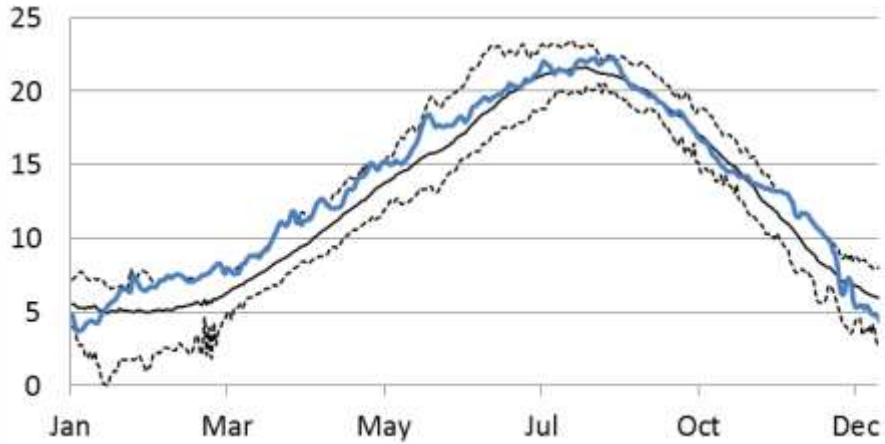
2014



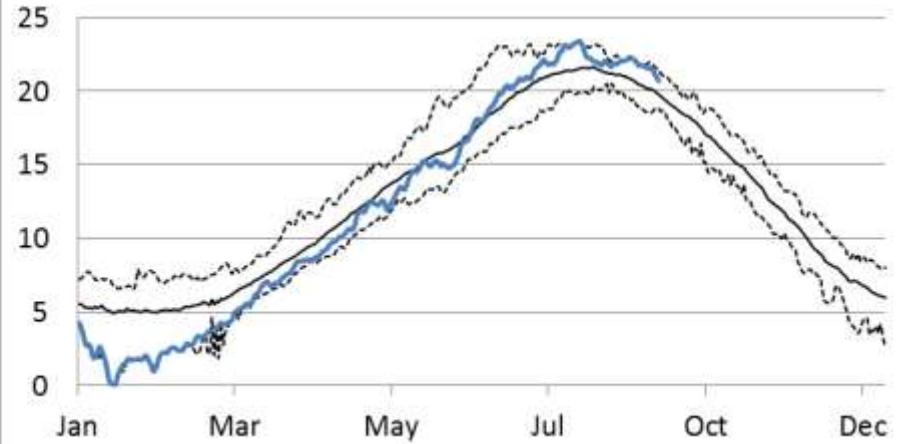
2015



2016

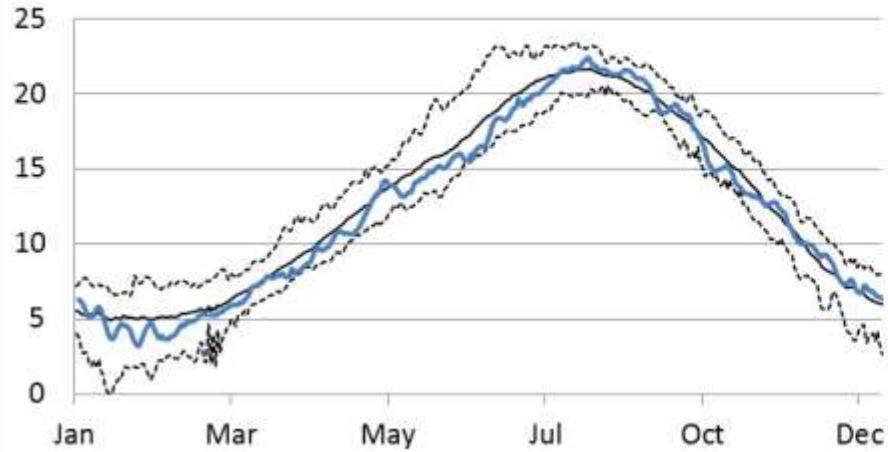


2017

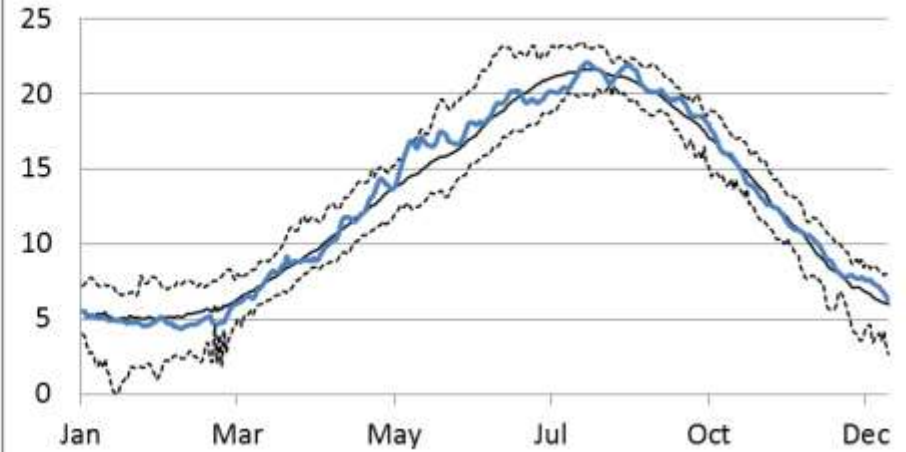


Mainstem Temperature

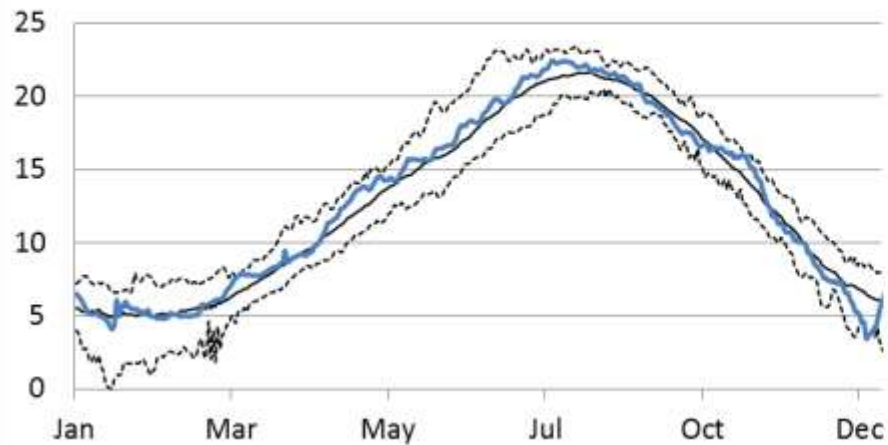
1997



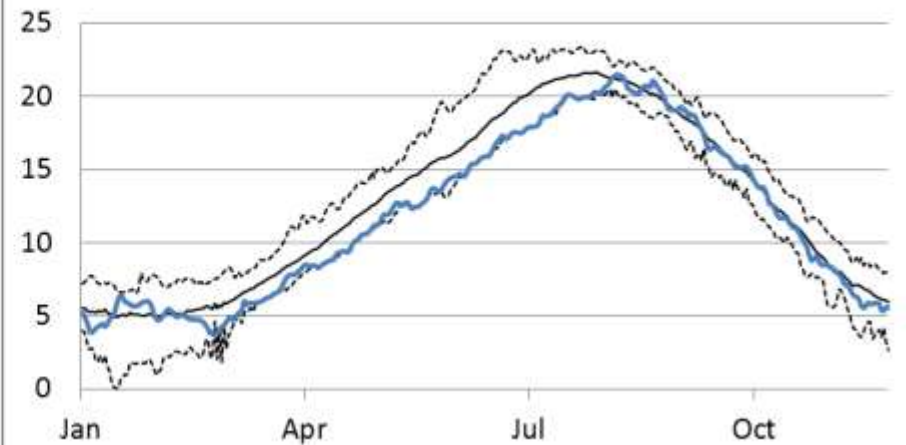
2001



2005

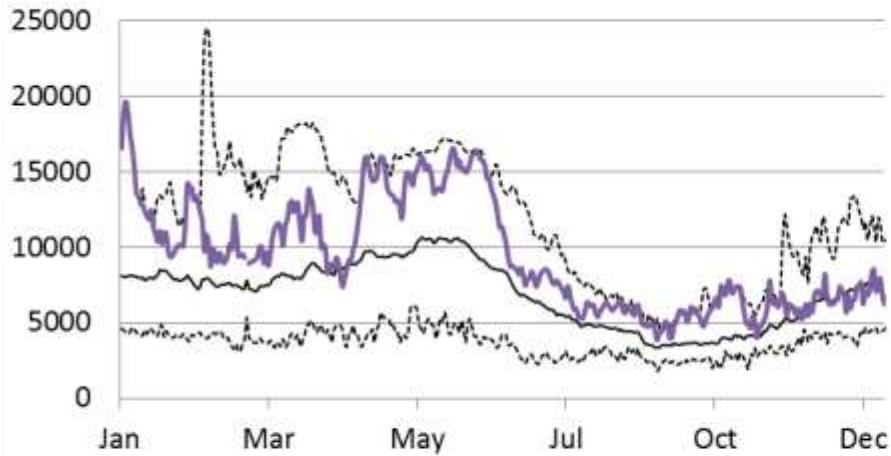


2011

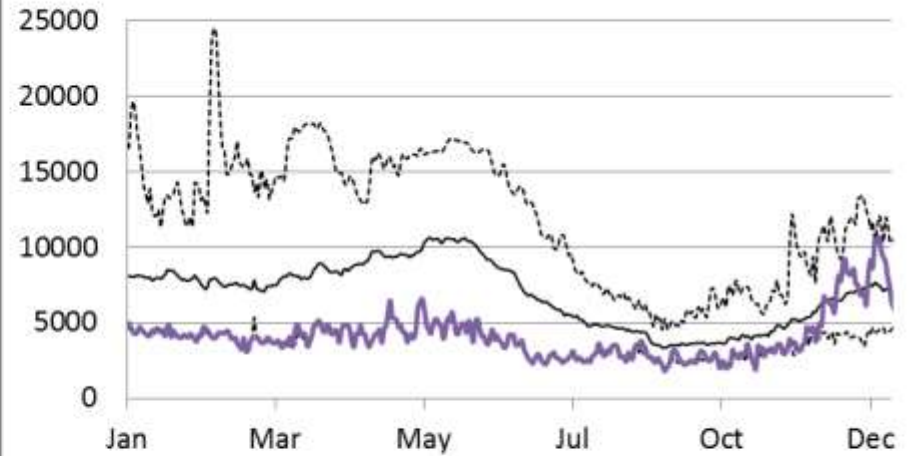


River Discharge at BAT

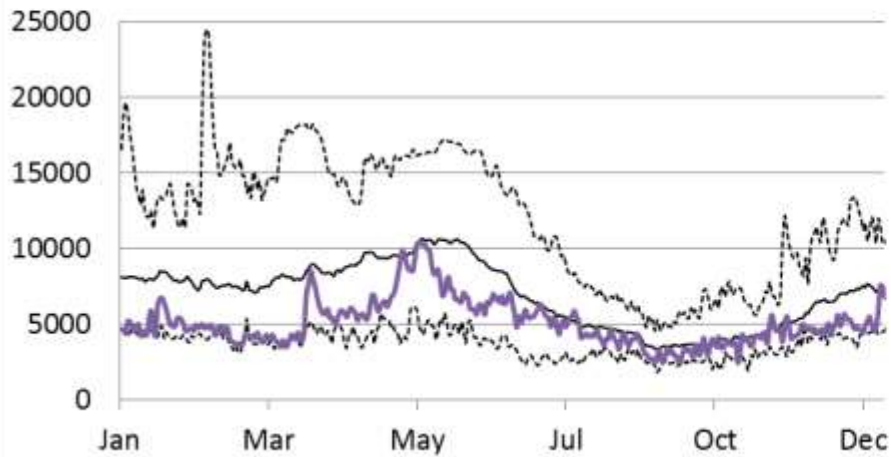
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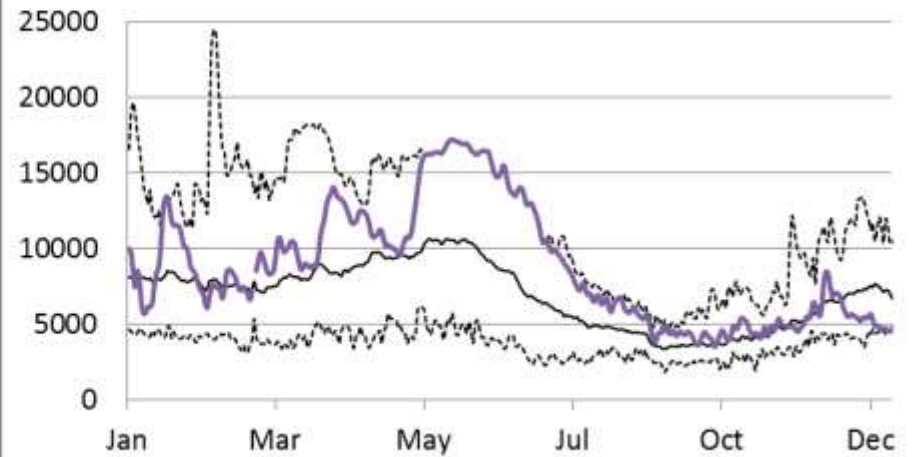
2001



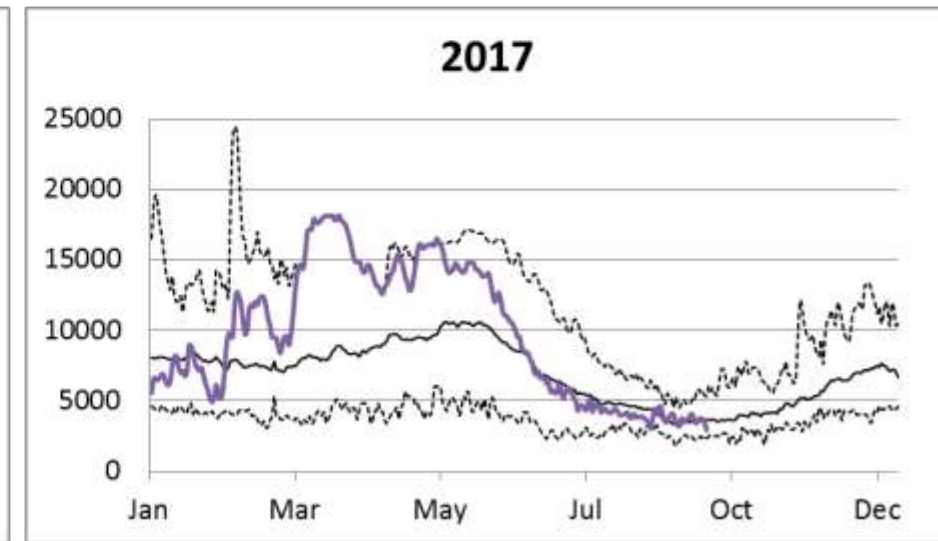
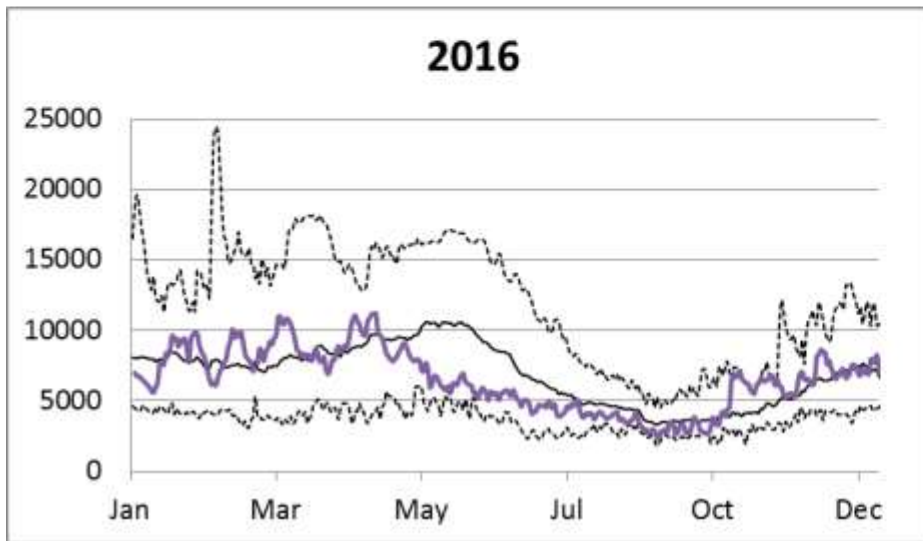
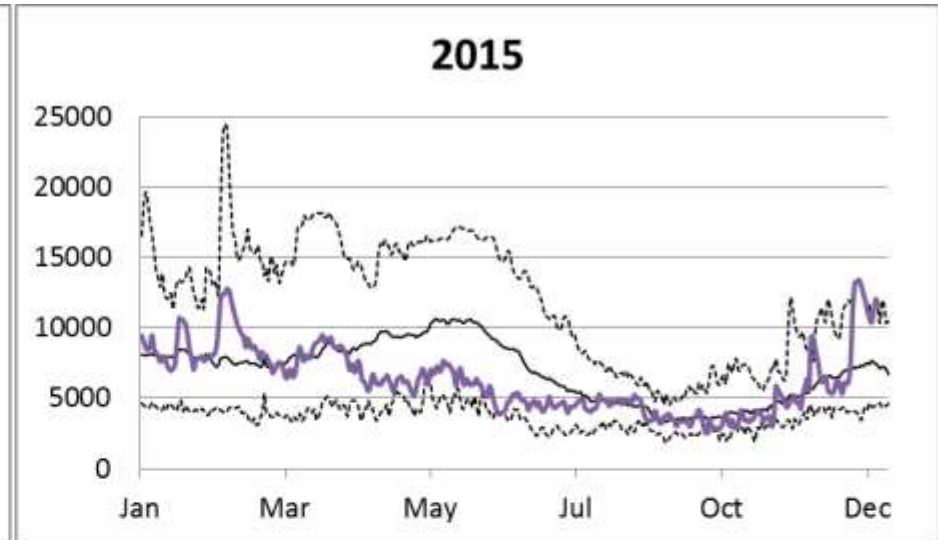
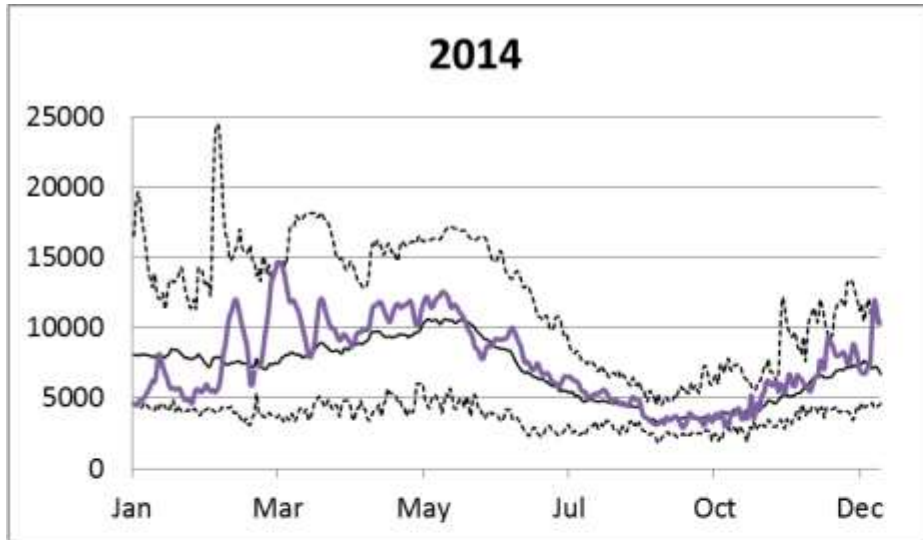
2005



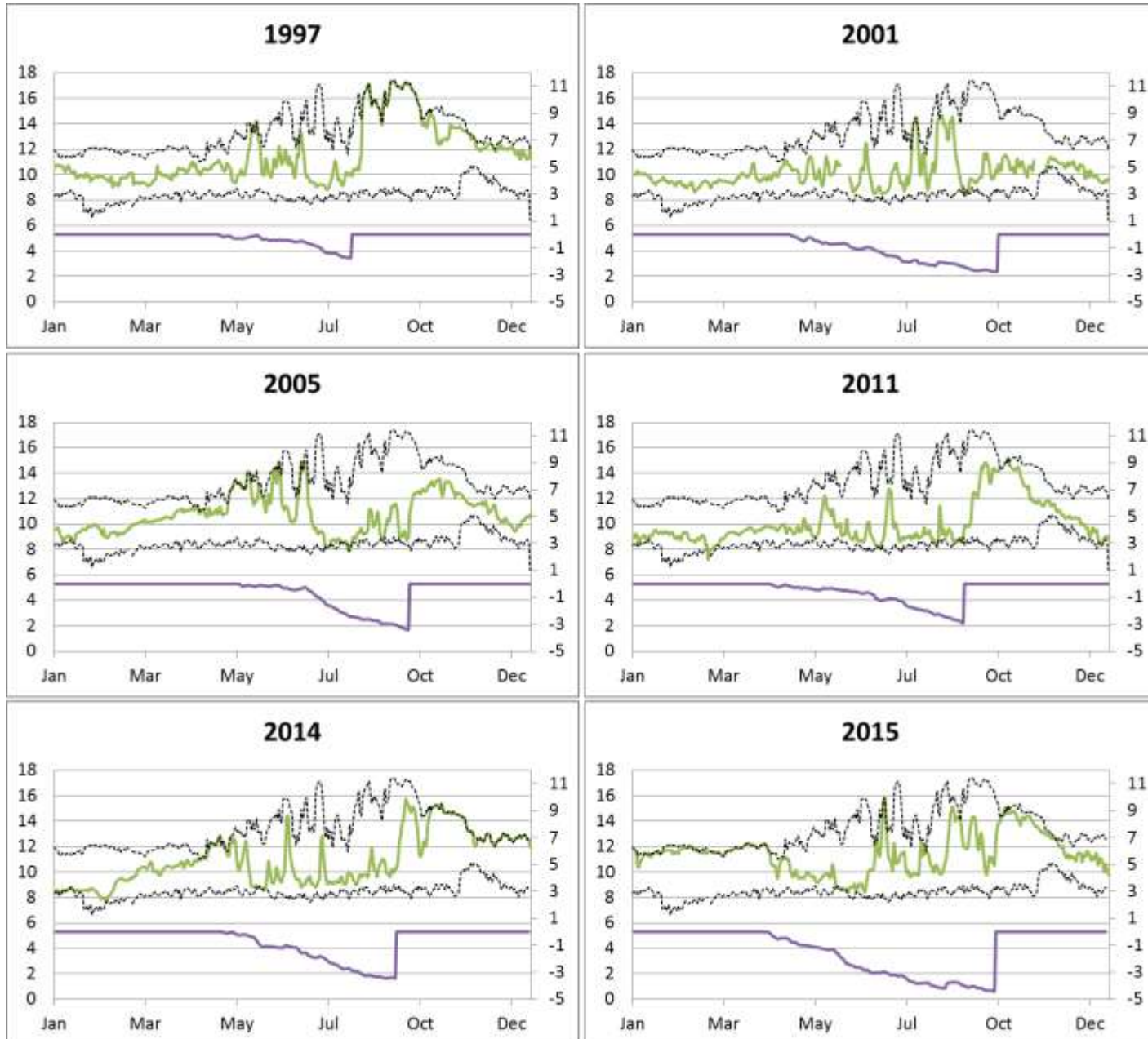
2011



River Discharge at BAT



Estuary-Ocean Temperature and Cumulative Upwelling



Water temperature and related variable metrics

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 average river temp was >19 °C between May –Sept (data 1992-2017)

Freshet: cumulative river discharge ($\text{m}^3 \times 10^{10}$) for May – Aug (1964-2017) (Bonneville Dam)

April CRB SWE: % of median (1981-2010) snow water equivalent across all Columbia River sub-basins (1981-2010) (National water and climate center, USDA)

April CRB Precip: % of median (1981-2010) cumulative precipitation across all Columbia River sub-basins (National water and climate center, USDA)

PDX air: # of days daily minimum air temperature > 58 °F (1981-2017) (www.ncdc.noaa.gov)

Variables related to water temperature

Year	EOT-US	EOT-DS	Upwelling	R-Temp	Freshet	CRB SWE	CRB Precip	PDX air temp
Avg	24 ± 13	25 ± 36	-3.0 ± 0.8	76 ± 12	7.0 ± 2.0	105 ± 29	102 ± 19	37 ± 14
1997	54 (2.3)	56 (0.9)	-1.7 (1.5)	69 (-0.5)	10.7 (1.9)	163 (2.0)	147 (2.4)	52 (1.07)
1998	13 (-0.8)	90 (1.8)	-3.0 (-0.0)	85 (0.76)	7.5 (0.3)	99 (-0.1)	94 (-0.3)	48 (0.79)
1999	2 (-1.7)	0 (-0.6)	-2.9 (0.0)	58 (-1.4)	8.3 (0.7)	157 (1.8)	128 (1.4)	34 (-0.2)
2000	28 (0.3)	5 (-0.5)	-2.7 (0.3)	81 (0.44)	6.1 (-0.5)	114 (0.4)	102 (0.1)	31 (-0.4)
2001	22 (-0.1)	0 (-0.6)	-2.7 (0.3)	86 (0.85)	3.6 (-1.8)	60 (-1.4)	60 (-2.0)	24 (-0.9)
2002	9 (-1.1)	0 (-0.6)	-3.8 (-1.0)	73 (-0.2)	7.2 (0.1)	126 (0.8)	108 (0.4)	28 (-0.6)
2003	11 (-1.0)	22 (-0.0)	-3.4 (-0.5)	82 (0.52)	6.3 (-0.4)	88 (-0.5)	92 (-0.4)	44 (0.50)
2004	33 (0.7)	1 (-0.6)	-1.7 (1.5)	81 (0.44)	6.1 (-0.5)	95 (-0.3)	93 (-0.3)	51 (1.00)
2005	42 (1.4)	23 (-0.0)	-3.3 (-0.5)	79 (0.27)	5.6 (-0.7)	59 (-1.5)	72 (-1.4)	38 (0.07)
2006	23 (-0.1)	0 (-0.6)	-5.1 (-2.7)	77 (0.11)	7.4 (0.2)	135 (1.1)	118 (0.9)	33 (-0.2)
2007	35 (0.8)	3 (-0.6)	-3.0 (-0.0)	77 (0.11)	6.1 (-0.5)	83 (-0.7)	103 (0.1)	40 (0.21)
2008	13 (-0.8)	7 (-0.4)	-3.6 (-0.8)	72 (-0.2)	7.7 (0.4)	141 (1.3)	113 (0.6)	36 (-0.0)
2009	20 (-0.3)	0 (-0.6)	-2.8 (0.1)	85 (0.76)	6.3 (-0.3)	112 (0.3)	99 (-0.0)	54 (1.22)
2010	23 (-0.1)	18 (-0.1)	-2.7 (0.3)	47 (-2.3)	6.3 (-0.4)	77 (-0.9)	77 (-1.1)	27 (-0.7)
2011	13 (-0.8)	26 (0.0)	-2.9 (0.1)	59 (-1.3)	10.4 (1.7)	130 (0.9)	121 (1.1)	38 (0.07)
2012	15 (-0.7)	0 (-0.6)	-3.2 (-0.3)	59 (-1.3)	9.2 (1.2)	119 (0.5)	109 (0.5)	38 (0.07)
2013	42 (1.4)	14 (-0.2)	-2.9 (0.1)	84 (0.68)	6.7 (-0.1)	88 (-0.5)	96 (-0.2)	57 (1.43)
2014	31 (0.5)	73 (1.3)	-3.4 (-0.5)	86 (0.85)	7.3 (0.1)	103 (-0.0)	97 (-0.1)	60 (1.65)
2015	33 (0.7)	134 (3.0)	-4.4 (-1.7)	102 (2.15)	4.7 (-1.1)	44 (-2.0)	92 (-0.4)	66 (2.08)
2016	n/a	n/a	-3.6	85 (0.72)	5.5 (-0.7)	105 (0.03)	114 (0.61)	49 (0.86)
2017	n/a	n/a	-3.5	78 (0.15)	8.7 (0.9)	120 (0.55)	138 (1.85)	45 (0.57)

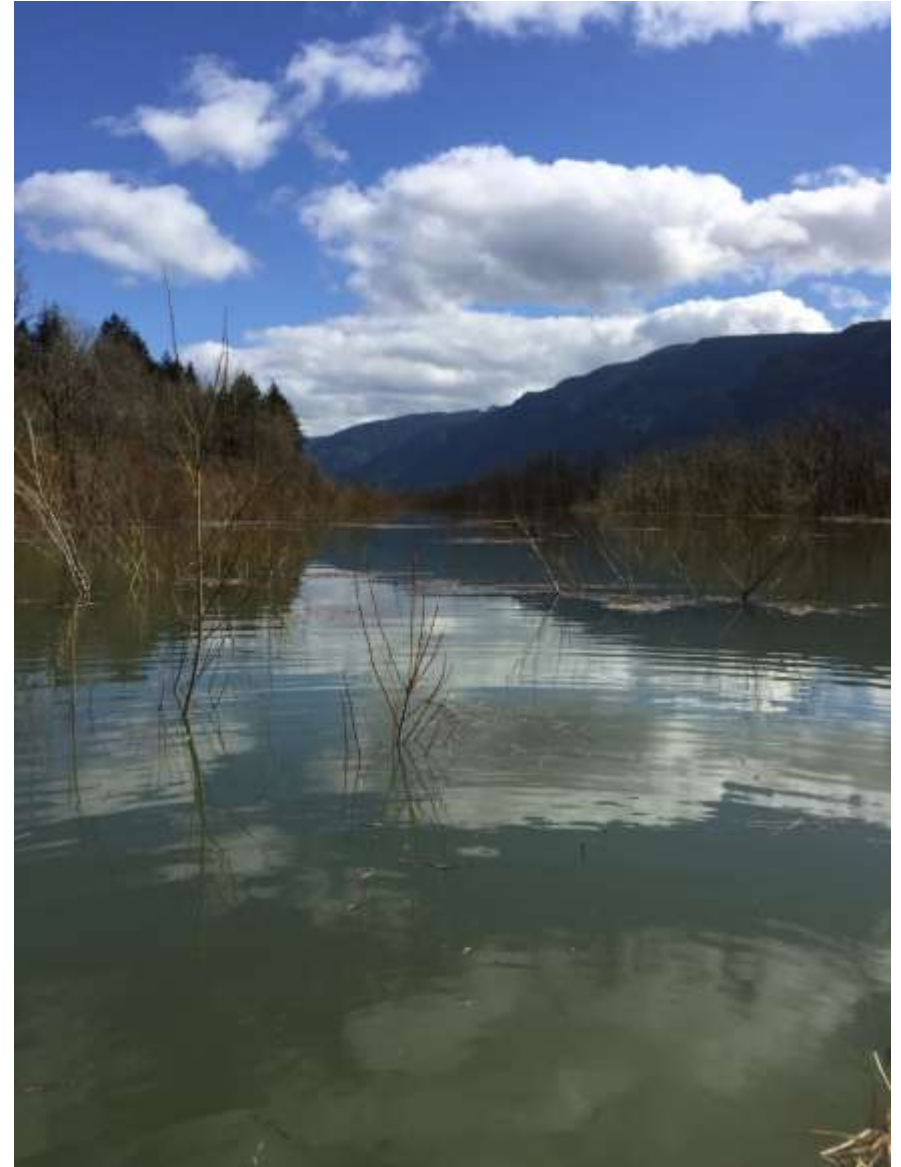
 Record year
 Runner up

} 2015 ranked high in 5 of 8 categories

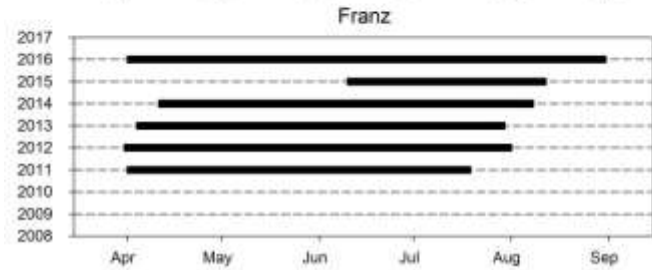
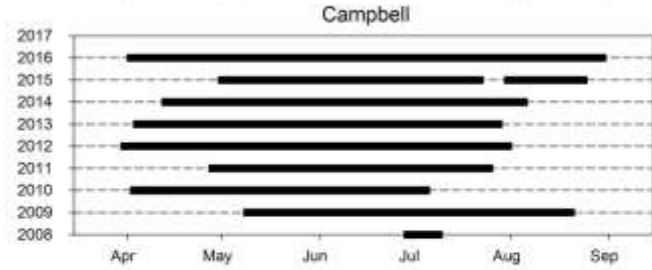
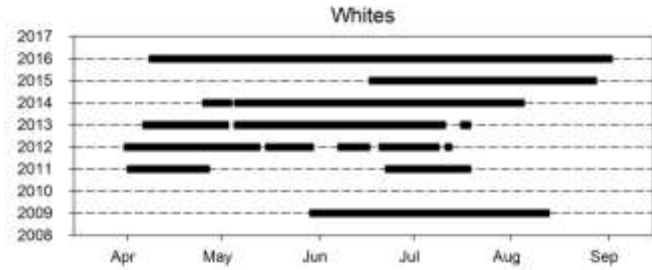
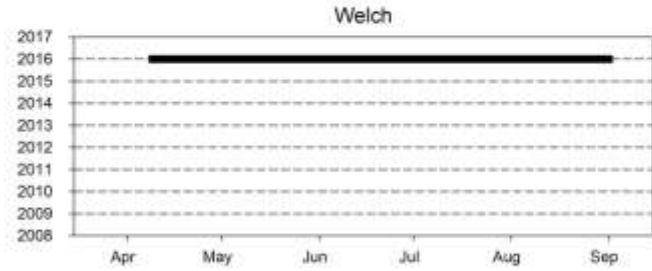
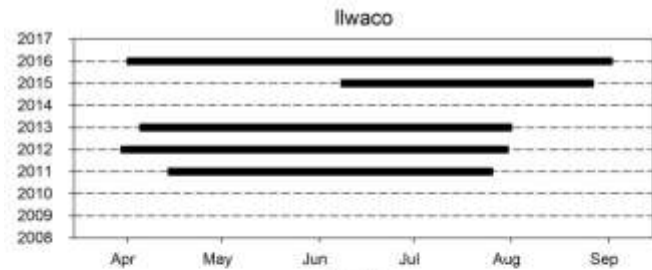
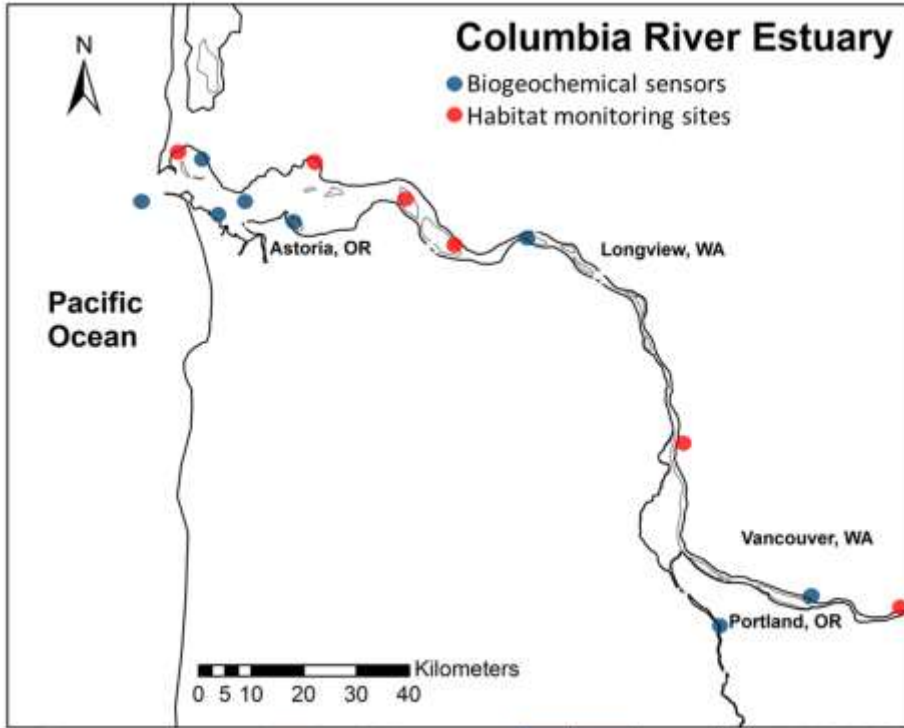
Off-channel habitats 2015 vs 2017



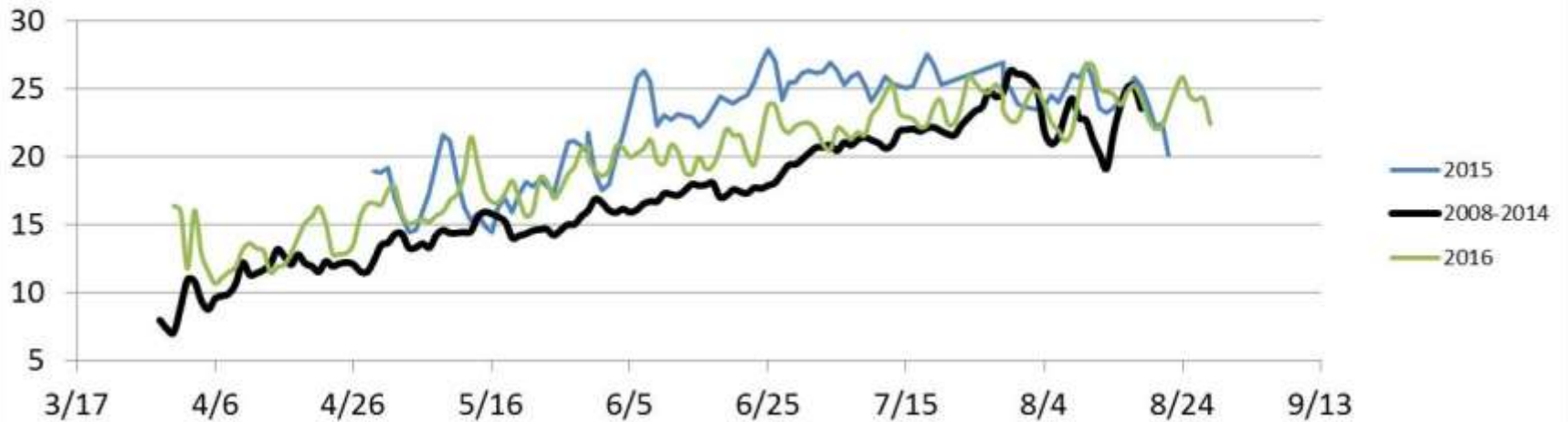
Off-channel habitats 2015-2017



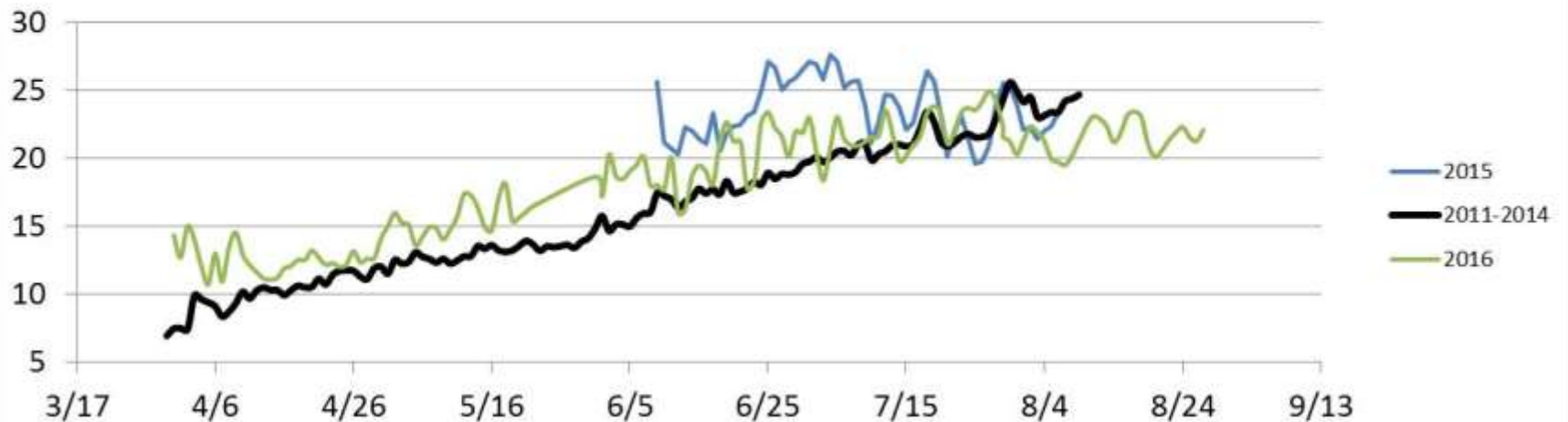
Water quality time series data from off-channel sites



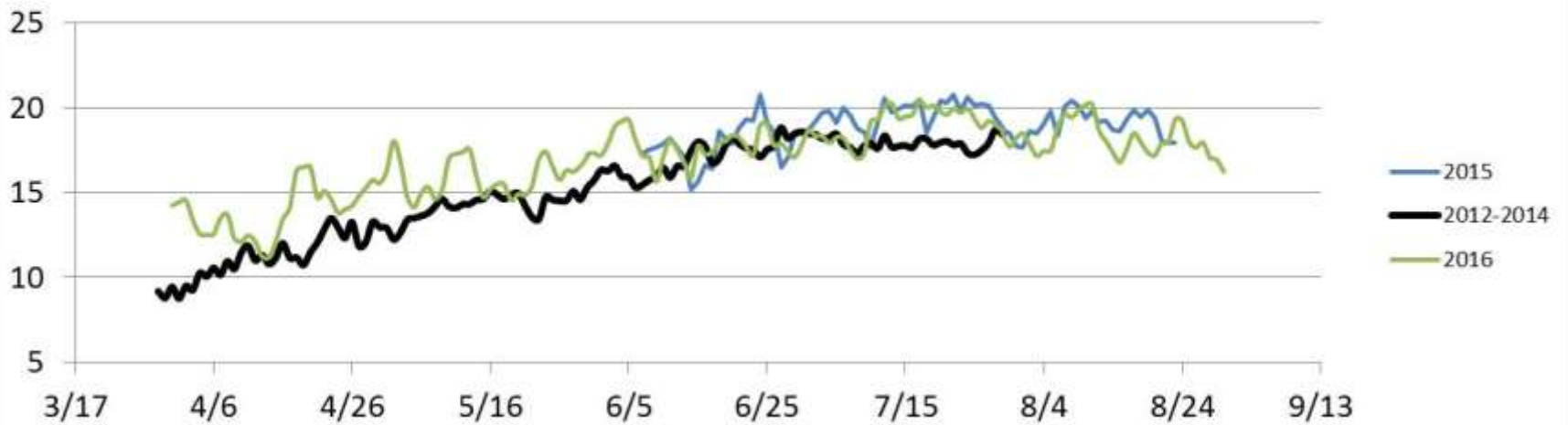
Campbell - Daily Avg Temp (°C)



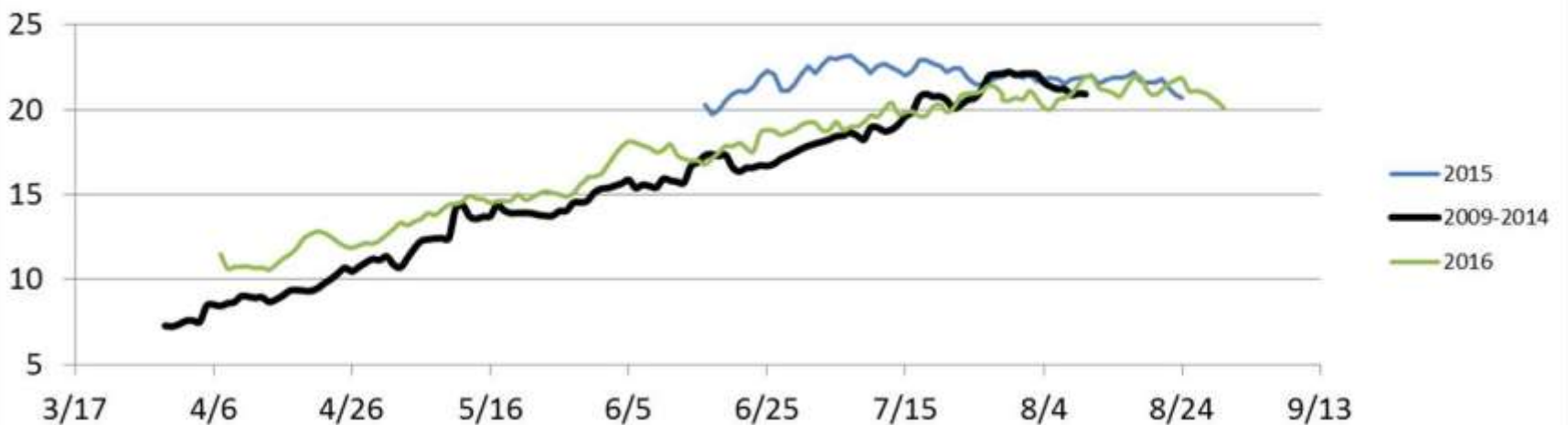
Franz - Daily Avg Temp (°C)



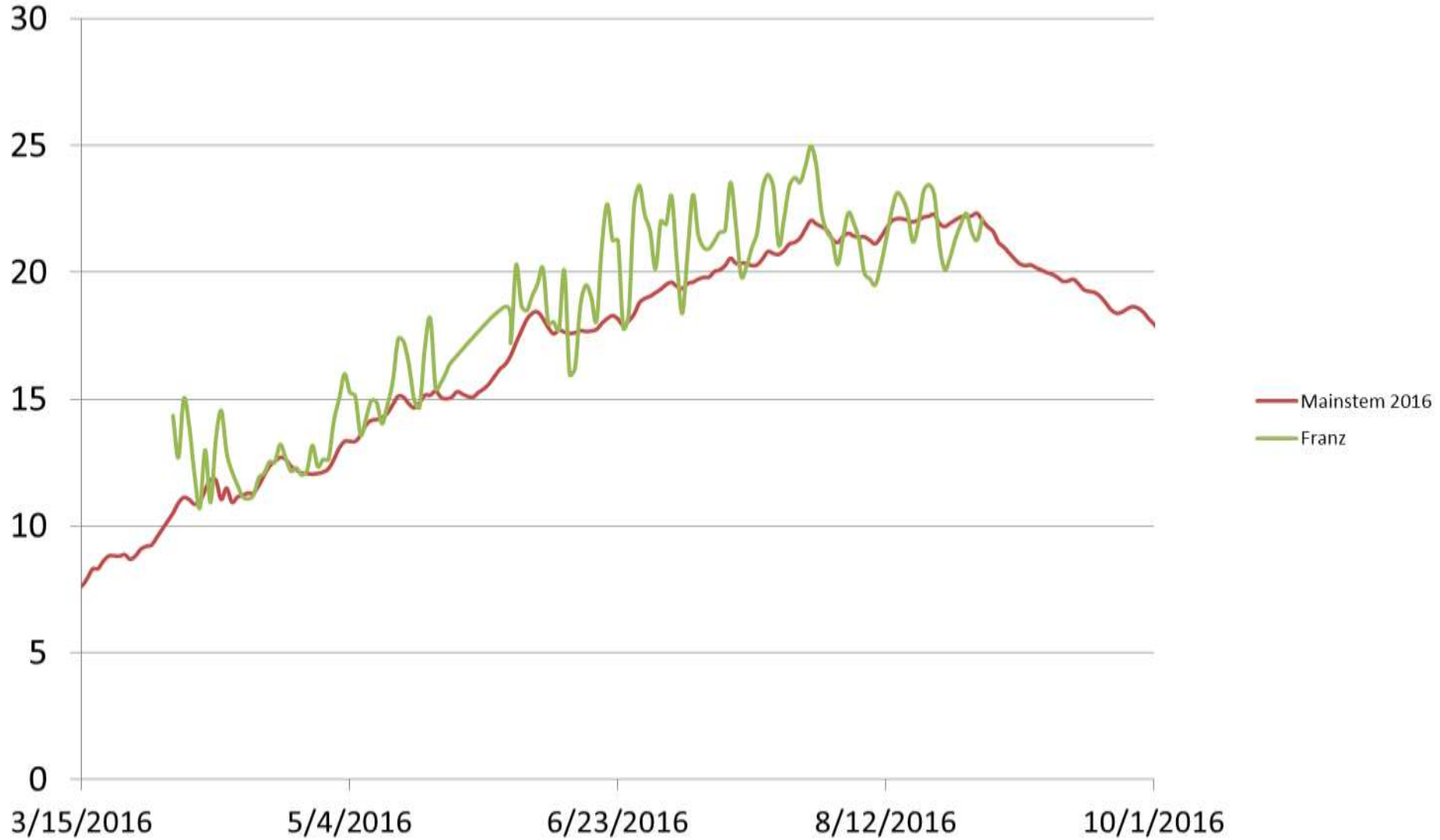
Ilwaco - Daily Avg Temp (°C)



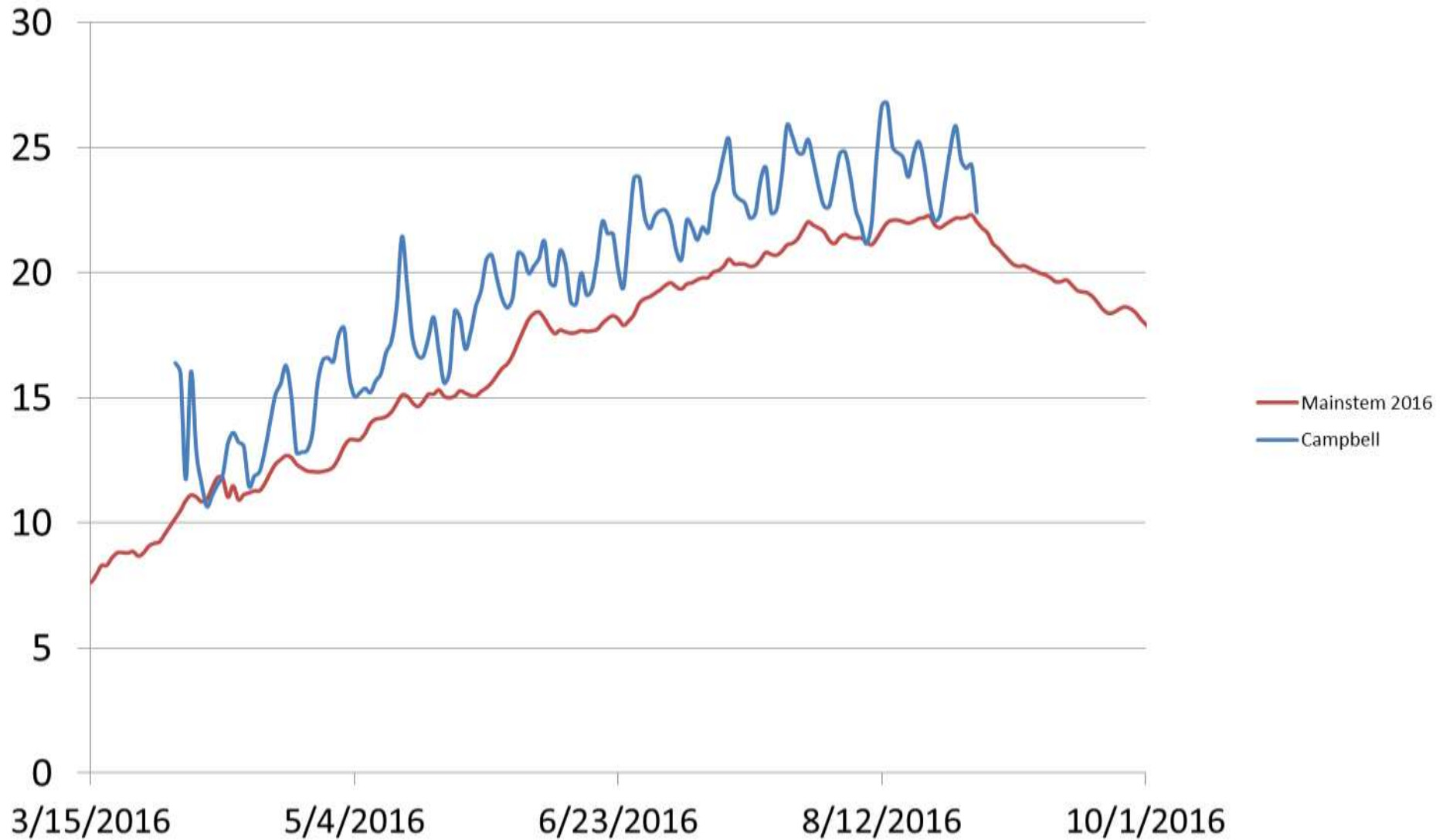
Whites - Daily Avg Temp (°C)



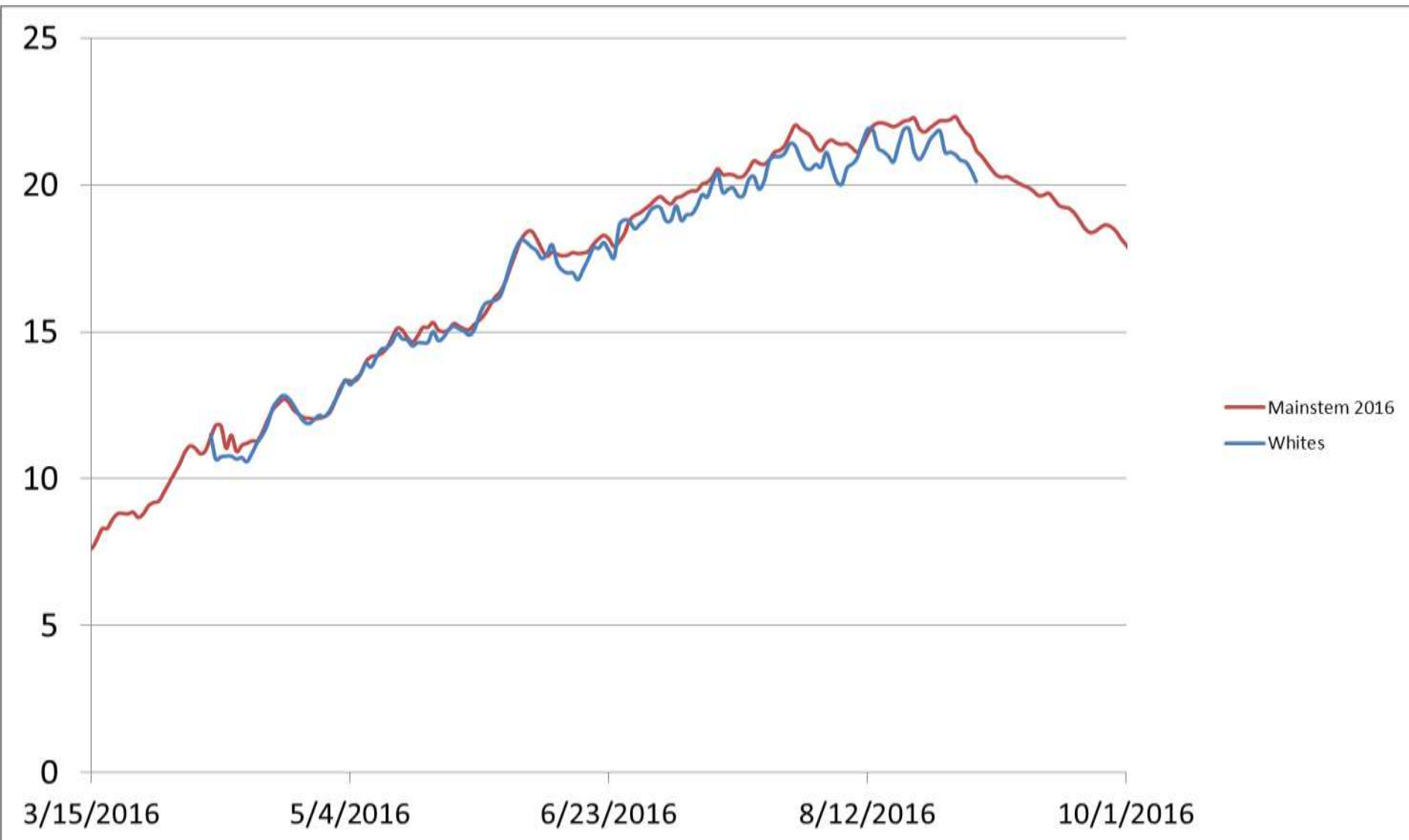
2016 Temperature comparison: Franz - Mainstem



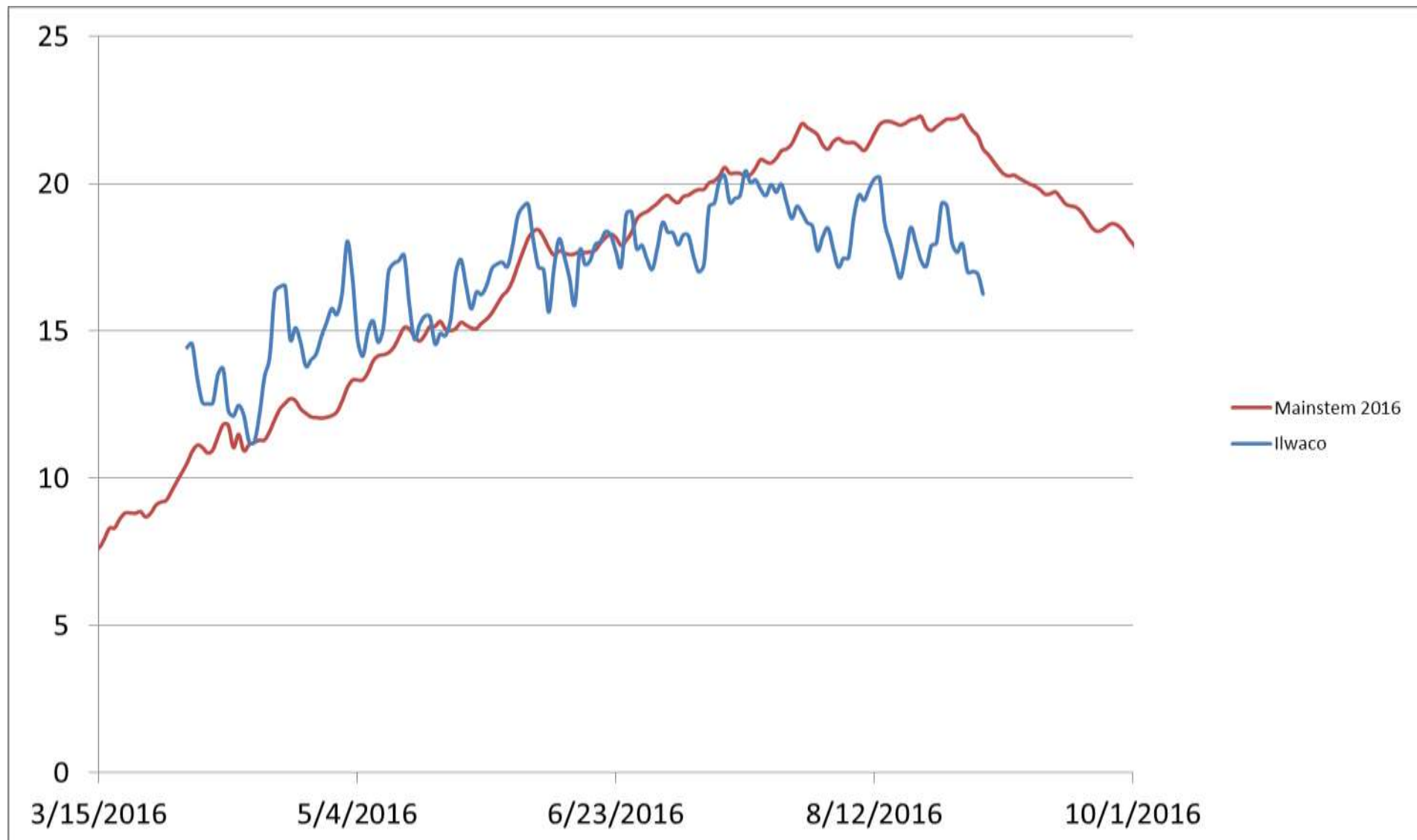
2016 Temperature comparison: Campbell - Mainstem



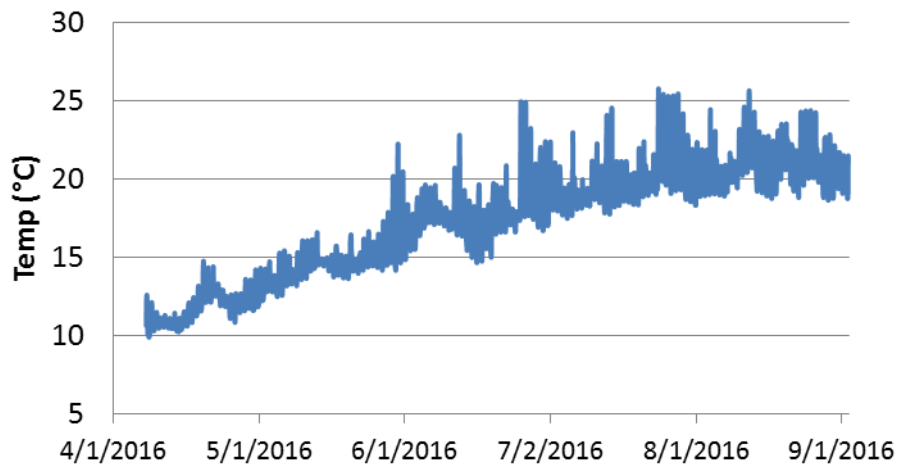
2016 Temperature comparison: Whites - Mainstem



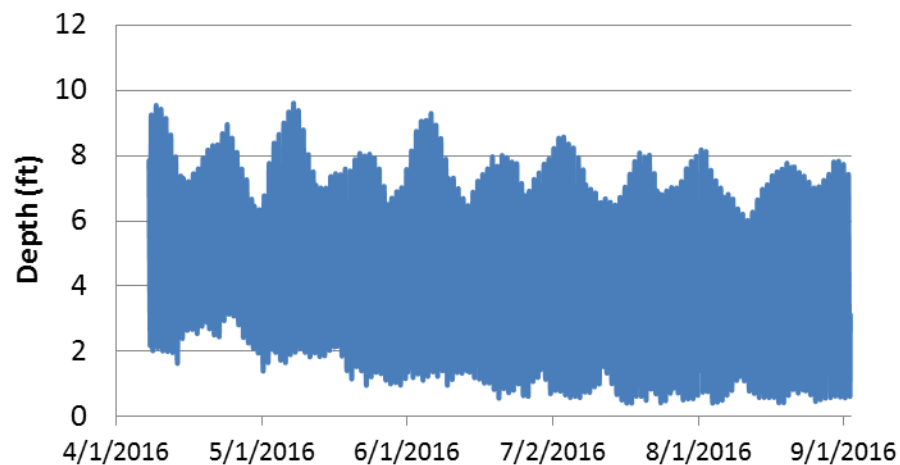
2016 Temperature comparison: Ilwaco - Mainstem



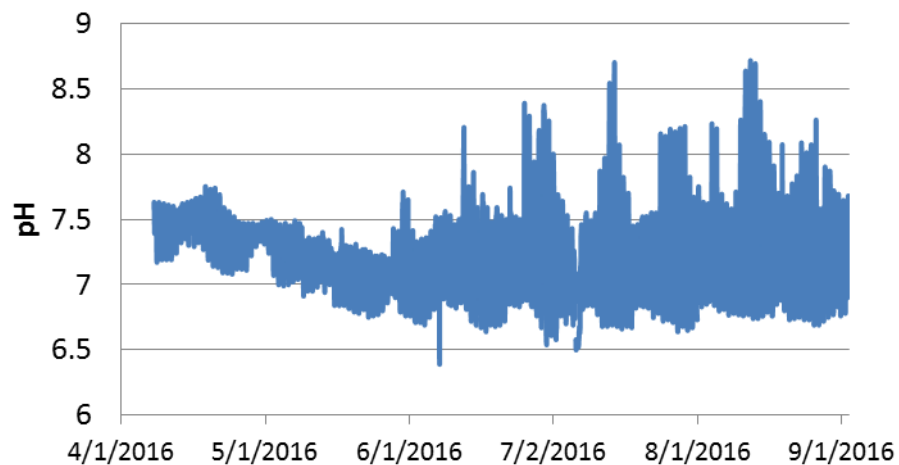
Water Temperature



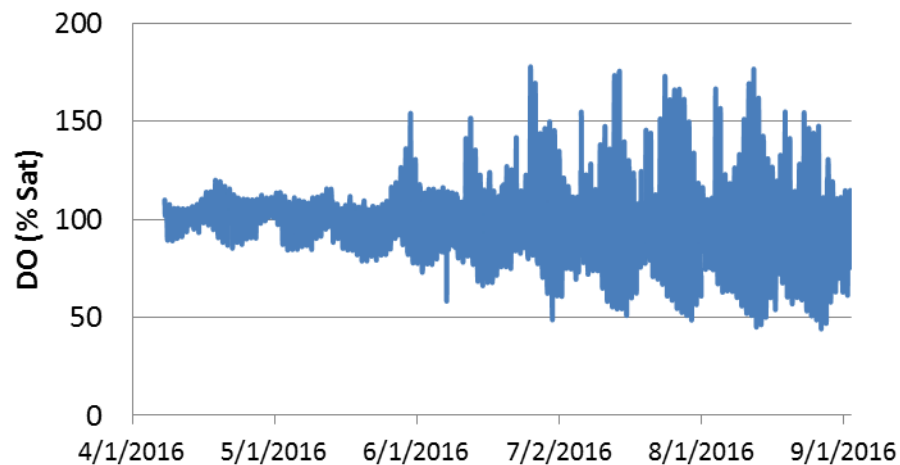
Depth



pH

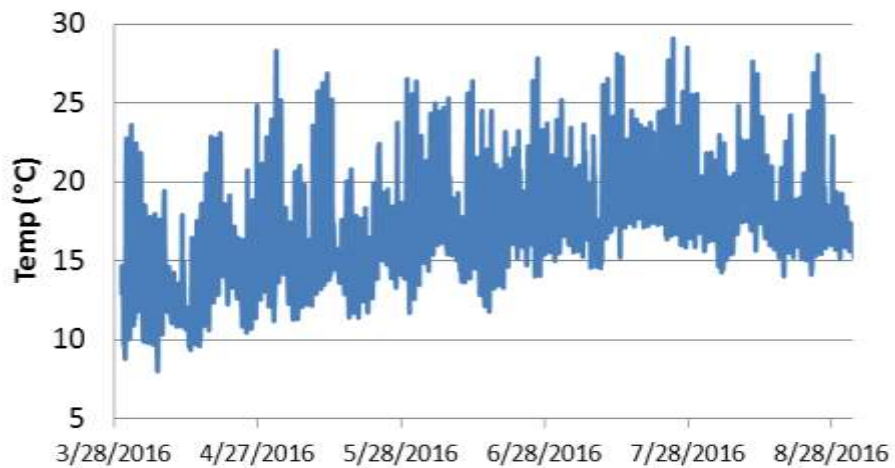


Dissolved Oxygen

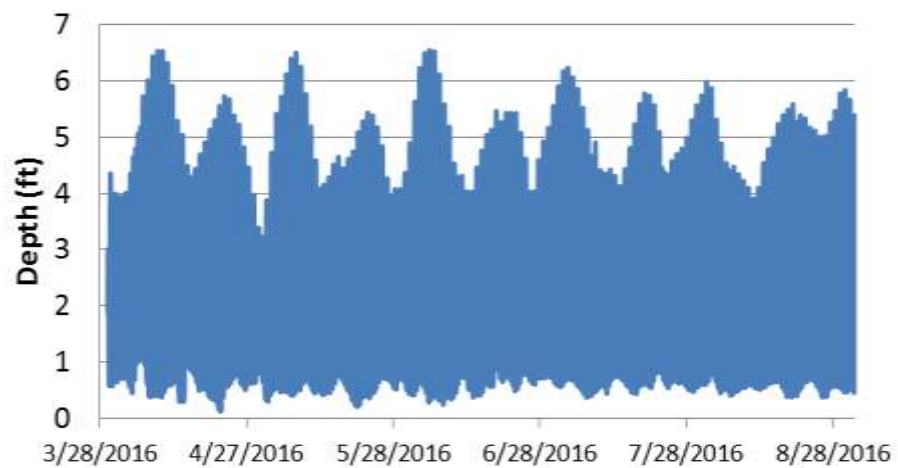


Whites Island

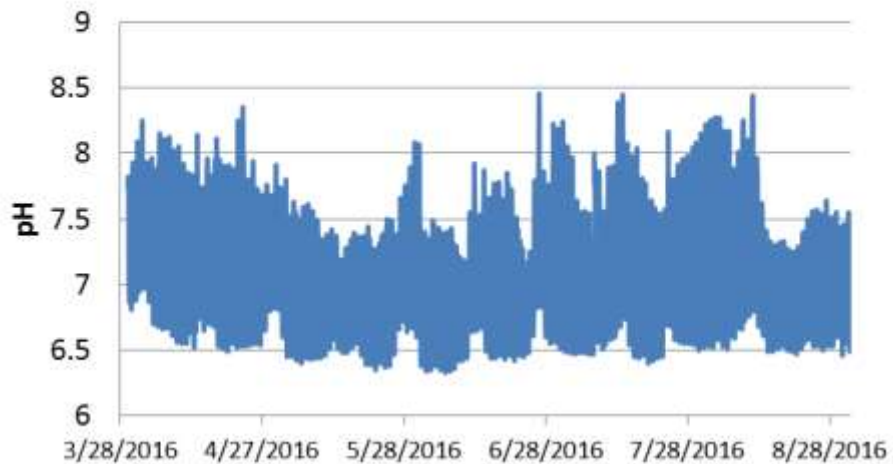
Water Temperature



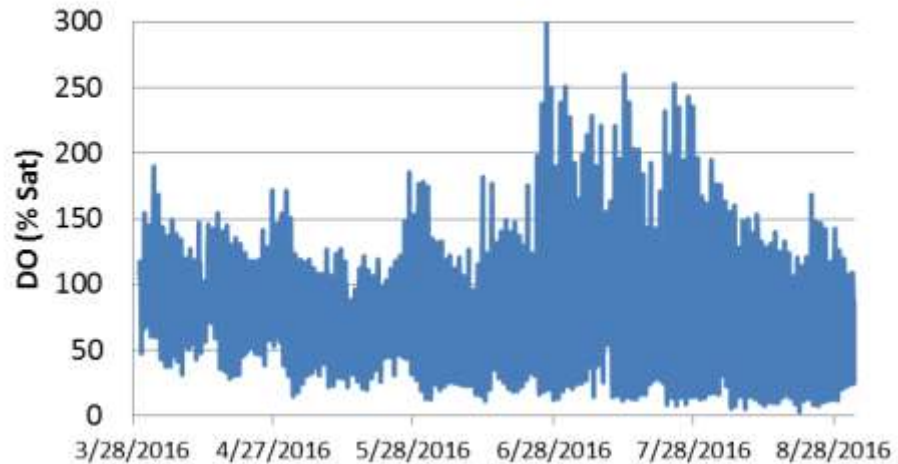
Depth

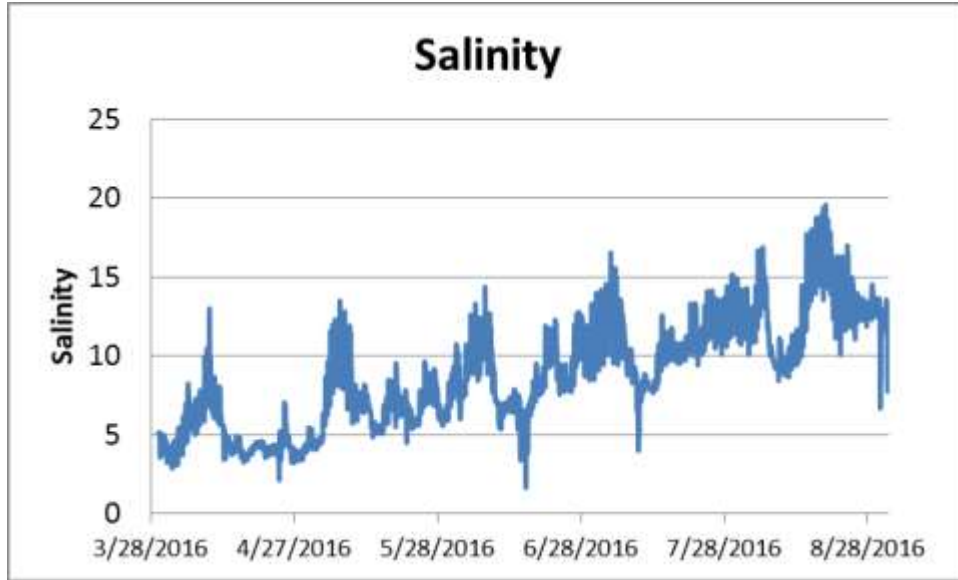


pH



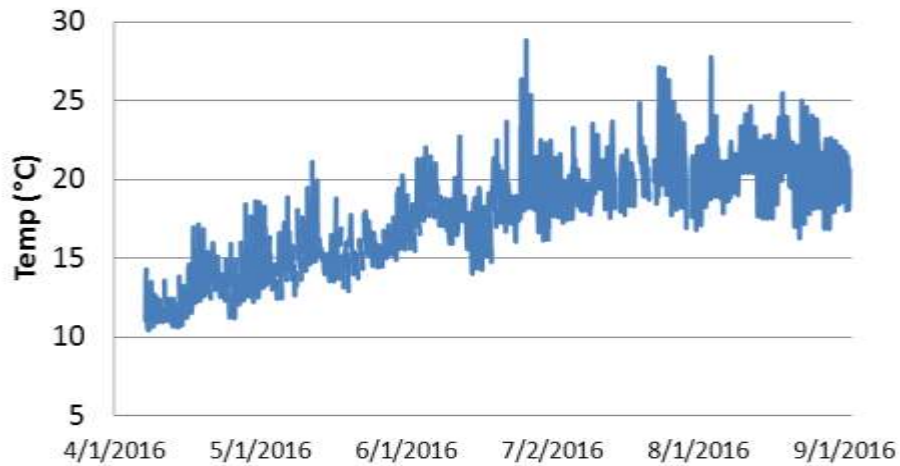
Dissolved Oxygen



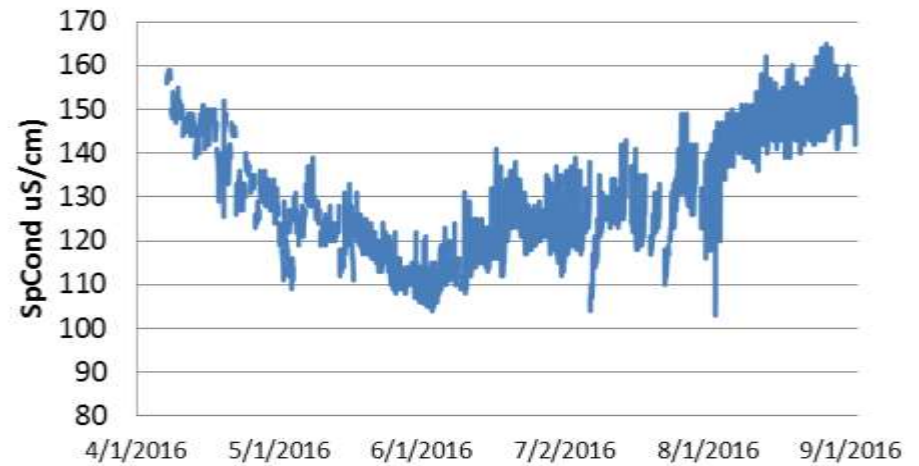


Ilwaco

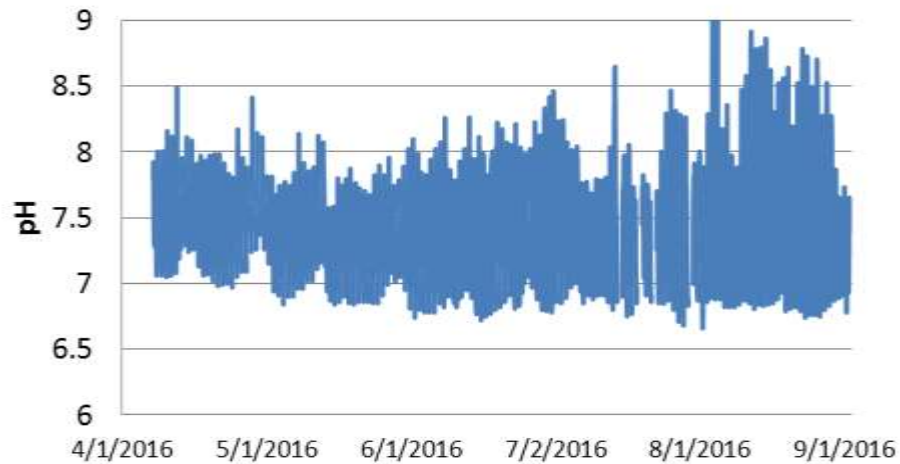
Water Temperature



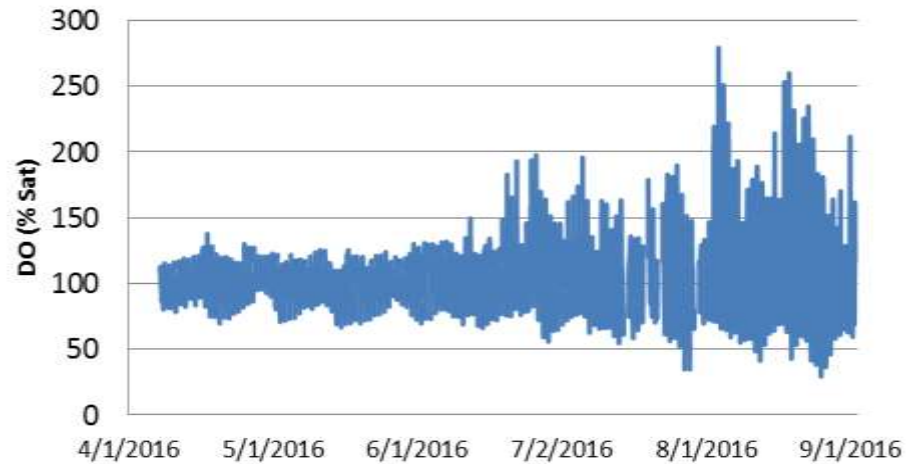
Conductivity



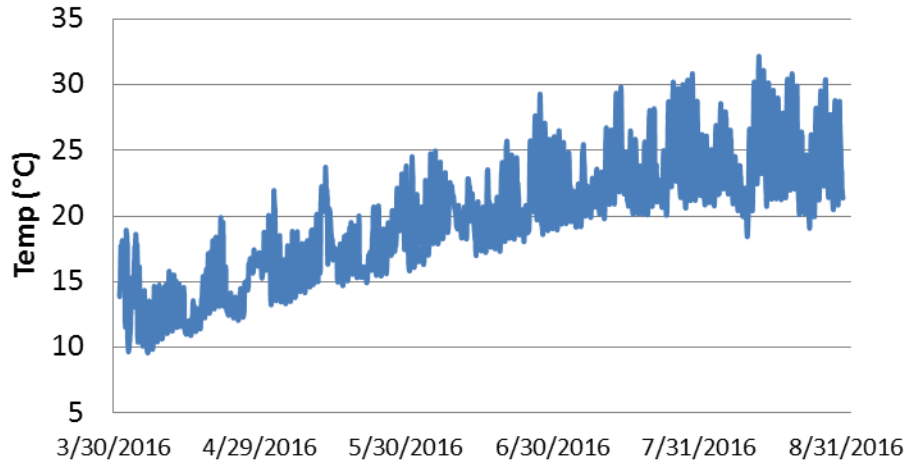
pH



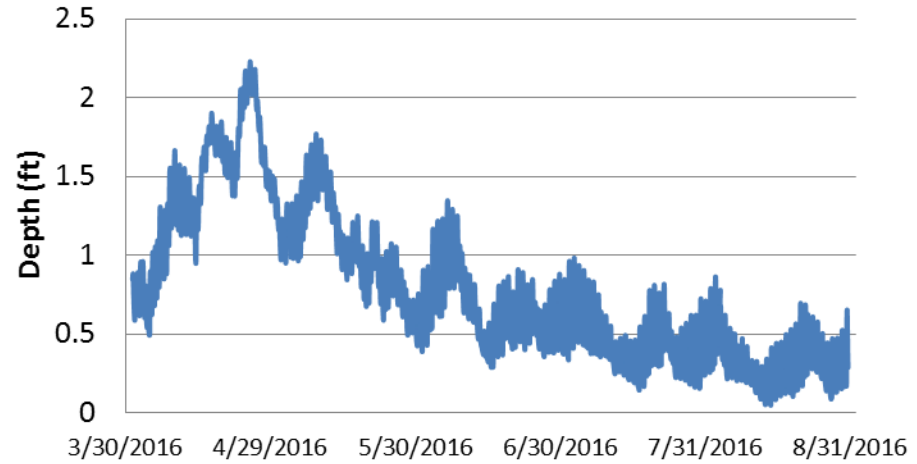
Dissolved Oxygen



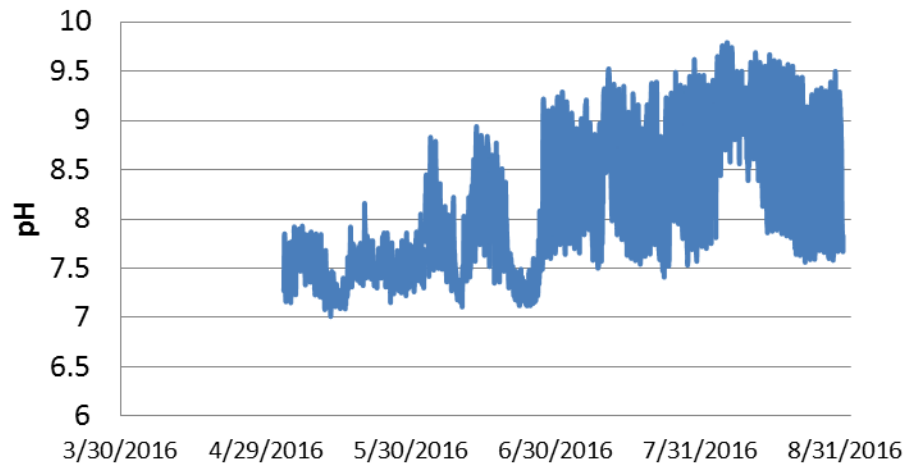
Water Temperature



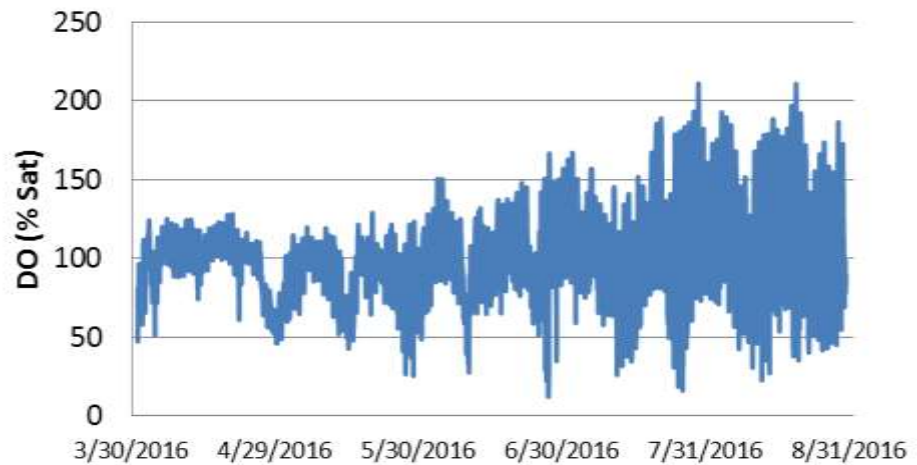
Sensor Depth

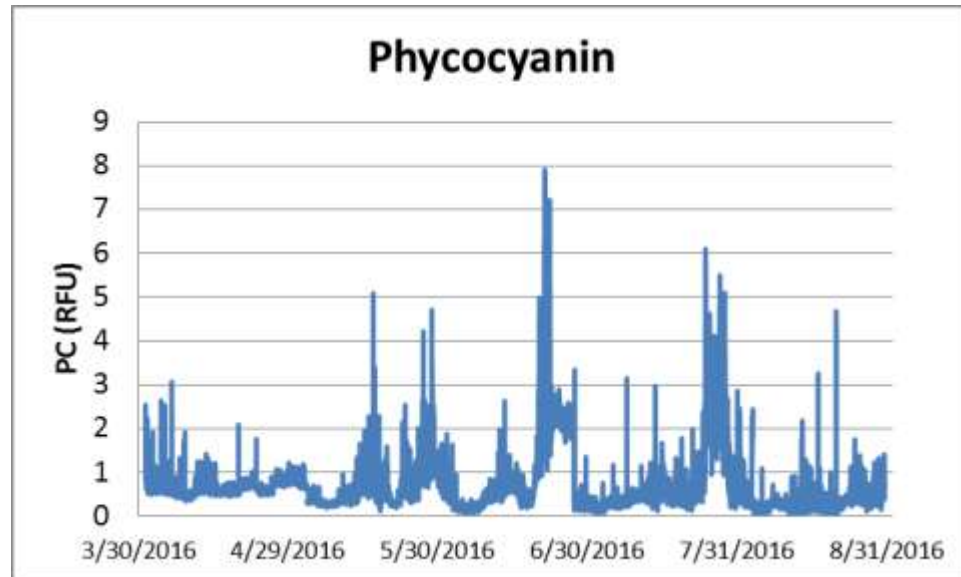
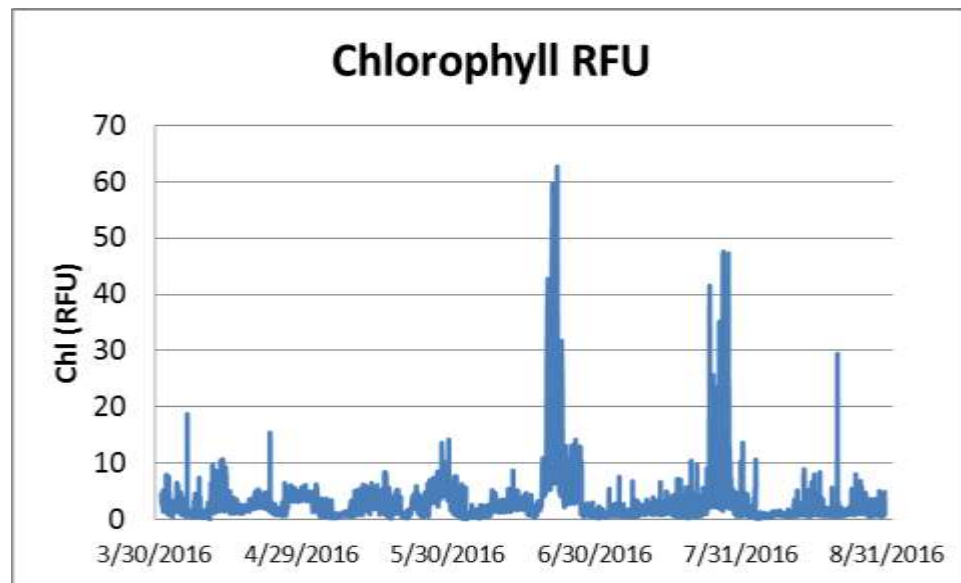


pH



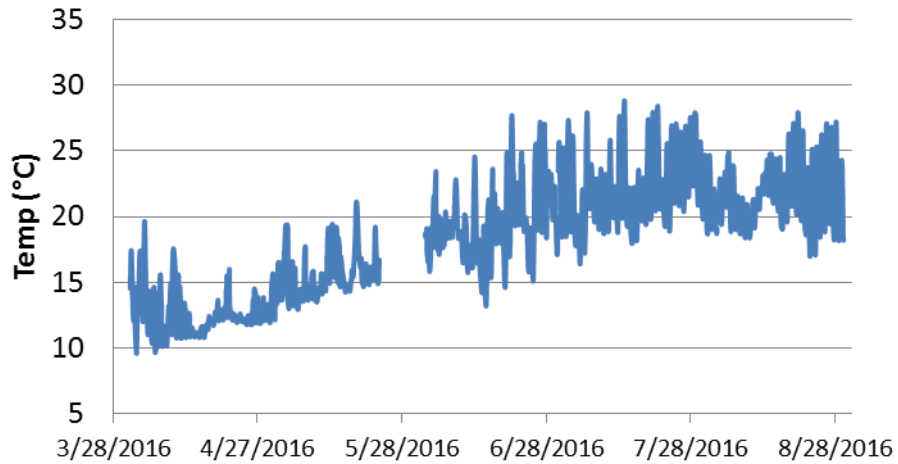
Dissolved Oxygen



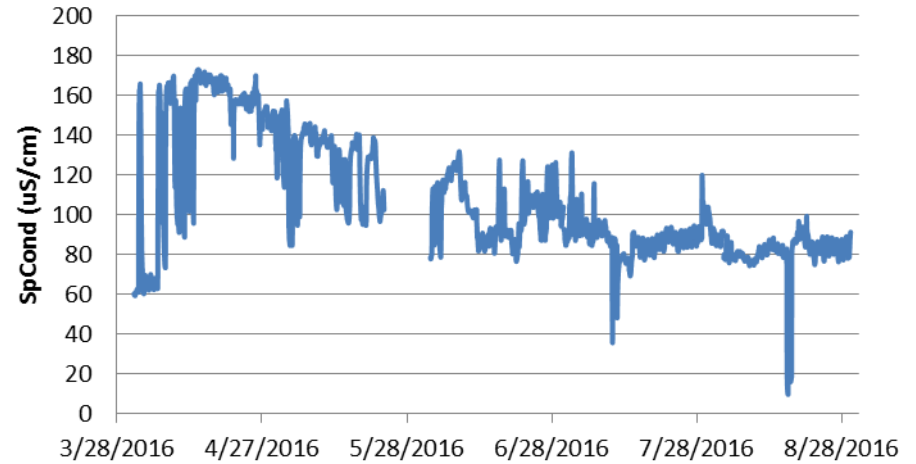


Campbell

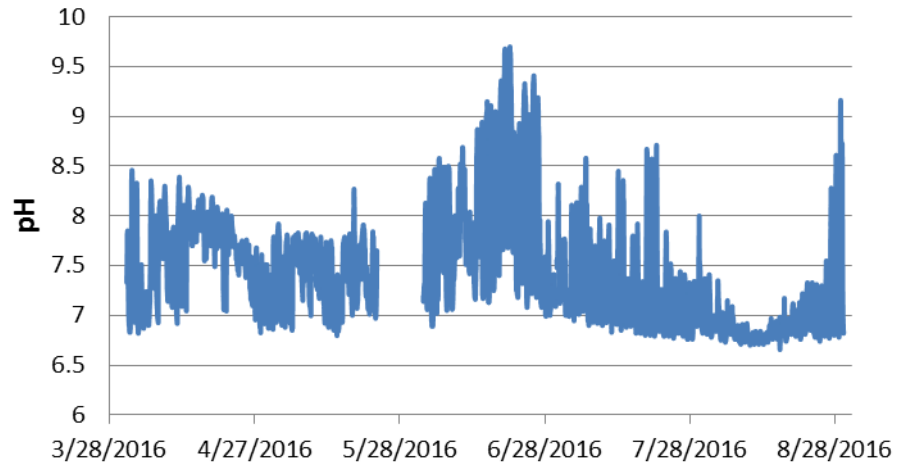
Water Temperature



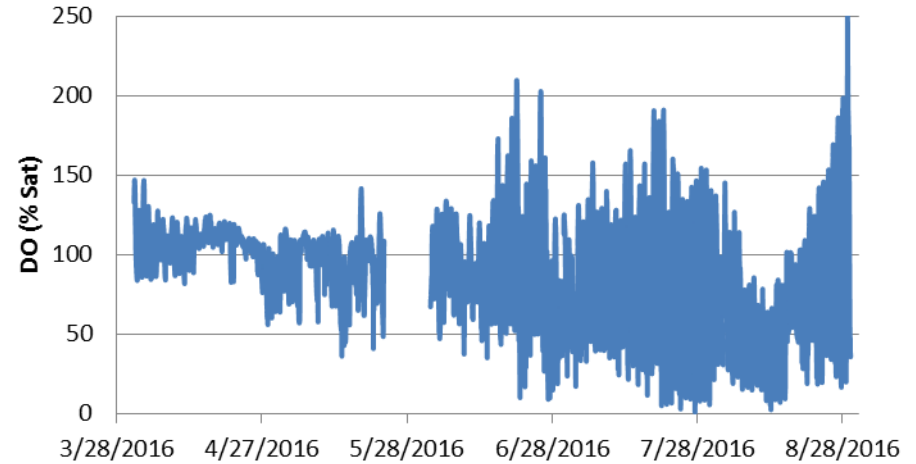
SpCond $\mu\text{S}/\text{cm}$

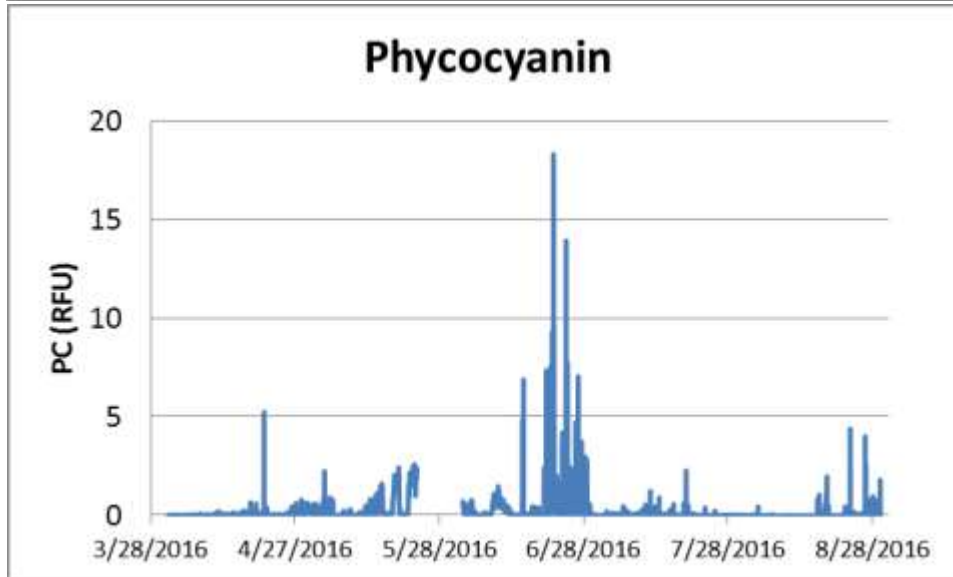
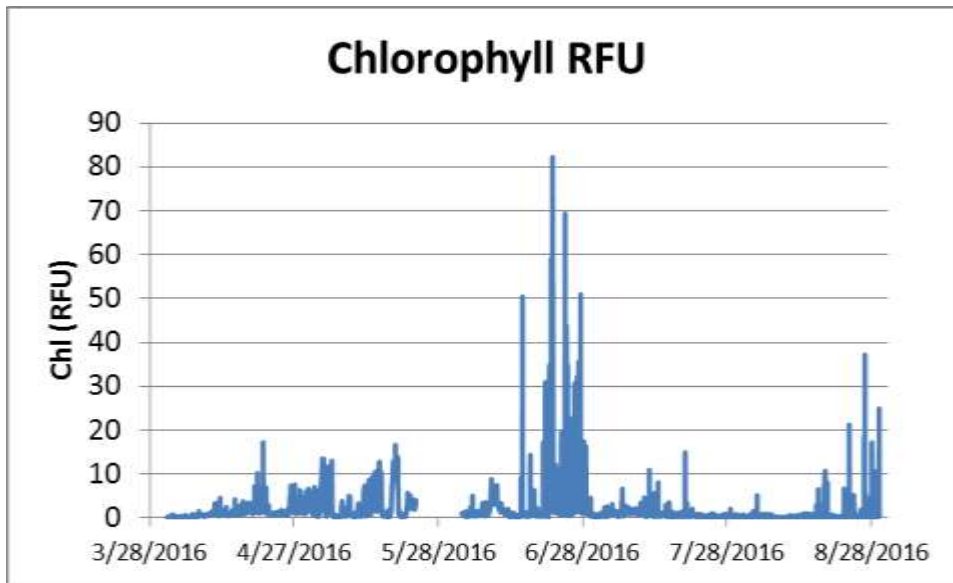


pH



Dissolved Oxygen





Franz

2016: # hours per month of dissolved oxygen below threshold of 6 mg/L

