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BOYNTON-DELRAY COASTAL WATER QUALITY MONITORING PROGRAM

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List of Acronyms

ADCP	Acoustic Doppler current profiler
AOML	Atlantic Oceanographic and Meteorological Laboratory
BDL	Below detection limit
DIN	Dissolved inorganic nitrogen
DIP	Dissolved inorganic phosphorus
DOC	Dissolved organic carbon
DOP	Dissolved organic phosphorus
FACE	Florida Area Coastal Environment
FAU	Florida Atlantic University
FIB	Fecal indicator bacteria
MGD	Million gallons per day
MLD	Minimum detection level
MPL	Million particles per liter
NOAA	National Oceanic and Atmospheric Administration
POM	Particulate organic matter
TDN	Total dissolved nitrogen
TDP	Total dissolved phosphorus
TN	Total nitrogen
TOC	Total organic carbon
TON	Total organic nitrogen
TSS	Total suspended solids
RSMAS	Rosenstiel School of Marine and Atmospheric Science

The Boynton-Delray Coastal Water Quality Monitoring Program

Abstract

This report discusses a sequence of six cruises in the vicinity of the Boynton-Delray (South Central) treated-wastewater plant outfall plume (26°27'43"N, 80°2'32"W), the Boynton Inlet (26°32'43"N, 80°2'30"W), and the Lake Worth Lagoon, Palm Beach County, Florida. The sampling cruises took place on June 5-6, 2007; August 28-29, 2007; October 18-19, 2007; February 14 and 18, 2008; May 19-20, 2008; and July 11-13, 2008. Water was sampled at 18 locations at the surface, middle, and near the seafloor (where there was sufficient depth) for a total of 45 samples; these samples were analyzed for a variety of nutrients and related parameters. The water sampling unit contained a conductivity-temperature-depth (CTD) instrument from which data were obtained at each sampling site. Synchronal ocean current data were measured by a nearby acoustic Doppler current profiler (ADCP) instrument.

The inlet measurements were consistently lower in salinity and more acidic (lower in pH) than the coastal ocean and were warmer during the May and, especially, during the February cruises. For most analytes, viz., nitrite+nitrate (N+N), total suspended solids (TSS), chlorophyll-a, silica (Si), and total dissolved nitrogen (TDN), the lagoon concentrations were significantly higher than the coastal ocean; the inlet concentrations appeared to be consistent with lagoon water with partial mixing with the coastal ocean, as expected. Estimates of the nutrient flux to the coastal ocean were computed: approximately 1,500 kg of dissolved nitrogen (N), 2,350 kg of silicate (Si), 33 kg of orthophosphate (P), and 59 kg of ammonium (NH_4) per day were delivered to the coastal ocean through the inlet.

The outfall boil at South Central outfall (the smallest in volume of the six outfalls in southeast Florida) is only visible under ideal conditions. In the six cruises described in this document, the outfall boil could be found in only one cruise (August 28-29, 2007). Elevated concentrations of nutrients (N+N, P, Si, and P) at the outfall vicinity were measured, and these concentrations decreased rapidly away from the outfall for most analytes, to become undistinguished from the background within 3 km or less. Not finding the boil, however, in five of six cruises meant that the waters with the highest concentrations were probably missed. When the boil was sampled in August 2007, N+N, P, and total dissolved phosphorus (TDP) concentrations at the boil were roughly the same as from the inlet. For other analytes (chlorophyll-a, TSS, Si, and dissolved organic carbon [DOC]), the concentrations at or near the outfall were significantly less than those from the lagoon and inlet on most of the cruises.

The coastal ocean appeared to be significantly impacted by the Boynton Inlet and less so from the inlet. A suggestion of a source to the south was seen in some analytes. Measurements from the Gulf Stream Reef area were the lowest in the study, and may provide “background” concentrations for this

region. As expected, the coastal ocean was warmer and more stratified in the summer compared to the winter, e.g., whereas no thermocline was noted in the CTD data from February 2007, a strong thermocline was observed in most casts during July 2008. In certain cases (e.g., N+N in June 2007, pH in July 2008), an increase in the concentration (decrease for pH) from north to south implied a source from the south, e.g., the Boca Raton Inlet or Boca Raton outfall.

1. Introduction

The present document provides a data summary for six water quality monitoring cruises conducted between June 2007 and July 2008. The area monitored extended from approximately 5 km south of the South Central outfall to just north of the Boynton Inlet.

2. Background

The coastal ocean area for which these water quality monitoring cruises were designed is subject to multiple coastal ocean processes and the presence of multiple water mass types. Multiple sources of nutrients to the coastal ocean area are likely to be present, including upwelled deep ocean water, inlet outflow, groundwater discharge, ocean wastewater effluent discharge, atmospheric deposition and, possibly, septic discharge. Only a limited database of nutrient and water mass type parameters exists for the coastal ocean area of Boynton-Delray. A local environmental group, Reef Rescue (Tichenor, 2005), most recently conducted an approximately five-month long water quality measurement program extending from August 2005 to December 2005. The monitoring program described herein measured many of the same parameters at or near the same locations as those used in the Reef Rescue effort. Other parameters were measured as well, which may be useful in examining water mass types and other regulatory concerns, e.g., ammonia.

3. Monitoring Goals and Objectives

The objectives of the water quality monitoring were as followed:

1. Obtain a database for water quality parameters including: (1) dissolved nutrients such as NH_4-N, nitrite-N, nitrate+nitrite-N, orthophosphate-P, silicate-Si, total dissolved phosphorus, and total dissolved nitrogen; (2) chlorophyll-a; (3) total suspended solids; (4) pH; and (5) dissolved organic carbon.

2. Obtain vertical profiles of temperature and salinity essentially concomitantly with water quality samples.

4. Water Quality Monitoring

4.1 Site Location and Description

The coral reef system (Gulf Stream Reef, Delray Ledge, and Seagate Reef) is located approximately one mile offshore of Palm Beach County (Figure 1). This area forms the northern section of the Florida reef tract, which extends from the Dry Tortugas through the Florida Keys and north to Palm Beach County. The reef ranges in depth from 10-30 meters and is in close proximity to the Gulf Stream. The Boynton Beach Inlet is located and discharges to the north and west of the reef system, while the South Central outfall is located and discharges to the south and on the edge of the reef system, with the exception of Seagate Reef which is located to the south of the outfall.

Sampling events occurred at 18 pre-established monitoring stations. Each station was sampled at three depths: surface, mid-depth, and near bottom (except for station BD-13 and BD-16 through BD-18 surface only, and station BD-14 surface and near bottom only). Station locations are identified in Table 1 and shown in Figure 1. Sampling events were conducted from south to north in an effort to increase the likelihood of obtaining samples from within the same water mass since the predominant current is to the north. All efforts were made to sample on an outgoing tidal cycle to obtain the maximum impact of the Lake Worth Lagoon on the sampling area. This was dependent upon timing and weather conditions.

Table 1: Water quality sampling sites.

Station Number	Latitude	Longitude	Station Number	Latitude	Longitude
BD-1A	26.42565	-80.04542	BD-8C	26.51073	-80.03543
BD-1B	26.42565	-80.04542	BD-9A	26.50833	-80.04167
BD-1C	26.42565	-80.04542	BD-9B	26.50833	-80.04167
BD-2A	26.44212	-80.04725	BD-9C	26.50833	-80.04167
BD-2B	26.44212	-80.04725	BD-10A	26.52273	-80.03228
BD-2C	26.44212	-80.04725	BD-10B	26.52273	-80.03228
BD-3A	26.45803	-80.04252	BD-10C	26.52273	-80.03228
BD-3B	26.45803	-80.04252	BD-11A	26.53333	-80.03583
BD-3C	26.45803	-80.04252	BD-11B	26.53333	-80.03583
BD-4A	26.46192	-80.04208	BD-11C	26.53333	-80.03583
BD-4B	26.46192	-80.04208	BD-12A	26.53874	-80.03980
BD-4C	26.46192	-80.04208	BD-12B	26.53874	-80.03980
BD-5A	26.46628	-80.04182	BD-12C	26.53874	-80.03980
BD-5B	26.46628	-80.04182	BD-13A	26.54542	-80.04300
BD-5C	26.46628	-80.04182	BD-14A	26.54747	-80.04003
BD-6A	26.47558	-80.03995	BD-14C	26.54747	-80.04003
BD-6B	26.47558	-80.03995	BD-15A	26.55907	-80.03327
BD-6C	26.47558	-80.03995	BD-15B	26.55907	-80.03327
BD-7A	26.48773	-80.03933	BD-15C	26.55907	-80.03327
BD-7B	26.48773	-80.03933	BD-16A	26.54626	-80.04818
BD-7C	26.48773	-80.03933	BD-17A	26.54266	-80.04793
BD-8A	26.51073	-80.03543	BD-18A	26.53944	-80.04954
BD-8B	26.51073	-80.03543			

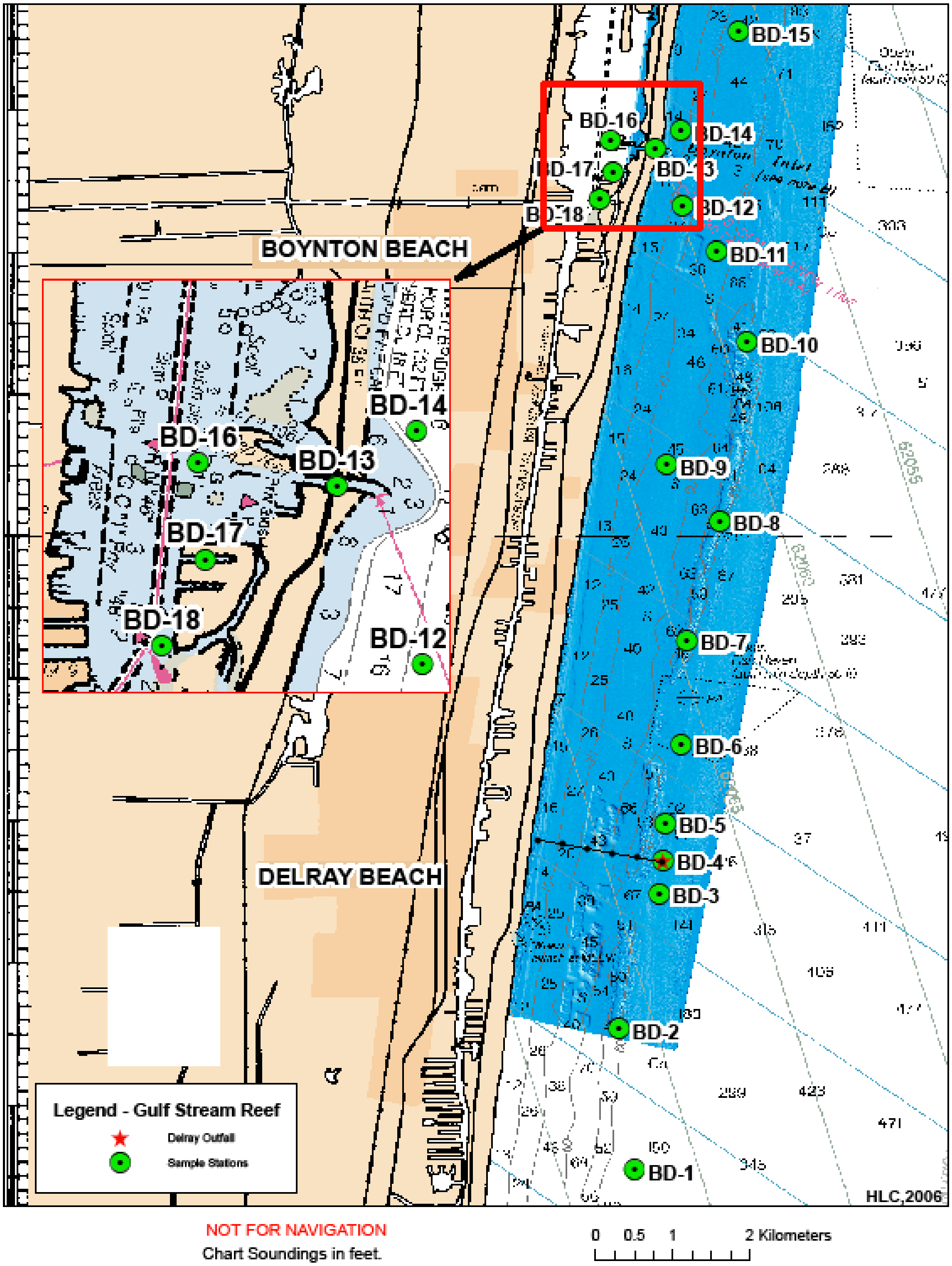

Figure 1: Map of station locations. Red star indicates location of the South Central outfall. Numbers indicate sample station.

4.2 Sampling Overview

Details of the six water quality monitoring cruises are given in Table 2.

Table 2: Water quality sampling cruises for 2007-2008.

Cruise	Calendar Days	Dec Day	Current	Inlet Flow	Boil	Ship
1	June 5-6, 2007	155, 156	N	Ebb	Not visible	RV *Cable*
2	August 28-29, 2007	240, 241	N	Ebb	Visible	RV *Cable*
3	October 18-19, 2007	291, 292	N	Ebb	Not visible	RV *Cable*
4	February 14 and 18, 2008	45, 49	N	Ebb	Not visible	RV *Nancy Foster*
5	May 19-20, 2008	140, 141	N	Ebb	Not visible	RV *Cable*
6	July 11-12, 2008	193, 194	N,S	Ebb	Not visible	RV *Walton Smith*

4.3 Field Parameters

Field parameters collected for the six water quality monitoring cruises are listed in Table 3.

Table 3: Measurements obtained from the water quality monitoring program.

Water Column Profile Measurements	Discrete Water Sample Measurements
Conductivity (mS/cm)	Nutrients (µM)[1]
Temperature (°C)	Chlorophyll-a (µg/L)
Depth (m)	pH (units)
Dissolved oxygen (mg/L)	Total suspended solids (mg/L)
pH (units)	Dissolved organic carbon (µg/L)
Salinity (units)	
Turbidity (NTU)	
Chlorophyll-a (µg/L)	

[1]Nutrients included ammonia, nitrate+nitrite, orthophosphate, silicate, total dissolved nitrogen, and total dissolved phosphorus.

5. Field Sample Collection Methods

5.1 Water Column Data Collection

A YSI 6600 Sonde or Seabird 911 CTD cast was conducted at each monitoring station at the same time that Niskin bottles were lowered. When the YSI/CTD was turned on, data were recorded internally every second. For each cast, the station number, cast number, and time were recorded.

The sensors on the YSI/CTD unit were equilibrated with sample water. The YSI/CTD unit was turned on, lowered into the water until the entire unit was submerged, and held stationary for one minute. The YSI/CTD unit was then slowly lowered to the bottom and retrieved. Data were subsequently processed, analyzed, and archived at AOML.

5.2 Water Sample Collection

At each station, discrete water samples were collected for nutrients, DOC, pH, TSS, and chlorophyll-a. Once on site, the depth was determined from the RV *Cable* or RV *Nancy Foster* using a depth sounder. Once the depth was determined, three 5-L Niskin bottles were attached to the line to sample the surface, mid depth, and near bottom of that particular station (the RV *Nancy Foster* used a CTD rosette with 12 2-L Niskin bottles). The Niskin bottles, along with the YSI/CTD unit, were lowered by winch, and water samples were collected by the Niskin bottles at the appropriate depths. Niskin bottles were retrieved and the sample water was withdrawn and placed in pre-labeled sample containers. Sample containers were placed on ice (4°C) in storage coolers aboard the RV *Cable* or RV *Nancy Foster* and transported to AOML for processing and analysis.

6. Analytical Methods

6.1 Chlorophyll-a and Phaeopigment Analysis

Chlorophyll-a concentrations were determined via a standardized filtration-extraction method using a 60:40 mixture of acetone and dimethyl sulfoxide (Shoaf and Lium, 1976; Kelble *et al.,* 2005). The fluorescence of each sample was measured before and after acidification to correct for phaeophytin on a Turner Designs model TD-700 fluorometer. The fluorescence values were calibrated using known concentrations of chlorophyll-a to yield chlorophyll-a concentrations in mg/m^{-3}.

6.2 Total Suspended Solids Analysis

Total suspended solids (TSS) were determined gravimetrically for each station following Young *et al.* (1981) and Kelble *et al.* (2005). As large a volume of the sample as possible, with a minimum of 200 ml, was filtered onto pre-weighed filters that were dried and reweighed to calculate TSS using the following equation:

$$TSS = (W_{post} - W_{pre})/V_{filtered}$$

where W_{pre} is the pre-filtration weight, W_{post} is the post-filtration weight, and $V_{filtered}$ is the volume filtered.

6.3 Nutrient Analysis

Nutrient analyses were conducted using the following EPA methods.

EPA method 349.0 was used to determine the concentration of ammonia (NH_4) for each station (Zhang *et al.,* 1997b). This method uses automated gas segmented continuous flow colorimetry for the analysis of ammonia. Ammonia in solution reacts with alkaline phenol and NADTT at 60°C to form indophenol blue in the presence of sodium nitroferricyanide as a catalyst. The absorbance of indophenol blue at 640 nm is linearly proportional to the concentration of ammonia in the sample. Results are given µM (10^{-6} moles of N per liter) units.

EPA method 353.4 was used to determine the concentration of nitrate and nitrite (N+N) for each station (Zhang *et al.,* 1997a). This method uses automated gas segmented continuous flow colorimetry for the analysis of nitrate (NO_2) and nitrate (NO_3). Samples are passed through a copper-coated cadmium reduction column. Nitrate is reduced to nitrite in a buffer solution. The nitrite is then determined by diazotizing with sulfanilamide and coupling with N-1-naphthylethylenediamine dihydrochloride to form a color azo dye. The absorbance measured at 450 nm is linearly proportional to the concentration of nitrite + nitrate in the sample. Nitrate concentrations are obtained by subtracting nitrite values, which have been separately determined without the cadmium reduction procedure, from the nitrite + nitrate values. Results are given in µM (10^{-6} moles of N per liter) units.

EPA method 365.5 was used to determine the concentration of orthophosphate (P) for each station (Zimmermann and Keefe, 1997; Zhang *et al.,* 2001). This method uses automated calorimetric and continuous flow analysis for the determination of low-level orthophosphate concentrations. Ammonium molybdate and antimony potassium tartrate react in an acidic medium with dilute solutions of phosphate to form an antimony-phospho-molybdate complex. This complex is reduced to an intensely blue-colored complex by ascorbic acid. The absorbance measured at 800 nm is proportional to the phosphate concentration in the sample. Results are given in µM (10^{-6} moles of P per liter) units.

EPA method 366.0 was used to determine the concentration of silica (Si) for each station (Zhang and Berberian, 1997). This method uses automated gas segmented continuous flow colorimetry for the analysis of dissolved silicate concentration. Silicate contained in the sample reacts with molybdate in acidic solution to form β-molybdosilicic acid. The β-molybdosilicic acid is then reduced by ascorbic acid to form molybdenum blue. The absorbance of the molybdenum blue, measured at 660 nm, is linearly proportional to the concentration of silicate in the sample. Results are given in µM (10^{-6} moles of Si per liter) units.

EPA method 367.0 was used to determine the total phosphorus (P) concentration for each station (Zhang *et al.,* 1998). This method determines total dissolved phosphorus (TDP) concentration by autoclave promoted persulfate oxidation of organically-bound phosphorus, followed by a gas segmented continuous flow colorimetric analysis of digested samples. In this method, dissolved organic phosphorus (DOP) in the water reacts with persulfate in acidic media at elevated temperature and pressure. An autoclave is used to achieve a temperature of 120°C and pressure of 2 atmospheres, which promotes oxidation. After samples are cooled to room temperature, an aliquot of ascorbic acid is added to remove the free chlorine formed in seawater during the digestion. These autoclaved samples are then analyzed for phosphate concentrations by the molybdenum blue calorimetric method using a gas segmented continuous flow analysis by a flow solution analyzer. In this method, phosphate reacts with molybdenum (VI) and antimony (III) in an acidic medium to form an antimonyphosphomolybdate complex. This complex is subsequently reduced by ascorbic acid to form a blue complex, and the absorbance is measured at 710 nm. Undigested samples are analyzed separately to obtain the concentration of dissolved inorganic phosphate (DIP). Dissolved organic phosphorus is calculated as the difference between total dissolved phosphorus and dissolved inorganic phosphorus (DOP = TDP – DIP). Results are given in µM (10^{-6} moles of P per liter) units.

Total dissolved nitrogen (TDN) was measured using the thermal decomposition/NO detection chemiluminescence method in a Shimadzu total organic carbon analyzer (Shimadzu, 2004). When a sample is introduced into the combustion tube (furnace temperature 720°C), the total nitrogen in the sample decomposes to nitrogen monoxide. Nitrogen gas does not become nitrogen monoxide under these circumstances. The carrier gas, which contains the nitrogen monoxide, is cooled and dehumidified by the electronic dehumidifier. The gas then enters a chemi-luminescence gas analyzer where nitrogen monoxide is detected. The detection signal from the chemiluminescence gas analyzer generates a peak and the TN concentration in the sample can then be measured. Results are given in µM (10^{-6} moles of N per liter) units.

6.4 Dissolved Organic Carbon Analysis

Dissolved organic carbon (DOC) was measured by a Shimadzu total organic carbon analyzer (Shimadzu, 2004). This method determines organic content after the removal of inorganic carbon. Samples are acidified to a pH of 2 to 3 and subsequently degassed. Carbonates are no longer stable with this pH value and, therefore, form carbon dioxide. The inorganic carbon is removed by degassing. The organic carbon content of the sample is introduced into the combustion tube, which is filled with an oxidation catalyst and heated to 680°C. The sample is burned in the combustion tube and the contents are converted to carbon dioxide. A carrier gas, which flows at a rate of 150 mL/min to the combustion tube, carries the sample combustion products from the combustion tube to an electronic dehumidifier where the gas is cooled and dehydrated. The gas then carries the sample combustion products through a halogen scrubber to remove chlorine and other halogens. Finally, the carrier gas delivers the sample combustion products to the cell of a non-dispersive infrared (NDIR) gas analyzer, where the carbon dioxide is detected. The NDIR outputs an analog detection signal that forms a peak. From this peak, the concentration of DOC can be determined. Results are given in µM (10^{-6} moles of C per liter) units.

7. Procedures for Water Sample Analysis

7.1 Chlorophyll Analysis

Water samples were filtered through 25 cm, 0.45-µm glass fiber filters using a filter apparatus either attached to a hand pump or a vacuum pump. Approximately 200 ml of sample water was filtered. Before filtering the next sample station, the filtering apparatus was cleaned by rinsing with deionized water. The filter was folded in half by forceps, making sure not to touch with hands and placed in a 2-ml polypropylene vial. A duplicate from the same sample was also filtered and placed in the same vial. Sample vials were placed in a 20 L Dewar of liquid nitrogen until analyzed.

7.2 Total Suspended Solids Analysis

Water samples were filtered through pre-weighed 47 mm, 0.4-µm polycarbonate filters. Each filter was placed in a pre-labeled 47-mm petri dish with a lid and placed in a drying oven for 24 hours at 60°C. Petri dishes with filters were taken from the oven and allowed to cool in a dessicator. After cooling, filters were removed from the petri dishes with forceps and weighed on an AD-6 autobalance. Filters were not touched or left out in the open air for any period of extended time to avoid collection of moisture which would lead to erroneous results. Filters were dried and pre-weighed before each water quality monitoring cruise.

7.3 Nutrient Analysis

Water samples were filtered through 0.45-µm membrane filters using a 50-ml syringe and collected in two 8-ml polystyrene test tubes, one for NH_4 analysis and the other for N+N, NO_2, P, and Si analysis. The filters were washed before use by passing 25 ml of sample water through them. The sample tubes were rinsed three times with sample water, shaking with the cap in place after each rinse, then filled with sample water and preserved. Ammonia samples were preserved by the addition of 0.2% (V/V) of chloroform. All sample tubes were placed upright in a test tube rack and refrigerated in the dark on ice (4°C) and transported to AOML for analysis.

7.4 Dissolved Organic Carbon Analysis

Water samples were filtered through GF/F filters to remove any particulate materials from the sample. Before filtering, the filters were baked at 450°C for 4 hours to remove any organic carbon from the filters. After filtration, a subsample was placed in a pre-cleaned, 10-ml glass vial and then placed in the auto-sampler of the Shimadzu total organic carbon analyzer V-CPH/CPN. The amount of dissolved organic carbon was measured.

8. Quality Assurance and Quality Control

Quality assurance (QA) provides a process for ensuring the reliability and value of measured data. Sound QA practices are essential to acquire data of the necessary type and quality for their intended use.

8.1 Measurement Quality Objectives

Measurement quality objectives are defined as acceptance criteria for the quality attributes measured by project quality indicators (EPA, 2002a). They are quantitative measures of performance. These are often the accuracy, precision, completeness, and bias guidelines against which laboratory and some field quality control (QC) results are compared. The acceptable levels listed in Table 4 are to be applied to batch-level data and may be assessed by only a few (QC) samples.

Table 4: Measurement quality objectives.

Analyte	Accuracy	Precision	Completeness
FIELD CONSTITUENTS			
Conductivity	± 0.5%	NA	90%
Salinity	± 1%	NA	90%
Temperature	± 0.15°C	NA	90%
pH	± 0.2 units	NA	90%
Dissolved oxygen	± 2%	NA	90%
Turbidity	± 5%	NA	90%
Chlorophyll	N/A	NA	90%
LABORATORY CONSTITUENTS			
Ammonia (NH_4)	10%	10%	95%
Nitrate + nitrite (N+N)	10%	10%	95%
Nitrite (NO_2)	10%	10%	95%
Orthophosphate (P)	10%	10%	95%
Silicate (Si)	10%	10%	95%
Total dissolved phosphorus (TDP)	10%	10%	95%
Dissolved organic carbon (DOC)	10%	10%	95%
Total dissolved nitrogen (TDN)	10%	10%	95%
pH	10%	10%	95%
Chlorophyll	20%	20%	95%
Total suspended solids (TSS)	20%	20%	95%

8.2 Accuracy

Accuracy is the measure of the agreement between an observed value and an accepted reference value or true value.

8.2.1 Field Accuracy

Field accuracy was assessed through the use of trip blanks. For the accuracy assessment to be relevant, all protocols concerning sample collection, handling, preservation, and holding times must be maintained.

For grab sampling, trip blanks were used to determine if the samples collected had been contaminated. Trip blanks consisting of reagent grade deionized water and/or low nutrient seawater (LNSW) were submitted to the analytical laboratory to assess the quality of the data resulting from the field monitoring program.

8.3 Precision

Precision is a measure of the variability in the results of replicate measurements due to random error (Lombard and Kirchmer, 2001). Random errors are always present due to normal variability in the many factors affecting the measurement results. Precision was determined by the following:

1. Collection and analysis of field duplicates for nutrients, TSS, chlorophyll-a, pH, and DOC.
2. Calculation of the relative percent difference (% RPD).
3. Documentation of ongoing field equipment maintenance, calibration, and operation.

8.3.1 Field Precision

Field precision tests were conducted for grab samples. The precision of grab samples was assessed by a comparison with field duplicates. The relative percent difference (RPD) between the analyte levels measured in the field duplicates was calculated as follows:

$$RPD = \frac{|C_A - C_B|}{0.5(C_A + C_B)} \times 100$$

where C_A is the measured concentration of a sample and C_B is the measured concentration of a duplicate sample.

8.4 Completeness

Completeness is a measure of the amount of valid data obtained from the monitoring program compared to the amount of data that were expected. Events that may contribute to reduction in measurement completeness include sample container breakage, inaccessibility to proposed sampling locations, automatic sampler failure, and laboratory equipment failures.

The percent completeness (% C) was determined as follows:

$$\% \, C = \frac{(M_V)}{(M_P)} \times 100$$

where M_V is the number of valid measurements and M_P is the number of planned measurements.

8.4.1 Laboratory Completeness

Laboratory completeness is a measure of the amount of valid measurements obtained from all samples submitted for each sampling activity. The completeness criterion for all measurements is 95%.

8.4.2 Field Completeness

Field completeness is determined by the number of measurements collected versus the number of measurements planned for collection. The completeness criterion for all measurements and sample collection is 90%, but will be influenced by environmental situations that may alter monitoring schedules.

8.5 Field Quality Control

Table 5a lists the type and number of quality control samples collected for each parameter during each water quality sampling trip.

Table 5a: Field quality control samples.

Parameter	Field Cleaned Equipment Blanks	Trip Blanks	Field Duplicates (10% of Total)
Chlorophyll-a	1	1	49
Total suspended solids	1	1	5
Ammonia	1	1	5
Nitrite	1	1	5
Nitrate+nitrite	1	1	5
Orthophosphate	1	1	5
Silicate	1	1	5
pH	0	0	5
Dissolved organic carbon	0	0	5
Total dissolved phosphorus	0	0	5
Total dissolved nitrogen	0	0	5

8.6 Laboratory Quality Control

The minimum detection levels (MDLs), preservation, and holding times are listed in Table 5b.

Table 5b: Laboratory minimum detection limits, number of samples, and preservative.

Analyte	Sample Matrix	Number of Samples/Month	MDL	Preservative
Chlorophyll-a	NA	49	0.05 µg/L	Liquid N
Total suspended solids	Total	49	0.1 mg/L	4°C; 7 days
Ammonia	Dissolved	49	0.3 µg N/L	Chloroform; ASAP
Nitrite	Dissolved	49	0.075 µg N/L	Freezing; 2 weeks
Nitrate+nitrite	Dissolved	49	0.075 µg N/L	Freezing; 2 weeks
Orthophosphate	Dissolved	49	0.7 µg P/L	Freezing; 2 months
Silicate	Dissolved	49	1.2 µg Si/L	Freezing; 2 months
pH	NA	49	0.004 pH units	4°C; ASAP
Dissolved organic carbon	Dissolved	49	4 µg C/L	Freezing, 2 months
Total dissolved phosphorus	Total dissolved	49	0.3 µg P/L	Freezing; 2 months
Total dissolved nitrogen	Total dissolved	49	4 µg N/L	Freezing; 2 months

9. Water Quality Monitoring Data Summary

9.1 June 2007

Water quality monitoring was conducted on June 5-6, 2007 from the RV *Cable*. All stations were sampled for the water quality parameters listed in Table 2, except for the vertical profiles of the water column. The ADV YSI could only sample every minute, which made it impossible to conduct vertical profiles. Separate salinity samples were collected from each Niskin bottle to obtain a salinity value for each depth sampled. Trip and equipment blanks were collected for the cruise. The times and dates of sample collection are listed in Table 6. The water quality data are listed in Tables 7-9.

Table 6: Dates and times of water sample collection for June 2007.

Date	Time (local)	Station	Latitude	Longitude	Depth (m)
6/5/2007	10:17	BD-1A	26.42550	-80.04545	0
6/5/2007	10:17	BD-1B	26.42550	-80.04545	16
6/5/2007	10:17	BD-1C	26.42550	-80.04545	35
6/5/2007	10:55	BD-2A	26.44201	-80.04729	0
6/5/2007	10:55	BD-2B	26.44201	-80.04729	8
6/5/2007	10:55	BD-2C	26.44201	-80.04729	16
6/5/2007	11:37	BD-3A	26.45828	-80.04247	0
6/5/2007	11:37	BD-3B	26.45828	-80.04247	16
6/5/2007	11:37	BD-3C	26.45828	-80.04247	33
6/5/2007	12:16	BD-4A	26.46192	-80.04195	0
6/5/2007	12:16	BD-4B	26.46192	-80.04195	16
6/5/2007	12:16	BD-4C	26.46192	-80.04195	32
6/5/2007	13:00	BD-5A	26.46620	-80.04167	0
6/5/2007	13:00	BD-5B	26.46620	-80.04167	15
6/5/2007	13:00	BD-5C	26.46620	-80.04167	30
6/5/2007	13:35	BD-6A	26.47532	-80.03976	0
6/5/2007	13:35	BD-6B	26.47532	-80.03976	15
6/5/2007	13:35	BD-6C	26.47532	-80.03976	30
6/5/2007	14:05	BD-7A	26.48737	-80.03871	0
6/5/2007	14:05	BD-7B	26.48737	-80.03871	10
6/5/2007	14:05	BD-7C	26.48737	-80.03871	20
6/6/2007	07:54	BD-8A	26.51507	-80.03542	0
6/6/2007	07:54	BD-8B	26.51507	-80.03542	10
6/6/2007	07:54	BD-8C	26.51507	-80.03542	20
6/6/2007	08:40	BD-9A	26.50838	-80.04129	0
6/6/2007	08:40	BD-9B	26.50838	-80.04129	7
6/6/2007	08:40	BD-9C	26.50838	-80.04129	15
6/6/2007	09:08	BD-10A	26.52261	-80.03223	0
6/6/2007	09:08	BD-10B	26.52261	-80.03223	8
6/6/2007	09:08	BD-10C	26.52261	-80.03223	16
6/6/2007	09:41	BD-11A	26.53333	-80.03584	0
6/6/2007	09:41	BD-11B	26.53333	-80.03584	7
6/6/2007	09:41	BD-11C	26.53333	-80.03584	13
6/6/2007	10:04	BD-12A	26.53874	-80.03980	0
6/6/2007	10:04	BD-12B	26.53874	-80.03980	5
6/6/2007	10:04	BD-12C	26.53874	-80.03980	8
6/6/2007	15:00	BD-13A	26.54542	-80.04300	0
6/6/2007	10:40	BD-14A	26.54242	-80.03996	0
6/6/2007	10:40	BD-14C	26.54242	-80.03996	3
6/6/2007	11:04	BD-15A	26.55919	-80.03329	0
6/6/2007	11:04	BD-15B	26.55919	-80.03329	6
6/6/2007	11:04	BD-15C	26.55919	-80.03329	13
6/6/2007	14:24	BD-16A	26.54618	-80.04791	0
6/6/2007	14:10	BD-17A	26.54264	-80.04790	0
6/6/2007	13:53	BD-18A	26.53950	-80.04951	0

Table 7: June 2007 Boynton-Delray nutrient values in µM.

Station	Depth (m)	N+N (µM)	NH_4 (µM)	P (µM)	Si (µM)
BD-1A	0	0.50	0.72	0.01	0.00
BD-1B	16	0.51	0.67	0.00	0.05
BD-1C	35	0.68	0.75	BDL	0.33
BD-2A	0	0.18	0.97	BDL	BDL
BD-2B	8	0.18	0.53	BDL	BDL
BD-2C	16	0.31	0.99	BDL	BDL
BD-3A	0	0.42	1.00	BDL	BDL
BD-3B	16	0.39	0.96	BDL	BDL
BD-3C	33	0.31	0.54	BDL	0.23
BD-4A	0	0.38	0.59	BDL	BDL
BD-4B	16	0.18	0.49	BDL	BDL
BD-4C	32	0.30	0.64	BDL	0.12
BD-5A	0	0.26	0.75	BDL	BDL
BD-5B	15	0.20	0.70	BDL	BDL
BD-5C	30	0.28	0.62	BDL	0.10
BD-6A	0	0.18	0.58	BDL	0.05
BD-6B	15	0.17	0.81	BDL	BDL
BD-6C	30	0.30	0.66	BDL	0.12
BD-7A	0	0.21	0.62	BDL	BDL
BD-7B	10	0.09	0.77	BDL	BDL
BD-7C	20	0.12	0.55	BDL	BDL
BD-8A	0	0.06	0.72	BDL	BDL
BD-8B	10	0.08	0.71	BDL	BDL
BD-8C	20	0.12	0.71	BDL	BDL
BD-9A	0	0.09	0.61	BDL	BDL
BD-9B	7	0.07	0.65	0.01	BDL
BD-9C	15	0.10	0.69	0.02	BDL
BD-10A	0	0.09	0.63	0.06	BDL
BD-10B	8	0.12	0.58	BDL	BDL
BD-10C	16	0.36	0.67	0.02	BDL
BD-11A	0	0.11	0.48	BDL	BDL
BD-11B	7	0.06	0.63	0.05	BDL
BD-11C	13	0.08	0.63	BDL	BDL
BD-12A	0	0.29	0.77	BDL	2.00
BD-12B	5	0.06	0.51	BDL	BDL
BD-12C	8	0.09	0.65	BDL	BDL
BD-13A	0	2.25	0.48	0.05	22.00
BD-14A	0	0.08	0.54	BDL	0.16
BD-14C	3	0.07	0.66	BDL	0.06
BD-15A	0	0.14	0.67	BDL	0.92
BD-15B	6	0.06	0.56	BDL	BDL
BD-15C	13	0.06	0.57	BDL	BDL
BD-16A	0	2.50	0.60	BDL	26.20
BD-17A	0	21.80	0.34	0.11	31.10
BD-18A	0	3.90	1.19	0.15	36.00

Table 8: June 2007 Boynton-Delray nutrient values in mg/L.

Station	Depth (m)	N+N (mg/L)	NH_4 (mg/L)	P (mg/L)	Si (mg/L)
BD-1A	0	0.007	0.010	BDL	BDL
BD-1B	16	0.007	0.009	BDL	0.001
BD-1C	35	0.010	0.011	BDL	0.009
BD-2A	0	0.003	0.014	BDL	BDL
BD-2B	8	0.003	0.007	BDL	BDL
BD-2C	16	0.004	0.014	BDL	BDL
BD-3A	0	0.006	0.014	BDL	BDL
BD-3B	16	0.005	0.013	BDL	BDL
BD-3C	33	0.004	0.008	BDL	0.006
BD-4A	0	0.005	0.008	BDL	BDL
BD-4B	16	0.003	0.007	BDL	BDL
BD-4C	32	0.004	0.009	BDL	0.003
BD-5A	0	0.004	0.011	BDL	BDL
BD-5B	15	0.003	0.010	BDL	BDL
BD-5C	30	0.004	0.009	BDL	0.003
BD-6A	0	0.003	0.008	BDL	0.001
BD-6B	15	0.002	0.011	BDL	BDL
BD-6C	30	0.004	0.009	BDL	0.003
BD-7A	0	0.003	0.009	BDL	BDL
BD-7B	10	0.001	0.011	BDL	BDL
BD-7C	20	0.002	0.008	BDL	BDL
BD-8A	0	0.001	0.010	BDL	BDL
BD-8B	10	0.001	0.010	BDL	BDL
BD-8C	20	0.002	0.010	BDL	BDL
BD-9A	0	0.001	0.009	BDL	BDL
BD-9B	7	0.001	0.009	BDL	BDL
BD-9C	15	0.001	0.010	0.001	BDL
BD-10A	0	0.001	0.009	0.002	BDL
BD-10B	8	0.002	0.008	BDL	BDL
BD-10C	16	0.005	0.009	0.005	BDL
BD-11A	0	0.002	0.007	BDL	BDL
BD-11B	7	0.001	0.009	0.002	BDL
BD-11C	13	0.001	0.009	BDL	BDL
BD-12A	0	0.004	0.011	BDL	0.056
BD-12B	5	0.001	0.007	BDL	BDL
BD-12C	8	0.001	0.009	BDL	BDL
BD-13A	0	0.032	0.007	0.002	0.616
BD-14A	0	0.001	0.008	BDL	0.004
BD-14C	3	0.001	0.009	BDL	0.002
BD-15A	0	0.002	0.009	BDL	0.026
BD-15B	6	0.001	0.008	BDL	BDL
BD-15C	13	0.001	0.008	BDL	BDL
BD-16A	0	0.035	0.008	BDL	0.734
BD-17A	0	0.305	0.005	0.003	0.871
BD-18A	0	0.055	0.017	0.005	1.008

Table 9: June 2007 Boynton-Delray salinity, pH, chlorophyll-a, phaeopigments, and TSS results.

Station	Depth (m)	Temperature (°C)	Salinity (units)	pH (units)	Chlorophyll-a (µg/L)	Phaeopigments (µg/L)	TSS (mg/L)
BD-1A	0	N/A	36.2	7.97	0.394	0.161	0.42
BD-1B	16	N/A	36.3	7.98	0.642	0.258	0.35
BD-1C	35	N/A	36.4	7.97	0.343	0.188	0.26
BD-2A	0	N/A	36.2	8.01	0.448	0.181	0.43
BD-2B	8	N/A	36.2	8.00	0.649	0.263	0.37
BD-2C	16	N/A	36.3	7.99	0.604	0.243	0.39
BD-3A	0	N/A	36.2	7.98	0.486	0.183	0.37
BD-3B	16	N/A	36.2	8.00	0.481	0.170	0.33
BD-3C	33	N/A	36.4	7.99	0.539	0.271	0.25
BD-4A	0	N/A	36.1	8.00	0.523	0.189	0.40
BD-4B	16	N/A	36.2	7.99	0.708	0.269	0.26
BD-4C	32	N/A	36.3	8.00	0.642	0.303	0.36
BD-5A	0	N/A	36.1	8.00	0.664	0.200	0.37
BD-5B	15	N/A	36.2	8.00	N/A	N/A	0.49
BD-5C	30	N/A	36.3	8.00	0.687	0.294	0.32
BD-6A	0	N/A	36.1	8.00	0.735	0.233	0.28
BD-6B	15	N/A	36.2	8.00	0.830	0.272	0.36
BD-6C	30	N/A	36.4	8.00	0.711	0.295	0.32
BD-7A	0	N/A	36.1	8.00	0.744	0.249	0.27
BD-7B	10	N/A	36.3	8.00	0.821	0.289	0.17
BD-7C	20	N/A	36.3	8.01	0.778	0.287	0.39
BD-8A	0	N/A	36.1	8.00	0.292	0.131	0.07
BD-8B	10	N/A	36.3	8.00	0.332	0.152	0.29
BD-8C	20	N/A	36.4	8.00	0.336	0.163	0.04
BD-9A	0	N/A	36.0	8.00	0.609	0.209	0.21
BD-9B	7	N/A	36.2	7.99	0.622	0.271	0.07
BD-9C	15	N/A	36.3	7.96	0.509	0.216	0.33
BD-10A	0	N/A	36.2	8.01	0.268	0.128	0.33
BD-10B	8	N/A	36.3	8.00	0.335	0.146	0.19
BD-10C	16	N/A	36.3	7.99	0.252	0.177	0.07
BD-11A	0	N/A	36.1	8.00	0.550	0.182	0.11
BD-11B	7	N/A	36.3	8.01	0.526	0.168	0.26
BD-11C	13	N/A	36.3	7.99	0.412	0.167	0.26
BD-12A	0	N/A	33.7	7.96	2.427	0.830	1.13
BD-12B	5	N/A	36.1	7.99	0.600	0.246	0.33
BD-12C	8	N/A	36.1	8.00	0.742	0.274	0.33
BD-13A	0	N/A	21.7	7.81	17.047	3.568	3.72
BD-14A	0	N/A	35.6	7.98	0.993	0.334	0.46
BD-14C	3	N/A	35.7	7.98	0.902	0.340	0.41
BD-15A	0	N/A	34.8	7.98	0.702	0.269	0.74
BD-15B	6	N/A	36.2	8.00	0.565	0.173	0.24
BD-15C	13	N/A	36.3	7.97	0.485	0.171	0.23
BD-16A	0	N/A	20.4	7.78	21.489	4.070	4.06
BD-17A	0	N/A	9.7	7.79	25.877	4.183	4.08
BD-18A	0	N/A	10.1	7.58	27.965	4.929	4.88

The tides on June 5, 2007 were at (01:22; 13:29) High and (08:01; 20:15) Low. On June 6, 2007, tides were at (02:06, 14:21) High and (08:51, 21:09) Low. Sea conditions were 2 feet or less, except for June 5th when seas became over 2 feet during the late afternoon, and sampling had to be suspended. Heavy rain occurred several days before sampling and during sampling on June 6th. A total of five duplicate samples were collected for each water quality parameter. The inlet sample BD-13A was collected on an outgoing tidal cycle. The surface boil of the South Central outfall was not visible at the surface; the sample was collected at the known coordinates of the outfall. The current was moving in a northerly direction.

Salinity values (Figure 2) varied little for the reef and outfall, with values ranging from 36.0-36.4 salinity units except for station BD-12A, which had a salinity value of 33.7 due to the possible influence from the Boynton Inlet discharge. The Boynton Inlet and Lake Worth Lagoon had values which ranged from 9.7-21.7 salinity units. The pH values (Figure 3) varied slightly, with values ranging from 7.96-8.01 for the reef and outfall areas and 7.58-7.81 for the Boynton Inlet and Lake Worth Lagoon. Chlorophyll values (Figure 4) ranged from 2.43-0.252 μg/L over the reef and outfall, while the Boynton Inlet and Lake Worth Lagoon ranged from 17.05-27.96 μg/L. TSS values (Figure 5) varied from 0.04-1.13 mg/L over the reef and outfall areas, while the Boynton Inlet and Lake Worth Lagoon values ranged from 3.72-4.88 mg/L. Station 12A had a much higher value of chlorophyll and TSS, possibly from the influence of the discharge from the Boynton Inlet.

The NO_3-N+NO_2-N values (Figure 6) ranged from 0.06-0.68 μM for the reef and outfall areas, while the Boynton Inlet and Lake Worth Lagoon values ranged from 2.25-21.80 μM. The NH_4-N values (Figure 7) ranged from 0.48-1.0 μM for the reef and outfall, while the Boynton Inlet and Lake Worth Lagoon values ranged from 0.48-1.19 μM. Ortho-PO_4-P values (Figure 8) ranged from below detection limit (BDL) to 0.06 μM over the reef and outfall, while the Boynton Inlet and Lake Worth Lagoon values ranged from BDL to 0.15 μM. SiO_4-Si values (Figure 9) ranged from BDL to 2.0 μM over the reef and outfall, while the Boynton Inlet and Lake Worth Lagoon values ranged from 22.0-36.0 μM.

9.2 August 2007

Water quality monitoring was conducted on August 28-29, 2007 from the RV *Cable*. Stations were sampled for all of the water quality parameters listed in Table 2, except for the vertical profiles of the water column due to the loss of the YSI after it detached from the line. It was later found and returned to AOML, and vertical profiles for stations BD-2 through BD-4 were obtained. Separate salinity samples were collected from each Niskin bottle to acquire a salinity value for each depth sampled. Trip and equipment blanks were collected for the cruise. The times and dates of sample collection are listed in Table 10; water quality data are listed in Tables 11-13.

The tides on August 28, 2007 were (10:14; 22:40) High and (04:40; 17:01) Low. The tides on August 29, 2007 were (11:02; 23:20) High and (5:24; 17:47) Low. Sea conditions were 2-3 feet with the winds east-northeast at 5-10 kts on both days of sampling. A total of five duplicate samples were collected for each of the water quality parameters. The inlet sample BD-13A was collected towards the end of an outgoing tidal cycle. The boil at the South Central outfall was visible at the surface, and the current direction was northerly during both days of water sampling. Subsequent ADCP results (section 11) indicated that stations BD-8 through BD-15 were sampled in a zero or slightly southward current. This may have resulted in lower values in the vicinity of the inlet (stations BD-12 to BD-14).

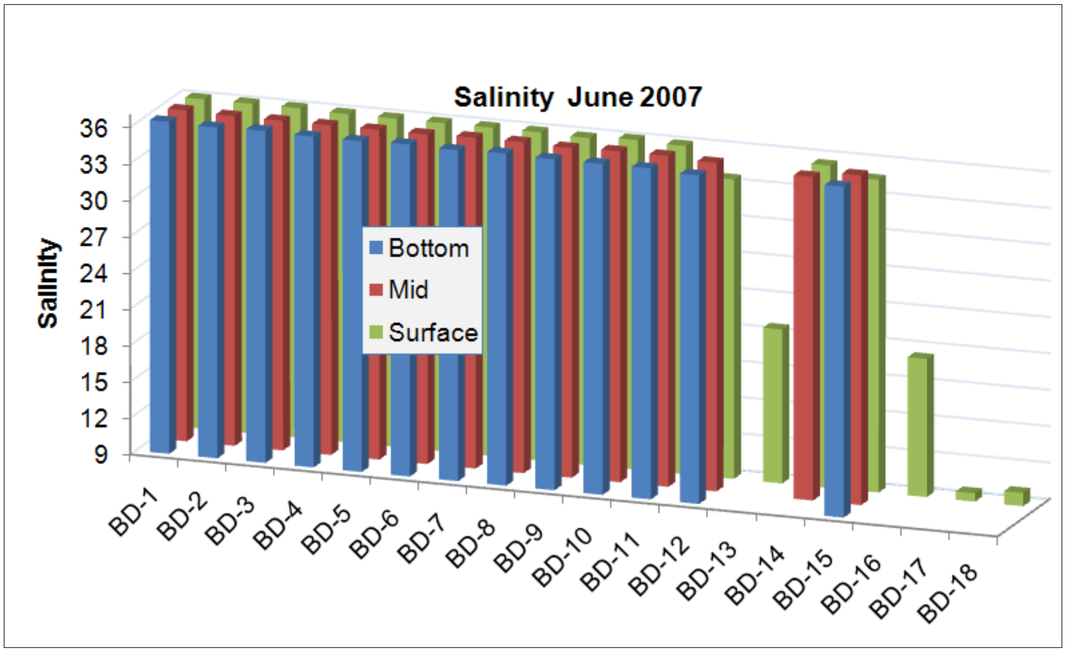

Figure 2: June 2007 salinity values for the Boynton-Delray water quality monitoring stations.

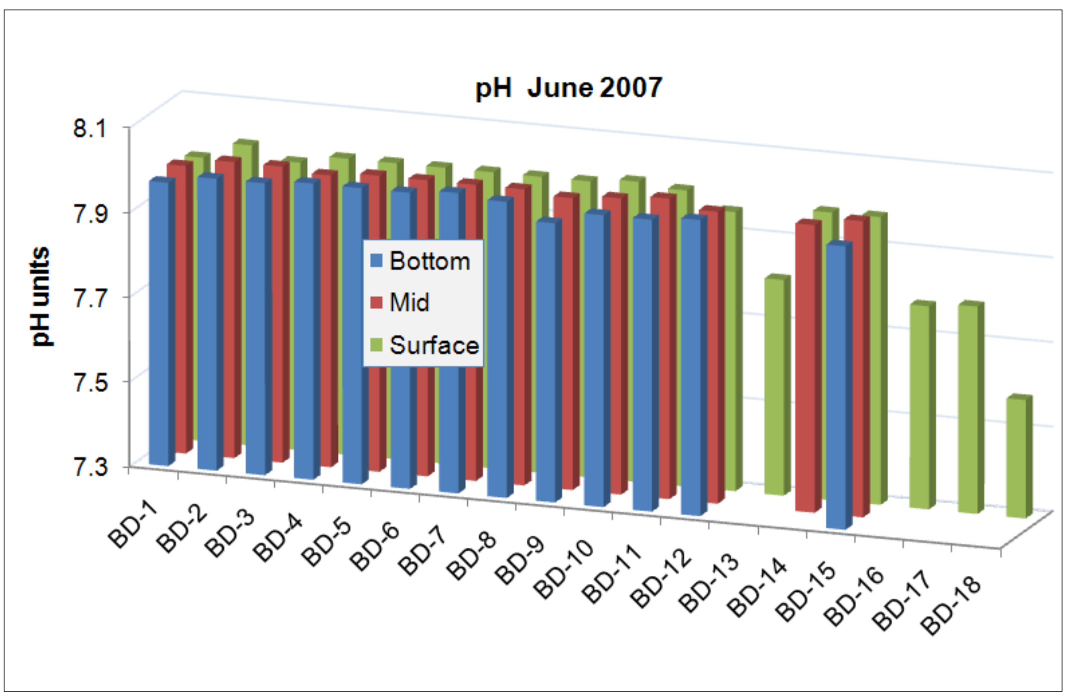

Figure 3: June 2007 pH values for the Boynton-Delray water quality monitoring stations.

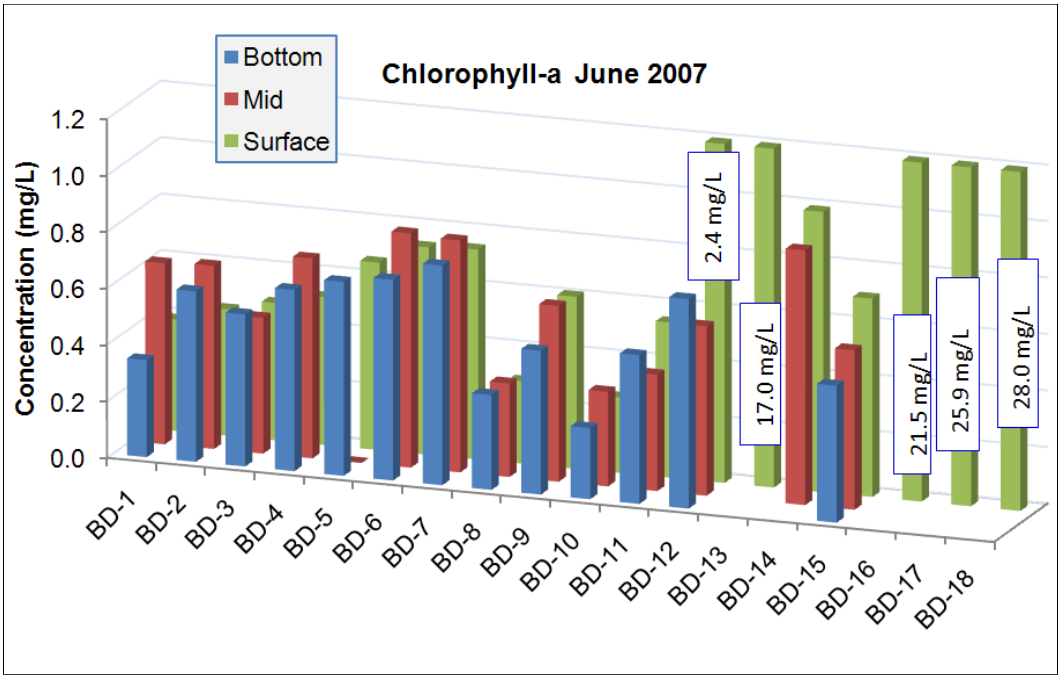

Figure 4: June 2007 chlorophyll-a values for the Boynton-Delray water quality monitoring stations.

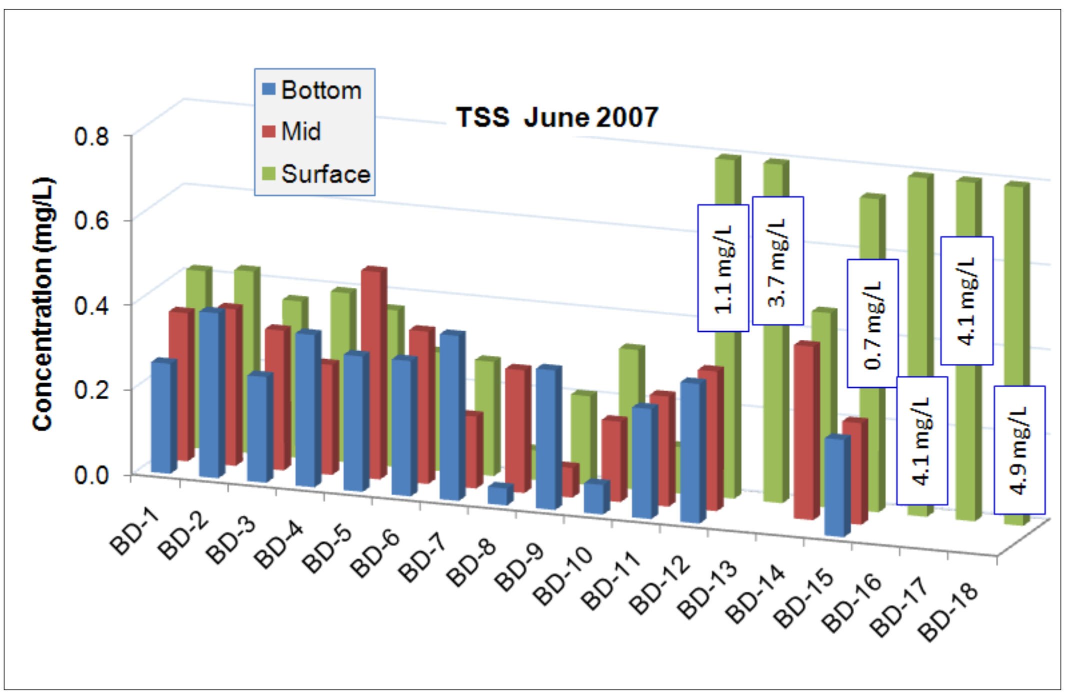

Figure 5: June 2007 total suspended solid values for the Boynton-Delray water quality monitoring stations.

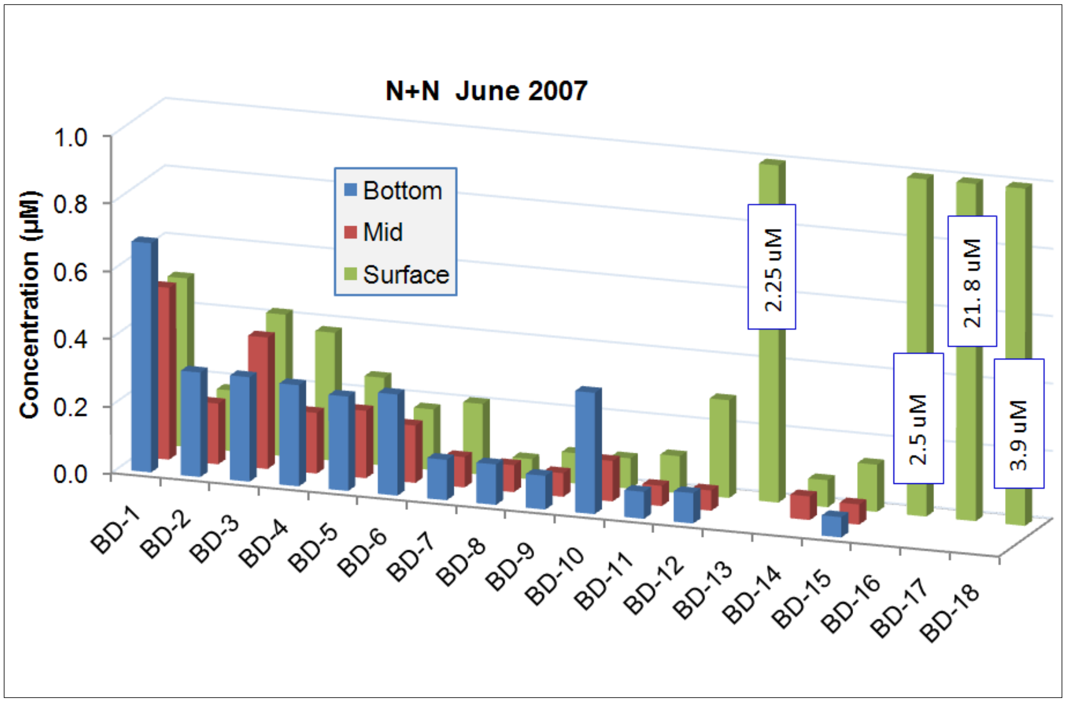

Figure 6: June 2007 nitrate+nitrite values for the Boynton-Delray water quality monitoring stations.

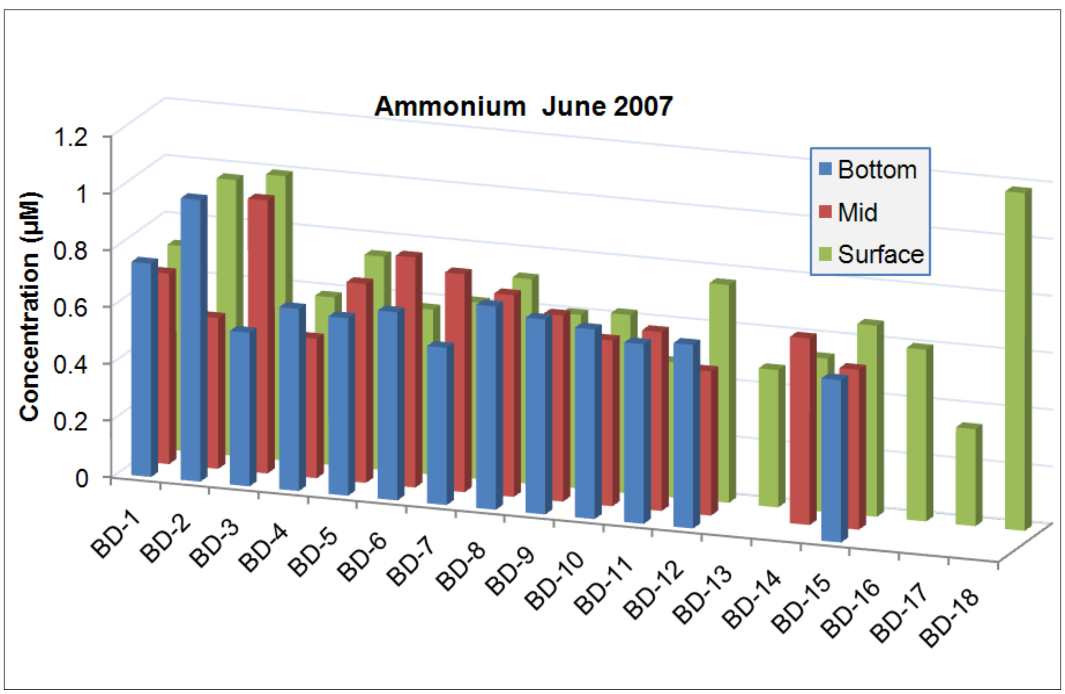

Figure 7: June 2007 ammonium values for the Boynton-Delray water quality monitoring stations.

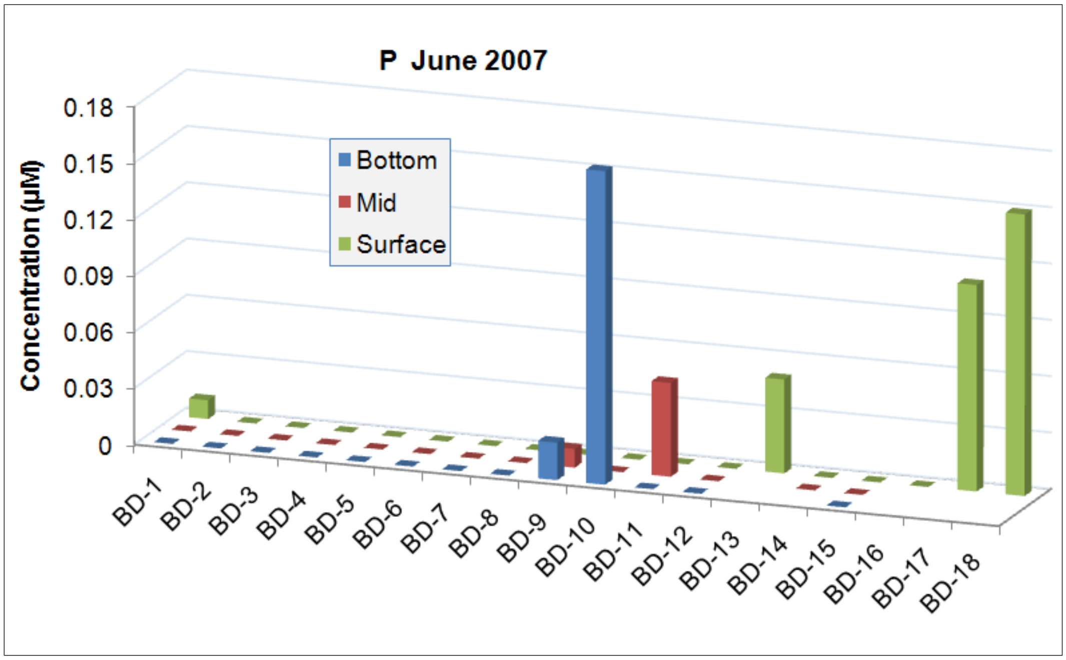

Figure 8: June 2007 orthophosphate values for the Boynton-Delray water quality monitoring stations.

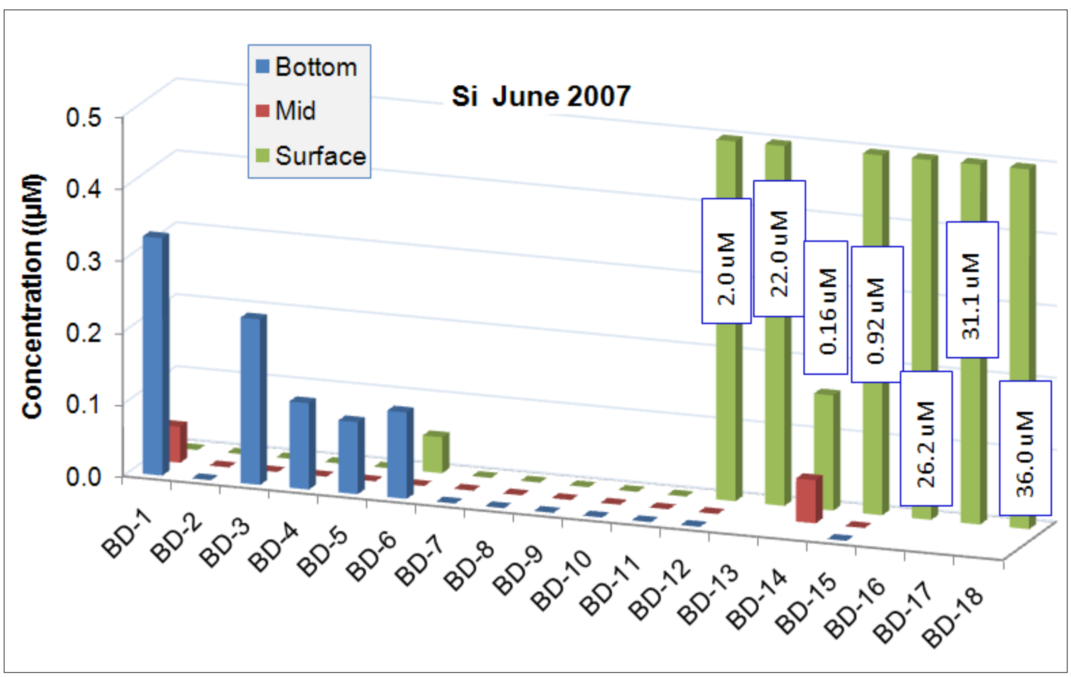

Figure 9: June 2007 silicate values for the Boynton-Delray water quality monitoring stations.

Table 10: Dates and times of water sample collection for August 2007.

Date	Time (local)	Station	Latitude	Longitude	Depth (m)
8/28/2007	09:15	BD-1A	26.42550	-80.04545	0
8/28/2007	09:15	BD-1B	26.42550	-80.04545	16
8/28/2007	09:15	BD-1C	26.42550	-80.04545	35
8/28/2007	10:10	BD-2A	26.44201	-80.04729	0
8/28/2007	10:10	BD-2B	26.44201	-80.04729	8
8/28/2007	10:10	BD-2C	26.44201	-80.04729	16
8/28/2007	10:45	BD-3A	26.45828	-80.04247	0
8/28/2007	10:45	BD-3B	26.45828	-80.04247	16
8/28/2007	10:45	BD-3C	26.45828	-80.04247	33
8/28/2007	11:30	BD-4A	26.46192	-80.04195	0
8/28/2007	11:30	BD-4B	26.46192	-80.04195	16
8/28/2007	11:30	BD-4C	26.46192	-80.04195	32
8/28/2007	12:36	BD-5A	26.46620	-80.04167	0
8/28/2007	12:36	BD-5B	26.46620	-80.04167	15
8/28/2007	12:36	BD-5C	26.46620	-80.04167	30
8/28/2007	13:11	BD-6A	26.47532	-80.03976	0
8/28/2007	13:11	BD-6B	26.47532	-80.03976	15
8/28/2007	13:11	BD-6C	26.47532	-80.03976	30
8/28/2007	13:30	BD-7A	26.48737	-80.03871	0
8/28/2007	13:30	BD-7B	26.48737	-80.03871	10
8/28/2007	13:30	BD-7C	26.48737	-80.03871	20
8/28/2007	14:10	BD-8A	26.51507	-80.03542	0
8/28/2007	14:10	BD-8B	26.51507	-80.03542	10
8/28/2007	14:10	BD-8C	26.51507	-80.03542	20
8/28/2007	14:40	BD-9A	26.50838	-80.04129	0
8/28/2007	14:40	BD-9B	26.50838	-80.04129	7
8/28/2007	14:40	BD-9C	26.50838	-80.04129	15
8/28/2007	15:05	BD-10A	26.52261	-80.03223	0
8/28/2007	15:05	BD-10B	26.52261	-80.03223	8
8/28/2007	15:05	BD-10C	26.52261	-80.03223	16
8/28/2007	15:30	BD-11A	26.53333	-80.03584	0
8/28/2007	15:30	BD-11B	26.53333	-80.03584	7
8/28/2007	15:30	BD-11C	26.53333	-80.03584	13
8/29/2007	08:10	BD-12A	26.53874	-80.03980	0
8/29/2007	08:10	BD-12B	26.53874	-80.03980	5
8/29/2007	08:10	BD-12C	26.53874	-80.03980	8
8/28/2007	16:00	BD-13A	26.54542	-80.04300	0
8/29/2007	08:45	BD-14A	26.54242	-80.03996	0
8/29/2007	08:45	BD-14C	26.54242	-80.03996	3
8/29/2007	08:56	BD-15A	26.55919	-80.03329	0
8/29/2007	08:56	BD-15B	26.55919	-80.03329	6
8/29/2007	08:56	BD-15C	26.55919	-80.03329	13
8/29/2007	09:20	BD-16A	26.54618	-80.04791	0
8/29/2007	09:35	BD-17A	26.54264	-80.04790	0
8/29/2007	09:50	BD-18A	26.53950	-80.04951	0

Table 11: August 2007 Boynton-Delray nutrient and DOC values in µM.

Station	Depth (m)	N+N (µM)	NH_4 (µM)	P (µM)	Si (µM)	TDN (µM)	DTP (µM)	DOC (µM)
BD-1A	0	0.07	0.51	BDL	BDL	0.09	0.24	91.62
BD-1B	16	0.02	0.14	BDL	BDL	0.11	0.17	49.44
BD-1C	35	0.19	BDL	BDL	BDL	0.11	0.19	44.80
BD-2A	0	0.02	0.05	BDL	BDL	0.12	0.18	47.92
BD-2B	8	0.04	0.06	BDL	BDL	0.09	0.17	47.98
BD-2C	16	0.45	0.07	0.02	BDL	0.10	0.20	43.40
BD-3A	0	1.80	5.70	0.21	BDL	0.11	0.42	55.18
BD-3B	16	0.01	BDL	BDL	BDL	0.08	0.19	44.68
BD-3C	33	0.21	0.07	0.01	BDL	0.09	0.20	41.73
BD-4A	0	8.00	22.50	0.91	4.40	0.08	1.22	66.84
BD-4B	16	0.05	BDL	0.02	0.74	6.18	0.17	44.62
BD-4C	32	0.68	0.19	0.05	0.88	7.72	0.19	47.06
BD-5A	0	0.02	BDL	0.01	0.77	7.57	0.17	49.38
BD-5B	15	0.56	0.89	0.02	0.77	11.00	0.26	48.00
BD-5C	30	0.28	1.20	0.01	0.60	8.97	0.22	44.20
BD-6A	0	BDL	0.16	0.01	0.06	9.29	0.23	49.86
BD-6B	15	0.05	0.11	BDL	BDL	10.53	0.22	44.99
BD-6C	30	0.41	0.15	BDL	BDL	8.09	0.21	43.99
BD-7A	0	0.03	BDL	BDL	BDL	8.89	0.17	50.07
BD-7B	10	BDL	BDL	BDL	BDL	7.69	0.18	52.02
BD-7C	20	0.28	0.02	0.02	BDL	7.44	0.18	38.90
BD-8A	0	0.06	BDL	BDL	BDL	5.53	0.16	40.57
BD-8B	10	0.01	0.79	BDL	BDL	11.15	0.16	37.66
BD-8C	20	BDL	0.28	BDL	0.48	5.36	0.21	39.32
BD-9A	0	BDL	0.15	BDL	0.36	5.01	0.21	40.99
BD-9B	7	0.51	0.08	0.10	0.34	4.59	0.19	40.24
BD-9C	15	0.01	0.10	BDL	0.27	2.36	0.18	41.33
BD-10A	0	BDL	0.12	BDL	2.40	6.48	0.33	56.61
BD-10B	8	BDL	0.05	BDL	0.30	10.55	0.13	41.12
BD-10C	16	0.02	BDL	BDL	0.23	7.06	0.17	43.96
BD-11A	0	0.02	BDL	BDL	2.90	7.34	0.25	59.53
BD-11B	7	0.01	BDL	BDL	0.11	7.52	0.27	43.79
BD-11C	13	0.09	BDL	BDL	0.07	7.66	0.20	41.24
BD-12A	0	BDL	BDL	BDL	0.66	25.41	0.78	87.71
BD-12B	5	0.02	BDL	BDL	0.64	6.34	0.33	52.26
BD-12C	8	0.06	BDL	BDL	0.25	5.18	0.22	45.00
BD-13A	0	0.08	BDL	0.02	9.60	9.46	0.19	115.22
BD-14A	0	0.05	BDL	BDL	0.64	5.36	0.19	46.92
BD-14C	3	N/A	N/A	N/A	N/A	6.07	0.18	45.63
BD-15A	0	BDL	BDL	BDL	BDL	4.25	0.18	42.79
BD-15B	6	0.05	BDL	BDL	BDL	6.68	0.24	45.25
BD-15C	13	BDL	BDL	BDL	BDL	4.16	0.18	42.04
BD-16A	0	0.03	BDL	0.01	0.21	4.84	0.21	45.42
BD-17A	0	3.30	0.69	0.24	17.00	15.84	0.80	132.47
BD-18A	0	0.61	0.17	0.10	39.10	22.36	0.93	260.05

Table 12: August 2007 Boynton-Delray nutrient and DOC values in mg/L.

Station	Depth (m)	N+N (mg/L)	NH_4 (mg/L)	P (mg/L)	Si (mg/L)	TDN (mg/L)	TDP (mg/L)	DOC (mg/L)
BD-1A	0	0.001	0.007	BDL	BDL	0.15	0.007	1.79
BD-1B	16	BDL	0.002	BDL	BDL	0.09	0.005	1.10
BD-1C	35	0.003	BDL	BDL	BDL	0.09	0.006	1.03
BD-2A	0	BDL	0.001	BDL	BDL	0.09	0.006	1.08
BD-2B	8	0.001	0.001	BDL	BDL	0.12	0.005	1.08
BD-2C	16	0.006	0.001	0.001	BDL	0.10	0.006	1.00
BD-3A	0	0.025	0.080	0.007	BDL	0.24	0.013	1.20
BD-3B	16	BDL	BDL	BDL	BDL	0.10	0.006	1.03
BD-3C	33	0.003	0.001	BDL	BDL	0.12	0.006	0.98
BD-4A	0	0.112	0.315	0.028	0.123	0.57	0.038	1.39
BD-4B	16	0.001	BDL	0.001	0.021	0.09	0.005	1.02
BD-4C	32	0.010	0.003	0.002	0.025	0.11	0.006	1.06
BD-5A	0	BDL	BDL	BDL	0.022	0.11	0.005	1.10
BD-5B	15	0.008	0.012	0.001	0.022	0.12	0.008	1.20
BD-5C	30	0.004	0.017	BDL	0.017	0.09	0.007	1.13
BD-6A	0	BDL	0.002	BDL	0.002	0.10	0.007	1.23
BD-6B	15	0.001	0.002	BDL	BDL	0.11	0.007	1.14
BD-6C	30	0.006	0.002	BDL	BDL	0.08	0.007	1.12
BD-7A	0	BDL	BDL	BDL	BDL	0.09	0.005	1.24
BD-7B	10	BDL	BDL	BDL	BDL	0.08	0.006	1.27
BD-7C	20	0.004	BDL	0.001	BDL	0.14	0.006	1.01
BD-8A	0	0.001	BDL	BDL	BDL	0.10	0.005	1.05
BD-8B	10	BDL	0.011	BDL	BDL	0.21	0.005	0.98
BD-8C	20	BDL	0.004	BDL	0.013	0.10	0.007	1.02
BD-9A	0	BDL	0.002	BDL	0.010	0.09	0.007	1.06
BD-9B	7	0.007	0.001	0.003	0.010	0.09	0.006	1.04
BD-9C	15	BDL	0.001	BDL	0.008	0.04	0.006	1.06
BD-10A	0	BDL	0.002	BDL	0.067	0.12	0.010	1.43
BD-10B	8	BDL	0.001	BDL	0.008	0.20	0.004	1.06
BD-10C	16	BDL	BDL	BDL	0.006	0.13	0.005	1.13
BD-11A	0	BDL	BDL	BDL	0.081	0.14	0.008	1.50
BD-11B	7	BDL	BDL	BDL	0.003	0.14	0.008	1.12
BD-11C	13	0.001	BDL	BDL	0.002	0.15	0.006	1.06
BD-12A	0	BDL	BDL	BDL	0.018	0.48	0.024	2.17
BD-12B	5	BDL	BDL	BDL	0.018	0.12	0.010	1.33
BD-12C	8	0.001	BDL	BDL	0.007	0.10	0.007	1.15
BD-13A	0	0.001	BDL	0.001	0.269	0.18	0.006	2.83
BD-14A	0	0.001	BDL	BDL	0.018	0.10	0.006	1.20
BD-14C	3	N/A	N/A	N/A	N/A	0.12	0.005	1.17
BD-15A	0	BDL	BDL	BDL	BDL	0.08	0.006	1.10
BD-15B	6	0.001	BDL	BDL	BDL	0.13	0.007	1.16
BD-15C	13	BDL	BDL	BDL	BDL	0.08	0.006	1.08
BD-16A	0	BDL	BDL	BDL	0.006	0.09	0.006	1.16
BD-17A	0	0.046	0.010	0.007	0.476	0.30	0.025	3.25
BD-18A	0	0.009	0.002	0.003	1.095	0.42	0.029	6.30

Table 13: August 2007 Boynton-Delray salinity, pH, chlorophyll-a, phaeopigments, and TSS results.

Station	Depth (m)	Temperature (°C)	Salinity (Units)	pH (Units)	Chlorophyll-a (µg/L)	Phaeopigments (µg/L)	TSS (mg/L)
BD-1A	0	N/A	36.1	8.10	0.206	0.040	0.33
BD-1B	16	N/A	36.2	8.16	0.094	0.032	0.09
BD-1C	35	N/A	36.3	8.09	0.268	0.118	0.21
BD-2A	0	N/A	36.1	8.11	0.160	0.044	0.03
BD-2B	8	N/A	36.2	8.10	0.135	0.045	0.15
BD-2C	16	N/A	36.2	8.10	0.209	0.102	0.15
BD-3A	0	N/A	35.9	8.11	0.168	0.047	0.20
BD-3B	16	N/A	36.2	8.13	0.091	0.020	0.25
BD-3C	33	N/A	36.2	8.12	0.232	0.103	0.05
BD-4A	0	N/A	35.1	8.08	0.164	0.060	0.44
BD-4B	16	N/A	36.2	8.12	0.099	0.028	0.24
BD-4C	32	N/A	36.2	8.10	0.149	0.111	0.15
BD-5A	0	N/A	36.2	8.11	0.111	0.023	0.09
BD-5B	15	N/A	36.2	8.12	0.158	0.079	0.15
BD-5C	30	N/A	36.4	8.08	0.472	0.209	0.23
BD-6A	0	N/A	36.1	8.13	0.241	0.019	0.20
BD-6B	15	N/A	36.2	8.12	0.270	0.089	0.08
BD-6C	30	N/A	36.4	8.10	0.564	0.220	0.19
BD-7A	0	N/A	36.2	8.13	0.370	0.061	0.09
BD-7B	10	N/A	36.2	8.12	0.102	0.033	0.09
BD-7C	20	N/A	36.2	8.12	0.138	0.042	0.05
BD-8A	0	N/A	36.2	8.12	0.161	0.021	0.20
BD-8B	10	N/A	36.2	8.11	0.137	0.031	0.20
BD-8C	20	N/A	36.2	8.12	0.142	0.040	0.31
BD-9A	0	N/A	36.2	8.13	0.157	0.025	0.31
BD-9B	7	N/A	36.1	8.14	0.188	0.094	0.21
BD-9C	15	N/A	36.1	8.12	0.280	0.070	0.24
BD-10A	0	N/A	35.0	8.09	1.468	0.323	0.44
BD-10B	8	N/A	36.1	8.12	0.145	0.021	0.21
BD-10C	16	N/A	36.2	8.11	0.122	0.037	0.23
BD-11A	0	N/A	34.7	8.06	1.744	0.398	0.39
BD-11B	7	N/A	36.1	8.09	0.229	0.058	0.25
BD-11C	13	N/A	36.2	8.10	0.342	0.096	0.03
BD-12A	0	N/A	35.7	8.14	0.625	0.236	0.01
BD-12B	5	N/A	35.7	8.13	0.665	0.202	0.59
BD-12C	8	N/A	35.9	8.13	0.513	0.150	0.31
BD-13A	0	N/A	30.4	8.10	6.075	1.169	0.52
BD-14A	0	N/A	35.5	8.13	0.656	0.183	0.31
BD-14C	3	N/A	35.8	8.13	0.610	0.177	0.35
BD-15A	0	N/A	36.1	8.12	0.203	0.064	0.25
BD-15B	6	N/A	36.1	8.14	0.398	0.081	0.19
BD-15C	13	N/A	36.2	8.14	0.210	0.066	0.21
BD-16A	0	N/A	35.8	8.10	0.560	0.178	0.32
BD-17A	0	N/A	26.9	7.97	1.945	0.795	0.14
BD-18A	0	N/A	18.4	7.94	9.367	4.108	2.52

Salinity values (Figure 10) varied between 34.7-36.2 salinity units over the reef and outfall areas with the lowest values occurring near the Boynton Inlet and over the outfall. The salinity in the Boynton Inlet and Lake Worth Lagoon ranged from 18.4-35.8 salinity units. The pH values (Figure 11) ranged from 8.08-8.14 for the reef and outfall stations, while the Boynton Inlet and Lake Worth Lagoon reported values between 7.94-8.10. Chlorophyll values (Figure 12) ranged from 1.74-0.091 µg/L over the reef and outfall, while the Boynton Inlet and Lake Worth Lagoon ranged from 0.560-9.37 µg/L. TSS results (Figure 13) varied from 0.03-0.59 mg/L for the reef and outfall stations, while the Boynton Inlet and Lake Worth Lagoon values ranged from 0.32-2.52 mg/L.

NO_3-N+NO_2-N values (Figure 14) ranged from BDL to 8.0 µM for the reef and outfall stations with the surface boil (BD-4A) having the highest value (8.0 µM). The Boynton Inlet and Lake Worth Lagoon values ranged from 0.03-3.30 µM. The NH_4-N values (Figure 15) ranged from BDL to 22.50 µM over the reef and outfall area with the surface boil containing the highest value (22.50 µM), while the values ranged from BDL to 0.69 µM for the Boynton Inlet and Lake Worth Lagoon. Ortho-PO_4-P values (Figure 16) ranged from BDL to 0.91 µM over the reef and outfall with the surface boil having the highest value (0.91 µM), while the Boynton Inlet and Lake Worth Lagoon values ranged from 0.01-0.24 µM. SiO_4-Si values (Figure 17) ranged from BDL to 4.40 µM over the reef and outfall with the surface boil containing the highest value of 4.40 µM, while the Boynton Inlet and Lake Worth Lagoon had values ranging from 0.21-39.10 µM. The TDN and TDP values (Figures 18 and 19) ranged from 0.08-11.0 µM and 0.17-1.22 µM for the reef and outfall stations, respectively, while the Boynton Inlet and Lake Worth Lagoon values ranged from 4.84-22.36 µM and 0.29-0.93 µM, respectively. The surface boil and just north of the boil had the largest values. Station BD-14C had no nutrient results due to a crack in the sample tube. Dissolved organic carbon (DOC) values (Figure 20) ranged from 37.66-91.62 µM for the reef and outfall stations, while the Boynton Inlet and Lake Worth Lagoon values ranged from 45.42-260.05µM.

Vertical water column profiles were conducted for stations BD-2, BD-3, and BD-4 (Figures 21-23). The YSI unit was lost during retrieval at station BD-4, and no further vertical casts were conducted. The vertical cast for station BD-1 was no good. No significant variations in the vertical profiles were observed except at station BD-4 where chlorophyll increased between 15-25 m depth.

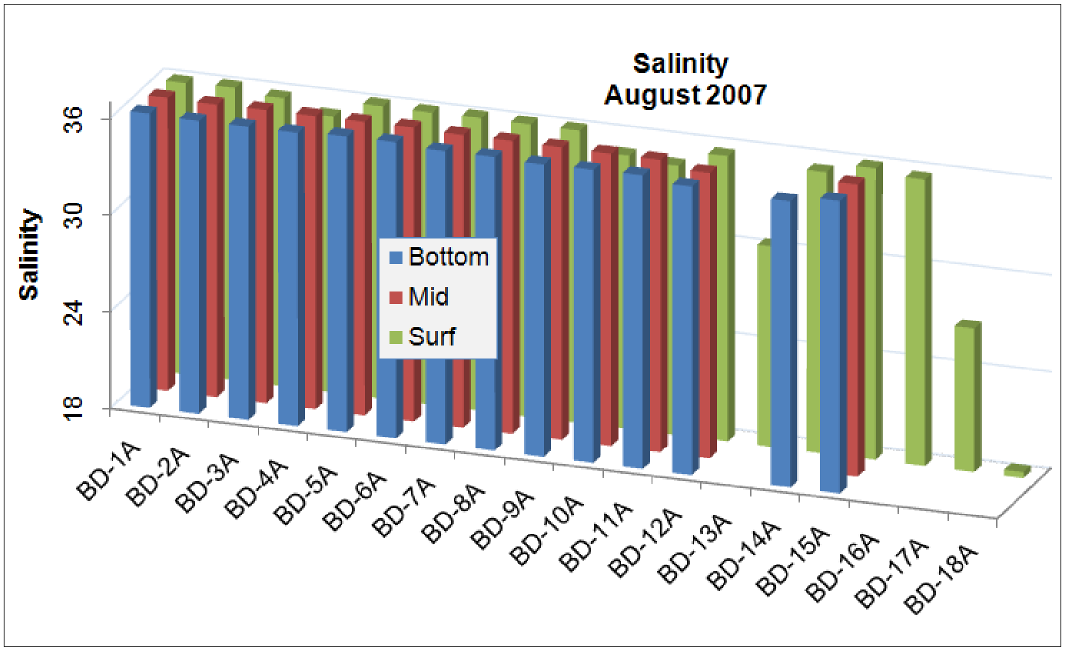

Figure 10: August 2007 salinity results for the Boynton-Delray water quality monitoring stations.

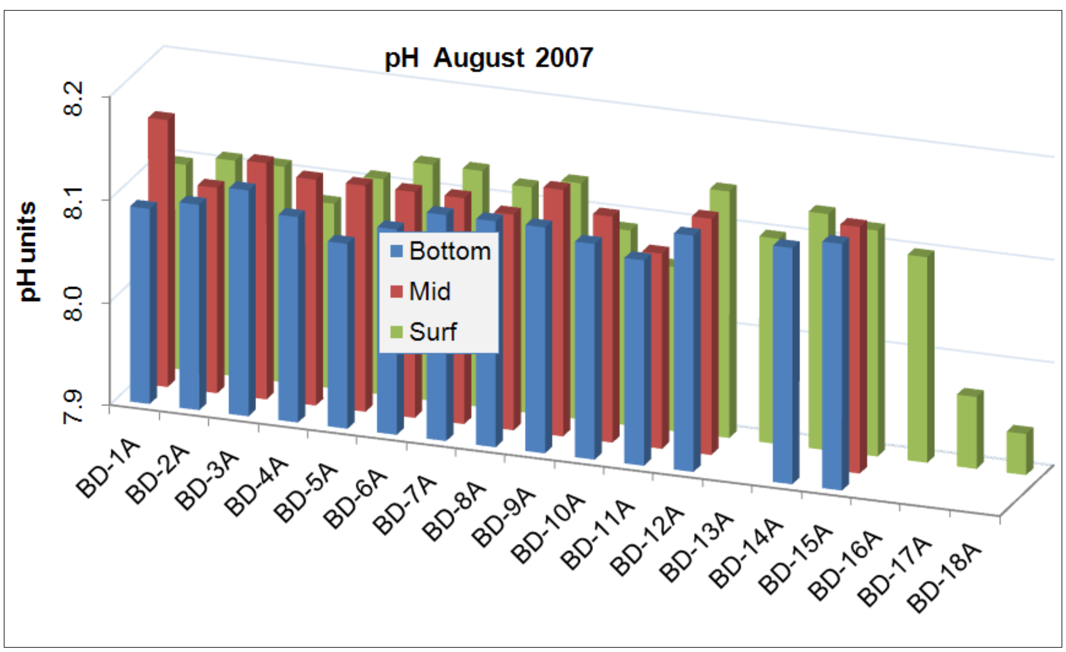

Figure 11: August 2007 pH measurements for the Boynton-Delray water quality monitoring stations.

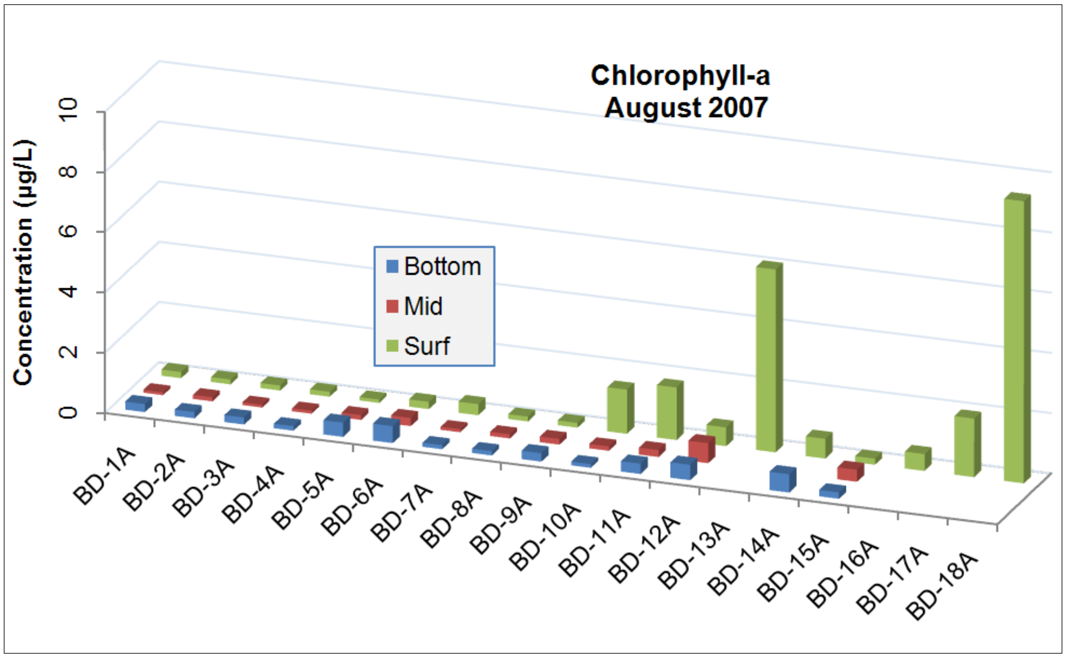

Figure 12: August 2007 chlorophyll-a concentrations for the Boynton-Delray water quality monitoring stations.

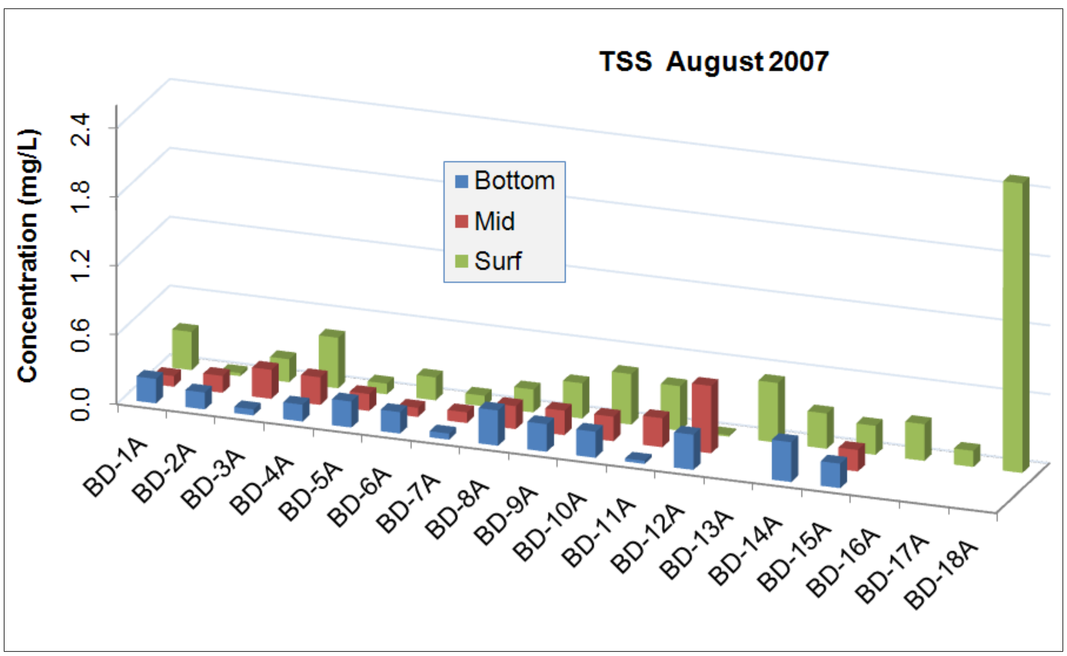

Figure 13: August 2007 total suspended solids concentrations for the Boynton-Delray water quality monitoring stations.

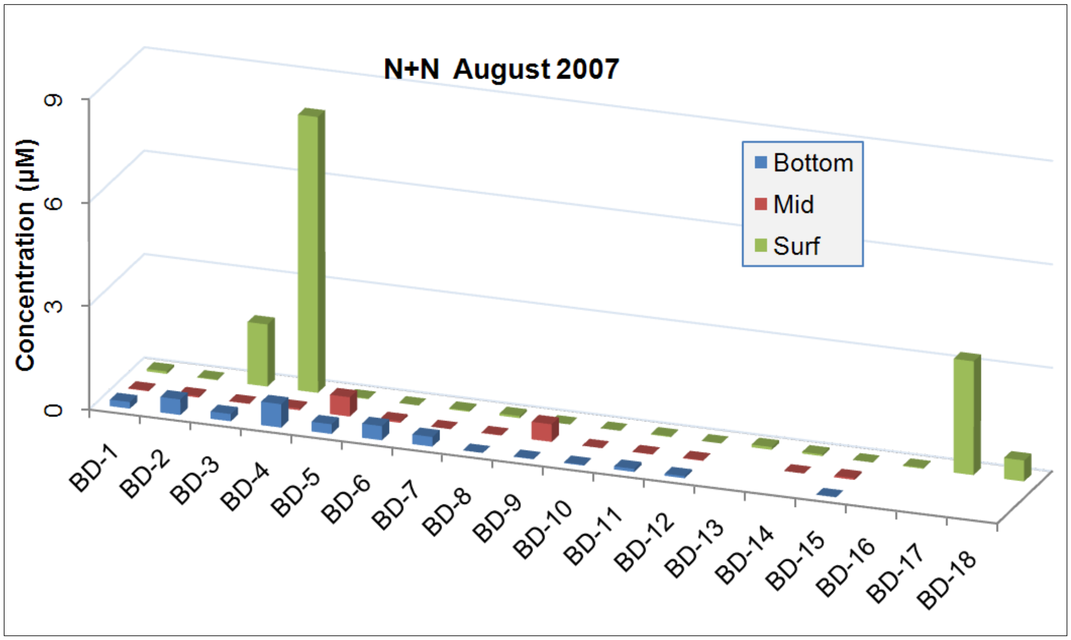

Figure 14: August 2007 nitrate+nitrite concentrations for the Boynton-Delray water quality monitoring stations.

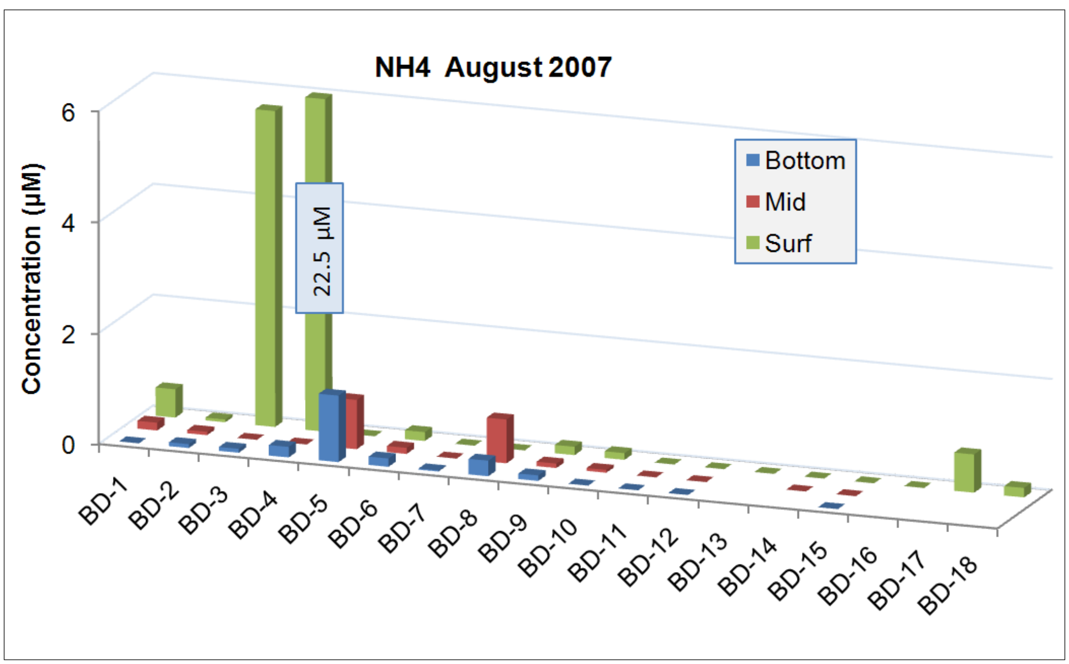

Figure 15: August 2007 ammonium concentrations for the Boynton-Delray water quality monitoring stations.

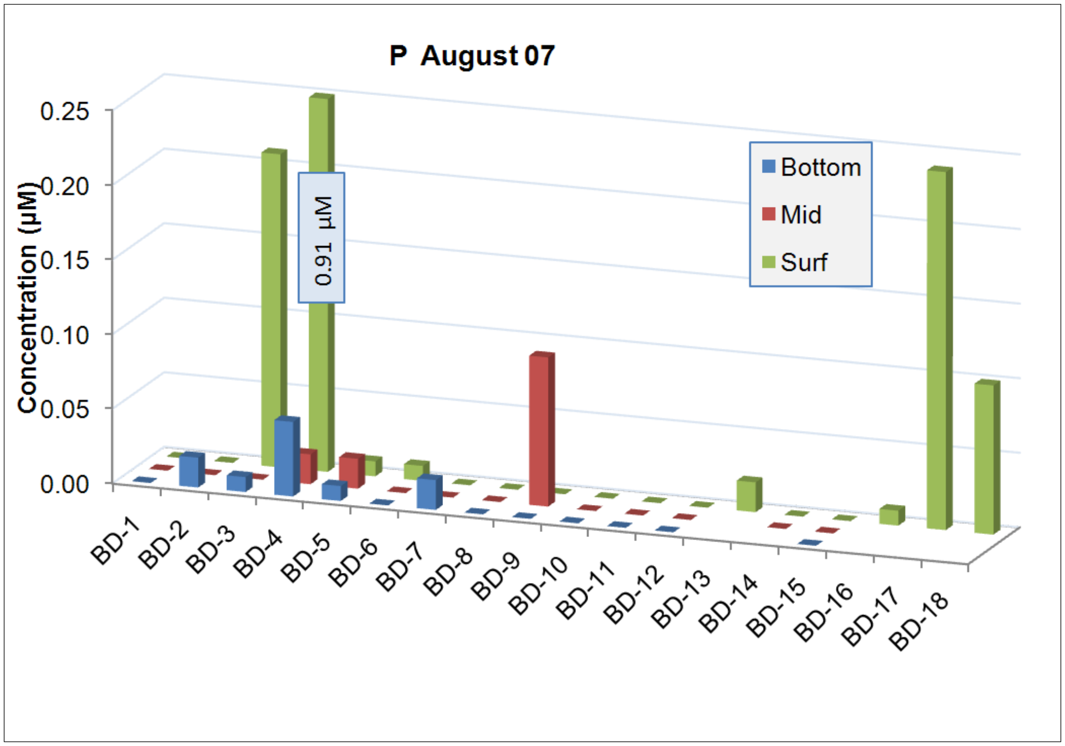

Figure 16: August 2007 orthophosphate concentrations for the Boynton-Delray water quality monitoring stations.

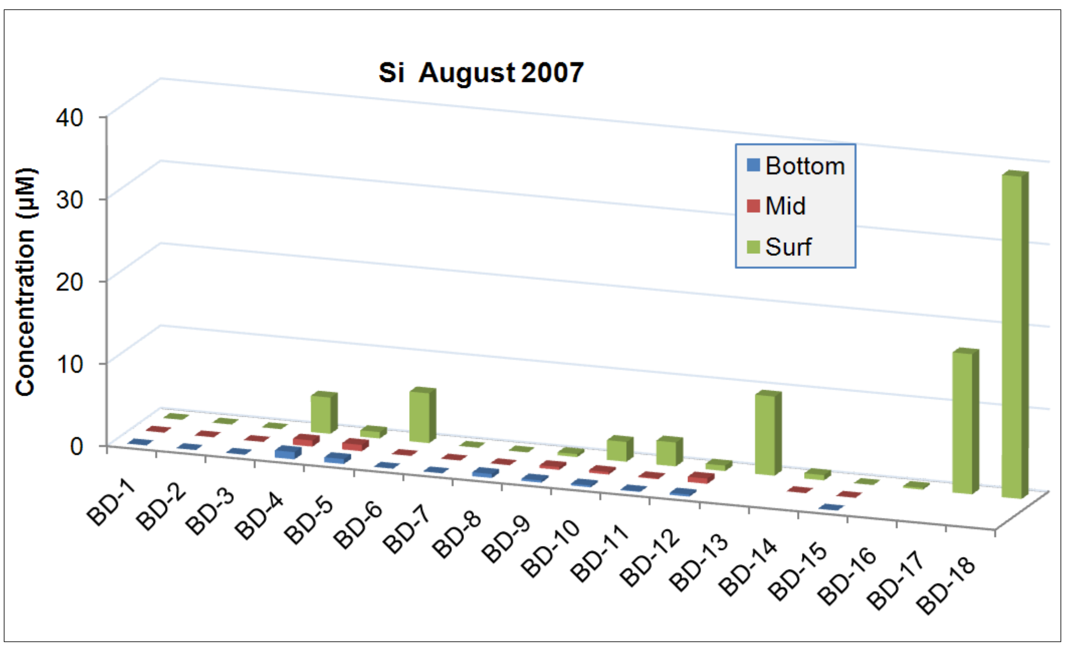

Figure 17: August 2007 silicate concentrations for the Boynton-Delray water quality monitoring stations.

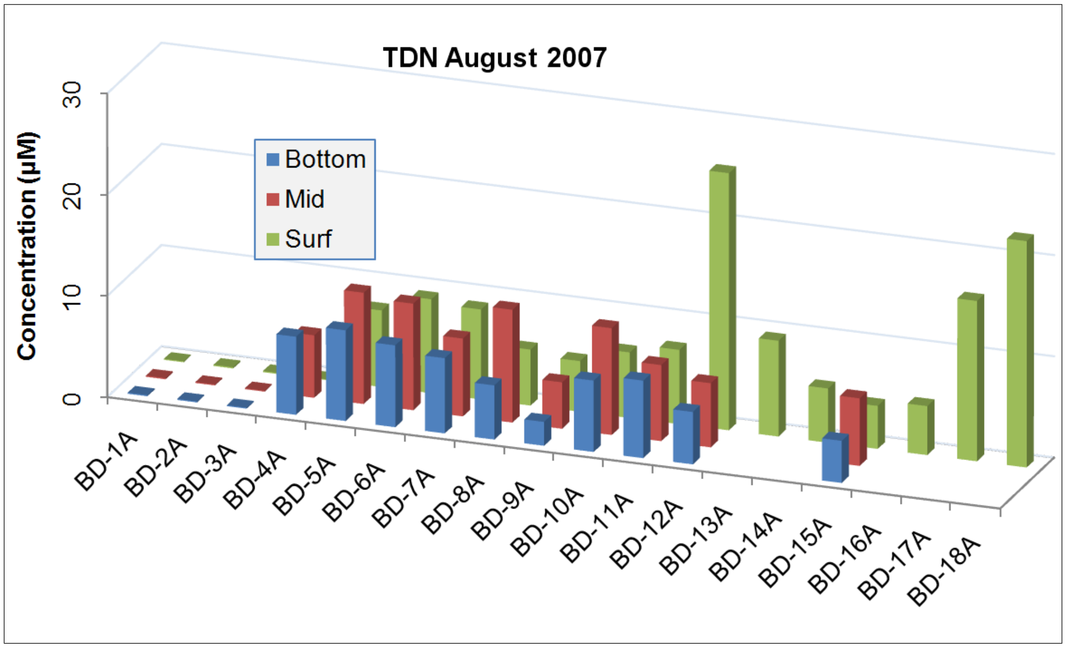

Figure 18: August 2007 total dissolved nitrogen values for the Boynton-Delray water quality monitoring stations.

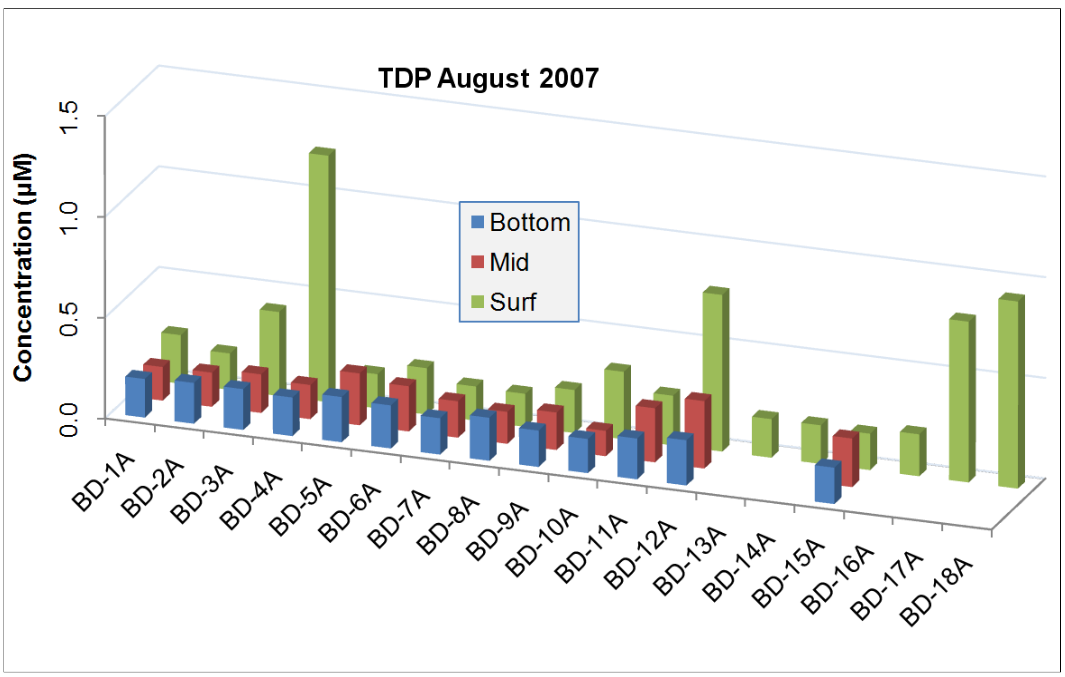

Figure 19: August 2007 total dissolved phosphorus concentrations for the Boynton-Delray water quality monitoring stations.

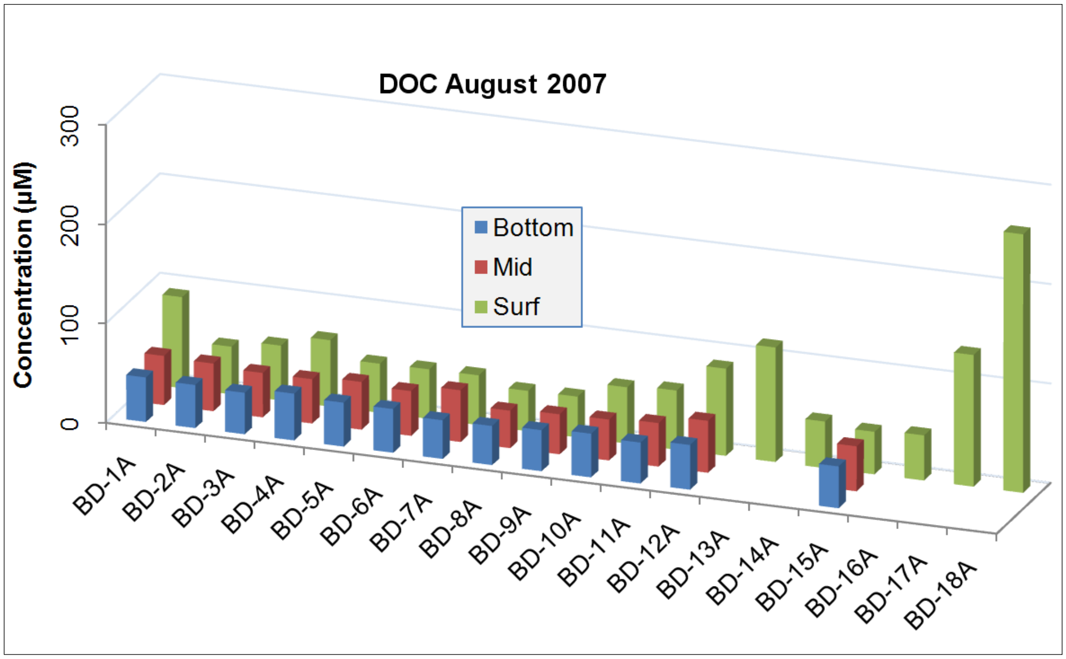

Figure 20: August 2007 dissolved organic carbon concentrations for the Boynton-Delray water quality monitoring stations.

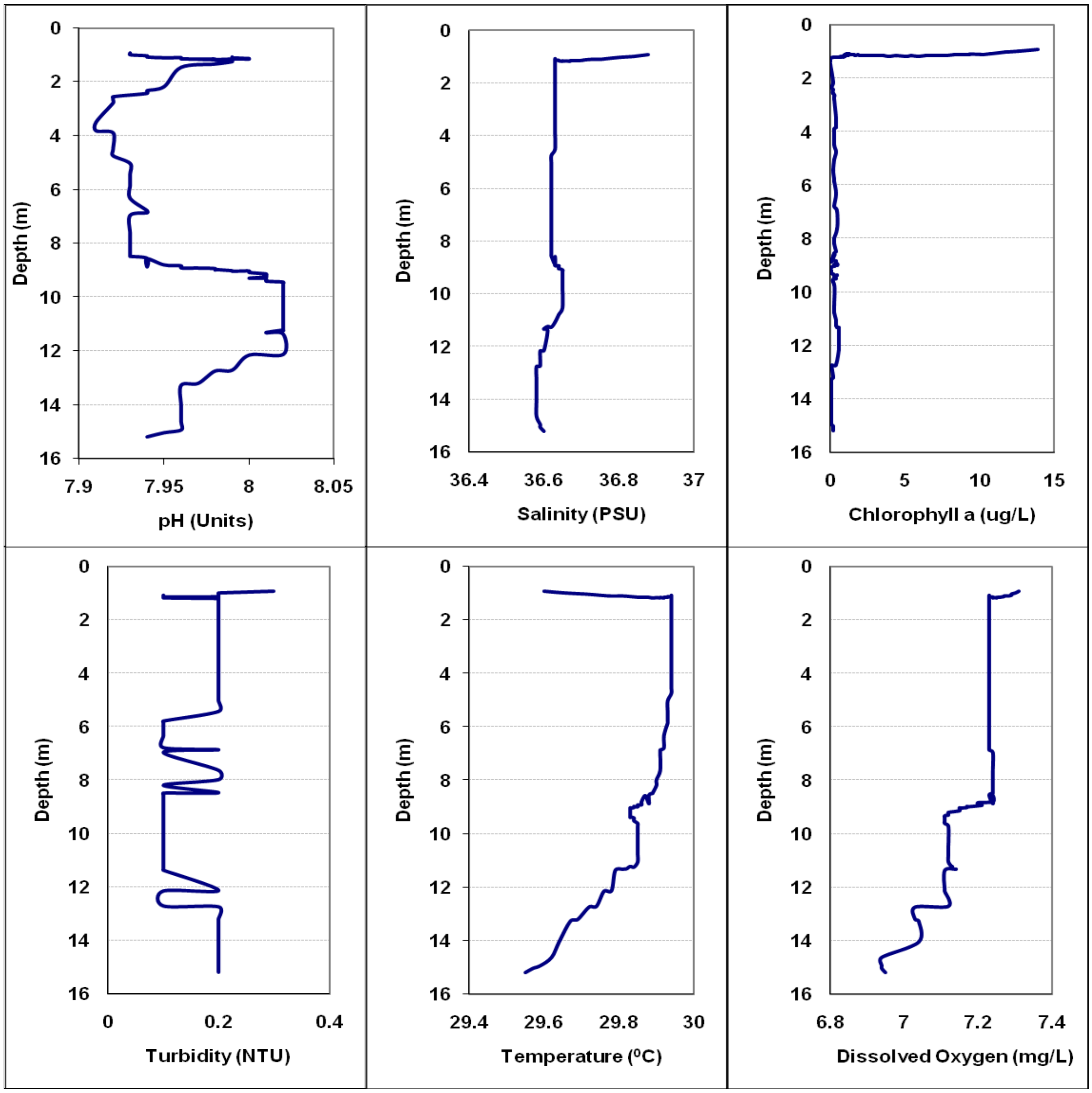

Figure 21: August 2007 Boynton-Delray water quality monitoring YSI cast at station BD-2.

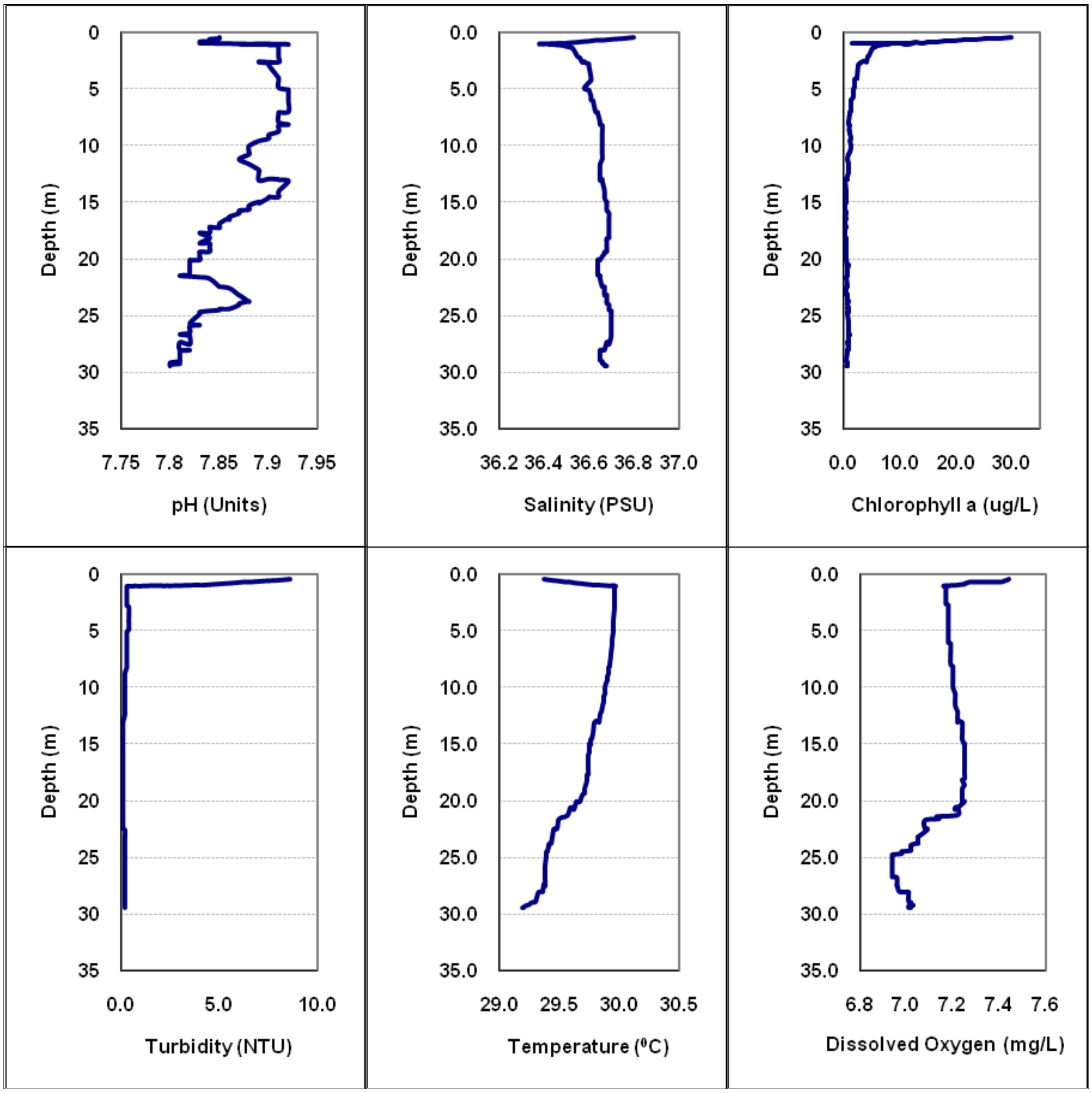

Figure 22: August 2007 Boynton-Delray water quality monitoring YSI cast at station BD-3.

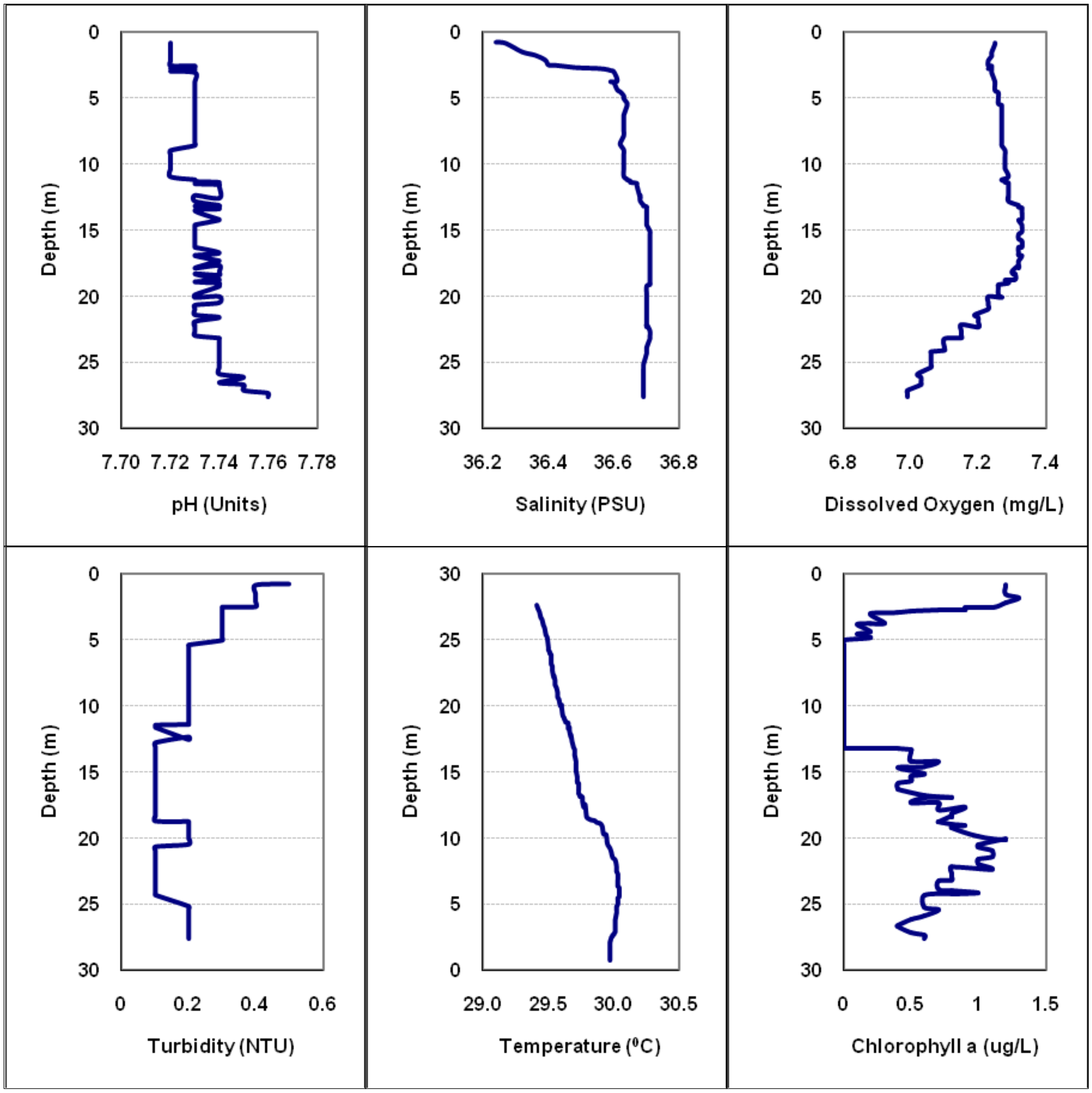

Figure 23: August 2007 Boynton-Delray water quality monitoring YSI cast at station BD-4.

9.3 October 2007

Water quality monitoring was conducted on October 18-19, 2007, from the RV *Cable*. All stations were sampled for the water quality parameters listed in Table 2. All vertical profiles were conducted using the YSI 6600 sonde. Stations BD-14 and BD-15 were not sampled due to unfavorable marine conditions. The times and dates of sample collection are listed in Table 14, and water quality data are listed in Tables 15-17. Water quality parameters are shown in Figures 24-34. Vertical profiles of the water column for each station are in Figures 35-48.

The tides on October 18th were (01:38; 14:28) High and (08:32; 21:06) Low, while the tides on October 19th were (02:28; 15:23) High and (09:26; 22:08) Low. Seas were 2 feet or less on October 18th, with winds southeast at 5-10 knots; on the 19th, seas were 4 feet with south-southeast winds at 15-20 knots. Palm Beach County received approximately 7 inches of rain on October 17th, the day before sampling began. The flood gates were opened and freshwater was released into Lake Worth Lagoon. A large presence of freshwater plants was observed floating in the Lake Worth Lagoon and exiting the Boynton Inlet to the coastal ocean on the outgoing tide. A water sample was also collected at a water release site and was analyzed for all the water quality parameters. A total of four duplicates were collected for each of the water quality parameters sampled. The Boynton Inlet station BD-13A was collected towards the end of an outgoing tidal cycle. The outfall boil was not visible at the surface; the samples were collected at the known coordinates of the South Central outfall. The nutrient values were higher at station BD-5A just north of the outfall, possibly indicating the presence of the boil at the surface. The current direction was northerly during sampling operations.

Salinity values (Figure 24) ranged from 35.7-36.5 salinity units over the reef and outfall sampling stations, while the salinity varied from 3.3-33.2 salinity units for the Lake Worth Lagoon and Boynton Inlet sites. Temperature did not vary much, ranging from 27.7-28.6°C for all stations with the Lake Worth Lagoon having the lowest temperatures (Figure 25). The pH values (Figure 26) ranged from 8.08-8.14 units over the reef and outfall area, while the Boynton Inlet and Lake Worth Lagoon sites ranged from 7.48-8.11 units. Chlorophyll values (Figure 27) ranged from 0.206-0.906 µg/L over the reef and outfall sites, while values ranged from 1.79-25.91 µg/L for the Boynton Inlet and Lake Worth Lagoon sampling sites. TSS values (Figure 28) varied from 0.02-0.52 mg/L for the reef and outfall sampling sites, while the Boynton Inlet and Lake Worth Lagoon sites varied from 1.63-5.14 mg/L.

NO_3-N+NO_2-N values (Figure 29) ranged from 0.02-2.20 µM over the reef and outfall stations with the highest value occurring just north of the boil (BD-5A). The Boynton Inlet and Lake Worth Lagoon values ranged from 1.40-8.90 µM. NH_4-N values (Figure 30) ranged from BDL to 3.45 µM with the highest value at station BD-5A just north of the boil, while the values varied from 0.64-7.13 µM for the Boynton Inlet and Lake Worth Lagoon. Ortho-PO_4-P values (Figure 31) varied from BDL to 0.50 µM over the reef and outfall with the highest value at BD-5A just north of the boil, while values ranged from 0.42-2.40 µM for Boynton Inlet and Lake Worth Lagoon. SiO_4-Si values (Figure 32) ranged from BDL to 0.53 µM over the reef and outfall, while values varied between BDL to 34.70 µM for the Boynton Inlet and Lake Worth Lagoon. TDN values (Figure 33) ranged from 3.96-17.94 µM for the reef and outfall stations, while Boynton Inlet and Lake Worth Lagoon varied between 9.59-41.52 µM. DOC values (Figure 34) ranged from 36.36-49.86 µM for the reef and outfall stations, while the Boynton Inlet and Lake Worth Lagoon varied between 82.43-465.29 µM.

Table 14: Dates and times of water sample collection for October 2007.

Date	Time (local)	Station	Latitude	Longitude	Depth (m)
10/18/2007	08:10	BD-1A	26.42550	-80.04545	0
10/18/2007	08:10	BD-1B	26.42550	-80.04545	16
10/18/2007	08:10	BD-1C	26.42550	-80.04545	35
10/18/2007	08:56	BD-2A	26.44201	-80.04729	0
10/18/2007	08:56	BD-2B	26.44201	-80.04729	8
10/18/2007	08:56	BD-2C	26.44201	-80.04729	16
10/18/2007	09:21	BD-3A	26.45828	-80.04247	0
10/18/2007	09:21	BD-3B	26.45828	-80.04247	16
10/18/2007	09:21	BD-3C	26.45828	-80.04247	33
10/18/2007	09:40	BD-4A	26.46192	-80.04195	0
10/18/2007	09:40	BD-4B	26.46192	-80.04195	16
10/18/2007	09:40	BD-4C	26.46192	-80.04195	32
10/18/2007	10:00	BD-5A	26.46620	-80.04167	0
10/18/2007	10:00	BD-5B	26.46620	-80.04167	15
10/18/2007	10:00	BD-5C	26.46620	-80.04167	30
10/18/2007	10:38	BD-6A	26.47532	-80.03976	0
10/18/2007	10:38	BD-6B	26.47532	-80.03976	15
10/18/2007	10:38	BD-6C	26.47532	-80.03976	30
10/18/2007	11:05	BD-7A	26.48737	-80.03871	0
10/18/2007	11:05	BD-7B	26.48737	-80.03871	10
10/18/2007	11:05	BD-7C	26.48737	-80.03871	20
10/18/2007	11:41	BD-8A	26.51507	-80.03542	0
10/18/2007	11:41	BD-8B	26.51507	-80.03542	10
10/18/2007	11:41	BD-8C	26.51507	-80.03542	20
10/18/2007	12:11	BD-9A	26.50838	-80.04129	0
10/18/2007	12:11	BD-9B	26.50838	-80.04129	7
10/18/2007	12:11	BD-9C	26.50838	-80.04129	15
10/18/2007	12:36	BD-10A	26.52261	-80.03223	0
10/18/2007	12:36	BD-10B	26.52261	-80.03223	8
10/18/2007	12:36	BD-10C	26.52261	-80.03223	16
10/18/2007	13:06	BD-11A	26.53333	-80.03584	0
10/18/2007	13:06	BD-11B	26.53333	-80.03584	7
10/18/2007	13:06	BD-11C	26.53333	-80.03584	13
10/18/2007	13:30	BD-12A	26.53874	-80.03980	0
10/18/2007	13:30	BD-12B	26.53874	-80.03980	5
10/18/2007	13:30	BD-12C	26.53874	-80.03980	8
10/19/2007	09:00	BD-13A	26.54542	-80.04300	0
10/19/2007	N/A	BD-14A	26.54242	-80.03996	0
10/19/2007	N/A	BD-14C	26.54242	-80.03996	3
10/19/2007	N/A	BD-15A	26.55919	-80.03329	0
10/19/2007	N/A	BD-15B	26.55919	-80.03329	6
10/19/2007	N/A	BD-15C	26.55919	-80.03329	13
10/19/2007	09:15	BD-16A	26.54618	-80.04791	0
10/19/2007	09:30	BD-17A	26.54264	-80.04790	0
10/19/2007	09:45	BD-18A	26.53950	-80.04951	0
10/19/2007	10:00	WR	N/A	N/A	0

Table 15: October 2007 Boynton-Delray nutrient and DOC values in µM.

Station	Depth (m)	N+N (µM)	NH_4 (µM)	P (µM)	Si (µM)	TDN (µM)	TDP (µM)	DOC (µM)
BD-1A	0	0.34	0.63	0.01	BDL	5.25	N/A	43.63
BD-1B	16	0.12	0.18	BDL	BDL	10.74	N/A	40.63
BD-1C	35	0.19	0.38	BDL	BDL	8.14	N/A	40.41
BD-2A	0	0.15	BDL	0.02	BDL	4.40	N/A	40.46
BD-2B	8	0.07	BDL	BDL	BDL	6.29	N/A	39.39
BD-2C	16	0.26	0.15	0.02	BDL	9.22	N/A	36.36
BD-3A	0	0.26	BDL	BDL	BDL	6.63	N/A	44.13
BD-3B	16	0.25	BDL	0.01	BDL	9.84	N/A	49.86
BD-3C	33	0.11	BDL	BDL	BDL	8.27	N/A	45.97
BD-4A	0	0.10	BDL	BDL	BDL	15.29	N/A	43.63
BD-4B	16	0.13	0.18	BDL	BDL	5.47	N/A	41.96
BD-4C	32	0.17	BDL	0.01	BDL	16.33	N/A	39.23
BD-5A	0	2.20	3.45	0.50	BDL	10.01	N/A	47.25
BD-5B	15	0.07	0.24	BDL	0.53	13.34	N/A	41.63
BD-5C	30	0.11	0.28	BDL	BDL	12.14	N/A	53.42
BD-6A	0	0.80	1.35	0.18	BDL	13.05	N/A	52.36
BD-6B	15	0.05	BDL	BDL	0.02	5.24	N/A	42.19
BD-6C	30	0.08	0.15	BDL	BDL	6.09	N/A	44.80
BD-7A	0	0.27	BDL	0.03	BDL	14.21	N/A	42.80
BD-7B	10	0.06	BDL	BDL	BDL	5.42	N/A	43.08
BD-7C	20	0.08	0.18	BDL	BDL	5.61	N/A	39.80
BD-8A	0	0.18	0.54	0.06	BDL	9.27	N/A	40.00
BD-8B	10	0.14	0.18	0.02	BDL	6.19	N/A	40.52
BD-8C	20	0.13	0.32	0.01	BDL	8.20	N/A	39.70
BD-9A	0	0.26	BDL	0.06	BDL	6.13	N/A	47.86
BD-9B	7	0.04	BDL	BDL	BDL	7.43	N/A	56.42
BD-9C	15	0.02	BDL	BDL	BDL	5.59	N/A	39.17
BD-10A	0	0.09	BDL	BDL	BDL	7.89	N/A	40.30
BD-10B	8	0.12	BDL	BDL	BDL	4.84	N/A	40.52
BD-10C	16	0.13	BDL	BDL	BDL	5.59	N/A	37.88
BD-11A	0	0.03	BDL	BDL	BDL	7.06	N/A	48.80
BD-11B	7	0.06	BDL	BDL	BDL	8.29	N/A	46.86
BD-11C	13	0.02	BDL	BDL	BDL	3.96	N/A	40.58
BD-12A	0	0.06	BDL	BDL	BDL	5.22	N/A	39.72
BD-12B	5	0.08	BDL	BDL	BDL	17.94	N/A	37.58
BD-12C	8	0.16	BDL	BDL	BDL	6.32	N/A	44.17
BD-13A	0	1.40	0.64	0.42	BDL	9.59	N/A	82.43
BD-14A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BD-14C	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BD-15A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BD-15B	6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BD-15C	13	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BD-16A	0	7.30	6.20	1.90	29.60	37.93	N/A	308.43
BD-17A	0	8.90	7.13	1.80	30.30	39.73	N/A	324.55
BD-18A	0	7.50	7.05	2.40	27.10	40.81	N/A	295.48
WR	0	8.10	2.95	0.94	34.70	41.52	N/A	465.29

Table 16: October 2007 Boynton-Delray nutrient and DOC values in mg/L.

Station	Depth (m)	N+N (mg/L)	NH4 (mg/L)	P (mg/L)	Si (mg/L)	TDN (mg/L)	TDP (mg/L)	DOC (mg/L)
BD-1A	0	0.005	0.009	BDL	BDL	0.09	N/A	1.06
BD-1B	16	0.002	0.003	BDL	BDL	0.18	N/A	1.00
BD-1C	35	0.003	0.005	BDL	BDL	0.14	N/A	1.00
BD-2A	0	0.002	BDL	0.001	BDL	0.08	N/A	1.00
BD-2B	8	0.001	BDL	BDL	BDL	0.11	N/A	0.98
BD-2C	16	0.004	0.002	0.001	BDL	0.16	N/A	0.93
BD-3A	0	0.004	BDL	BDL	BDL	0.11	N/A	1.07
BD-3B	16	0.004	BDL	BDL	BDL	0.17	N/A	1.17
BD-3C	33	0.002	BDL	BDL	BDL	0.14	N/A	1.10
BD-4A	0	0.001	BDL	BDL	BDL	0.26	N/A	1.06
BD-4B	16	0.002	0.003	BDL	BDL	0.09	N/A	1.03
BD-4C	32	0.002	BDL	BDL	BDL	0.28	N/A	0.98
BD-5A	0	0.031	0.048	0.016	BDL	0.17	N/A	1.12
BD-5B	15	0.001	0.003	BDL	0.015	0.23	N/A	1.02
BD-5C	30	0.002	0.004	BDL	BDL	0.21	N/A	1.23
BD-6A	0	0.011	0.019	0.006	BDL	0.22	N/A	1.21
BD-6B	15	0.001	BDL	BDL	0.001	0.09	N/A	1.03
BD-6C	30	0.001	0.002	BDL	BDL	0.10	N/A	1.08
BD-7A	0	0.004	BDL	0.001	BDL	0.24	N/A	1.04
BD-7B	10	0.001	BDL	BDL	BDL	0.09	N/A	1.05
BD-7C	20	0.001	0.003	BDL	BDL	0.10	N/A	0.99
BD-8A	0	0.003	0.008	0.002	BDL	0.16	N/A	0.99
BD-8B	10	0.002	0.003	BDL	BDL	0.11	N/A	1.00
BD-8C	20	0.002	0.004	BDL	BDL	0.14	N/A	0.99
BD-9A	0	0.004	BDL	0.002	BDL	0.11	N/A	1.13
BD-9B	7	0.001	BDL	BDL	BDL	0.13	N/A	1.29
BD-9C	15	BDL	BDL	BDL	BDL	0.10	N/A	0.98
BD-10A	0	0.001	BDL	BDL	BDL	0.14	N/A	1.00
BD-10B	8	0.002	BDL	BDL	BDL	0.08	N/A	1.00
BD-10C	16	0.002	BDL	BDL	BDL	0.10	N/A	0.95
BD-11A	0	BDL	BDL	BDL	BDL	0.12	N/A	1.15
BD-11B	7	0.001	BDL	BDL	BDL	0.14	N/A	1.12
BD-11C	13	BDL	BDL	BDL	BDL	0.07	N/A	1.00
BD-12A	0	0.001	BDL	BDL	BDL	0.09	N/A	0.99
BD-12B	5	0.001	BDL	BDL	BDL	0.31	N/A	0.95
BD-12C	8	0.002	BDL	BDL	BDL	0.11	N/A	1.07
BD-13A	0	0.020	0.009	0.013	BDL	0.17	N/A	1.76
BD-14A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BD-14C	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BD-15A	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BD-15B	6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BD-15C	13	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BD-16A	0	0.102	0.087	0.059	0.829	0.65	N/A	5.82
BD-17A	0	0.125	0.100	0.056	0.848	0.68	N/A	6.11
BD-18A	0	0.105	0.099	0.074	0.759	0.70	N/A	5.59
WR	0	0.113	0.041	0.029	0.972	0.72	N/A	8.64

Table 17: October 2007 Boynton-Delray salinity, pH, chlorophyll-a, phaeopigments, and TSS results.

Station	Depth (m)	Temperature (°C)	Salinity (units)	pH (units)	Chlorophyll a (µg/L)	Phaeopigments (µg/L)	TSS (mg/L)
BD-1A	0	28.3	36.2	8.10	0.585	0.136	0.21
BD-1B	16	28.4	36.3	8.13	0.327	0.118	0.17
BD-1C	35	28.5	36.4	8.11	0.206	0.110	0.16
BD-2A	0	28.3	36.2	8.09	0.556	0.156	0.15
BD-2B	8	28.5	36.3	8.12	0.555	0.133	0.19
BD-2C	16	28.5	36.4	8.13	0.344	0.103	0.15
BD-3A	0	28.3	36.2	8.13	0.666	0.100	0.19
BD-3B	16	28.5	36.5	8.11	0.297	0.134	0.11
BD-3C	33	28.5	36.5	8.12	0.288	0.091	0.05
BD-4A	0	28.4	35.9	8.11	0.772	0.210	0.16
BD-4B	16	28.5	36.4	8.13	0.676	0.154	0.15
BD-4C	32	28.5	36.5	8.14	0.291	0.097	0.12
BD-5A	0	28.4	36.1	8.12	0.639	0.125	0.24
BD-5B	15	28.5	36.5	8.14	0.308	0.101	0.04
BD-5C	30	28.5	36.5	8.14	0.287	0.124	0.12
BD-6A	0	28.4	36.2	8.09	0.796	0.165	0.21
BD-6B	15	28.5	36.5	8.13	0.288	0.106	0.15
BD-6C	30	28.5	36.5	8.12	0.314	0.097	0.14
BD-7A	0	28.6	36.2	8.12	0.906	0.130	0.31
BD-7B	10	28.5	36.4	8.11	0.351	0.096	0.44
BD-7C	20	28.5	36.5	8.13	0.362	0.110	0.15
BD-8A	0	N/A	35.8	8.10	0.497	0.146	0.24
BD-8B	10	N/A	35.7	8.11	0.535	0.107	0.18
BD-8C	20	N/A	35.9	8.11	0.488	0.094	0.16
BD-9A	0	28.6	36.4	8.08	0.517	0.083	0.27
BD-9B	7	28.5	36.4	8.10	0.610	0.089	0.20
BD-9C	15	28.5	36.4	8.11	0.633	0.123	0.34
BD-10A	0	28.5	36.4	8.10	0.540	0.080	0.32
BD-10B	8	28.5	36.4	8.10	0.520	0.081	0.16
BD-10C	16	28.5	36.4	8.11	0.500	0.077	0.17
BD-11A	0	28.6	36.4	8.11	0.568	0.082	0.16
BD-11B	7	28.5	36.4	8.12	0.563	0.073	0.02
BD-11C	13	28.5	36.5	8.12	0.563	0.088	0.15
BD-12A	0	28.5	36.3	8.12	0.466	0.045	0.30
BD-12B	5	28.5	36.4	8.13	0.529	0.080	0.52
BD-12C	8	28.5	36.4	8.11	0.522	0.087	0.43
BD-13A	0	28.2	33.2	8.11	1.789	0.925	1.83
BD-14A	0	N/A	N/A	N/A	N/A	N/A	N/A
BD-14C	3	N/A	N/A	N/A	N/A	N/A	N/A
BD-15A	0	N/A	N/A	N/A	N/A	N/A	N/A
BD-15B	6	N/A	N/A	N/A	N/A	N/A	N/A
BD-15C	13	N/A	N/A	N/A	N/A	N/A	N/A
BD-16A	0	27.9	19.8	7.75	6.627	2.966	1.63
BD-17A	0	28.7	17.7	7.69	6.089	3.181	2.08
BD-18A	0	27.7	13.2	7.70	5.876	2.564	1.56
WR	0	28.5	3.3	7.48	25.912	8.407	5.14

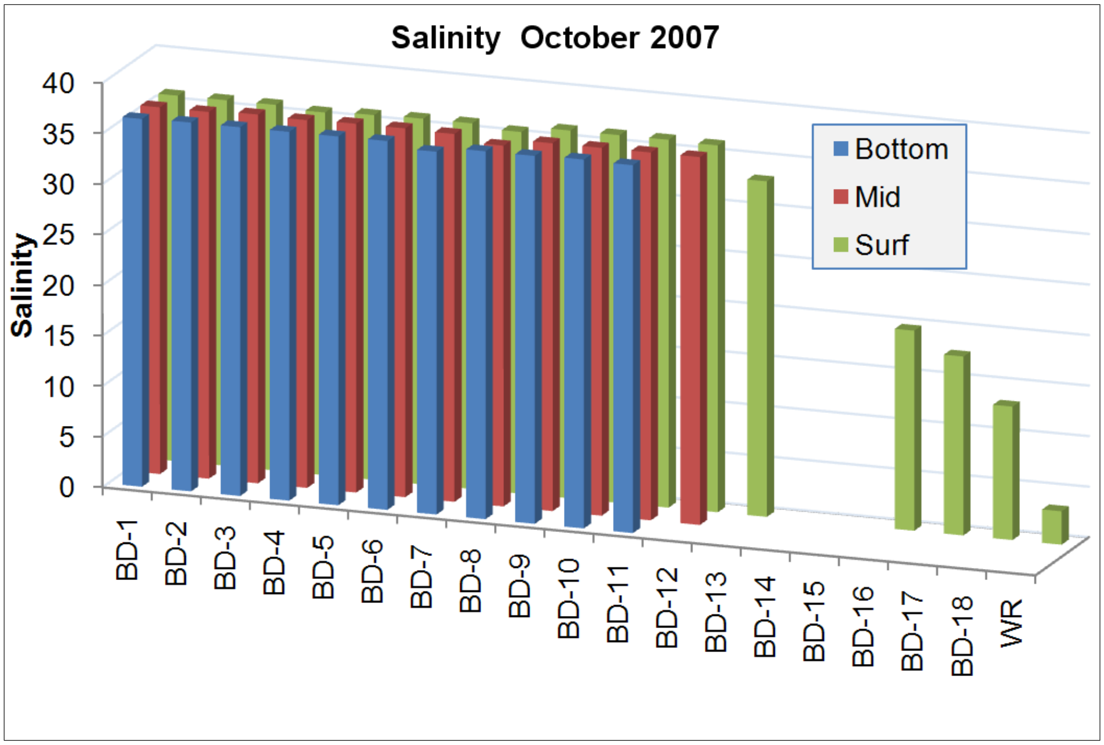

Figure 24: October 2007 salinity results for the Boynton-Delray water quality monitoring stations.

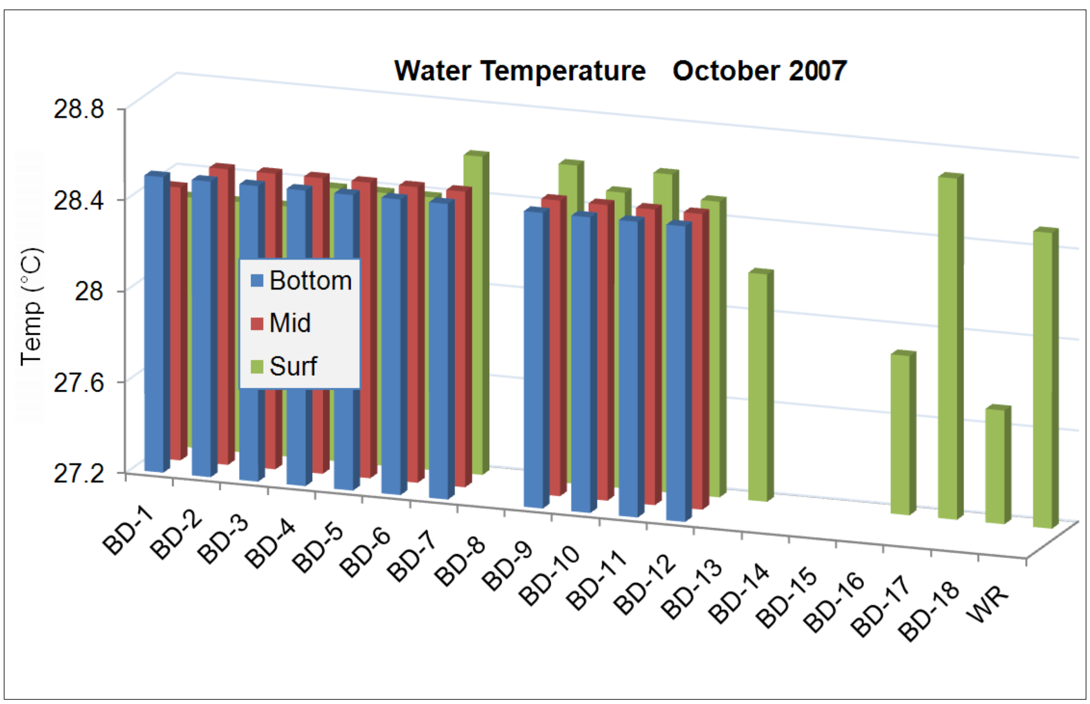

Figure 25: October 2007 temperature measurements for the Boynton-Delray water quality monitoring stations.

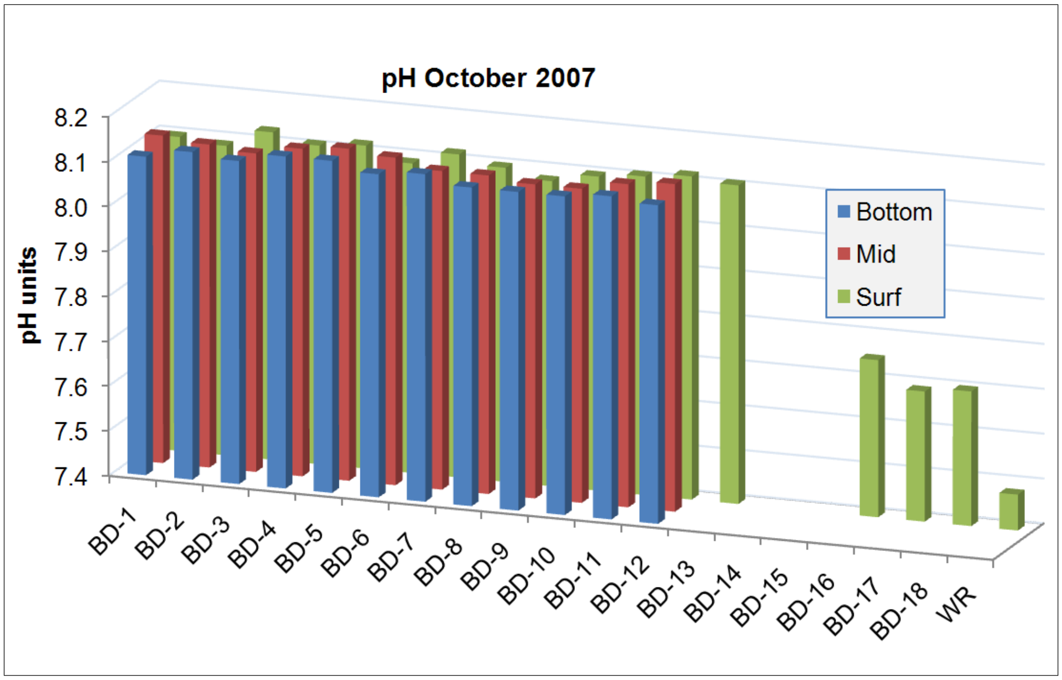

Figure 26: October 2007 pH measurements for the Boynton-Delray water quality monitoring stations.

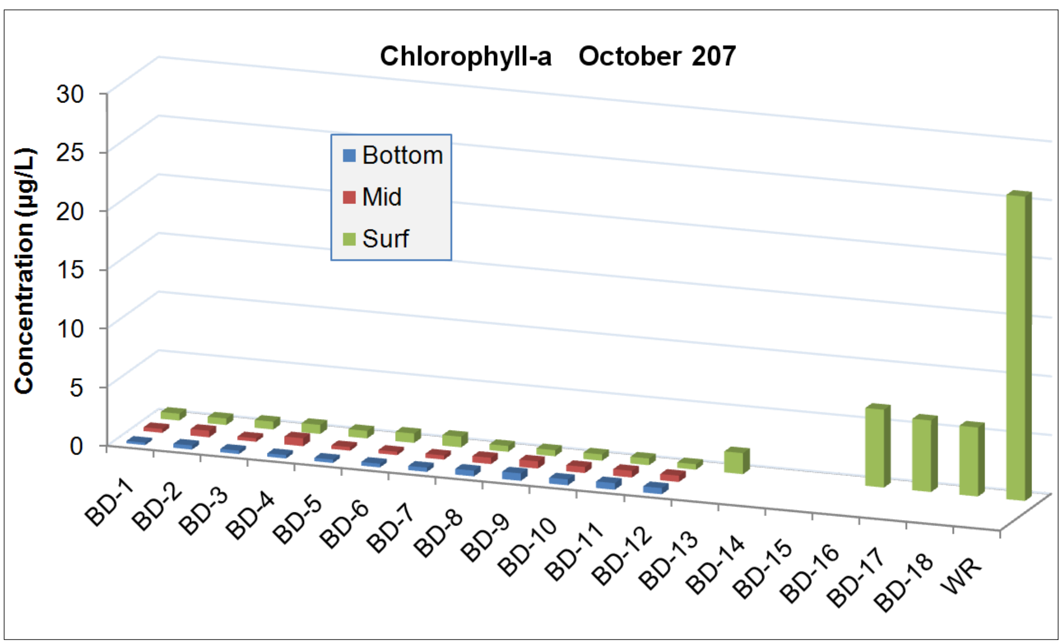

Figure 27: October 2007 chlorophyll-a concentrations for the Boynton-Delray water quality monitoring stations.

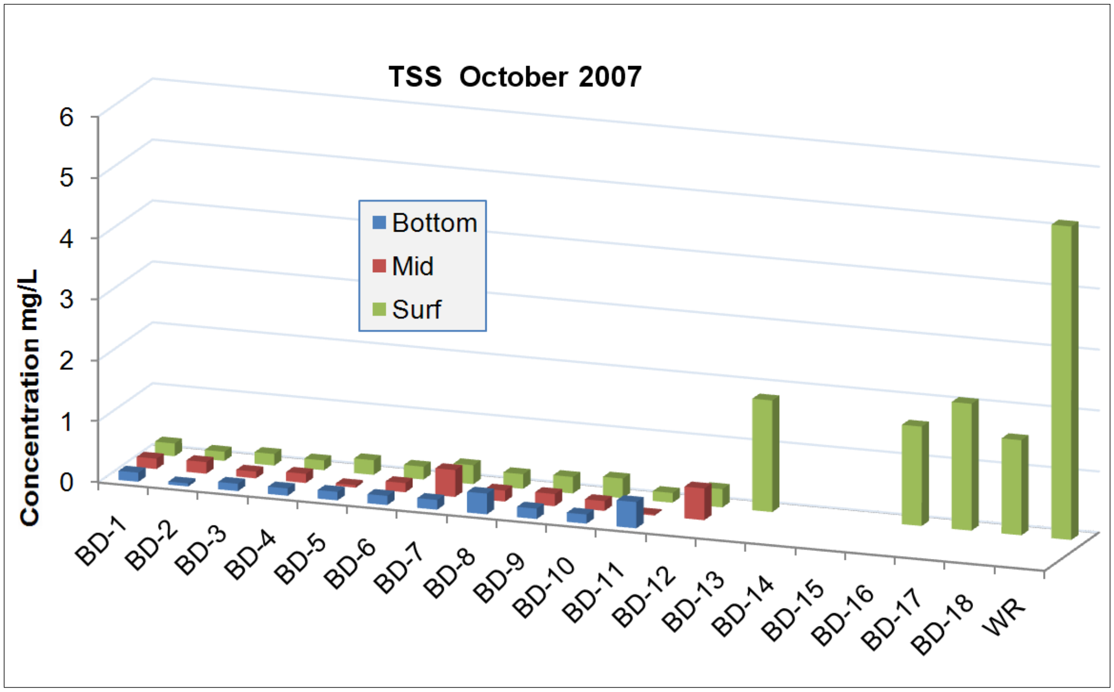

Figure 28: October 2007 total suspended solids concentrations for the Boynton-Delray water quality monitoring stations.

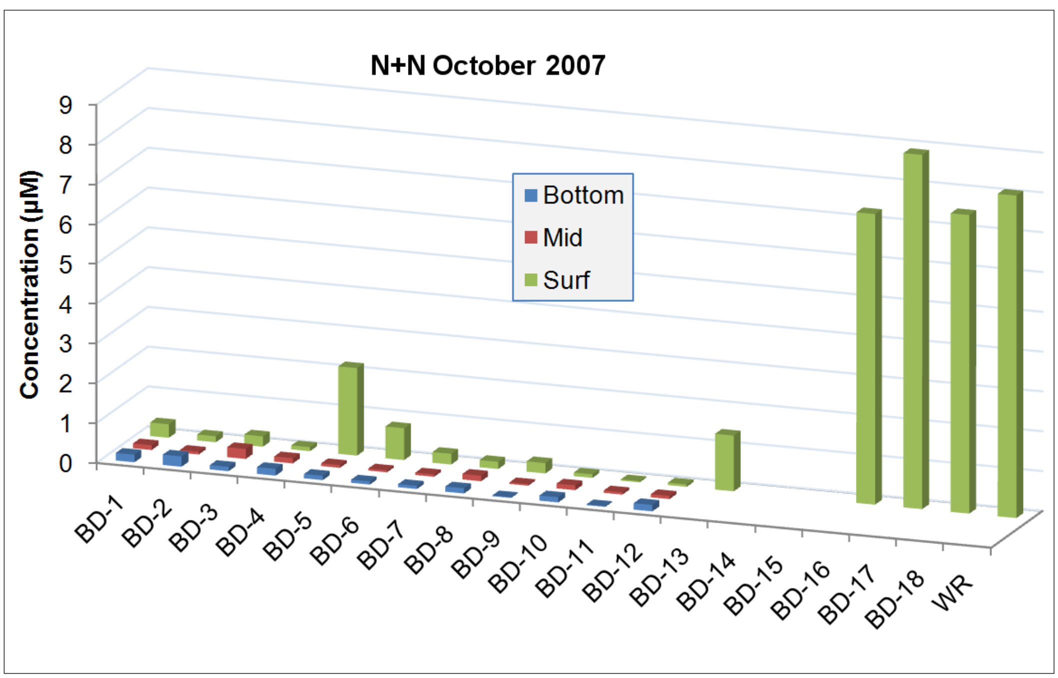

Figure 29: October 2007 nitrate+nitrite concentrations for the Boynton-Delray water quality monitoring stations.

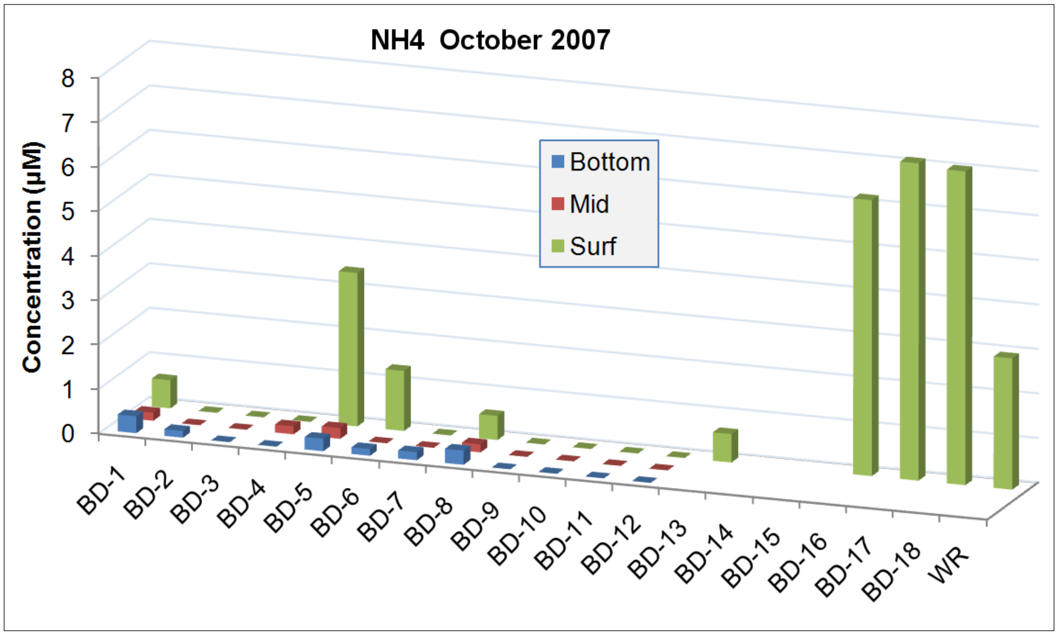

Figure 30: October 2007 ammonium concentrations for the Boynton-Delray water quality monitoring stations.

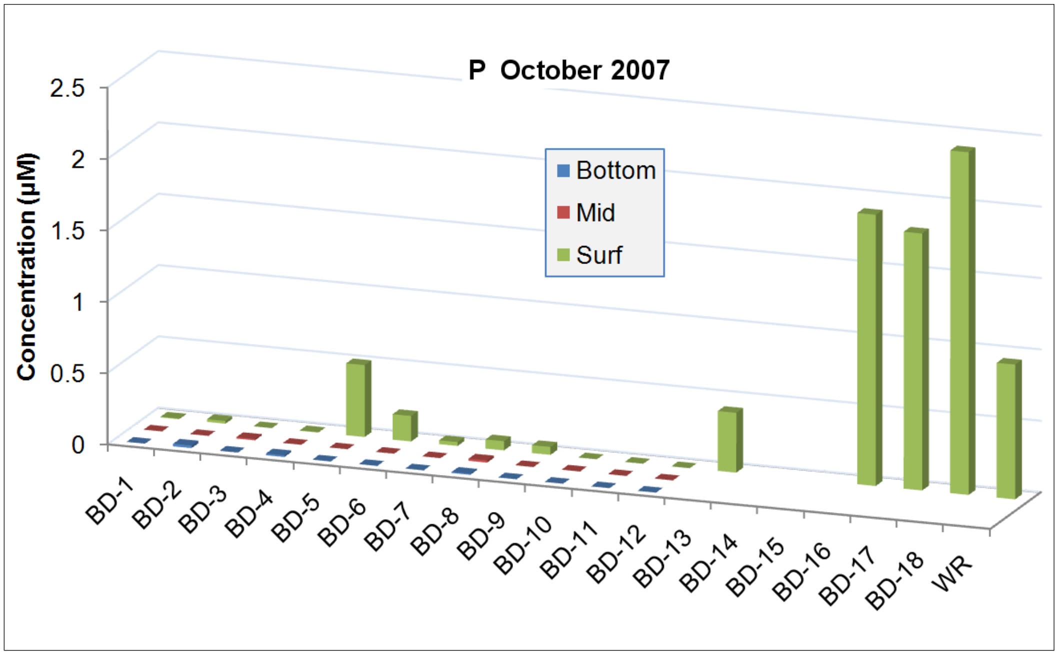

Figure 31: October 2007 orthophosphate concentrations for the Boynton-Delray water quality monitoring stations.

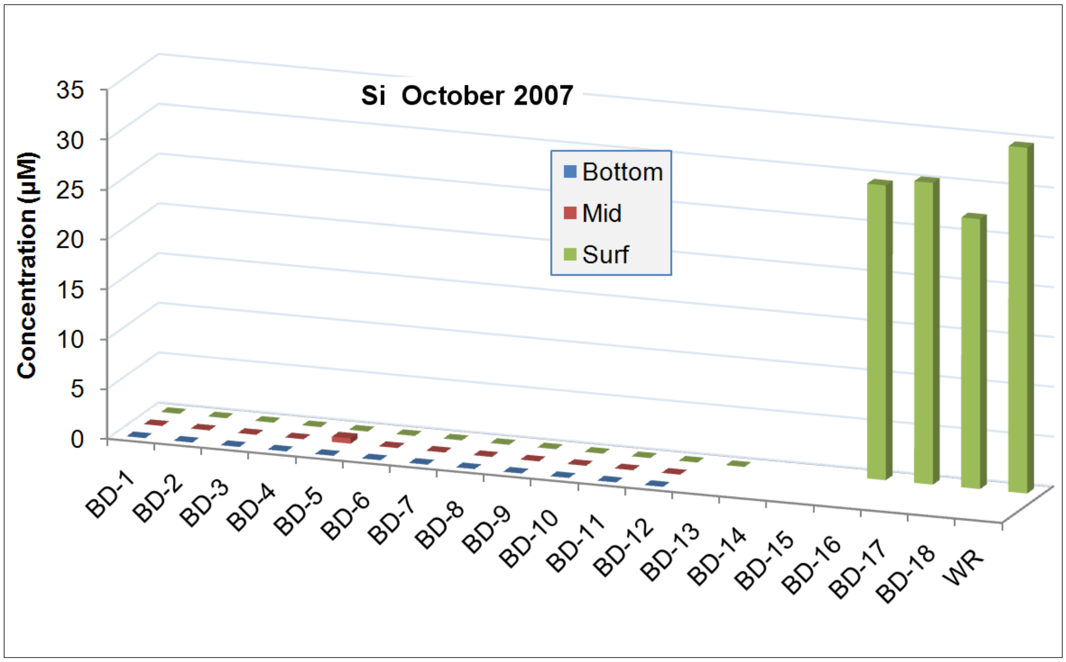

Figure 32: October 2007 silicate concentrations for the Boynton-Delray water quality monitoring stations.

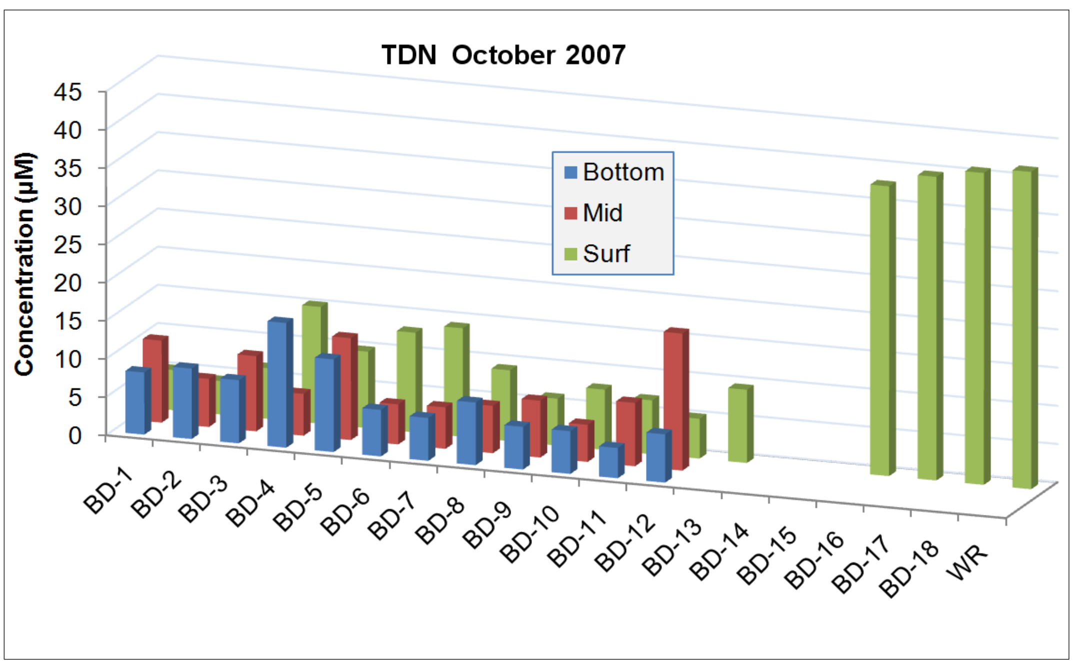

Figure 33: October 2007 total dissolved nitrogen concentrations for the Boynton-Delray water quality monitoring stations.

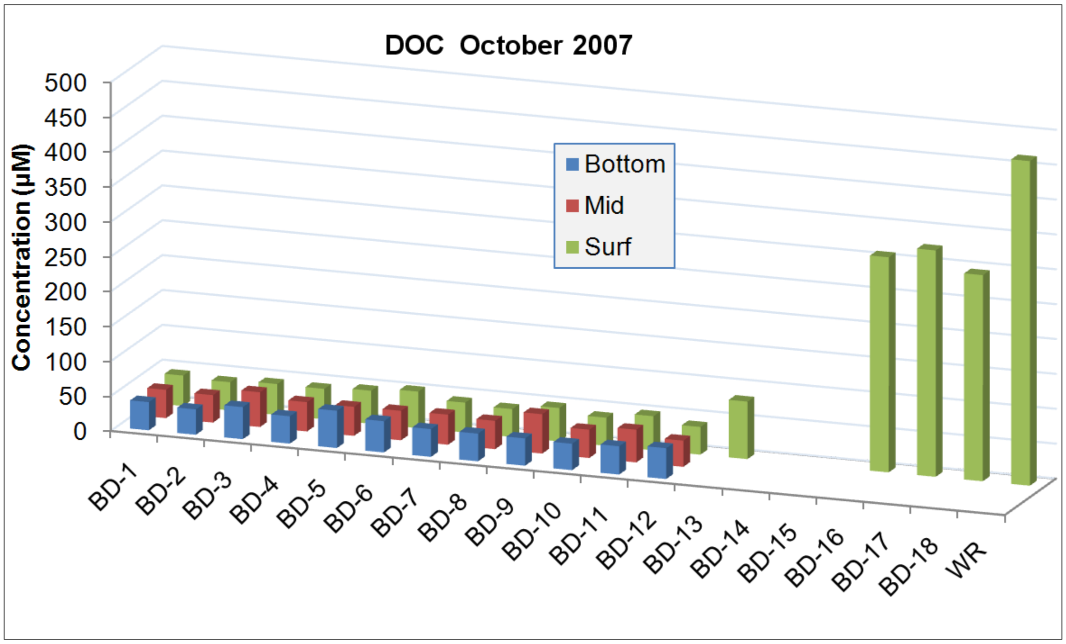

Figure 34: October 2007 dissolved organic carbon concentrations for the Boynton-Delray water quality monitoring stations.

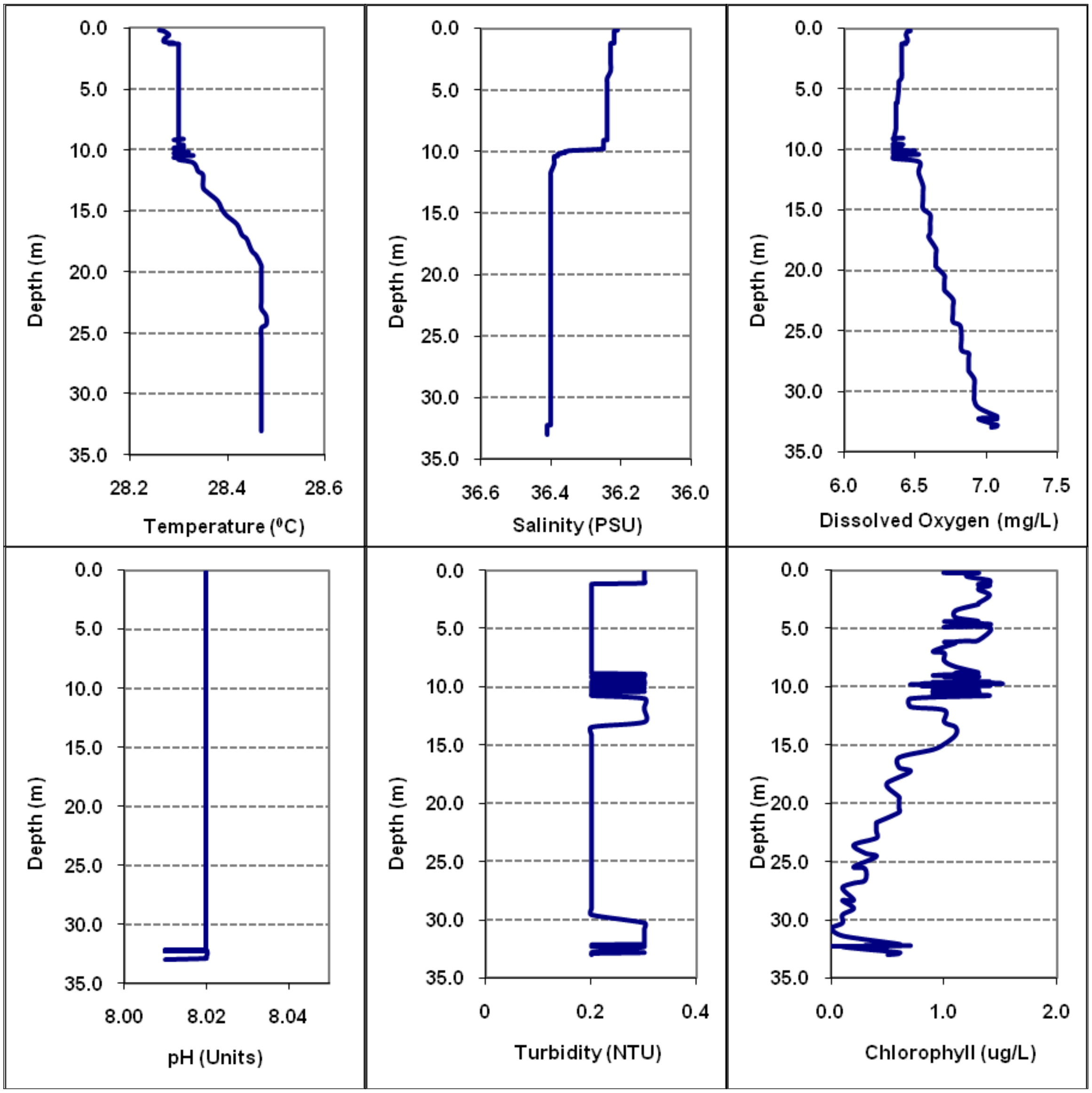

Figure 35: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-1.

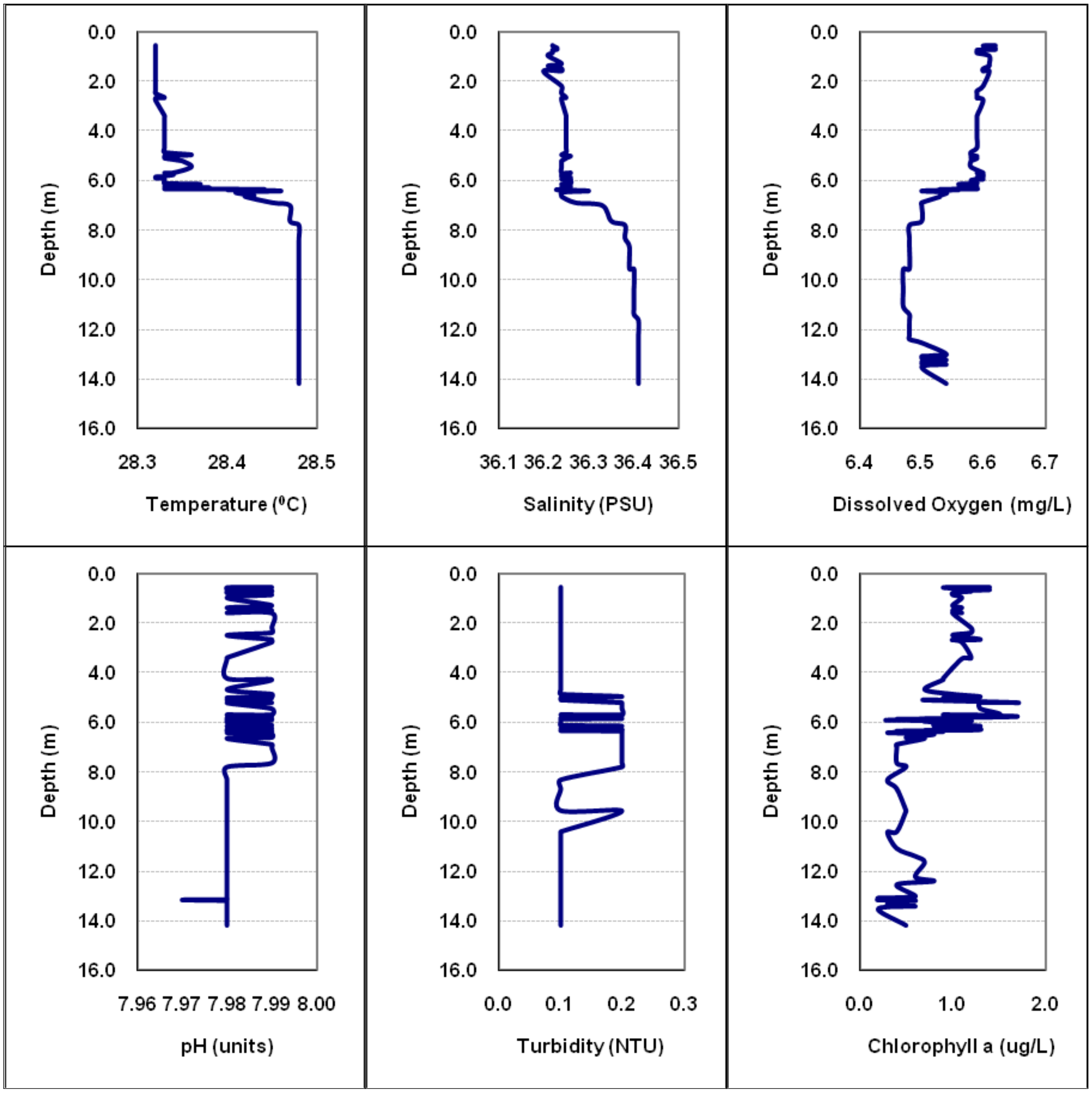

Figure 36: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-2.

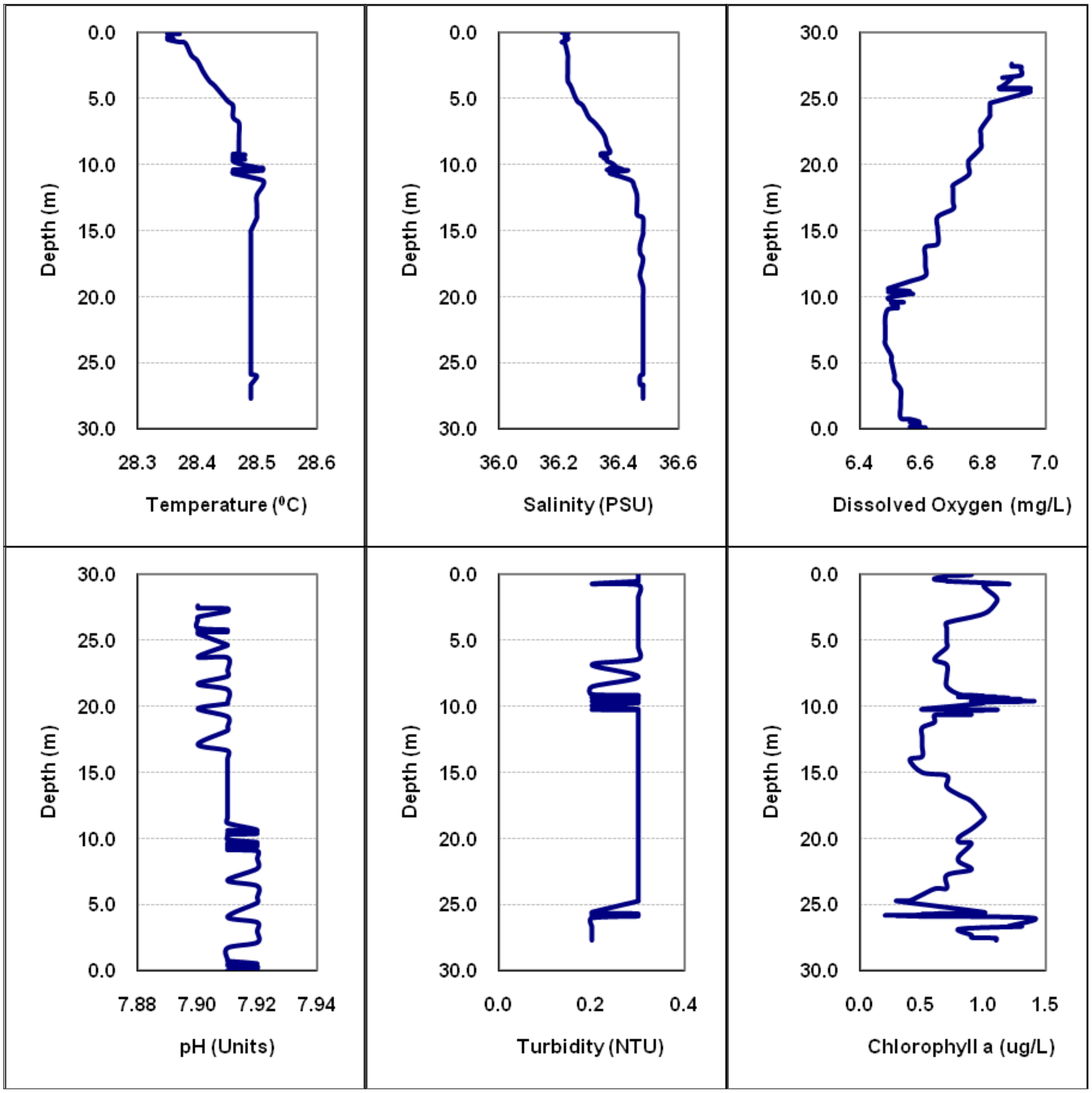

Figure 37: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-3.

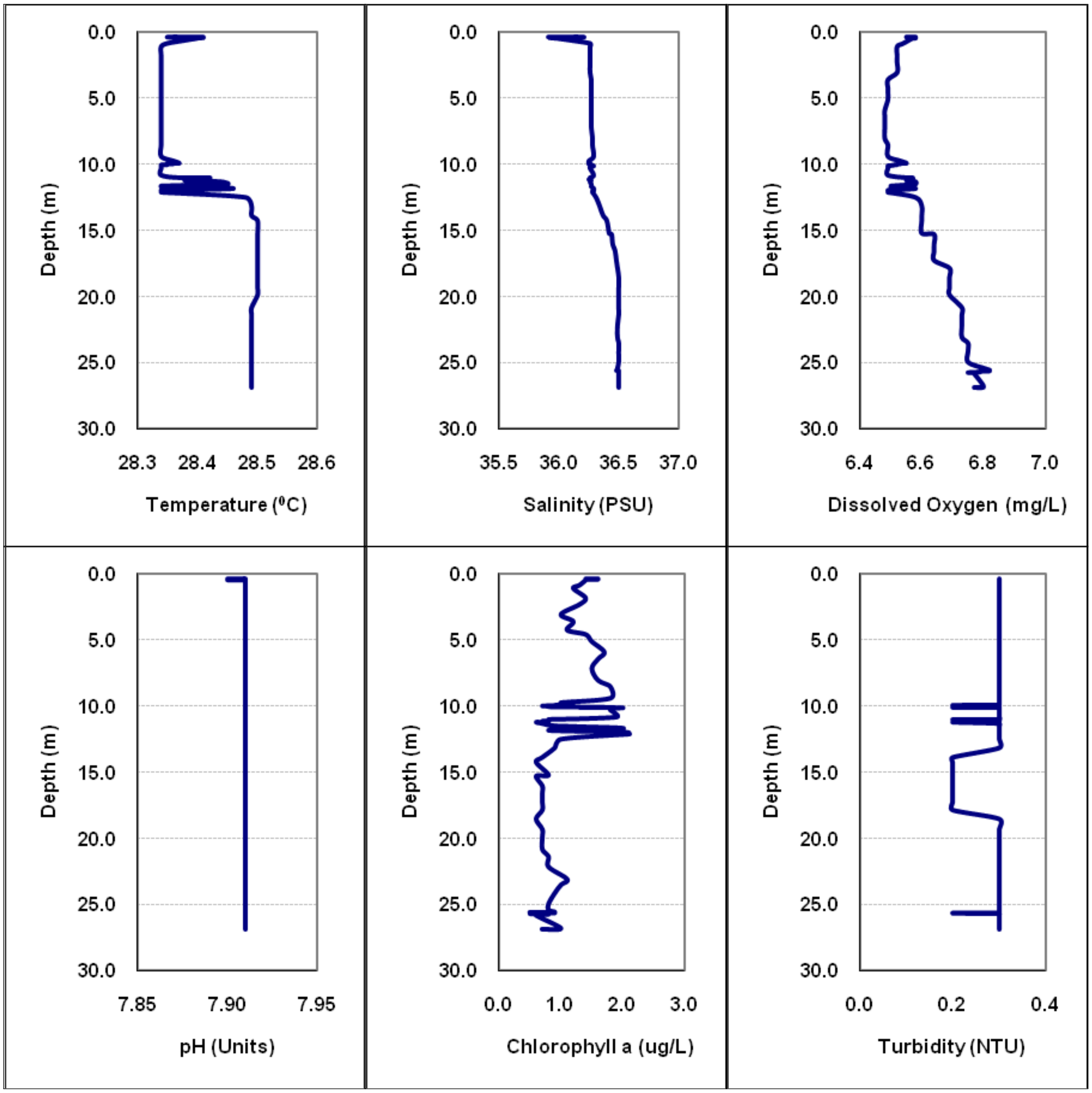

Figure 38: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-4.

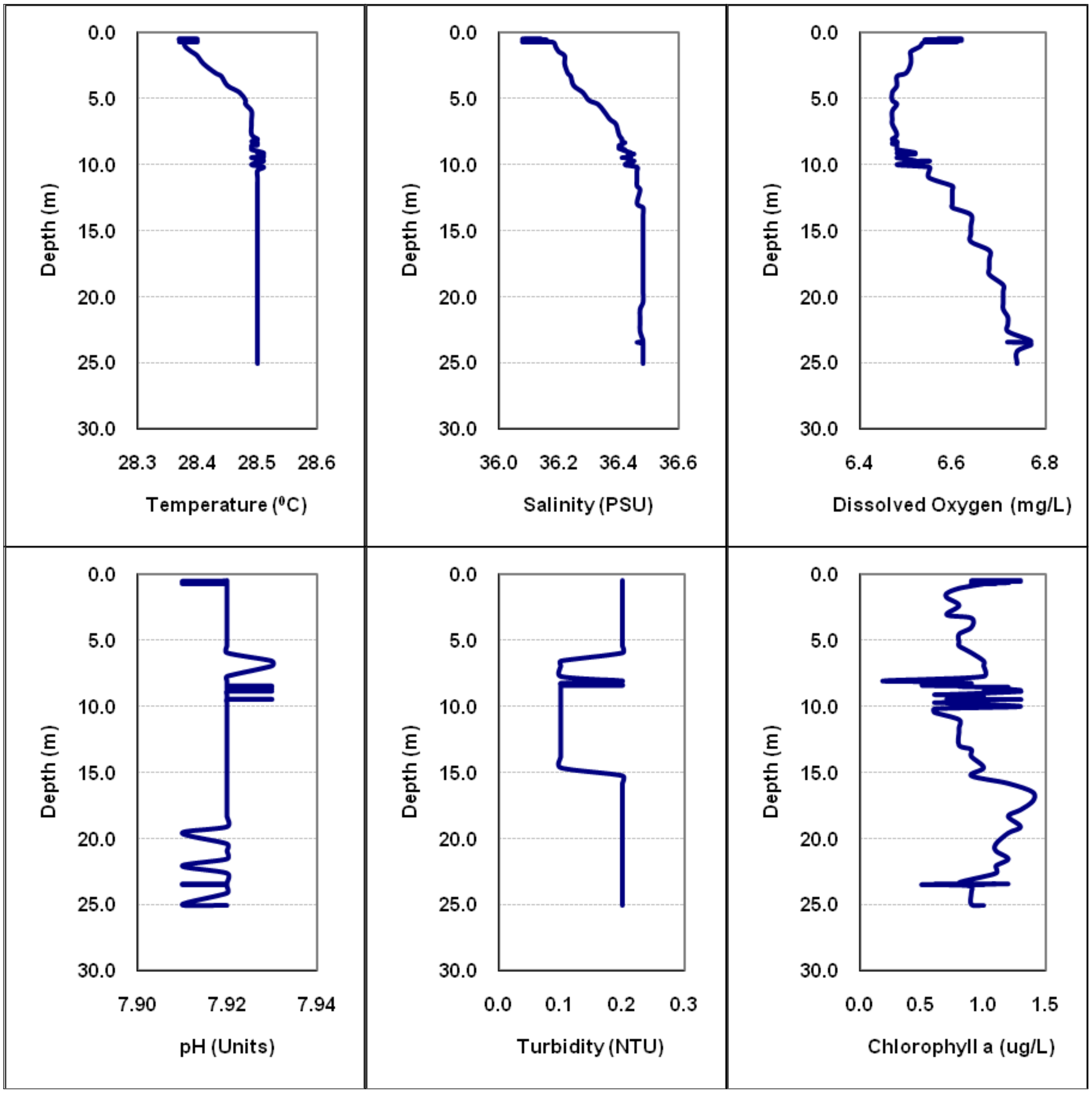

Figure 39: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-5.

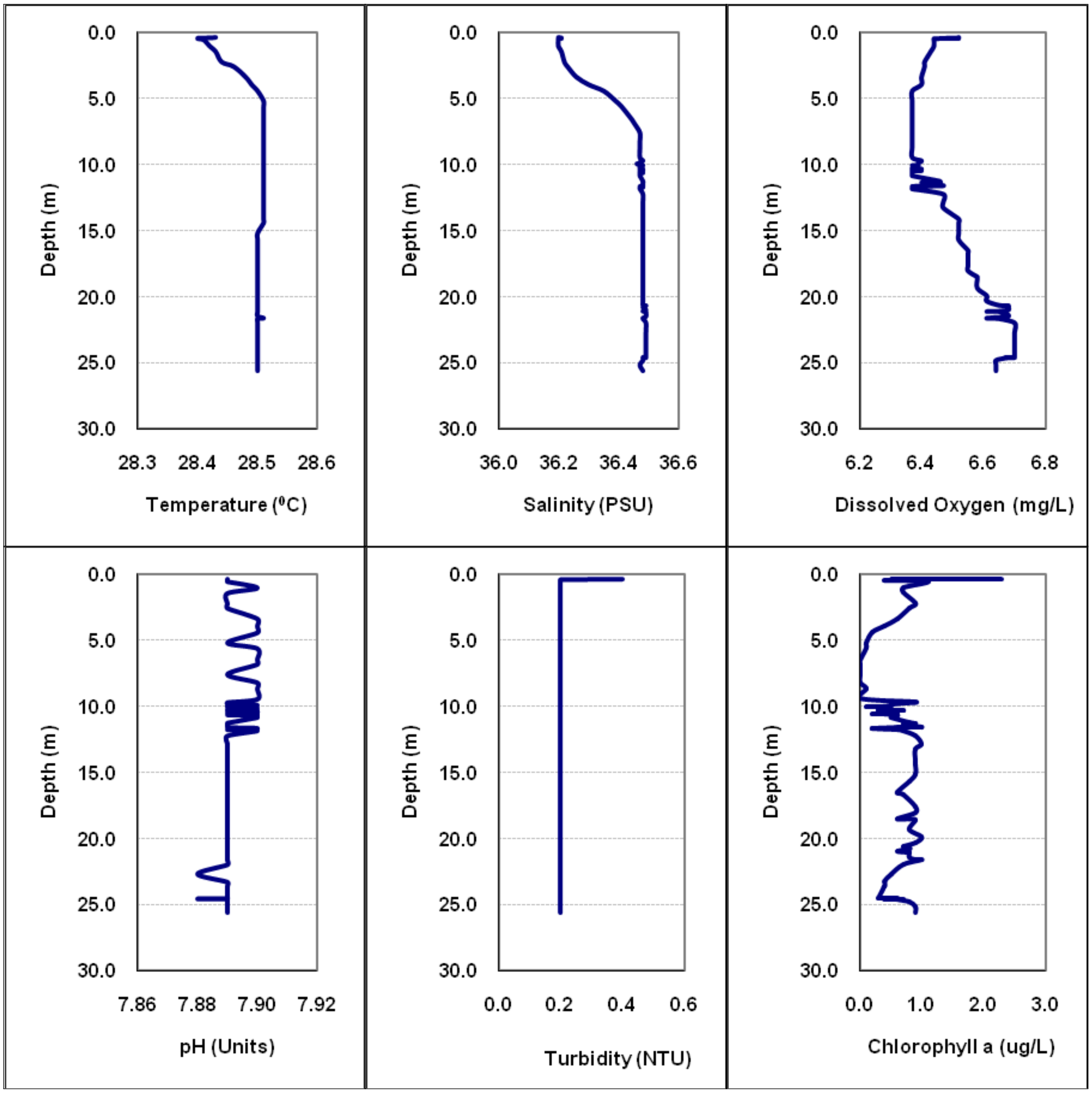

Figure 40: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-6.

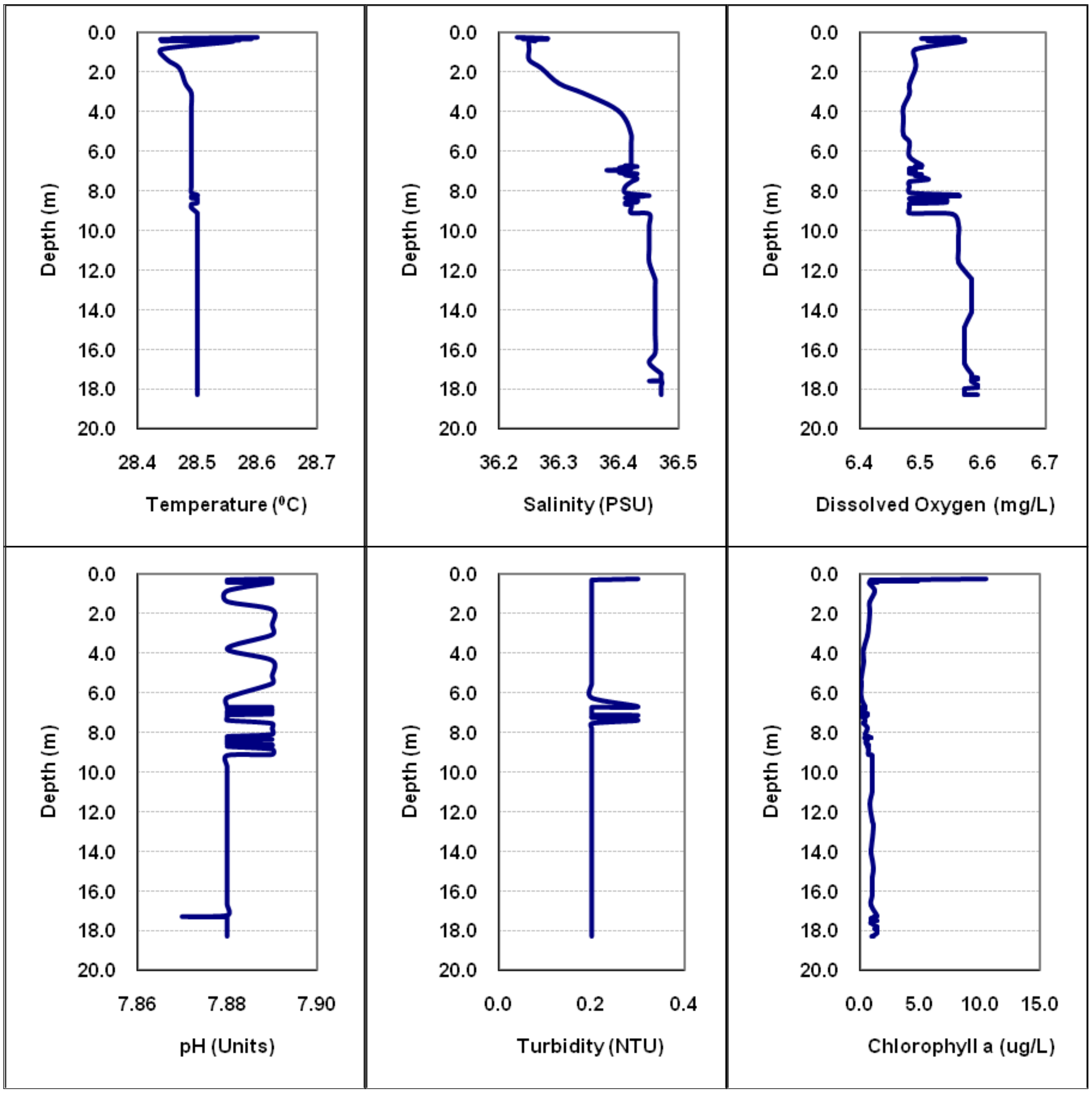

Figure 41: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-7.

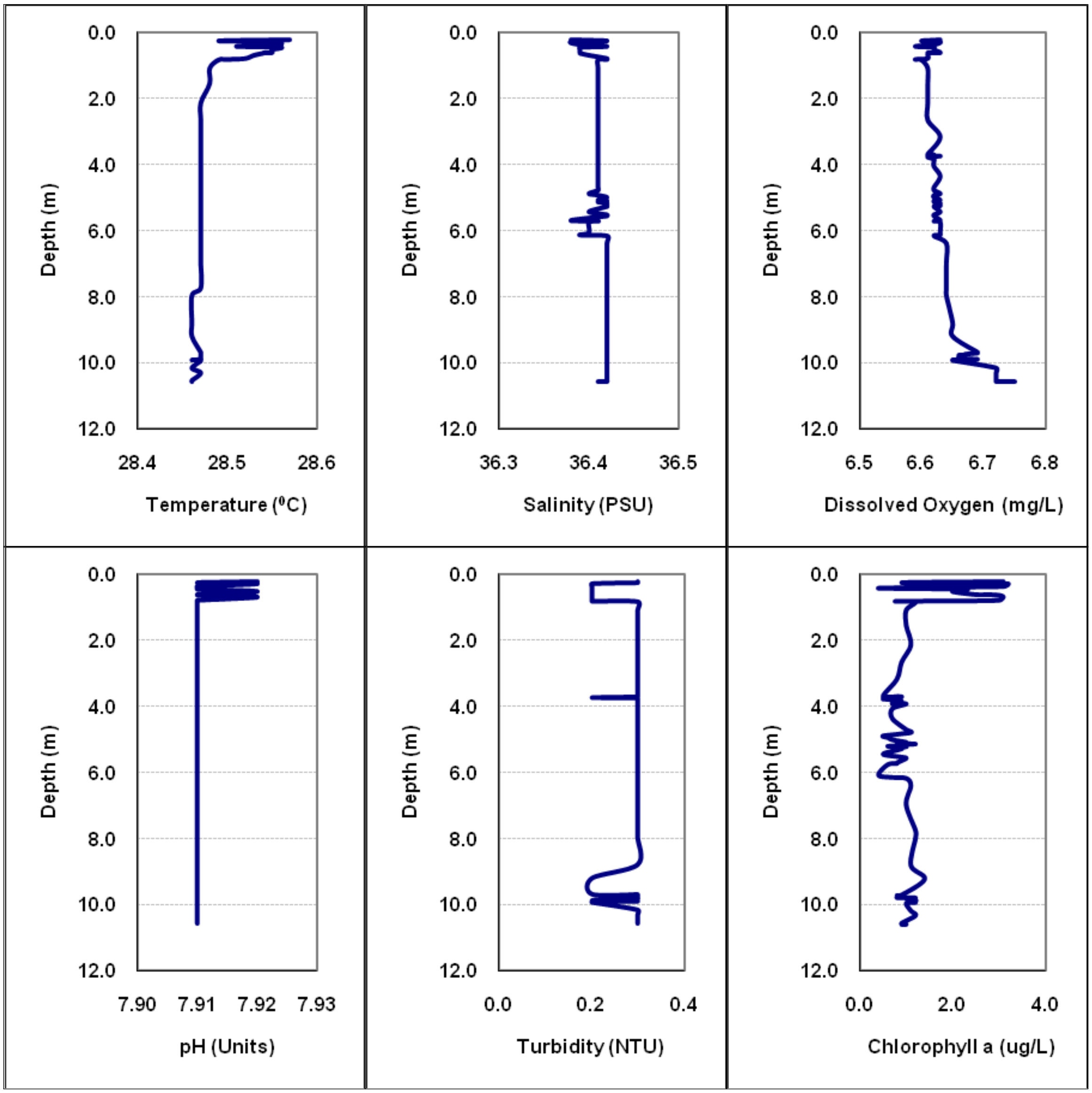

Figure 42: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-9.

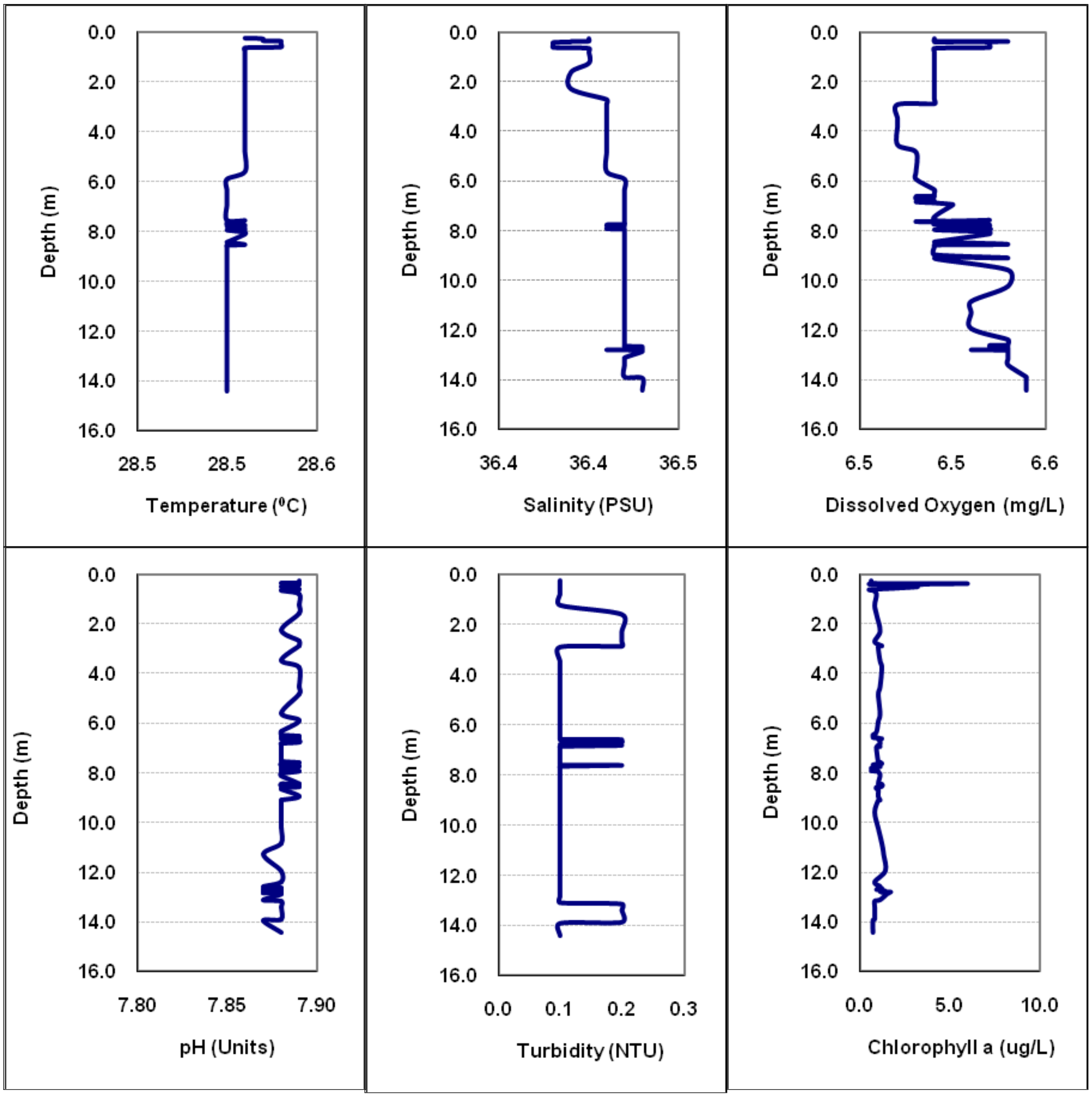

Figure 43: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-10.

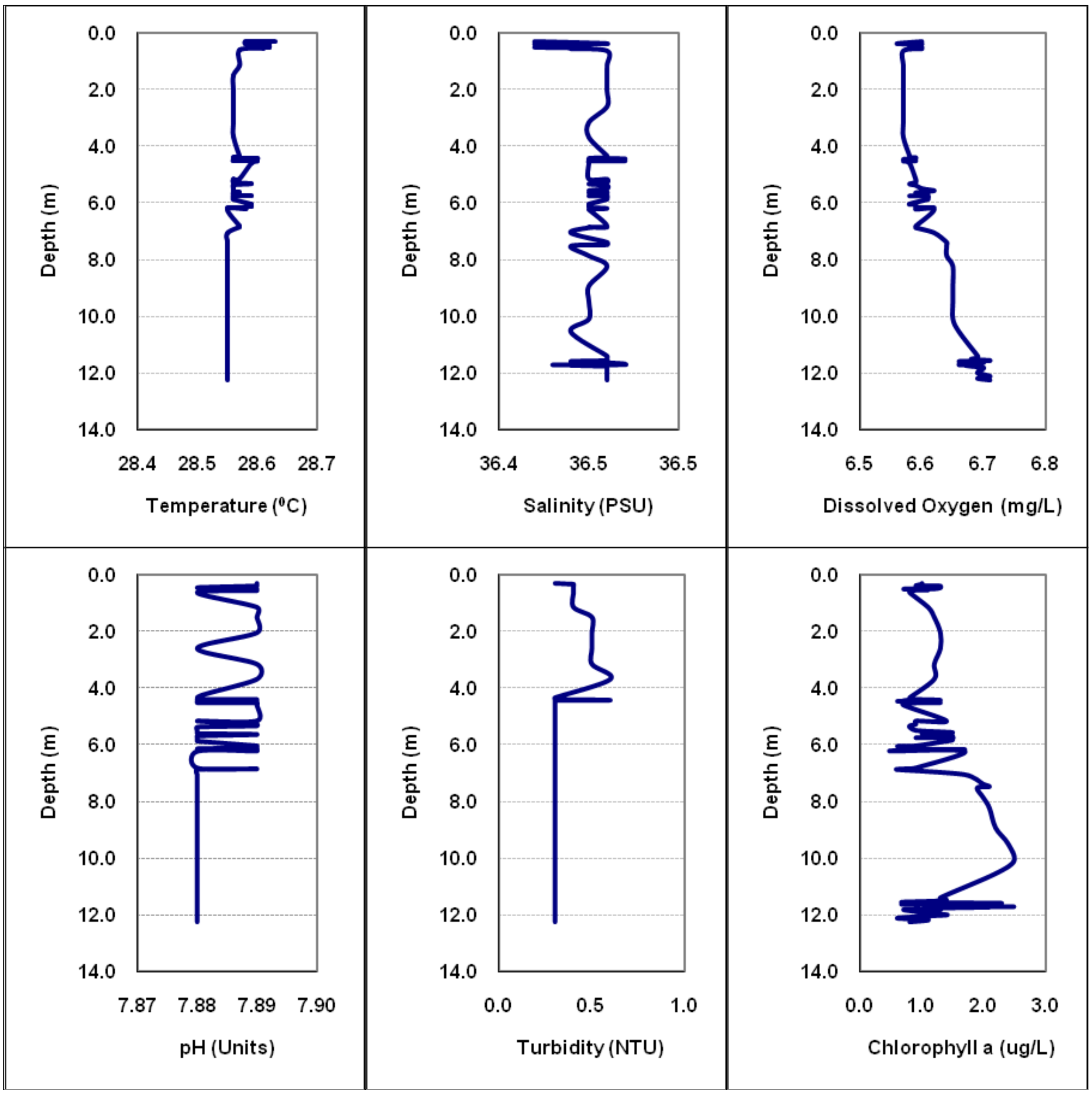

Figure 44: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-11.

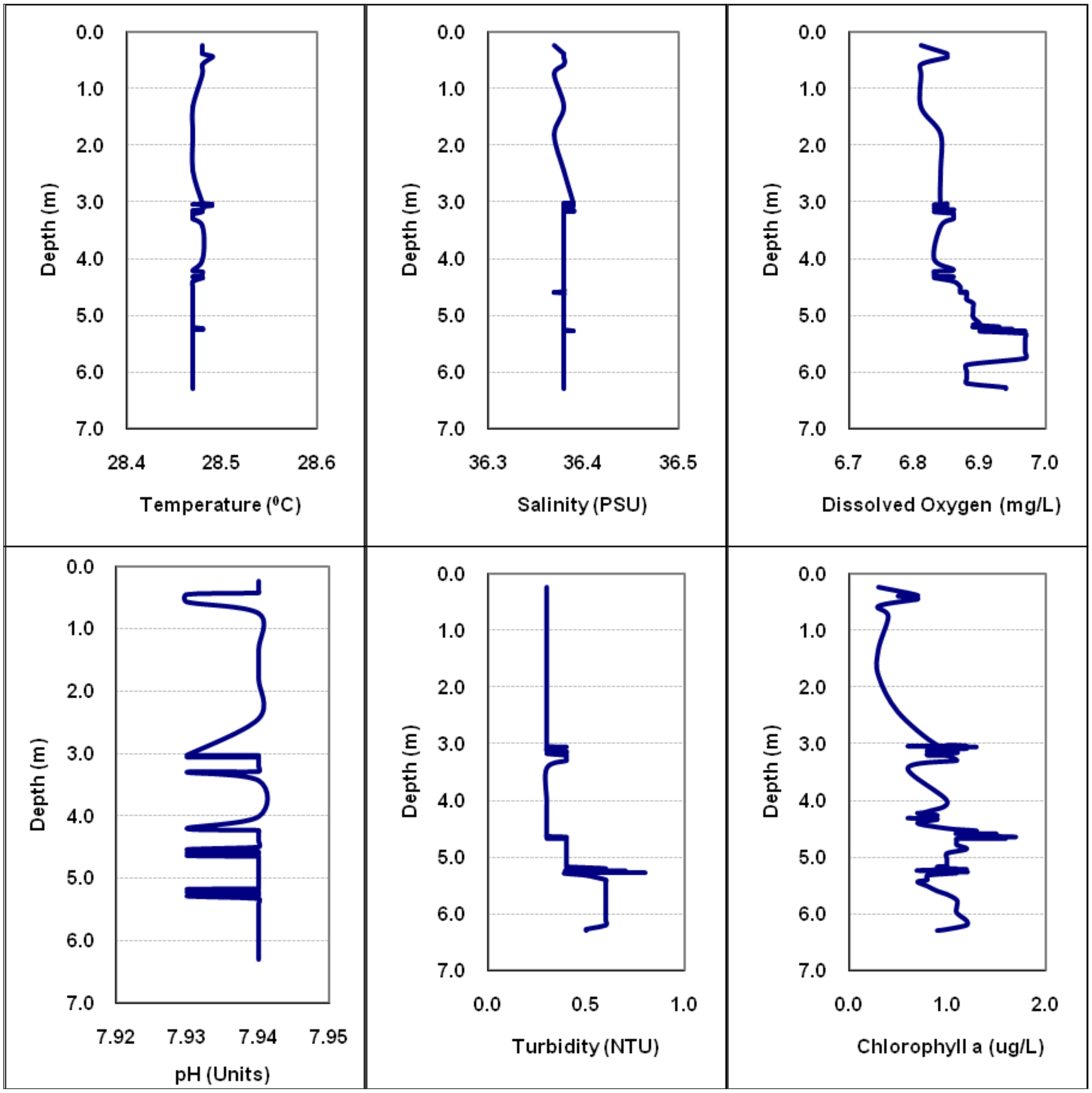

Figure 45: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-12.

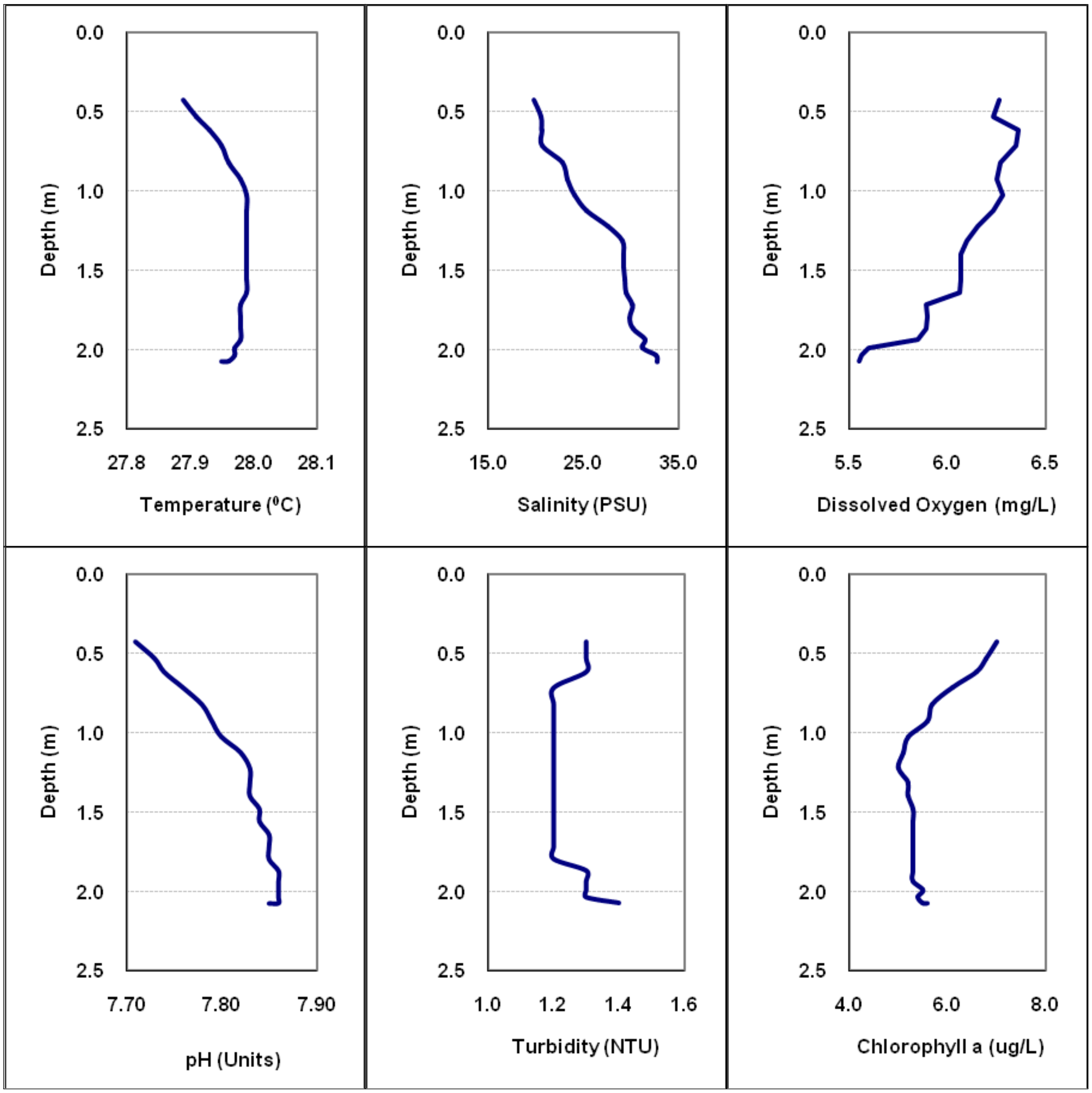

Figure 46: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-16.

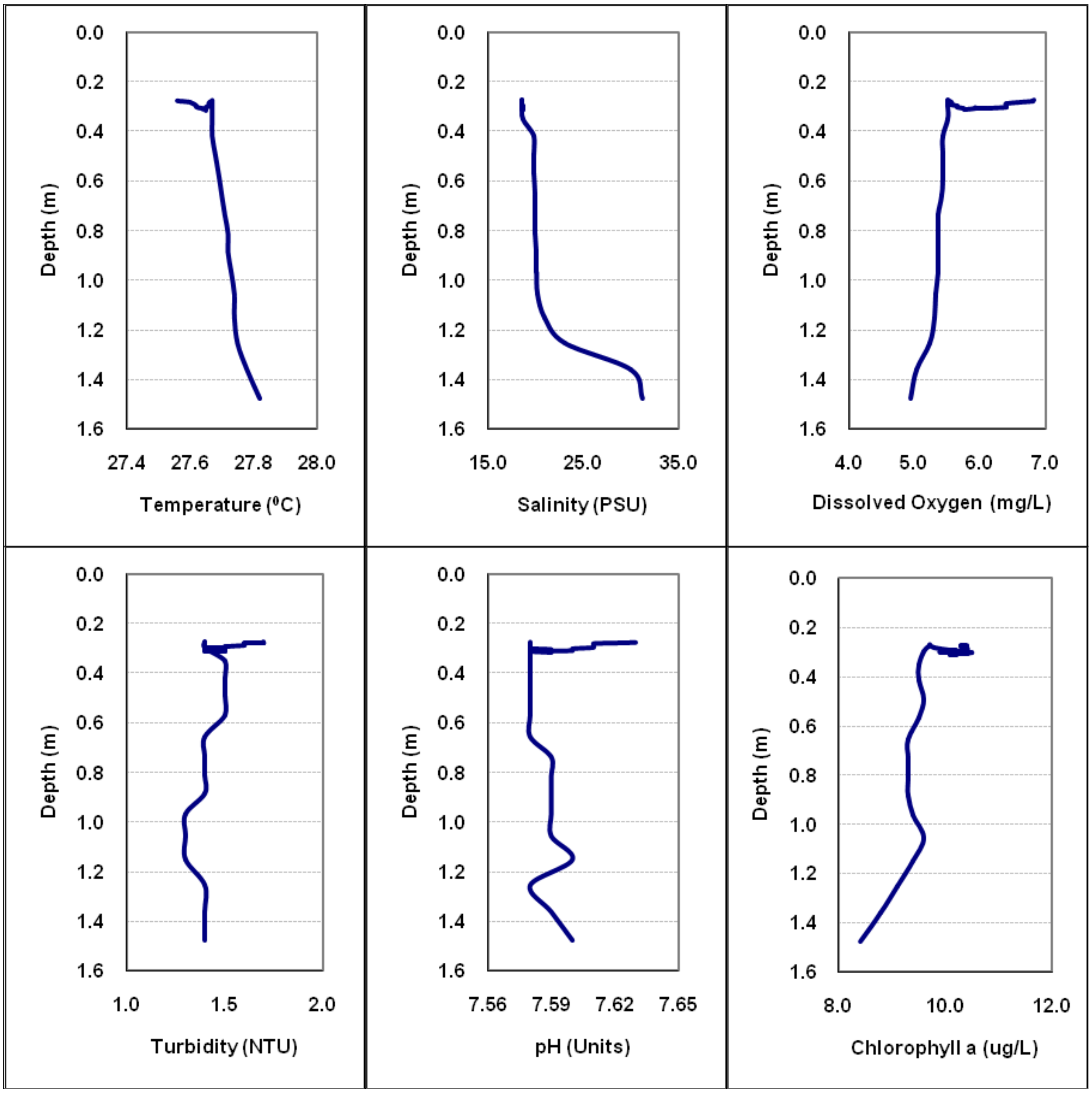

Figure 47: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-17.

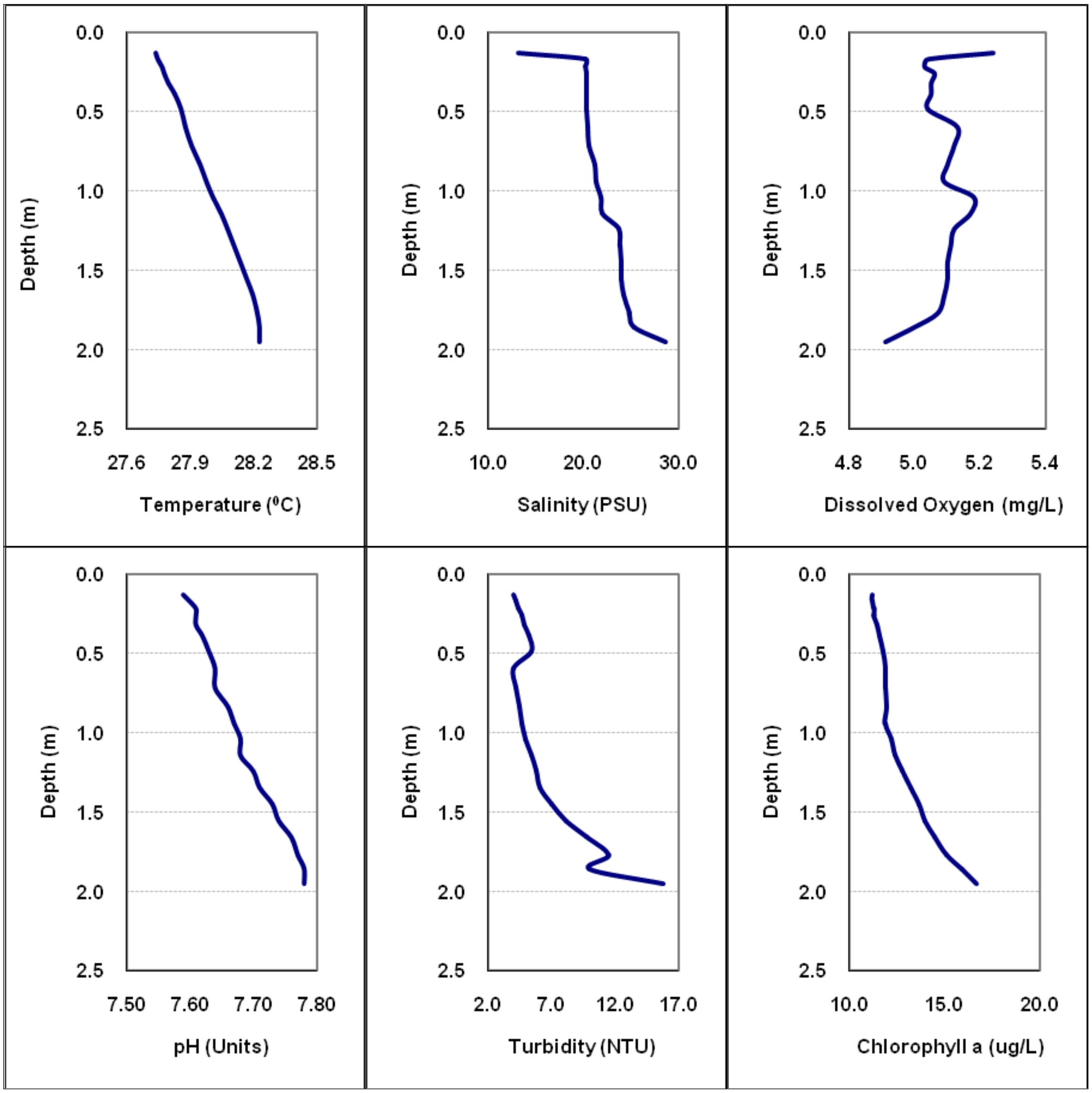

Figure 48: October 2007 Boynton-Delray water quality monitoring YSI cast at station BD-18.

9.4 February 2008

Water quality monitoring was conducted on February 14 and 18, 2008 from the RV *Nancy Foster*. The inlet stations were collected by small boat on February 18th. All stations were sampled for the water quality parameters listed in Table 2. Vertical water column profiles were collected with a Sea-Bird 911 CTD. No trip or equipment blanks were collected for the cruise. The times and dates of sample collection are listed in Table 18; water quality data are listed in Tables 19-21. Water quality parameters are shown in Figures 49-58. Water column profiles are depicted in Figures 59-69.

The tides on February 14, 2008 were (03:02; 15:07) High and (09:50; 22:21) Low. On February 18, 2008, the tides were (07:33; 19:44) High and (01:44; 14:16) Low. The seas were 2-4 feet with winds from the northeast at 10-15 knots during February 14th, while seas were 4-6 feet with winds from the south at 15-20 knots on February 18th. The current flow was northerly during both days of sampling. Stations BD-9, BD-12, and BD-14 were not sampled due to depth restrictions of the RV *Nancy Foster* and sea conditions for small boat operations. A total of four duplicates were collected for the water quality parameters sampled. The Boynton Inlet was sampled on an incoming tidal cycle. The surface boil was not visible at the surface; the sample was, therefore, collected at the appropriate coordinates for the South Central outfall.

Salinity values (Figure 49) ranged from 35.09-36.13 salinity units over the reef and outfall, while values varied from 24.10-24.50 salinity units for the Boynton Inlet and Lake Worth Lagoon. Temperature values (Figure 50) ranged from 23.8-24.5°C for the reef and outfall sites, while the Boynton Inlet and Lake Worth Lagoon sites varied from 27.7-29.3°C. The difference in temperature may be due to the reef and outfall stations being collected during the night and the inlet samples being collected during the daylight hours. The pH values (Figure 51) ranged from 8.03-8.18 units over the reef and outfall area, while the Boynton Inlet and Lake Worth Lagoon values ranged from 7.75-8.01 units. Chlorophyll-a values (Figure 52) varied from 0.184-0.586 µg/L at the reef and outfall sites, while the Boynton Inlet and Lake Worth Lagoon sites varied from 2.31-8.26 µg/L. TSS values (Figure 53) ranged from 0.18-0.61 mg/L for the reef and outfall, while values ranged from 1.40-3.08 mg/L for the Boynton Inlet and Lake Worth Lagoon.

The NO_3-N+NO_2-N values (Figure 54) ranged from 0.09-1.48 µM over the reef and outfall area, while the Boynton Inlet and Lake Worth Lagoon values ranged from 3.30-6.70 µM. NH_4-N was not collected due to the 10-day length of the trip and the inability to analyze the samples in an appropriate time frame to achieve reparable results. Ortho-PO_4-P values (Figure 55) ranged from BDL to 0.10 µM over the reef and outfall sites, while values varied from 0.43-0.84 µM for the Boynton Inlet and Lake Worth Lagoon. SiO_4-Si results (Figure 56) were BDL for all the reef and outfall sites, while the Boynton Inlet and Lake Worth Lagoon sites varied from 9.90-17.30 µM. TDN values (Figure 57) ranged from 0.65-18.12 µM over the reef and outfall area, while values varied from 16.69-20.77 µM for the Boynton Inlet and Lake Worth Lagoon sites. DOC values (Figure 58) varied from 46.29-118.64 µM for the reef and outfall sampling sites, while the Boynton Inlet and Lake Worth Lagoon sites varied from 168.56-225.05 µM.

Vertical water column casts were completed for all stations except BD-9, BD-12, BD-14, BD-16, BD-17, and BD-18. No large changes in temperature, salinity, dissolved oxygen, or chlorophyll-a were observed in any of the water column profiles.

Table 18: Dates and times of water sample collection for February 2008.

Date	Time (local)	Station	Latitude	Longitude	Depth (m)
2/14/2008	N/A	BD-1A	26.42550	-80.04545	0
2/14/2008	N/A	BD-1B	26.42550	-80.04545	16
2/14/2008	N/A	BD-1C	26.42550	-80.04545	35
2/14/2008	N/A	BD-2A	26.44201	-80.04729	0
2/14/2008	N/A	BD-2B	26.44201	-80.04729	8
2/14/2008	N/A	BD-2C	26.44201	-80.04729	16
2/14/2008	N/A	BD-3A	26.45828	-80.04247	0
2/14/2008	N/A	BD-3B	26.45828	-80.04247	16
2/14/2008	N/A	BD-3C	26.45828	-80.04247	33
2/14/2008	N/A	BD-4A	26.46192	-80.04195	0
2/14/2008	N/A	BD-4B	26.46192	-80.04195	16
2/14/2008	N/A	BD-4C	26.46192	-80.04195	32
2/14/2008	N/A	BD-5A	26.46620	-80.04167	0
2/14/2008	N/A	BD-5B	26.46620	-80.04167	15
2/14/2008	N/A	BD-5C	26.46620	-80.04167	30
2/14/2008	N/A	BD-6A	26.47532	-80.03976	0
2/14/2008	N/A	BD-6B	26.47532	-80.03976	15
2/14/2008	N/A	BD-6C	26.47532	-80.03976	30
2/14/2008	N/A	BD-7A	26.48737	-80.03871	0
2/14/2008	N/A	BD-7B	26.48737	-80.03871	10
2/14/2008	N/A	BD-7C	26.48737	-80.03871	20
2/14/2008	N/A	BD-8A	26.51507	-80.03542	0
2/14/2008	N/A	BD-8B	26.51507	-80.03542	10
2/14/2008	N/A	BD-8C	26.51507	-80.03542	20
2/14/2008	N/A	BD-9A	26.50838	-80.04129	0
2/14/2008	N/A	BD-9B	26.50838	-80.04129	7
2/14/2008	N/A	BD-9C	26.50838	-80.04129	15
2/14/2008	N/A	BD-10A	26.52261	-80.03223	0
2/14/2008	N/A	BD-10B	26.52261	-80.03223	8
2/14/2008	N/A	BD-10C	26.52261	-80.03223	16
2/14/2008	N/A	BD-11A	26.53333	-80.03584	0
2/14/2008	N/A	BD-11B	26.53333	-80.03584	7
2/14/2008	N/A	BD-11C	26.53333	-80.03584	13
2/14/2008	N/A	BD-12A	26.53874	-80.03980	0
2/14/2008	N/A	BD-12B	26.53874	-80.03980	5
2/14/2008	N/A	BD-12C	26.53874	-80.03980	8
2/18/2008	N/A	BD-13A	26.54542	-80.04300	0
2/14/2008	N/A	BD-14A	26.54242	-80.03996	0
2/14/2008	N/A	BD-14C	26.54242	-80.03996	3
2/14/2008	N/A	BD-15A	26.55919	-80.03329	0
2/14/2008	N/A	BD-15B	26.55919	-80.03329	6
2/14/2008	N/A	BD-15C	26.55919	-80.03329	13
2/18/2008	N/A	BD-16A	26.54618	-80.04791	0
2/18/2008	N/A	BD-17A	26.54264	-80.04790	0
2/18/2008	N/A	BD-18A	26.53950	-80.04951	0

Table 19: February 2008 Boynton-Delray nutrient and DOC values in µM.

Station	Depth (m)	N+N (µM)	NH_4 (µM)	P (µM)	Si (µM)	TDN (µM)	DOC (µM)
BD-1A	0	0.45	N/A	0.04	BDL	6.18	77.01
BD-1B	16	0.50	N/A	BDL	BDL	3.20	118.64
BD-1C	35	0.55	N/A	BDL	BDL	2.73	90.18
BD-2A	0	0.57	N/A	BDL	BDL	5.30	70.60
BD-2B	8	0.53	N/A	BDL	BDL	3.99	78.35
BD-2C	16	0.55	N/A	BDL	BDL	2.36	62.59
BD-3A	0	1.48	N/A	0.10	BDL	18.12	115.95
BD-3B	16	0.51	N/A	0.07	BDL	7.19	114.24
BD-3C	33	0.43	N/A	0.03	BDL	4.99	94.75
BD-4A	0	0.56	N/A	0.03	BDL	4.26	81.22
BD-4B	16	0.29	N/A	0.03	BDL	N/A	69.49
BD-4C	32	0.66	N/A	BDL	BDL	5.43	58.75
BD-5A	0	0.48	N/A	0.04	BDL	4.94	71.13
BD-5B	15	0.40	N/A	0.04	BDL	4.37	63.41
BD-5C	30	0.39	N/A	BDL	BDL	4.60	53.26
BD-6A	0	0.16	N/A	BDL	BDL	3.50	64.10
BD-6B	15	0.17	N/A	BDL	BDL	5.74	65.08
BD-6C	30	0.24	N/A	BDL	BDL	0.65	46.29
BD-7A	0	0.24	N/A	BDL	BDL	3.87	61.63
BD-7B	10	0.22	N/A	BDL	BDL	6.11	101.84
BD-7C	20	0.26	N/A	BDL	BDL	3.33	79.24
BD-8A	0	0.17	N/A	0.03	BDL	2.49	77.93
BD-8B	10	0.18	N/A	BDL	BDL	4.19	64.03
BD-8C	20	0.52	N/A	BDL	BDL	4.49	54.86
BD-9A	0	N/A	N/A	N/A	N/A	N/A	N/A
BD-9B	7	N/A	N/A	N/A	N/A	N/A	N/A
BD-9C	15	N/A	N/A	N/A	N/A	N/A	N/A
BD-10A	0	0.15	N/A	BDL	BDL	1.83	52.04
BD-10B	8	0.12	N/A	BDL	BDL	3.52	67.61
BD-10C	16	0.09	N/A	BDL	BDL	3.32	103.06
BD-11A	0	0.18	N/A	0.05	BDL	2.31	91.81
BD-11B	7	0.22	N/A	BDL	BDL	2.64	74.61
BD-11C	13	0.12	N/A	BDL	BDL	3.63	77.99
BD-12A	0	N/A	N/A	N/A	N/A	N/A	N/A
BD-12B	5	N/A	N/A	N/A	N/A	N/A	N/A
BD-12C	8	N/A	N/A	N/A	N/A	N/A	N/A
BD-13A	0	3.30	N/A	0.43	9.60	19.72	219.37
BD-14A	0	N/A	N/A	N/A	N/A	N/A	N/A
BD-14C	3	N/A	N/A	N/A	N/A	N/A	N/A
BD-15A	0	0.39	N/A	0.06	BDL	4.30	76.81
BD-15B	6	0.31	N/A	0.03	BDL	3.02	89.53
BD-15C	13	0.34	N/A	BDL	BDL	5.95	74.84
BD-16A	0	5.00	N/A	0.73	17.30	19.38	226.05
BD-17A	0	6.70	N/A	0.72	9.90	20.77	221.65
BD-18A	0	4.50	N/A	0.84	12.00	16.69	168.56

Table 20: February 2008 Boynton-Delray nutrient and DOC values in mg/L.

Station	Depth (m)	N+N (mg/L)	NH_4 (mg/L)	P (mg/L)	Si (mg/L)	TDN (mg/L)	DOC (mg/L)
BD-1A	0	0.006	N/A	0.001	BDL	0.07	0.94
BD-1B	16	0.007	N/A	BDL	BDL	0.04	1.46
BD-1C	35	0.008	N/A	BDL	BDL	0.03	1.11
BD-2A	0	0.008	N/A	BDL	BDL	0.06	0.87
BD-2B	8	0.007	N/A	BDL	BDL	0.05	0.96
BD-2C	16	0.008	N/A	BDL	BDL	0.03	0.77
BD-3A	0	0.021	N/A	0.003	BDL	0.22	1.42
BD-3B	16	0.007	N/A	0.002	BDL	0.09	1.40
BD-3C	33	0.006	N/A	0.001	BDL	0.06	1.16
BD-4A	0	0.008	N/A	0.001	BDL	0.05	1.00
BD-4B	16	0.004	N/A	0.001	BDL	N/A	0.85
BD-4C	32	0.009	N/A	BDL	BDL	0.07	0.72
BD-5A	0	0.007	N/A	0.001	BDL	0.06	0.87
BD-5B	15	0.006	N/A	0.001	BDL	0.05	0.78
BD-5C	30	0.005	N/A	BDL	BDL	0.06	0.65
BD-6A	0	0.002	N/A	BDL	BDL	0.04	0.79
BD-6B	15	0.002	N/A	BDL	BDL	0.07	0.80
BD-6C	30	0.003	N/A	BDL	BDL	0.01	0.57
BD-7A	0	0.003	N/A	BDL	BDL	0.05	0.76
BD-7B	10	0.003	N/A	BDL	BDL	0.07	1.25
BD-7C	20	0.004	N/A	BDL	BDL	0.04	0.97
BD-8A	0	0.002	N/A	0.001	BDL	0.03	0.96
BD-8B	10	0.003	N/A	BDL	BDL	0.05	0.79
BD-8C	20	0.007	N/A	BDL	BDL	0.05	0.67
BD-9A	0	N/A	N/A	N/A	N/A	N/A	N/A
BD-9B	7	N/A	N/A	N/A	N/A	N/A	N/A
BD-9C	15	N/A	N/A	N/A	N/A	N/A	N/A
BD-10A	0	0.002	N/A	BDL	BDL	0.02	0.64
BD-10B	8	0.002	N/A	BDL	BDL	0.04	0.83
BD-10C	16	0.001	N/A	BDL	BDL	0.04	1.26
BD-11A	0	0.003	N/A	0.002	BDL	0.03	1.13
BD-11B	7	0.003	N/A	BDL	BDL	0.03	0.92
BD-11C	13	0.002	N/A	BDL	BDL	0.04	0.96
BD-12A	0	N/A	N/A	N/A	N/A	N/A	N/A
BD-12B	5	N/A	N/A	N/A	N/A	N/A	N/A
BD-12C	8	N/A	N/A	N/A	N/A	N/A	N/A
BD-13A	0	0.046	N/A	0.013	0.269	0.24	2.69
BD-14A	0	N/A	N/A	N/A	N/A	N/A	N/A
BD-14C	3	N/A	N/A	N/A	N/A	N/A	N/A
BD-15A	0	0.005	N/A	0.002	BDL	0.05	0.94
BD-15B	6	0.004	N/A	0.001	BDL	0.04	1.10
BD-15C	13	0.005	N/A	BDL	BDL	0.07	0.92
BD-16A	0	0.070	N/A	0.023	0.484	0.23	2.77
BD-17A	0	0.094	N/A	0.022	0.277	0.25	2.72
BD-18A	0	0.063	N/A	0.026	0.336	0.20	2.07

Table 21: February 2008 Boynton-Delray salinity, pH, chlorophyll-a, phaeopigments, and TSS values.

Station	Depth (m)	Temperature (°C)	Salinity (units)	pH (units)	Chlorophyll-a (µg/L)	Phaeopigments (µg/L)	TSS (mg/L)
BD-1A	0	24.3	36.08	8.12	0.361	0.160	0.400
BD-1B	16	24.1	36.04	8.13	0.586	0.177	0.410
BD-1C	35	24.1	36.02	8.14	0.284	0.206	0.460
BD-2A	0	24.1	36.10	8.11	0.346	0.153	0.540
BD-2B	8	23.9	35.96	8.11	0.325	0.173	0.600
BD-2C	16	23.8	35.95	8.12	0.318	0.137	0.540
BD-3A	0	24.2	35.90	8.03	0.333	0.182	0.610
BD-3B	16	24.3	36.06	8.16	0.359	0.192	0.380
BD-3C	33	24.2	36.06	8.18	0.364	0.167	0.450
BD-4A	0	24.3	36.09	8.16	0.359	0.192	0.390
BD-4B	16	24.4	26.09	8.17	0.386	0.170	0.310
BD-4C	32	24.4	36.09	8.18	0.253	0.146	0.380
BD-5A	0	24.3	36.10	8.14	0.300	0.128	0.460
BD-5B	15	24.3	36.10	8.15	0.299	0.148	0.310
BD-5C	30	24.2	36.12	8.17	0.291	0.159	0.350
BD-6A	0	24.4	36.12	8.14	0.225	0.101	0.290
BD-6B	15	24.4	36.12	8.14	0.256	0.124	0.270
BD-6C	30	24.4	36.12	8.16	0.262	0.089	0.220
BD-7A	0	24.3	36.12	8.14	0.593	0.183	0.330
BD-7B	10	24.3	36.12	8.17	0.274	0.105	0.290
BD-7C	20	24.3	36.12	8.17	0.271	0.110	0.250
BD-8A	0	24.4	36.13	8.15	0.231	0.116	0.290
BD-8B	10	24.4	36.13	8.16	0.252	0.110	0.210
BD-8C	20	34.4	36.13	8.17	0.270	0.096	0.350
BD-9A	0	N/A	N/A	N/A	N/A	N/A	N/A
BD-9B	7	N/A	N/A	N/A	N/A	N/A	N/A
BD-9C	15	N/A	N/A	N/A	N/A	N/A	N/A
BD-10A	0	24.5	36.12	8.15	0.268	0.098	0.310
BD-10B	8	24.5	36.12	8.16	0.206	0.114	0.200
BD-10C	16	24.5	36.12	8.18	0.184	0.067	0.180
BD-11A	0	24.4	36.10	8.16	0.253	0.115	0.420
BD-11B	7	24.3	36.08	8.15	0.345	0.151	0.420
BD-11C	13	24.3	36.09	8.17	0.339	0.099	0.310
BD-12A	0	N/A	N/A	N/A	N/A	N/A	N/A
BD-12B	5	N/A	N/A	N/A	N/A	N/A	N/A
BD-12C	8	N/A	N/A	N/A	N/A	N/A	N/A
BD-13A	0	29.3	24.50	8.01	4.876	0.722	1.400
BD-14A	0	N/A	N/A	N/A	N/A	N/A	N/A
BD-14C	3	N/A	N/A	N/A	N/A	N/A	N/A
BD-15A	0	24.1	36.05	8.16	0.555	0.269	0.400
BD-15B	6	24.1	36.05	8.15	0.428	0.204	0.370
BD-15C	13	24.1	36.05	8.17	0.571	0.214	0.340
BD-16A	0	27.7	24.50	7.91	8.261	4.086	2.340
BD-17A	0	28.7	24.20	7.83	2.315	1.049	1.860
BD-18A	0	28.7	24.10	7.75	3.361	1.790	3.080

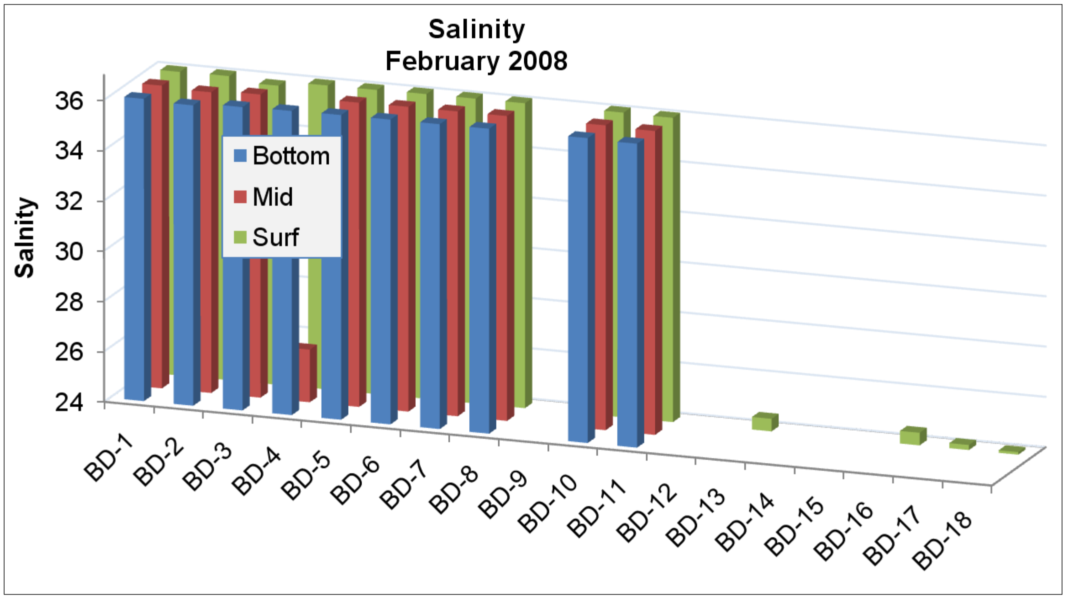

Figure 49: February 2008 salinity values for the Boynton-Delray water quality monitoring stations.

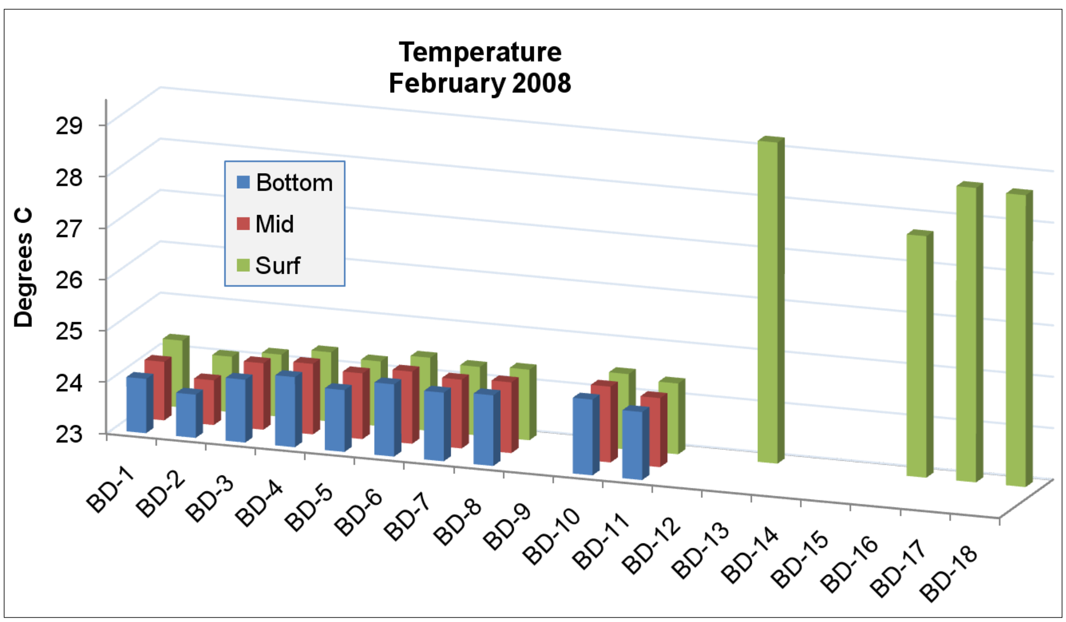

Figure 50: February 2008 temperature results for the Boynton-Delray water quality monitoring stations.

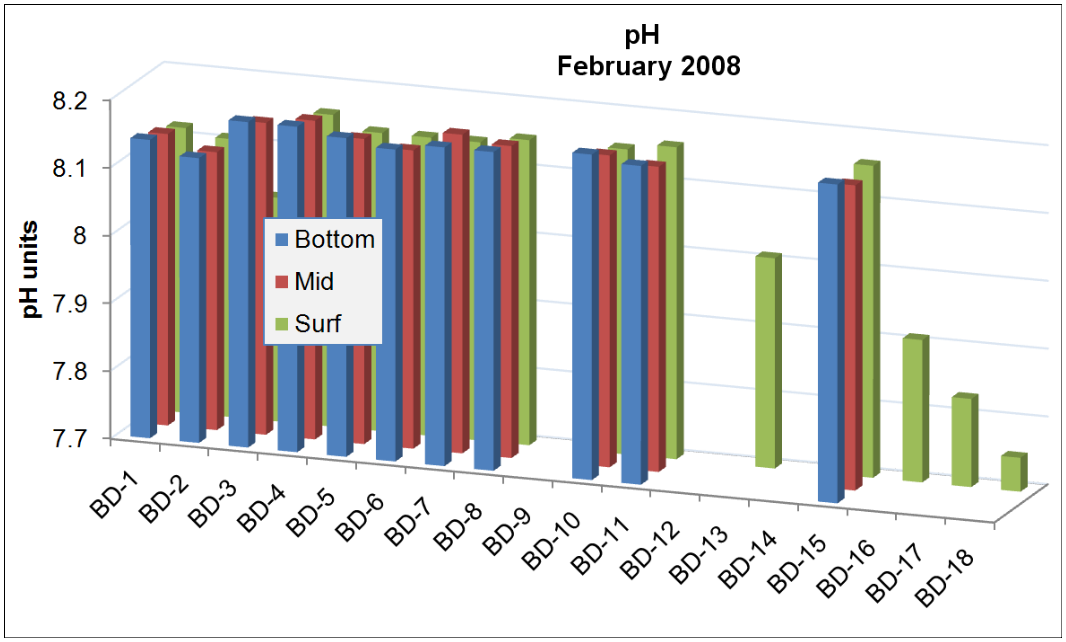

Figure 51: February 2008 pH measurements for the Boynton-Delray water quality monitoring stations.

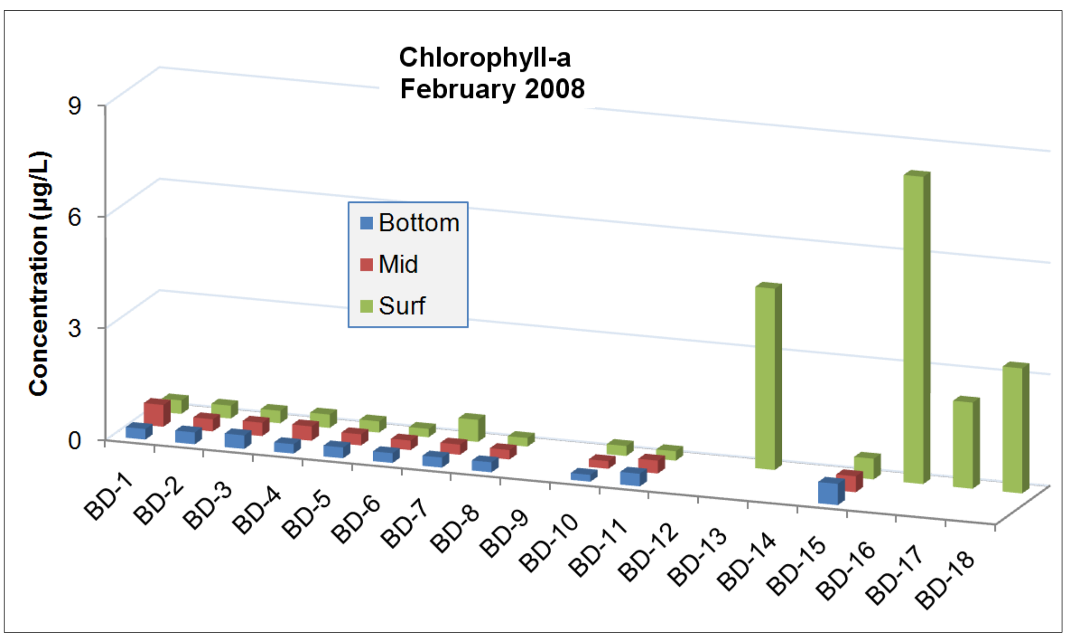

Figure 52: February 2008 chlorophyll-a concentrations for the Boynton-Delray water quality monitoring stations.

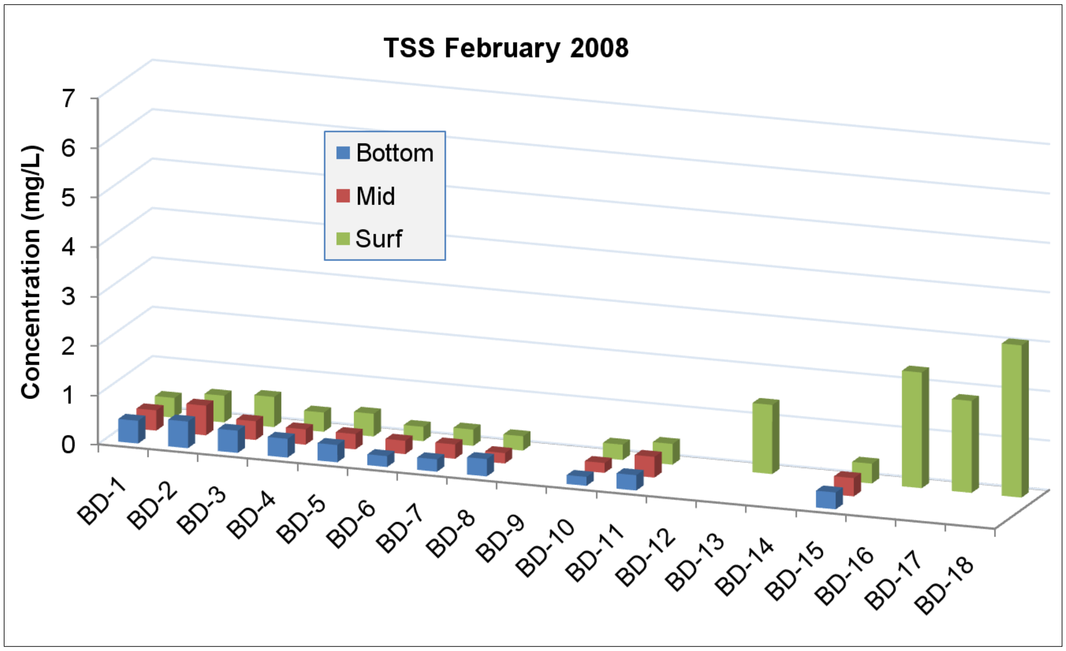

Figure 53: February 2008 total suspended solids concentrations for the Boynton-Delray water quality monitoring stations.

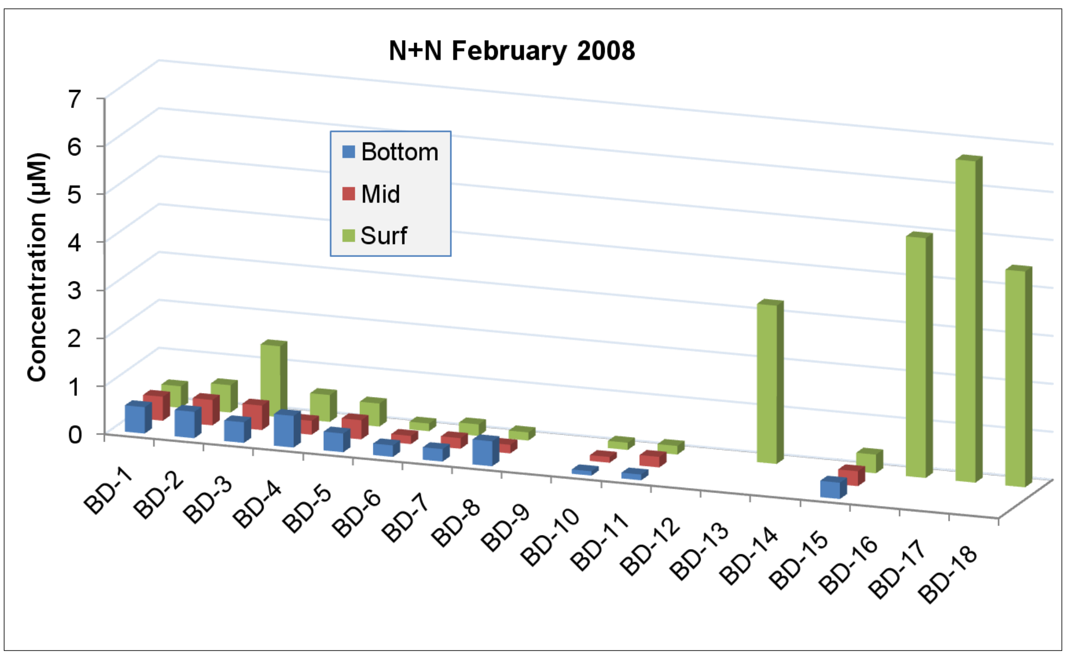

Figure 54: February 2008 nitrate+nitrite concentrations for the Boynton-Delray water quality monitoring stations.

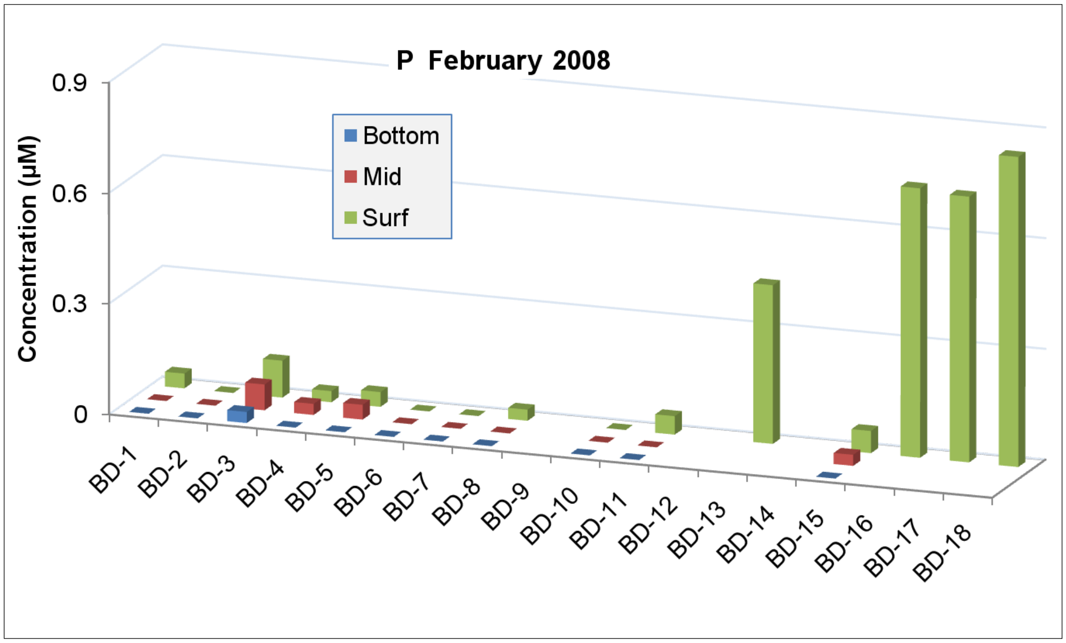

Figure 55: February 2008 orthophospate concentrations for the Boynton-Delray water quality monitoring stations.

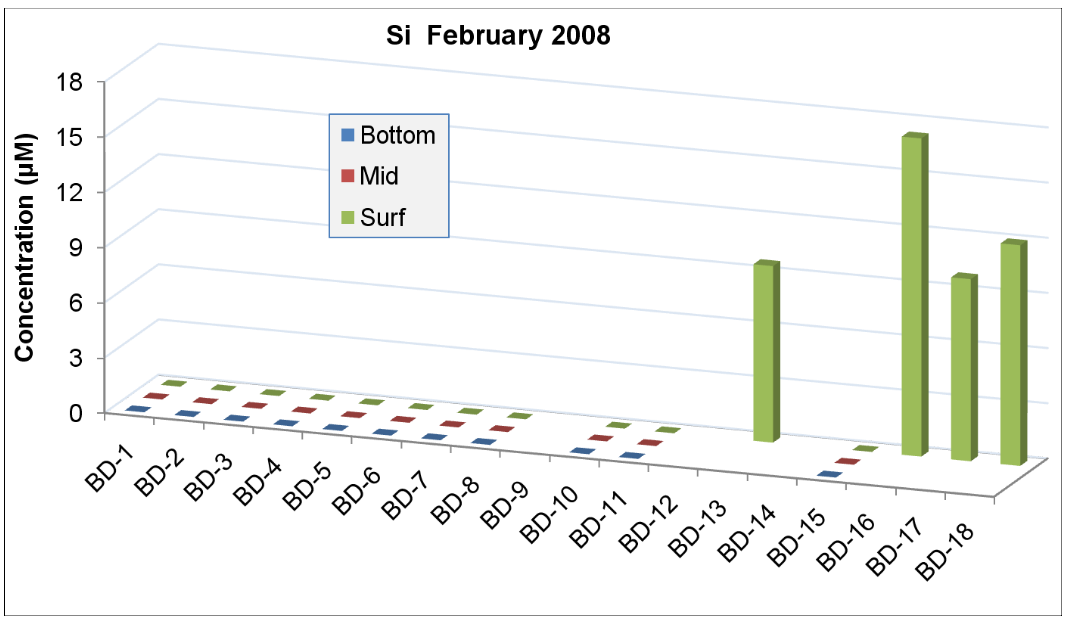

Figure 56: February 2008 silicate concentrations for the Boynton-Delray water quality monitoring stations.

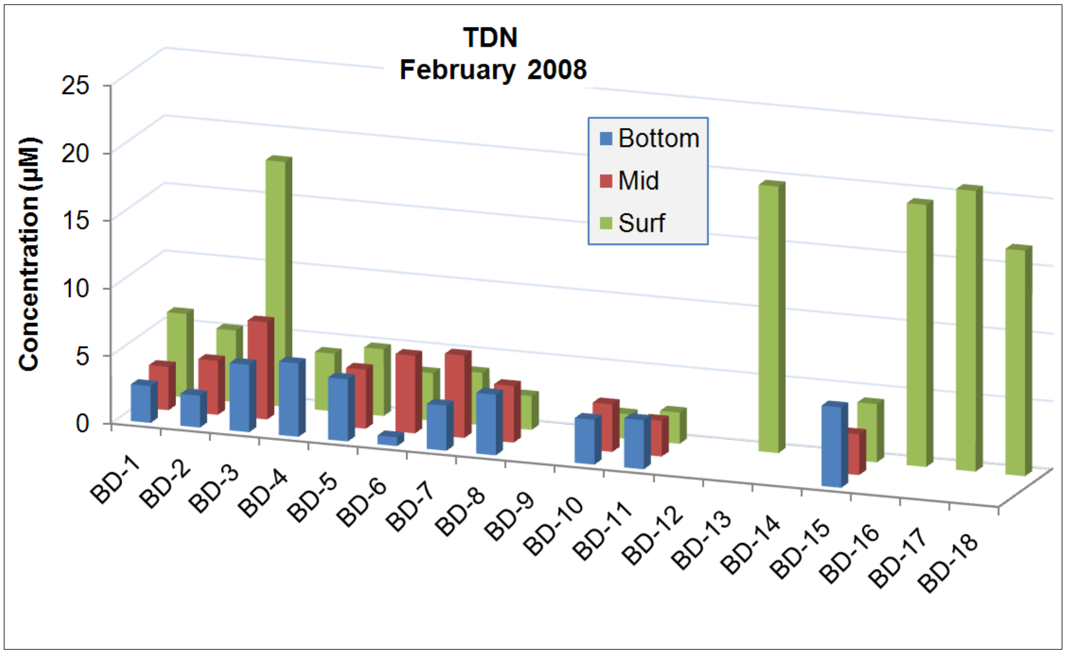

Figure 57: February 2008 total dissolved nitrogen concentrations for the Boynton-Delray water quality monitoring stations.

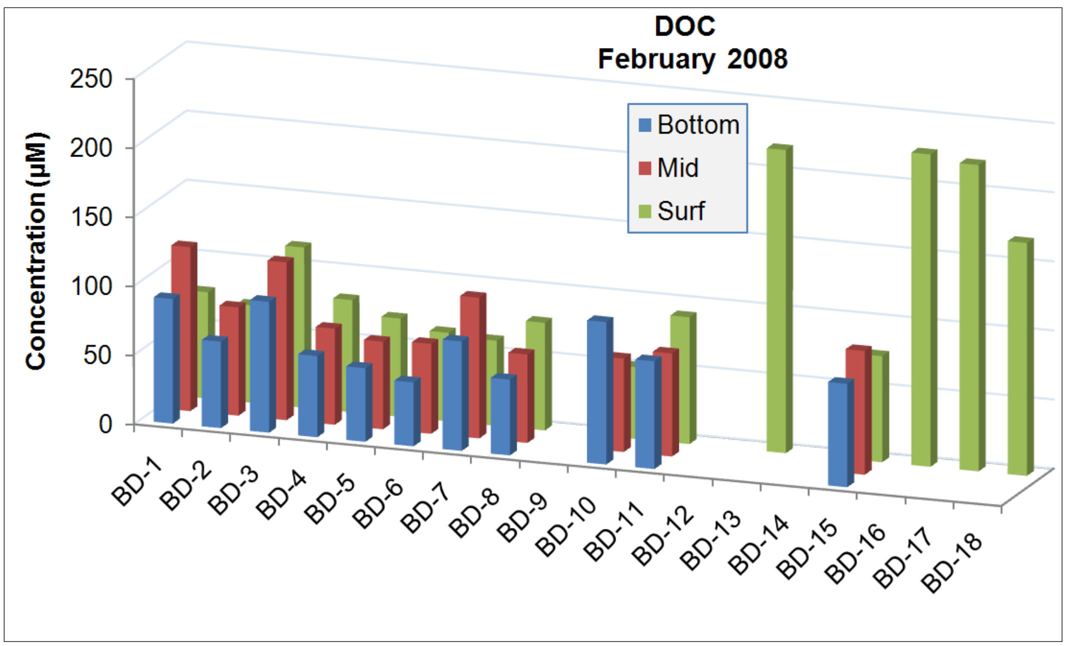

Figure 58: February 2008 dissolved organic carbon concentrations for the Boynton-Delray water quality monitoring stations.

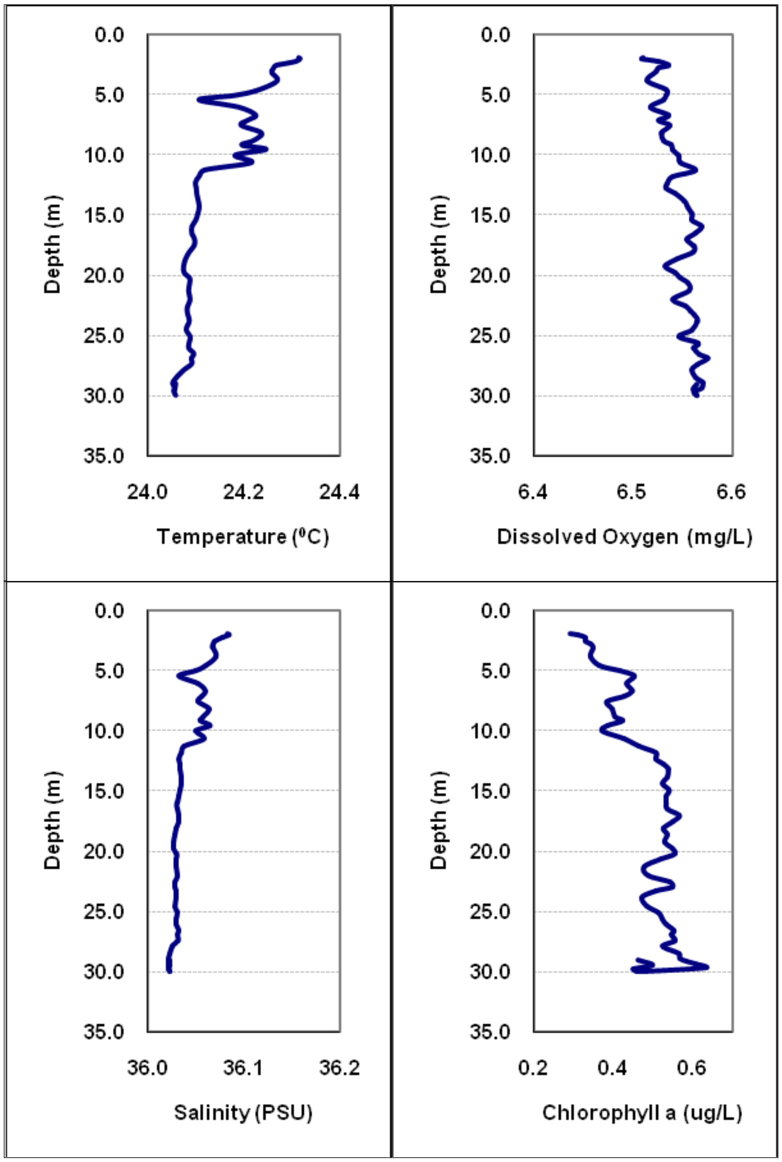

Figure 59: February 2008 Boynton-Delray water quality monitoring CTD cast at station BD-1.

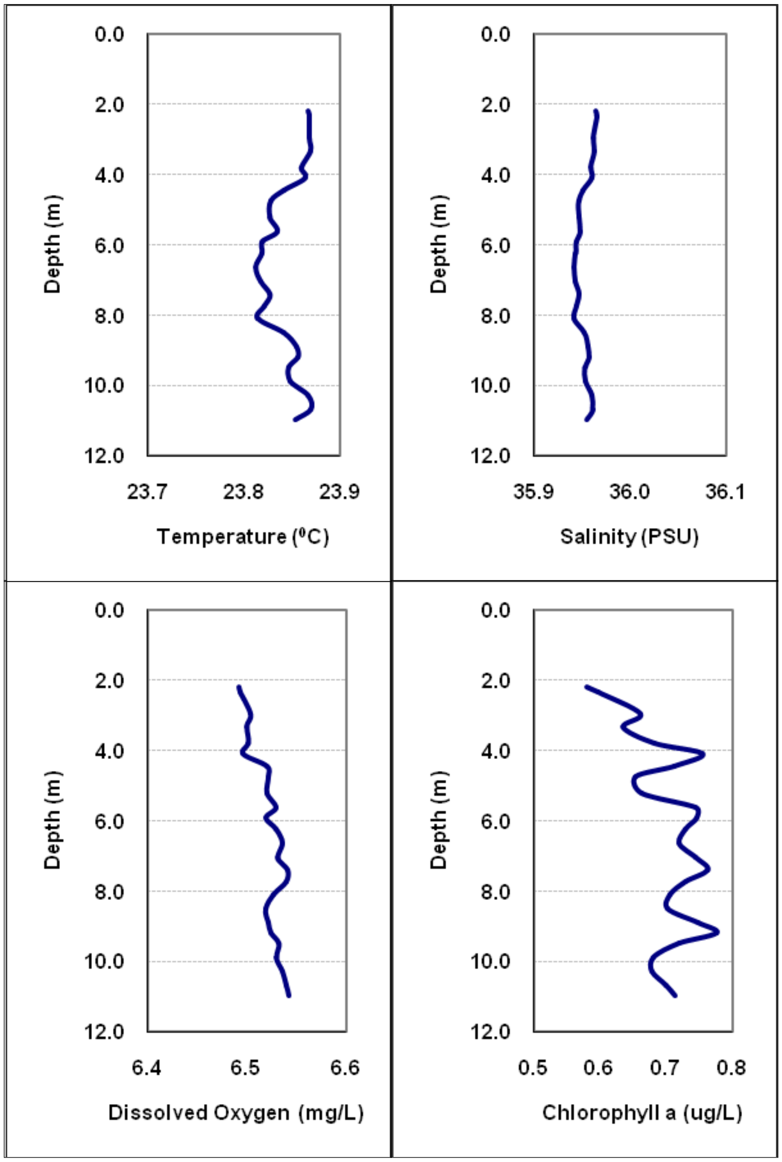

Figure 60: February 2008 Boynton-Delray water quality monitoring CTD cast at station BD-2.

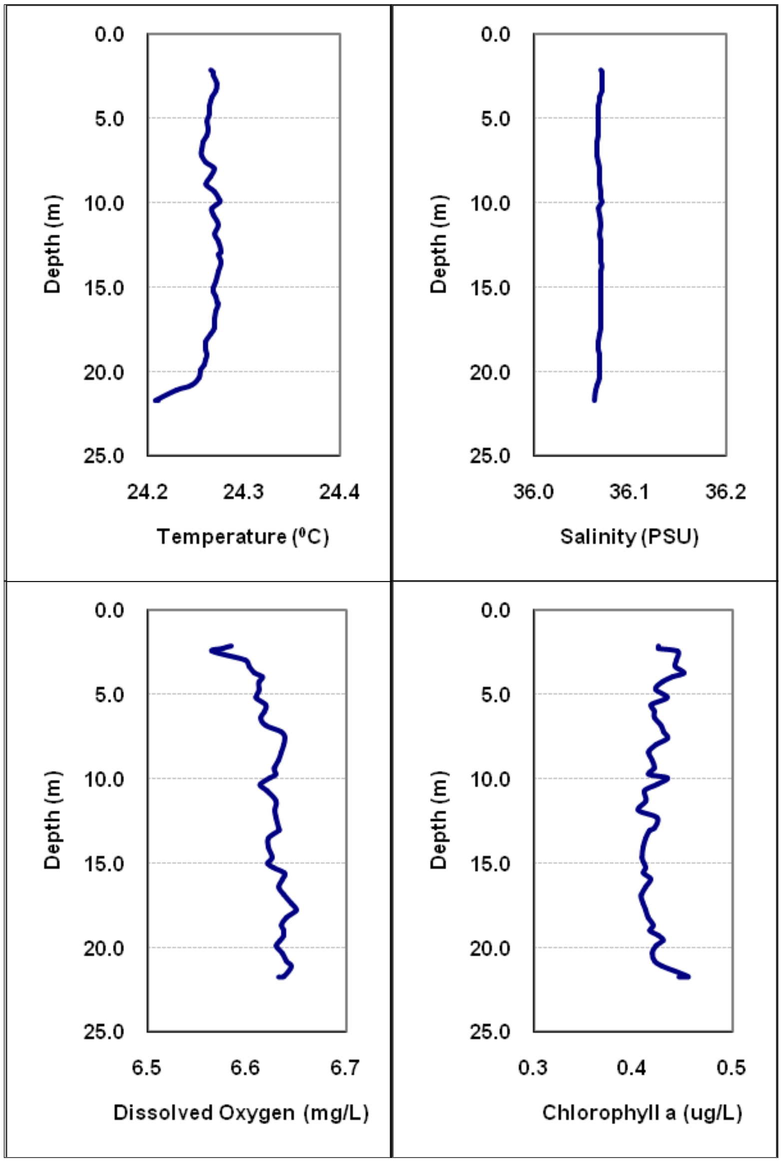

Figure 61: February 2008 Boynton-Delray water quality monitoring CTD cast at station BD-3.

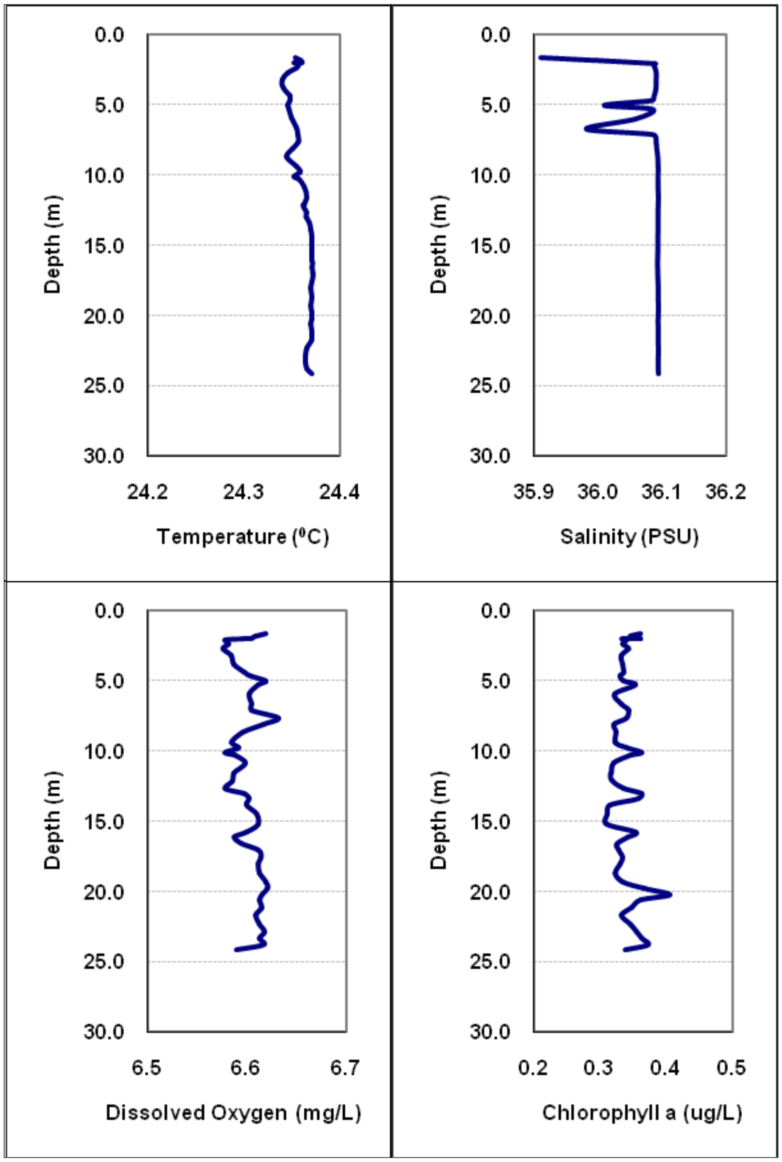

Figure 62: February 2008 Boynton-Delray water quality monitoring CTD cast at station BD-4.

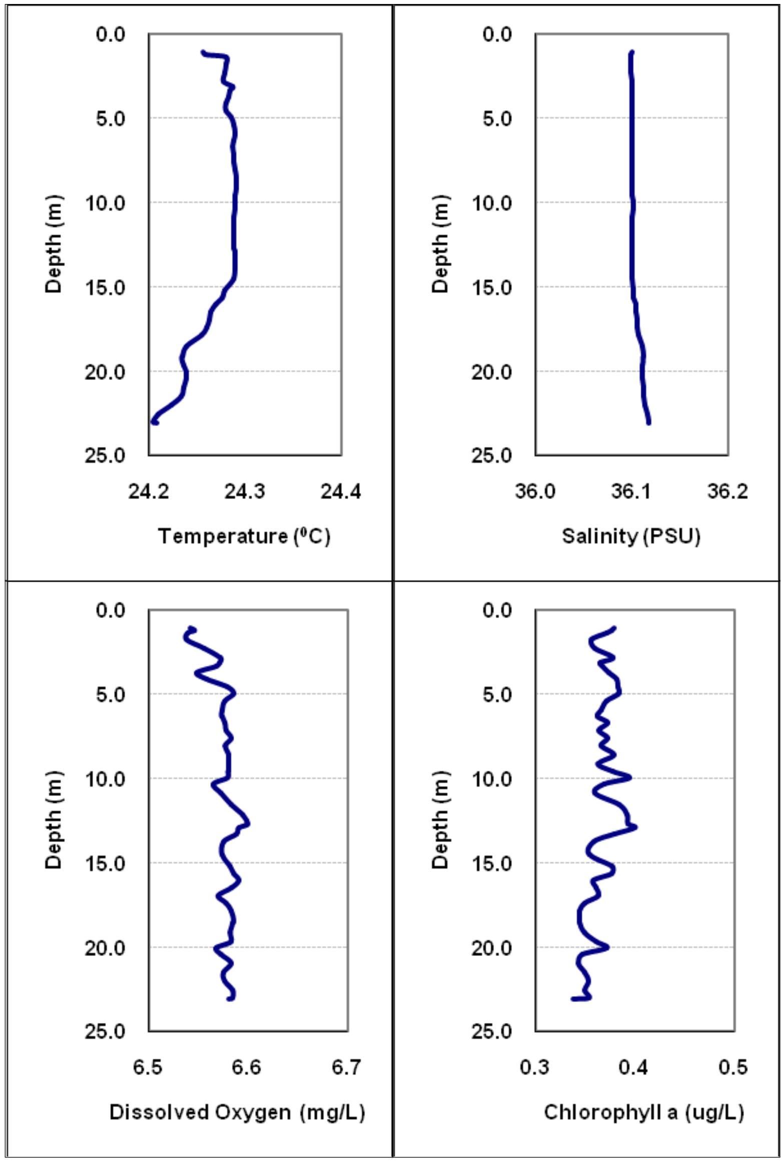

Figure 63: February 2008 Boynton-Delray water quality monitoring CTD cast at station BD-5.

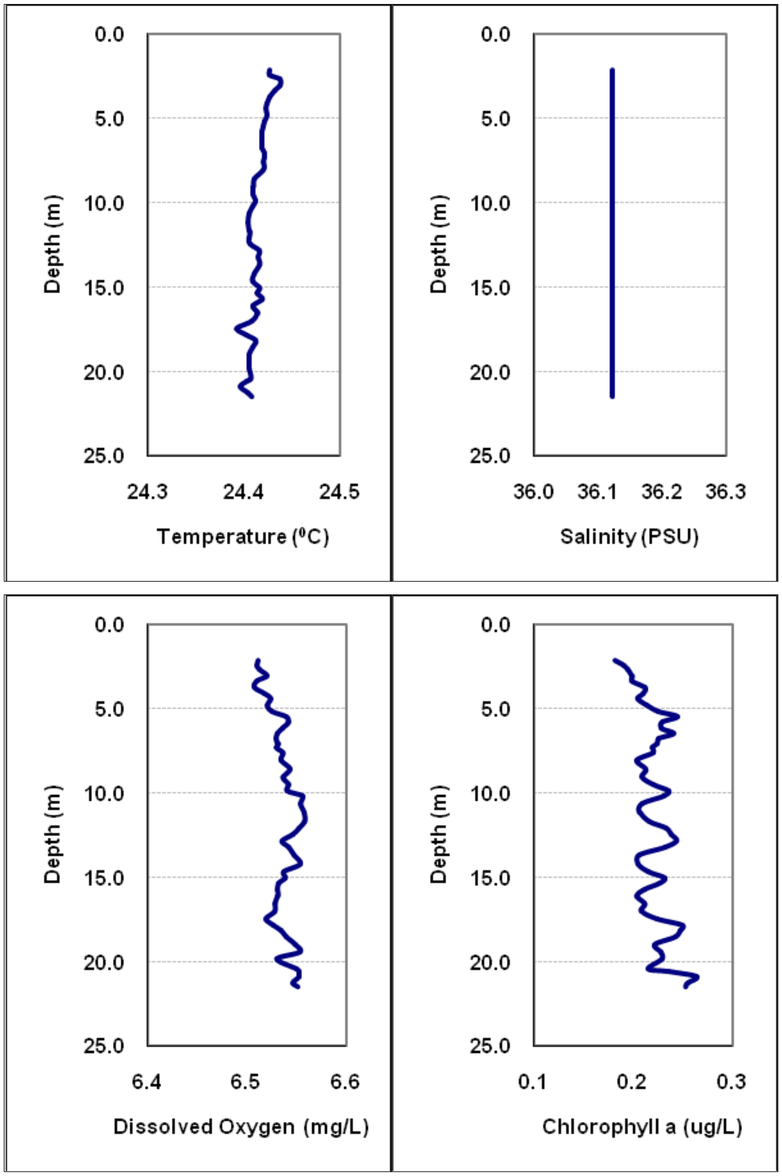

Figure 64: February 2008 Boynton-Delray water quality monitoring CTD cast at station BD-6.

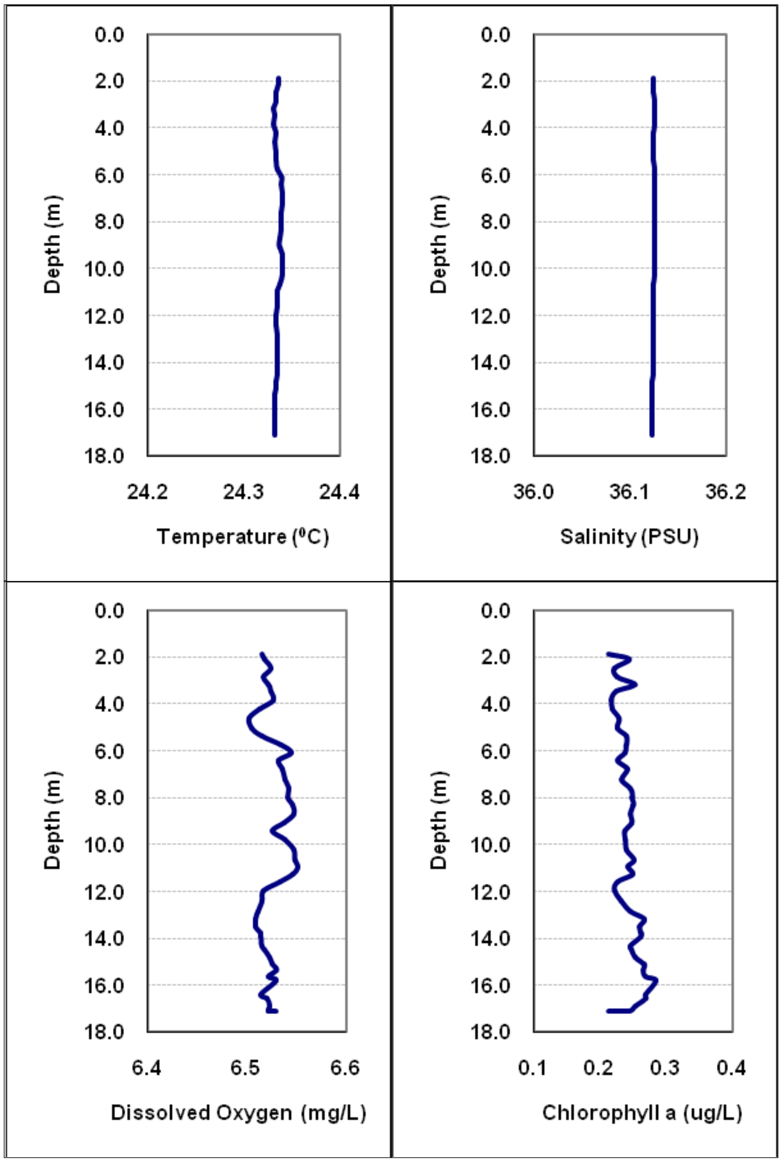

Figure 65: February 2008 Boynton-Delray water quality monitoring CTD cast at station BD-7.

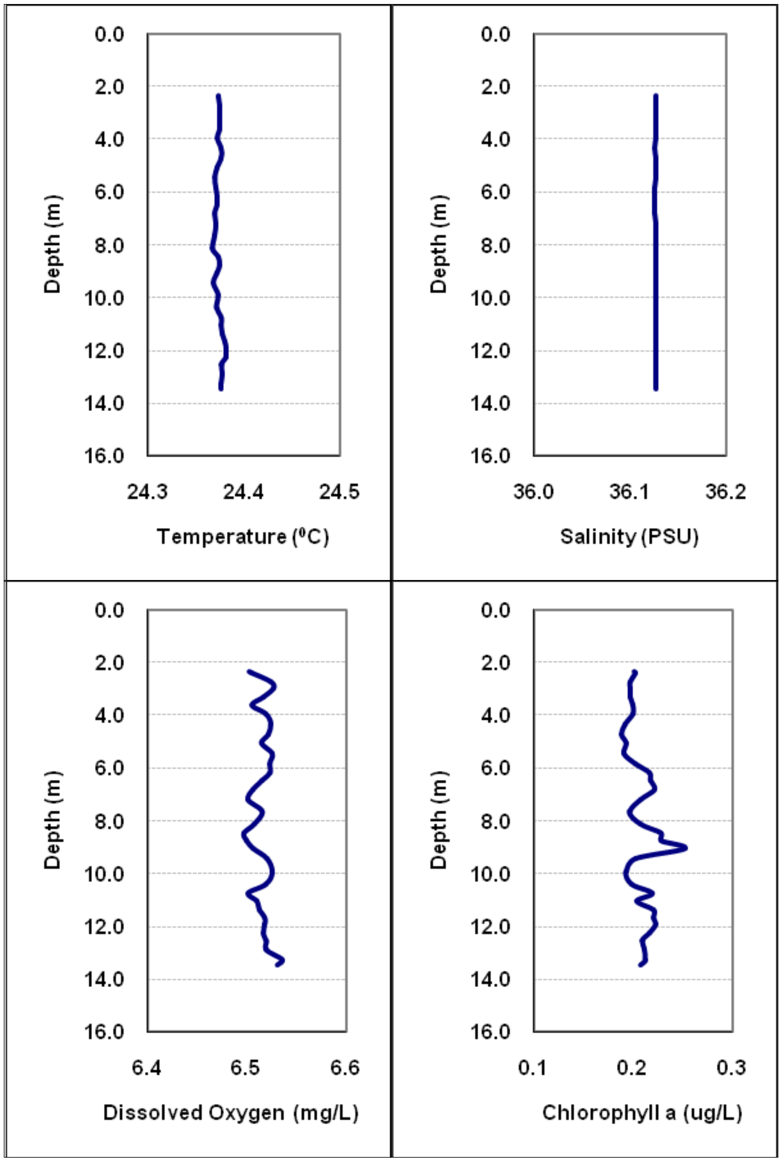

Figure 66: February 2008 Boynton-Delray water quality monitoring CTD cast at station BD-8.

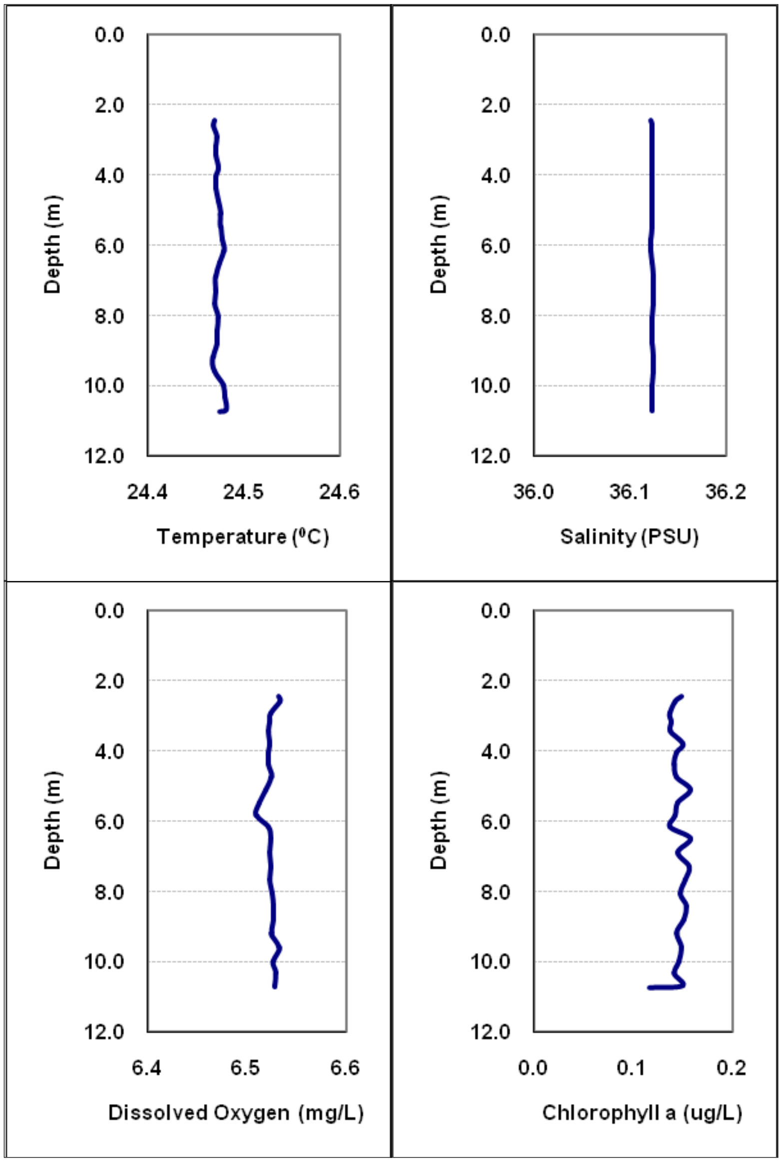

Figure 67: February 2008 Boynton-Delray water quality monitoring CTD cast at station BD-10.

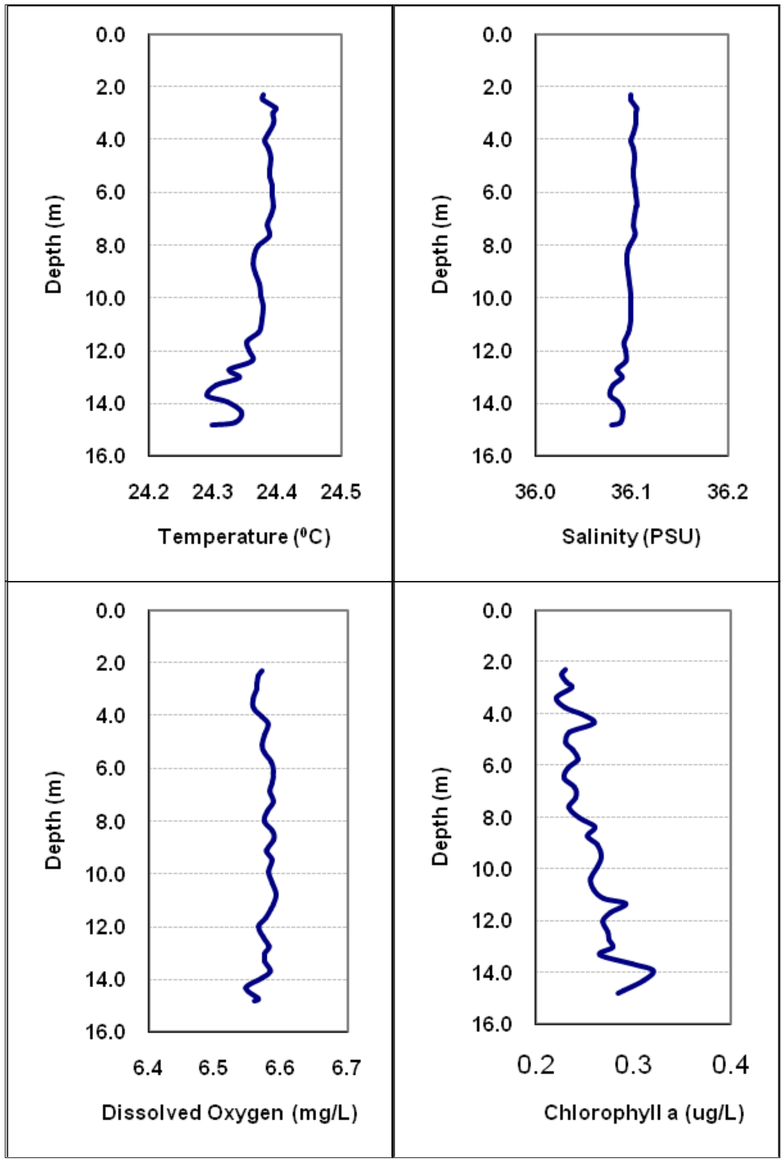

Figure 68: February 2008 Boynton-Delray water quality monitoring CTD cast at station BD-11.

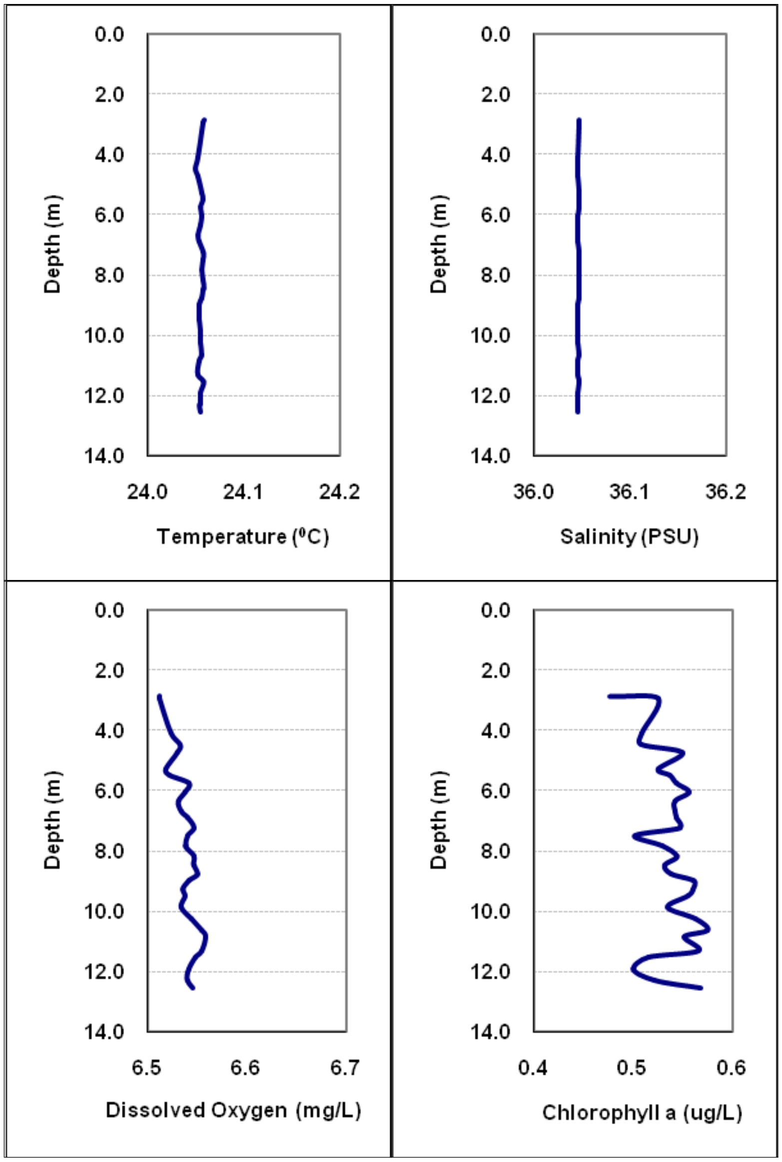

Figure 69: February 2008 Boynton-Delray water quality monitoring CTD cast at station BD-15.

9.5 May 2008

Water quality monitoring was conducted on May 19-20, 2008 from the RV *Cable*. All stations were sampled for the water quality parameters listed in Table 2. Vertical water column profiles were collected using a YSI 6600 sonde, and trip and equipment blanks were collected for the cruise. The times and dates of sample collection are listed in Table 22, and water quality data are listed in Tables 23-25. Water quality parameters are shown in Figures 70-81, while water column profiles are depicted in Figures 82-98.

The tides for May 19, 2008 were (09:47; 22:28) High and (04:39; 16:44) Low. On May 20, 2008, the tides were (10:22; 23:05) High and (05:16; 1720) Low. The sea conditions were calm during the morning and early afternoon hours for both days of sampling with winds less than 5 knots out of the south-southwest. However, seas increased to 3 feet by 1 p.m. on both days, with winds out of the south-southwest at 15 knots. A total of four duplicates were collected for all the water quality parameters sampled. Boynton Inlet station BD-13 was sampled on an outgoing tidal cycle. The boil was not visible at the surface; sampling, therefore, took place at the appropriate coordinates for the South Central outfall. The current was in a northerly direction during both sampling days.

Salinity values (Figure 70) ranged from 34.98-35.40 salinity units for the reef and outfall sites, while the Boynton Inlet and Lake Worth Lagoon sites varied from 33.04-34.34 salinity units. Temperature values (Figure 71) ranged from 23.98-26.38°C over the reef and outfall area, while values ranged from 27.94-29.26°C for the Boynton Inlet and Lake Worth Lagoon. The pH values (Figure 72) ranged from 8.05-8.16 units over the reef and outfall, while values ranged from 7.82-8.03 units for the Boynton Inlet and Lake Worth Lagoon. Chlorophyll-a values (Figure 73) ranged from 0.224-0.512 µg/L for the reef and outfall sites, while the Boynton Inlet and Lake Worth Lagoon sites ranged from 2.51-6.86 µg/L. TSS values (Figure 74) ranged from 0.18-0.59 mg/L over the reef and outfall, while values varied from 1.24-4.46 mg/L in the Boynton Inlet and Lake Worth Lagoon.

NO_3-N+NO_2-N values (Figure 75) ranged from BDL to 0.25 µM over the reef and outfall sites, while the Boynton Inlet and Lake Worth Lagoon values ranged from BDL to 0.48 µM. NH_4-N values (Figure 76) ranged from 0.17-1.24 µM over the reef and outfall stations, while the values varied from 0.60-0.93 µM for the Boynton Inlet and Lake Worth Lagoon stations. Ortho-PO_4-P values (Figure 77) ranged from BDL to 0.26 µM over the reef and outfall sites, while values from Boynton Inlet and Lake Worth Lagoon varied between 0.0-0.17 µM. SiO_4-Si values (Figure 78) were BLD for the reef and outfall stations, while the Boynton Inlet and Lake Worth Lagoon values varied from 2.0-3.5 µM. TDN values (Figure 79) ranged from 0.28-21.28 µM over the reef and outfall, while values ranged from 8.51-10.83 µM for the Boynton Inlet and Lake Worth Lagoon sites. TDN samples for stations BD-7C and BD-15A were no good. DOC values (Figure 80) ranged from 1.28-403.86 µM for the reef and outfall sites, while values ranged from 87.82-141.10 µM for the Boynton Inlet and Lake Worth Lagoon sites. DOC samples for stations BD-11C and BD-15A were determined to be no good. Phaeopigments are shown in Figure 81; the high value of 15 at site 6 is probably an outlier.

Water column profiles were conducted at each station. Turbidity data are not included with the profiles due to the functioning of the turbidity probe. Only small changes were observed in all of the parameters for the water column profiles. The chlorophyll probe seemed to produce higher values than the discrete samples.

Table 22: Dates and times of water sample collection for May 2008.

Date	Time (local)	Station	Latitude	Longitude	Depth (m)
5/19/2008	830	BD-1A	26.42550	-80.04545	0
5/19/2008	830	BD-1B	26.42550	-80.04545	17
5/19/2008	830	BD-1C	26.42550	-80.04545	35
5/19/2008	912	BD-2A	26.44201	-80.04729	0
5/19/2008	912	BD-2B	26.44201	-80.04729	10
5/19/2008	912	BD-2C	26.44201	-80.04729	20
5/19/2008	946	BD-3A	26.45828	-80.04247	0
5/19/2008	946	BD-3B	26.45828	-80.04247	16
5/19/2008	946	BD-3C	26.45828	-80.04247	31
5/19/2008	1015	BD-4A	26.46192	-80.04195	0
5/19/2008	1015	BD-4B	26.46192	-80.04195	14
5/19/2008	1015	BD-4C	26.46192	-80.04195	28
5/19/2008	1059	BD-5A	26.46620	-80.04167	0
5/19/2008	1059	BD-5B	26.46620	-80.04167	13
5/19/2008	1059	BD-5C	26.46620	-80.04167	25
5/19/2008	1124	BD-6A	26.47532	-80.03976	0
5/19/2008	1124	BD-6B	26.47532	-80.03976	13
5/19/2008	1124	BD-6C	26.47532	-80.03976	27
5/19/2008	1159	BD-7A	26.48737	-80.03871	0
5/19/2008	1159	BD-7B	26.48737	-80.03871	9
5/19/2008	1159	BD-7C	26.48737	-80.03871	18
5/19/2008	1223	BD-8A	26.51507	-80.03542	0
5/19/2008	1223	BD-8B	26.51507	-80.03542	8
5/19/2008	1223	BD-8C	26.51507	-80.03542	17
5/19/2008	1252	BD-9A	26.50838	-80.04129	0
5/19/2008	1252	BD-9B	26.50838	-80.04129	5
5/19/2008	1252	BD-9C	26.50838	-80.04129	10
5/19/2008	1322	BD-10A	26.52261	-80.03223	0
5/19/2008	1322	BD-10B	26.52261	-80.03223	8
5/19/2008	1322	BD-10C	26.52261	-80.03223	15
5/20/2008	952	BD-11A	26.53333	-80.03584	0
5/20/2008	952	BD-11B	26.53333	-80.03584	9
5/20/2008	952	BD-11C	26.53333	-80.03584	16
5/20/2008	1050	BD-12A	26.53874	-80.03980	0
5/20/2008	1050	BD-12B	26.53874	-80.03980	5
5/20/2008	1050	BD-12C	26.53874	-80.03980	12
5/19/2008	1354	BD-13A	26.54542	-80.04300	0
5/20/2008	1120	BD-14A	26.54242	-80.03996	0
5/20/2008	1120	BD-14C	26.54242	-80.03996	3
5/20/2008	1147	BD-15A	26.55919	-80.03329	0
5/20/2008	1147	BD-15B	26.55919	-80.03329	6
5/20/2008	1147	BD-15C	26.55919	-80.03329	12
5/19/2008	1425	BD-16A	26.54618	-80.04791	0
5/19/2008	1435	BD-17A	26.54264	-80.04790	0
5/19/2008	1450	BD-18A	26.53950	-80.04951	0

Table 23: May 2008 Boynton-Delray nutrient and DOC values in µM.

Station	Depth (m)	N+N (µM)	NH_4 (µM)	P (µM)	Si (µM)	TDN (µM)	TDP (µM)	DOC (µM)
BD-1A	0	BDL	0.77	0.07	BDL	7.70	0.56	77.27
BD-1B	17	BDL	0.40	BDL	BDL	21.28	0.31	76.03
BD-1C	35	BDL	0.61	0.03	BDL	0.28	0.17	60.92
BD-2A	0	BDL	0.55	BDL	BDL	10.48	0.20	50.84
BD-2B	10	BDL	0.47	BDL	BDL	7.97	0.23	151.28
BD-2C	20	BDL	0.46	BDL	BDL	5.99	0.17	54.82
BD-3A	0	BDL	0.49	BDL	BDL	5.49	0.13	45.60
BD-3B	16	0.25	0.38	BDL	BDL	3.73	0.13	48.88
BD-3C	31	BDL	0.30	BDL	BDL	9.19	0.08	50.66
BD-4A	0	0.17	4.58	0.26	BDL	6.85	0.77	53.62
BD-4B	14	BDL	0.51	BDL	BDL	12.99	0.17	62.81
BD-4C	28	BDL	0.52	BDL	BDL	2.39	0.24	60.65
BD-5A	0	BDL	1.24	0.08	BDL	10.82	0.25	102.06
BD-5B	13	0.03	0.92	BDL	BDL	4.23	0.32	53.80
BD-5C	25	BDL	0.36	BDL	BDL	16.60	0.18	52.01
BD-6A	0	BDL	0.75	BDL	BDL	6.21	0.32	82.65
BD-6B	13	BDL	0.33	BDL	BDL	2.33	0.19	43.23
BD-6C	27	BDL	0.30	BDL	BDL	2.99	0.37	46.09
BD-7A	0	BDL	0.34	BDL	BDL	4.87	0.17	68.32
BD-7B	9	BDL	0.49	BDL	BDL	3.71	0.26	53.35
BD-7C	18	BDL	0.49	BDL	BDL	N/A	0.37	30.11
BD-8A	0	BDL	0.40	BDL	BDL	8.92	0.12	37.61
BD-8B	8	BDL	0.40	BDL	BDL	5.27	0.22	16.71
BD-8C	17	BDL	0.28	BDL	BDL	5.45	0.35	20.91
BD-9A	0	BDL	0.35	BDL	BDL	6.08	0.32	45.19
BD-9B	5	BDL	0.52	BDL	BDL	4.12	0.31	30.15
BD-9C	10	BDL	0.38	BDL	BDL	4.72	0.30	38.13
BD-10A	0	BDL	0.64	BDL	BDL	6.95	0.32	43.92
BD-10B	8	BDL	0.24	BDL	BDL	4.87	0.30	30.66
BD-10C	15	BDL	0.17	BDL	BDL	5.08	0.29	51.48
BD-11A	0	0.12	0.51	0.06	BDL	3.84	0.16	403.86
BD-11B	9	BDL	0.43	BDL	BDL	6.15	0.48	46.85
BD-11C	16	0.18	0.46	0.03	BDL	4.48	0.20	N/A
BD-12A	0	BDL	0.44	BDL	BDL	7.75	0.19	49.32
BD-12B	5	BDL	0.42	BDL	BDL	3.82	0.13	39.48
BD-12C	12	0.02	0.36	BDL	BDL	2.82	0.26	4.33
BD-13A	0	0.48	0.60	0.11	2.00	10.83	0.52	112.64
BD-14A	0	0.03	0.31	BDL	BDL	2.81	0.16	1.28
BD-14C	3	0.12	0.48	BDL	BDL	2.66	0.19	17.42
BD-15A	0	BDL	0.52	BDL	BDL	N/A	0.20	N/A
BD-15B	6	0.16	0.49	BDL	BDL	4.11	0.23	68.52
BD-15C	12	BDL	0.46	BDL	BDL	2.73	0.17	2.78
BD-16A	0	0.62	0.93	0.14	2.10	8.51	0.61	87.82
BD-17A	0	BDL	0.66	0.06	3.40	9.19	0.71	125.94
BD-18A	0	0.28	0.64	0.17	3.50	10.12	0.82	141.10

Table 24: May 2008 Boynton-Delray nutrient and DOC values in mg/L.

Station	Depth (m)	N+N (mg/L)	NH_4 (mg/L)	P (mg/L)	Si (mg/L)	TDN (mg/L)	TDP (mg/L)	DOC (mg/L)
BD-1A	0	BDL	0.011	0.002	BDL	0.10	0.017	1.16
BD-1B	17	BDL	0.006	BDL	BDL	0.26	0.010	1.14
BD-1C	35	BDL	0.009	0.001	BDL	0.00	0.005	0.94
BD-2A	0	BDL	0.008	BDL	BDL	0.13	0.006	0.80
BD-2B	10	BDL	0.007	BDL	BDL	0.10	0.007	2.18
BD-2C	20	BDL	0.006	BDL	BDL	0.07	0.005	0.85
BD-3A	0	BDL	0.007	BDL	BDL	0.07	0.004	0.73
BD-3B	16	0.004	0.005	BDL	BDL	0.05	0.004	0.77
BD-3C	31	BDL	0.004	BDL	BDL	0.11	0.003	0.80
BD-4A	0	0.002	0.064	0.008	BDL	0.09	0.024	0.84
BD-4B	14	BDL	0.007	BDL	BDL	0.16	0.005	0.96
BD-4C	28	BDL	0.007	BDL	BDL	0.03	0.007	0.93
BD-5A	0	BDL	0.017	0.002	BDL	0.13	0.008	1.50
BD-5B	13	BDL	0.013	BDL	BDL	0.05	0.010	0.84
BD-5C	25	BDL	0.005	BDL	BDL	0.21	0.006	0.81
BD-6A	0	BDL	0.010	BDL	BDL	0.08	0.010	1.24
BD-6B	13	BDL	0.005	BDL	BDL	0.03	0.006	0.69
BD-6C	27	BDL	0.004	BDL	BDL	0.04	0.012	0.73
BD-7A	0	BDL	0.005	BDL	BDL	0.06	0.005	1.04
BD-7B	9	BDL	0.007	BDL	BDL	0.04	0.008	1.08
BD-7C	18	BDL	0.007	BDL	BDL	N/A	0.012	0.84
BD-8A	0	BDL	0.006	BDL	BDL	0.11	0.004	0.92
BD-8B	8	BDL	0.006	BDL	BDL	0.06	0.007	0.70
BD-8C	17	BDL	0.004	BDL	BDL	0.06	0.011	0.75
BD-9A	0	BDL	0.005	BDL	BDL	0.07	0.010	0.99
BD-9B	5	BDL	0.007	BDL	BDL	0.05	0.010	0.84
BD-9C	10	BDL	0.005	BDL	BDL	0.06	0.009	0.92
BD-10A	0	BDL	0.009	BDL	BDL	0.08	0.010	0.98
BD-10B	8	BDL	0.003	BDL	BDL	0.06	0.009	0.85
BD-10C	15	BDL	0.005	BDL	BDL	0.06	0.009	1.06
BD-11A	0	0.002	0.007	0.002	BDL	0.05	0.005	4.64
BD-11B	9	BDL	0.006	BDL	BDL	0.07	0.015	1.01
BD-11C	16	0.003	0.006	0.001	BDL	0.05	0.006	N/A
BD-12A	0	BDL	0.006	BDL	BDL	0.09	0.006	1.04
BD-12B	5	BDL	0.006	BDL	BDL	0.05	0.004	0.94
BD-12C	12	BDL	0.005	BDL	BDL	0.03	0.008	0.58
BD-13A	0	0.007	0.008	0.003	0.056	0.13	0.016	1.68
BD-14A	0	BDL	0.004	BDL	BDL	0.03	0.005	0.55
BD-14C	3	0.002	0.007	BDL	BDL	0.03	0.006	0.71
BD-15A	0	BDL	0.007	BDL	BDL	N/A	0.006	N/A
BD-15B	6	0.002	0.007	BDL	BDL	0.05	0.007	1.23
BD-15C	12	BDL	0.006	BDL	BDL	0.03	0.005	0.56
BD-16A	0	0.009	0.013	0.004	0.059	0.10	0.019	1.43
BD-17A	0	BDL	0.009	0.002	0.095	0.11	0.022	1.81
BD-18A	0	0.004	0.009	0.005	0.098	0.12	0.025	1.97

Table 25: May 2008 Boynton-Delray salinity, pH, chlorophyll-a, phaeopigments, and TSS values.

Station	Depth (m)	Temperature (°C)	Salinity (units)	pH (units)	Chlorophyll-a (µg/L)	Phaeopigments (µg/L)	TSS (mg/L)
BD-1A	0	26.2	35.21	8.12	0.276	0.081	0.320
BD-1B	17	25.7	35.35	8.11	0.377	0.135	0.260
BD-1C	35	24.0	35.17	8.11	0.418	0.213	0.180
BD-2A	0	26.2	35.21	8.05	0.345	0.114	0.210
BD-2B	10	26.1	35.24	8.13	0.349	0.107	0.220
BD-2C	20	25.8	34.98	8.12	0.318	0.112	0.220
BD-3A	0	26.3	35.25	8.10	0.297	0.095	0.350
BD-3B	16	26.0	35.32	8.12	0.258	0.096	0.200
BD-3C	31	25.1	35.02	8.14	0.369	0.156	0.190
BD-4A	0	26.3	35.27	8.10	0.318	0.098	0.250
BD-4B	14	26.1	35.31	8.14	0.294	0.098	0.220
BD-4C	28	25.5	35.10	8.16	0.411	0.014	0.460
BD-5A	0	26.2	35.20	8.10	0.311	0.105	0.480
BD-5B	13	26.0	35.32	8.09	0.325	0.113	0.510
BD-5C	25	25.7	35.20	8.11	0.399	0.130	0.470
BD-6A	0	26.4	35.29	8.11	0.293	0.099	0.590
BD-6B	13	26.0	35.33	8.14	0.336	0.116	0.560
BD-6C	27	25.5	35.22	8.13	0.379	15.000	0.260
BD-7A	0	26.4	35.30	8.12	0.330	0.075	0.270
BD-7B	9	26.1	35.32	8.12	0.269	0.116	0.280
BD-7C	18	26.0	35.26	8.10	0.318	0.120	0.260
BD-8A	0	26.2	35.32	8.10	0.321	0.095	0.500
BD-8B	8	26.1	35.33	8.10	0.332	0.117	0.270
BD-8C	17	25.9	35.27	8.12	0.376	0.109	0.260
BD-9A	0	26.1	35.32	8.12	0.230	0.075	0.230
BD-9B	5	26.1	35.32	8.16	0.224	0.078	0.250
BD-9C	10	26.1	35.31	8.18	0.241	0.080	0.270
BD-10A	0	26.4	35.34	8.11	0.277	0.081	0.270
BD-10B	8	26.0	35.35	8.16	0.308	0.094	N/A
BD-10C	15	25.9	35.33	8.15	0.376	0.115	N/A
BD-11A	0	26.0	35.32	8.06	0.272	0.098	N/A
BD-11B	9	25.7	35.34	8.08	0.325	0.121	N/A
BD-11C	16	25.6	35.29	8.10	0.342	0.122	N/A
BD-12A	0	26.1	35.36	8.03	0.255	0.091	0.290
BD-12B	5	25.8	35.40	8.04	0.289	0.104	0.310
BD-12C	12	25.7	35.34	8.07	0.329	0.117	0.300
BD-13A	0	27.9	34.34	8.03	2.685	0.816	1.930
BD-14A	0	26.2	35.31	8.08	0.512	0.157	0.420
BD-14C	3	26.0	35.34	8.10	0.460	0.146	0.390
BD-15A	0	26.1	35.40	8.08	0.394	0.134	0.470
BD-15B	6	25.8	35.38	8.09	0.333	0.111	0.310
BD-15C	12	25.8	35.36	8.11	0.325	0.115	0.310
BD-16A	0	28.0	34.01	7.96	2.508	0.876	2.570
BD-17A	0	29.3	33.04	7.77	6.859	1.070	1.240
BD-18A	0	29.0	33.52	7.82	4.552	1.847	4.460

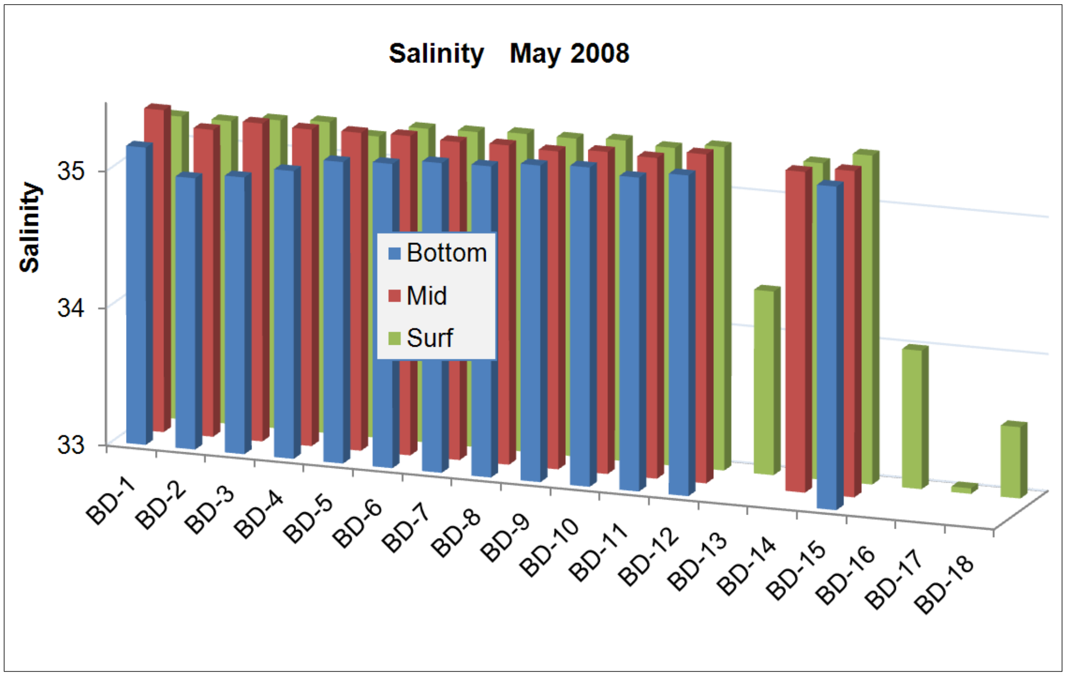

Figure 70: May 2008 salinity values for the Boynton-Delray water quality monitoring stations.

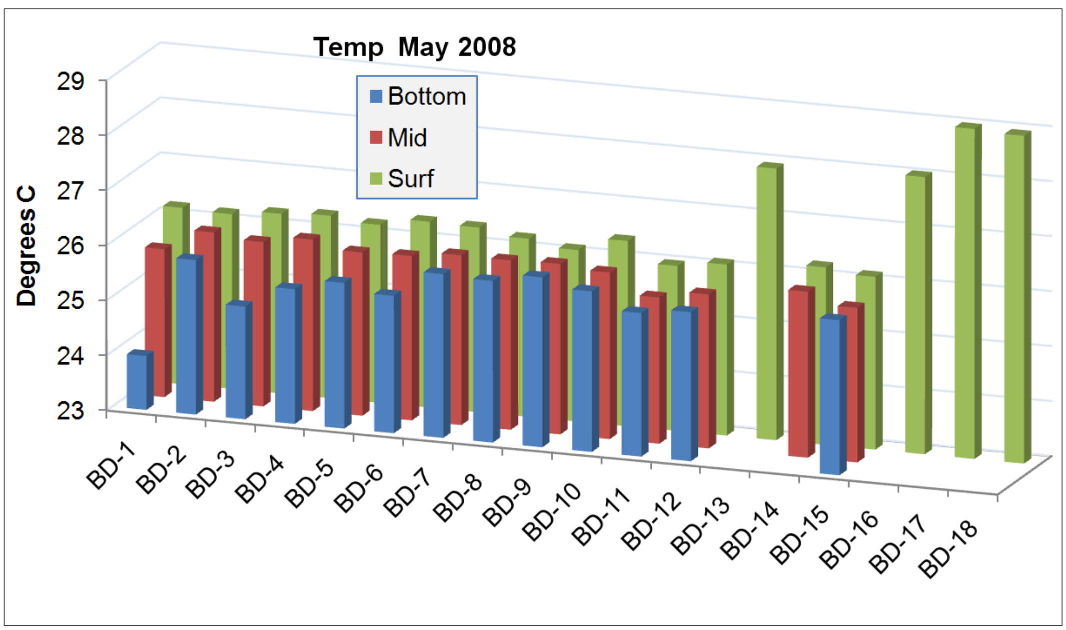

Figure 71: May 2008 temperature values for the Boynton-Delray water quality monitoring stations.

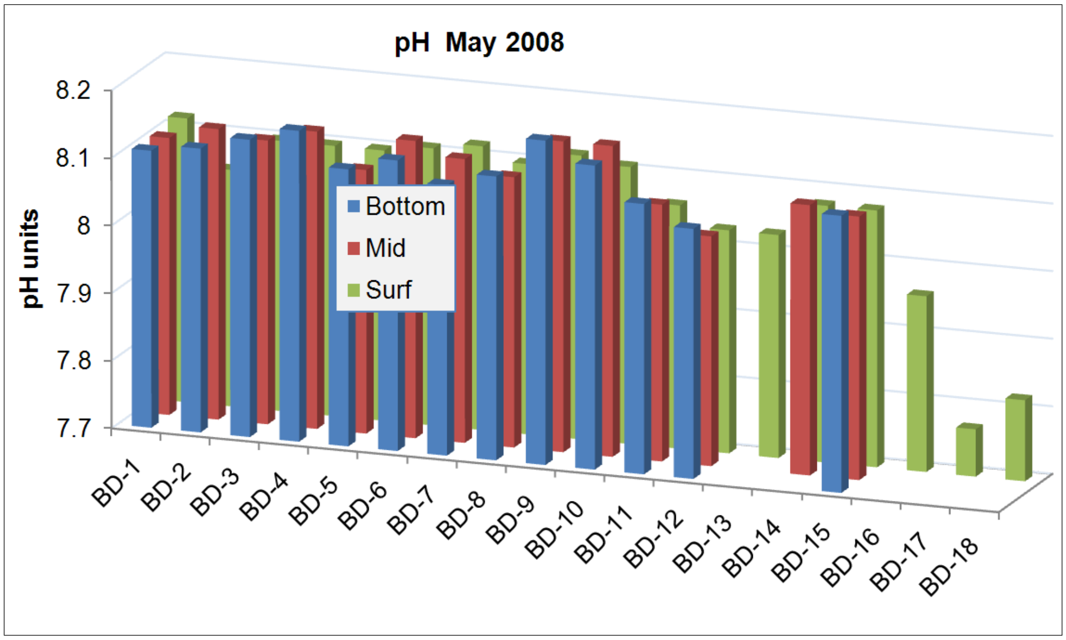

Figure 72: May 2008 pH results for the Boynton-Delray water quality monitoring stations.

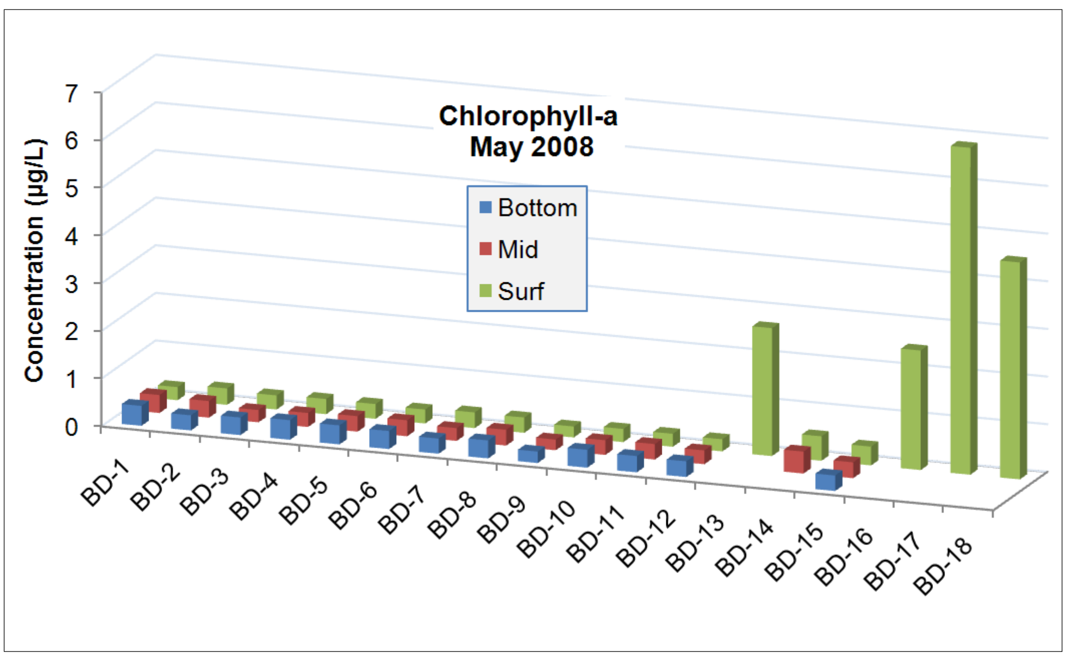

Figure 73: May 2008 chlorophyll-a concentrations for the Boynton-Delray water quality monitoring stations.

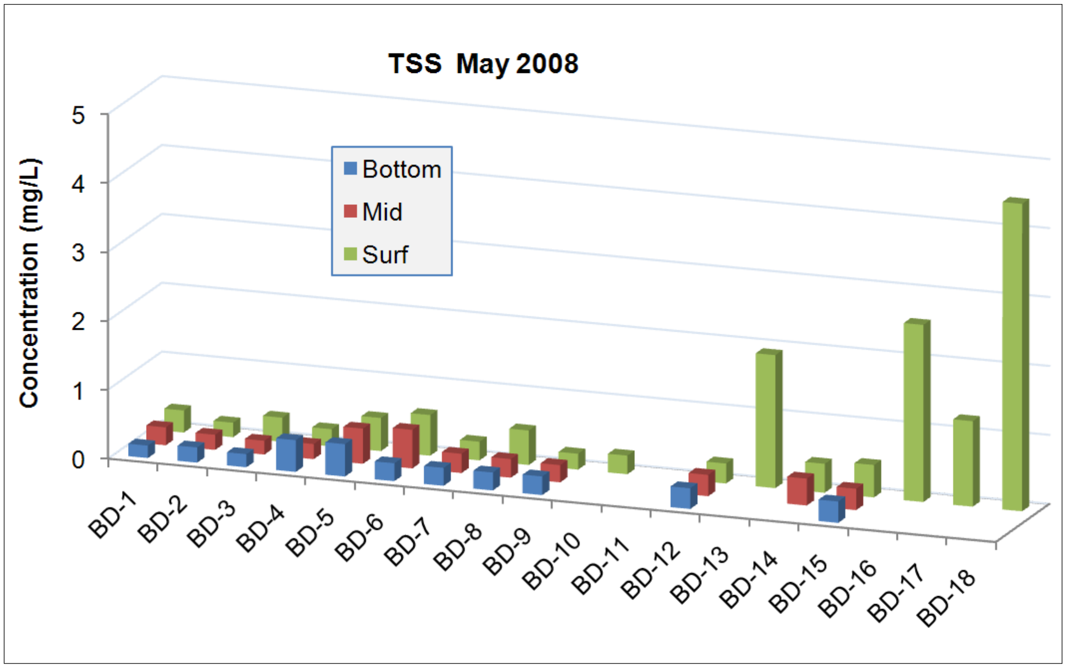

Figure 74: May 2008 total suspended solids concentrations for the Boynton-Delray water quality monitoring stations.

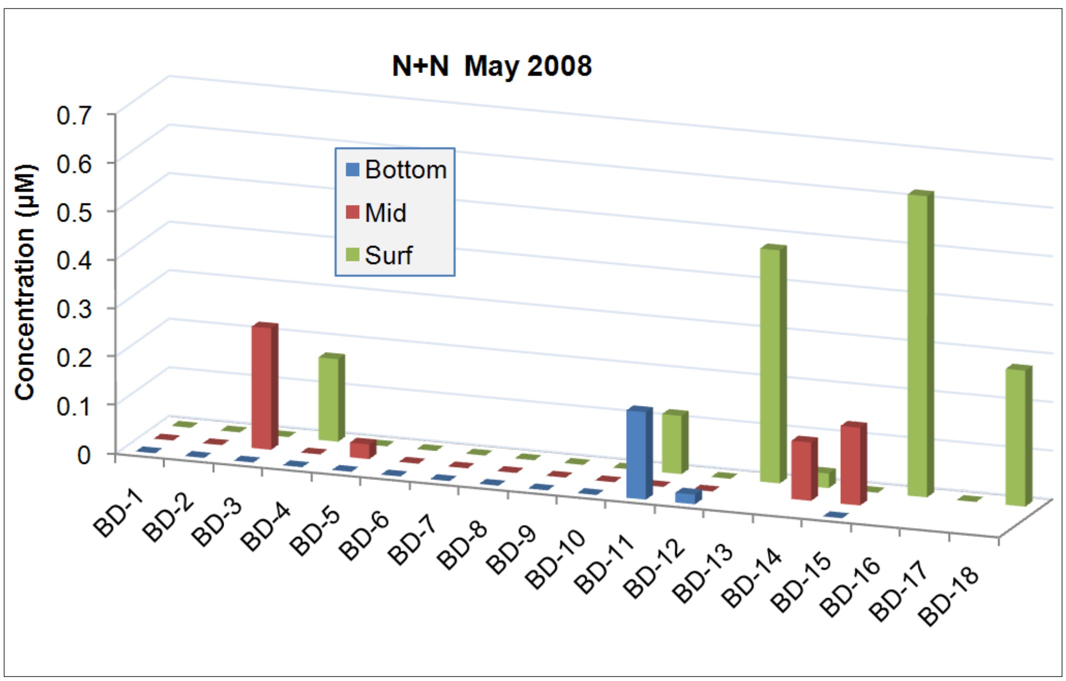

Figure 75: May 2008 nitrate+nitrite concentrations for the Boynton-Delray water quality monitoring stations.

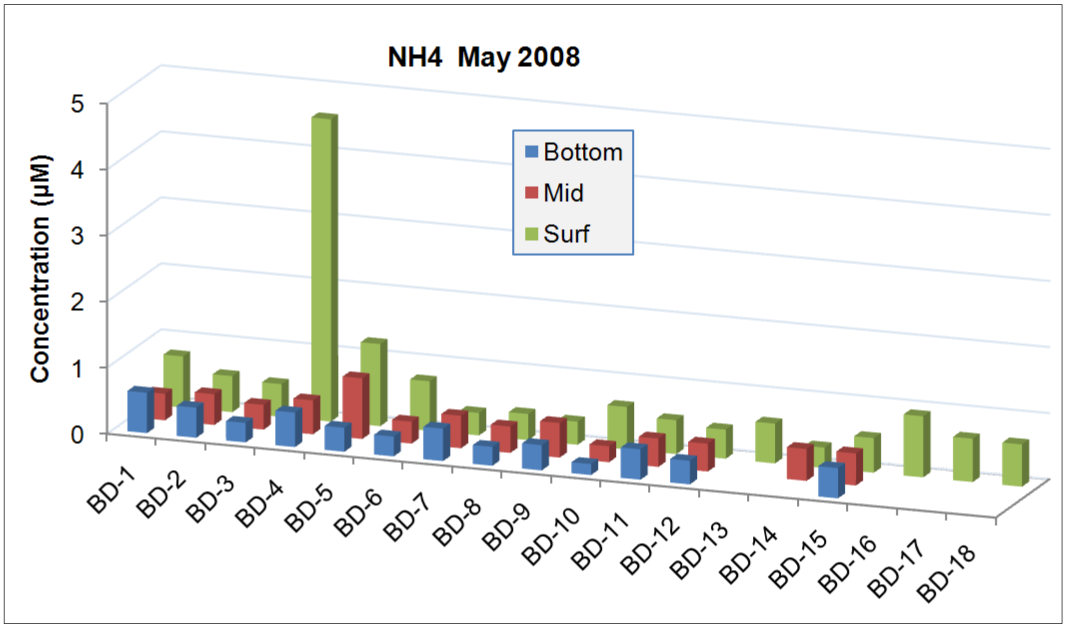

Figure 76: May 2008 ammonium concentrations for the Boynton-Delray water quality monitoring stations.

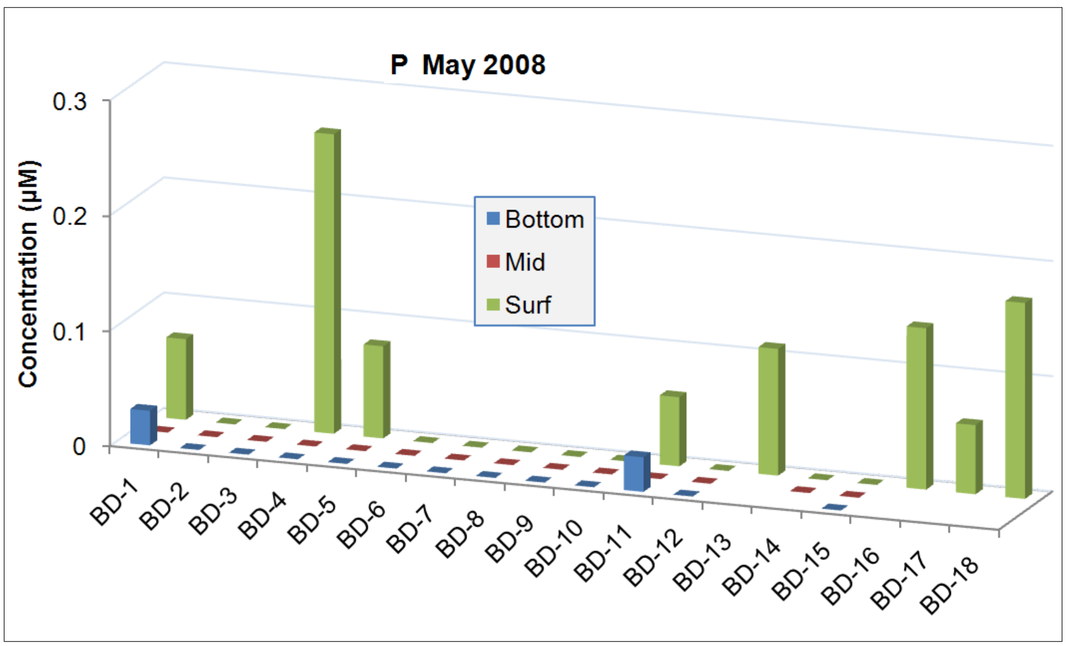

Figure 77: May 2008 orthophoshate concentrations for the Boynton-Delray water quality monitoring stations.

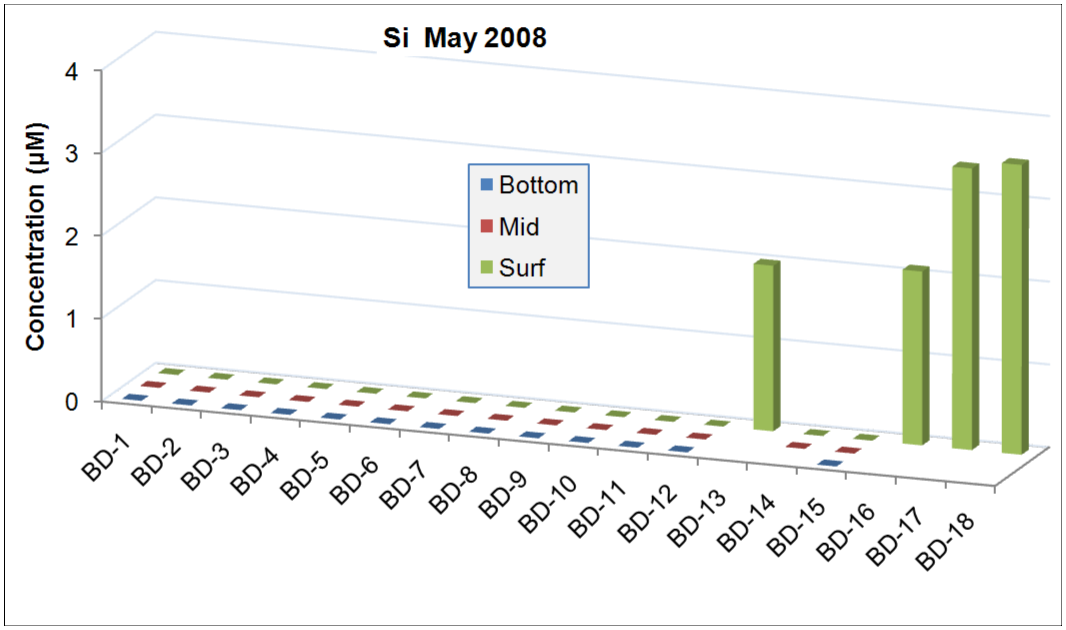

Figure 78: May 2008 silicate concentrations for the Boynton-Delray water quality monitoring stations.

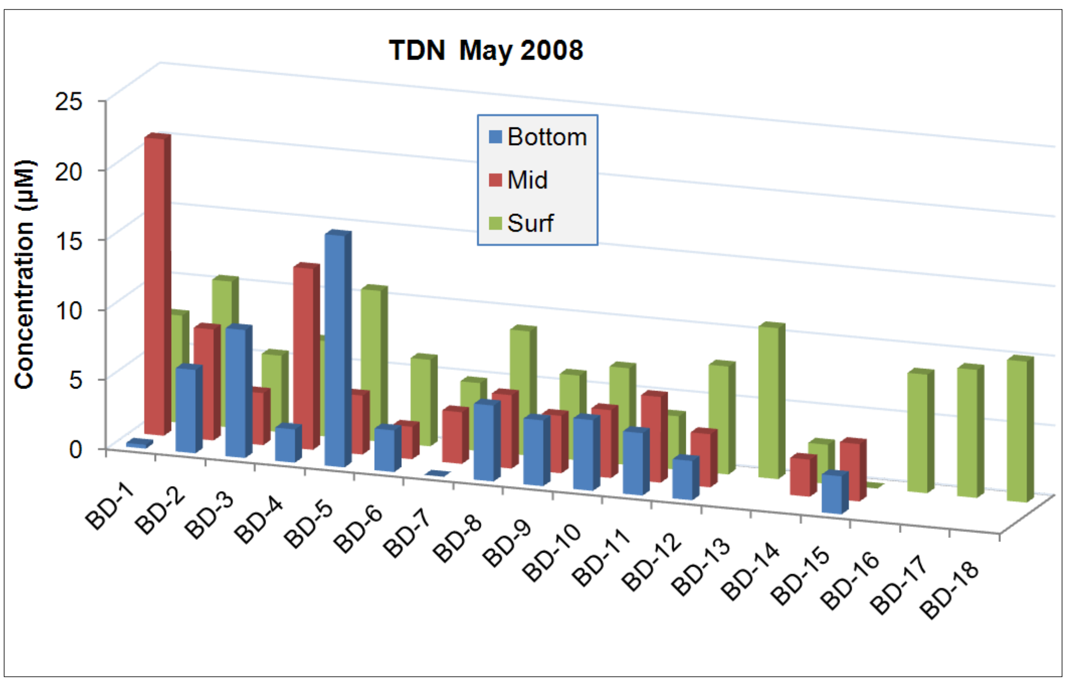

Figure 79: May 2008 total dissolved nitrogen concentrations for the Boynton-Delray water quality monitoring stations.

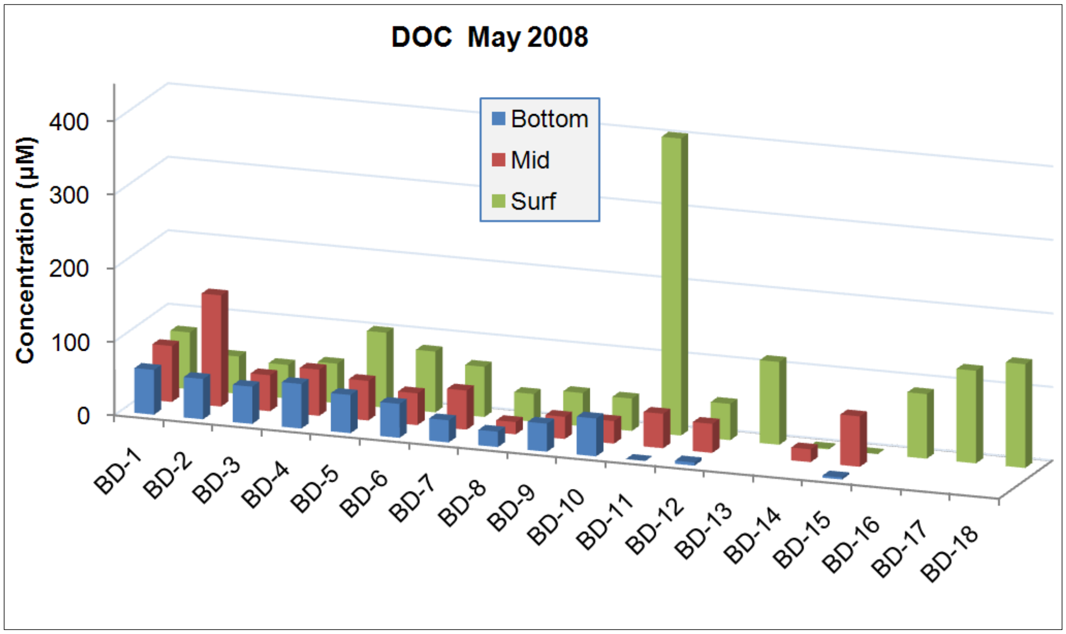

Figure 80: May 2008 dissolved organic carbon concentrations for the Boynton-Delray water quality monitoring stations.

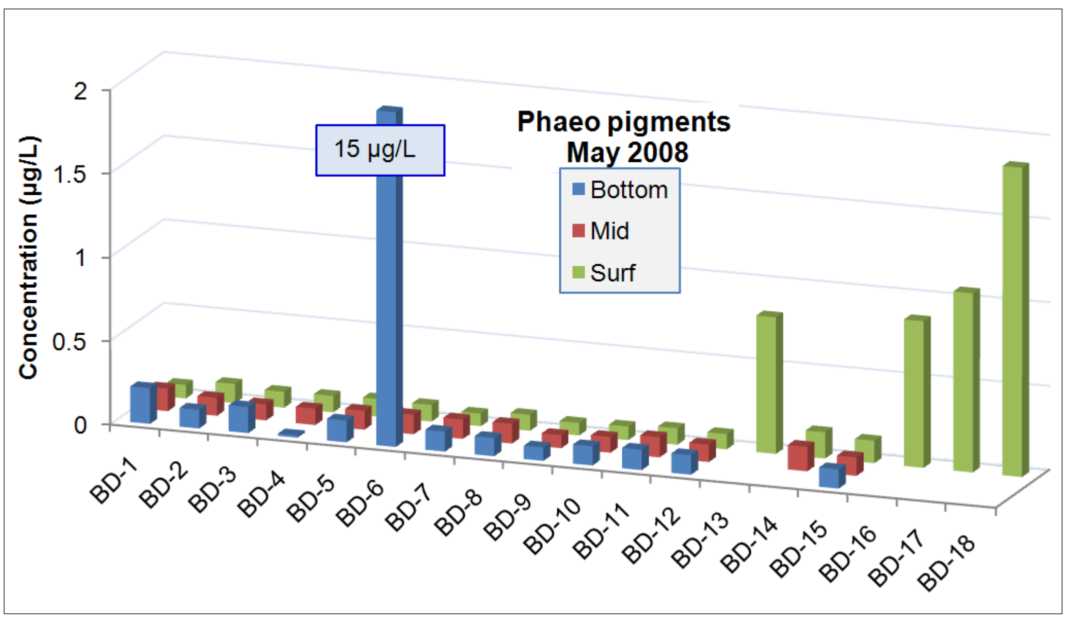

Figure 81: May 2008 phaeopigment concentrations for the Boynton-Delray water quality monitoring stations.

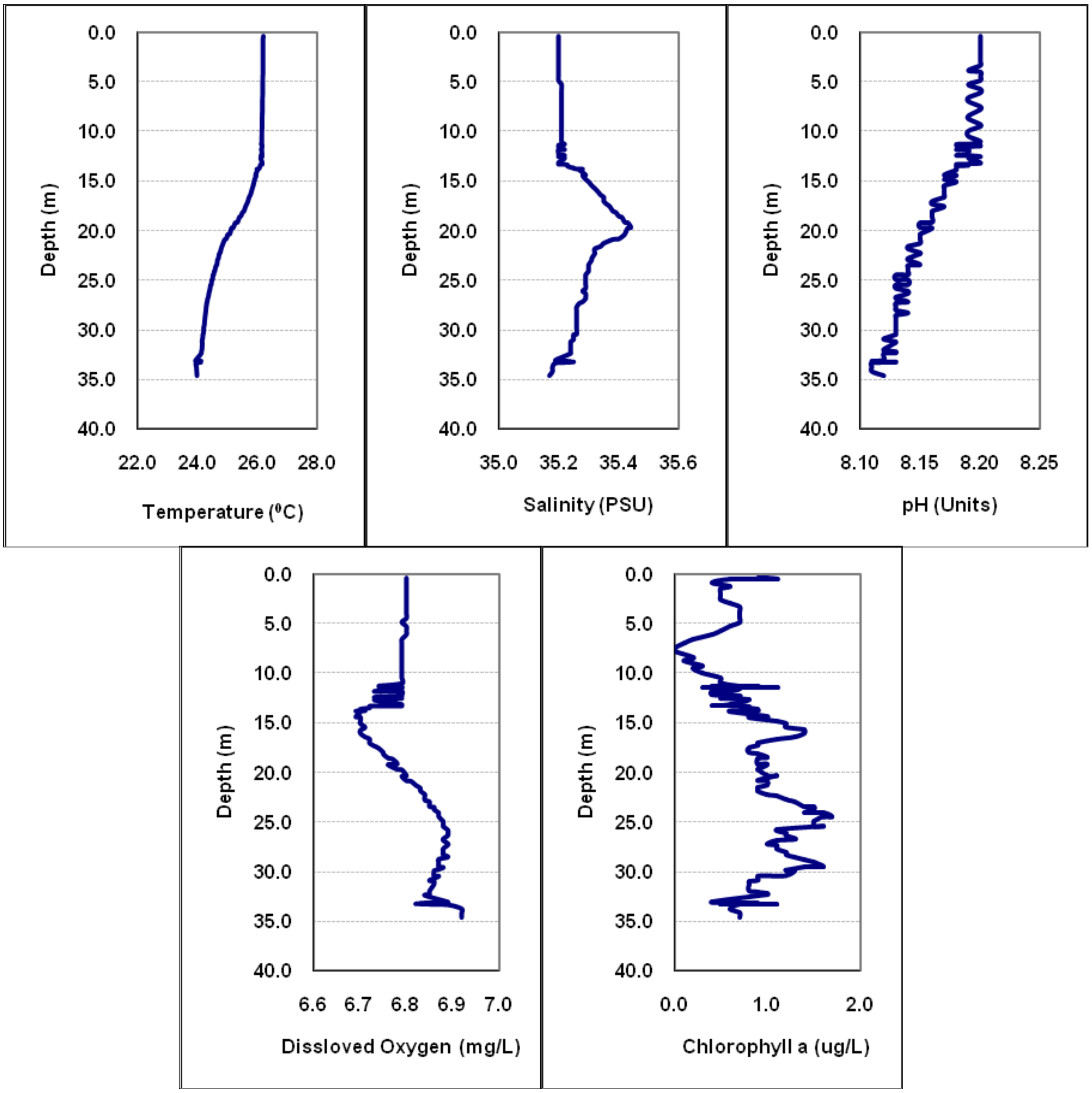

Figure 82: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-1.

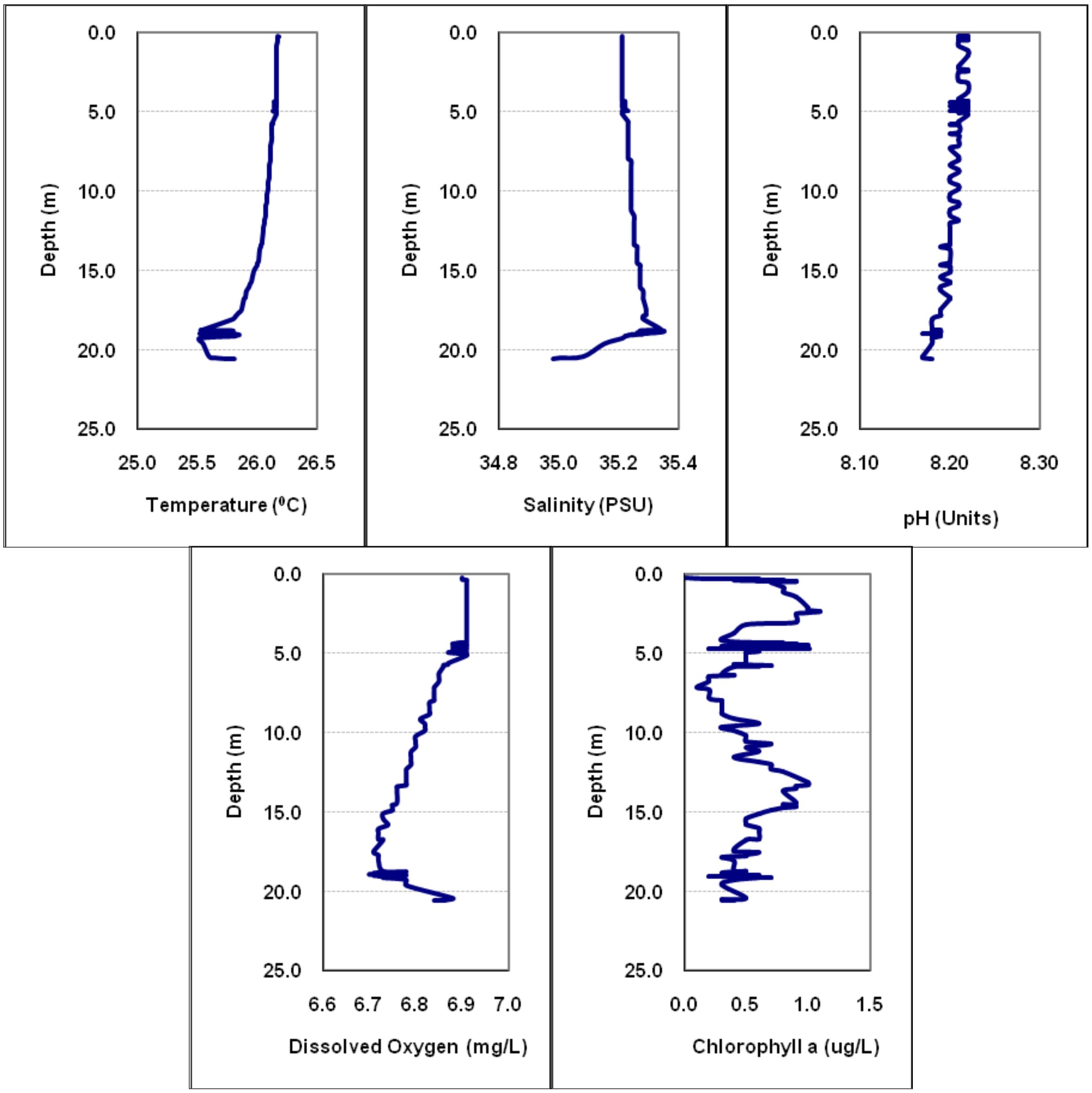

Figure 83: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-2.

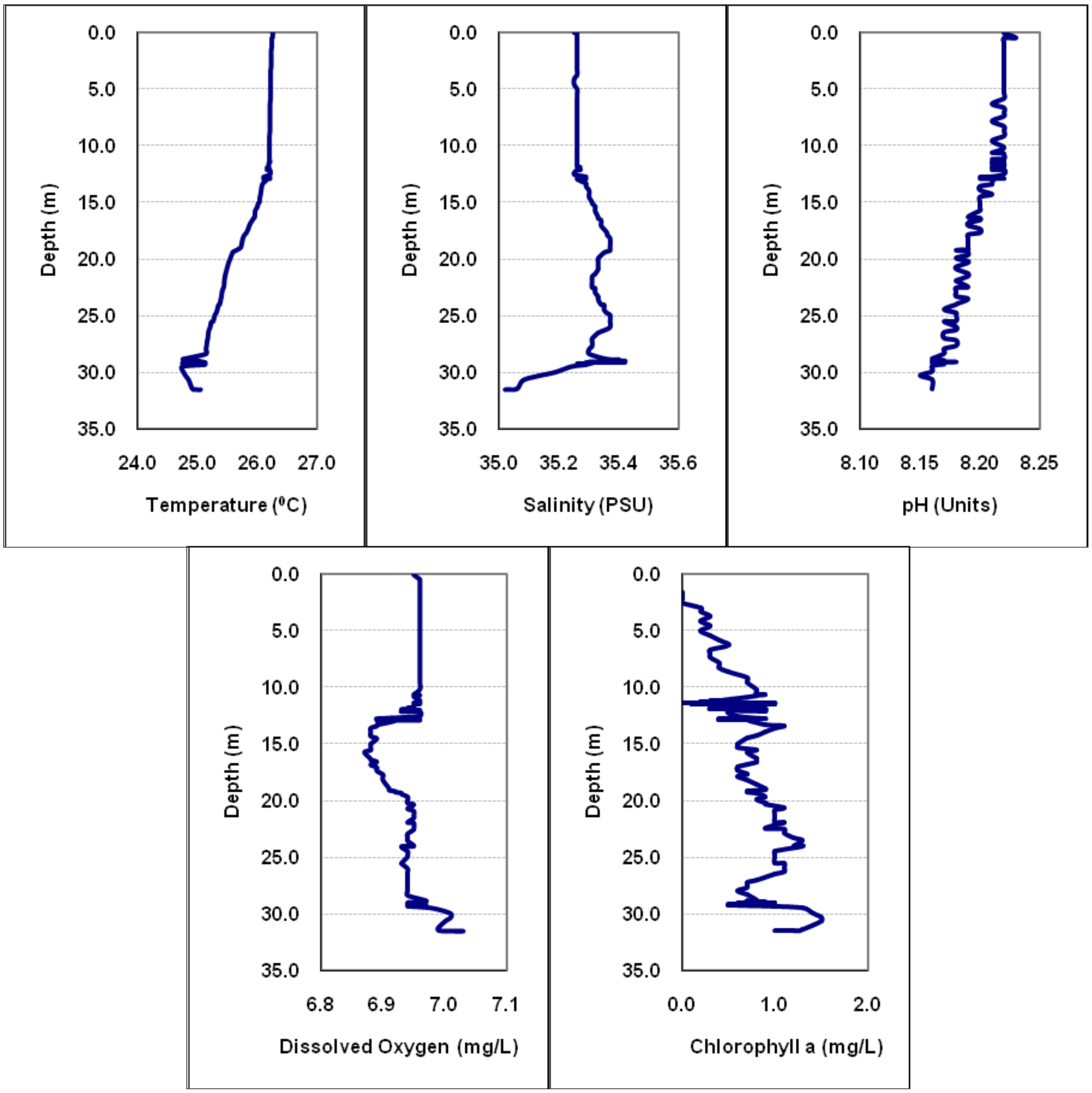

Figure 84: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-3.

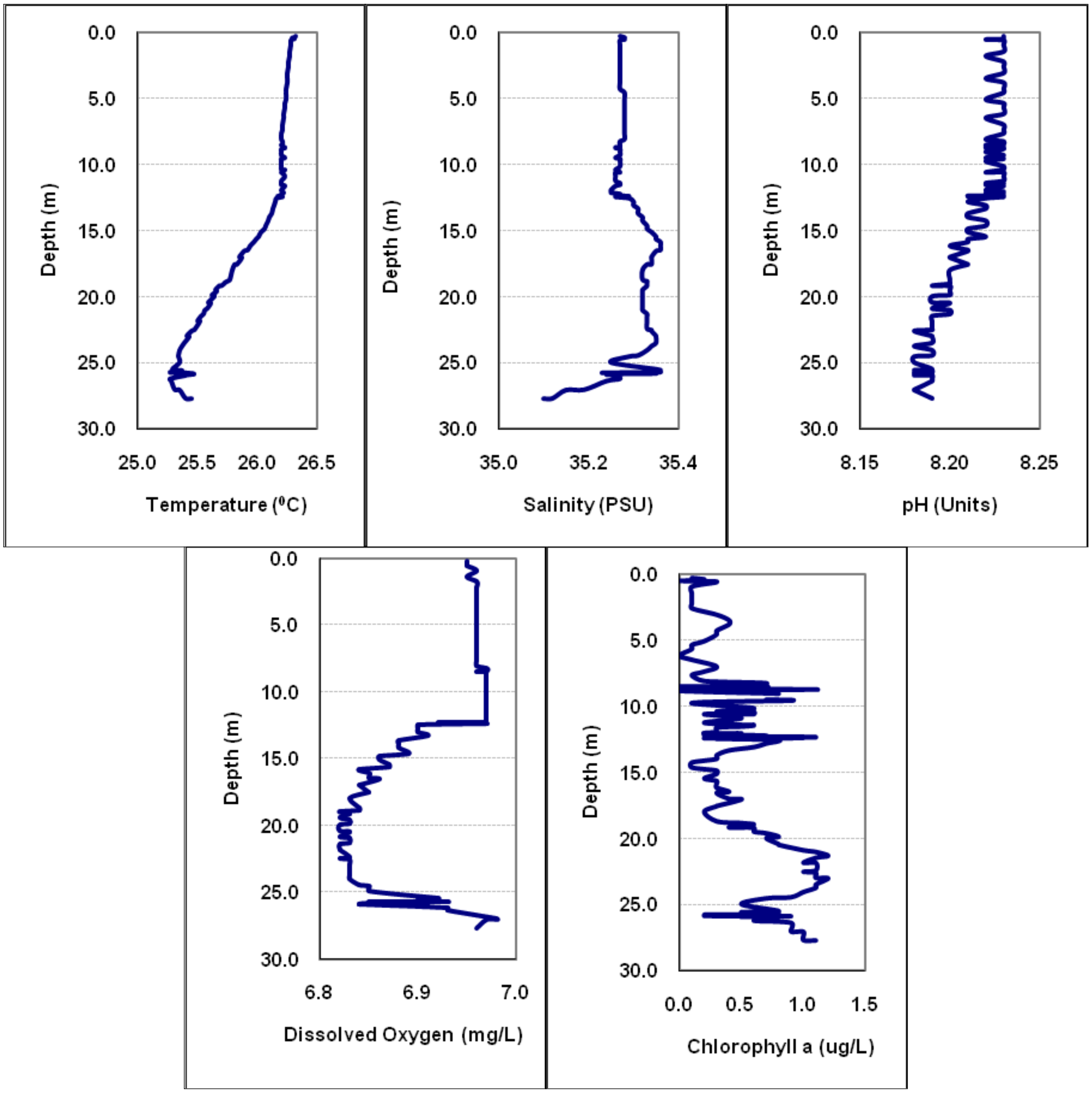

Figure 85: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-4.

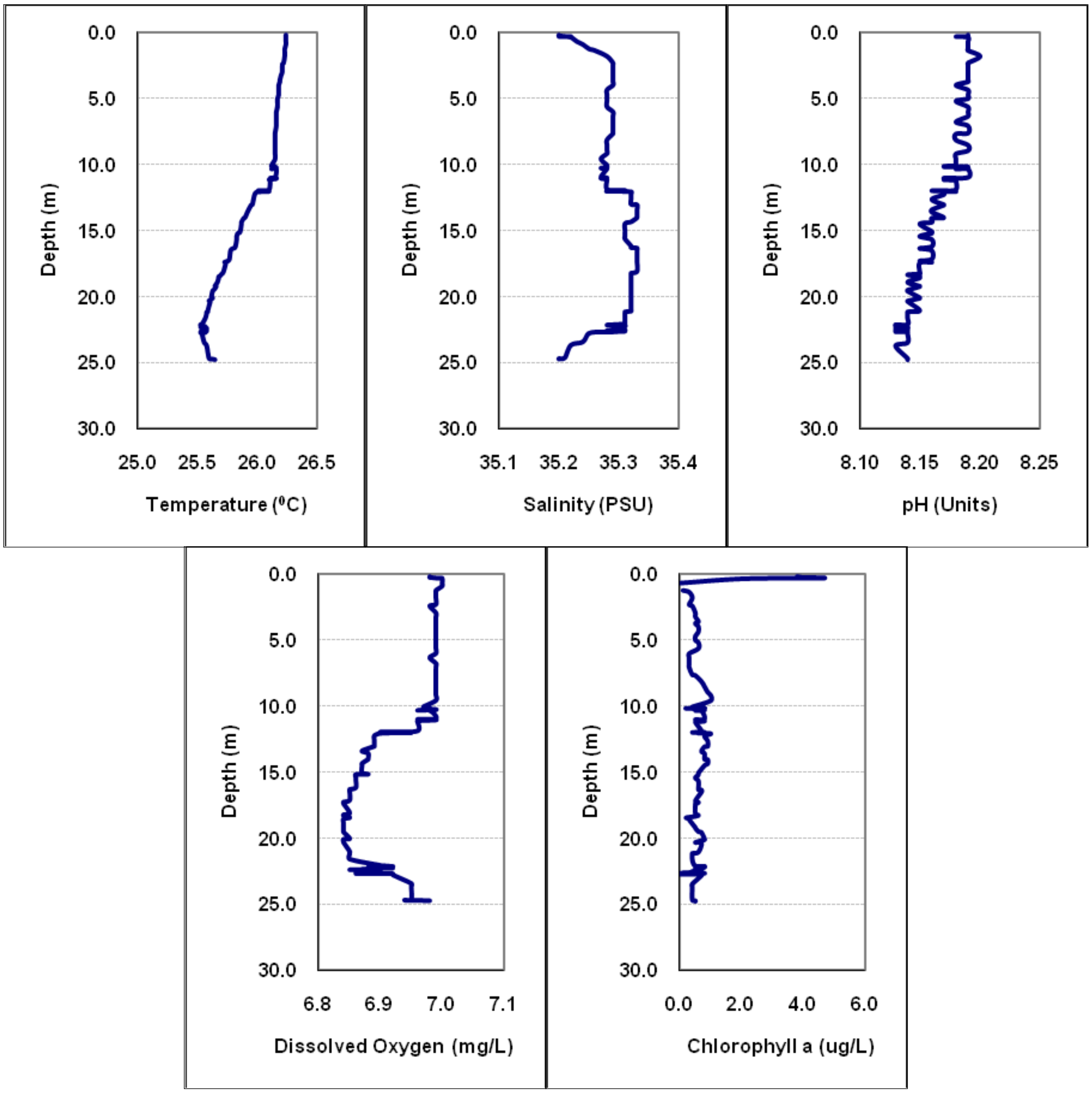

Figure 86: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-5.

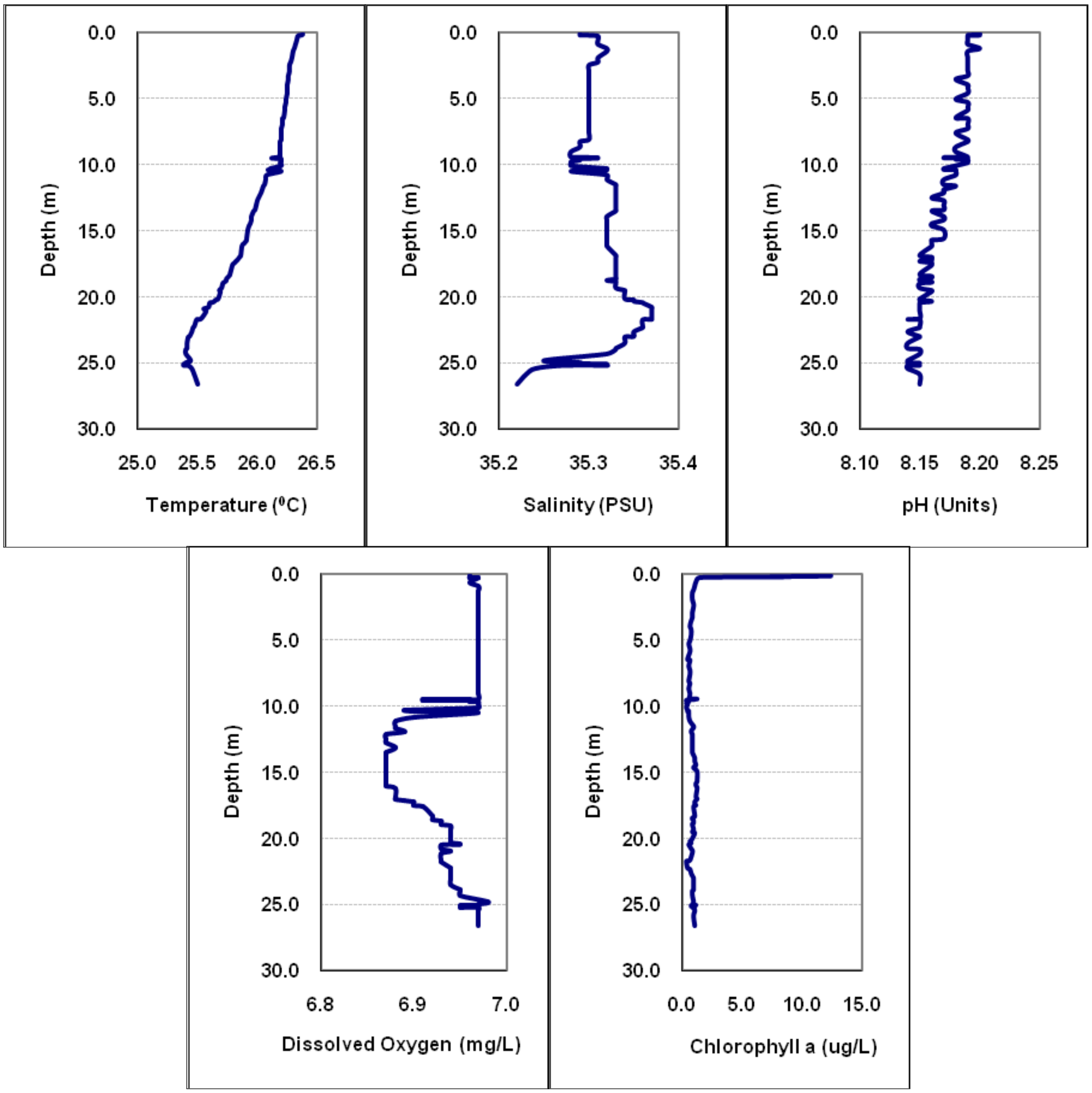

Figure 87: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-6.

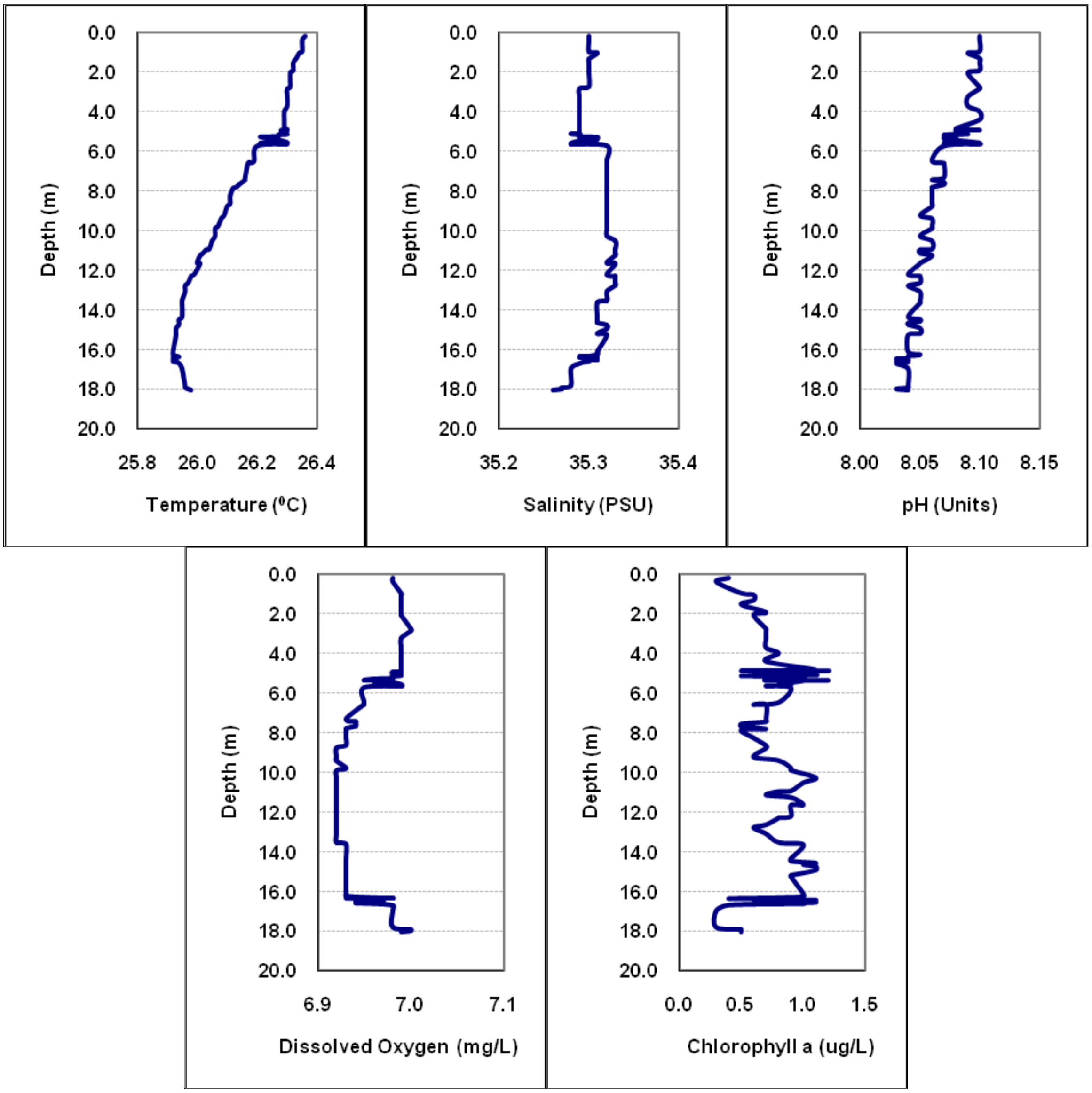

Figure 88: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-7.

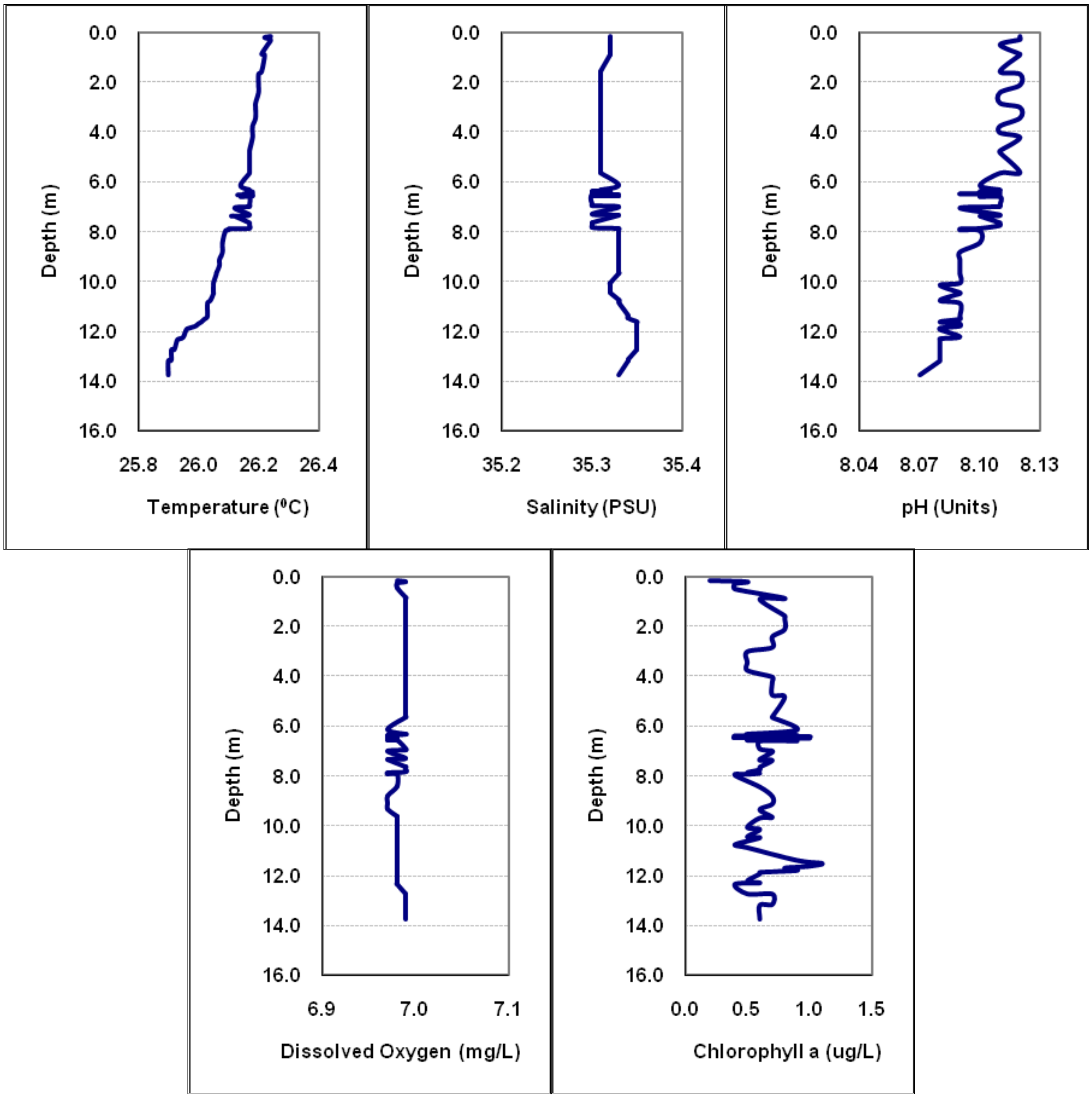

Figure 89: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-8.

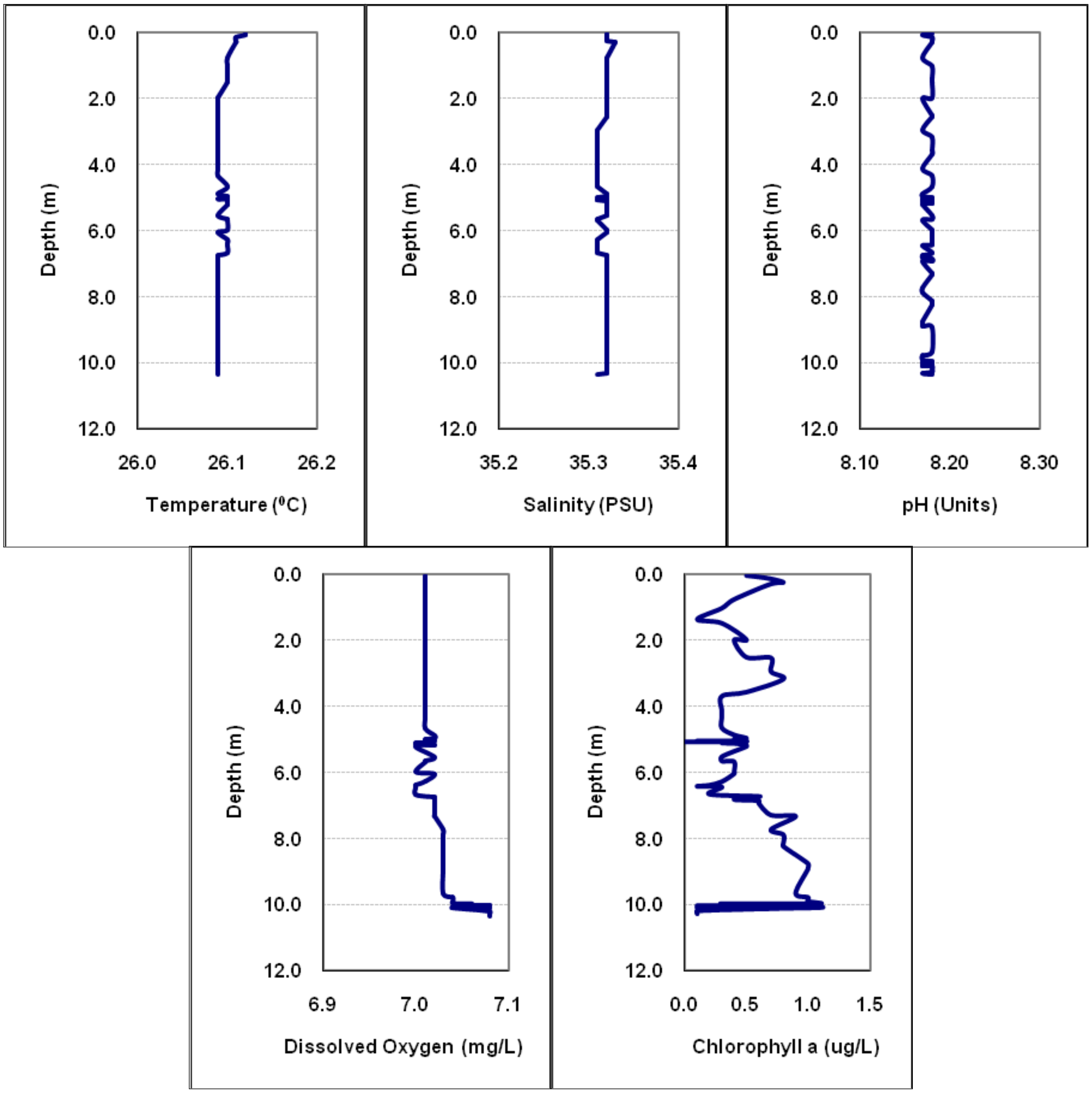

Figure 90: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-9.

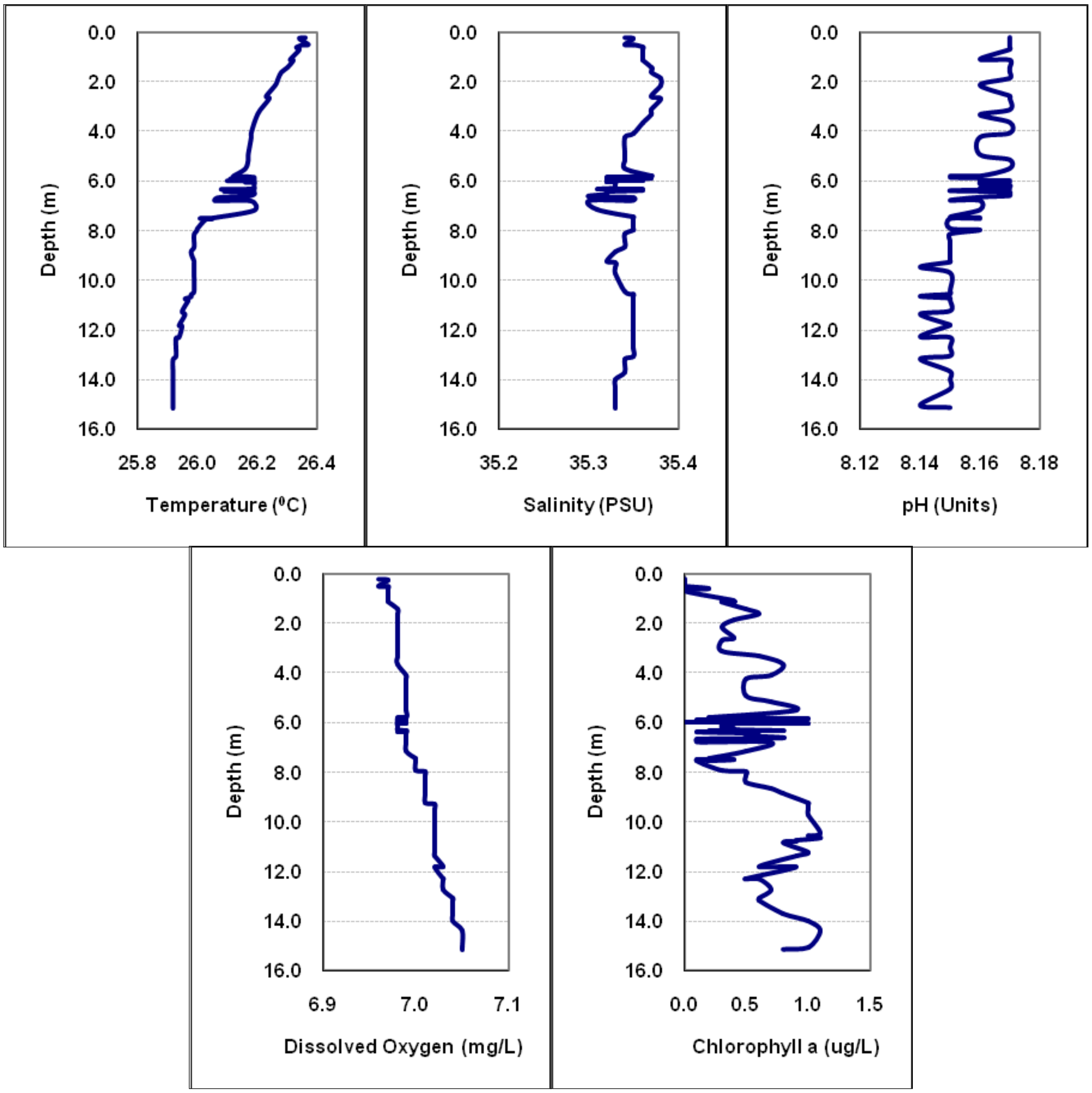

Figure 91: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-10.

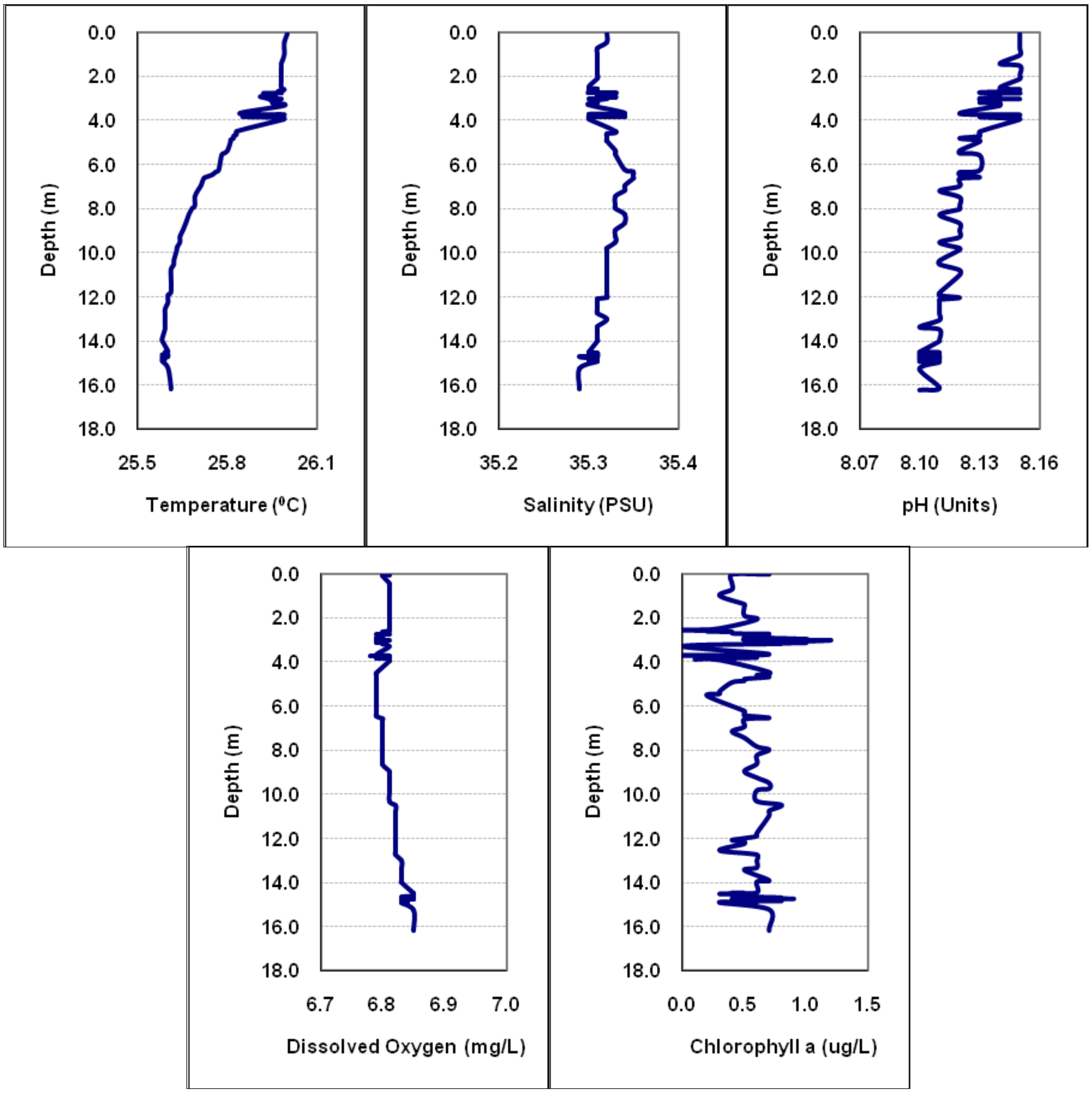

Figure 92: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-11.

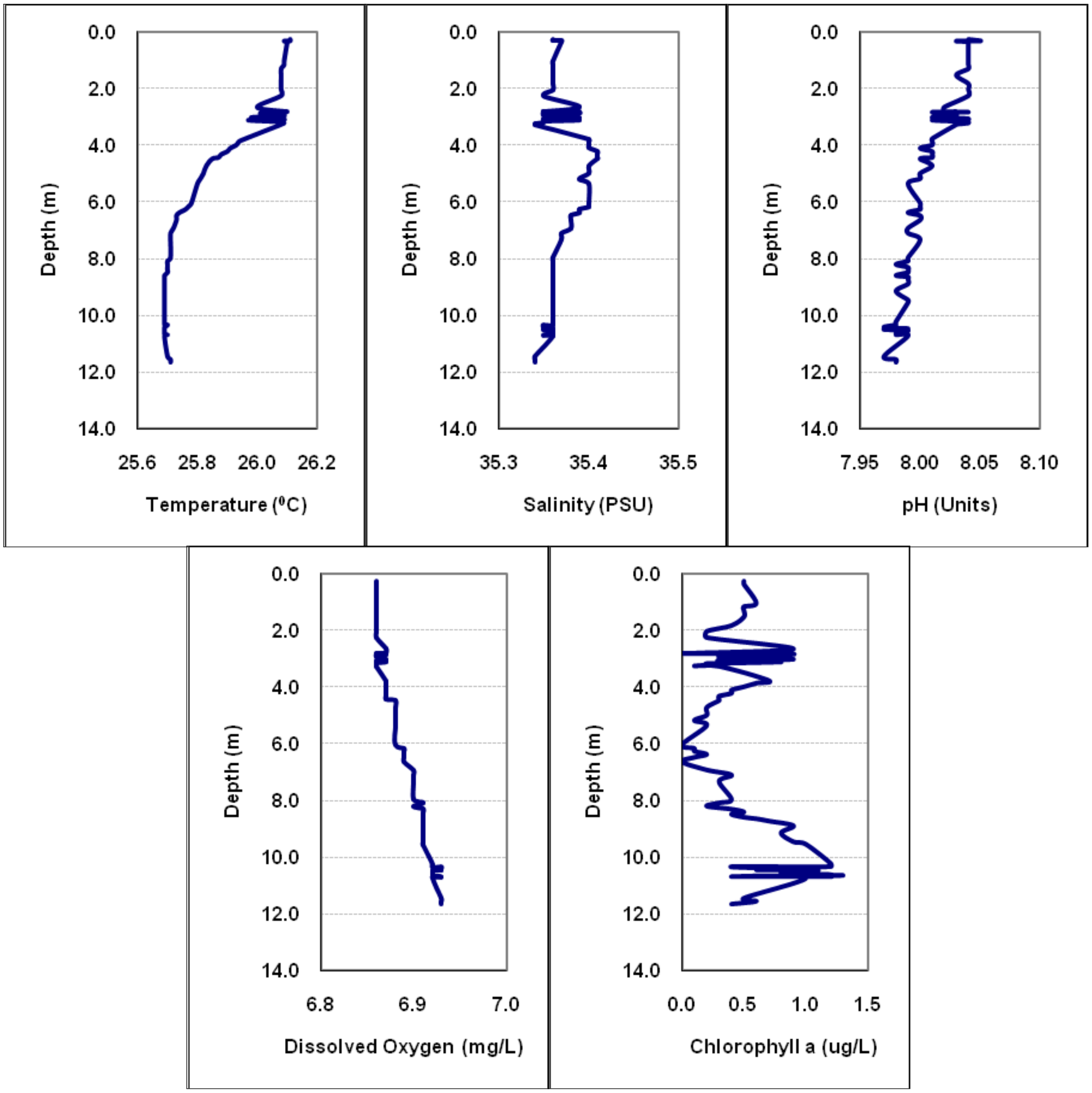

Figure 93: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-12.

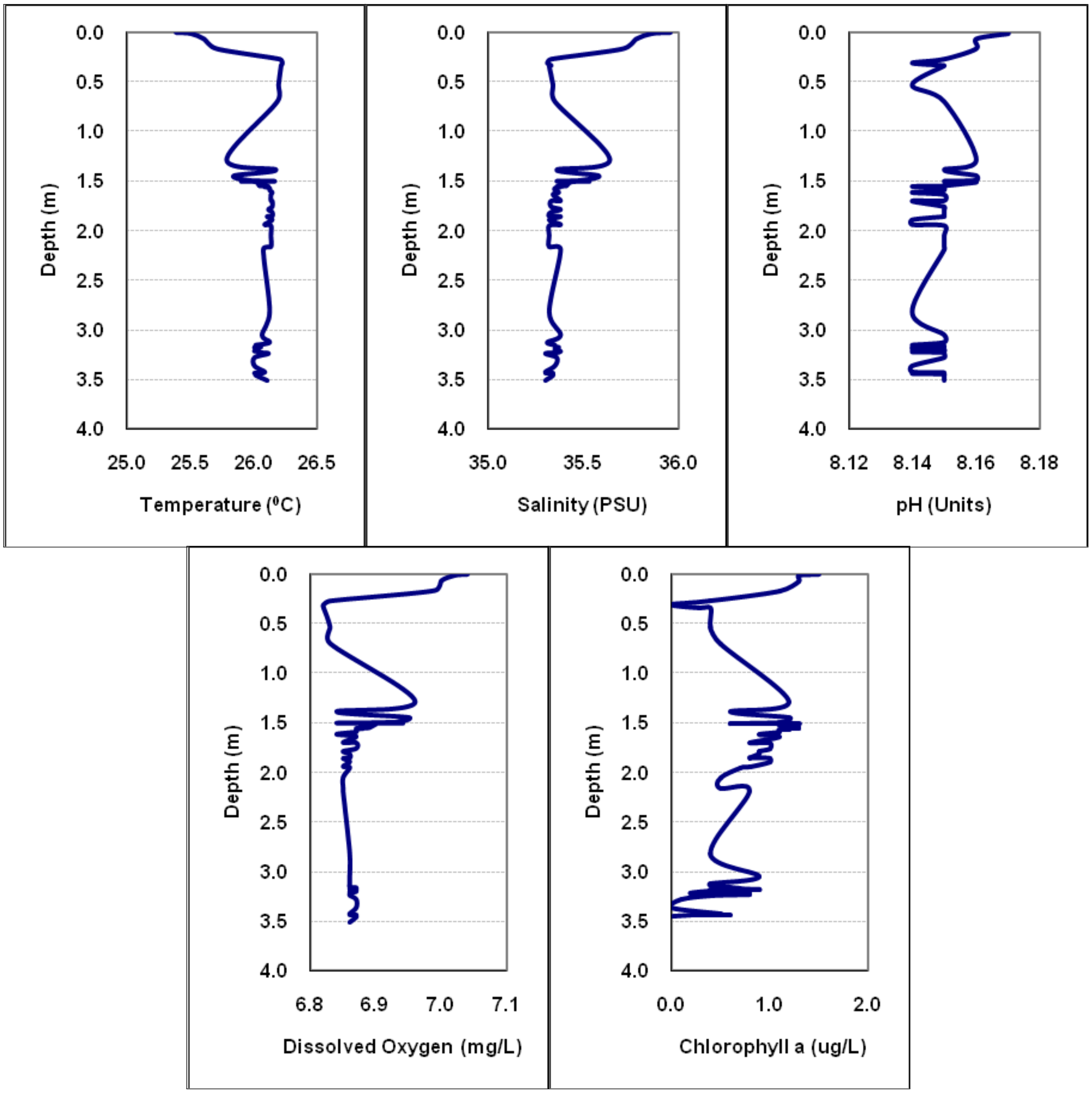

Figure 94: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-14.

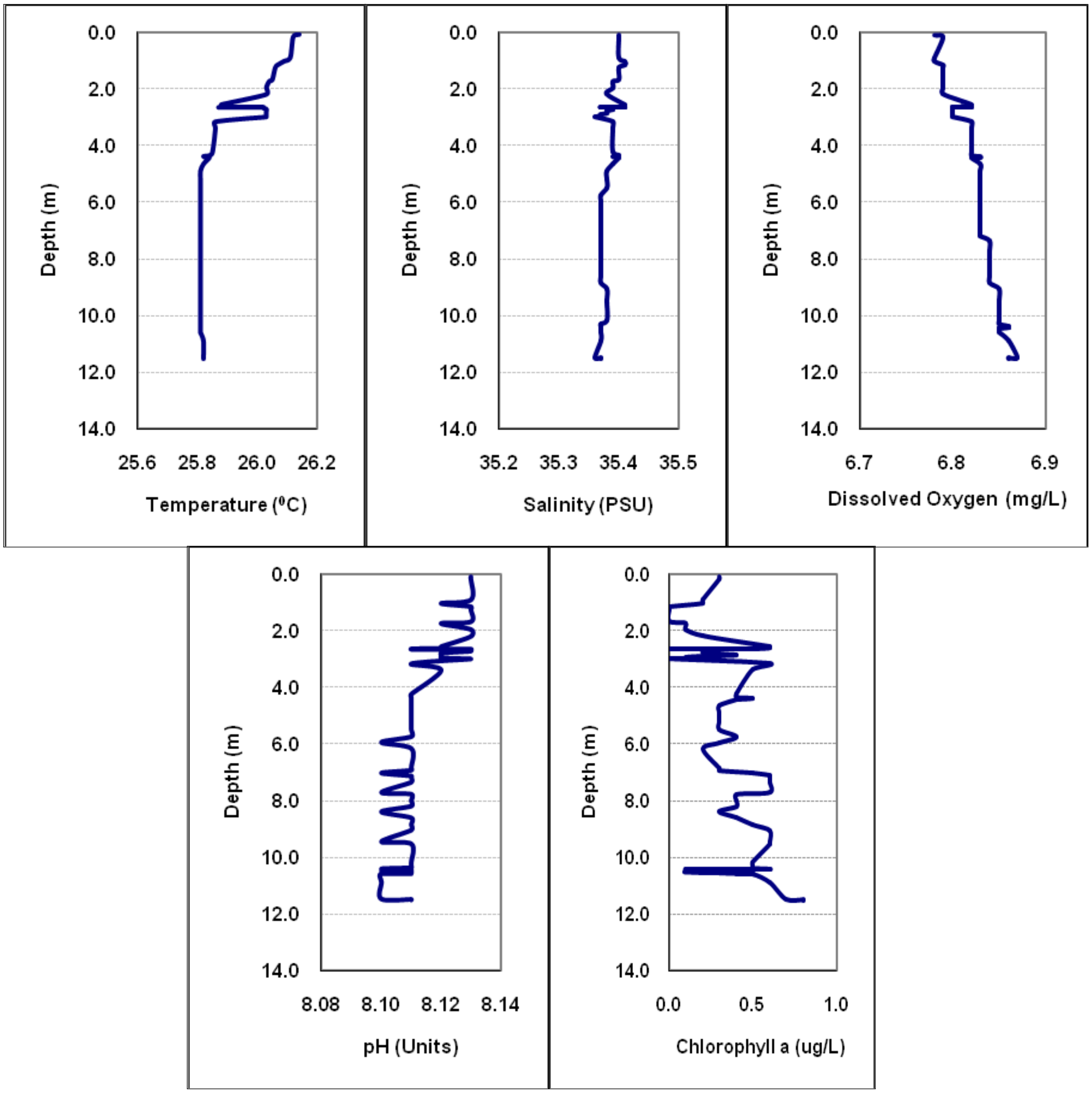

Figure 95: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-15.

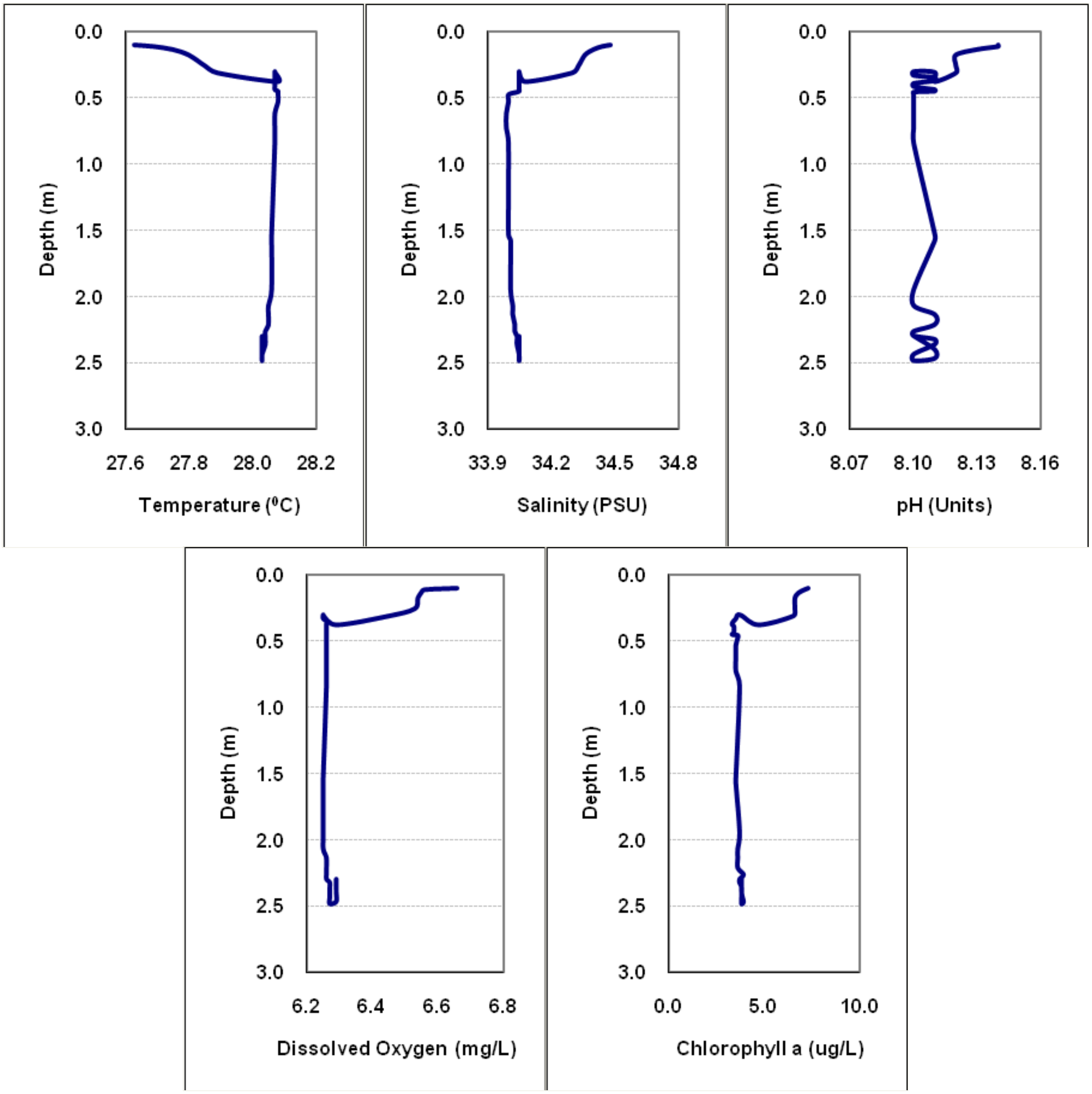

Figure 96: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-16.

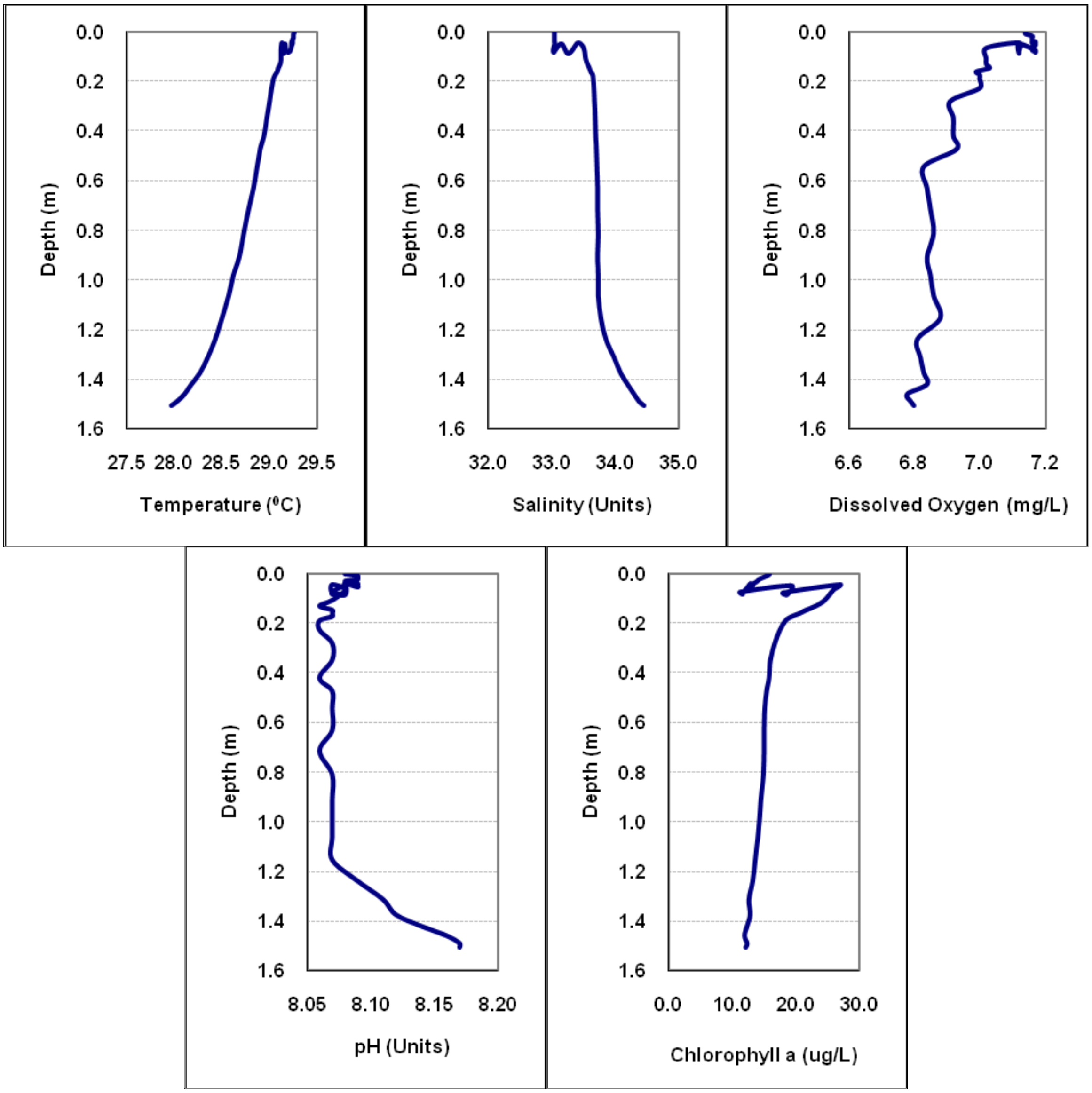

Figure 97: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-17.

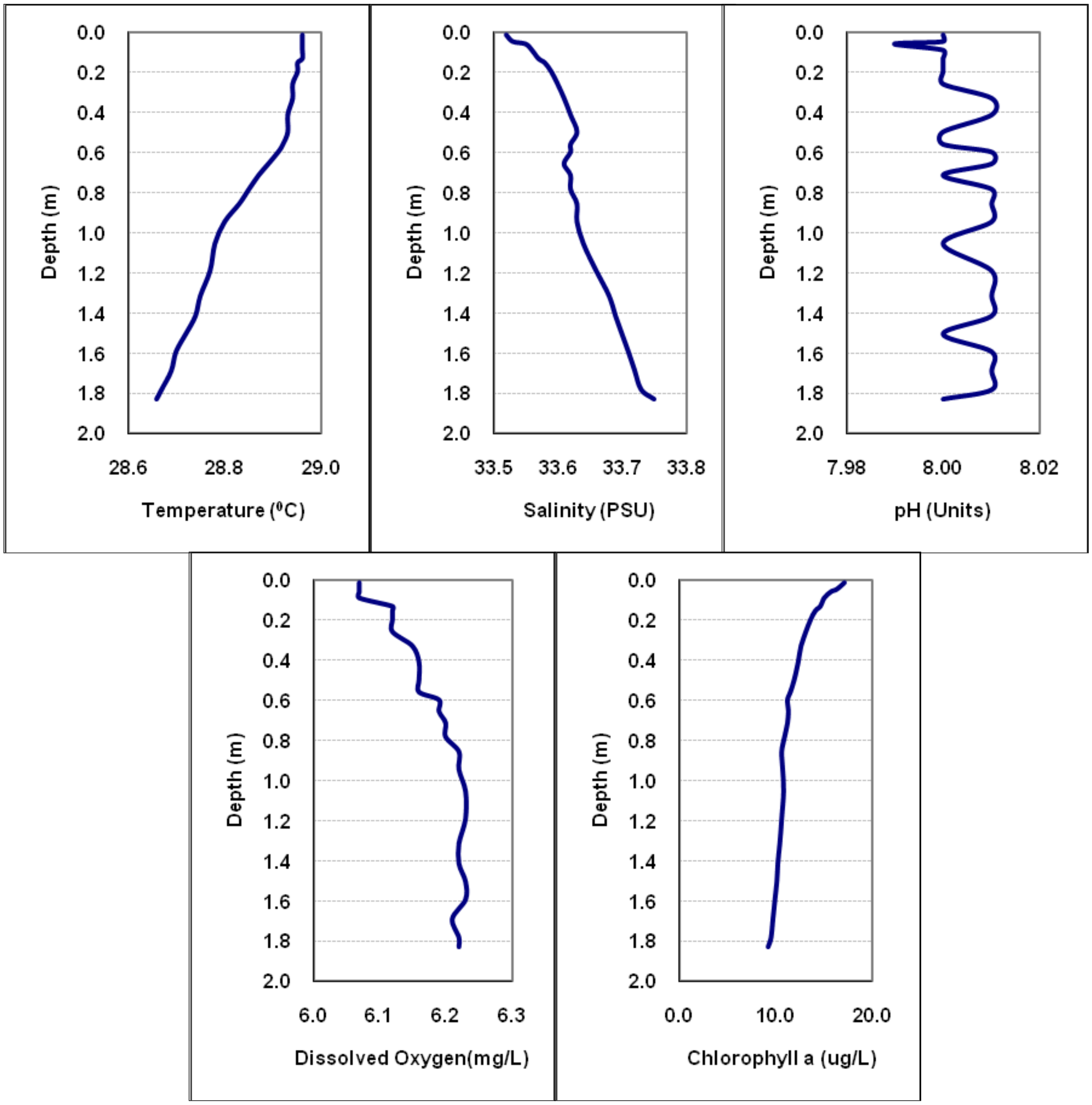

Figure 98: May 2008 Boynton-Delray water quality monitoring YSI cast at station BD-18.

9.6 July 2008

Water quality monitoring was conducted on July 11-13, 2008, from the RV *Walton Smith*. All stations were sampled for all water quality parameters listed in Table 2. Vertical water column profiles were collected using the ship's Sea-Bird 911 CTD; trip and equipment blanks were collected for the cruise. The times and dates of sample collection are listed in Table 26. Water quality data are listed in Tables 27-29, while water quality parameters are shown in Figures 99-110. Water column profiles are depicted in Figures 111-124.

The tides on July 11, 2008 were (04:46; 17:41) High and (11:55; 23:29) Low. On July 12, 2008, the tides were (05:38; 18:37) High and (00:26; 12:47) Low. During the Boynton Inlet and Lake Worth Lagoon sampling on July 13, 2008, the tides were (14:24; 01:53) High and (08:53; 21:10) Low. Seas were 2-3 feet during both days of sampling with winds out of the east at 5-10 knots. The Boynton Inlet and Lake Worth Lagoon samples were collected on July 13th by small boat on an outgoing tidal cycle. A total of five duplicates were collected for each of the water quality parameters sampled. The boil was not visible at the surface; therefore, sampling was conducted at the appropriate coordinates for the South Central outfall. The current was in a northerly direction but later changed to southerly.

Salinity values (Figure 99) varied from 35.97-36.39 salinity units for the reef and outfall sites, while the Boynton Inlet and Lake Worth Lagoon sites varied from 24.99-29.85 salinity units. Temperature values (Figure 100) ranged from 28.6-29.7°C over the reef and outfall, while values ranged from 28.6-29.5°C for the Boynton Inlet and Lake Worth Lagoon. The pH values (Figure 101) ranged from 8.03-8.21 units over the reef and outfall, while values ranged from 8.05-8.29 units in the Boynton Inlet and Lake Worth Lagoon. Chlorophyll-a values (Figure 102) ranged from 0.090-0.307 µg/L for the reef and outfall sites, while values varied from 4.63-6.07 µg/L for the Boynton Inlet and Lake Worth Lagoon sites. Chlorophyll samples for BD-4 were no good. TSS values (Figure 103) ranged from 0.10-0.44 mg/L over the reef and outfall, while values ranged from 1.08-2.12 mg/L for the Boynton Inlet and Lake Worth Lagoon.

NO_3-N+NO_2-N values (Figure 104) ranged from BDL to 0.21 µM over the reef and outfall, while values ranged from 1.70-10.10 µM in the Boynton Inlet and Lake Worth Lagoon. NH_4-N values (Figure 105) ranged from 0.11-1.08 µM for the reef and outfall sites, while the values for the Boynton Inlet and Lake Worth Lagoon varied from 0.41-3.62 µM. Ortho-PO_4-P values (Figure 106) were BDL for the reef and outfall areas, while values ranged from BDL to 0.31 µM for the Boynton Inlet and Lake Worth Lagoon. SiO_4-Si values (Figure 107) ranged from BDL to 2.20 µM over the reef and outfall sites, while the Boynton Inlet and Lake Worth Lagoon values ranged from 5.90-23.12 µM. TDN values (Figure 108) ranged from 4.02-13.22 µM for the reef and outfall stations, while the Boynton Inlet and Lake Worth Lagoon stations varied from 13.63-30.66 µM. TDP values (Figure 109) ranged from BDL to 0.11 µM over the reef and outfall area, while values varied from 0.02-0.66 µM for the Boynton Inlet and Lake Worth Lagoon. TDN sample BD-1A and TDP samples for BD-12A and BD-18A were no good. DOC values (Figure 110) ranged from 36.80-68.96 µM for the reef and outfall sites, while the Boynton Inlet and Lake Worth Lagoon sites ranged from 157.70-277.04 µM. DOC sample BD-1A was no good.

Water column profiles were collected for stations BD-1 through BD-15. No profiles were collected during small boat operations to collect inlet samples (BD-13, BD-16 to BD-18). Only minor changes were observed in the water column profiles for the water quality parameters measured. pH and turbidity profiles were not collected because the RV *Walton Smith's* CTD system does not have probes to measure these two parameters.

Table 26: Dates and times of water sample collection for July 2008.

Date	Time (local)	Station	Latitude	Longitude	Depth (m)
7/11/2008	08:51	BD-1A	26.42550	-80.04545	4
7/11/2008	08:51	BD-1B	26.42550	-80.04545	17
7/11/2008	08:51	BD-1C	26.42550	-80.04545	29
7/11/2008	09:19	BD-2A	26.44201	-80.04729	3
7/11/2008	09:19	BD-2B	26.44201	-80.04729	7
7/11/2008	09:19	BD-2C	26.44201	-80.04729	15
7/11/2008	09:45	BD-3A	26.45828	-80.04247	3
7/11/2008	09:45	BD-3B	26.45828	-80.04247	8
7/11/2008	09:45	BD-3C	26.45828	-80.04247	18
7/12/2008	08:43	BD-4A	26.46192	-80.04195	4
7/11/2008	08:43	BD-4B	26.46192	-80.04195	7
7/11/2008	08:43	BD-4C	26.46192	-80.04195	17
7/11/2008	08:43	BD-4D	26.46192	-80.04195	28
7/11/2008	21:31	BD-5A	26.46620	-80.04167	3
7/11/2008	21:31	BD-5B	26.46620	-80.04167	12
7/11/2008	21:31	BD-5C	26.46620	-80.04167	24
7/11/2008	21:57	BD-6A	26.47532	-80.03976	3
7/11/2008	21:57	BD-6B	26.47532	-80.03976	6
7/11/2008	21:57	BD-6C	26.47532	-80.03976	11
7/11/2008	22:19	BD-7A	26.48737	-80.03871	3
7/11/2008	22:19	BD-7B	26.48737	-80.03871	10
7/11/2008	22:19	BD-7C	26.48737	-80.03871	22
7/11/2008	22:43	BD-8A	26.51507	-80.03542	3
7/11/2008	22:43	BD-8B	26.51507	-80.03542	11
7/11/2008	22:43	BD-8C	26.51507	-80.03542	19
7/11/2008	23:13	BD-9A	26.50838	-80.04129	3
7/11/2008	23:13	BD-9B	26.50838	-80.04129	7
7/11/2008	23:13	BD-9C	26.50838	-80.04129	14
7/11/2008	23:43	BD-10A	26.52261	-80.03223	3
7/11/2008	23:43	BD-10B	26.52261	-80.03223	10
7/11/2008	23:43	BD-10C	26.52261	-80.03223	16
7/12/2008	00:19	BD-11A	26.53333	-80.03584	3
7/12/2008	00:19	BD-11B	26.53333	-80.03584	5
7/12/2008	00:19	BD-11C	26.53333	-80.03584	11
7/12/2008	00:47	BD-12A	26.53874	-80.03980	3
7/12/2008	00:47	BD-12B	26.53874	-80.03980	4
7/12/2008	00:47	BD-12C	26.53874	-80.03980	10
7/13/2008	09:22	BD-13A	26.54542	-80.04300	0
7/12/2008	01:47	BD-14A	26.54242	-80.03996	3
7/12/2008	01:47	BD-14C	26.54242	-80.03996	6
7/12/2008	01:18	BD-15A	26.55919	-80.03329	3
7/12/2008	01:18	BD-15B	26.55919	-80.03329	4
7/12/2008	01:18	BD-15C	26.55919	-80.03329	9
7/13/2008	09:15	BD-16A	26.54618	-80.04791	0
7/13/2008	08:50	BD-17A	26.54264	-80.04790	0
7/13/2008	80:30	BD-18A	26.53950	-80.04951	0

Table 27: July 2008 Boynton-Delray nutrient and DOC values in µM.

Station	Depth (m)	N+N (µM)	NH_4 (µM)	P (µM)	Si (µM)	TDN (µM)	TDP (µM)	DOC (µM)
BD-1A	4	0.13	0.24	BDL	BDL	N/A	0.01	N/A
BD-1B	17	0.16	0.67	BDL	BDL	6.71	0.01	64.03
BD-1C	29	0.05	0.67	BDL	BDL	8.14	0.06	50.37
BD-2A	3	BDL	0.72	BDL	BDL	6.43	0.04	74.33
BD-2B	7	BDL	0.70	BDL	BDL	7.61	0.10	63.88
BD-2C	15	BDL	0.72	BDL	BDL	7.35	0.04	58.36
BD-3A	3	BDL	0.66	BDL	BDL	7.53	0.04	54.69
BD-3B	8	0.06	0.65	BDL	BDL	4.96	0.02	56.80
BD-3C	18	0.11	1.08	BDL	0.32	6.92	0.05	56.09
BD-4A	4	0.18	0.72	BDL	0.64	5.92	0.04	62.63
BD-4B	7	0.08	0.11	BDL	0.86	5.33	BDL	51.42
BD-4C	17	0.07	0.34	BDL	1.70	5.63	BDL	53.78
BD-4D	28	0.12	0.63	BDL	2.20	5.25	0.01	57.40
BD-5A	3	0.12	0.64	BDL	2.20	4.02	0.10	43.48
BD-5B	12	BDL	0.53	BDL	1.90	5.33	0.04	56.90
BD-5C	24	BDL	0.62	BDL	1.90	13.22	0.02	57.80
BD-6A	3	0.09	0.80	BDL	2.10	6.22	0.02	58.00
BD-6B	6	BDL	0.53	BDL	1.50	10.12	0.05	48.00
BD-6C	11	BDL	0.51	BDL	1.50	5.98	0.04	44.29
BD-7A	3	0.18	0.69	BDL	1.40	4.76	0.07	41.02
BD-7B	10	0.07	0.73	BDL	1.20	6.41	0.05	50.01
BD-7C	22	BDL	0.75	BDL	1.00	8.64	0.02	45.79
BD-8A	3	0.05	0.83	BDL	1.20	5.74	0.05	42.38
BD-8B	11	0.08	1.08	BDL	0.94	5.80	0.02	65.24
BD-8C	19	0.07	0.77	BDL	0.97	6.22	BDL	49.96
BD-9A	3	0.07	0.79	BDL	0.80	6.13	0.05	54.29
BD-9B	7	BDL	0.70	BDL	0.78	5.99	0.01	49.86
BD-9C	14	0.07	0.74	BDL	0.75	5.78	0.04	44.59
BD-10A	3	BDL	0.91	BDL	0.61	6.67	0.05	47.80
BD-10B	10	0.21	0.90	BDL	0.70	6.24	0.01	50.87
BD-10C	16	0.09	0.83	BDL	1.10	6.06	0.06	52.38
BD-11A	3	0.07	0.82	BDL	1.30	6.36	0.04	45.89
BD-11B	5	0.05	0.75	BDL	1.10	7.37	BDL	51.47
BD-11C	11	BDL	0.73	BDL	1.10	7.98	BDL	48.31
BD-12A	3	0.11	0.63	BDL	1.00	6.47	0.05	39.81
BD-12B	4	BDL	0.57	BDL	1.00	5.94	0.01	36.80
BD-12C	10	BDL	0.23	BDL	BDL	4.99	N/A	63.88
BD-13A	0	9.00	1.18	0.10	13.40	17.98	0.02	176.54
BD-14A	3	BDL	0.26	BDL	0.92	7.26	0.04	68.56
BD-14C	6	BDL	0.25	BDL	0.96	5.86	0.04	57.50
BD-15A	3	0.08	0.34	BDL	1.00	6.21	0.01	47.15
BD-15B	4	0.08	0.24	BDL	1.00	6.87	BDL	55.49
BD-15C	9	BDL	0.23	BDL	1.00	5.93	0.11	68.96
BD-16A	0	10.10	0.41	BDL	5.90	13.63	0.66	157.70
BD-17A	0	1.70	3.62	0.31	23.10	30.66	0.56	277.04
BD-18A	0	1.96	2.11	0.29	22.80	24.37	N/A	265.89

Table 28: July 2008 Boynton-Delray nutrient and DOC values in mg/L.

Station	Depth (m)	N+N (mg/L)	NH_4 (mg/L)	P (mg/L)	Si (mg/L)	TDN (mg/L)	TDP (mg/L)	DOC (mg/L)
BD-1A	4	0.002	0.003	BDL	BDL	N/A	BDL	N/A
BD-1B	17	0.002	0.009	BDL	BDL	0.09	BDL	0.90
BD-1C	29	0.001	0.009	BDL	BDL	0.11	0.002	0.71
BD-2A	3	BDL	0.010	BDL	BDL	0.09	0.001	1.04
BD-2B	7	BDL	0.010	BDL	BDL	0.11	0.003	0.89
BD-2C	15	BDL	0.010	BDL	BDL	0.10	0.001	0.82
BD-3A	3	BDL	0.009	BDL	BDL	0.11	0.001	0.77
BD-3B	8	0.001	0.009	BDL	BDL	0.07	0.001	0.80
BD-3C	18	0.002	0.015	BDL	0.009	0.10	0.001	0.79
BD-4A	4	0.003	0.010	BDL	0.018	0.08	0.001	0.88
BD-4B	7	0.001	0.002	BDL	0.024	0.07	BDL	0.72
BD-4C	17	0.001	0.005	BDL	0.048	0.08	BDL	0.75
BD-4D	28	0.031	0.009	BDL	1.607	0.07	BDL	0.80
BD-5A	3	0.002	0.009	BDL	0.062	0.06	0.003	0.61
BD-5B	12	BDL	0.007	BDL	0.053	0.07	0.001	0.80
BD-5C	24	BDL	0.009	BDL	0.053	0.19	0.001	0.81
BD-6A	3	0.001	0.011	BDL	0.059	0.09	0.001	0.81
BD-6B	6	BDL	0.007	BDL	0.042	0.14	0.001	0.67
BD-6C	11	BDL	0.007	BDL	0.042	0.08	0.001	0.62
BD-7A	3	0.003	0.010	BDL	0.039	0.07	0.002	0.57
BD-7B	10	0.001	0.010	BDL	0.034	0.09	0.001	0.70
BD-7C	22	BDL	0.011	BDL	0.028	0.12	0.001	0.64
BD-8A	3	0.001	0.012	BDL	0.034	0.08	0.001	0.59
BD-8B	11	0.001	0.015	BDL	0.026	0.08	0.001	0.91
BD-8C	19	0.001	0.011	BDL	0.027	0.09	BDL	0.70
BD-9A	3	0.001	0.011	BDL	0.022	0.09	0.001	0.76
BD-9B	7	BDL	0.010	BDL	0.022	0.08	BDL	0.70
BD-9C	14	0.001	0.010	BDL	0.021	0.08	0.001	0.62
BD-10A	3	BDL	0.013	BDL	0.017	0.09	0.001	0.67
BD-10B	10	0.003	0.013	BDL	0.020	0.09	BDL	0.71
BD-10C	16	0.001	0.012	BDL	0.031	0.08	0.002	0.73
BD-11A	3	0.001	0.012	BDL	0.036	0.09	0.001	0.64
BD-11B	5	0.001	0.010	BDL	0.031	0.10	BDL	0.72
BD-11C	11	BDL	0.010	BDL	0.031	0.11	BDL	0.68
BD-12A	3	0.002	0.009	BDL	0.028	0.09	0.001	0.56
BD-12B	4	BDL	0.008	BDL	0.028	0.08	BDL	0.52
BD-12C	10	BDL	0.003	BDL	BDL	0.07	N/A	0.89
BD-13A	0	0.126	0.016	0.003	0.375	0.25	0.001	2.47
BD-14A	3	BDL	0.004	BDL	0.026	0.10	0.001	0.96
BD-14C	6	BDL	0.003	BDL	0.027	0.08	0.001	0.81
BD-15A	3	0.001	0.005	BDL	0.028	0.09	BDL	0.66
BD-15B	4	0.001	0.003	BDL	0.028	0.10	BDL	0.59
BD-15C	9	BDL	0.003	BDL	0.028	0.08	0.003	0.97
BD-16A	0	0.141	0.006	BDL	0.165	0.19	0.020	2.21
BD-17A	0	0.024	0.051	0.010	0.647	0.43	0.017	3.88
BD-18A	0	0.027	0.030	0.009	0.638	0.33	N/A	4.05

Table 29: July 2008 Boynton-Delray salinity, pH, chlorophyll-a, phaeopigments, and TSS values.

Station	Depth (m)	Temperature (°C)	Salinity (units)	pH (units)	Chlorophyll-a (µg/L)	Phaeopigments (µg/L)	TSS (mg/L)
BD-1A	4	28.9	36.22	8.04	0.236	0.111	0.30
BD-1B	17	28.8	36.38	8.05	0.125	0.044	0.20
BD-1C	29	29.0	36.38	8.09	0.128	0.051	0.19
BD-2A	3	29.0	36.16	8.07	0.298	0.104	0.29
BD-2B	7	29.0	36.22	8.03	0.280	0.091	0.37
BD-2C	15	28.9	36.32	8.05	0.203	0.103	0.26
BD-3A	3	29.0	36.15	8.04	0.292	0.089	0.26
BD-3B	8	29.0	36.27	8.07	0.184	0.055	0.22
BD-3C	18	28.7	36.34	8.09	0.214	0.073	0.18
BD-4A	4	29.1	36.21	8.08	0.093	0.066	0.10
BD-4B	7	29.1	36.21	8.08	0.108	0.036	0.14
BD-4C	17	29.0	36.32	8.10	0.090	0.027	0.15
BD-4D	28	28.7	36.37	8.12	N/A	N/A	0.17
BD-5A	3	29.7	35.97	8.09	0.280	0.086	0.44
BD-5B	12	29.0	36.26	8.09	0.302	0.095	0.26
BD-5C	24	28.6	36.39	8.13	0.256	0.069	0.23
BD-6A	3	29.5	36.06	8.08	0.244	0.096	0.42
BD-6B	6	29.1	36.23	8.09	0.245	0.102	0.37
BD-6C	11	29.0	36.29	8.11	0.245	0.087	0.38
BD-7A	3	29.2	36.21	8.11	0.307	0.088	0.28
BD-7B	10	28.9	36.32	8.15	0.235	0.069	0.30
BD-7C	22	28.6	36.39	8.17	0.185	0.081	0.22
BD-8A	3	29.2	36.20	8.17	0.248	0.132	0.21
BD-8B	11	29.0	36.31	8.18	0.139	0.058	0.17
BD-8C	19	28.9	36.32	8.20	0.189	0.053	0.17
BD-9A	3	29.0	36.26	8.11	0.280	0.083	0.31
BD-9B	7	29.0	36.30	8.11	0.266	0.089	0.31
BD-9C	14	20.9	36.31	8.13	0.256	0.065	0.29
BD-10A	3	29.4	36.09	8.16	0.213	0.063	0.22
BD-10B	10	29.1	36.25	8.17	0.136	0.035	0.19
BD-10C	16	29.1	36.27	8.17	0.181	0.070	0.22
BD-11A	3	29.2	36.15	8.18	0.256	0.092	0.28
BD-11B	5	29.1	36.21	8.18	0.242	0.096	0.42
BD-11C	11	29.0	36.26	8.20	0.254	0.105	0.33
BD-12A	3	29.2	36.24	8.19	0.213	0.089	0.30
BD-12B	4	29.2	36.24	8.20	0.214	0.093	0.31
BD-12C	10	29.2	36.25	8.21	0.216	0.106	0.34
BD-13A	0	29.5	29.85	8.28	4.629	1.728	2.06
BD-14A	3	29.2	36.24	8.09	0.263	0.103	0.33
BD-14C	6	29.2	36.24	8.10	0.232	0.123	0.36
BD-15A	3	29.1	36.26	8.14	0.231	0.100	0.30
BD-15B	4	29.1	36.25	8.16	0.208	0.094	0.27
BD-15C	9	29.1	36.26	8.16	0.224	0.089	0.22
BD-16A	0	29.5	28.62	8.29	5.165	1.704	1.96
BD-17A	0	28.6	24.99	8.05	4.496	1.825	1.08
BD-18A	0	29.5	25.18	8.14	6.073	2.656	2.12

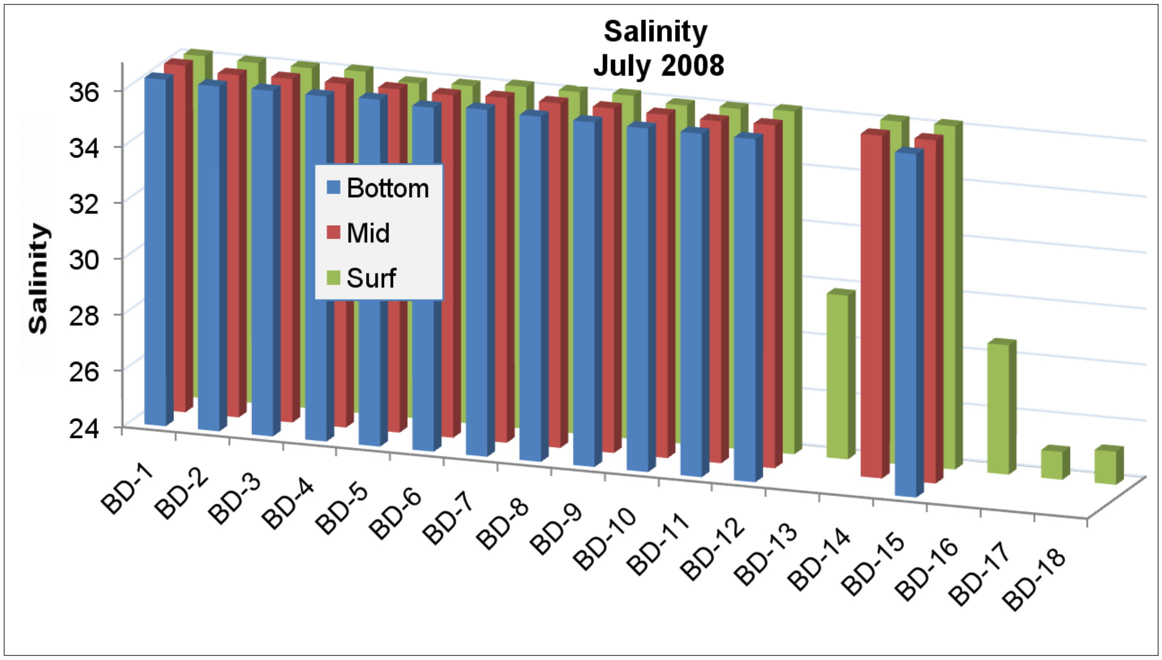

Figure 99: July 2008 salinity values for the Boynton-Delray water quality monitoring stations.

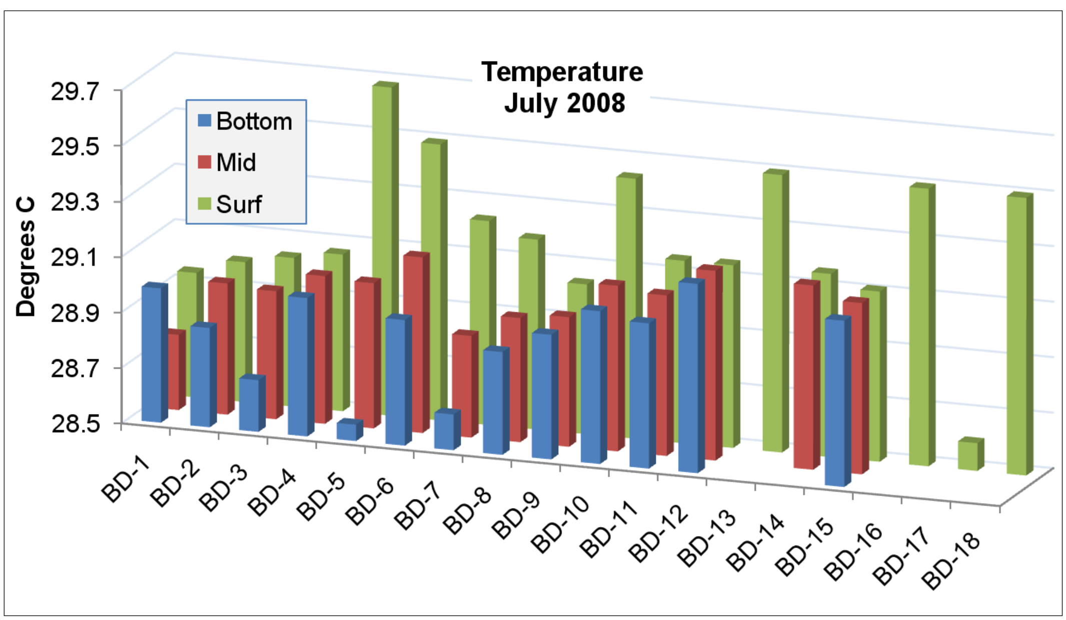

Figure 100: July 2008 temperature measurements for the Boynton-Delray water quality monitoring stations.

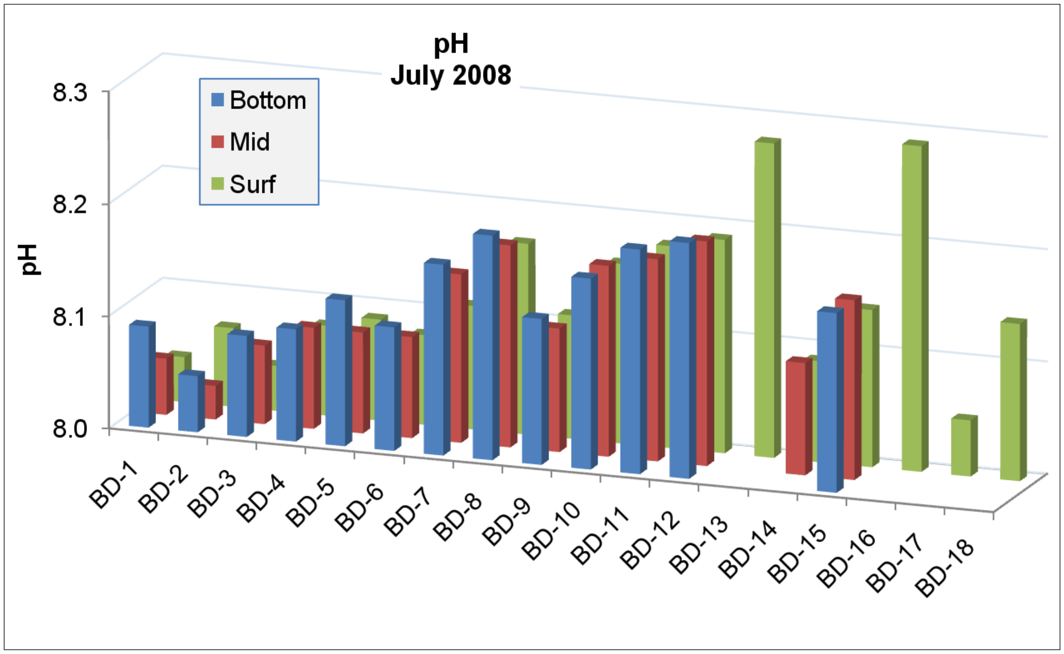

Figure 101: July 2008 pH measurements for the Boynton-Delray water quality monitoring stations.

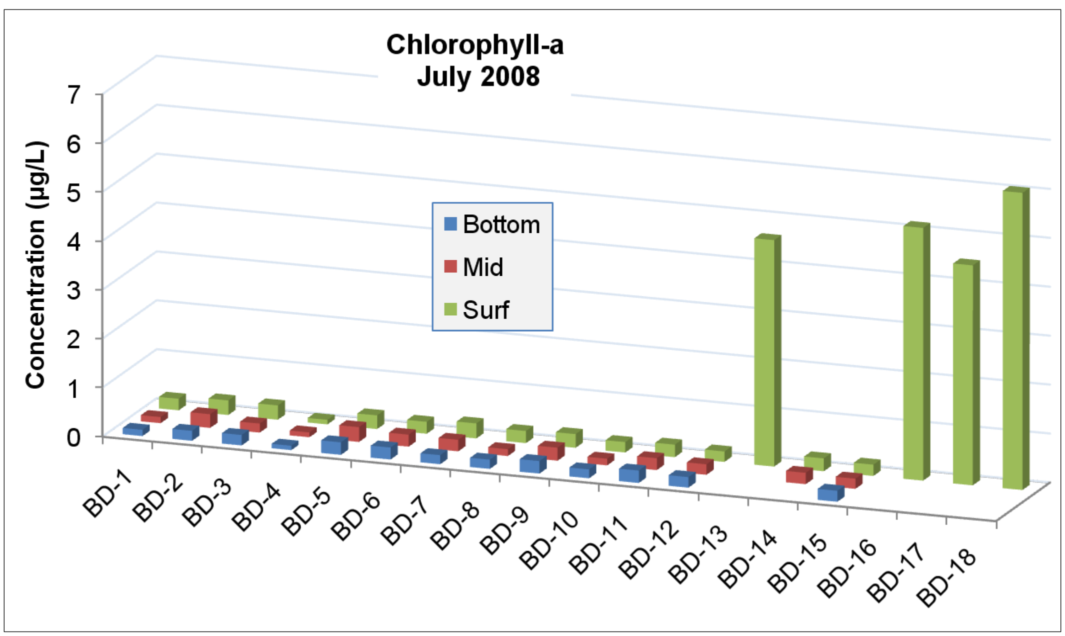

Figure 102: July 2008 chlorophyll-a concentrations for the Boynton-Delray water quality monitoring stations.

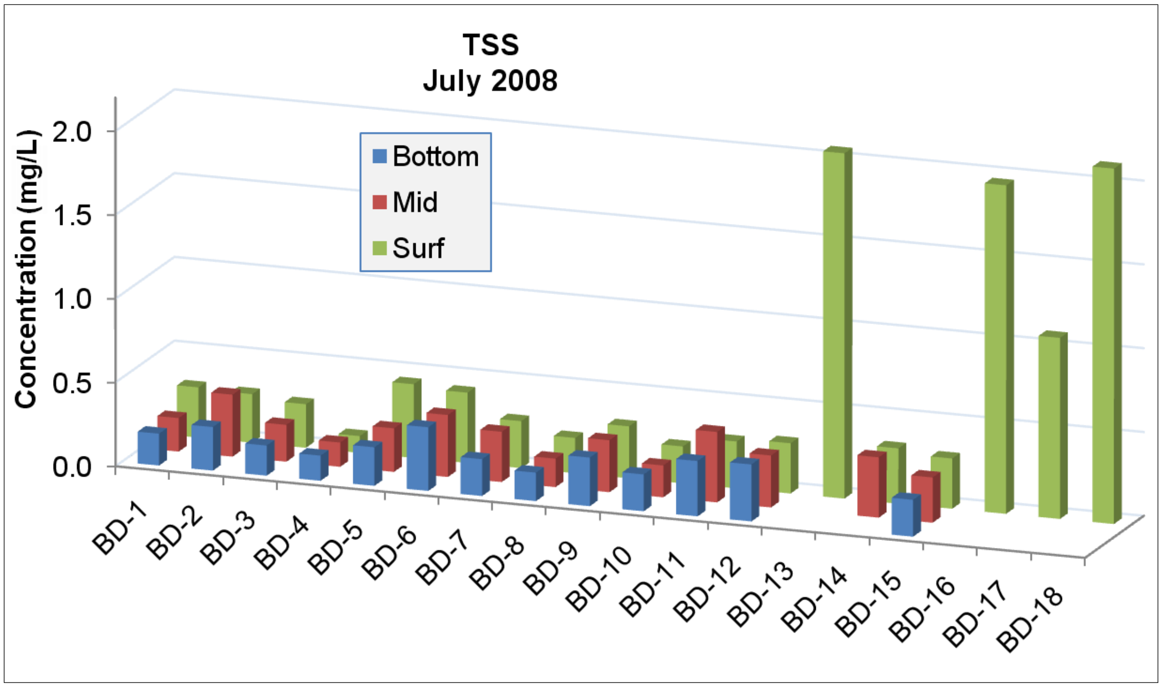

Figure 103: July 2008 total suspended solids concentrations for the Boynton-Delray water quality monitoring stations.

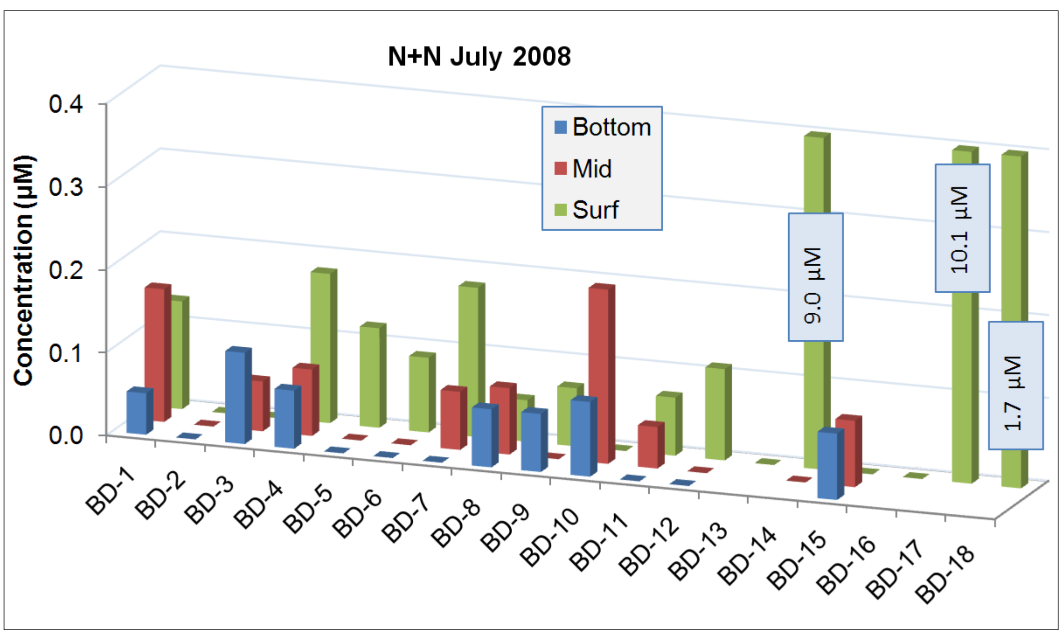

Figure 104: July 2008 nitrate+nitrite concentrations for the Boynton-Delray water quality monitoring stations. Concentrations higher than 0.4 µM are specifically denoted.

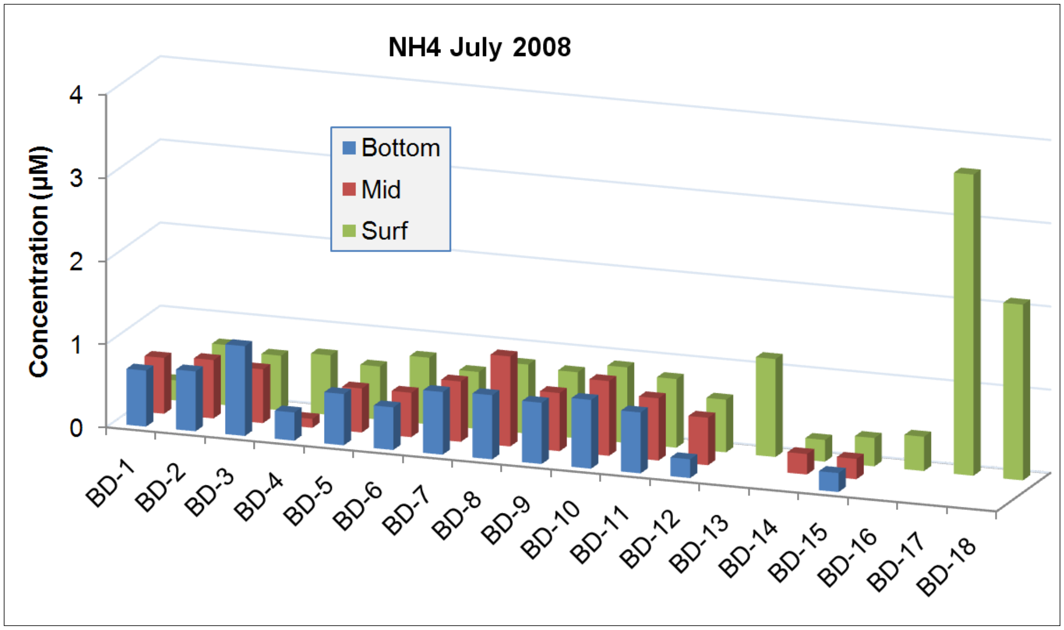

Figure 105: July 2008 ammonium concentrations for the Boynton-Delray water quality monitoring stations.

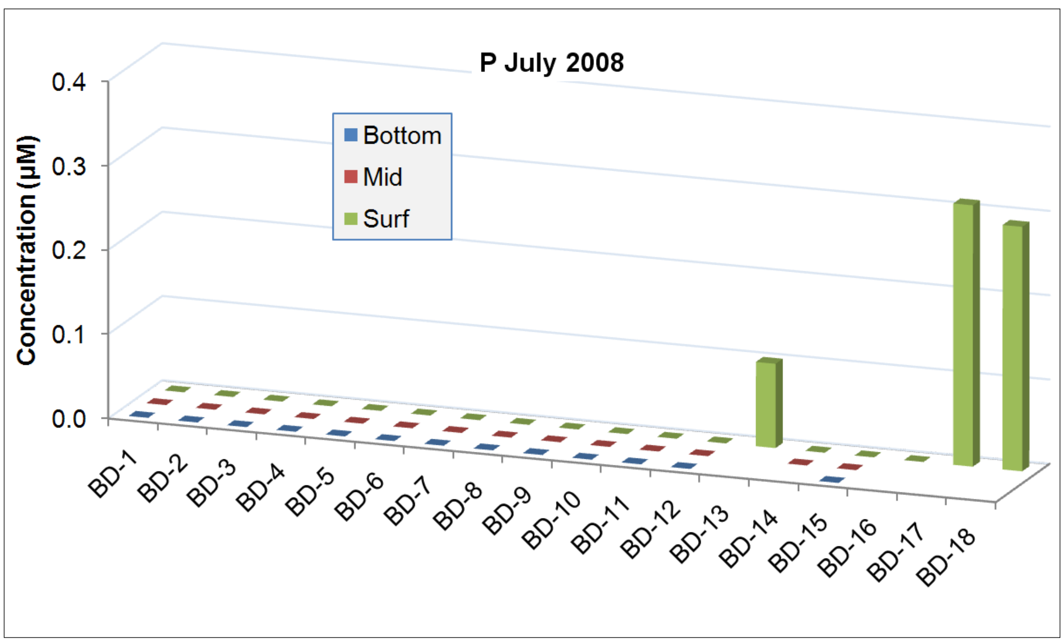

Figure 106: July 2008 orthophosphate concentrations for the Boynton-Delray water quality monitoring stations.

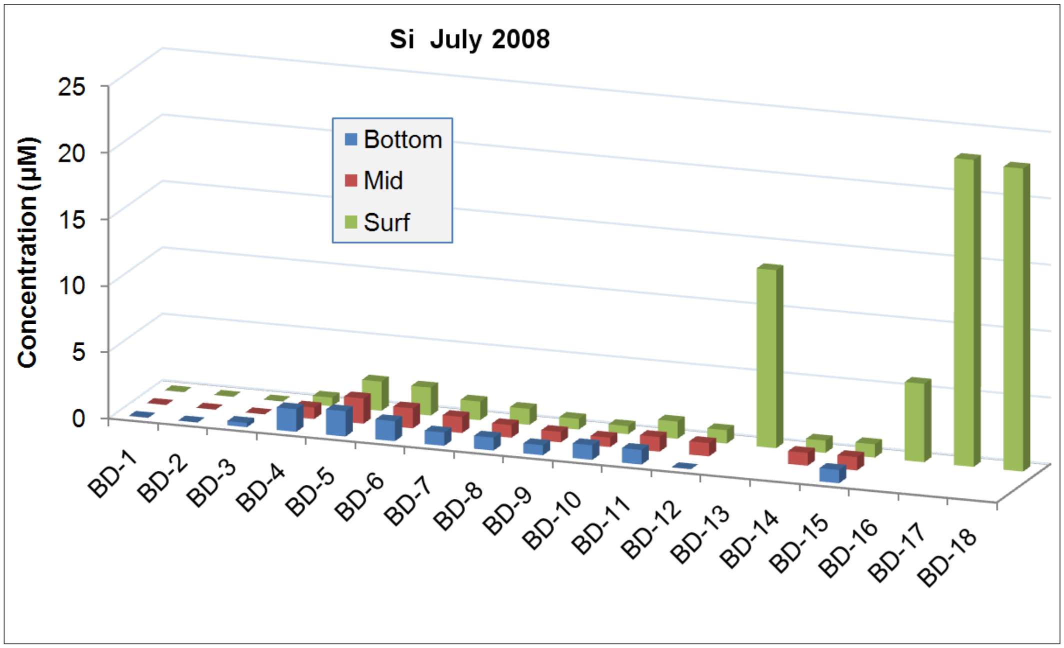

Figure 107: July 2008 silicate concentrations for the Boynton-Delray water quality monitoring stations.

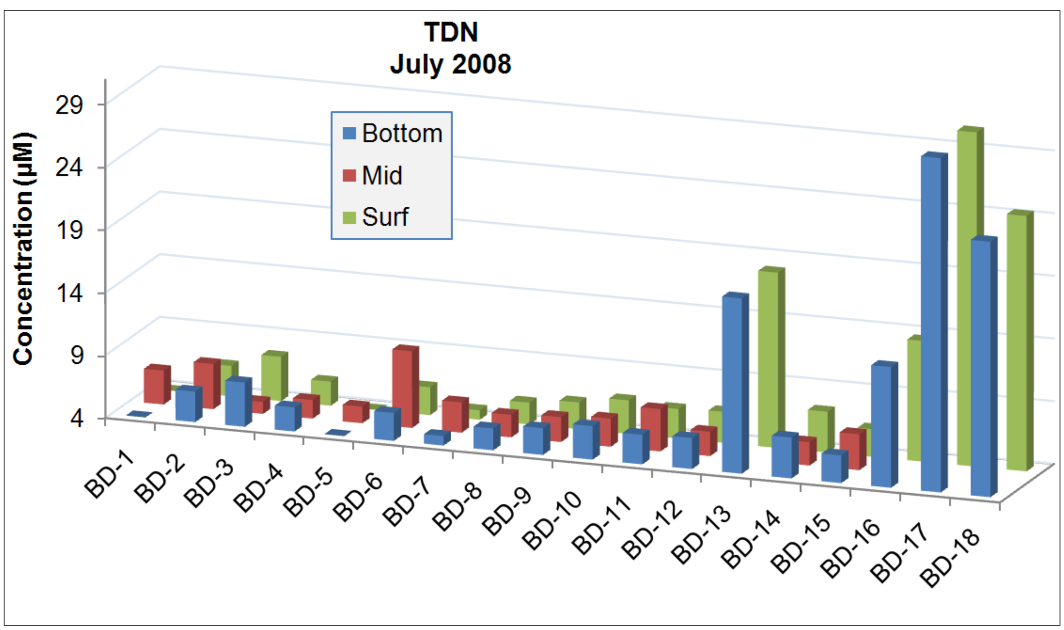

Figure 108: July 2008 total dissolved nitrogen concentrations for the Boynton-Delray water quality monitoring stations.

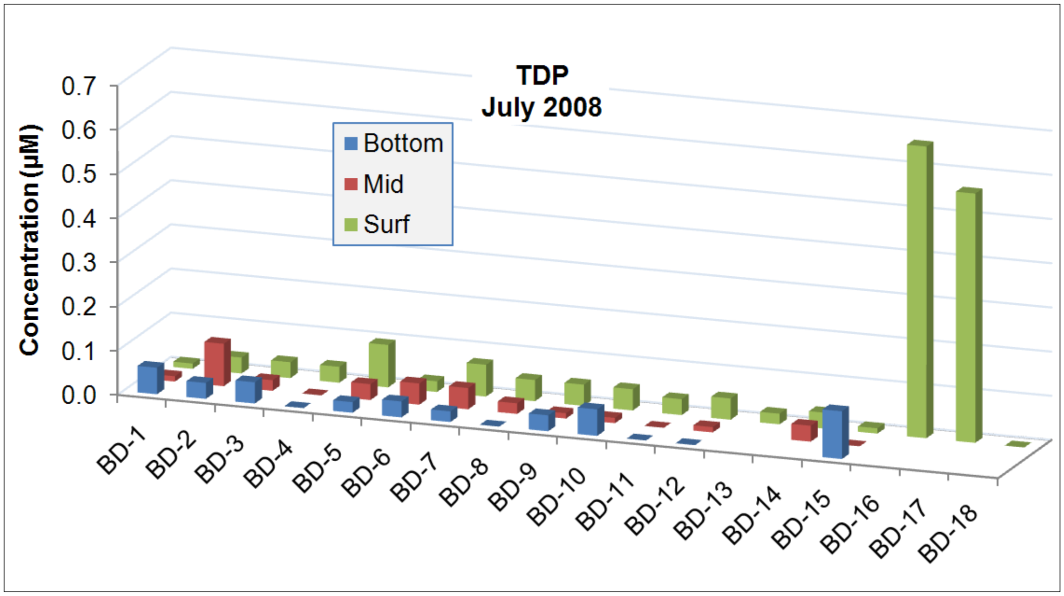

Figure 109: July 2008 total dissolved phosphorus concentrations for the Boynton-Delray water quality monitoring stations.

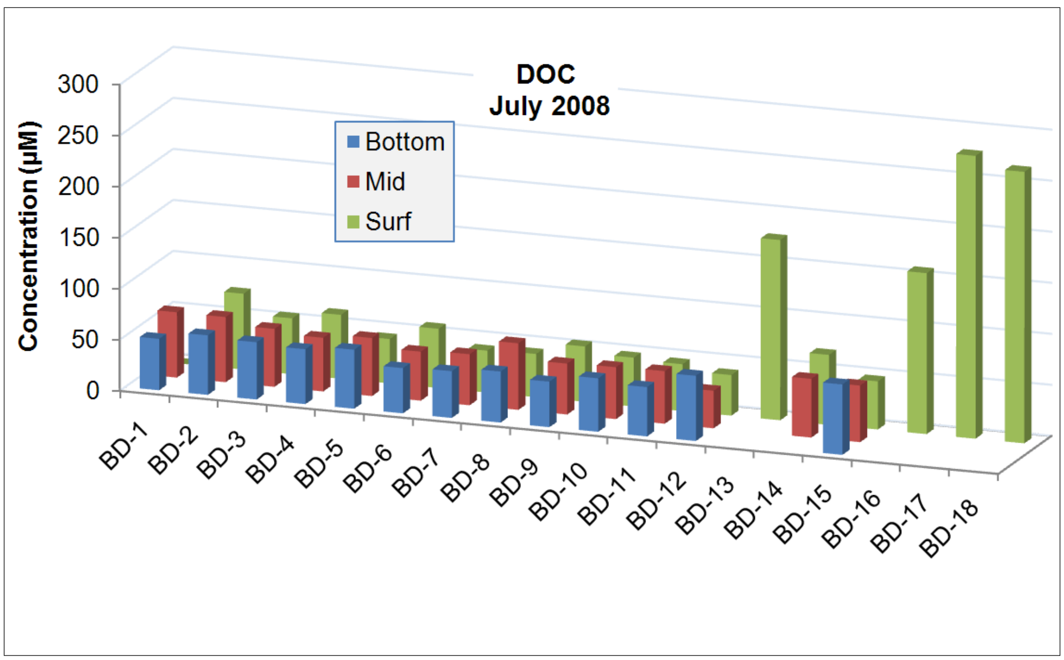

Figure 110: July 2008 dissolved organic carbon concentrations for the Boynton-Delray water quality monitoring stations.

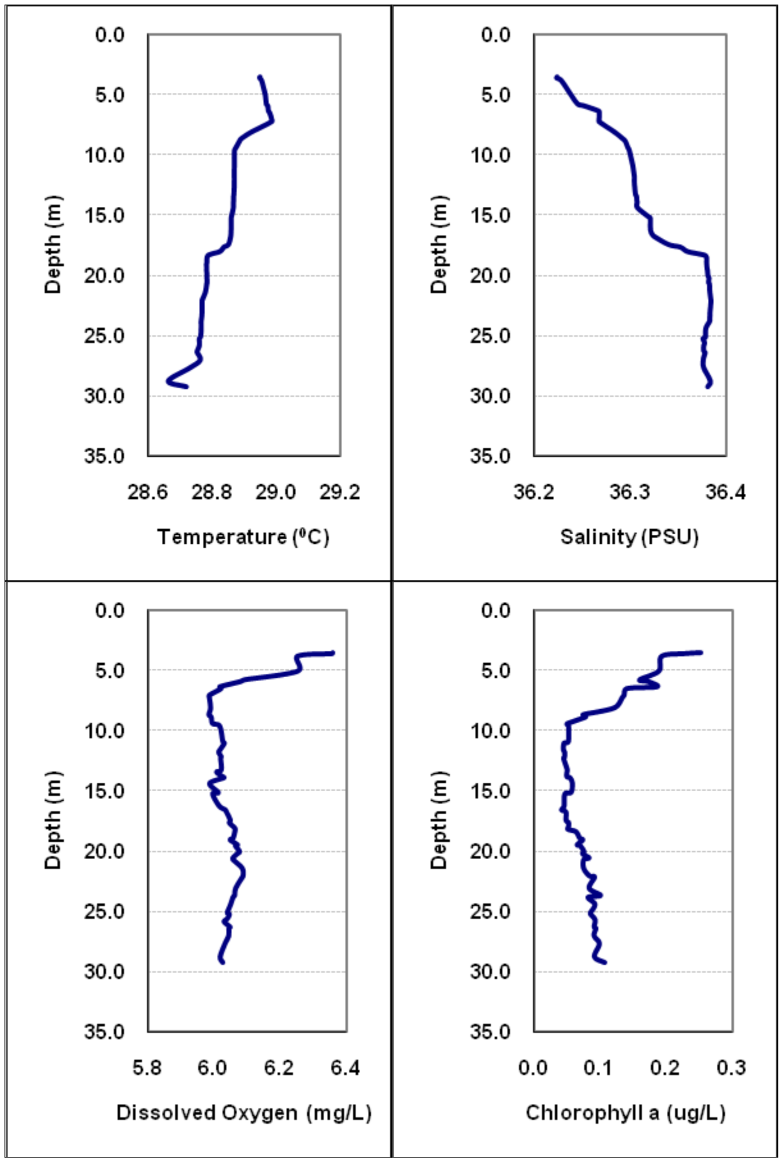

Figure 111: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-1.

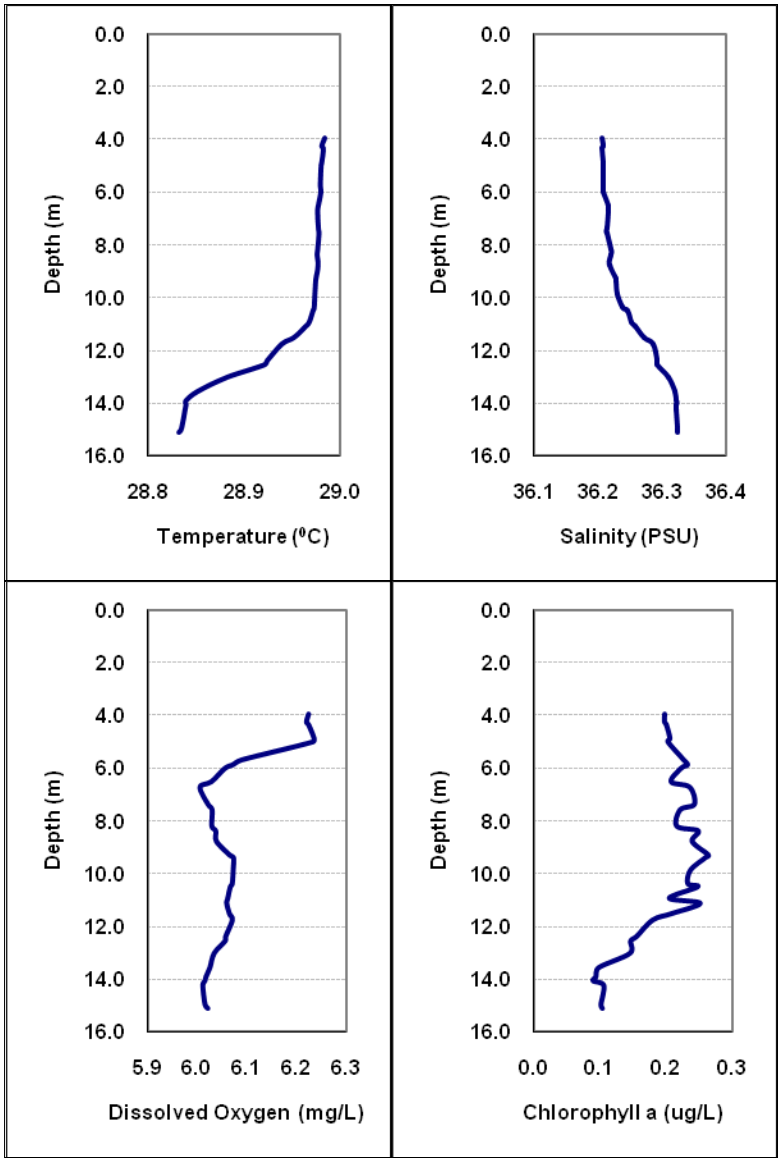

Figure 112: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-2.

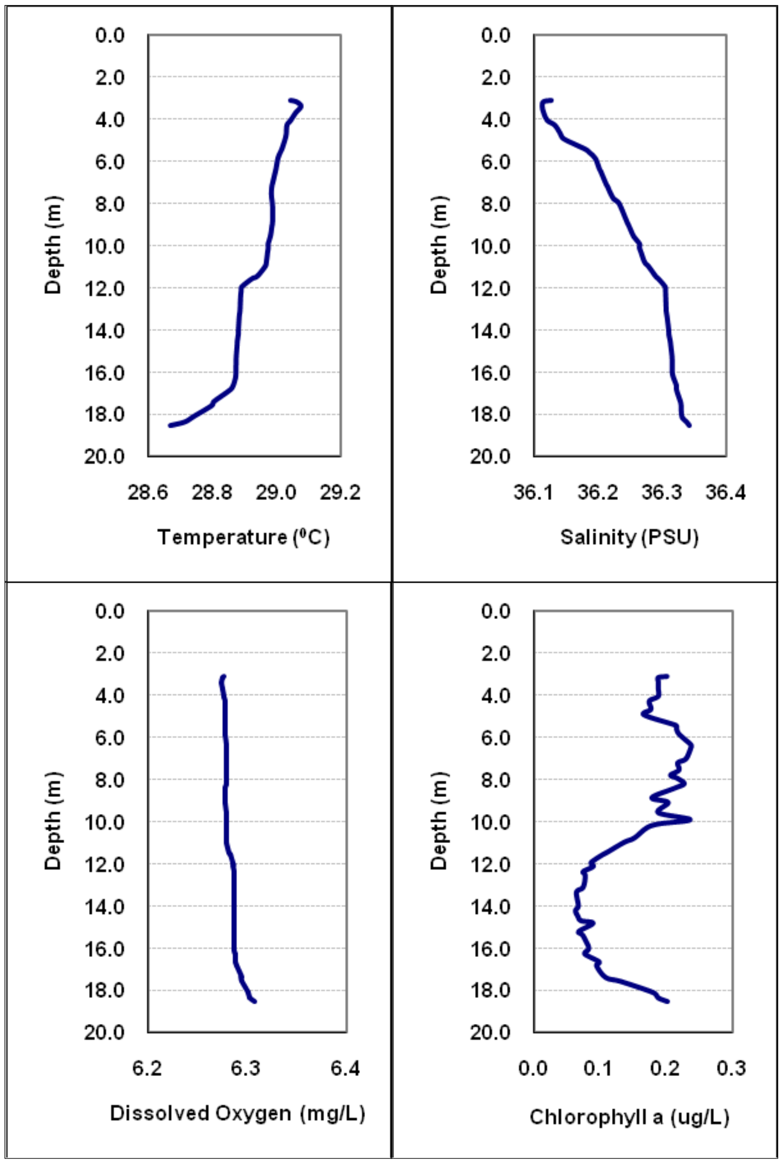

Figure 113: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-3.

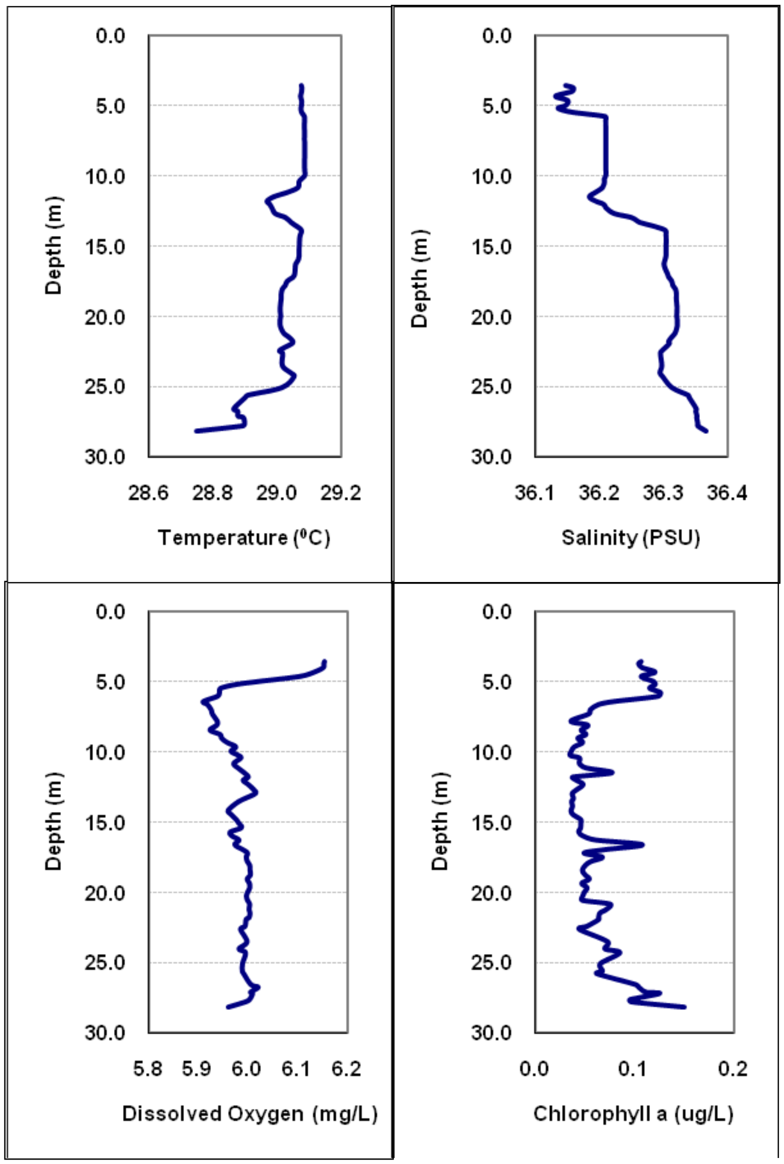

Figure 114: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-4.

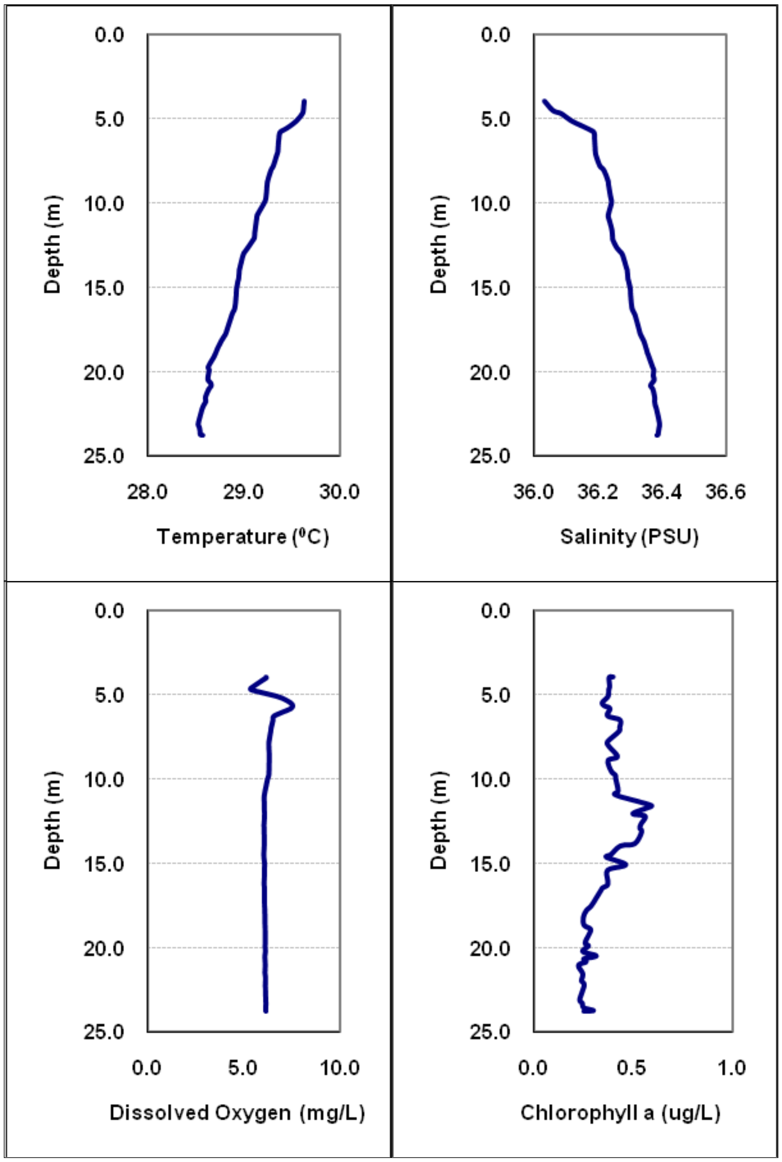

Figure 115: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-5.

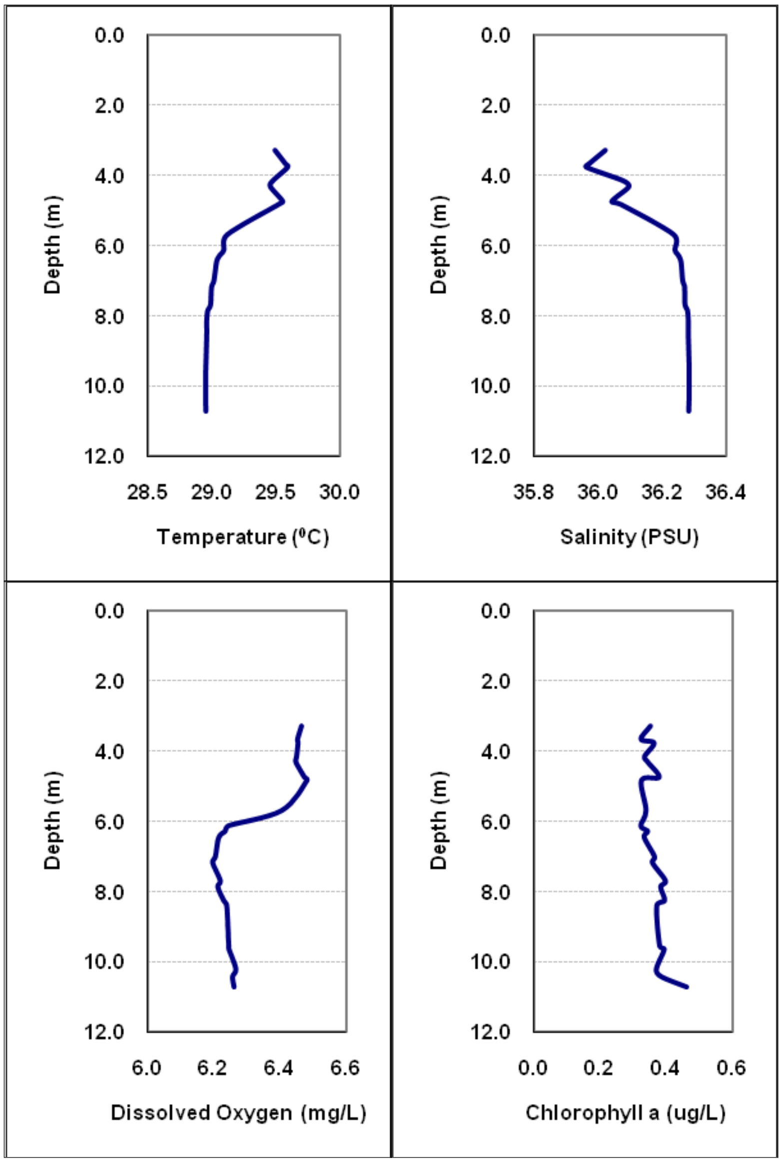

Figure 116: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-6.

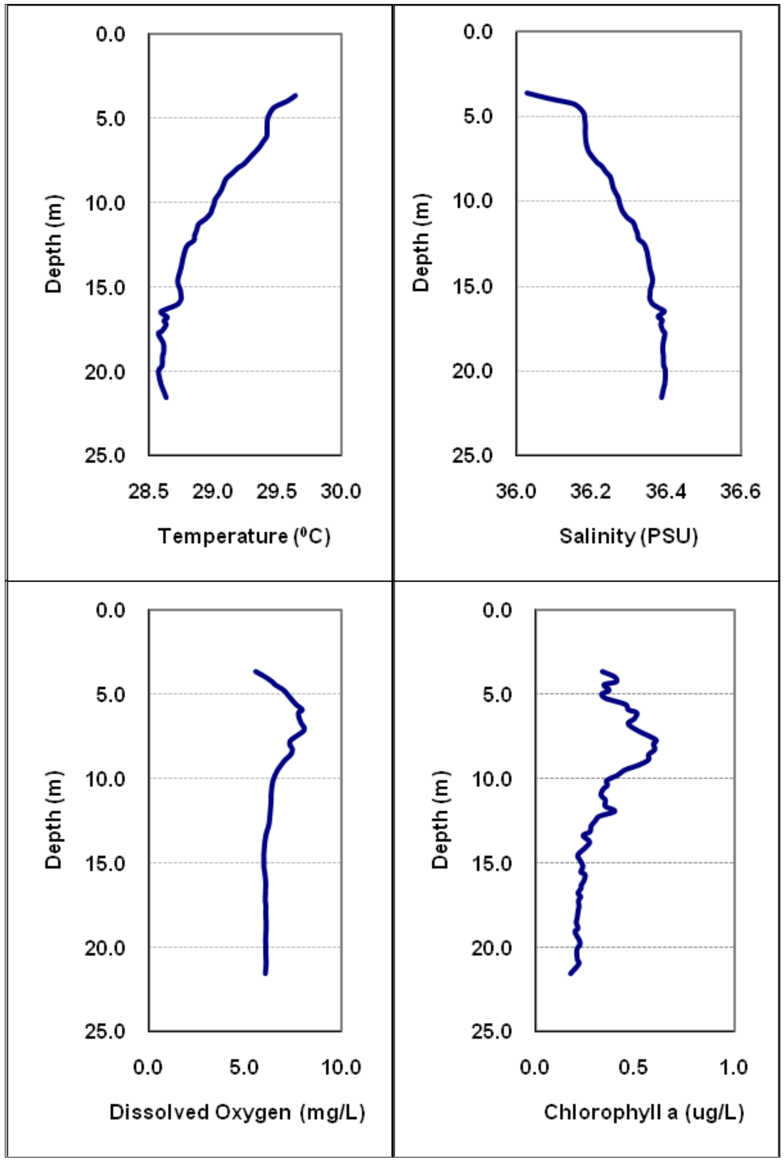

Figure 117: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-7.

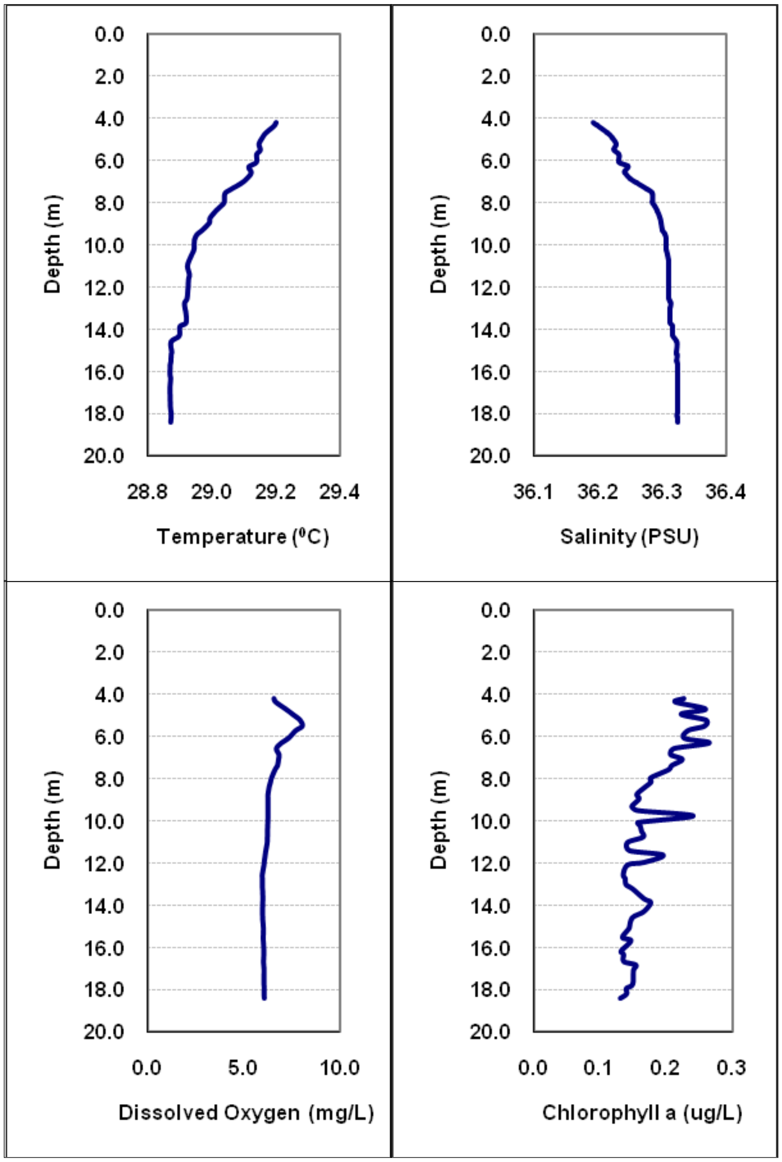

Figure 118: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-8.

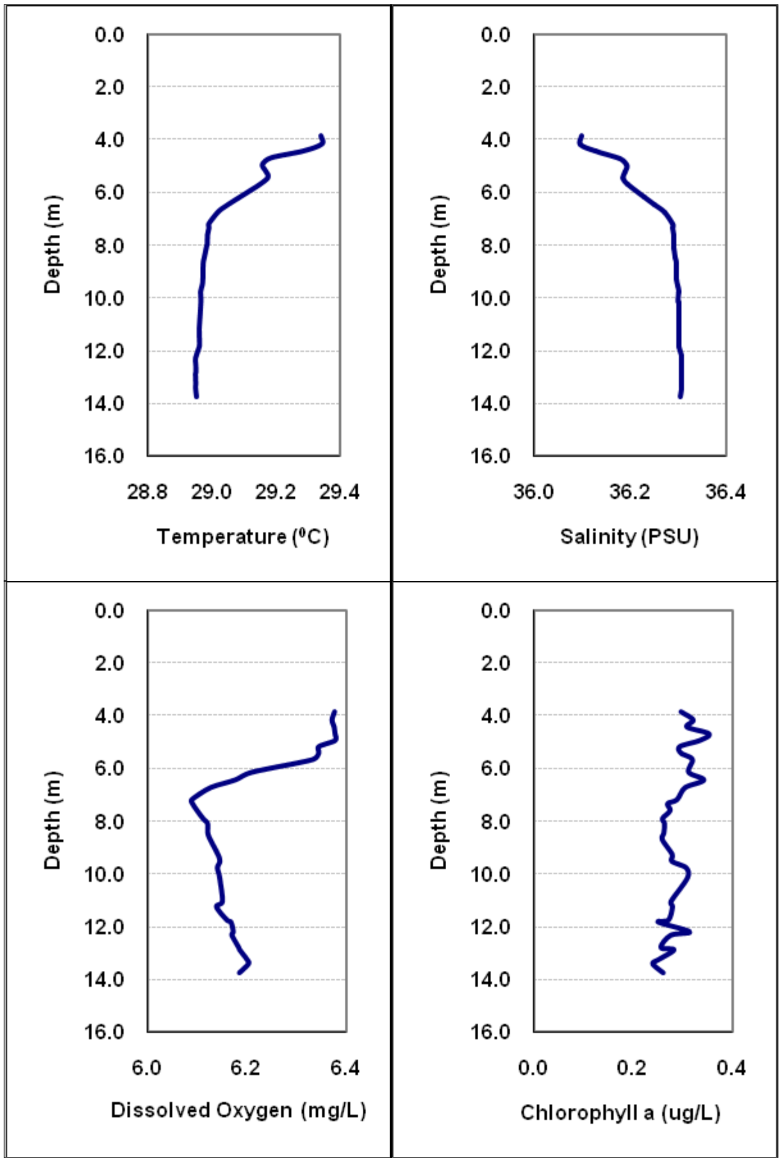

Figure 119: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-9.

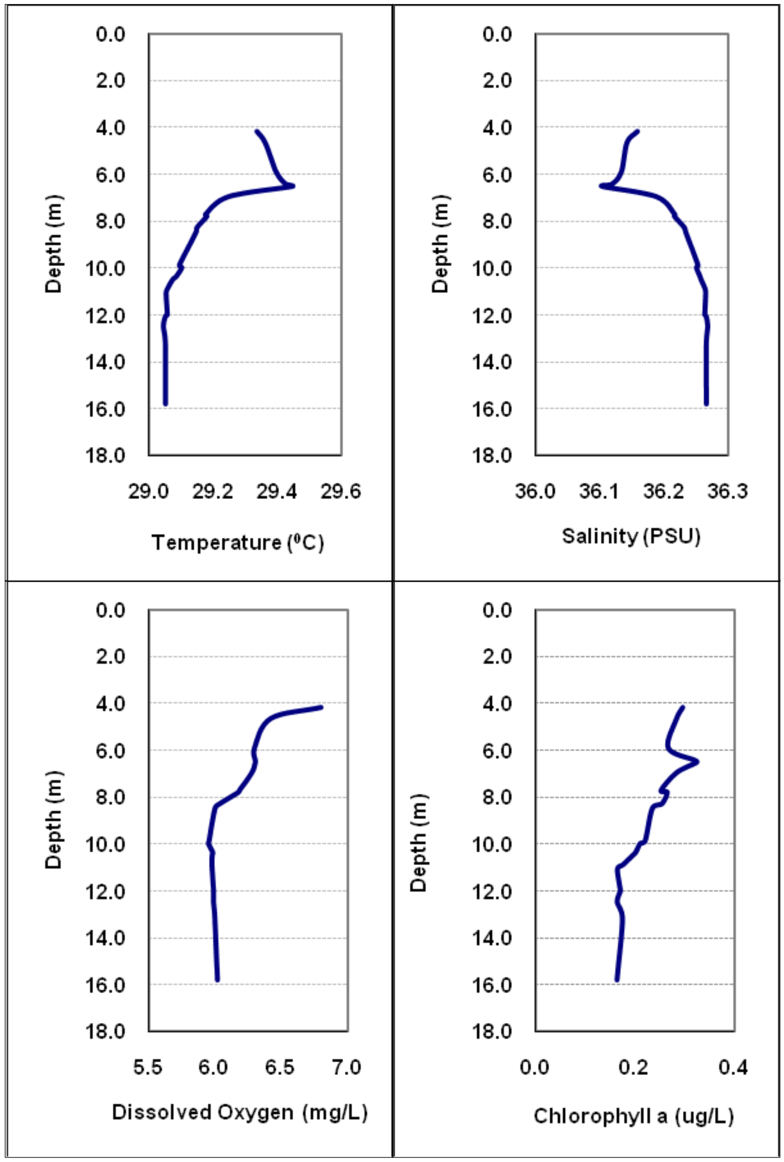

Figure 120: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-10.

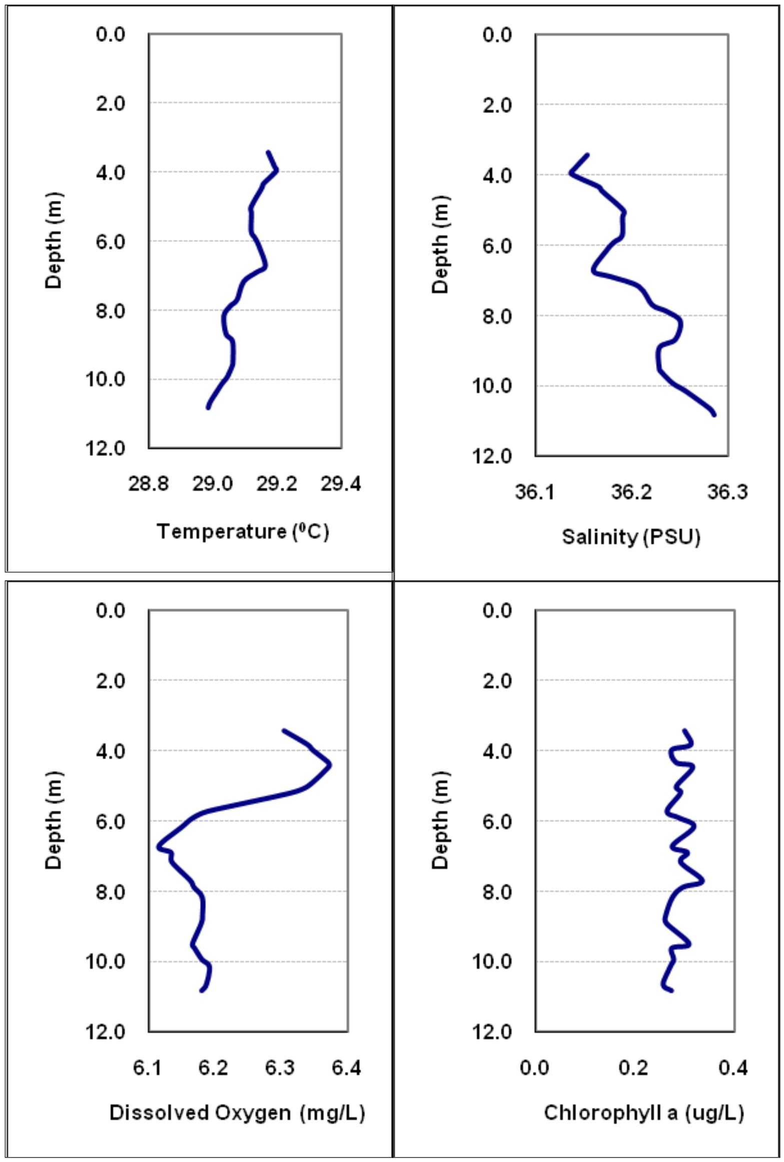

Figure 121: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-11.

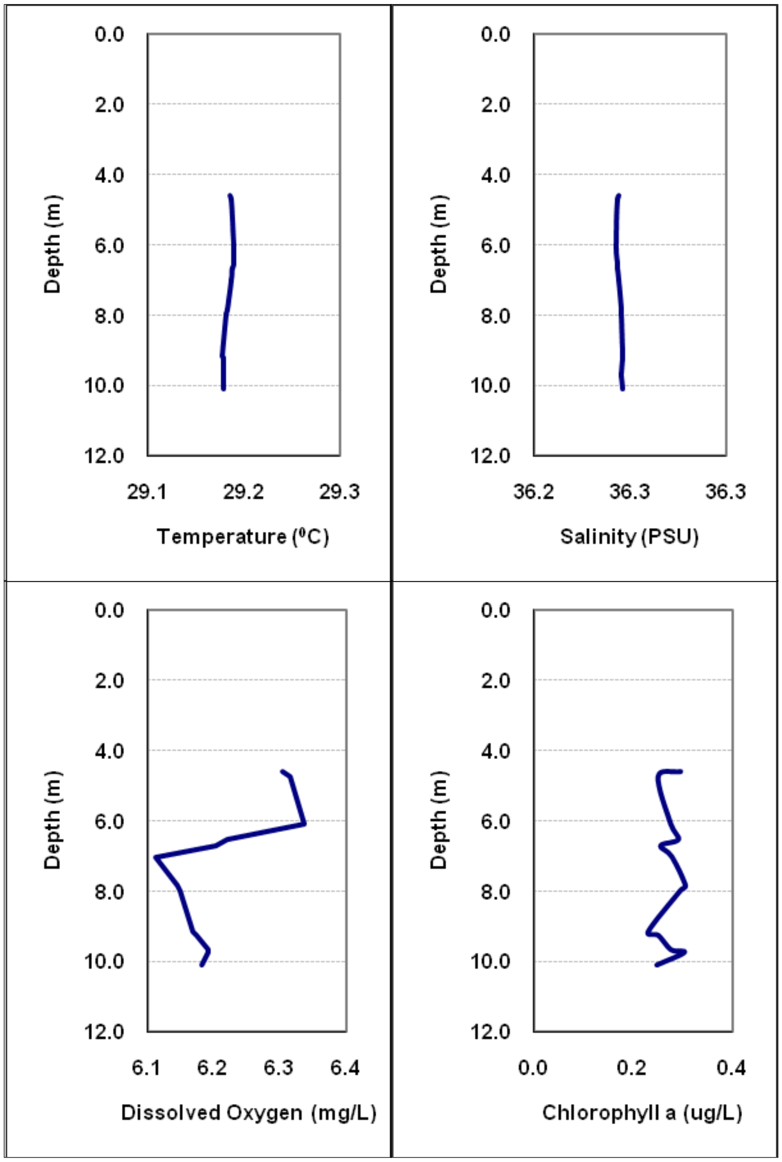

Figure 122: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-12.

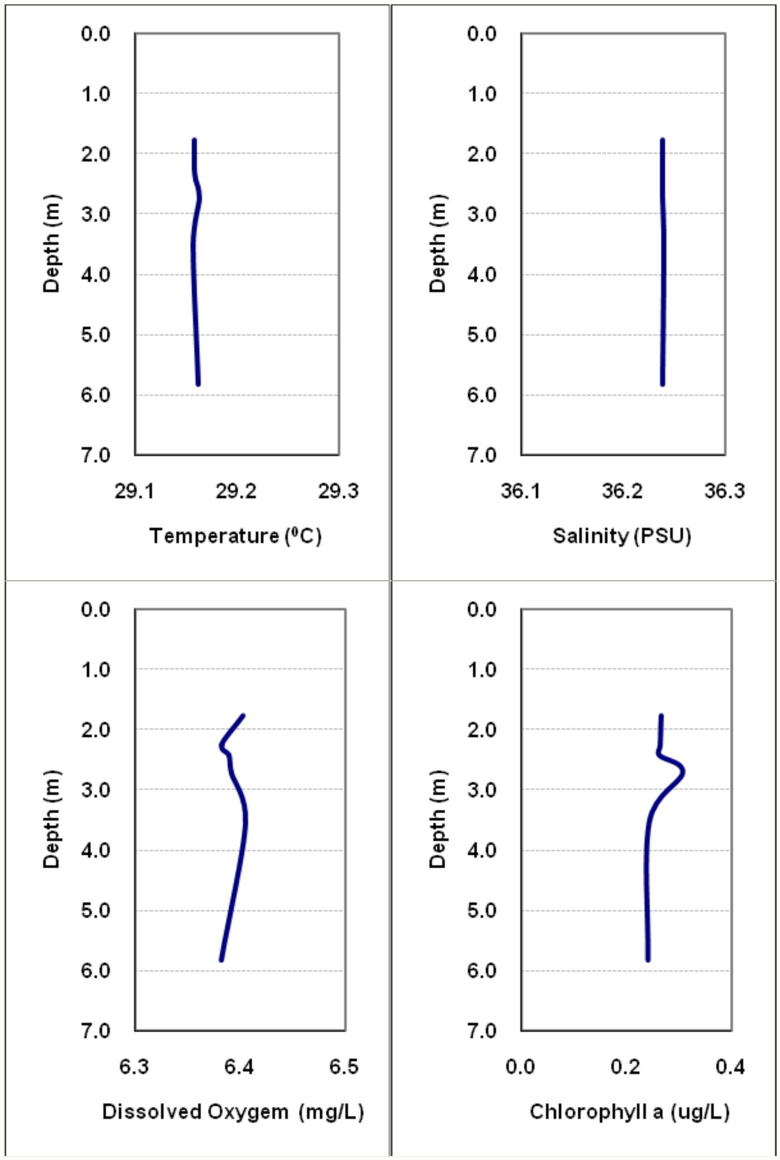

Figure 123: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-14.

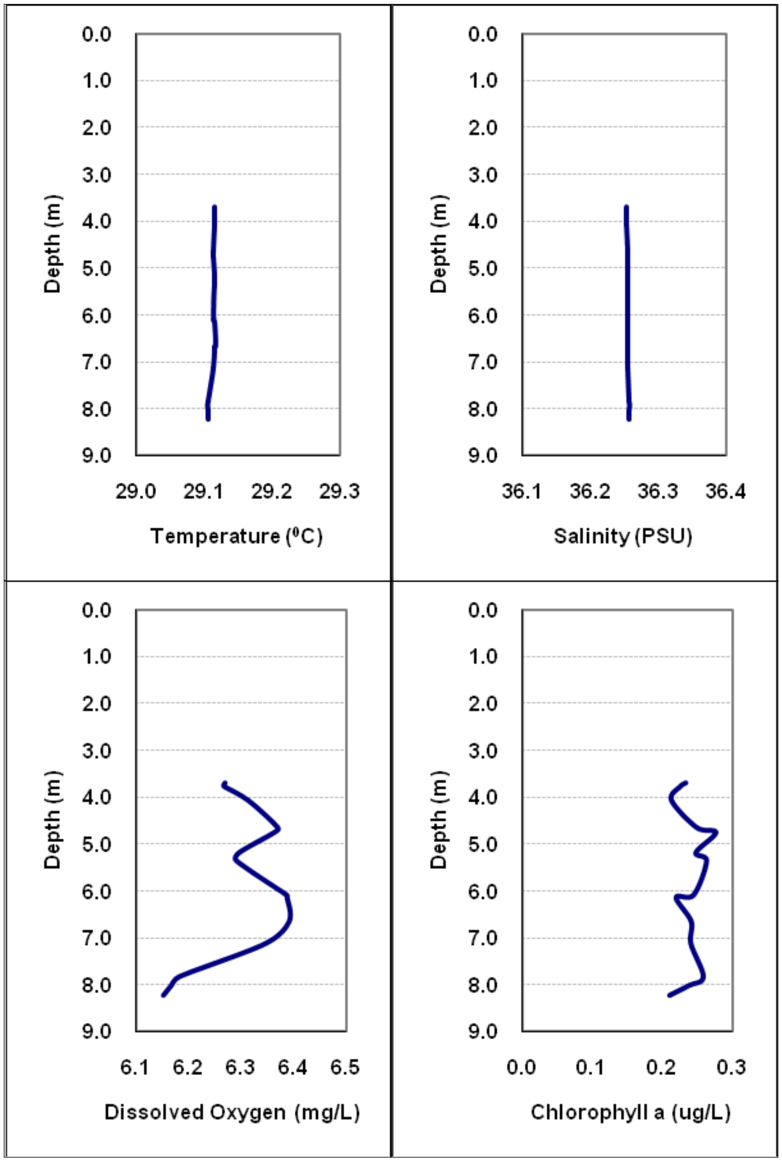

Figure 124: July 2008 Boynton-Delray water quality monitoring CTD cast at station BD-15.

9.7 Chemical and Physical Data Summary

This section will provide a brief overview of the physical and chemical oceanographic data obtained during the six sampling cruises.

9.7.1 Nutrient Concentrations around the Outfall

A central question concerns the fate of nutrients in the outfall effluent; in particular, how rapid is the dilution of nutrients until the concentrations are indistinguishable from ambient (e.g., unaffected) coastal waters. There is a qualitative nature to the discussion, as defining a "background" or unaffected concentration is not straightforward in a region exposed to a number of nutrient sources. Nevertheless, we posit that a comparison of the concentrations north (down-current) of the outfall with those south of the outfall (up-current) is trenchant, i.e., if the outfall has an effect, it should be apparent in the former data when compared to the latter.

In Figures 125-128, the surface, mid, and bottom sample results are plotted for specific analytes for each monitoring cruise versus distance from the outfall (north being positive). The bottom panel in each figure presents the results averaged over the six sampling cruises. Results from the outfall site (at zero distance) show the expected significantly elevated concentrations in the surface sample analyses (but much less elevated in the mid or bottom samples). For N+N, NH_4, and P, there was a rapid decrease in the surface concentrations and zero or minimal increase in the mid and bottom sample concentrations, with no discernable effect >3 km from the outfall. For silicate (Figure 128), there was strong evidence for downward mixing downcurrent of the plume, which persists over the 5.5 km of this study.

A second analysis considers downward flux of nutrients from the boil. In Figure 129, the surface, mid, and bottom sample results are plotted and averaged over all six cruises. Recall that BD-2 and BD-3 are upcurrent of the boil and thus represent water column concentrations without impact from the outfall. Sample BD-4 attempted to sample the boil; elevated concentrations were observed in the surface samples only. In the subsequent samples (samples BD-5 to BD-8), where downward flux of the nutrients would be reflected in increased concentrations in the mid and bottom samples concomitant with decreases in the surface concentrations, it was observed that for N+N, P, and NH_4 minimal increases were seen in the latter depths as the surface concentrations decreased.

For silicate, there was evidence for downward mixing although, again, the more distant samples (i.e., samples BD-7 and BD-8) appear to be near that of the unaffected samples.

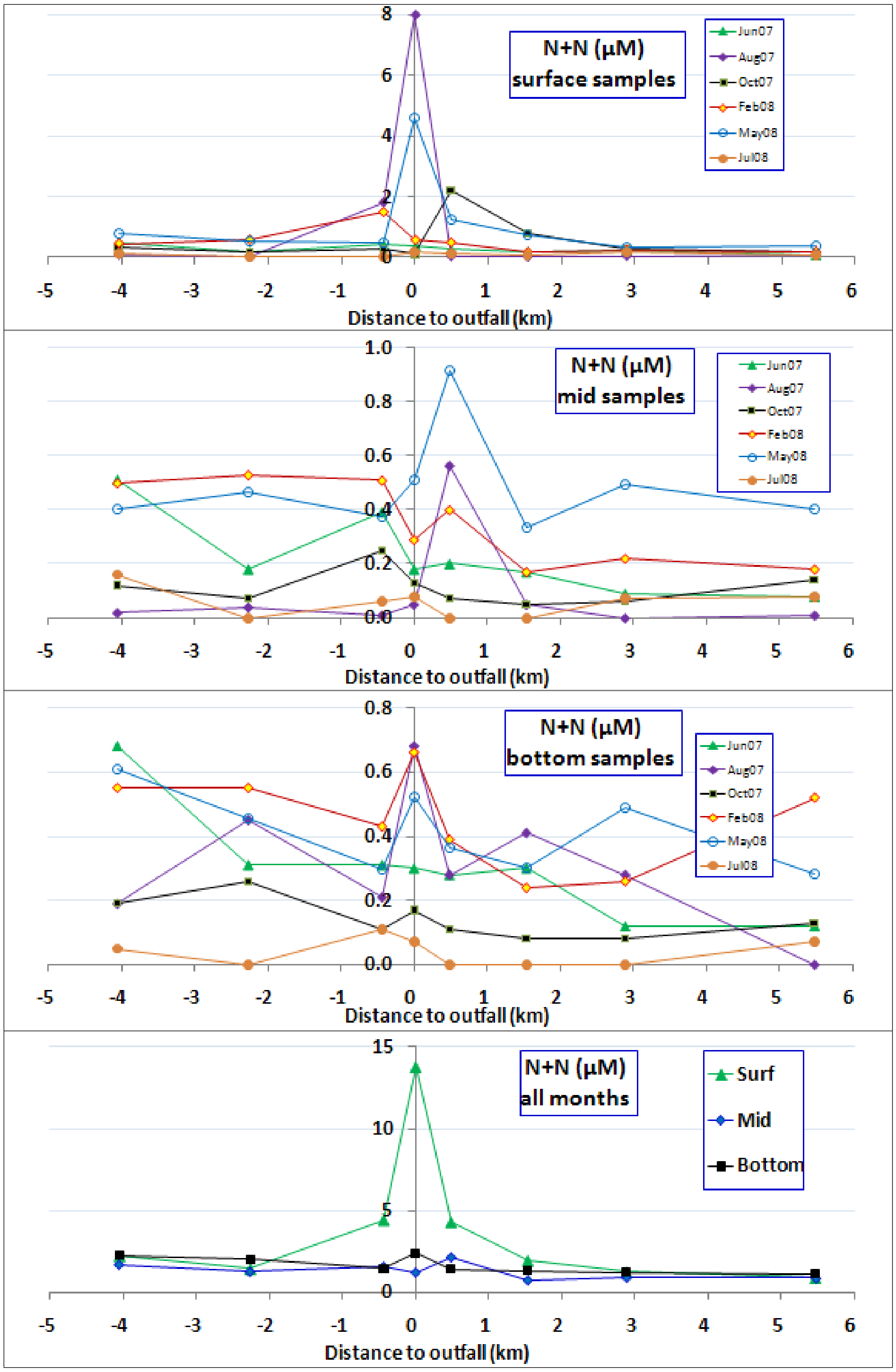

Figure 125: Nitrate+nitrite concentrations for sampling sites BD-1 to BD-8 for surface (top panel), mid (second from top), and bottom samples (third from top); the averaged values (over all months) are shown in the bottom panel. Horizontal axis is the distance (in km) of each site from the outfall.

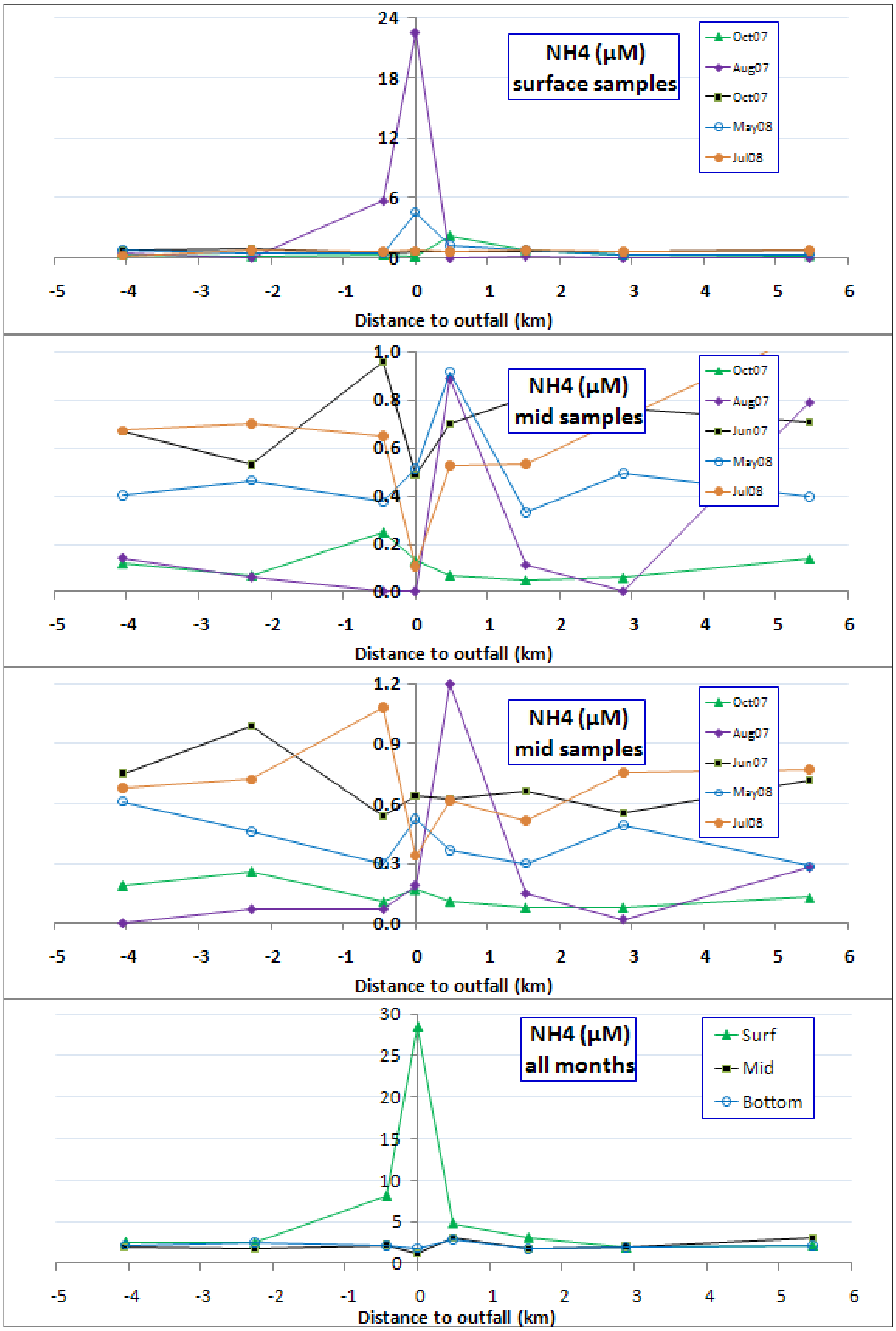

Figure 126: Ammonium concentrations for sampling sites BD-1 to BD-8. Format is the same as in Figure 125. Ammonium was not measured in February 2008 due to a lack of instrument availability.

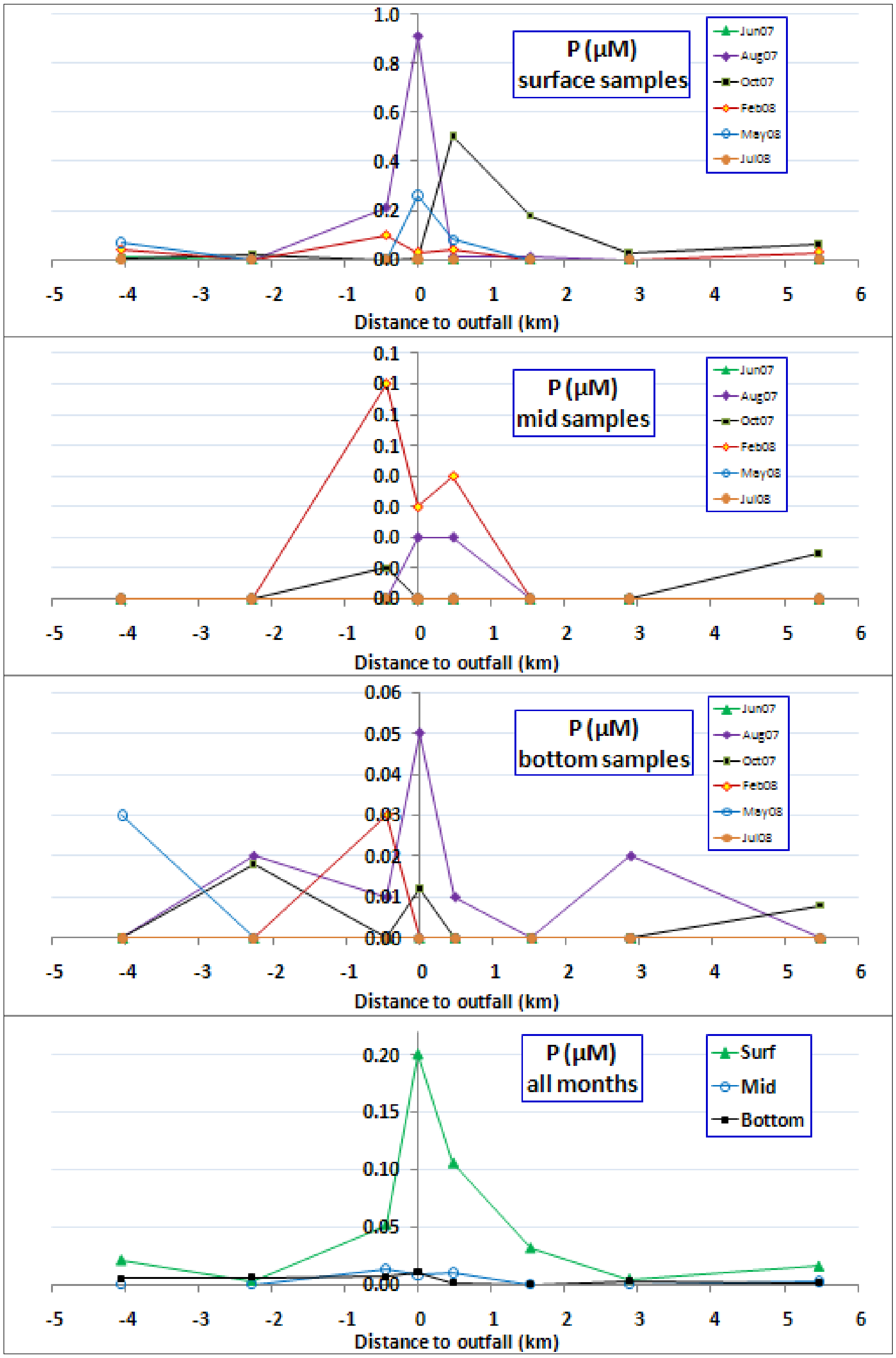

Figure 127: Orthophosphate concentrations for sampling sites BD-1 to BD-8. Format is the same as in Figure 125.

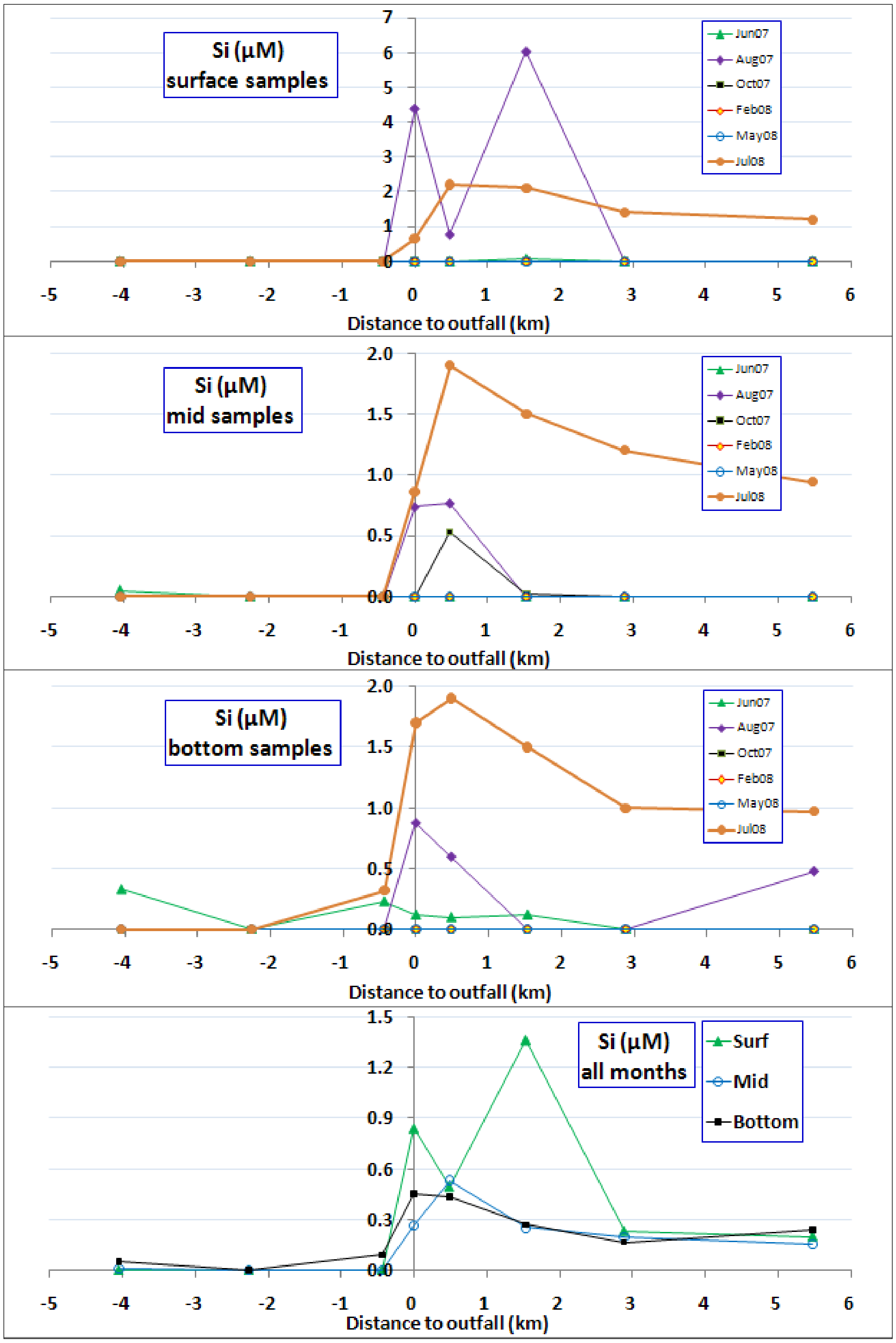

Figure 128: Silicate concentrations for sampling sites BD-1 to BD-8. Format is the same as in Figure 125. In the July 2008 samples (and, to a smaller degree, August 2007), elevated silicate concentration were observed down-current from the outfall at all three depths.

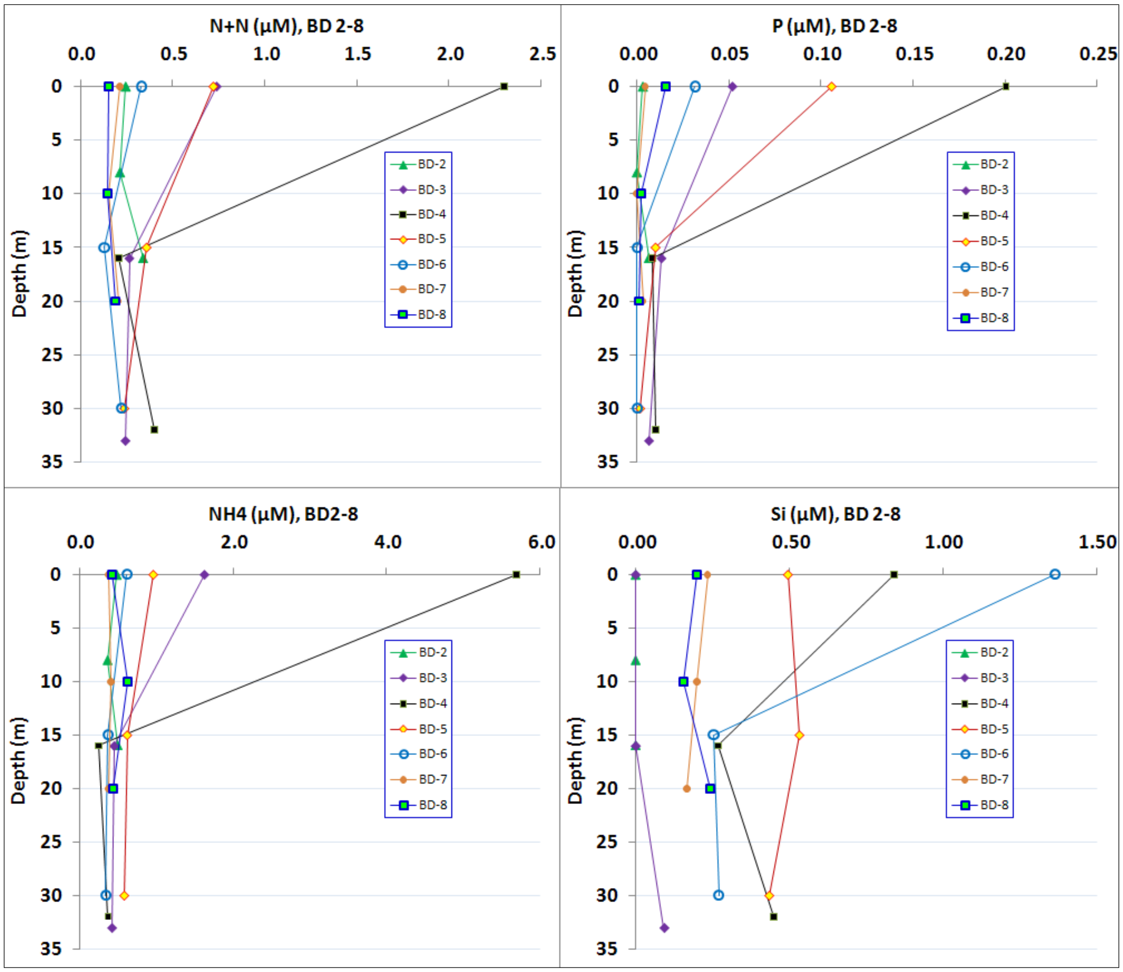

Figure 129: Each point represents the average of data from the six monitoring cruises, for the specified analyte and from the sampling sites indicated, plotted versus sampling depth. Locations BD-2 and BD-3 are south (upcurrent) of the outfall (BD4), while the other sites are sequentially more northerly (down-current) of the outfall.

9.7.2 Seasonal Variations

In southern Florida, winds are generally from the east year around but weakest during the summer months (Henry *et al*., 1994). In winter, winds from the north may dominate and produce storms. These conditions result in a more mixed (less stratified) coastal ocean during the winter. This can be seen in the data in this report, e.g., the thermocline was not evident in most CTD casts during the February cruise.

In general, precipitation is highest during summer (June through September). During the time of this experiment (October 2007 through July 2008), precipitation was somewhat atypical. A plot of rainfall during this period is given in Figure 130. The month of October 2007 was unusually wet. Subsequent months (November 2007 through January 2008) were dryer than normal, while the latter months (February-April 2008) were wetter. Notably, May and June 2008 were dryer.

Precipitation would clearly affect the Lake Worth Lagoon and Boynton Inlet most directly. In Figure 131 is plotted the concentration of four nutrients (averaged over the three sampling depths) across time (sampling month) and grouped into geographic regions south to north. We first note that N+N and Si concentrations in the Lake Worth Lagoon (and less so in the inlet) closely parallel the rainfall shown in Figure 130. Input into the lagoon is, of course, a function of many factors besides rain, e.g., canal flow. In general, seasonal variations in the nutrient concentrations are likely to be a result of complex changes in a variety of factors too numerous to elucidate in this document. Recall that, for most samples, the ocean current was flowing northward when the CTD was cast.

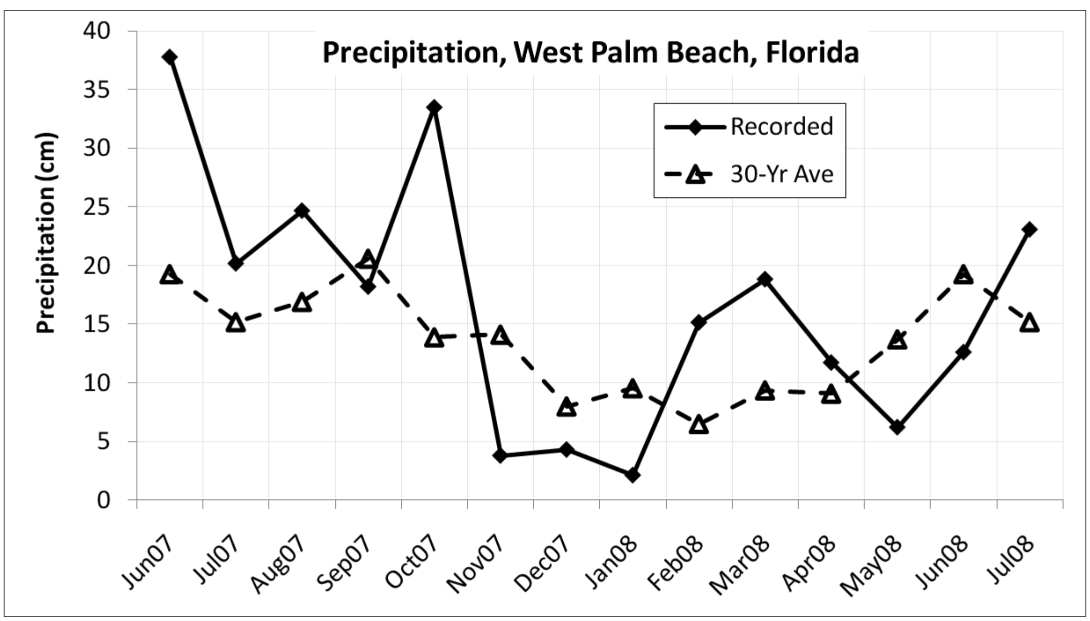

Figure 130: Rainfall measured at West Palm Beach, Florida. Solid line: measured values; dotted line: 30-year average. All data are from NOAA's National Oceanographic Data Center (www.nodc.noaa.gov).

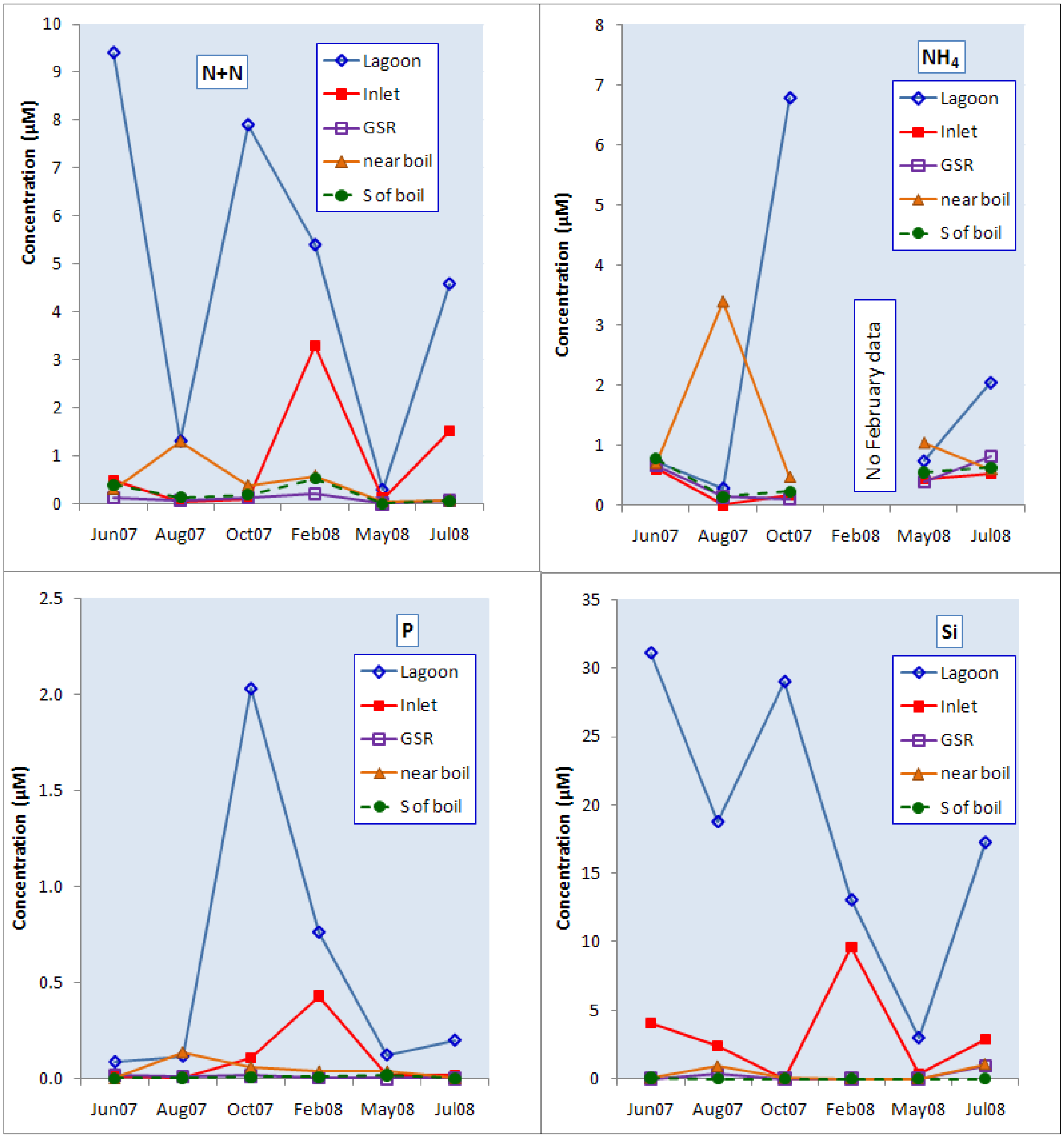

Figure 131: Concentrations of four nutrients, averaged over depth and grouped into five categories, plotted per sampling month. Categories are as follows: South of boil—sites BD-1 and BD-2; Near boil—sites BD-3 to BD-5; Gulf Stream Reef—sites BD-7 to BD-10; Boynton Inlet—sites BD-12 to BD-14; and Lake Worth Lagoon—sites BD-16 to BD-18. There was no ammonium data set for the February 2008 cruise.

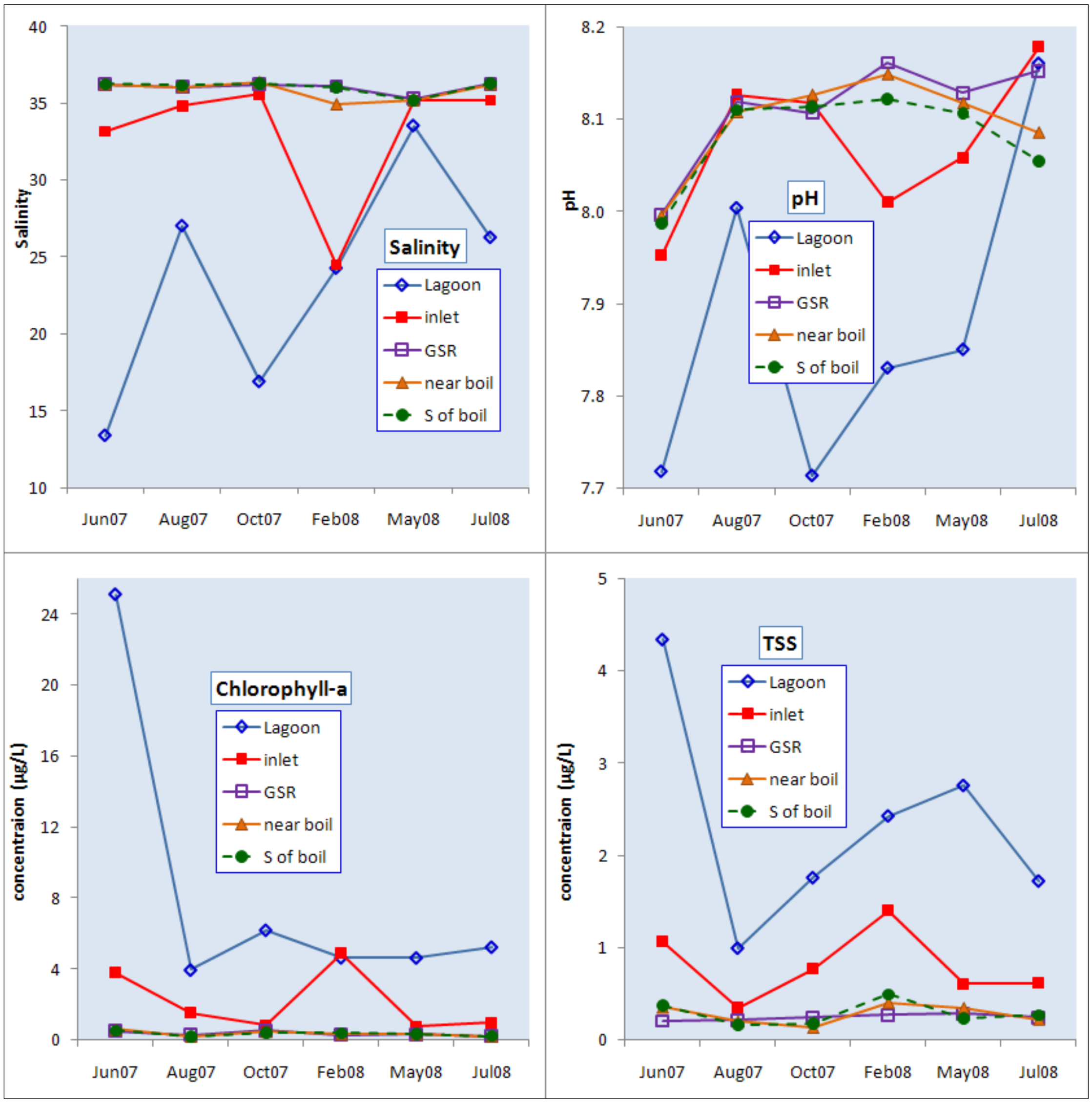

Figure 132: Measurements of salinity, pH, chlorophyll-a, and total suspended solids plotted as in Figure 131.

The concentrations for Lake Worth Lagoon shown in Figures 131 and 132 nearly always exceeded the concentrations in the Boynton Inlet and coastal ocean, another indication of rapid dilution of the plume. For N+N, Si, and P, the lagoon concentrations were the highest of all the categories of samples; the importance of the lagoon as a nutrient source to the coastal ocean is again reinforced. For ammonium, the boil concentrations (or south of the boil for June 2007) were highest, indicating the importance of the outfall as a source. As has been noted elsewhere (e.g., Carsey *et al.,* 2010), the ammonium concentration rapidly decreased away from the boil.

The lagoon always had a lower pH (i.e., was more acidic) than all other sites, except in July 2008 when the lagoon and inlet had about the same pH as the Gulf Stream Reef sites. Sites near the boil and south of the boil were somewhat lower in pH. Similarly, the lagoon had significantly lower salinity than all other sites (as expected), with the inlet being intermediate between the lagoon and coastal ocean, again as expected. Measurements of salinity and pH from the other sites were at or near open ocean values (salinity 34-35 psu, pH ~8, Segar, 1998). The results for chlorophyll-a and TSS were the reverse of that of pH and salinity, with the lagoon and (to a lesser degree) the inlet having higher concentrations than the coastal ocean locations. In these data, the boil measurements were at or very near the values from the other coastal sites. The anomalous lagoon data set may be that of June 2007, which had elevated N+N, Si, chlorophyll-a, and TSS, and low salinity and pH, but not P or NH_4. This was the month of the highest rainfall (Figure 130). The month of October 2007 was almost as wet, and had elevated P, N+N, NH_4, Si levels, but not chlorophyll-a or TSS. A complete understanding of the trends will have to incorporate additional data not available at this time.

We may roughly estimate the flux of nutrient mass from the Boynton Inlet into the coastal ocean by assuming the concentrations measured at station BD-13 represent the nutrient concentration during ebb tide flow. The outgoing (ebb) flow through the inlet, measured in a companion project, was about 7.4E+06 L/day with a Sontek 500-kHz side-looking Doppler sonar installed on the north side of the inlet in February 2007 and maintained for more than one year. (J. Stamates, unpublished results). We averaged the six measurements and employed the average daily water flow through the inlet to generate Table 30.

Finally, we consider a rough estimate of a "minimally affected" ("background") concentration for various analytes in the coastal ocean. Of course, this area is influenced by a number of nutrient sources, including the outfalls, the inlets, oceanic upwelling, ground water seepage, and atmospheric deposition. However, in the measurements reported in this document, we consider that the lowest concentrations of most analytes are from sites BD-7 to BD-10, e.g., between the inlet and the outfall and over the Gulf Stream Reef. Thus, we may propose these measurements to provide a basis for a discussion of "background" concentrations. To this end, Table 31 provides the average concentrations, averaged over time, of various analytes at the three depths and the overall average.

Table 30. Estimates of flux from the Boynton Inlet.

Day: Hour:	6-Jun 15:00	28-Aug 16:00	18-Oct 9:00	18-Feb 9:30	19-May 21:36	13-Jul 9:22	Ave Conc μM	Ave kg/day
N+N (μM)	2.25	0.08	1.40	3.30	0.48	9.00	3.02	314
Si (μM)	22.00	9.60	0.00	9.60	2.00	13.40	11.32	2,359
P (μM)	0.05	0.02	0.42	0.43	0.11	0.10	0.14	33
NH_4 (μM)	0.48	0.00	0.64		0.60	1.18	0.57	59
TDN (μM)		9.46	9.59	19.72	10.83	17.98	14.50	1,506
DOC (μM)		115.22	82.43	219.37	112.64	176.54	155.94	13,885
TSS (mg/L)	3.72	0.52	1.83	1.40	1.93	2.06	1.91	14,172

Table 31. Average values from sites BD-6 through BD-12.

Measurement	Unit	Surface	Mid	Bottom	Average
Depth	m	0.53	8.36	16.34	8.41
Temperature	°C	27.26	27.12	27.05	27.14
Salinity	---	35.88	36.06	36.09	36.01
N+N	µM	0.11	0.08	0.11	0.10
NO_2	µM	0.14	0.08	0.08	0.10
NO_3	µM	0.10	0.00	0.01	0.04
Si	µM	0.42	0.22	0.20	0.28
P	µM	0.01	0.00	0.01	0.01
NH_4	µM	0.45	0.40	0.36	0.40
Chl-a	µg/L	0.50	0.35	0.36	0.40
Phaeo	µg/L	0.14	0.11	0.49	0.25
pH	---	8.10	8.11	8.11	8.11
TSS	mg/L	0.30	0.27	0.24	0.27
TDN	µM	7.02	6.49	5.35	6.30
TDP	µM	0.18	0.12	0.12	0.14
NPOC	µM	63.78	48.64	46.30	52.97
DIN	µM	0.78	0.76	0.82	0.78

10. Microbiological Analysis

During each sampling event, a total of 102 L of sample water was collected from stations BD-4A (surface boil), BD-5A (500 m north of surface boil), and BD-13A (Boynton Inlet). The samples collected from station BD-13A were obtaineed on an outgoing tidal cycle. Water samples were analyzed for the following microbiological parameters: (1) fecal indicator bacteria; (2) the presence of pathogenic bacteria; (3) pathogenic protozoans; and (4) the presence of human viruses.

10.1 Culture Analysis

Selective and differential media were used to analyze samples for viable enterococci, *Escherichia coli*, *Bacteroides* species, and *Staphylococcus aureus*. Viable enterococci were enumerated using two methods: (1) membrane filtration with incubation on mEI agar according to EPA Method 1600 (EPA, 2002b); and (2) the EPA-approved Enterolert™ chromogenic substrate assay (IDEXX, Inc.). Viable *E. coli* were enumerated by membrane filtration and incubation on mTEC agar using EPA Method 1603 (EPA, 2002c). Viable *Bacteroides* spp. were enumerated by the membrane filter method incubated on BBE agar under anaerobic conditions (Baums *et al.,* 2007). Viable *Staphylococcus aureus* were enumerated by membrane filtration incubated on CHROMagar™ Staph aureus (Goodwin *et al.,* 2009). Water samples (800-2100 ml) processed by membrane filtration used 0.45-µm cellulose nitrate membrane filters (Whatman).

10.2 Immunofluorescent Analysis

Cryptosporidium oocysts and *Giardia* cysts were concentrated from 200 L. The oocysts and cysts were recovered using the EPA-approved Filta-Max® system according to the manufacturer's instructions (IDEXX, Inc.). The Filta-Max wash station and sample concentration equipment was graciously supplied by H. Solo-Gabriele. The protists were enumerated by immunomagnetic separation and immunofluorescent microscopy according to EPA Method 1623 (EPA, 2001). Analysis was conducted by the NELAP-certified facilities of BSC Labs, Inc., Miami, Florida.

10.3 Viral Analysis

Samples were collected, filtered, eluted, and shipped on ice to the NOAA laboratory in Charleston, South Carolina for analysis of enteric viruses. Briefly, 1.2-3 L of water were filtered through ViroCap positively charged aluminum fiber filters (Scientific Methods, Inc., Granger, Indiana). The viruses were then eluted using 2 mL Optima RE solution (Scientific Methods, Inc., Granger, Indiana) with the addition of 0.01% Tween. The eluate was frozen and shipped, then thawed for extraction of viral RNA. Extraction followed either the CEFAS protocol (Lee *et al.,* 2004) or the Qiagen MIDI extraction kit per manufacturer's instructions. Both protocols were performed on each sample for the sake of comparison. Extracts were then analyzed for viruses using the reverse-transcriptase polymerase chain reaction (RT-PCR) method. Assays for detection of norovirus and enterovirus were performed as described in Jothikumar *et al.* (2005) and Gregory *et al.* (2006), respectively. Norovirus analysis included individual assays for genogroup I and genogroup II. The MS2 assay is currently unpublished. Given the lack of quantitative controls used for these assays, results were reported as the presence or absence for each virus. The minimum detection limit for the MS2 assay was 5 genomes per reaction, and the detection limit for norovirus and enterovirus was 25 genomes per reaction.

In addition to that described above, norovirus and enterovirus were analyzed by quantitative PCR at AOML using kits by Cepheid, Inc., as described in Sinigalliano *et al.* (2007).

10.4 Polymerase Chain Reaction Analysis

In general, 1.5 L of water was filtered onto 0.2-µm, Supor-200 filters (Pall Corporation) for the purpose of total DNA extraction. Crude DNA lysates were obtained from filters, while onboard the ship by bead-beating (Haughland *et al.,* 2005) in Qiagen AE buffer with a Qbiogene FastPrep bead beating instrument at speed 6.5 for a total of 40 s. The lysates were diluted 1:5 with fresh AE buffer and stored at -80°C until analysis.

An aliquot (5 µL) of each 1:5 dilution was utilized as template DNA in 50 µL PCR reactions according to the following: 5 µL Finzyme 10X buffer, 1.25 µL dNTPs (10 mM), 1.5 µL BSA (10 mg/mL), 2.5 µL forward primer (10 µM), 2.5 µL reverse primer (10 µM), 0.75 µL Finzyme, Hotstart Taq Polymerase. Cycling conditions were as follows: 94°C denaturation for 10 min; 30 cycles of 94°C 30 s, 58°C 30 s, 72°C 30 s; followed by a 70°C extension for 8 min; hold at 4°C.

The lysates were analyzed for the presence of the following fecal indicators, pathogens, and markers of fecal pollution, as described in LaGier *et al.* (2007):

- enterococci (23S rRNA gene)
- human-specific enterococci (esp gene)
- *Campylobacter jejuni* (hipO gene)
- *Salmonella* spp. (IpaB gene)
- *E. coli* strain 0157:H7 (rfb gene)
- *Staphylococcus aureus* (clfA gene)
- human adenovirus (Hexon gene)

In addition to standard positive and negative controls, samples were also tested for the presence of amplifiable DNA and for PCR inhibition using primers that amplify a universal region of the bacterial 16S rRNA gene (Unifor/Unirev primer set; Zheng *et al.,* 1996).

10.5 Microbiological Data Summary

Viable enterococci varied between BDL to 21 MPN/100 ml for the outfall boil, while all samples at BD-5A were <10 MPN/100 ml. Total enterococci varied between BDL to 35 GEU/100 ml for the surface boil and from BDL to 9.6 GEU/100 ml for BD-5A. There was no presence of the human-specific *Enterococus faecium* at either site during all sampling events. Viable *Bacteroides* varied from 2-37 CFU/100 ml at the outfall boil, while BD-5A had levels <1-7 CFU/100 ml. Human-specific *Bacteroides* (BacHum-UCD primers) varied from BDL to 215 GEU/100 ml at the outfall boil and from BDL to 9.5 GEU/100 ml at station BD-5A. Human-specific *Bacteroides* (HF8 gene cluster) was BDL for the outfall boil and BD-5A during all sampling events. Norovirus was found to be present during three of the sampling events at the outfall boil site but not present at site BD-5A. Enterovirus was found to be present during most sampling events for the outfall boil and only once for site BD-5A (May 2008). Human Adenovirus was found to be present during half of the sampling events at the outfall boil and absent at BD-5A. *Cryptosporidium* oocysts varied from 2-10.7 cysts/100 L at the outfall boil and from <1 to <2.1 cysts/100 L at BD-5A. *Giardia* cysts varied from <1-72.1 cysts/100 L at the outfall boil, while BD-5A varied from <1-2.1 cysts/100 L. *Campylobacter jejuni* (HipO), *Salmonella sp*. (IpaB gene), and *E. coli* (strain 0157:H7 rfb gene) were found to be absent from both sites during all sampling events. Coagulase negative *Staphylococcus aureus* c1fA gene was found to be present at the outfall boil only during the May 2008 sampling event, while no presence was found at BD-5A during all sampling events (Table 32).

Viable enterococci varied from <1-82 MPN/100 ml at the Boynton Inlet site (BD-13A). The presence of human source enterococci was found during the August 2007 and May 2008 sampling events at BD-13A. The presence of human source *Bacteroides* HF8 was found during the August 2007, October 2007, and May 2008 sampling events at the Boynton Inlet. Human source *Bacteroides* HuBac was found at BD-13A during all sampling events except June 2007 and February 2008. *Salmonella sp*., *E. coli* O157:H7, and *Campylobacter jejuni* were not present at BD-13A during all sampling events. *Staphylococcus aureus* was present during half of the sampling events at BD-13A. *Cryptosporidium* oocysts and *Giardia* cysts varied from <1-24.9 cysts/100 L at BD-13A. The presence of human viruses, human Adenovirus, Norovirus, and Enterovirus were found to be present at BD-13A during some of the sampling events (Table 33).

Table 32: Microbiological parameters analyzed for stations BD-4A and BD-5A (June 2007-July 2008).

Target Indicator or Pathogen ↓	Treated Wastewater Outfall Sample site Method ↓	→ Units↓	BD-4 June 2007	BD-5 June 2007	BD-4 August 2007	BD-5 August 2007	BD-4 Oct 2007	BD-5 Oct 2007	BD-4 Feb 2008 (*Nancy Foster*)	BD-5 Feb 2008 (*Nancy Foster*)	BD-4 May 2008	BD-5 May 2008	BD-4 July 2008 (*Walton Smith*)	BD-5 July 2008 (*Walton Smith*)
viable enterococci	Idexx EnteroLert™	MPN/100 mL	<10	<10	<10	<10	<10	<10	<10	<10	21	<10	<10	<10
total enterococci (23S rRNA gene)	qPCR (Haugland *et al.*, 2005)	GEU/100 mL	BDL	BDL	14.2	BDL	BDL	BDL	BDL	9.6	35	BDL	BDL	BDL
Human-specific *Enterococcus faecium* esp gene	PCR (Scott *et al.*, 2005)	presence or absence +/-	-	-	-	-	-	-	-	-	-	-	-	-
viable *Bacteroides*	membrane filtration plate counts on BBE agar	CFU/100 mL	5	<1	37	7	2	<1	4	<1	<1	<1	2	<1
Human-specific Bacteroides (BacHum-UCD primers)	qPCR (Kildare *et al.*, 2007)	GEU/100 mL	BDL	BDL	215	6.1	BDL	4.4	27.6	BDL	BDL	BDL	BDL	9.5
Human-specific Bacteroides (HF8 gene cluster)	qPCR (adapted from Bernhard and Field, 2000)	GEU/100 mL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
norovirus	qPCR (Cephied, Inc.)	presence or absence +/-	+	-	+	-	-	-	-	-	+	-	-	-
enterovirus	qPCR (Cephied, Inc.)	presence or absence +/-	-	-	+	-	+	-	N/A	N/A	+	+	+	-
Human Adenovirus hexon gene	PCR (He and Jiang, 2005)	presence or absence +/-	+	-	-	-	+	-	-	-	-	-	+	-
Cryptosporidium oocysts	IMS/IMF (by Troy Scott, BSC labs)	cysts/100 L	2	<2.1	10.7	<1	3.3	<1	DP	DP	5.6	<1	N/A	N/A
Giardia cysts	IMS/IMF (by Troy Scott, BSC labs)	cysts/100 L	34.8	2.1	72.1	<1	<1	<1	DP	DP	30.2	2.1	N/A	N/A
Campylobacter jejuni HipO gene	PCR (LaGier *et al.*, 2004)	presence or absence +/-	-	-	-	-	-	-	-	-	-	-	-	-
Salmonella sp. IpaB gene	PCR (Kong *et al.*, 2002)	presence or absence +/-	-	-	-	-	-	-	-	-	-	-	-	-
coagulase negative *Staphylococcus aureus* clfA gene	PCR (Mason *et al.*, 2001)	presence or absence +/-	-	-	-	-	-	-	-	-	+	-	-	-
E. coli strain 0157:H7 rfb gene	PCR (Maurer *et al.*, 1999)	presence or absence +/-	-	-	-	-	-	-	-	-	-	-	-	-

Table 33: Microbiological parameters analyzed for station BD-13A (June 2007-July 2008).

	Assay	June 2007	Aug 2007	Oct 2007	Feb 2008	May 2008	July 2008
Fecal Indicator Bacteria	Viable enterococci by IDEXX EnteroLert, MPN/100 mL	**10**	**52**	**20**	**<1**	**82**	**<1**
	Presence of Human-source Enterococci by PCR (esp gene marker)	-	+	-	-	+	-
	Presence of Human-source *Bacteroides* HF8 marker by PCR	-	+	+	-	+	-
	Presence of Human-source *Bacteroides* HuBac marker by PCR	-	+	+	-	+	+
Presence of Pathogenic Bacteria (by PCR)	*Salmonella sp*. (IpaB gene)	-	-	-	-	-	-
	E. coli O157:H7 (rfb gene)	-	-	-	-	-	-
	Campylobacter jejuni (HipO gene)	-	-	-	-	-	-
	Staphylococcus aureus (clfA gene)	-	+	-	-	+	+
Pathogenic Protozoans (by IMS/IMF)	*Cryptosporidium* oocysts (per 100 L)	6.3	24.9	3.1	<1	5.4	1.2
	Giardia cysts (per 100 L)	4.2	19.4	1.8	<1	12.3	5.1
Presence of Human Viruses (by PCR)	Human Adenovirus	-	+	-	+	+	+
	Noroviruses	-	+	-	-	+	-
	Enteroviruses	-	+	+	-	-	-

11. Ocean Current and Wind Measurements

An acoustic Doppler current profiler (ADCP, Teledyne RD Instruments, Poway, California) was installed at a location on the southern end of Gulf Stream Reef at 26°29.272'N; 80°02.35'W, mounted on the bottom at a depth of 17 m (Figure 133). The instrument reports a current measurement every 20 minutes. Current direction and velocity data for the six monitoring cruises are shown in Figures 134a-139a. Four depths were selected to represent the water column. The data are presented as stick plots where true north is at the top of the page and East is clockwise to the right. The magnitude of the current is represented by the length of the sticks and scaled to the y axis (cm s^{-1}).

Wind data from the LKWF1 buoy at Lake Worth, Florida (26°36'42"N; 80°2'0"W) were used for the plots below (www.ndbc.noaa.gov/station_page.php?station=LKWF). In general, there is no correlation with winds and surface currents (Figures 133b-139b).

Figure 133: Photograph of the acoustic Doppler current profiler unit installed on the Gulf Steam Reef (south), operational beginning September 29, 2006.

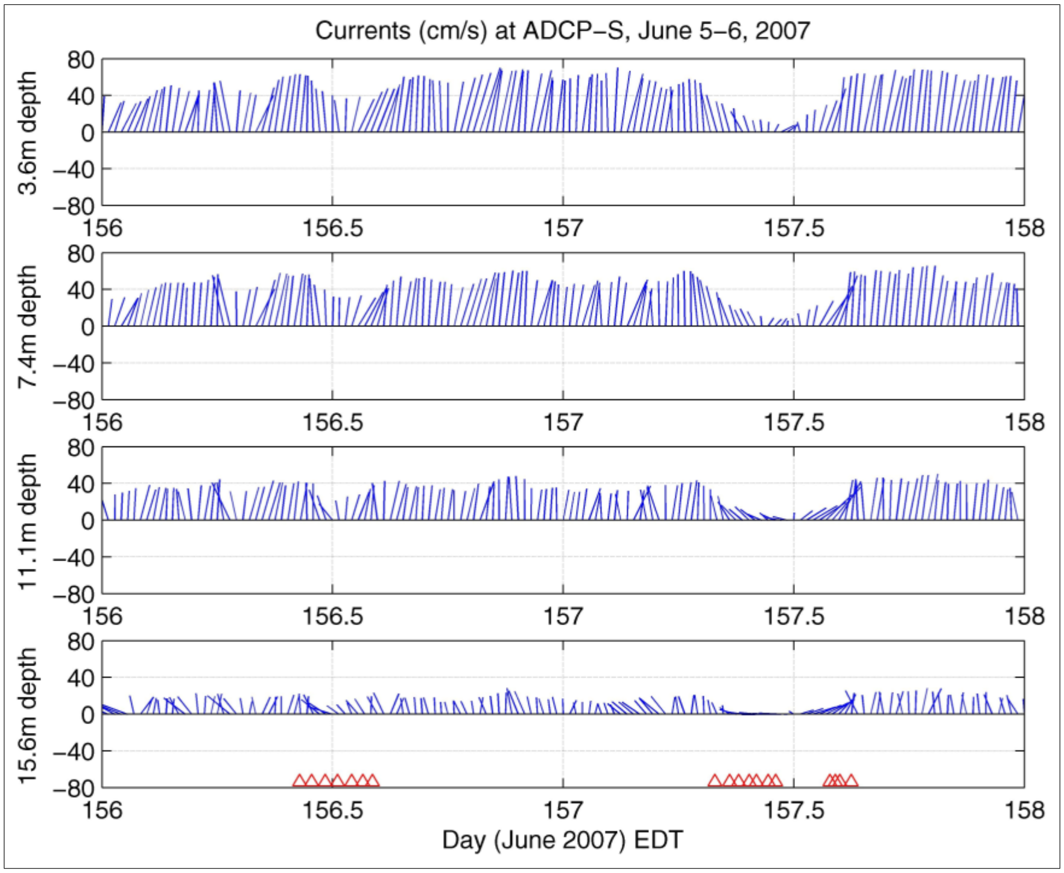

Figure 134a: Current direction and velocity during the June 2007 cruise. Depths were chosen to represent the surface, near the bottom, and two intermediary depths. Red triangles in the lowest panel denote times of each CTD cast. Length of each stick is proportional to the current speed as given by the y-axis (arrows point to the direction the current is going).

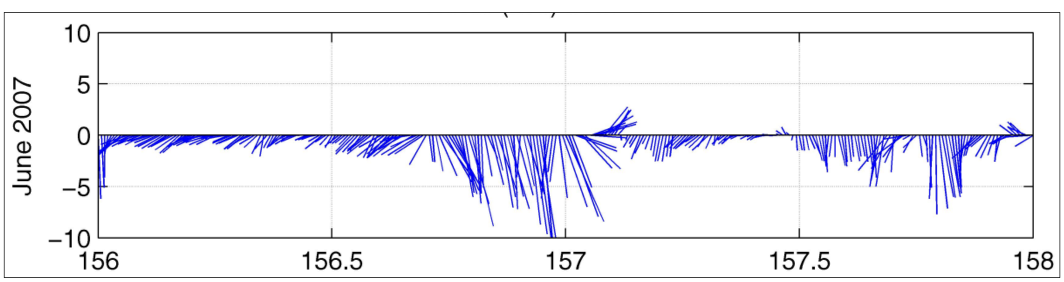

Figure 134b: Wind direction and velocity data from buoy LKWF1 during the time of the June 2007 cruise. Length of each stick is proportional to the wind speed (m/s) as given by the y-axis (arrows point to the direction the wind is coming from).

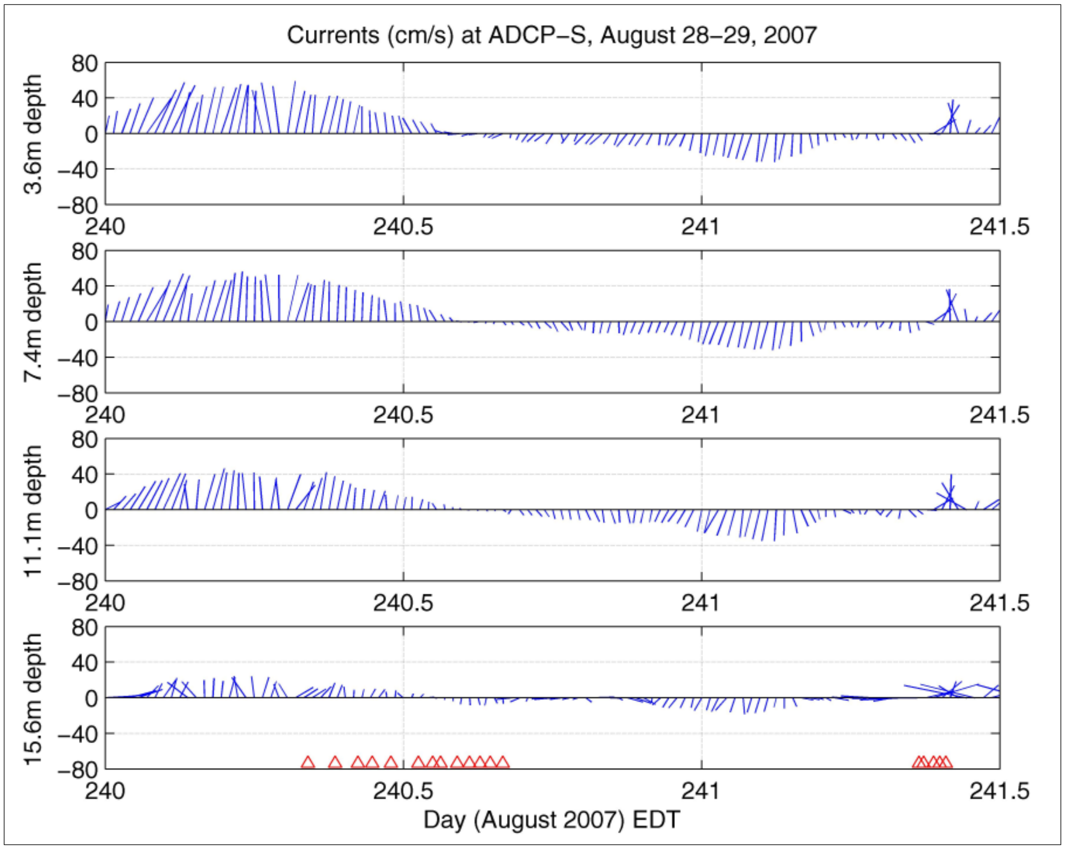

Figure 135a: Current direction and velocity during the August 2007 cruise. Format is similar to Figure 134a. Some samples around 240.65 (i.e., BD-11) were evidently obtained in a southerly flow regime.

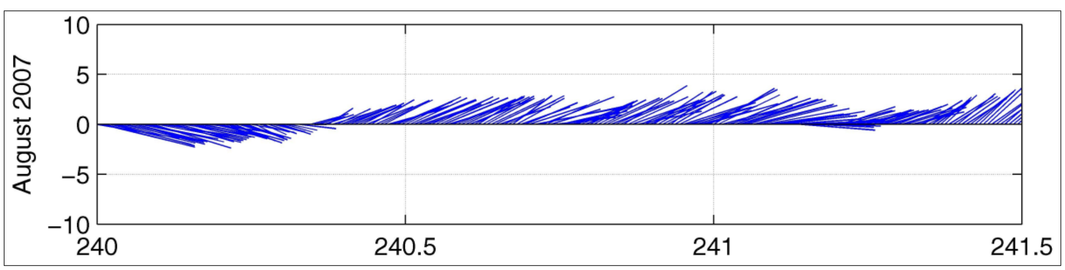

Figure 135b: Wind direction and velocity data from buoy LKWF1 during the time of the August 2007 cruise. Format is similar to Figure 134b.

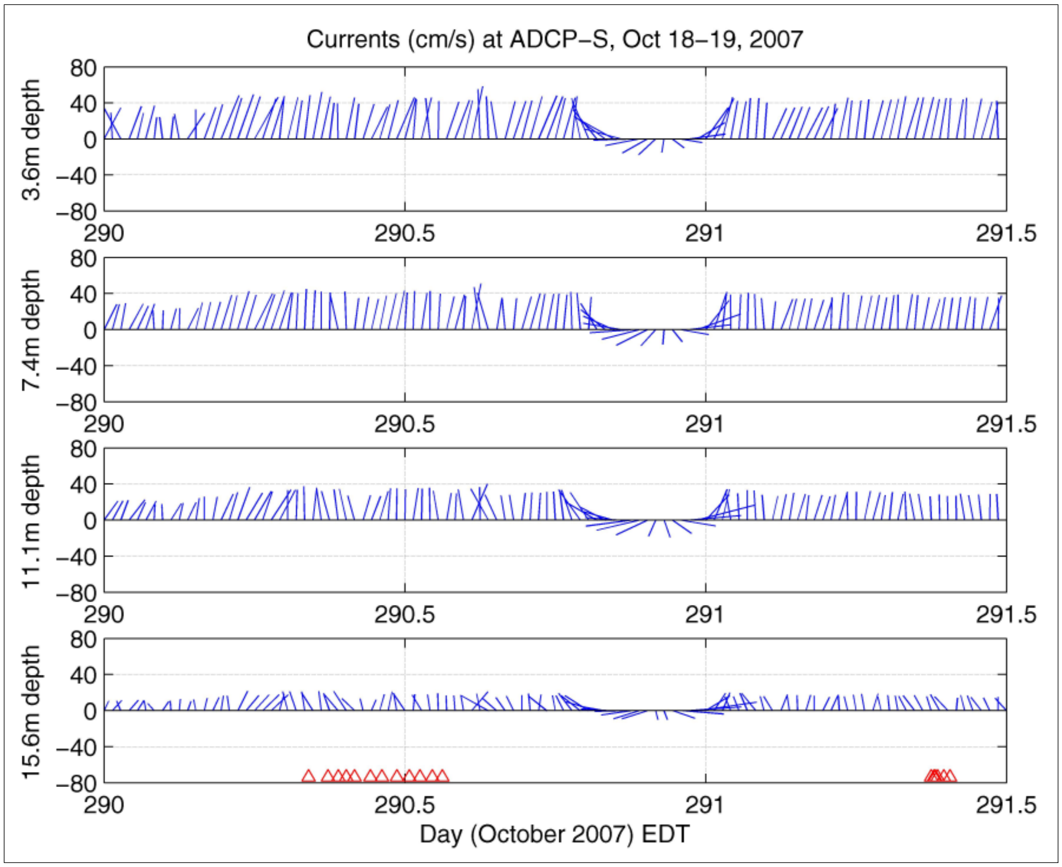

Figure 136a: Current direction and velocity during the October 2007 cruise. Format is similar to Figure 134a.

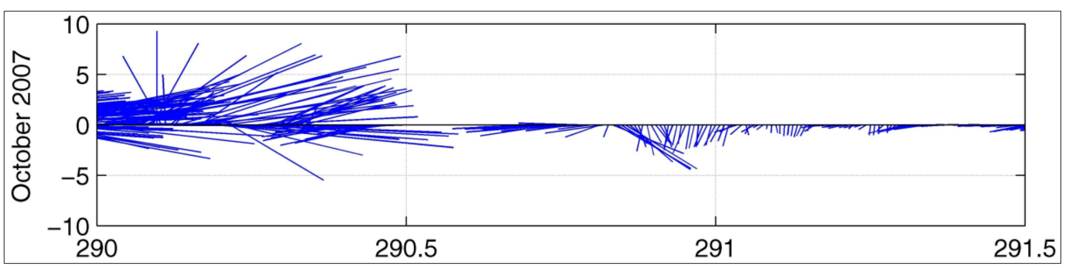

Figure 136b: Wind direction and velocity data from buoy LKWF1 during the time of the October 2007 cruise. Format is similar to Figure 134b.

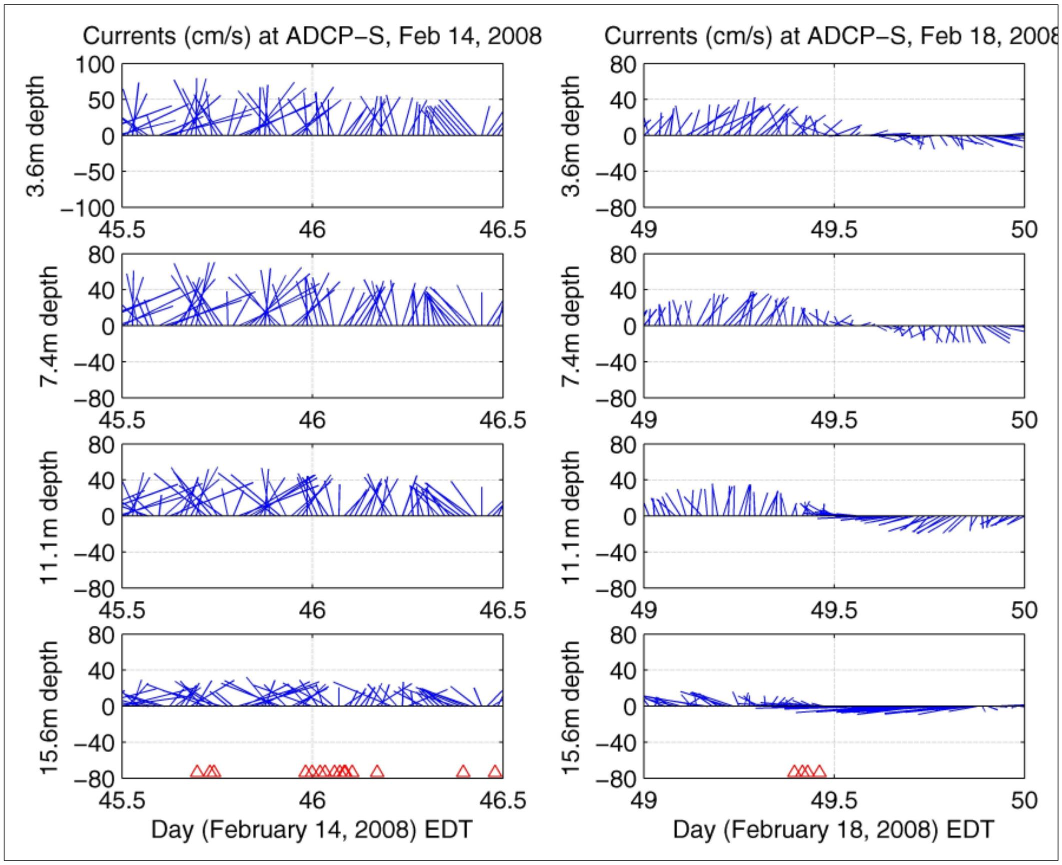

Figure 137a: Current direction and velocity during the February 2008 Boynton-Delray water quality monitoring cruise. Data from February 14th is presented in the left panel; February 18th on the right panel. Note that the 3.6-m depth for February 14th has a different vertical axis scale. Otherwise, format is similar to Figure 134a.

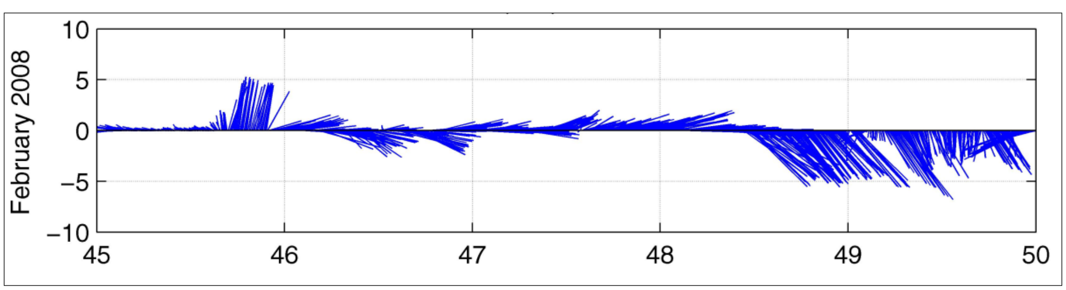

Figure 137b: Wind direction and velocity data from buoy LKWF1 during the time of the February 2008 cruise. Format is similar to Figure 134b.

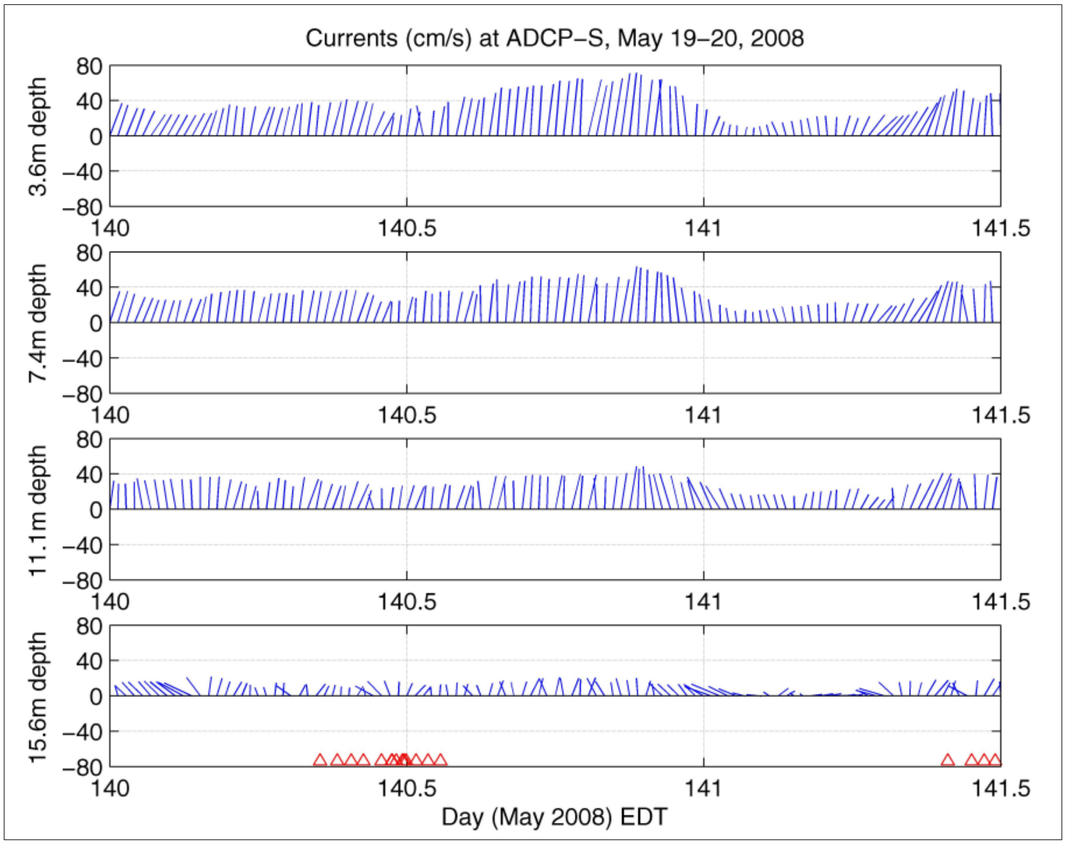

Figure 138a: Current direction and velocity during the May 2008 cruise. Format is similar to Figure 134a.

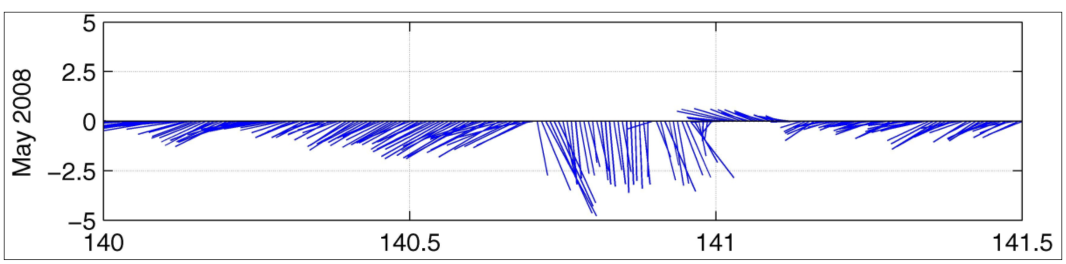

Figure 138b: Wind direction and velocity data from buoy LKWF1 during the time of the May 2008 cruise. Format is similar to Figure 134b.

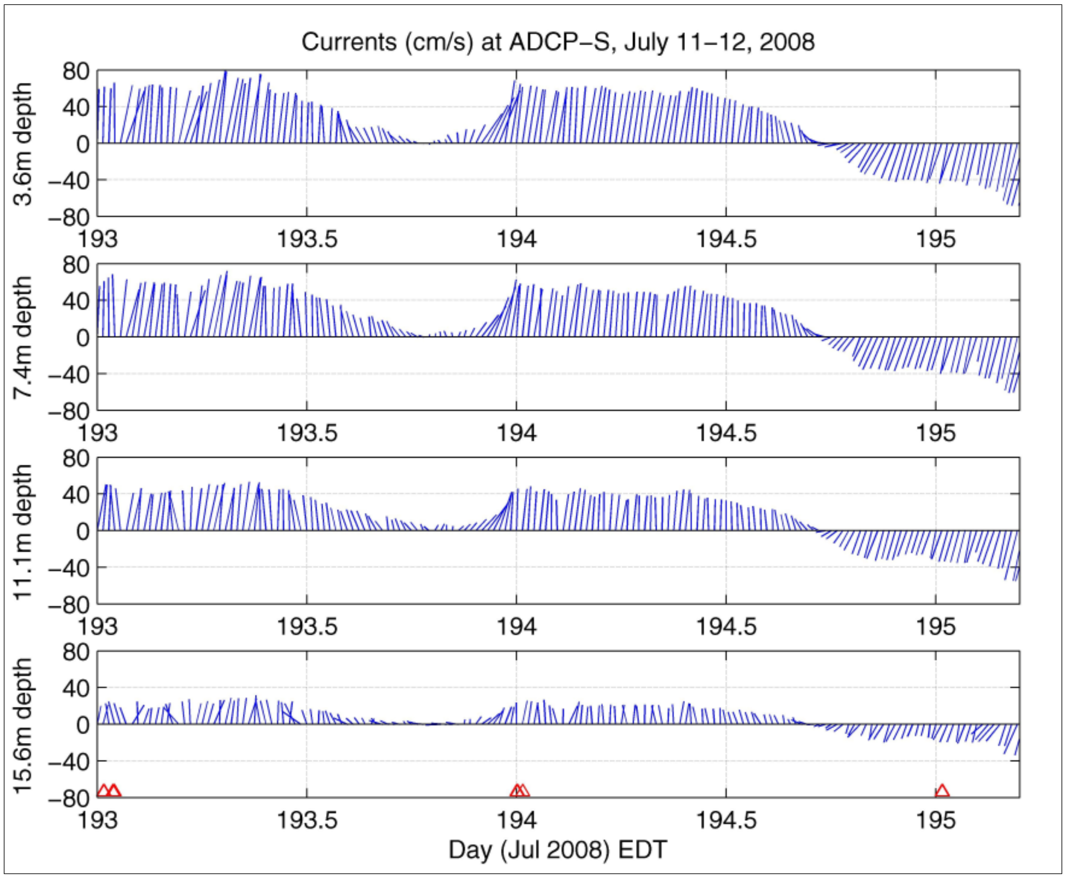

Figure 139a: Current direction and velocity during the July 2008 cruise. Format is similar to Figure 134a. Lagoon samples (BD16 to BD-18) were obtained during southerly current flow.

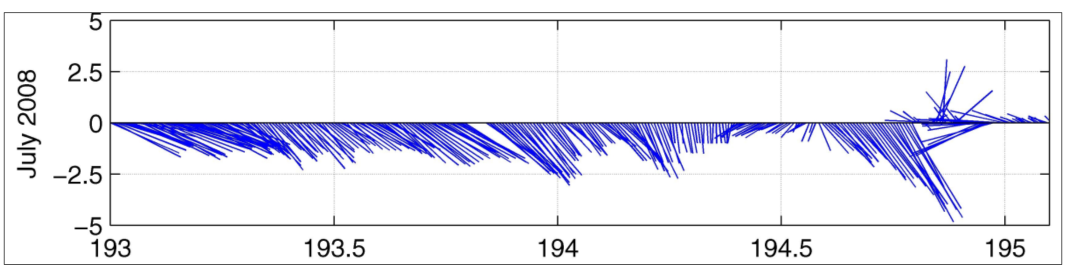

Figure 139b: Wind direction and velocity data from buoy LKWF1 during the time of the July 2008 cruise. Format is similar to Figure 134b.

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Appendix A:
13. Particulate Characterization

Water samples were collected during the July 2008 sampling event to characterize the particulates at the outfall (BD-4A, BD-4B, BD-4C), the Boynton Inlet (BD-13A), and a reef site (BD-8A, BD-8B, BD-8C). Approximately 1-L of water was collected at each site and preserved in 2% gluteraldehyde buffered seawater. A 200 ml sample was filtered through a 47-mm diameter 0.4-µm Millepore® isopore membrane filter. Filters were then rinsed with 50 ml of distilled water to remove salts and air dried. A portion of each filter was placed on an aluminum stub with a carbon adhesive tab and coated with palladium. Each sample was analyzed by using a Scanning Electron Microscope (FEI XL-30 ESEM-FEG) at the University of Miami Center for Advanced Microscopy.

Enumeration of particles was computed using the following protocols:

A. >5 µm size fraction particulate characterization:
   1. Surface area of 47 mm = 1320 mm^2 (excluding filter edge)
   2. Total area viewed per frame at 500 x = 0.175 mm^2
   3. 14 frames viewed at 500 x = 2.45 mm^2
   4. Particles per liter extrapolation was calculated by

      Number of particles/surface area examined x total surface area of the filter x 5 (200 ml filtered) = Number particles per liter

B. ≦5 µm size fraction particulate characterization:
   1. Surface area of 47 mm = 1320 mm^2 (excluding filter edge)
   2. Total area viewed per frame at 5000 x = 0.0175 mm^2
   3. 10 frames viewed at 5000 x = 0.0175 mm^2
   4. Particles per liter extrapolation was calculated by

      Number of particles/surface area examined x total surface area of the filter x 5 (200 ml filtered) = Number particles per liter

Total Particle Concentration (TPC) = Sum of both size fractions

13.1 > 5 µm Particulates

The >5 µm particulates ranged in concentration from 0.04-0.40 million particles per liter (MPL) (Table 1). The highest concentration of particulates >5 µm were found at the Boynton Inlet site (BD-13A) (Figure 1). The Boynton Inlet site contained more than twice as many >5 µm particulates than any other locality examined in this study. Scanning electron microscopy (SEM) examination revealed that large chained centric diatoms (*Skelatonema sps*., *Chaetoceras sps*., and *Cyclotella sps*.) dominated the population with pinnate diatoms contributing a minor contribution (Figures 1-9). The surface sample collected at the South Central outfall boil (BD-4A) and near bottom reef sample (BD-8C) exhibited the lowest particulate concentrations. The mid- and near-bottom outfall (BD-4B, BD-4C) and surface and mid-depth reef samples (BD-8A, BD-8B) contained a similar number of particulates per liter (Table 1 and Figure 1). Particulates most commonly found at all the sample sites, but in varying concentrations, are shown in Figures 1-9.

Table 1: Particulate size concentration for each of the sample stations in million particles per liter (MPL) collected during July 2008 Boynton-Delray water quality monitoring cruise.

Station	Particles >5 µm	Particles ≤5 µm	Total Particles/L
BD- 13 inlet	0.40	3.62	4.02
BD-4A surface outfall	0.04	1.55	1.58
BD-4B mid-depth outfall	0.13	3.84	3.97
BD-4C near bottom outfall	0.11	2.11	2.22
BD-8A surface reef	0.19	5.54	5.73
BD-8B mid-depth reef	0.11	3.77	3.88
BD-8C near bottom reef	0.06	1.13	1.19

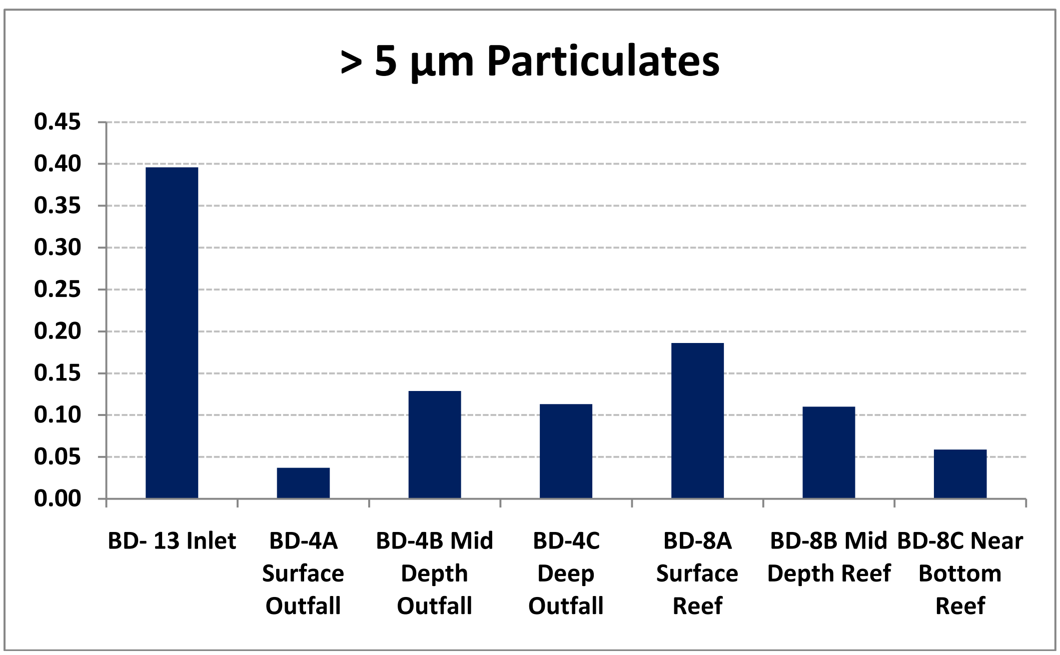

Figure 1: Particulate concentration (MPL) of the >5 µm size fraction in water samples collected during July 2008 Boynton-Delray water quality sampling cruise.

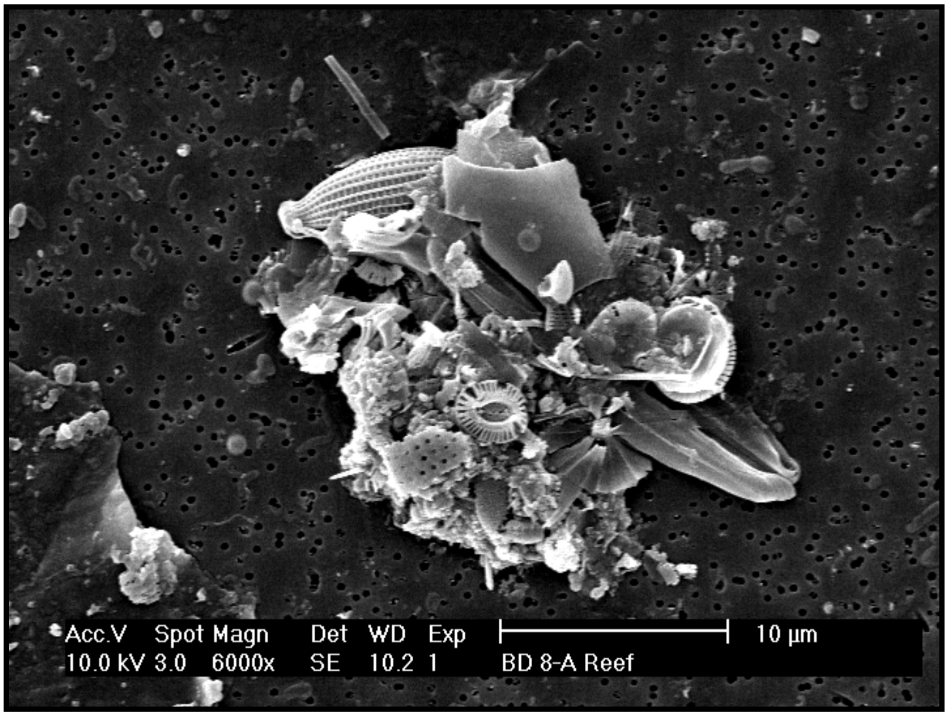

Figure 2: Fecal pellet containing diatoms and coccoliths in the >5 µm size fraction at station BD-8A (surface waters over the reef).

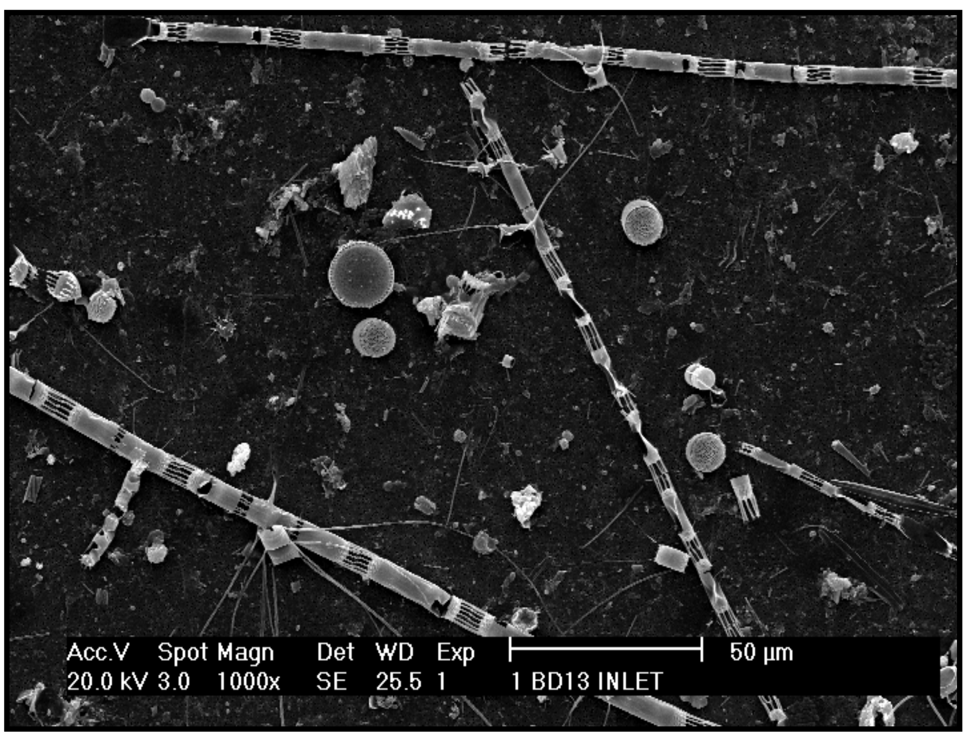

Figure 3: Diatom distribution (predominately *Skelatonema sps*. and *Cyclotella sps*.) in the >5 µm size fraction in Boynton Inlet sample BD-13A.

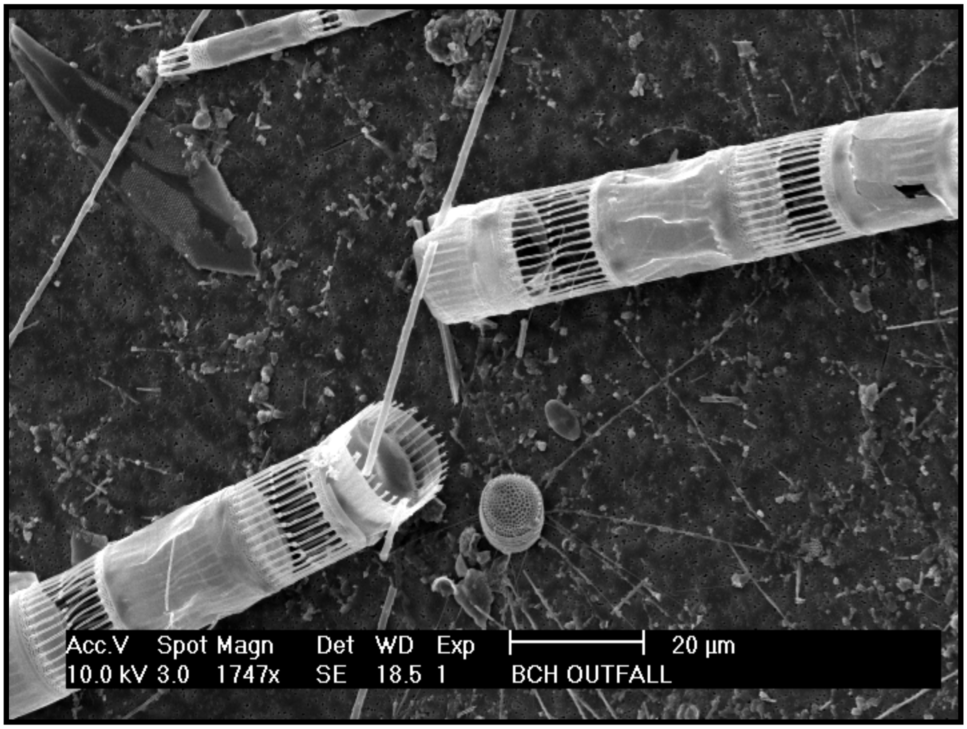

Figure 4: Detail of *Skelatonema sps.* in the >5 µm size fraction from Boynton Inlet station BD-13A.

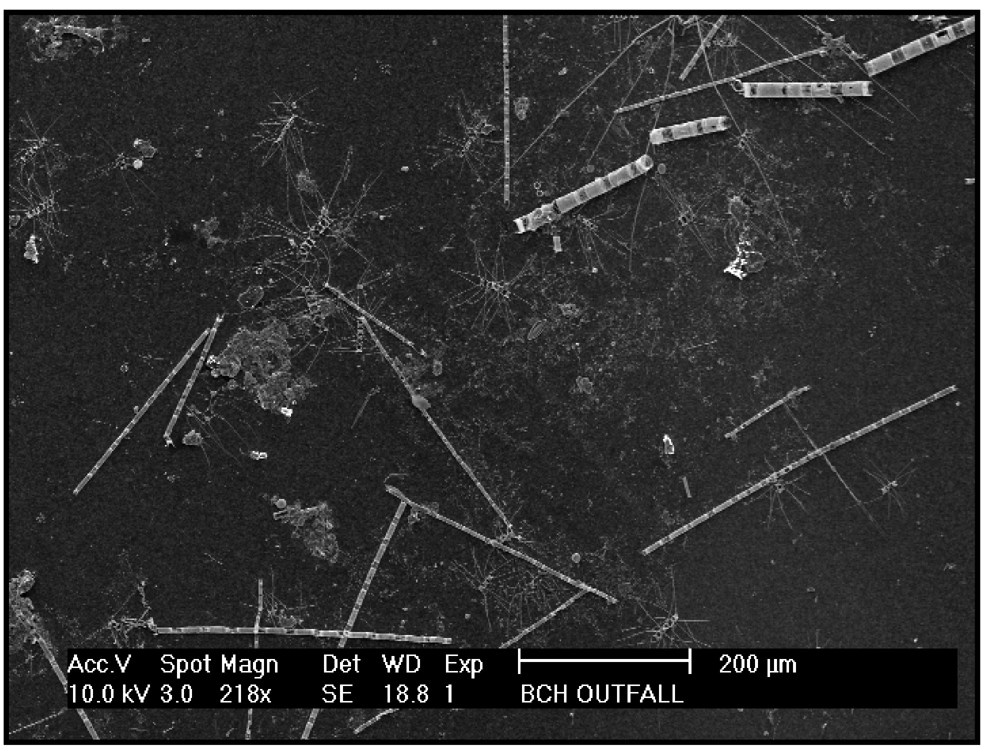

Figure 5: Centric diatom distribution in the >5 µm size fraction from Boynton Inlet station BD-13A.

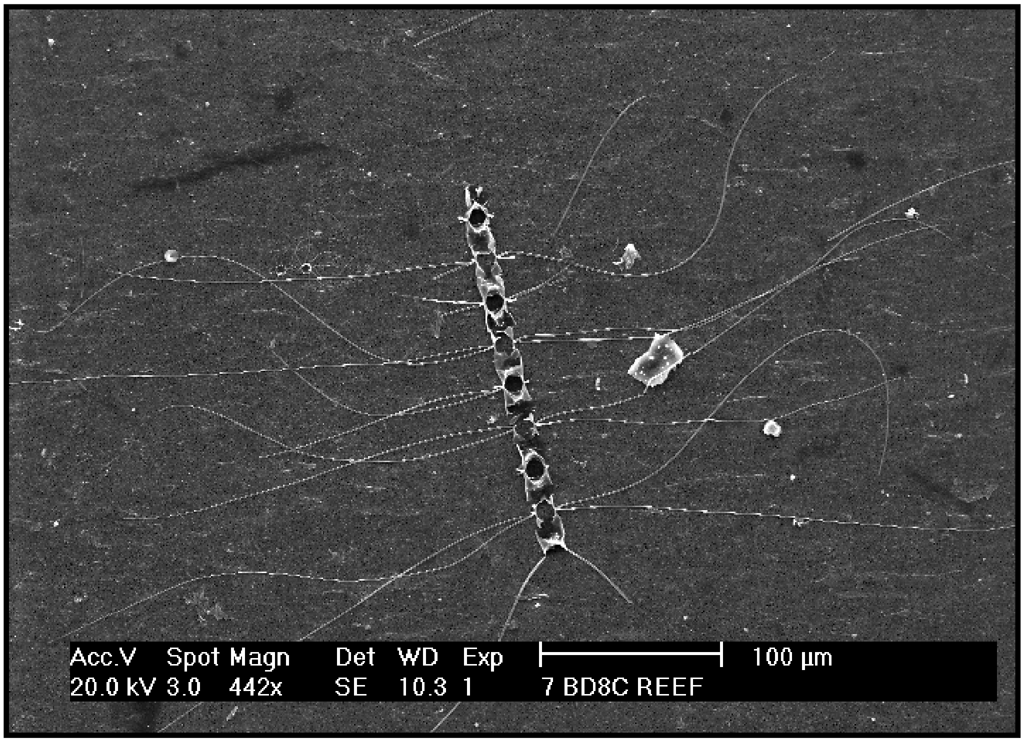

Figure 6: *Chaetoceros sps*. observed in the >5 µm centric diatom population from sample BD-8C (near bottom, reef).

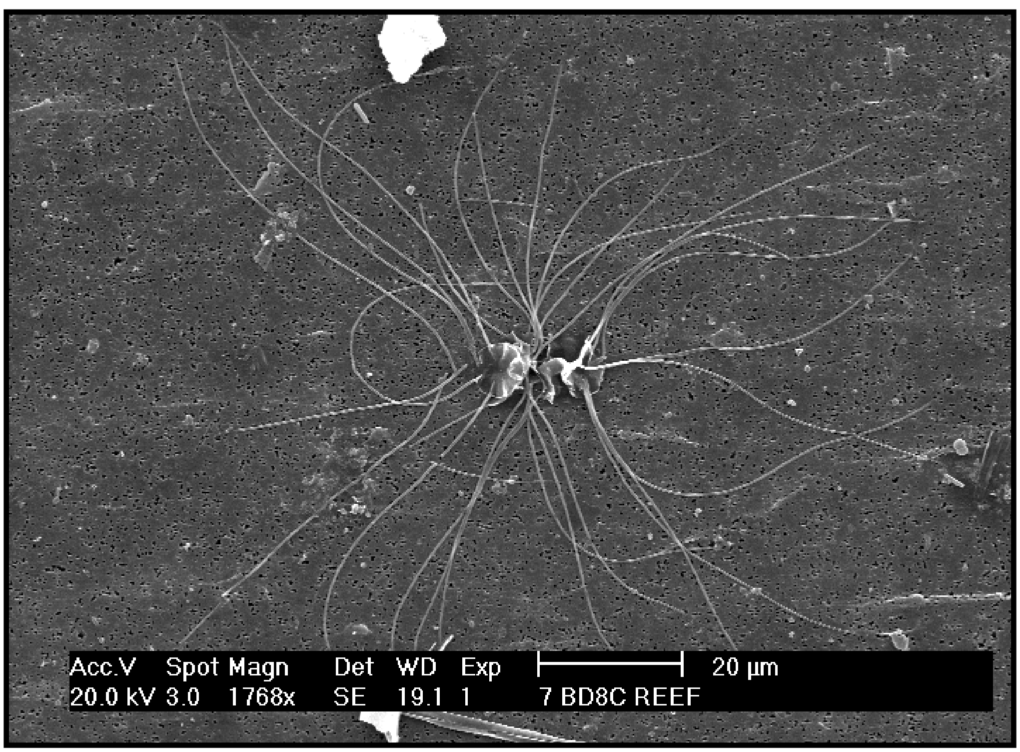

Figure 7: > 5 µm centric diatom in sample BD-8C (near bottom, reef).

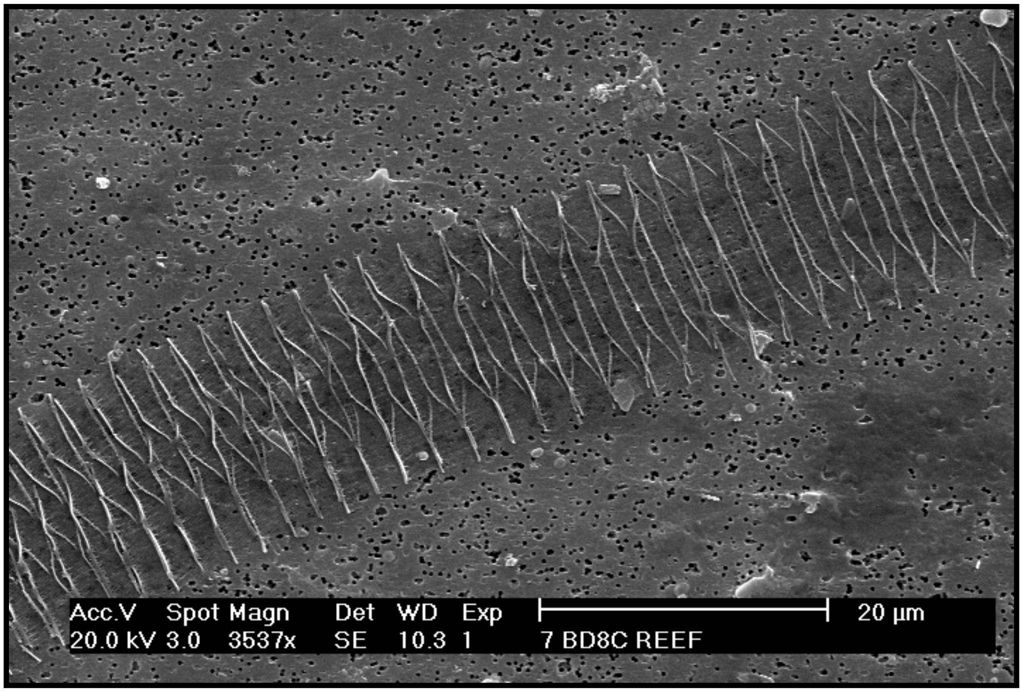

Figure 8: Chain of pennate diatoms in sample BD-8C (near bottom, reef).

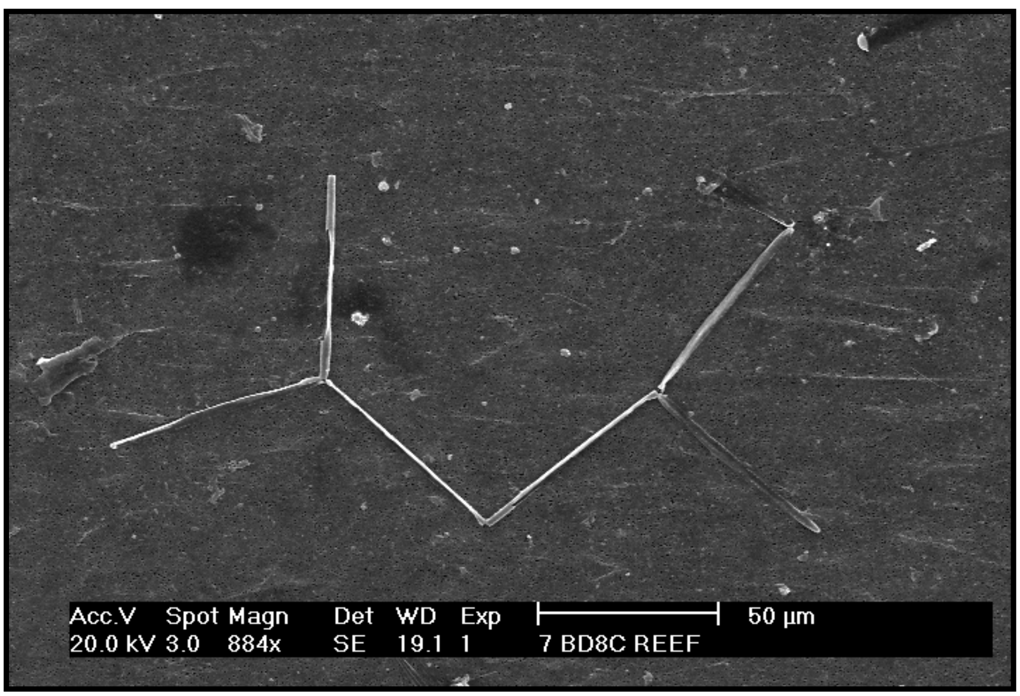

Figure 9: >5 µm pennate diatoms in sample BD-8C (near bottom, reef).

13.2 ≤ 5 µm Particulates

The ≤ 5 µm particulates ranged in concentration from 1.13-5.54 MPL (Table 1), with the highest concentration at the surface reef site (BD-8A, Figure 10). The Boynton Inlet (BD-13), mid-depth outfall (BD-4B), and mid-depth reef (BD-8B) sites had similar concentrations of ≤5 µm particulates ranging from 3.62-3.84 MPL. The surface and near bottom outfall (BD-4A, BD-4B), and near bottom reef (BD-8C) sites had the lowest concentrations of ≤5 µm particulates, ranging from 1.13-2.11 MPL. The majority of the ≤ 5 µm particulates were comprised of small algae and elongate and coccoid-shaped bacteria (Figures 11-20).

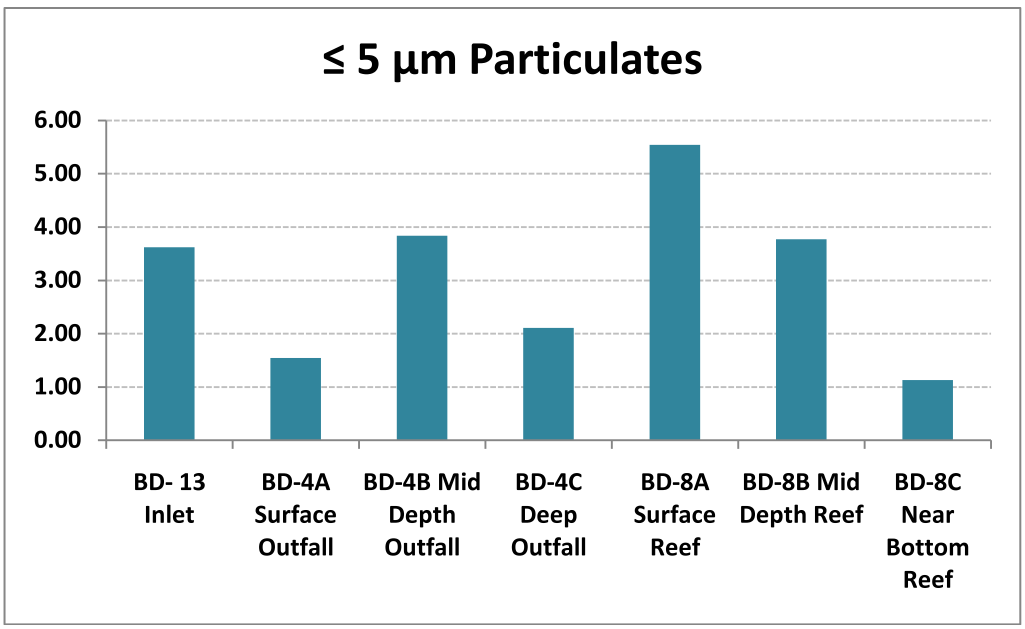

Figure 10: Total particle concentration (MPL) in the ≤5 µm size fraction for water samples collected during July 2008 Boynton-Delray water quality sampling cruise.

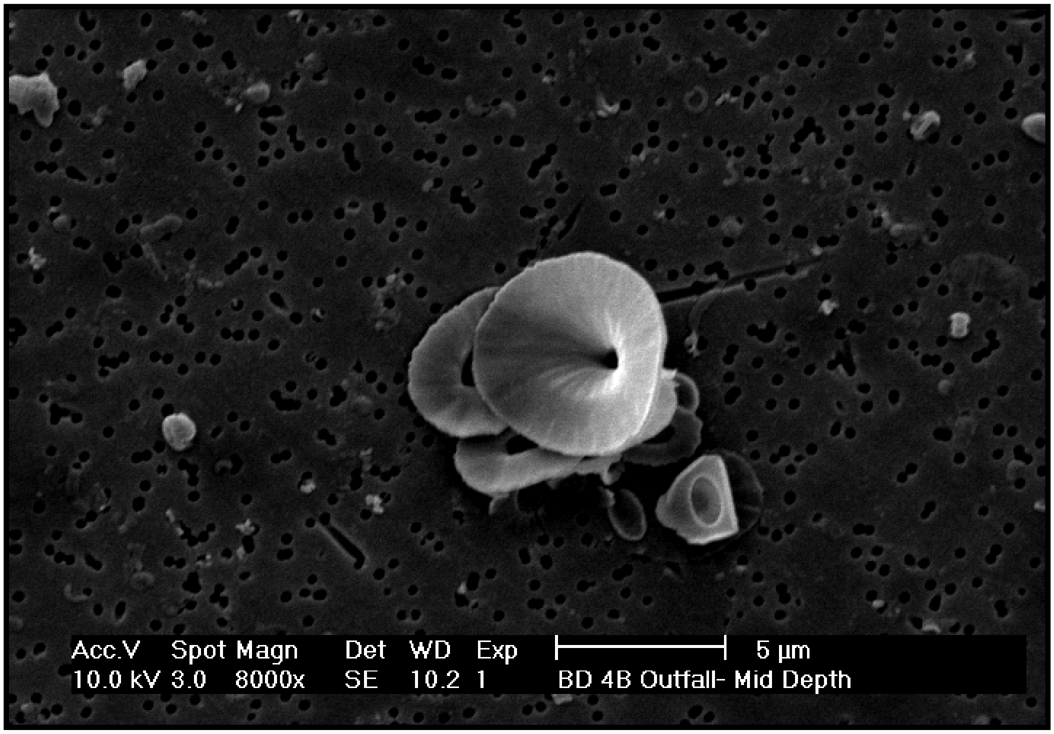

Figure 11: Coccoliths (disarticulated calcium carbonate plates of coccolithophorid algae) collected in the ≤5 µm size fraction at site BD-4B (mid-depth, South Central outfall).

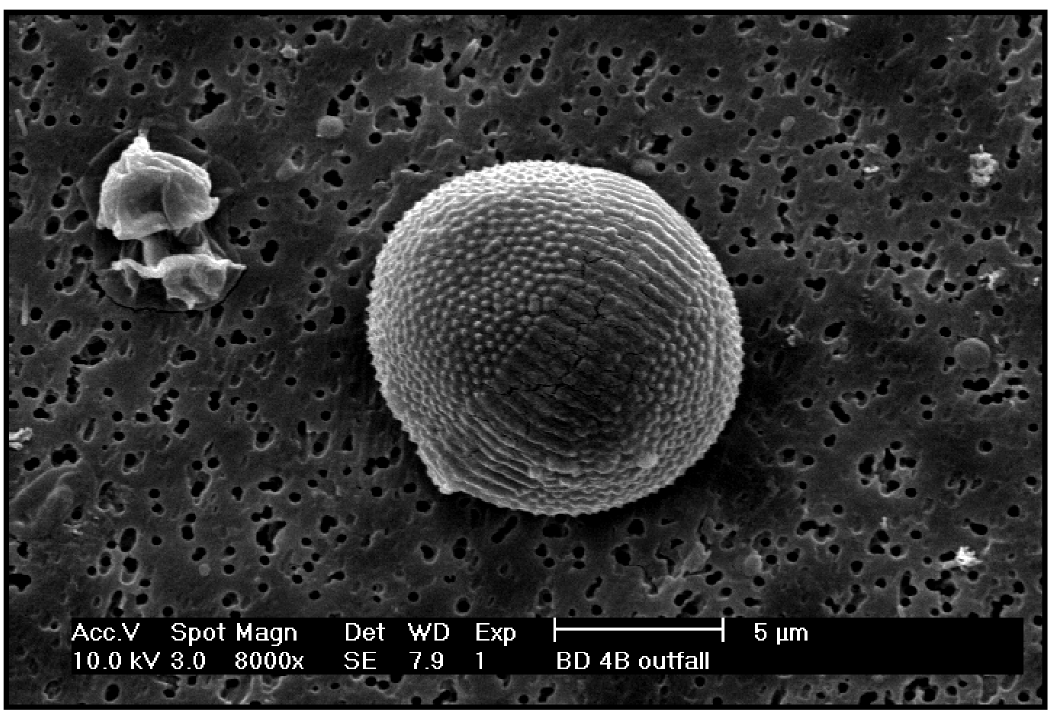

Figure 12: Dinoflagellate in the ≤5 µm size fraction at site BD-4B (mid-depth, South Central outfall).

Figure 13: Small centric siliceous diatoms at site BD-4B (mid-depth, South Central outfall).

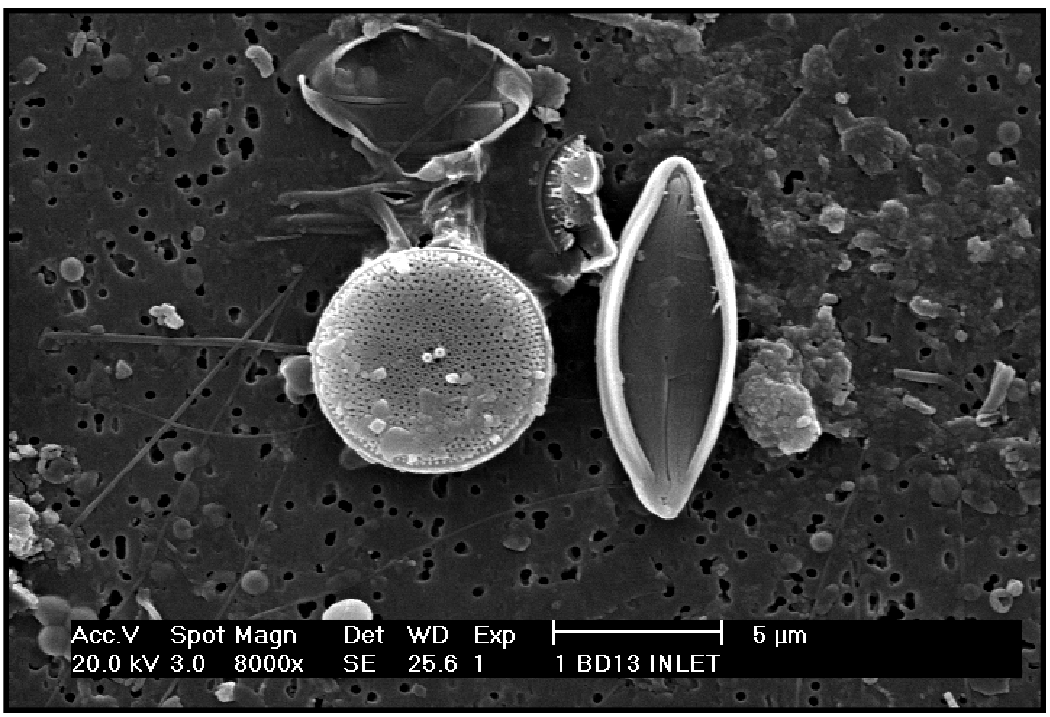

Figure 14: Small siliceous centric and pennate diatoms in the near ≤5 µm size fraction from BD-13A (Boynton Inlet).

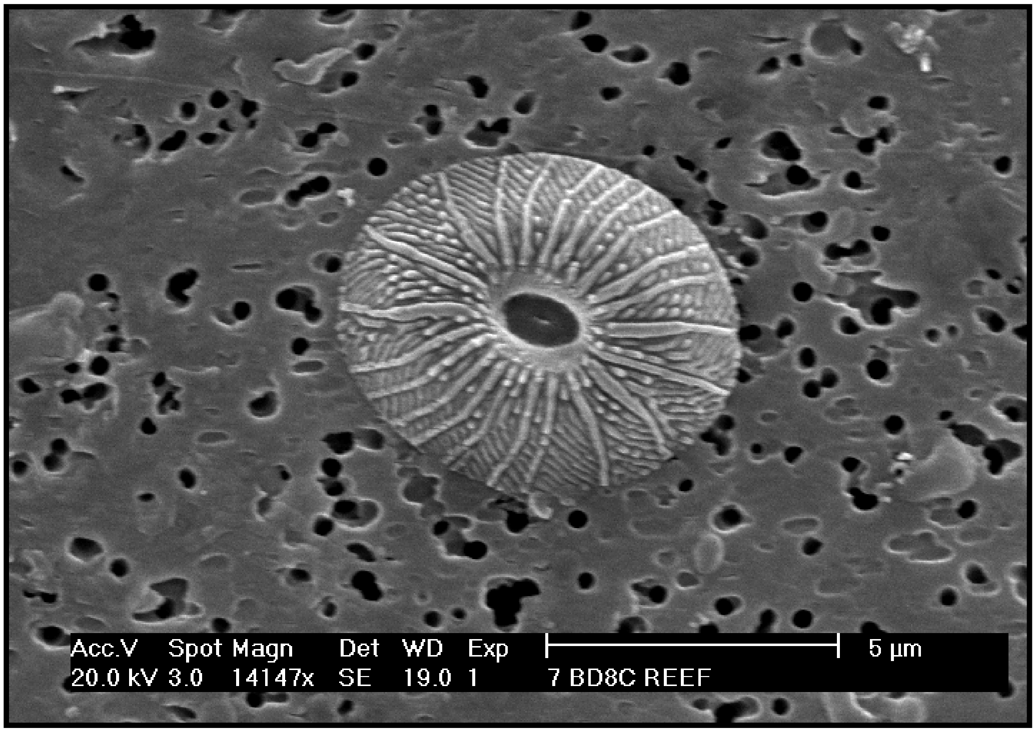

Figure 15: A calcium carbonate cocccolith (*Umbellosphaera tenuis*) in the ≤5 µm size fraction at site BD-8C (near bottom, reef).

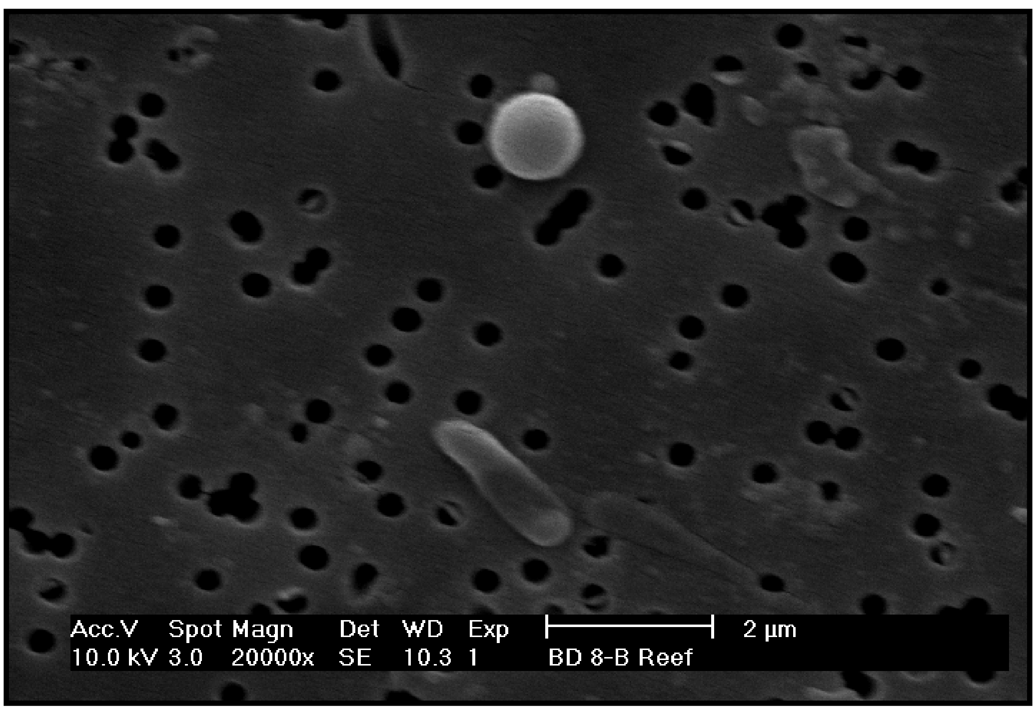

Figure 16: Elongate and coccoid shaped bacteria from sample BD-8B (mid-depth, reef).

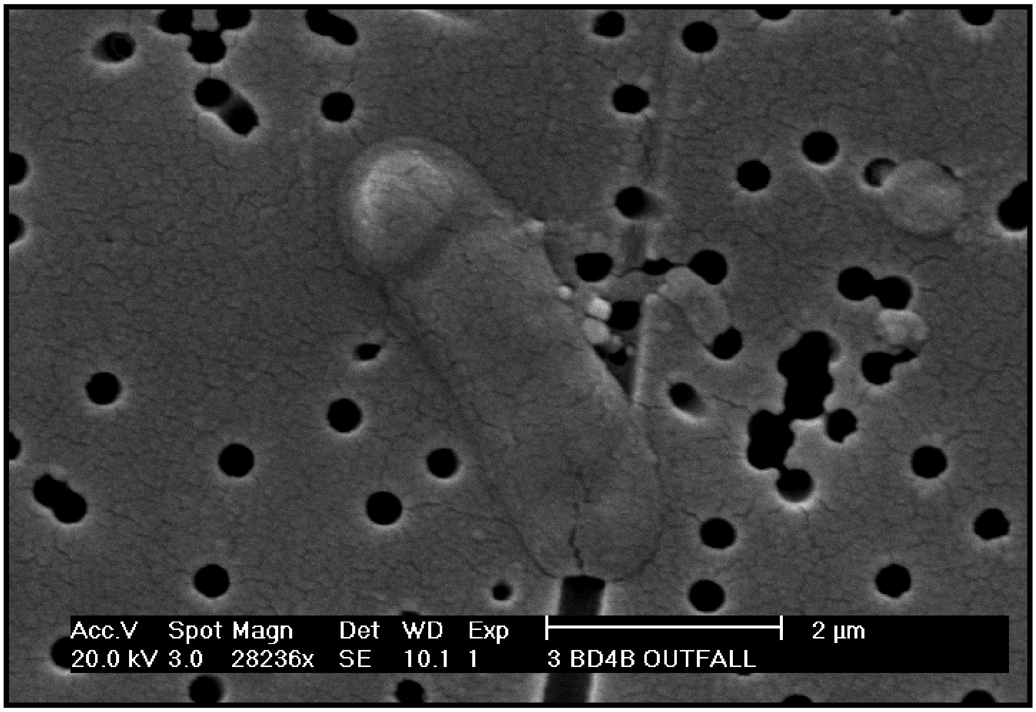

Figure 17: Rod-shaped bacteria from sample BD-4B (mid-depth, South Central outfall).

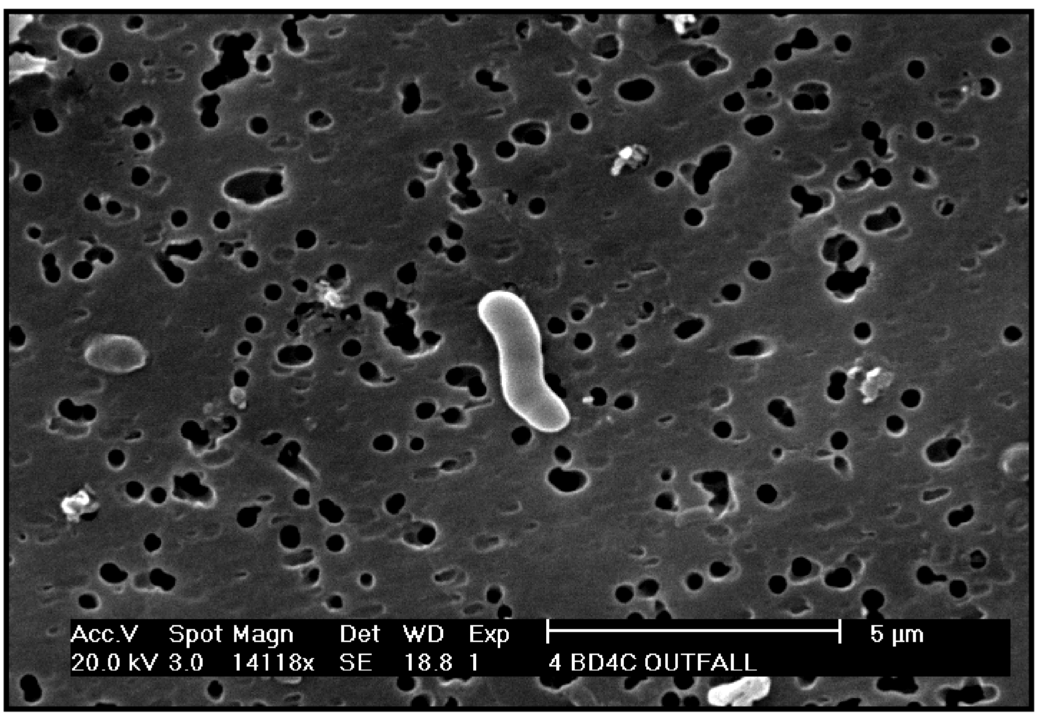

Figure 18: Bacteria from sample BD-4C (near bottom, South Central outfall).

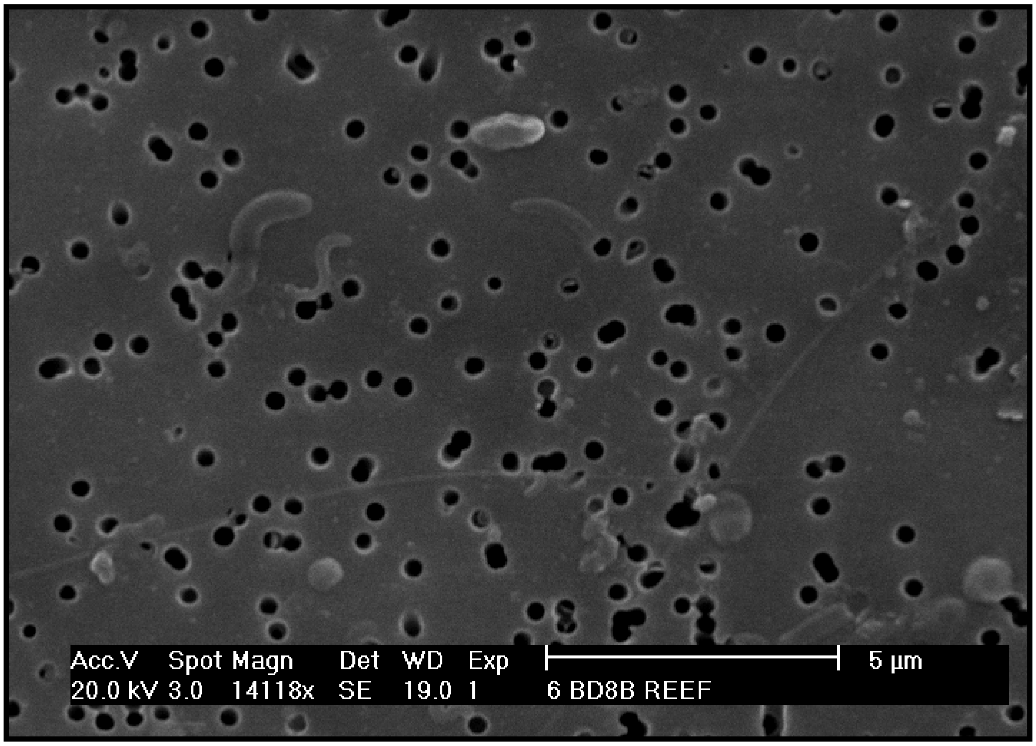

Figure 19: Coccoid-shaped bacteria from sample BD-8B (mid-depth, reef).

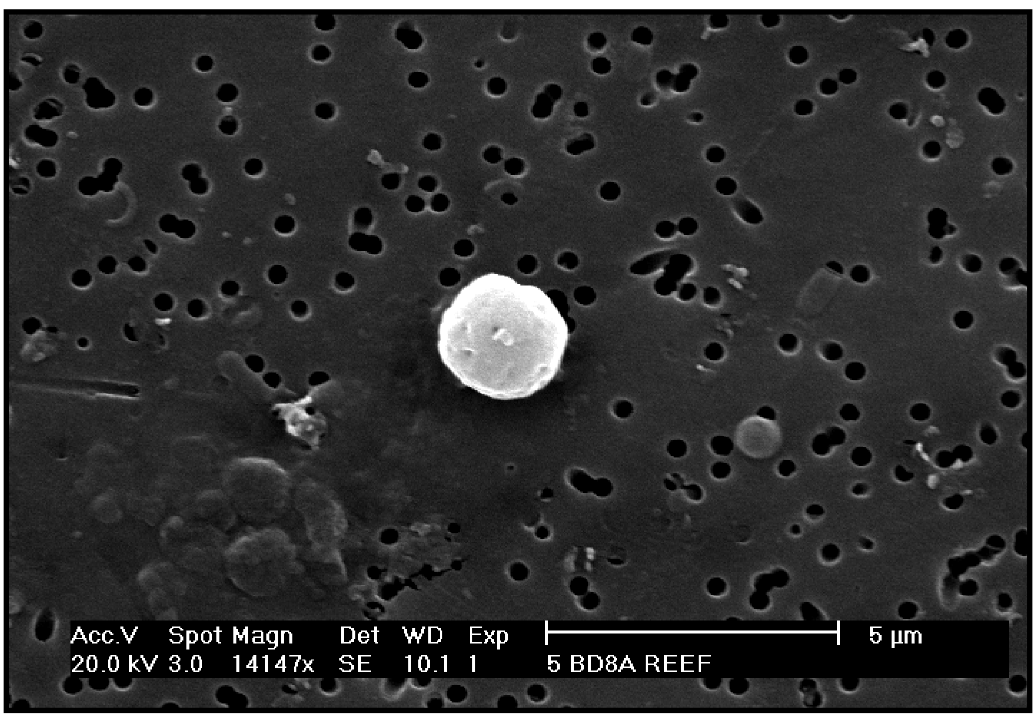

Figure 20: Coccoid-shaped bacteria (background) from sample BD-8A (surface, reef).

13.3 Total Particulates

Total particulate concentrations estimated in the SEM ranged from 1.19-5.73 MPL (Figure 21). The high concentration at the surface reef site (BD-8A, 5.73 MPL) (Figure 21, Figure 10) was due to the ≤ 5 µm size fraction contribution. The Boynton Inlet (BD-13), mid-depth outfall (BD-4B), and mid-depth reef (BD-8B) sites had similar concentrations ranging from 3.88-4.02 MPL. The surface outfall (BD-4A), deep outfall (BD-4C), and near bottom reef (BD-8C) sites had similar concentrations ranging from 1.19-2.22 MPL.

The higher concentration of the larger particulates in BD-13 (0.40 MPL) compared to the other localities, which ranged from 0.04-0.19 (Figure 21), would result in a much greater biomass concentration from this sample. This is consistent with the chlorophyll-a and Si results reported in this technical report. There was a greater concentration of small particles in BD-8A (Figure 10) comprised of very small bacteria. Although qualitatively important, they contribute relatively little to biomass. Future studies will include an estimation of mass, which will provide additional information and enable conversion from concentration (MPL) to relative mass (gms/liter).

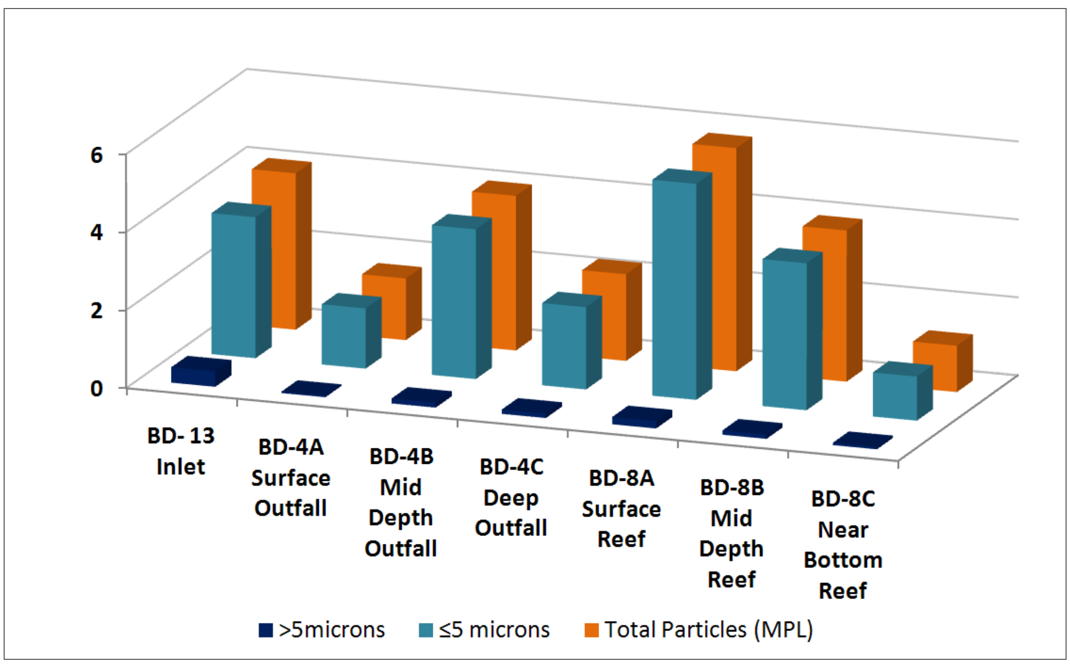

Figure 21: Comparison of the total number of particles (MPL) in the >5 µm size fraction and ≤5 µm size fraction in water samples collected during the July 2008 Boynton-Delray water quality sampling cruise. Although concentration of >5 µm particulates in BD-13 (Boynton Inlet) was twice as high as in the other samples collected, the concentration of very small particulates was highest in sample BD-8A (reef surface).

Appendix B:
14. Quality Control-Quality Assurance Assessment

Quality control-quality assurance (QC-QA) procedures for the Boynton-Delray water quality monitoring surveys involved collecting field duplicates from the same five stations (BD-4A, BD-7B, BD-10C, BD-15C, and BD-18A) during the duration of the project. Duplicates were collected for the following water quality parameters: N+N, NH_4, P, Si, TDN, TDP, DOC, TSS, chlorophyll, and pH. Duplicate samples were collected in separate sample containers for individual analysis. Blanks (laboratory, equipment, and trip) were also collected and analyzed for the following water quality parameters: N+N, NH_4, P, Si, TSS, and chlorophyll.

Nutrient samples were filtered aboard the boat immediately after collection and placed on ice. DOC, TDN, phosphorus, and TSS were placed on ice and filtered at AOML. Chlorophyll samples were filtered aboard the boat following collection if sea conditions allowed; if not, samples were placed on ice and filtered at the end of the survey day, which provided a more immediate sample preservation than waiting until returning to AOML.

14.1 Precision

The precision of the QC-QA data was estimated by calculating the relative percent difference (RPD) of field duplicate samples. The field duplicate results provided an estimate of the total variability due to both sampling and analytical procedures. Tables 1-6 show the relative percent difference for nutrients, DOC, chlorophyll, TSS, and pH. Table 7 shows the overall number of samples that fell within each relative percent difference range. The target RPD ranges were based on the Boynton-Delray water quality monitoring plan and were 0-10% for nutrient, DOC, and pH, and 0-20% for chlorophyll and TSS samples. Approximately 65% of the nutrient sample duplicates fell within the 0-10% RPD range. Forty-two percent of TSS duplicates, 60% of DOC duplicates, 93% of chlorophyll duplicates, and 100% of pH duplicates fell within their appropriate RPD ranges. Chlorophyll and pH had the best field precision, while nutrient, DOC, and TSS had much lower precision. A number of contributing factors could have lead to lower RPDs: instrument malfunction while analyzing duplicate samples, static while weighing filters, a duplicate filter having a larger particle on it such as a piece of algae, and possible contamination while sampling. Overall, the field precision was good for all six of the water quality monitoring sampling events.

14.2 Accuracy

Field accuracy was assessed through the use of trip and equipment blanks. The blanks were also used to determine if samples were contaminated. Trip and equipment blanks consisted of reagent grade deionized water and/or low nutrient seawater (LNSW) collected from the Gulf Stream. Tables 8 and 9 show the results for the equipment and trip blanks collected during each of the six water quality monitoring sampling events. No trip or equipment blanks were collected during the February 2008 and July 2008 sampling events. The minimum detection limit (MDL) for each parameter sampled is listed in Table 5 of this report. All equipment and trip blanks were found to be below the MDL for each parameter sampled for each of the sampling events in which blanks were collected except for the following: (1) the trip and equipment blanks had

Table 1: Relative percent difference (RPD) for water quality parameters during the June 2007 Boynton-Delray water quality monitoring survey.

Station	N+N	NH_4	P	Si	TDN	TDP	DOC	TSS	Chlorophyll	pH
BD-4A	71.4	0.0	0.0	0.0	N/A	N/A	N/A	6.9	3.9	0.1
BD-7B	2.9	0.0	0.0	0.0	N/A	N/A	N/A	24.1	2.3	0.0
BD-10C	0.0	4.6	157.9	0.0	N/A	N/A	N/A	76.5	2.9	0.1
BD-15C	0.0	1.8	1.8	0.0	N/A	N/A	N/A	16.5	1.8	0.0
BD-18A	2.5	27.7	100.0	0.0	N/A	N/A	N/A	5.3	0.2	0.1

Table 2: Relative percent difference (RPD) for water quality parameters during the August 2007 Boynton-Delray water quality monitoring survey.

Station	N+N	NH_4	P	Si	TDN	TDP	DOC	TSS	Chlorophyll	pH
BD-4A	2.5	0.4	2.2	0.2	23.8	4.0	3.2	14.6	2.7	0.1
BD-7B	66.7	100.0	100.0	0.0	9.4	8.4	2.6	34.8	89.3	0.0
BD-10C	0.0	100.0	0.0	24.3	22.2	4.4	4.1	91.3	2.6	0.0
BD-15C	0.0	0.0	0.0	0.0	9.5	17.6	1.1	17.2	2.1	0.0
BD-18A	7.9	5.7	26.1	1.0	0.3	8.1	0.4	27.7	0.3	0.0

Table 3: Relative percent difference (RPD) for water quality parameters during the October 2007 Boynton-Delray water quality monitoring survey.

Station	N+N	NH_4	P	Si	TDN	TDP	DOC	TSS	Chlorophyll	pH
BD-4A	10.5	0.0	100.0	0.0	17.5	N/A	15.5	31.6	1.0	0.1
BD-7B	15.4	100.0	0.0	0.0	7.7	N/A	3.2	44.4	1.1	0.1
BD-10C	14.3	0.0	0.0	0.0	3.9	N/A	1.3	4.0	0.6	0.1
BD-15C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BD-18A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.1	N/A

Table 4: Relative percent difference (RPD) for water quality parameters during the February 2008 Boynton-Delray water quality monitoring survey.

Station	N+N	NH_4	P	Si	TDN	TDP	DOC	TSS	Chlorophyll	pH
BD-4A	35.6	N/A	0.0	0.0	7.6	N/A	14.3	38.6	3.1	0.1
BD-7B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BD-10C	50.0	N/A	0.0	0.0	20.9	N/A	1.3	6.7	8.2	0.1
BD-15C	N/A	N/A	N/A	N/A	18.3	N/A	8.1	3.4	7.9	0.1
BD-18A	2.2	N/A	3.6	0.0	12.3	N/A	11.0	3.0	4.6	1.1

Table 5: Relative percent difference (RPD) for water quality parameters during the May 2008 Boynton-Delray water quality monitoring survey.

Station	N+N	NH_4	P	Si	TDN	TDP	DOC	TSS	Chlorophyll	pH
BD-4A	100.0	39.8	31.1	0.0	6.8	23.1	10.6	10.1	0.2	0.1
BD-7B	0.0	5.9	0.0	0.0	94.1	12.9	1.0	4.7	0.2	0.1
BD-10C	0.0	50.0	0.0	0.0	23.3	3.6	40.5	N/A	2.5	0.0
BD-15C	0.0	8.2	0.0	0.0	3.0	134.4	145.5	2.1	1.4	0.1
BD-18A	33.3	4.8	12.5	22.2	13.7	2.0	25.7	9.1	2.9	0.2

Table 6: Relative percent difference (RPD) for water quality parameters during the July 2008 Boynton-Delray water quality monitoring survey.

Station	N+N	NH_4	P	Si	TDN	TDP	DOC	TSS	Chlorophyll	pH
BD-4A	5.4	111.0	0.0	25.8	15.1	81.8	22.5	3.6	23.5	0.2
BD-7B	0.0	13.3	0.0	0.0	5.1	100.0	7.0	0.7	14.4	0.1
BD-10C	13.3	11.8	0.0	0.0	0.2	14.3	3.3	0.5	N/A	0.1
BD-15C	0.0	40.0	0.0	6.2	13.4	34.8	12.3	16.9	N/A	0.1
BD-18A	3.1	4.6	3.5	3.1	3.0	0.0	5.7	2.4	4.3	0.3

Table 7: Overall relative percent difference (RPD) of duplicate samples collected during the Boynton-Delray water quality monitoring surveys for each of the water quality parameters.

RPD (%)	N+N	NH_4	P	Si	TDN	TDP	DOC	TSS	Chlorophyll	pH
0-10	16	13	19	23	11	7	13	10	26	27
10-20	4	2	1	0	6	3	5	5	1	0
20-30	0	1	0	3	4	2	2	3	0	0
30-40	2	2	2	0	0	0	0	3	0	0
40-50	1	1	0	0	0	0	1	1	0	0
50-60	0	0	0	0	0	0	0	0	0	0
60-70	1	0	0	0	0	0	0	0	0	0
70-80	1	0	0	0	0	0	0	1	0	0
80-90	0	0	0	0	0	1	0	0	1	0
90-100	1	3	3	0	1	1	0	1	0	0
>100	0	1	1	0	0	1	1	0	0	0
Total Samples	**26**	**23**	**26**	**26**	**22**	**15**	**22**	**24**	**28**	**27**

Table 8: Equipment blank results for all six Boynton-Delray water quality monitoring cruises. Units are µM for nutrients, mg/L for TSS, and µg/L for chlorophyll.

Date	N+N	NH_4	P	Si	TSS	Chlorophyll
June 2007	0	0.011	0	0	0.01	0.089
August 2007	0.36	0	0	0	0.08	0.006
October 2007	0.06	0	0.015	0	0.03	0.002
February 2008	N/A	N/A	N/A	N/A	N/A	N/A
May 2008	0.08	1.42	0	0	0.10	0.001
July 2008	N/A	N/A	N/A	N/A	N/A	N/A

Table 9: Trip blank results for all six Boynton-Delray water quality monitoring cruises. Units are µM for nutrients, mg/L for TSS, and µg/L for chlorophyll.

Date	N+N	NH_4	P	Si	TSS	Chlorophyll
June 2007	0.001	0.011	0	0	0.03	0.002
August 2007	0.36	0	0	0	N/A	0.003
October 2007	0	0	0	0	0.43	0.002
February 2008	N/A	N/A	N/A	N/A	N/A	N/A
May 2008	0.01	1.42	0	0	0.09	0.003
July 2008	N/A	N/A	N/A	N/A	N/A	N/A

a high NH_4 reading of 1.42 μM, suggesting that the LNSW used during May 2008 was high in this constituent and was not caused by contamination from sampling; (2) the trip and equipment blanks had an above MDL reading in Nitrate-N + Nitrite-N (0.36 μM), suggesting that the LNSW used during August 2008 was high in this constituent and was not caused by contamination from sampling; (3) the trip blank for TSS during October 2007 had a value above the MDL, which may be the result of an erroneous weight measurement due to interference of static in the filter with the microbalance during the initial weighing process; and (4) the equipment blank for chlorophyll during June 2007 had a slightly higher value above the MDL, which may indicate contamination.

14.3 Below Detection Limits

Table 10 lists the percentage of data for each parameter for each of the six water quality monitoring sampling events that fell below detection levels. Orthophosphate-P and Si had the largest percentage of data below detection limits.

14.4 Completeness

Tables 11 and 12 show the percentage of completeness for each parameter sampled during each of the six water quality monitoring sampling events. Field completeness during sample collection was good for all sampling events except for the following: (1) during October 2007 (89%) due to foul weather and marine conditions in which stations BD-14 and BD-15 were not sampled; and (2) during February 2008 (82%) due to depth-related issues with the R/V *Nancy Foster* and poor marine conditions for smaller boat operations in which stations BD-9, BD-12, and BD-14 were not sampled. Laboratory completeness was good for each parameter sampled during all six sampling events except for TDN and TDP during June 2007 and TDP during October 2007 and February 2008. TDN and TDP samples were retained past their holding times due to equipment malfunctions. Due to the possible questionable results, the samples were not analyzed.

Table 10: Number and percentage of data which fell below detection limits for each parameter sampled during the six sampling events.

Number BDL	N+N	NH_4	P	Si	TDN	TDP	DOC	TSS	Chlorophyll	pH
June 2007	0	0	36	30	N/A	N/A	N/A	0	0	0
August 2007	9	20	28	19	0	0	0	0	0	0
October 2007	0	22	24	35	0	N/A	0	0	0	0
February 2008	0	N/A	21	33	0	N/A	0	0	0	0
May 2008	33	0	35	41	0	0	0	0	0	0
July 2008	17	0	43	9	0	6	0	0	0	0
Total Number	272	227	272	272	227	136	227	272	272	272
% BDL	21.7%	18.5%	68.7%	61.4%	0.0%	6.6%	0.0%	0.0%	0.0%	0.0%

Table 11: Percentage of field completeness for sample collection during each of the six sampling events.

Date	N+N	NH_4	P	Si	TDN	TDP	DOC	TSS	Chlorophyll	pH
June 2007	100%	100%	100%	100%	100%	100%	100%	100%	98%	100%
August 2007	98%	98%	98%	98%	100%	100%	100%	100%	100%	100%
October 2007	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
February 2008	82%	0%	82%	82%	82%	82%	82%	82%	82%	82%
May 2008	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
July 2008	100%	100%	100%	100%	100%	100%	100%	100%	98%	100%

Table 12: Percentage of laboratory completeness for sample analysis during each of the six sampling events.

Date	N+N	NH_4	P	Si	TDN	TDP	DOC	TSS	Chlorophyll	pH
June 2007	100%	100%	100%	100%	0%	0%	0%	100%	98%	100%
August 2007	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
October 2007	100%	100%	100%	100%	100%	0%	100%	100%	100%	100%
February 2008	100%	N/A	100%	100%	100%	0%	100%	100%	100%	100%
May 2008	100%	100%	100%	100%	96%	100%	100%	100%	96%	100%
July 2008	100%	100%	100%	100%	98%	94%	98%	100%	980%	98%