



Fixed-Station Water-Quality Monitoring at Fort Matanzas National Monument

2013-2014 Data Summary

Natural Resource Data Series NPS/SECN/NRDS—2017/1138



ON THE COVER

The Matanzas River, in the vicinity of Fort Matanzas National Monument

Photo by Eric Starkey

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The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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This report is available from the [Southeast Coast Network website](#) and the [Natural Resource Publications Management website](#). Data summarized in this report can be found at the [Aquarius Web Portal](#). To receive this report in a format optimized for screen readers, please email irma@nps.gov.

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Summary and Key Findings

In 2010 the National Park Service (NPS) Southeast Coast Network (SECN) Inventory and Monitoring Program began collecting water-quality data in the estuarine waters near Fort Matanzas National Monument (FOMA) as part of the NPS Vital Signs monitoring program.

The continuous-monitoring data station is located at the visitors center dock. This station collects pH, dissolved oxygen, temperature, salinity, specific conductance, turbidity, and water-level data every 30 minutes. The FOMA fixed-station water-quality monitoring site is part of the SECN estuarine water-quality monitoring program, which routinely collects data in the vicinity of seven coastal parks located along the southeastern U.S. coast (DeVivo et al. 2008).

Summary data are presented in annual data reports published by the network. Information collected by this monitoring program will be used to help managers make better-informed decisions by understanding trends and variability related to water-quality conditions in park waters. Summary findings below are based on continuous data and discrete sampling collected during 1 January 2013–31 December 2014.

Continuous Monitoring

- Continuous data were collected at one fixed-station site by the Southeast Coast Network.
- Mean monthly dissolved oxygen levels were generally good throughout the entire year, ranging from a low of 5.8 mg/L in several months to a high of 8.3 mg/L in multiple months. Individual dissolved oxygen readings

ranged from 3.8 mg/L in September 2013 to 9.6 mg/L in March 2014.

- Mean monthly pH values ranged from a low of 7.9 in multiple months to a high of 8.1 in multiple months. Individual pH readings ranged from 7.5 in September 2014 to 8.5 in January 2013.
- Monthly mean turbidity values ranged from 5.6 NTU in September 2013 to 11.7 NTU in June 2013. Individual turbidity readings ranged from 0.3 NTUs in multiple months to 199.5 NTUs in September 2013.
- Mean monthly water temperatures ranged from 14.0°C (57.2°F) in several months to 28.7 °C (83.7 °F) in July 2014. Individual temperature readings ranged from 9.8°C (49.6°F) in January 2014 to 31.6°C (88.9°F) in September 2014.
- The tidal range for the Fort Matanzas National Monument site was approximately 2.25 meters (7.4 feet).

Discrete Sampling

Monthly water-quality data (discrete samples) are not collected at Fort Matanzas National Monument.

Fort Matanzas National Monument Significant Waters Map

Southeast Coast Network
National Park Service
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Figure 1. Locations of Southeast Coast Network water-quality monitoring station in Fort Matanzas National Monument during 2013–2014. Depicted are areas of salt marsh (USFWS 2015), urban areas (United States Census Bureau 2015), 303(d) listed areas (EPA 2017), and shell fish harvesting areas (FDEP 2011).

Introduction

Due to the importance of water resources to park management from ecological, regulatory, and visitor experience perspectives, estuarine water quality in and around parks was selected as one of several Vital Signs to be monitored by the I&M program (DeVivo et al. 2008). Data collected as a part of this effort are intended to foster a better understanding of water resources in and in the vicinity of park units, and contribute to a better understanding of park ecological processes and physical systems in the region (Gregory et al. 2013).

To effectively monitor diverse and dynamic estuarine water resources, the Southeast Coast Network has implemented a two-pronged monitoring approach which consists of collecting data from continuously recording fixed stations located in each park unit and also collecting periodic discrete water samples for analysis (Gregory et al. 2013). When combined, these two approaches provide a more complete understanding of physical processes, diurnal and seasonal variations, and spatial patterns during critical portions of the year than either could if implemented singularly.

The Southeast Coast Network has identified four specific monitoring objectives for which data are collected and analyzed as part of this effort (Gregory et al. 2013). The contents of this report address objective 1 below:

1. Determine daily and seasonal water-quality patterns for five core parameters (dissolved oxygen, salinity, temperature, pH, and turbidity) at fixed monitoring stations using continuous data loggers.
2. Determine monthly and seasonal patterns in nutrients (nitrogen, phosphorus, and chlorophyll *a*) at fixed monitoring stations by collecting discrete water samples.
3. Determine status and spatial variability of water and nutrient chemistry conditions in estuarine waters every five years.
4. Determine status and spatial variability of benthic sediment quality (organic contaminants, carbon, and metal levels) every ten years in estuarine waters.

This report provides an annual summary of data collected at Fort Matanzas National Monument during 2013–2014 and places these values in context of current water-quality criteria suggested by the U.S. Environmental Protection Agency (EPA 2012), as well as concurrent regional climatic

conditions that may influence local water-quality conditions. This report is intended to provide park resource managers and partners with information on the short-term variability and seasonal trends in water quality across Fort Matanzas National Monument.

Fort Matanzas National Monument

Fort Matanzas National Monument (FOMA) is located 14 miles south of St. Augustine on the northeast Atlantic coast of Florida. Fort Matanzas encompasses a total of 298 acres divided between the southern tip of Anastasia Island (108 acres) and the northern end of Rattlesnake Island (190 acres) by the Matanzas River Inlet (Figure 1). The visitors center is located on a barrier island separated from the Florida mainland by the Matanzas River and the Intracoastal Waterway and consists of stabilized beach dunes rising as much as 25 feet (7.6 meters) above sea level. The main habitats in this portion of the park include beaches along both the Matanzas River and the Atlantic shore, stabilized sand dunes supporting maritime forest, secondary dunes further inland, and salt marsh. Land area at Fort Matanzas NM has actually increased in size by an estimated 13 acres (5.3 hectares) over the past three decades due to shifting sand bars (DeVivo et al. 2008).

The main attraction of Fort Matanzas NM is a ferry ride across the Matanzas River to the eighteenth century coquina limestone fort on scenic Rattlesnake Island. The island is less than 5 feet (1.5 meters) above sea level, though it rises to 15 feet (4.6 meters) at one point on its northern end. Much of the northern portion of Rattlesnake Island consists of sandy fill pumped in from dredging operations that maintain the boat channels in the Intracoastal Waterway. In addition to the habitats found on Anastasia Island, Rattlesnake Island supports slash pine and red bay woodlands, oyster shell beaches, and developing hardwood forests typified by wax myrtle, cedar, and cabbage palm. Shoals along the river currently allow fishermen on Rattlesnake Island to wade into the middle of the Matanzas River west of the inlet bridge, while shallow bars outside break Atlantic waves before they can roll into the mouth of the Matanzas River. At the Matanzas Inlet, many fish are caught from the bridge, which has a separate protected lane for fishermen, as well as around the inside and outside of the inlet. During the seasonal mullet run, castnetters may take hundreds of pounds. Sharks and tarpon weighing over 100 pounds have been caught by fishermen standing on the shores of the inlet (SJRWMD 2009).

River water quality at the monument is heavily influenced by the daily tides and flows from upstream portions of the Matanzas River. Water quality is potentially affected by nearby urban and residential development which mostly occurs immediately adjacent to the eastern sides of the river both north and south of the Matanzas River Inlet. Although not currently 303(d) listed by the US Environmental Protection Agency (USEPA), as recently as 2008 the State of Florida listed the segment of the Matanzas River from State Route 206 to the Matanzas Inlet as impaired due to elevated mercury and fecal coliform bacteria (SJRWMD 2009). SJRWMD is currently monitoring water quality monthly in the Matanzas River at County Road 312 approximately 15 miles north of the park as part of their ongoing water-quality assessment program. Even with the level of development in

the watershed, the Matanzas River is one of the most natural areas within the St. Johns River Water Management District's (SJRWMD) 18-county region along Florida's central east coast and was recently nominated as an Outstanding Florida Waters (OFW) by the St. Johns River Water Management District (2009).

Weather and Hydrologic Setting

Daily precipitation totals are included as an aid to interpreting water-quality results and were derived from data collected at the Federal Point weather station by the National Climatic Data Center. The station is located 19 miles northwest of Fort Matanzas National Monument. These data are presented as daily precipitation for 2013–2014 (NOAA-NCDC 2015; Figure 2).

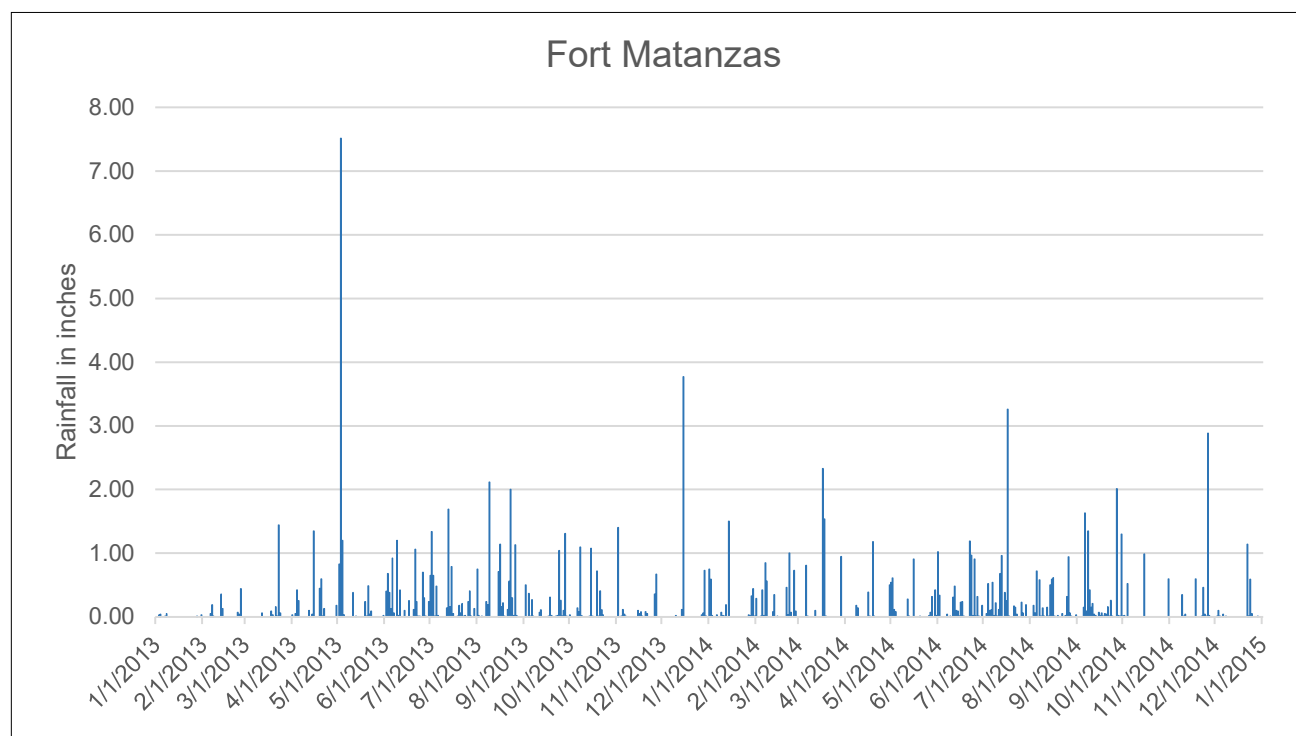


Figure 2. Daily precipitation at Fort Matanzas National Monument, 1 January 2013 through 31 December 2014 (NOAA-NCDC 2015).

Methods

Data collection at sites in this network are modeled after an ongoing water-quality monitoring program established by the National Estuarine Research Reserve Program (Wenner and Geist 2001) and protocols that are in compliance with Florida Department of Environmental Protection’s standard operating procedures (FDEP 2014). Detailed field and lab standard operating procedures and methods have been reported for the continuously collected data in Gregory et al. (2013). Methods for both are briefly summarized in the following sections. Relative water levels and tidal amplitude information collected by the Southeast Coast Network are made available in this report as additional relevant data to help interpret changes and patterns observed in water-quality data.

This report summarizes water-quality data collected at 1 site (Table 1), which is monitored periodically for nutrients and chlorophyll *a*, and monitored continuously for dissolved oxygen, pH, specific conductance, water temperature, depth, and turbidity.

Sampling Locations

The fixed-station site at Fort Matanzas National Monument (Figure 3). The sampling location is located at the Visitor Center dock. This area experiences heavy boating traffic on weekends in the spring and summer. The nearby shoreline is lined with *Spartina* sp. and *Juncus* sp., with some oyster beds present. Due to tidal ranges and the presence of numerous sandbars, there is a risk of high turbidity, especially during low tide events.

Table 1. Monitoring station identification code, location, and name for data collected at Fort Matanzas National Monument 2013–2014.

Location Description	Location Latitude / Longitude	Period of Record
Visitor Center Dock	29.714566 / -81.235145	09/2010 to present



Figure 3. Continuous data collection platform used at Fort Matanzas National Monument. Photo by Pete Mockus, SECN Staff.

Continuous data

Continuously collected data include dissolved oxygen, pH, specific conductance, temperature, depth and turbidity. Data were collected at 30-minute intervals using YSI datasondes (Model 6600) in 2013. In January 2014, the Southeast Coast Network began using YSI EXO2 datasondes. The sondes are deployed for 3- to 5-week intervals depending on routine instrument maintenance schedules. The data collection platform (mount, Figure 3) consists of a 4-inch diameter PVC pipe attached vertically to a piling at the Fort Matanzas National Monument dock with the sonde suspended within. All mounts were designed to keep the sonde 0.5 meters above the bottom substrate, with a carriage bolt inserted through the housing at the submerged end to prevent instrument loss should the attachment hardware fail. A locking cap on the top of the PVC pipe prevents unwanted tampering. To extend development intervals and combat biofouling (growth of barnacles and algae), anti-fouling paint is applied to the PVC pipe (Figure 3). The sonde guard is covered with 0.25-inch

brass or plastic mesh to prevent fish, crabs, and detritus from entering the protective housing, as this intrusion could skew measurements or damage the instrument's probes. Additional details on initial site selection and installation procedures can be found in Gregory et al. (2013).

Prior to deployment, the data sonde is calibrated according to YSI recommendations for pH (two-point calibration), dissolved oxygen, specific conductance, depth, and turbidity (two-point calibration; YSI 2011) with additional instructions provided by Gregory et al. (2013). After instrument retrieval, data sondes are returned to the laboratory where post-deployment readings are made using calibration standards to evaluate the accuracy and validity of the data collected for that deployment period. All pre-deployment and post-retrieval calibration information is recorded on calibration data sheets that are archived at the Southeast Coast Network office location in Athens, Georgia. After post-retrieval processing is complete, the sonde is cleaned, reconditioned, and readied for re-deployment with methods outlined by YSI (2011). Performance specifications of the YSI 6600 are shown in Table 2. Performance specifications of the YSI EXO 2 are shown in Table 3.

Data generated during the deployment periods are reviewed and certified by SECN staff prior to being made available to park staff or the public. During 2013, as the Southeast Coast Network transitioned continuous data management tasks to Aquarius (Aquatic Informatics Inc. 2015), all parameters were certified with undefined grades, and invalid (i.e., unusable) data were deleted from the data set.

Beginning in January 2014, turbidity, dissolved oxygen, specific conductance, and pH values were assigned grades of excellent, good, fair, or poor—and corrections to these values were made when appropriate—based on differences between pre-calibration and post-calibration measurement data based on guidance from USGS (Wagner et al. 2006). Temperature and depth data were neither graded nor corrected, but were assumed accurate unless post calibration data indicated a failure. As with previous years, invalid or unusable data were deleted from datasets prior to publication. Data sets are available at the NPS Aquarius Web Data Portal at <https://irma.nps.gov/aqwebportal/>.

Table 2. Performance specifications of YSI 6600 EDS data loggers deployed at Fort Matanzas National Monument during 2013 (YSI 2011).

Parameter	Range	Resolution	Accuracy
Dissolved Oxygen (% saturation)	0 to 500%	0.1 %	0 to 200%: +/- 2% of reading or 2% air saturation, whichever is greater.
Dissolved Oxygen (mg/L)	0 to 50 mg/L	0.01 mg/L	0 to 20 mg/L: +/- 2% of reading or 0.2 mg/L, whichever is greater.
Conductivity	0 to 100 mS/cm	0.001 to 0.1 mS/cm; range dependent	+/- 0.5% of reading + 0.001 mS/cm
Temperature	-5 to +50 °C	0.01 °C	+/- 0.15 °C
pH	0 to 14 units	0.01 units	+/- 0.2 unit
Depth	0 to 9 m (0 to 30 ft)	0.001m (0.001ft)	+/- 0.018m (+/- 0.06 ft.)
Salinity	0 to 70 ppt	0.01 ppt	+/- 1% of reading or 0.1 ppt, whichever is greater.
Turbidity	0 to 1000 NTU	0.1 NTU	+/- 2% of reading or 0.3 NTU, whichever is greater.

Table 3. Performance specifications of YSI EXO2 datasondes deployed at Fort Matanzas National Monument during 2014 (YSI 2014).

Parameter	Range	Resolution	Accuracy
Dissolved oxygen (% saturation)	0 to 500%	0.10%	0 to 200%: +1% reading or 1% air sat, whichever is greater 200 to 500%: +5% reading
Dissolved oxygen (mg/L)	0 to 50 mg/L	0.01 mg/L	0 to 20 mg/L: +1% of reading or 0.1 mg/L 20 to 50 mg/L: +5% of reading
Conductivity	0 to 200 mS/cm	0.0001 to 0.01 mS/cm range-dependent	0-100 mS/cm +0.5% of reading or 0.001 mS/cm, whichever is greater
Temperature	-5 to +50 °C	0.001 degrees Celcius	-5 to +35 °C: +0.01 °C 35 to 50 °C: +0.05 °C
pH	0 to 14	0.01 units	+0.1 pH units within +10 °C of calibration temperature; +0.2 pH units for entire temp range
Depth	Shallow: 0 to 33 feet (10 meters)	0.001 feet (0.001 meters)	Shallow: +0.04% FS (+0.013 feet or +0.004 meters)
Turbidity	0 to 4000 FNU	0 to 999 FNU: 0.01 FNU 1000 to 4000 FNU: 0.1 FNU	0 to 999 FNU: 0.3 FNU or 2% of reading, whichever is greater. 1000 to 4000 FNU: 0.1 FNU

Results

Continuous Data

Figures 4 through 9 depict the daily mean for each parameter for the 2013–2014 period. Relative water depth collected by SECN staff at the site (Figure 9) is included in this section as an aid to data interpretation because it includes information that shows daily tidal fluctuations.

Summary statistics (minimum, maximum, mean, and standard deviation) are provided in Table 5. The percentage-of-values field indicates the level of completeness of the monthly data sets used for calculating mean, maximum, and minimum statistics, and equals the number of valid data points collected (i.e., not missing or flagged) divided by the total number of expected points for a complete month of data. For those months where all of the data were either missing and/or flagged, the percentage of values is 0% and no statistics (mean, maximum, or minimum) are presented. When the percentage of values is low, the statistics (mean, maximum, and minimum) may be less accurate than months where all data were used in the calculation of summary statistics.

Continuous data were collected at one fixed-station site by the Southeast Coast Network.

Mean monthly dissolved oxygen levels were generally good throughout the entire year, ranging from a low of 5.8 mg/L in several months to a high of 8.3 mg/L in multiple months. Individual dissolved oxygen readings ranged from 3.8 mg/L in September 2013 to 9.6 mg/L in March 2014.

Mean monthly pH values ranged from a low of 7.9 in multiple months to a high of 8.1 in multiple months. Individual pH readings ranged from 7.5 in September 2014 to 8.5 in January 2013.

Monthly mean turbidity values ranged from 5.6 NTU in September 2013 to 11.7 NTU in June 2013. Individual turbidity readings ranged from 0.3 NTUs in multiple months to 199.5 NTUs in September 2013.

Mean monthly water temperatures ranged from 14.0°C (57.2°F) in several months to 28.7 °C (83.7 °F) in July 2014. Individual temperature readings ranged from 9.8°C (49.6°F) in January 2014 to 31.6°C (88.9°F) in September 2014.

The tidal range for the Fort Matanzas National Monument site was approximately 2.25 meters (7.4 feet).

Discrete Sampling

Monthly water-quality data (discrete samples) are not collected at Fort Matanzas National Monument.

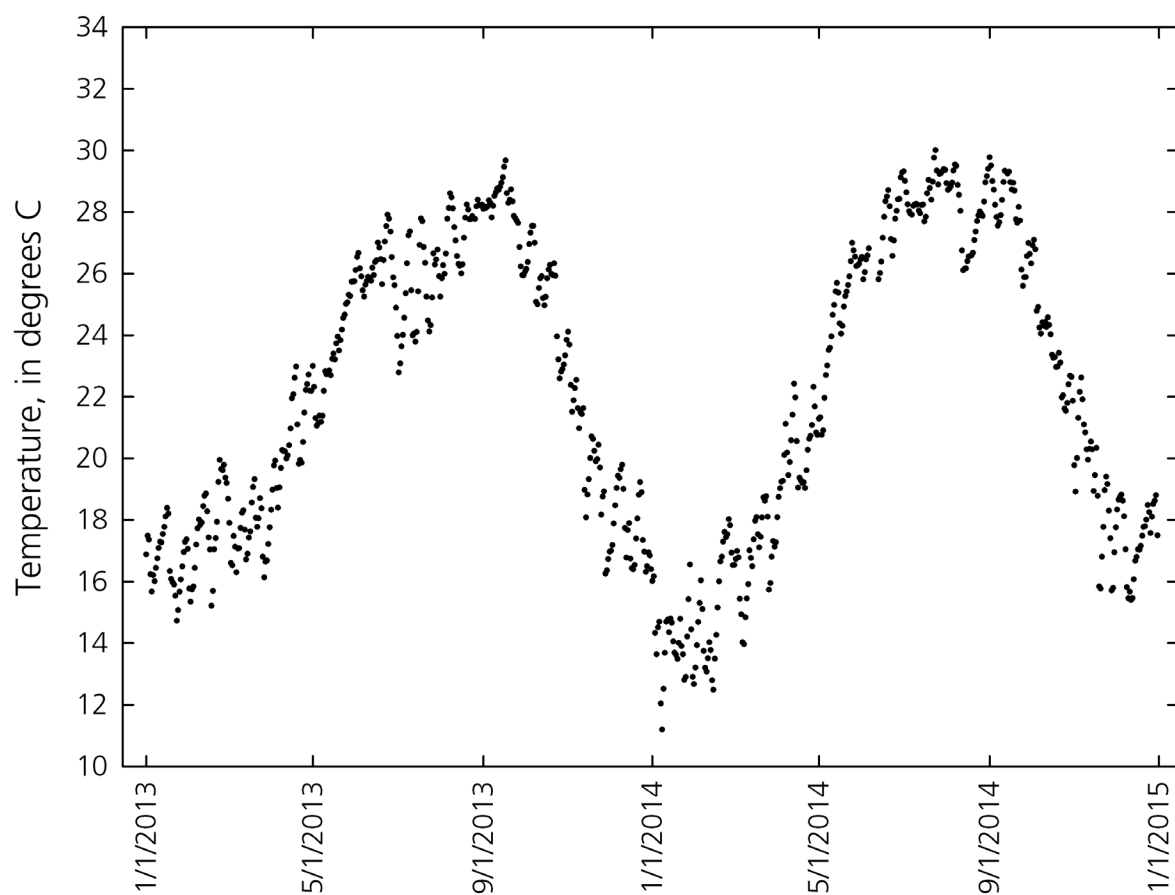


Figure 4. Mean daily water temperature at Fort Matanzas National Monument during 2013–2014. Breaks in data record indicate missing and/or flagged data.

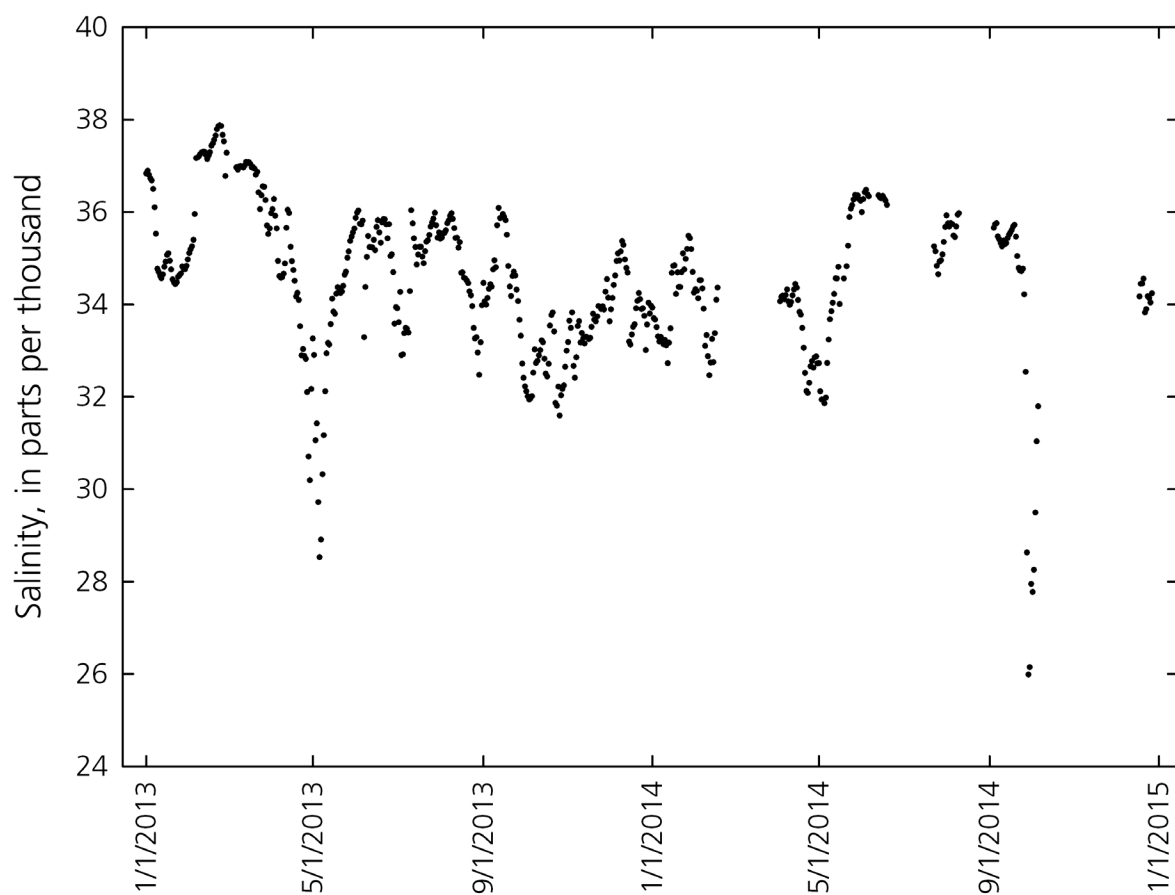


Figure 5. Mean daily values for salinity at Fort Matanzas National Monument during 2013–2014. Breaks in data record indicate missing and/or flagged data.

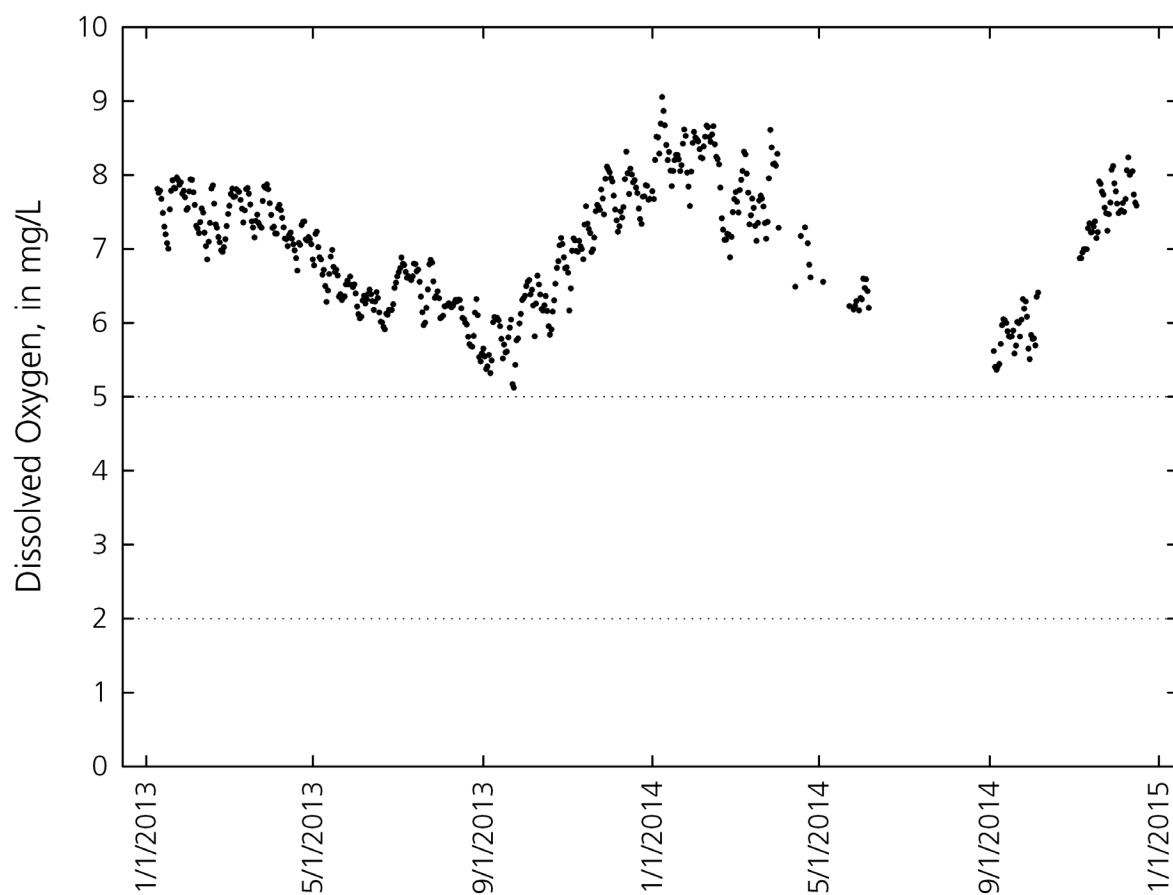


Figure 6. Mean daily values for dissolved oxygen at Fort Matanzas National Monument during 2013–2014. Breaks in data record indicate missing and/or flagged data. Dotted lines indicate minimum value for a rating of good (5 mg/L) and fair (2 mg/L)(USEPA 2012).

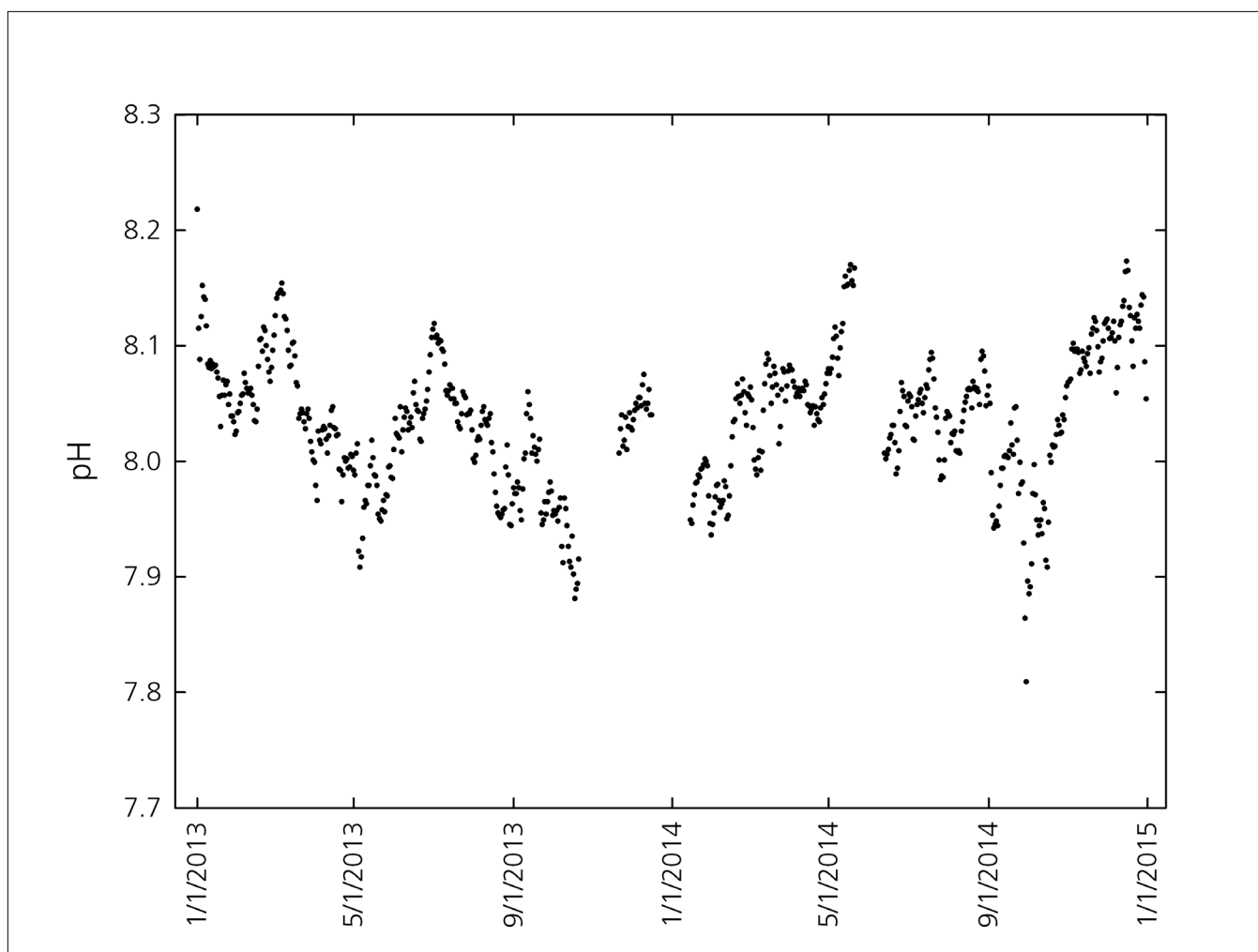


Figure 7. Mean daily pH at Fort Matanzas National Monument during 2013–2014. Breaks in data record indicate missing and/or flagged data.

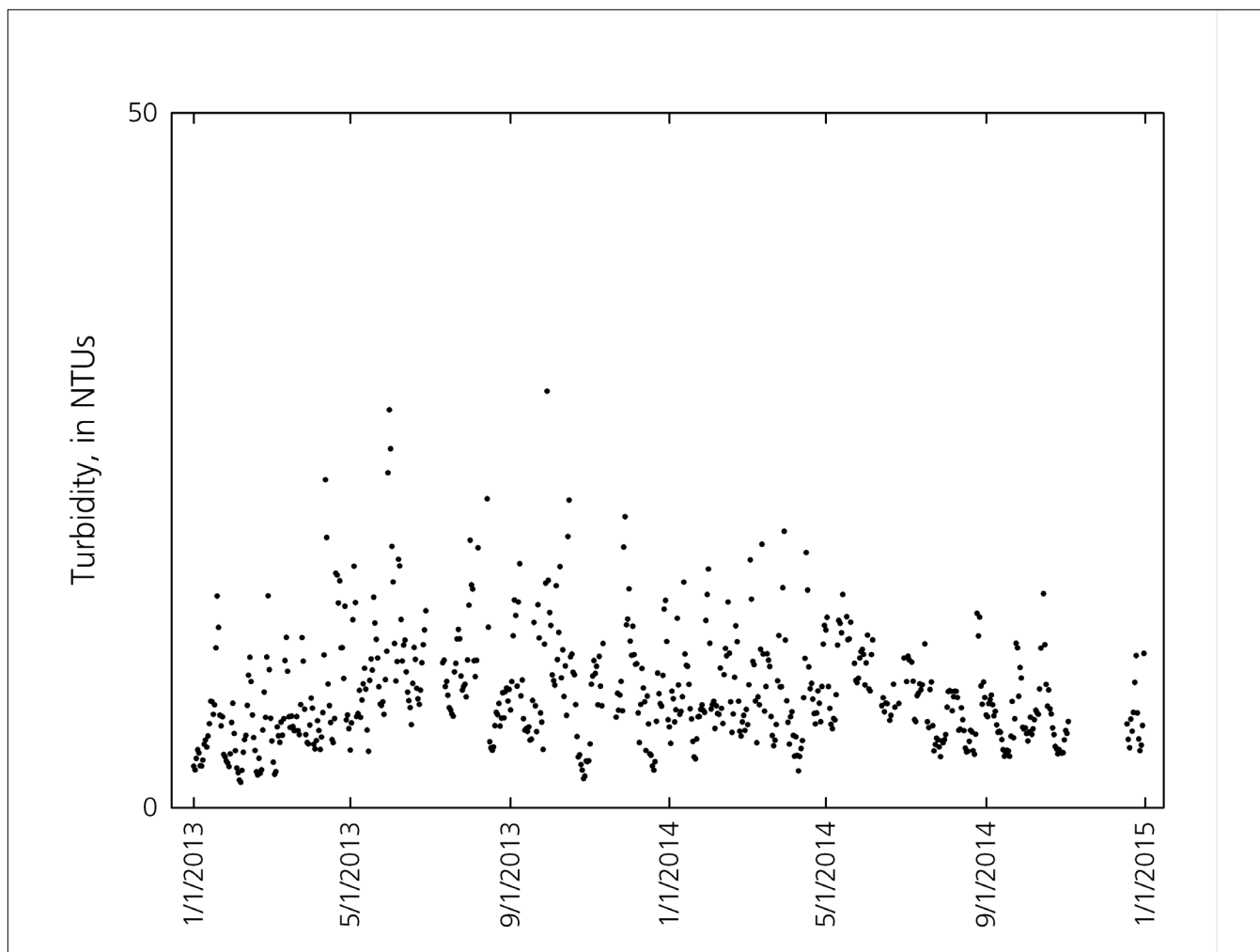


Figure 8. Mean daily turbidity (NTUs; FNUs after February 2014) at Fort Matanzas National Monument during 2013–2014. Breaks in data record indicate missing and/or flagged data.

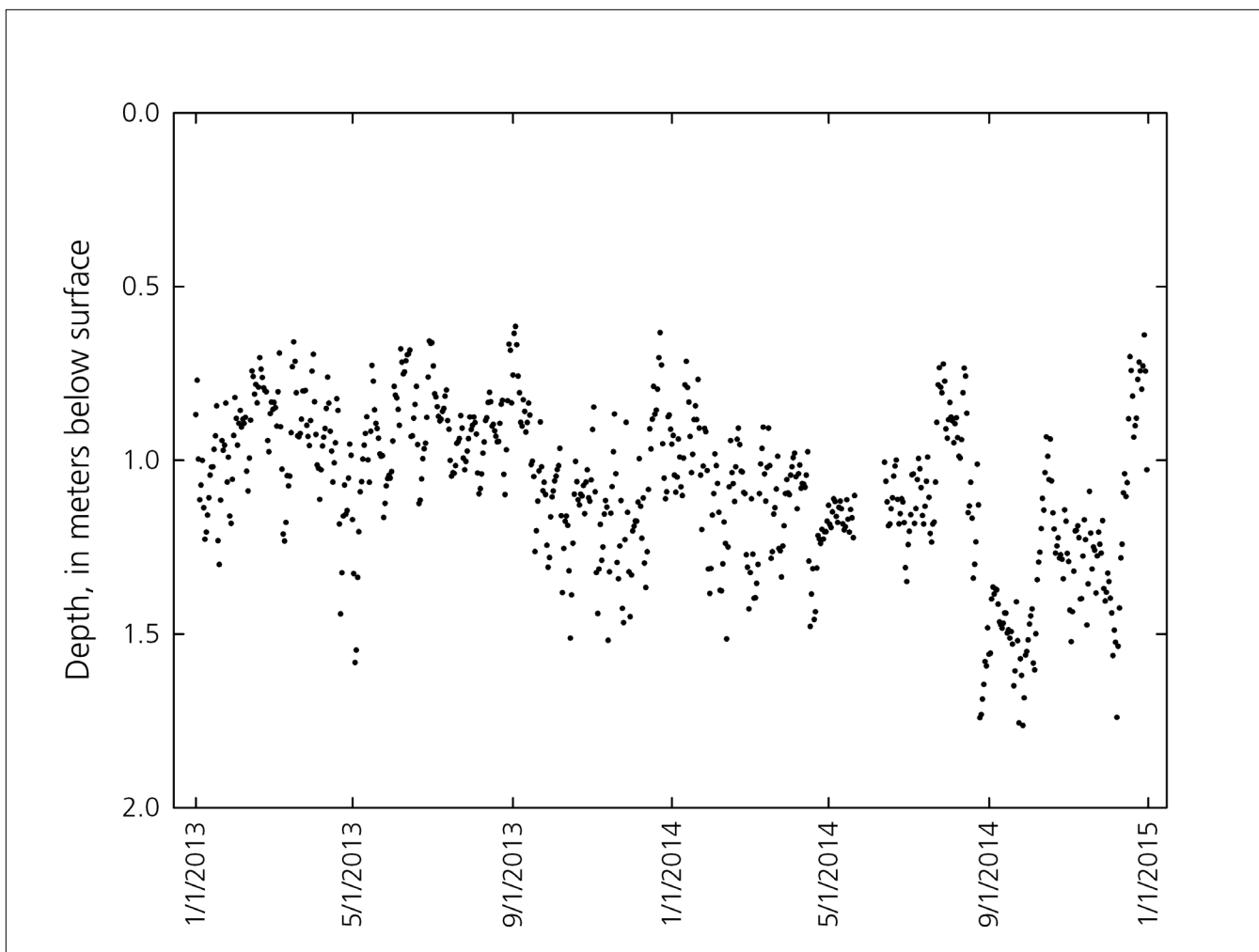


Figure 9. Mean daily depth at Fort Matanzas National Monument during 2013–2014. Breaks in data record indicate missing and/or flagged data.

Table 4 Monthly minimum, maximum, and mean values for parameters collected by the YSI datasondes at Fort Matanzas National Monument during 2013–2014. Percentage of values for each month indicates the number of data points collected during one calendar month of data collection divided by the total number of expected points for a complete month of data.

Month / Expected count	Metric	Temperature (°C)	Salinity (PPT)	Dissolved Oxygen, (mg/L)	Depth (m)	pH	Turbidity (NTU)
January 2013 (Expected count 2976)	Actual Count	1488	1488	1118	1488	1488	1486
	Minimum	14	34.3	6	0.22	8	1
	Maximum	19.8	37.1	8.4	1.88	8.5	32.6
	Mean	16.7	35.2	7.7	1.03	8.1	5.6
	SD	1	0.8	0.4	0.4	0.06	4
	Percent	100%	100%	75%	100%	100%	100%
February 2013 (Expected count 2688)	Actual Count	1344	1333	1344	1344	1344	1344
	Minimum	13.6	35	5.9	0.14	7.9	1
	Maximum	20.9	38	8.4	1.78	8.2	32.7
	Mean	17.7	37	7.4	0.86	8.1	5.6
	SD	1.5	0.9	0.4	0.4	0.04	4
	Percent	100%	99%	100%	100%	100%	100%
March 2013 (Expected count 2976)	Actual Count	1488	1221	1488	1488	1488	1486
	Minimum	13.7	35.4	6.4	0.11	7.9	1.5
	Maximum	20.1	37.3	8.3	1.8	8.2	23
	Mean	17.6	36.7	7.6	0.9	8.1	6.3
	SD	1	0.5	0.3	0.4	0.06	2.9
	Percent	100%	82%	100%	100%	100%	100%
April 2013 (Expected count 2880)	Actual Count	1440	1437	1440	1440	1440	1437
	Minimum	17	28.2	5.9	0.12	7.8	1.2
	Maximum	24.1	36.7	8.2	1.92	8.1	178.7
	Mean	20.6	34.3	7.2	1	8	9.3
	SD	1.6	1.6	0.4	0.4	0.05	9.3
	Percent	100%	100%	100%	100%	100%	100%
May 2013 (Expected count 2976)	Actual Count	1488	1488	1488	1488	1488	1486
	Minimum	20.1	22.2	5.5	0.3	7.7	0.6
	Maximum	27.6	35.9	7.6	2	8.1	124.5
	Mean	23.4	33.3	6.7	1.05	8	10.3
	SD	1.6	2.5	0.4	0.4	0.06	9.4
	Percent	100%	100%	100%	100%	100%	100%
June 2013 (Expected count 2880)	Actual Count	1440	1440	1440	1440	1440	1340
	Minimum	23.5	25.8	4.8	0.06	7.8	2.3
	Maximum	29.5	37	7.5	1.81	8.2	122.6
	Mean	26.3	35.3	6.2	0.84	8	11.7
	SD	1.1	1.3	0.5	0.4	0.06	7.7
	Percent	100%	100%	100%	100%	100%	93%

Table 4 (continued). Monthly minimum, maximum, and mean values for parameters collected by the YSI datasondes at Fort Matanzas National Monument during 2013–2014. Percentage of values for each month indicates the number data points collected during one calendar month of data collection divided by the total number of expected points for a complete month of data.

Month / Expected count	Metric	Temperature (°C)	Salinity (PPT)	Dissolved Oxygen, (mg/L)	Depth (m)	pH	Turbidity (NTU)
July 2013 (Expected count 2976)	Actual Count	1488	1488	1488	1488	1488	1026
	Minimum	21.2	30.2	4.9	0.07	7.8	1.4
	Maximum	29.6	36.8	7.8	1.68	8.2	31.5
	Mean	25.4	34.8	6.6	0.91	8.1	9.5
	SD	1.8	1.4	0.5	0.3	0.06	4.7
	Percent	100%	100%	100%	100%	100%	69%
August 2013 (Expected count 2976)	Actual Count	1488	1488	1488	1488	1488	1228
	Minimum	23.9	29.2	3.9	0.16	7.8	0.3
	Maximum	30.2	36.9	7.2	1.66	8.1	177.8
	Mean	27.4	34.7	6	0.91	8	10.1
	SD	1.3	1.3	0.5	0.3	0.07	9.1
	Percent	100%	100%	100%	100%	100%	83%
September 2013 (Expected count 2880)	Actual Count	1440	1440	1440	1440	1440	1405
	Minimum	25.3	32	3.8	0.11	7.8	0.8
	Maximum	30.7	37	7.2	1.83	8.1	199.5
	Mean	28.1	34.6	5.8	0.97	8	10.1
	SD	1	1	0.5	0.4	0.07	17.1
	Percent	100%	100%	100%	100%	100%	98%
October 2013 (Expected count 2976)	Actual Count	1488	1488	1488	1488	1035	1451
	Minimum	21.3	29.7	5.2	0.42	7.7	0.6
	Maximum	28.3	35	7.8	1.99	8.1	192.6
	Mean	25.4	32.6	6.4	1.14	7.9	8.9
	SD	1.5	0.8	0.5	0.3	0.07	16.9
	Percent	100%	100%	100%	100%	70%	98%
November 2013 (Expected count 2880)	Actual Count	1440	1440	1440	1440	495	1032
	Minimum	15.2	30.2	5.6	0.22	7.9	1.5
	Maximum	24.7	35.2	8.3	2.07	8.1	50.8
	Mean	20.2	33.5	7.3	1.2	8	10.2
	SD	2	0.6	0.5	0.4	0.04	6.4
	Percent	100%	100%	100%	100%	34%	72%
December 2013 (Expected count 2976)	Actual Count	1488	1474	1413	1488	786	1488
	Minimum	15.6	31	6.4	0.15	8	1.2
	Maximum	20.9	35.8	8.7	1.97	8.1	37.8
	Mean	17.7	34.2	7.7	1.02	8	8.3
	SD	1.2	0.9	0.4	0.4	0.03	4.9
	Percent	100%	99%	95%	100%	53%	100%

Table 4 (continued). Monthly minimum, maximum, and mean values for parameters collected by the YSI datasondes at Fort Matanzas National Monument during 2013–2014. Percentage of values for each month indicates the number data points collected during one calendar month of data collection divided by the total number of expected points for a complete month of data.

Month / Expected count	Metric	Temperature (°C)	Salinity (PPT)	Dissolved Oxygen, (mg/L)	Depth (m)	pH	Turbidity (NTU)
January 2014 (Expected count 2976)	Actual Count	1488	1388	1378	1488	818	1455
	Minimum	9.8	31.3	6.9	0.14	7.8	2.2
	Maximum	17.4	36.7	9.4	2.04	8.1	39.1
	Mean	14	34.1	8.3	0.99	8	8.2
	SD	1.3	1	0.4	0.4	0.03	4.9
	Percent	100%	93%	93%	100%	55%	98%
February 2014 (Expected count 2688)	Actual Count	1344	753	1298	1344	1338	1323
	Minimum	11.6	29.8	6.3	0.4	7.9	2.7
	Maximum	19	36.2	9	2	8.1	43
	Mean	15.2	33.8	8	1.13	8	8.2
	SD	1.8	1.2	0.6	0.4	0.06	4
	Percent	100%	56%	97%	100%	100%	98%
March 2014 (Expected count 2976)	Actual Count	1488	0	1443	1488	1488	1449
	Minimum	13	NA	6.4	0.35	7.8	2.2
	Maximum	20.3	NA	9.6	2.06	8.1	45.7
	Mean	16.8	NA	7.7	1.17	8	9.6
	SD	1.4	NA	0.5	0.4	0.05	5.8
	Percent	100%	0%	97%	100%	100%	97%
April 2014 (Expected count 2880)	Actual Count	1439	1366	974	1439	1439	1426
	Minimum	16.8	31.9	5.2	0.38	7.9	0.3
	Maximum	24.4	34.8	8.9	2.05	8.1	30.5
	Mean	20.2	33.5	6.9	1.17	8.1	7.5
	SD	1.5	0.8	0.6	0.4	0.05	4.5
	Percent	100%	95%	68%	100%	100%	99%
May 2014 (Expected count 2976)	Actual Count	1488	1380	1003	1029	1031	1308
	Minimum	19.9	30.4	4.7	0.35	7.9	3.2
	Maximum	28.2	36.5	7.3	1.89	8.2	59.7
	Mean	24.5	34.4	6.2	1.16	8.1	10.8
	SD	2	1.6	0.5	0.3	0.06	5.7
	Percent	100%	93%	67%	69%	69%	88%
June 2014 (Expected count 2880)	Actual Count	1187	647	281	885	883	1006
	Minimum	25.1	35.8	5.1	0.34	7.9	1.5
	Maximum	30.4	36.6	7.3	1.94	8.1	35
	Mean	27.3	36.3	6.4	1.13	8	8.7
	SD	1.2	0.2	0.4	0.4	0.06	4.1
	Percent	82%	45%	20%	61%	61%	70%

Table 4 (continued). Monthly minimum, maximum, and mean values for parameters collected by the YSI datasondes at Fort Matanzas National Monument during 2013–2014. Percentage of values for each month indicates the number data points collected during one calendar month of data collection divided by the total number of expected points for a complete month of data.

Month / Expected count	Metric	Temperature (°C)	Salinity (PPT)	Dissolved Oxygen, (mg/L)	Depth (m)	pH	Turbidity (NTU)
July 2014 (Expected count 2976)	Actual Count	1488	403	0	1488	1485	1329
	Minimum	26.7	32.5	NA	0.22	7.8	0.3
	Maximum	31	37	NA	1.92	8.2	105.7
	Mean	28.7	35.1	NA	1.03	8	7.2
	SD	0.8	1.3	NA	0.4	0.06	5
	Percent	100%	27%	0%	100%	100%	89%
August 2014 (Expected count 2976)	Actual Count	1488	490	0	1488	1487	1453
	Minimum	24.8	34.4	NA	0.13	7.9	0.3
	Maximum	30.9	36.8	NA	2.24	8.2	42.3
	Mean	27.9	35.7	NA	1.14	8	7.1
	SD	1.4	0.7	NA	0.4	0.07	4.3
	Percent	100%	33%	0%	100%	100%	98%
September 2014 (Expected count 2880)	Actual Count	1440	1319	1318	1440	1434	1429
	Minimum	24.9	15.7	4.3	0.49	7.5	1.1
	Maximum	31.6	36.1	7.2	2.29	8.2	22
	Mean	28	34.3	5.8	1.51	8	6.5
	SD	1.3	3.2	0.6	0.3	0.09	3.3
	Percent	100%	92%	92%	100%	100%	99%
October 2014 (Expected count 2976)	Actual Count	1488	312	313	1488	1488	1456
	Minimum	20.8	21.9	4.8	0.41	7.7	1.7
	Maximum	27.9	34.2	7.5	2.17	8.1	38.3
	Mean	23.8	29.6	6	1.25	8	6.7
	SD	1.6	3.5	0.7	0.4	0.08	4.2
	Percent	100%	21%	21%	100%	100%	98%
November 2014 (Expected count 2880)	Actual Count	1440	0	1272	1440	1440	160
	Minimum	13.8	NA	6.4	0.5	7.9	2.9
	Maximum	23.3	NA	8.5	2.09	8.2	10.7
	Mean	19.2	NA	7.4	1.3	8.1	5.6
	SD	2	NA	0.4	0.3	0.04	1.5
	Percent	100%	0%	88%	100%	100%	11%
December 2014 (Expected count 2976)	Actual Count	1483	529	769	1483	1471	679
	Minimum	14.6	32.6	6.9	0.08	7.9	2.4
	Maximum	19.7	35.4	8.6	2.31	8.4	21.6
	Mean	17.5	34.2	7.7	1.09	8.1	6.4
	SD	1.2	0.7	0.4	0.5	0.05	3.1
	Percent	100%	36%	52%	100%	99%	46%

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