

West Point Treatment Plant

Ongoing Marine Water Quality Monitoring

Water Quality Report –Update April 14th, 2017

OVERVIEW

As part of a long-term monitoring program, King County monitors water quality at 12 offshore and 20 beach locations (see Figure 1) to provide an understanding of water quality within the Puget Sound Central Basin, including stations at all treatment plant outfalls. The West Point Treatment Plant main outfall is the site labeled KSSK02 on the map, located 3,600 ft. offshore at approximately 230-ft deep. The county maintains a long-term dataset, over 50 years at some locations, which provides insight into natural variation. This monitoring program and dataset form the basis from which water quality conditions can be assessed that may be affected by the West Point wastewater discharge during its period of reduced treatment.

At the offshore sampling stations, dissolved oxygen, temperature, salinity, density (calculated), chlorophyll, and light intensity and transmission are measured throughout the entire water column from surface to bottom every two weeks. Additionally, nutrients, fecal indicator bacteria (FIB), suspended solids, and chlorophyll are measured at specific depths at each site, and phytoplankton composition and abundance are assessed at a subset of sites. Beach locations are monitored monthly for nutrients, FIB, temperature, and salinity.

Additional Monitoring: During reduced treatment at the West Point plant, the sampling frequency at a subset of four offshore monitoring stations has been increased to a weekly basis. In addition, a new site was added at the emergency bypass outfall and also sampled weekly. This frequency and variety of biological, chemical, and physical conditions can capture some impacts on ecosystem functions. The County's monitoring is sufficient to evaluate the most relevant water quality conditions that have the potential to result in any acute adverse effects to Puget Sound aquatic life. The most recent data results available, from March 20th-22nd (offshore and beaches) and March 29th (offshore only) sampling events, are summarized for three key water quality indicators below. More data results are available in the appendix.

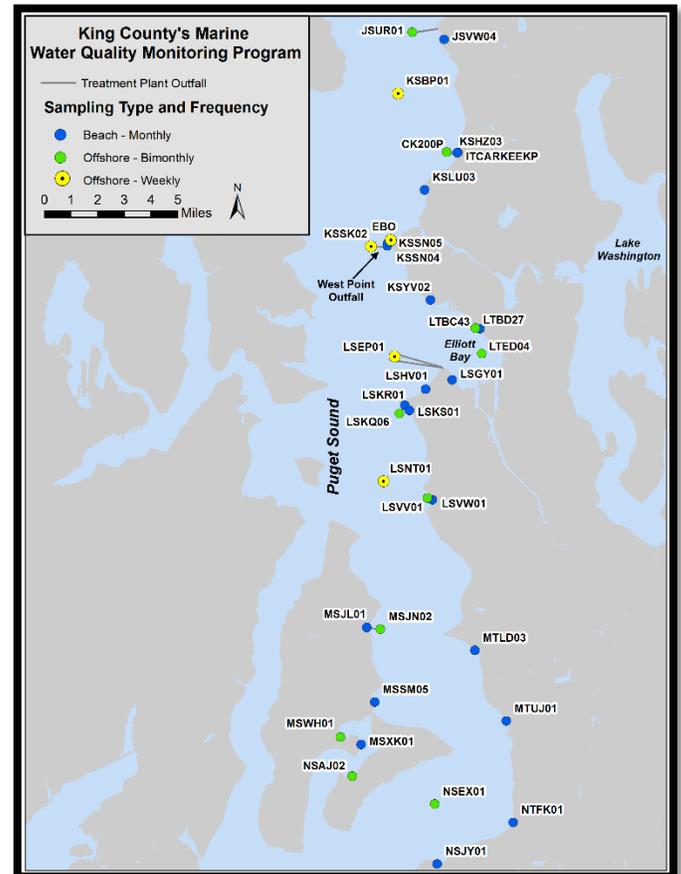


Figure 1. Map of King County's marine water quality monitoring stations.

BACTERIA

Fecal coliforms, along with *Enterococcus*, are a type of indicator bacteria that King County routinely monitors at freshwater and marine beaches, as well as offshore waters. These bacteria are found in the intestinal tracts and feces of humans and other warm-blooded animals, and can make their way into our waterways through various pathways. Although these bacteria are typically not pathogenic, they are important to monitor as they can be an indicator that pathogens that make people sick may be present.

The State of Washington has a two part standard to protect human primary contact recreation and shellfish consumption in marine waters. The standard includes a 14 colony forming unit/100 mL geometric mean average

and a 43 CFU/100 mL peak concentration (the peak concentration is not to be exceeded in greater than 10% of samples). These standards are used for comparing data from multiple samples at a station rather than a single sample.

Comparing individual samples to the bacteria standards for reference indicates that concentrations of fecal coliforms from surface waters at all offshore stations, including KSSK02 off of West Point, were at or below the geometric mean standard and well below the peak standard during both sampling events in late March (Figure 2). Although fecal coliforms near the West Point Outfall were elevated above seasonal norms in surface waters on March 29th, the concentrations remained below state water quality standards. Fecal coliform concentrations in the West Point treated discharge were periodically elevated compared to normal levels intermittently during the month of March, indicating that this may be the source of the elevated concentration at the KSSK02 location. Fecal coliform concentrations were also elevated at LTBC43 and LTED04 in Elliott Bay on March 20th. This past March was one of the wettest on records and as a consequence, there was more freshwater input into Puget Sound. Sub-surface bacteria concentrations were all below state water quality criteria as well. For data on subsurface and *Enterococcus* bacteria concentrations, see Appendix Table A-2.

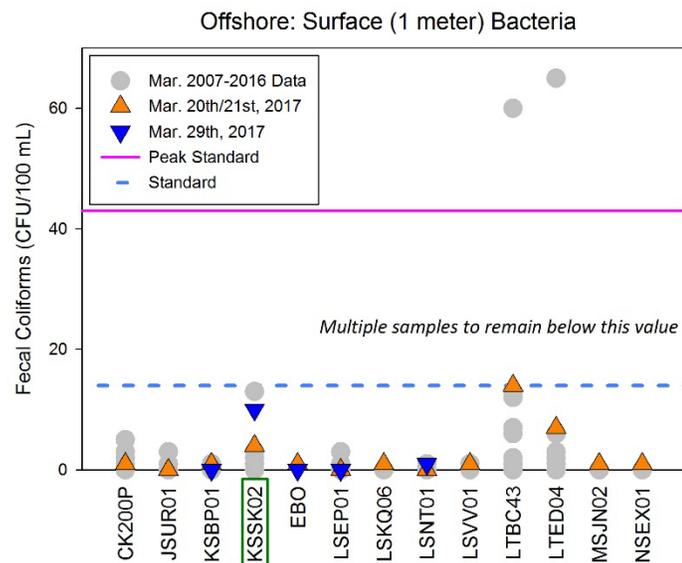


Figure 2. Bacteria concentrations of single samples collected near surface (1 meter) at a subset of offshore stations in Central Puget Sound during the late March 2017 sampling events are illustrated with historical bacteria concentrations. Note: station KSSK02, West Point outfall, highlighted.

Concentrations of bacteria at beach monitoring stations near the West Point outfall were all similar to typical concentrations seen during the month of March. Although KSSN04 near West Point had a concentration of 14

CFU/100 mL, this single sample was well below the peak standard and within the typical range expected for a beach monitoring site (see Appendix Figure A-7 and Table A-2).

NUTRIENTS

Nutrients, such as nitrogen compounds (ammonia and nitrate) and orthophosphate, are essential elements for aquatic plants. Silica is a micronutrient needed by some microscopic plants (phytoplankton) and other organisms for skeletal growth. However, excess nutrients can cause a sudden increase in aquatic plants that can lead to unfavorable conditions. High ammonia concentrations can be toxic to aquatic organisms, including fish.

Nutrients in offshore waters on March 20/21st and March 29th were within normal values based upon past March values. The emergency bypass station (EBO) had not routinely been sampled prior to the early March sampling event; therefore, comparisons with previous data cannot be made. All ammonia values were low and well below the lowest (chronic) water quality criterion, which is based upon temperature, salinity, and pH factors (anticipated to be about 1.6 mg/L for March conditions). Although meeting the criterion, the ammonia value at the deepest depth at the West Point outfall on March 29th was higher than most past values and other stations (Figure 3). Surface values, including at the outfall, were all low (see Appendix Figure A-6).

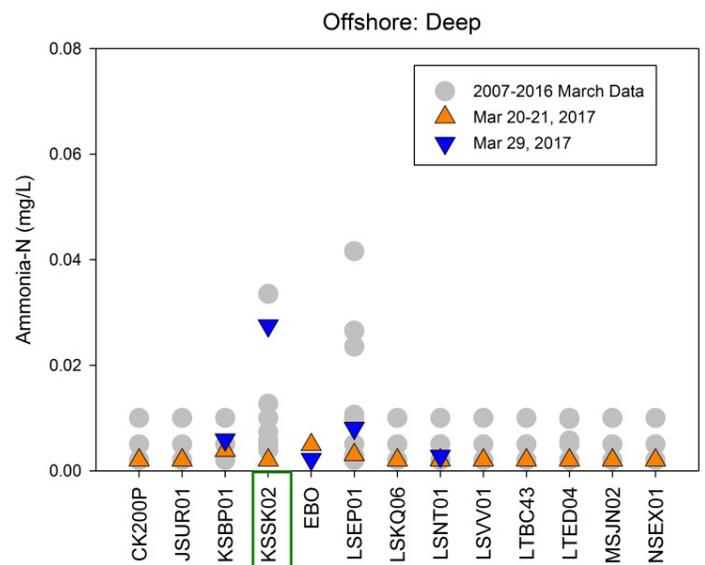


Figure 3. Ammonia levels in surface (1 meter) waters for offshore stations in Central Puget Sound during the late March 2017 sampling events are shown with historical concentrations. Note: most values in March were below detectable levels, therefore, the method detection limit value was used. Detection limits have changed from 0.01 to the current 0.005 mg/L with laboratory advancements. Note: station KSSK02, West Point outfall, highlighted.

Nitrate, orthophosphate, and silica at offshore stations for all depths were within normal ranges for all sites. Nitrate, ammonia, and orthophosphate were also within normal ranges for all beach sites on March 22.

DISSOLVED OXYGEN

Dissolved oxygen is important for marine life, and can control the presence or absence of species. Aquatic plants and animals require a certain amount of oxygen dissolved in the water to live, and different species have different tolerances. Waters with high concentrations of dissolved oxygen are considered healthy for sustaining many species.

In deep waters in particular, it can be too dark for aquatic plants to live and is separated from surface mixing with the air, so processes like decomposition by bacteria can result in low dissolved oxygen. Human inputs of organic materials and decay of aquatic plants at depth may decrease oxygen levels. In addition, deep waters from the Pacific Ocean enter Puget Sound at depth and can result in naturally occurring low dissolved oxygen levels.

The State of Washington dissolved oxygen standard to protect aquatic life depends on the designated waterbody use. For Central Puget Sound, the one-day minimum dissolved oxygen standard is 7 mg/L for waters of extraordinary quality. At the dissolved oxygen level of 5 mg/L, biological stress can be induced on marine life. If dissolved oxygen levels fall below 3 mg/L, then this can displace or potentially result in death of some marine species.

The most recent offshore sample data from March 20-21st and 29th show typical conditions for March across King County's monitoring stations in Central Puget Sound, and all sites show deep oxygen levels above the state water quality standard (Figure 4). Near-bottom oxygen levels did not change significantly when compared to the data collected from the prior sampling event in early March, and remain at healthy levels.

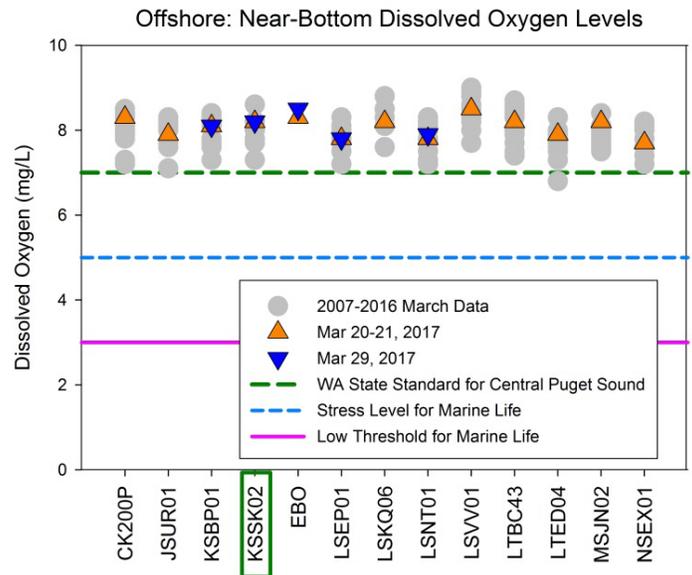


Figure 4. In Puget Sound, the lowest dissolved oxygen levels are typically found near the seafloor, so near bottom dissolved oxygen levels are shown by sampling site on top of historical oxygen conditions for the second half of March. Note: station KSSK02, West Point outfall, highlighted in green. The EBO site, Emergency Bypass Outfall, was added recently, so no historical data are available here.

SUMMARY

Water sample results collected between March 20th-22nd and March 29th, 2017 are summarized below. Additional results are provided in the Appendix.

- Concentrations of fecal coliforms at all offshore stations were at or below the geometric mean reference water quality standards and well below the peak standard for March.
- Bacteria concentrations at most offshore stations were similar to expected values during the month of March with the exception of two Elliott Bay and the one West Point outfall station, which were at or below the geometric mean reference water quality standard which is made for comparing to multiple samples at a single station.
- Fecal coliform levels near the West Point outfall may have been affected by West Point effluent that intermittently had slightly higher levels.
- Beach bacteria concentrations at sites near West Point Treatment Plant were within the range of expected values for the month of March with some stations exhibiting concentrations above the geometric mean but below the peak standard.
- The ammonia value at the deepest sampling depth was higher at the West Point outfall on March 29th but still within the water quality criterion. All surface ammonia values were low.

- All nitrate/nitrite, orthophosphate, and silica results were within expected values for both offshore and beach waters (note silica is not analyzed in beach waters).
- Near-bottom dissolved oxygen values were at healthy levels and all above the state water quality standard, and did not change significantly from the prior sampling event in late March.
- Dissolved oxygen levels were high throughout the top and bottom of the water column, and reflect typical conditions for March.
- March conditions continued to be wet, and by mid-March, total precipitation over the last five months exceeded the typical annual water-year amount, as measured by the National Weather Service at Sea-Tac airport. This March was one of the wettest on record.



King County's conductivity-temperature-depth (CTD) profiler pictured above, which is lowered through the water from the boat. It measures water quality parameters throughout the water column and collects water samples for laboratory analysis.

FOR MORE INFORMATION

- **King County Marine & Sediment Assessment Group:**
<http://green2.kingcounty.gov/marine>
- **Download Water Column Data:**
<http://green2.kingcounty.gov/marine/Download>
- **West Point Marine Monitoring:**
<http://www.kingcounty.gov/depts/dnrp/wtd/system/west/west-point-restoration/marine-monitoring.aspx>
- **Wastewater Incidence Response:**
<http://kingcounty.gov/depts/dnrp/wtd/response/incident-response.aspx>

Appendix: March, Part 2, Marine Water Quality Data

The following graphs and tables display data from the March 20th/21st/22nd and March 29th marine monitoring events. General water quality data are shown by site. For the offshore sites, parameters shown include water temperature, salinity, dissolved oxygen, relative chlorophyll fluorescence, total suspended solids, percent light transmission, nutrient concentrations, and fecal indicator bacteria. Nutrients include nitrate and nitrite, ammonia, orthophosphate, and silica. For the beach sites, parameters shown include fecal indicator bacteria, nitrate and nitrite, and ammonia. For more explanation of parameters and sampling methods, see the marine monitoring program website:

<http://green2.kingcounty.gov/marine/>

Description of station locators from the map on the first page (Figure 1) are given in the table below. Data from a subset of stations from the routine monitoring program are displayed to provide context for data collected near the West Point Treatment Plant and Treatment Plant Outfall. For more details on all monitoring stations, see the [marine monitoring plan](#).

Table A-1. Location of sampling stations that include data in this summary report. The following data graphs and tables in the Appendix are from the stations highlighted in blue.

Offshore Stations

Locator	Description
JSUR01	Brightwater Treatment Plant Outfall
KSBP01	Point Jefferson
CK200P	Carkeek CSO Treatment Plant Outfall
KSSK02	West Point Treatment Plant Outfall
EBO	Emergency Bypass Outfall for West Point
LTBC43	Elliott West CSO Treatment Plant Outfall
LTED04	Central Elliott Bay
LTXQ01	Henderson/MLK CSO Treatment Plant Outfall
LSEP01	South Treatment Plant Outfall
LSKQ06	Alki CSO Treatment Plant Outfall
LSNT01	Fauntleroy/Vashon
LSVV01	Barton CSO Outfall
MSJN02	Vashon Treatment Plant Outfall
NSEX01	East Passage

Beach Stations

Locator	Description
ITCARKEEKP	Carkeek Park
KSLU03	Golden Gardens
KSSN04	West Point North, Discovery Park
KSSN05	West Point South, Discovery Park
KSYV02	Magnolia CSO
LSHV01	Alki Beach

Offshore Water Quality: KSSK02 – West Point Outfall

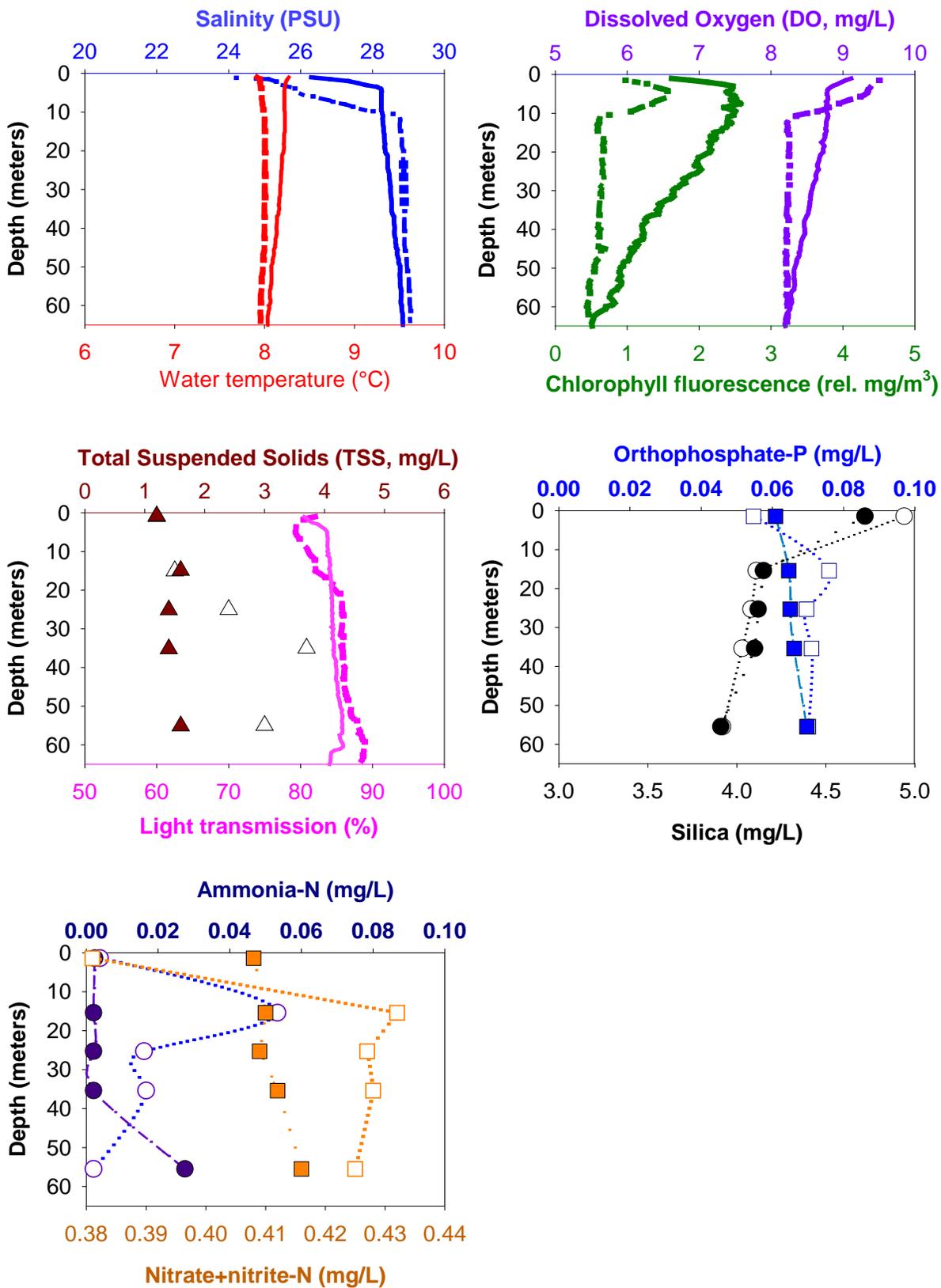


Figure A-1. Offshore water column profile (lines) and discrete water quality results (points) from the second two weeks of March 2017 at the West Point Outfall. Dashed lines and open symbols represent the March 20th/21th sampling event and solid lines and solid symbols represent the March 29th sampling event.

Offshore Water Quality: KSBP01 – Point Jefferson

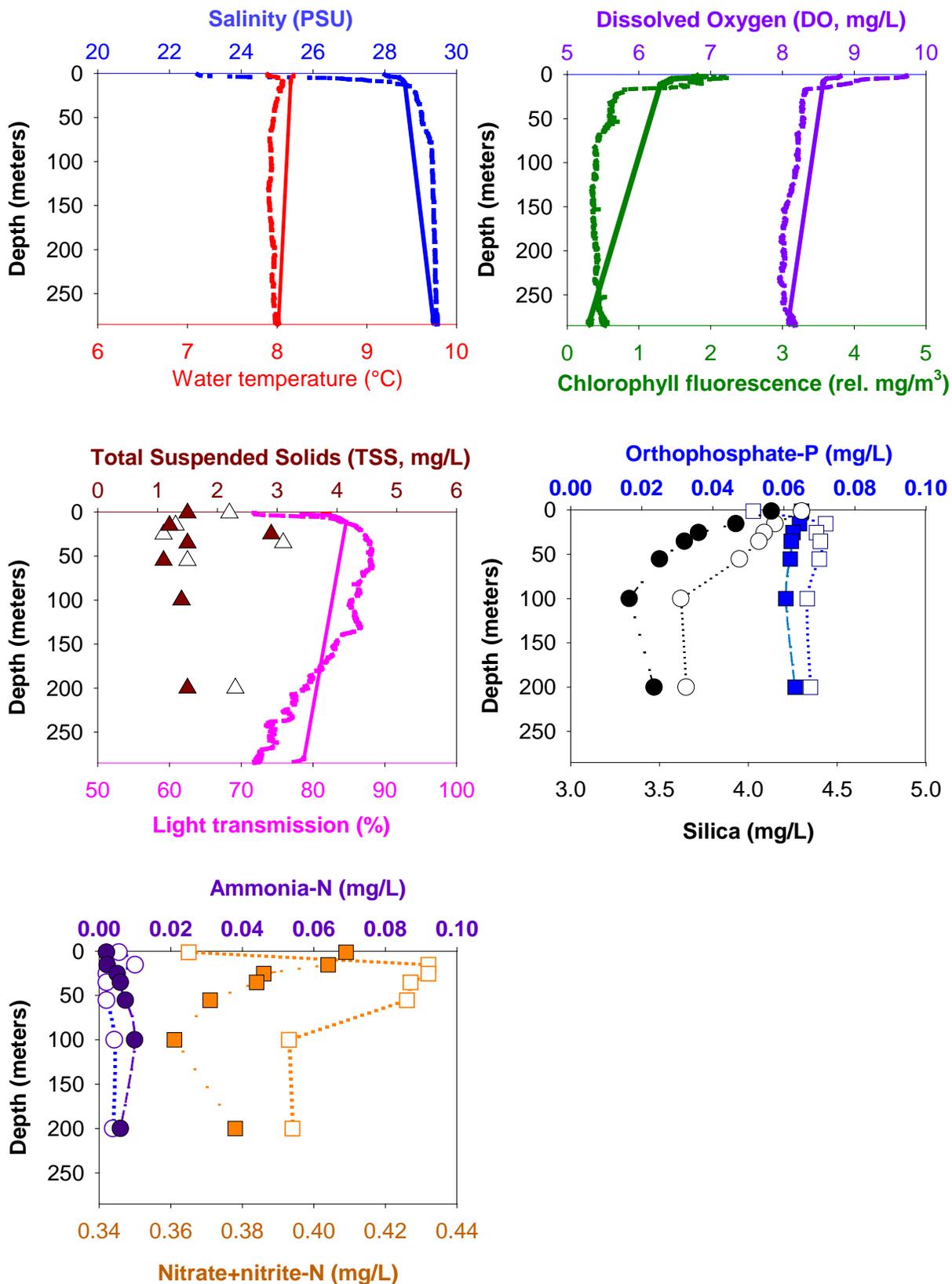


Figure A-2. Offshore water column profile (lines) and discrete water quality results (points) from the second two weeks of March 2017 at Point Jefferson. Dashed lines and open symbols represent the March 20th/21th sampling event and solid lines and solid symbols represent the March 29th sampling event.

Offshore Water Quality: EBO – Emergency Bypass Outfall

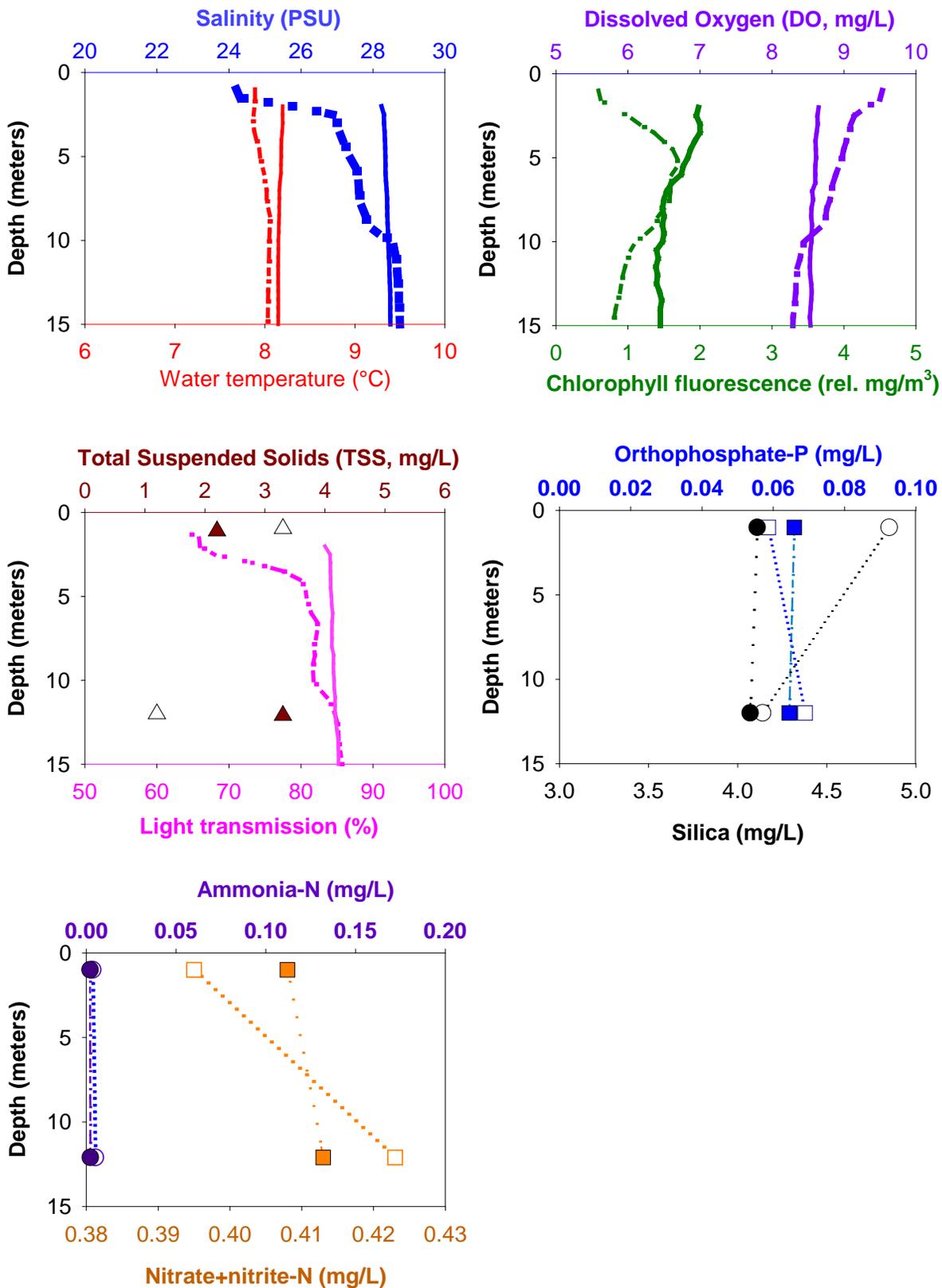


Figure A-3. Offshore water column profile (lines) and discrete water quality results (points) from the second two weeks of March 2017 at West Point’s emergency bypass outfall. Dashed lines and open symbols represent the March 20th/21st sampling event and solid lines and solid symbols represent the March 29th sampling event.

Offshore Water Quality: LSEP01 – South Plant Outfall

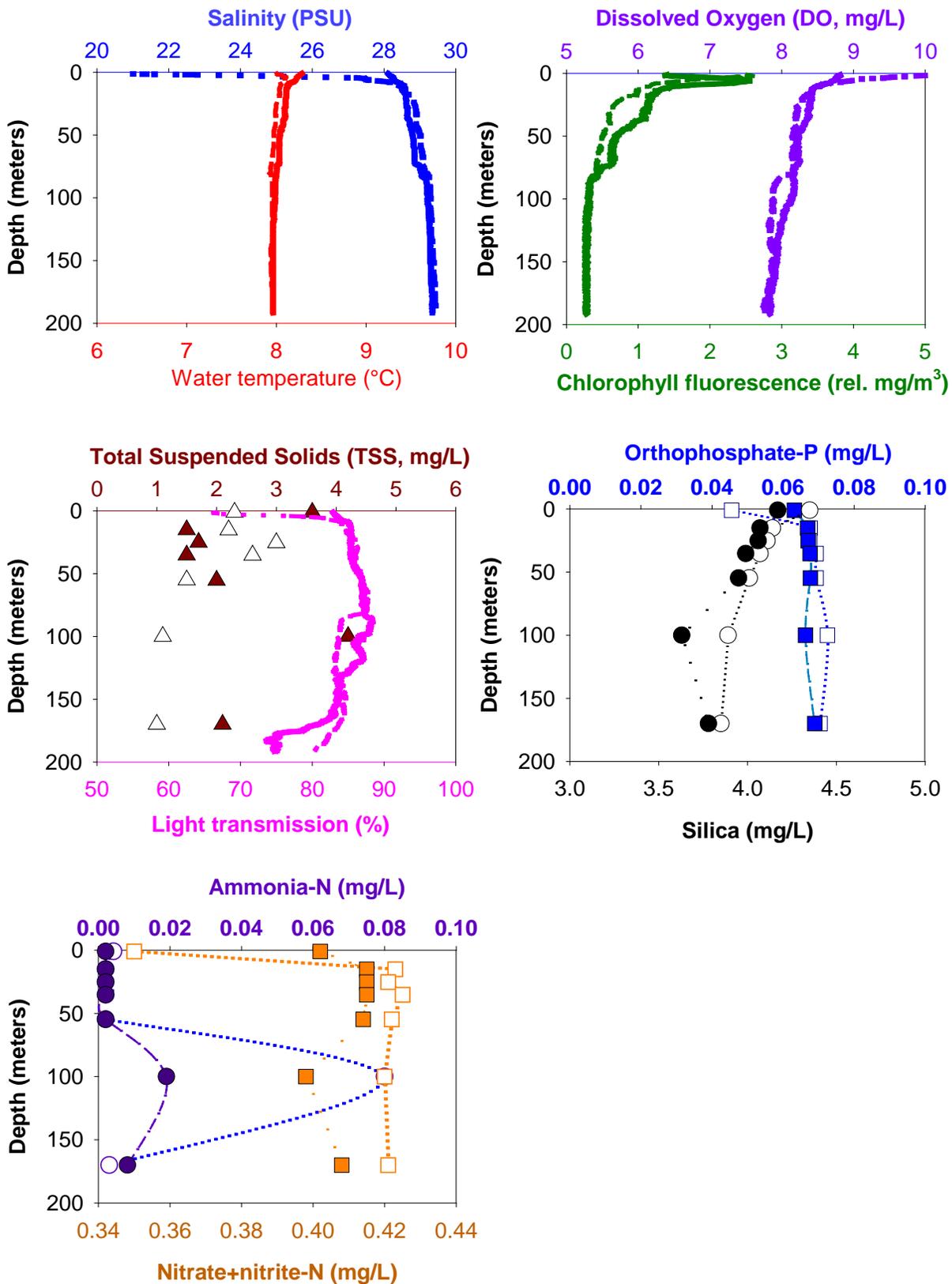


Figure A-4. Offshore water column profile (lines) and discrete water quality results (points) from the second two weeks of March 2017 at the South Plant Outfall. Dashed lines and open symbols represent the March 20th/21th sampling event and solid lines and solid symbols represent the March 29th sampling event.

Offshore Water Quality: LSNT01 – Point Williams

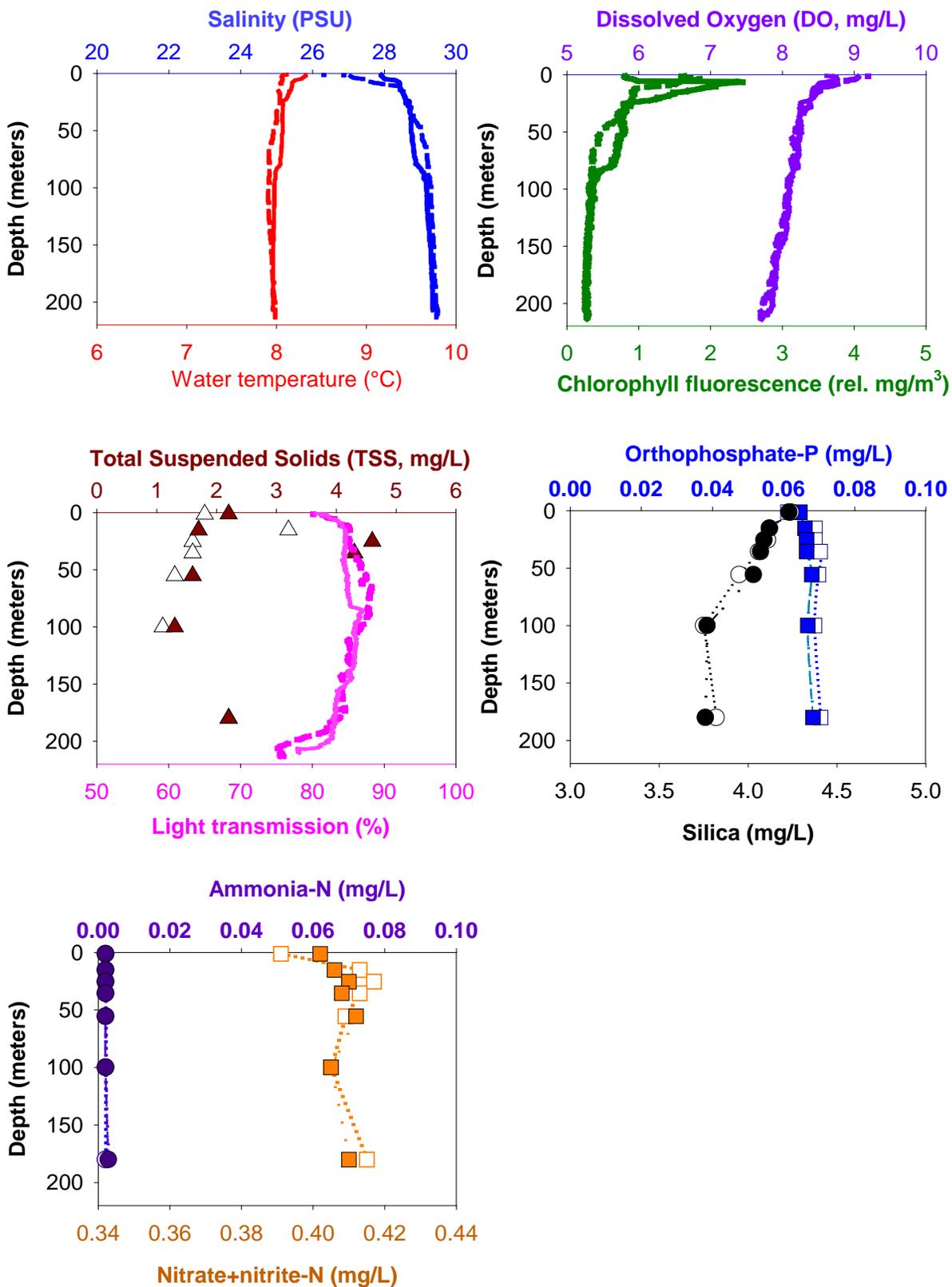


Figure A-5. Offshore water column profile (lines) and discrete water quality results (points) from the second two weeks of March 2017 at Point Williams. Dashed lines and open symbols represent the March 20th/21th sampling event and solid lines and solid symbols represent the March 29th sampling event.

Offshore Water Quality: Other Interesting Results

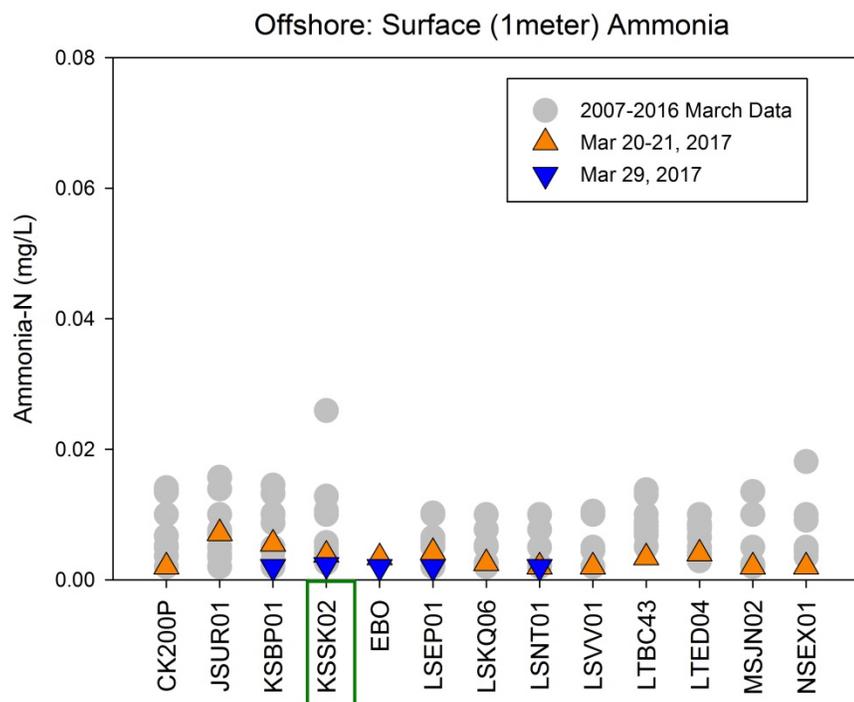


Figure A-6. Ammonia concentrations in offshore waters on March 20-21st and March 29th, 2017. Historical concentrations in March for each station are shown as gray circles.

Fecal Indicator Bacteria: Offshore and Beaches

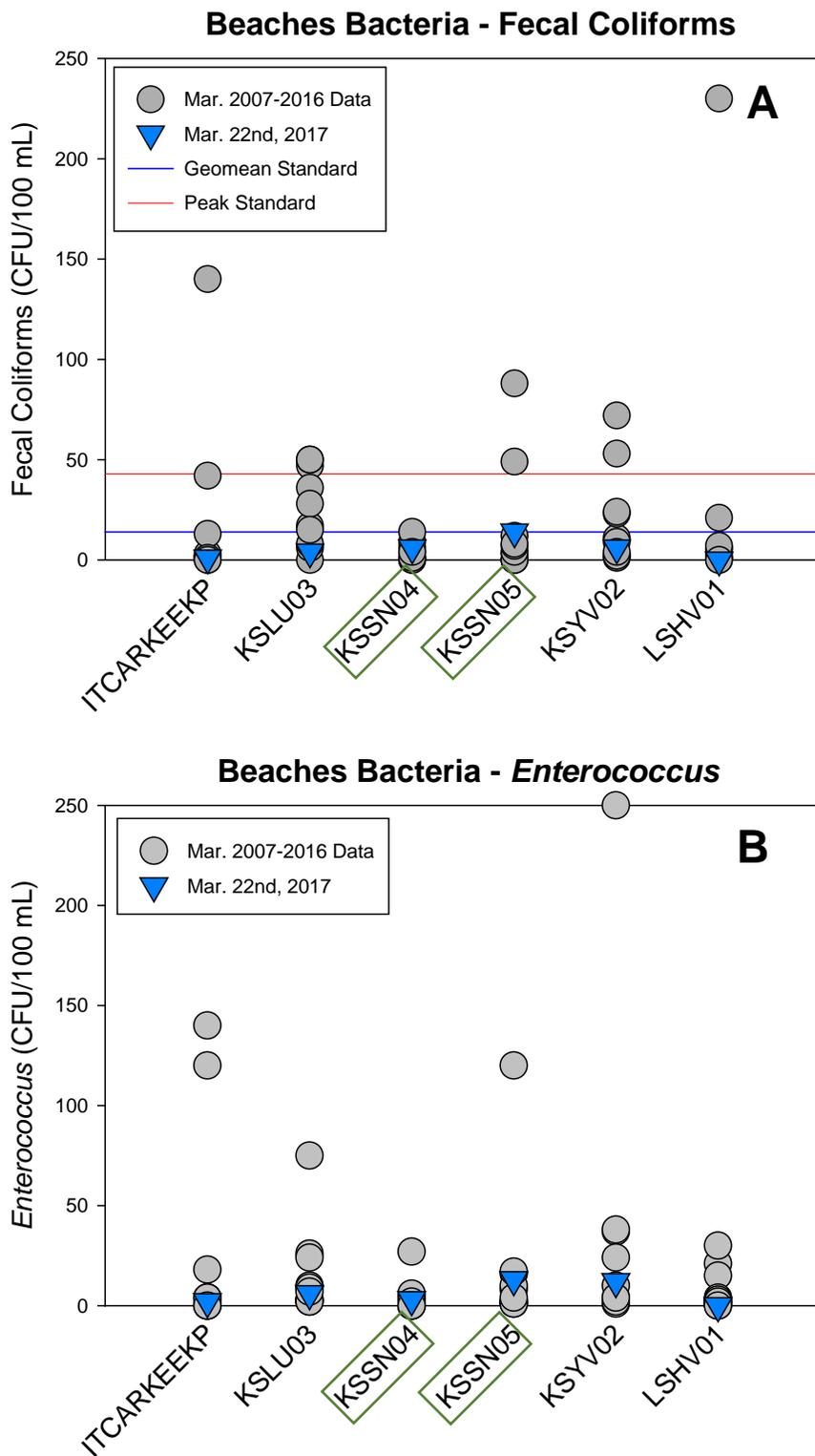


Figure A-7. Bacteria concentrations (**A.** Fecal coliforms; **B.** *Enterococcus*) of single samples collected at a subset of beach stations during the March 2017 sampling event are illustrated with historical bacteria concentrations. Although not appropriate to compare single samples to Washington State water quality criteria, the state’s geometric mean and peak standards for primary contact recreational and shellfish harvesting uses are provided for reference. Note: KSSN04 and KSSN05, near the West Point outfall are highlighted.

Table A-2. Offshore fecal indicator bacteria concentrations at select monitoring sites during the second two weeks of March, 2017. Stations near West Point Treatment Plant Outfall are highlighted.

	Station	Date	Depth (m)	Fecal Coliform (CFU/100 mL)	<i>Enterococcus</i> (CFU/100 mL)
Offshore	KSBP01	3/20/2017	1.2	1	0
	KSSK02	3/20/2017	1.0	4	6
	KSSK02	3/20/2017	25.0	1	8
	KSSK02	3/20/2017	55.0	0	2
	EBO	3/20/2017	1.0	1	1
	EBO	3/20/2017	12.0	0	14
	LSEP01	3/21/2017	1.1	0	0
	LSEP01	3/21/2017	99.9	0	0
	LSEP01	3/21/2017	170	0	0
	LSNT01	3/21/2017	1.3	0	0
	KSBP01	3/29/2017	1.1	0	0
	KSSK02	3/29/2017	0.81	10	5
	KSSK02	3/29/2017	25.1	0	0
	KSSK02	3/29/2017	55.1	0	1
	EBO	3/29/2017	1.1	0	1
	EBO	3/29/2017	12.1	0	0
	LSEP01	3/29/2017	1.1	0	0
	LSEP01	3/29/2017	100	1	0
	LSEP01	3/29/2017	170	1	0
	LSNT01	3/29/2017	1.1	1	0
Beaches	ITCARKEEKP	3/22/2017	--	1	2
	KSLU03	3/22/2017	--	4	6
	KSSN04	3/22/2017	--	6	3
	KSSN05	3/22/2017	--	14	13
	KSYV02	3/22/2017	--	6	12
	LSHV01	3/22/2017	--	0	0

Beach Nutrients: Nitrate + Nitrite

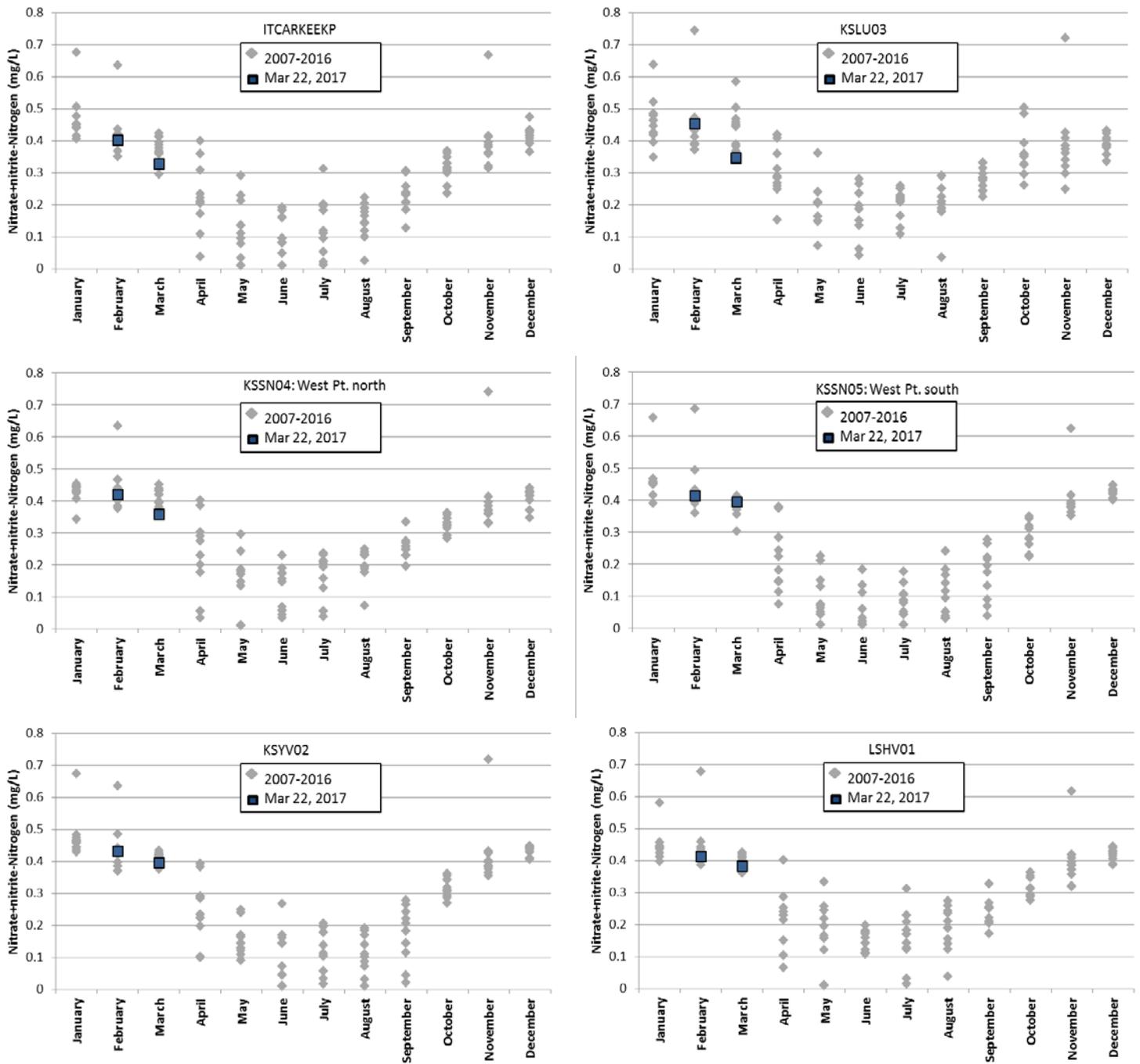


Figure A-8. Nitrate+nitrite values for six beach stations sampled on Mar 22, 2017 (blue squares) compared to historical values for March. Additional months are shown to indicate the yearly seasonal cycle and where the current month falls in that cycle.

Beach Nutrients: Ammonia

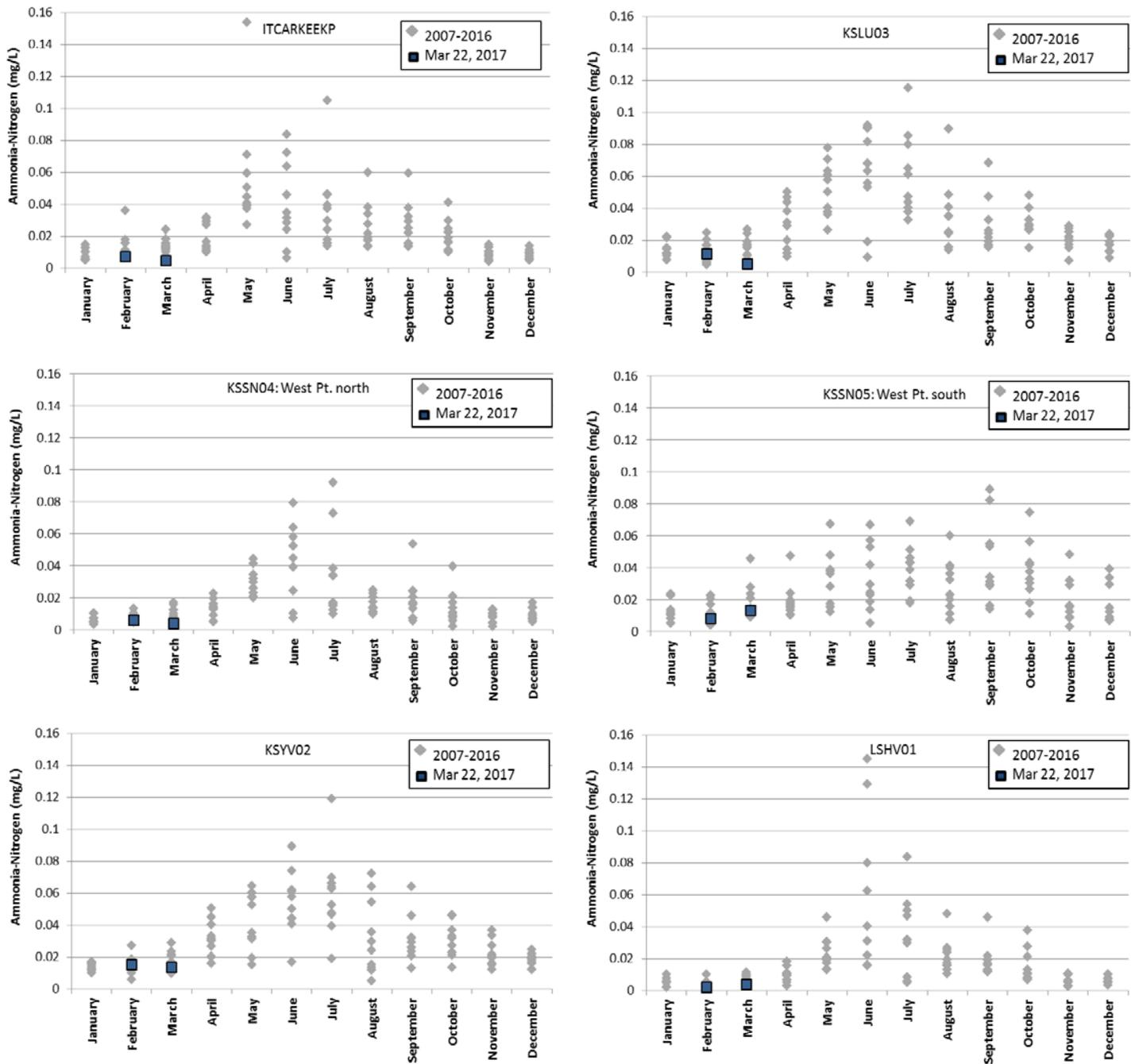


Figure A-9. Ammonia values for six beach stations sampled on Mar 22, 2017 (blue squares) compared to historical values for March. Additional months are shown to indicate the yearly seasonal cycle and where the current month falls in that cycle.