



Fixed-Station Water-Quality Monitoring at Canaveral National Seashore

2015-2016 Data Summary—Version 1.1

Natural Resource Data Series NPS/SECN/NRDS—2020/1307



ON THE COVER

Indian River (Intracoastal Waterway) October 2016 during vegetation accuracy assessment at Canaveral National Seashore. NPS photo / Eric Starkey

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Mark Hynds and Eric N. Starkey

Southeast Coast Network
National Park Service
135 Phoenix Road
Athens, Georgia 30605

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U.S. Department of the Interior
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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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Revision Log

Revision Date	Author	Changes Made	Reason for Change	New Version #
9/2020	M. Hynds	The second "Fair" in the Figure 6 caption changed to "Poor."	Correct a typo in Figure 6. DIP value in Summary and Results sections extended from three to four decimal places.	1.1

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Acknowledgments

The Southeast Coast Network wishes to acknowledge the dedicated work conducted by the St. Johns River Water Management District staff, and thank them for the water-quality data they contributed to this report.

Summary and Key Findings

In 2007 the National Park Service (NPS) Southeast Coast Network (SECN) began collecting water-quality data in the estuarine waters of Canaveral National Seashore as part the NPS Vital Signs Monitoring Program. The scope of the monitoring program includes Mosquito Lagoon and is comprised of continuous water-quality monitoring conducted by the network at one site and augmented with monthly data collected at five stations by St. Johns River Water Management District (SJRWMD; Figure 1).

The continuous-monitoring data station is located at the Canaveral National Seashore visitor center dock and collects dissolved oxygen, pH, salinity, temperature, turbidity, and water-level data every 30 minutes. The five stations located throughout Mosquito Lagoon are sampled by Volusia County for the SJRWMD as part of the District's Indian River Lagoon Water-Quality Monitoring Network; data at these five stations include monthly measurements of water-clarity conditions, nutrients, and chlorophyll *a* levels.

Both the network and the SJRWMD programs use methods adapted from, or compatible with, the water-quality monitoring program established by the National Estuarine Research Reserve Program (Wenner and Geist 2001). The Canaveral National Seashore fixed-station water-quality monitoring site is part of the SECN estuarine water- and sediment-quality monitoring efforts, which routinely collects data in the vicinity of seven park units along the southeastern U.S. coast (DeVivo et al. 2008; Gregory et al. 2013). 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.

A summary of 2015–2016 data is presented below.

- Continuous data were collected at one fixed-station site (CANAvctr) by the Southeast Coast Network.
- Mean monthly dissolved oxygen concentrations were mostly good to fair throughout 2015–2016, ranging from a low of 4.7 mg/L in July 2015 to a high of 8.1 mg/L in February 2016. Individual dissolved oxygen concentrations ranged from 1.3 mg/L in June 2015 to 13.1 mg/L in December 2015.
- Mean monthly pH values ranged from a low of 7.7 in October 2016 to a high of 8.3 in July 2016. Individual

pH values ranged from 7.5 to 8.5 in several months throughout the two-year period of record.

- Monthly mean turbidity values ranged from 5.3 FNU in January 2015 to 16.1 FNU in July 2016. Individual turbidity values ranged from 1.5 FNU in January 2015 to 156.2 FNU in October 2016.
- Mean monthly water temperatures ranged from 16.1 °C (70 °F) in February 2015 to 31.9 °C (89.4 °F) in July 2016. Individual temperature readings ranged from 9.3 °C (48.7 °F) in February 2015 to 34.7 °C (94.5 °F) in July 2016.
- The tidal range for Canaveral National Seashore in 2015–2016 was approximately 0.94 meters (3.1 feet).

Discrete Data

Monthly water-quality data collected during 2015–2016 at the St. Johns Water Management District sites near Canaveral National Seashore are shown in Table 5. Condition categories generally correspond to those used by the EPA in the National Coastal Condition Report IV (2012) and detailed in Table 3.

- Water clarity (143 total measurements) was mostly poor (130 visits), with ten measurements rated as fair and three as good.
- In 143 samples tested for chlorophyll *a* concentrations, results ranged from 0.53 µg/L to 60.88 µg/L. Twenty-three samples were rated as good, fifty-three as fair, and sixty-seven as poor.
- Dissolved inorganic nitrogen (DIN) concentrations ranged from below detection levels to 0.111 mg/L in 139 samples with values available to calculate DIN. Concentrations for 137 samples were rated as good, and two were fair.
- A total of 139 samples were tested for dissolved inorganic phosphorus (DIP). Concentrations ranged from below detection levels to 0.0277 mg/L. A total of 110 samples were rated as good and twenty-nine were rated as fair.

Canaveral National Seashore Significant Waters

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National Park Service
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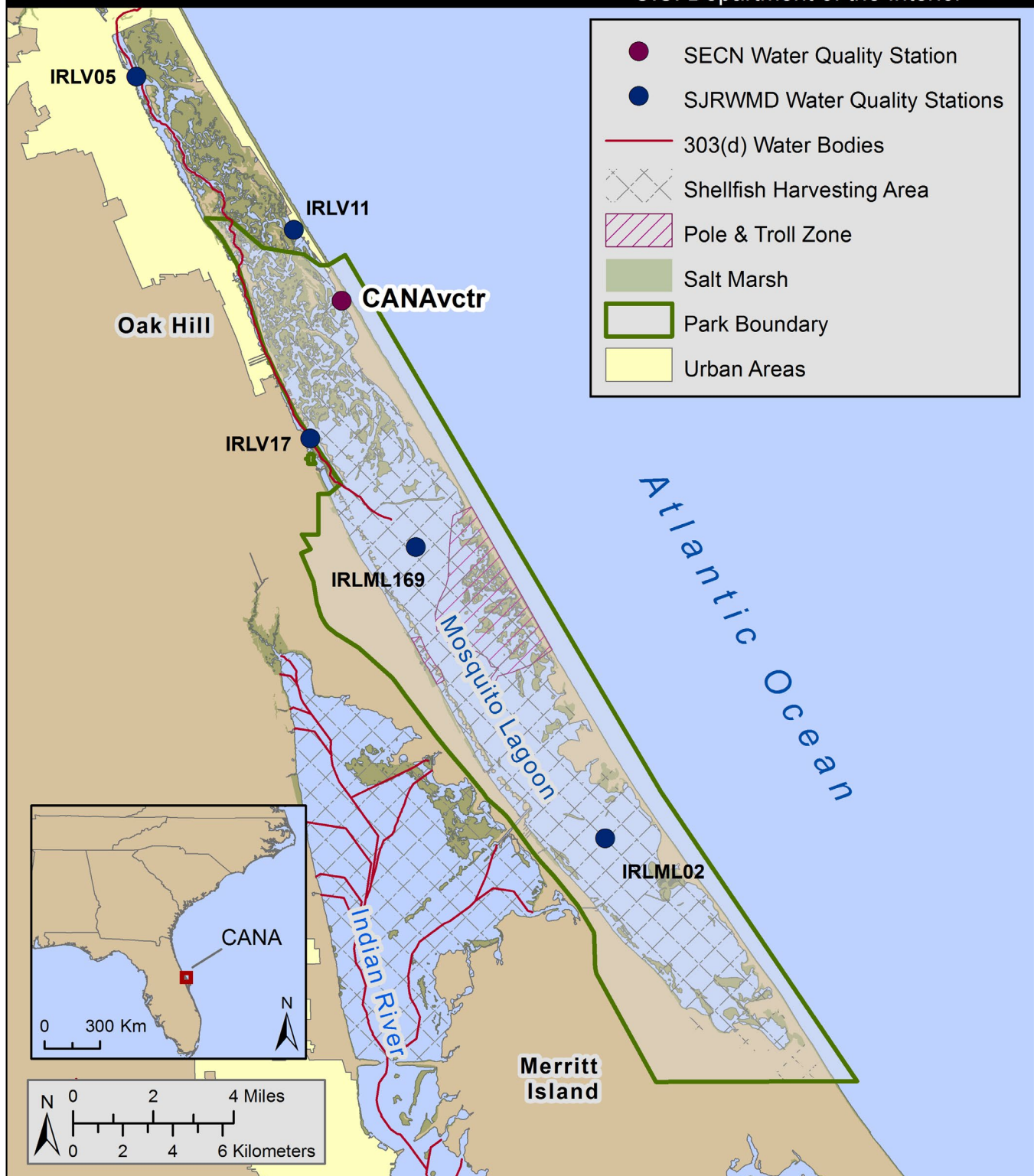


Figure 1. Estuarine and marine water resources in the vicinity of Canaveral National Seashore in Florida. Indicated are areas of salt marsh (USFWS 2019), 303(d) water bodies (EPA 2019), and shellfish harvesting areas and pole and troll zones (FDEP 2019).

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 National Park Service (NPS) Inventory and Monitoring (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 objectives 1 and 2 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 Canaveral National Seashore during 2015–2016 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 Canaveral National Seashore.

Canaveral National Seashore

Natural resources at Canaveral National Seashore (Figure 1) include a diverse assemblage of wildlife species, plant communities, geophysical features, and natural processes reflecting the complexity of the land/lagoon/sea interface of east central Florida. Throughout the seashore, the relationship between land and water is paramount. Unlike many barrier islands, Canaveral National Seashore has only a single dune ridge, averaging 12 feet (3.7 meters) in height. For the vast majority of its length the dune is quite stable, backed by a dense growth of saw palmetto (*Serenoa repens*) and several other species of hardy shrubs and grasses. Mosquito Lagoon, extending along the backside of Canaveral National Seashore's barrier island, is the northernmost part of the Indian River Lagoon. Containing the most diverse assemblage of aquatic species on the entire eastern seaboard, this 155-mile long lagoon has been designated as an Estuary of National Significance by the Environmental Protection Agency and an Outstanding Florida Water by the State of Florida. Commercial shell fishing is extremely important to the local economy; recreational fishing and shrimping in the lagoon support a multimillion-dollar tourist industry. The estuary also acts as an important nursery area for a number of commercially important ocean-going species such as flounder, mullet, black drum and shrimp.

Canaveral National Seashore faces a number of complex issues regarding water quality in Mosquito Lagoon. The water in Mosquito Lagoon is designated by the State of Florida as Class II, which is suitable for shellfish propagation and harvesting. As shellfish have been depleted along other portions of the Atlantic coast, harvesting pressure has increased significantly in Mosquito Lagoon. Additionally, the seashore has long been concerned about the impact of commercial harvesting on hard clams (*Mercenaria* spp.) and eastern oysters (*Crassostrea virginica*). Fishermen are coming into Canaveral National Seashore in increasing numbers due to the growing popularity of fly-fishing for redfish,

causing harvesting concerns and potential problems related to seagrass scarring by boat propellers. Oyster reefs along major boat channels have also been reported to be stressed or dying (J. Stiner, resource manager Canaveral National Seashore, personal communication). Currently, park waters are closed to shell fishing when rainfall exceeds 1.5 inches in a 72-hour period, due to high fecal coliform levels. Mosquito control is another issue at Canaveral National Seashore. In the designation of lands for NPS management, both NASA and the State of Florida stipulated that Canaveral National Seashore must cooperate with the local mosquito control districts to control salt marsh mosquitoes (Walters et al. 2001).

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 Titusville weather station near Canaveral National Seashore on www.climateanalyzer.org. These data are presented as daily precipitation for 2015–2016 (NOAA-NCDC 2019; Figure 2).

Additional climate data and analyses, such as departure from 30-year averages and extended drought and precipitation information, are available for individual interpretation on the [Southeast Coast Network Climate Analyzer Website](http://www.southcoastclimateanalyzer.org). This additional data may add context to the data presented in this report.

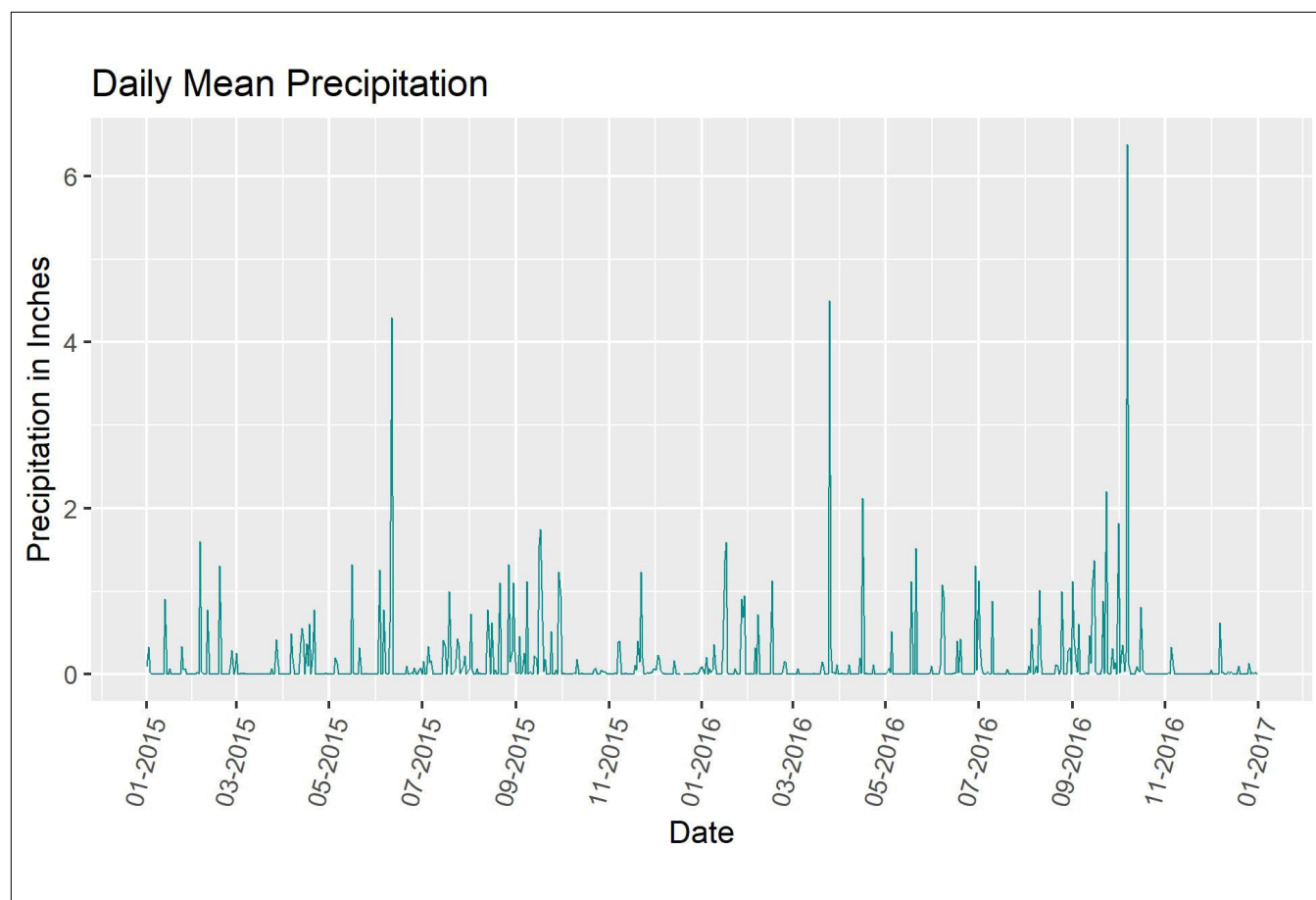


Figure 2. Daily precipitation at the Titusville weather station near Canaveral National Seashore, January 1, 2015–December 31, 2016. Data obtained from NOAA (NOAA-NCDC 2018) through The Climate Analyzer (www.climateanalyzer.org/secn; The Climate Analyzer 2018).

Methods

Monitoring data are collected using methods adapted from the NOAA 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 (SOPs; FDEP 2018). Monitoring data for Objective 1 are collected from continuous monitoring of water-quality parameters using permanently deployed data sondes at near-shore locations selected to be representative of areas near parks, and monitoring data for Objective 2 are collected monthly at locations at or near the fixed-monitoring station. Detailed field and lab standard operating procedures and methods have been reported for the continuously collected data in Gregory et al. (2013), and for the monthly samples collection/analysis in two SJRWMD standard operating procedures (SJRWMD 2010a and 2010b). Methods for both are briefly summarized in the following sections.

Sampling Locations

The fixed station at Canaveral National Seashore is located on the visitor center dock, on the northeast side of Mosquito Lagoon. Primary emergent vegetation along the shoreline is salt marsh cordgrass (*Spartina alterniflora*) and black mangrove (*Avicennia germinans*). The area on either side of the dock is covered with rip-rap (broken pieces of concrete) to minimize erosion. Just landward of the emergent vegetation, groundsel (*Baccharis* spp.) is the dominant plant species. Boat traffic in the lagoon can be heavy on weekends and moderate to light during the week. Occasionally boats will pull up to the dock where the monitoring station is located. The main boat ramp is just to the north of the visitor center dock. No fishing or crabbing is allowed from the visitor center dock.

Water quality in this area is designated as Class II, which is suitable for shellfish propagation and harvesting. Normal tide fluctuation is only a matter of inches, and currents in the lagoon are primarily wind driven. The water in the lagoon can become highly saline for an estuary when freshwater inputs are low (daily average as high as 45 ppt. in 2012), and water temperatures can exceed 29 °C (84.2 °F) in summer months. Submerged vegetation consists primarily of manatee grass (*Syringodium filiforme*) and shoalweed (*Halode wrightii*). Oyster reefs and salt marsh islands are located nearby. Marsh species include saltgrass (*Distichlis spicata*), seashore paspalum (*Paspalum varigatum*), seashore dropseed (*Sporobolus virginicus*), saltwort (*Batis maritima*), glasswort (*Sarcocornia perrennis*), annual glasswort (*Salicornia bigelowii*), and salt marsh cordgrass.

St. Johns River Water Management District has numerous sites in the vicinity of the Indian River and Mosquito Lagoon. The stations were originally selected to provide information on the long-term spatial and temporal trends of water quality and help discern the covariant or causal link between seagrass coverage (distribution/density) and water quality (Sigua et al. 1999). Five of these sites are in Mosquito Lagoon and are included in this report to help give resources managers at Canaveral National Seashore a broader look at water quality issues that may affect park resources. Site locations are detailed in Table 1.

Table 1. Monitoring location names, descriptions, and responsible organization for stations in the Canaveral National Seashore water-quality monitoring network [SJWMD—St. Johns Water Management District; SECN—Southeast Coast Network]. Coordinates given in decimal degrees.

Site Name, Location and Description	Latitude	Longitude	Monitoring Organization
IRLV05. Located just south of New Smyrna Beach at channel marker 47 near the South Canal discharge	29.008056	-80.909444	SJRWMD
IRLV11. Located east of Cedar Island and west of Bethune Beach and just north of the northern boundary of Canaveral National Seashore; approximately 3 miles northeast of the Canaveral National Seashore visitor center.	28.952500	-80.844722	SJRWMD
CANA Visitor Center. Located on the northeast side of Mosquito Lagoon on the dock behind the Canaveral National Seashore visitor center.	28.926856	-80.825027	SECN
IRLV17. Located just south of channel marker 7 near Barlow's Crab Building and the Oak Hill dock.	28.876871	-80.838101	SJRWMD
IRLML169. Located midway between Gaines Island and Vanns Island	28.837492	-80.794820	SJRWMD
IRLML02. Located between Pardon Island and Cucumber Island; south of Haulover Canal	28.731915	-80.717235	SJRWMD



Figure 3. Continuous data collection platform used at Canaveral National Seashore. Photo shows sonde housing and locking cap. NPS Photo / SECN staff.

Continuous data

Continuously collected data include depth, dissolved oxygen, pH, specific conductance, temperature, and turbidity. Data were collected at 30-minute intervals using YSI datasondes (Model EXO2). The sondes are deployed for three- to five- week intervals depending on routine instrument maintenance schedules. The data collection platform (mount, Figure 3) consists of a 4-inch (10.2-centimeter) diameter PVC pipe attached vertically to a piling on the dock with the sonde suspended within. All mounts were designed to keep the sonde 0.5 meters (1.3 feet) 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), depth, dissolved oxygen, specific conductance, 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 EXO 2 are shown in Table 2.

Data generated during the deployment periods are reviewed and certified by SECN staff prior to being made available to park staff or the public.

Beginning in January 2015, dissolved oxygen, pH, specific conductance, temperature and turbidity 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. USGS guidance served as the basis for data grades and corrections (Wagner et al. 2006). As with previous years, invalid or unusable data were deleted from data sets prior to publication. Data sets are available at the [NPS Aquarius Web Data Portal](#). (Aquatic Informatics Inc. 2019).

Table 2. Performance specifications of YSI EXO2 datasondes deployed at Canaveral National Seashore during 2015–2016 (YSI 2014).

Parameter	Range	Resolution	Accuracy
Dissolved oxygen (% saturation)	0 to 500% air sat.	0.10% air sat.	0 to 200%: $\pm 1\%$ reading or 1% air sat., whichever is greater; 200 to 500%: $\pm 5\%$ reading
Dissolved oxygen (mg/L)	0 to 50 mg/L	0.01 mg/L	0 to 20 mg/L: $\pm 1\%$ of reading or 0.1 mg/L; 20 to 50 mg/L: $\pm 5\%$ of reading
Conductivity	0 to 200 mS/cm	0.0001 to 0.01 mS/cm range-dependent	0–100 mS/cm $\pm 0.5\%$ of reading or 0.001 mS/cm, whichever is greater; 100–200 mS/cm: $\pm 1\%$ of reading
Temperature	-5 to +50 °C	0.001 °C	-5 to +35 °C: ± 0.01 °C +35 to +50 °C: ± 0.05 °C
pH	0 to 14 units	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: $\pm 0.04\%$ 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 $\pm 2\%$ of reading, whichever is greater; 1000 to 4000 FNU: $\pm 5\%$ of reading ¹

¹Performance based on 3-point calibration done with YSI AMCO-AEPA standards of 0, 124, and 1010 FNU. The same type of standard must be used for all calibration points.

Discrete data

Water sample collection for this project was conducted by SJRWMD according to their program's design and sampling protocols that are in compliance with Florida Department of Environmental Protection's (FDEP) SOPs (FDEP 2018). Site visits included the deployment of a multiparameter sonde to collect pH, conductivity, dissolved oxygen, and turbidity. Secchi depth was measured as an average of two readings using standard equipment. Water samples were collected as grabs in clean, field rinsed, sample containers. Filtration was conducted using a 0.45-micron filter within 15 minutes of sample collection and prior to acidification of any sample component. Samples were transported and shipped on wet ice.

QA/QC field sampling included both field blanks and duplicates (Lasi et al. 2009). Filtered samples, unfiltered samples and chlorophyll filters were placed on ice prior to shipment for lab analyses. Original chain of custody paperwork accompanied all samples to the laboratory. Data collection SOPs are further documented in the St. Johns River Water Management District Field Standard Operating Procedures for Surface Water Sampling (Lasi et al. 2009).

Water-clarity conditions were assessed using thresholds for % transmittance at one meter. Percent transmittance at one meter was calculated using methods from EPA (2016). As outlined in EPA (2016), light attenuation coefficients (Kd) are estimated using the equation: $Kd = c / \text{Secchi depth}$ (in

meters). "c" is assigned to one of three values depending on the water body's naturally occurring clarity conditions—i.e., $c = 1.0$ for naturally turbid conditions, $c = 1.4$ for normal turbidity conditions, or $c = 1.7$ for waters supporting submerged aquatic vegetation (SAV) restoration (EPA 2016). Canaveral National Seashore uses a coefficient of 1.7 because it falls into the Indian River Lagoon (SAV) region (EPA 2016 and Smith et al. 2006). Percent transmittance is then calculated using the equation $\%Trans @ 1 m = \exp(-Kd) * 100$. This method of estimating water-clarity condition is used when information on light transmission in the water column is missing. The Southeast Coast Network is reporting derived values to maintain data consistency across other network parks.

Assessment Criteria

Water quality was assessed for each of the parameters following the East/Gulf Coast site criteria in the EPA's National Coastal Assessment IV Report (EPA 2012; Table 4) using data from the monthly samples. The categorical assessments (i.e., good, fair, and poor) use measurements of chlorophyll *a*, nutrients, dissolved oxygen, and water clarity and are intended to highlight a range of conditions including acutely degraded water-quality conditions. Light attenuation coefficients (k) were used to assess water-clarity conditions using criteria categories in Smith et al. (2006) which are equivalent to the EPA criteria for the assessed water bodies.

Table 3. Coastal water-quality monitoring condition criteria for water-quality parameters collected by the Southeast Coast Network. Based on thresholds set by the EPA (2012).

Rating	Water Clarity (k) ¹	Chlorophyll <i>a</i> (µg/L)	Dissolved Inorganic Nitrogen (DIN) (mg/L)	Dissolved Inorganic Phosphorus (DIP) (mg/L)	Dissolved Oxygen (mg/L)
Good	> 40%	< 5	< 0.1	< 0.01	>5
Fair	>20% to ≤40%	5–20	0.1–0.5	0.01–0.05	2–5
Poor	≤ 20%	> 20	> 0.5	> 0.05	<2

¹Percent transmittance at one meter was used to assess water-clarity conditions using criteria categories in USEPA (2016) which are comparable to the USEPA (2012) criteria for the assessed water bodies.

Results

Continuous Data

Figures 4 through 9 depict the daily mean for each parameter for the 2015–2016 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 4. 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 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 (CANAvctr) by the Southeast Coast Network.

Mean monthly dissolved oxygen concentrations were mostly good to fair throughout 2015–2016, ranging from a low of 4.7 mg/L in July 2015 to a high of 8.1 mg/L in February 2016. Individual dissolved oxygen concentrations ranged from 1.3 mg/L in June 2015 to 13.1 mg/L in December 2015.

Mean monthly pH values ranged from a low of 7.7 in October 2016 to a high of 8.3 in July 2016. Individual pH values ranged from 7.5 to 8.5 in various months throughout the two-year period of record.

Monthly mean turbidity values ranged from 5.3 FNUs in January 2015 to 16.1 FNUs in July 2016. Individual turbidity values ranged from 1.5 FNUs in January 2015 to 156.2 FNUs in October 2016.

Mean monthly water temperatures ranged from 16.1 °C (70 °F) in February 2015 to 31.9 °C (89.4 °F) in July 2016. Individual temperature readings ranged from 9.3°C (48.7 °F) in February 2015 to 34.7 °C (94.5 °F) in July 2016.

The tidal range for Canaveral National Seashore in 2015–2016 was approximately 0.94 meters (3.1 feet).

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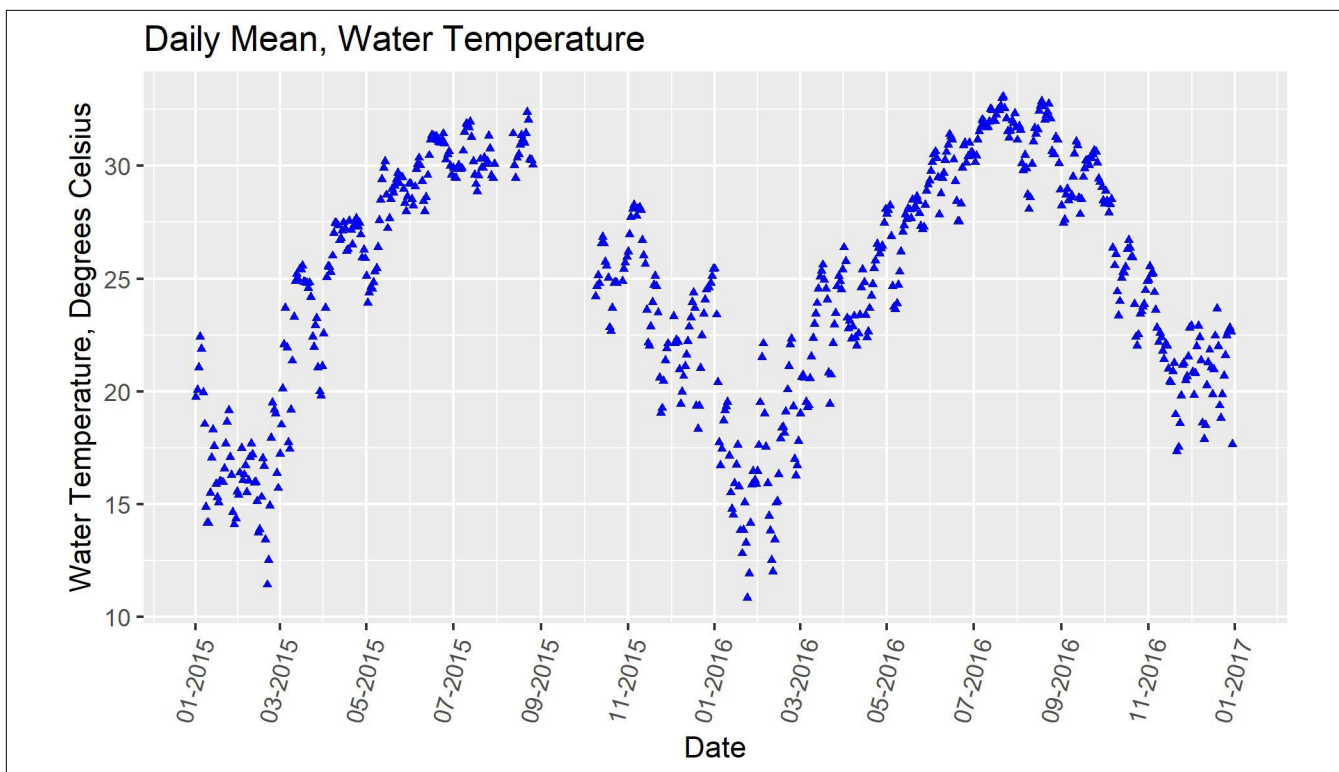


Figure 4. Mean daily water temperature at Canaveral National Seashore during 2015–2016. Breaks in data record indicate missing and/or flagged data.

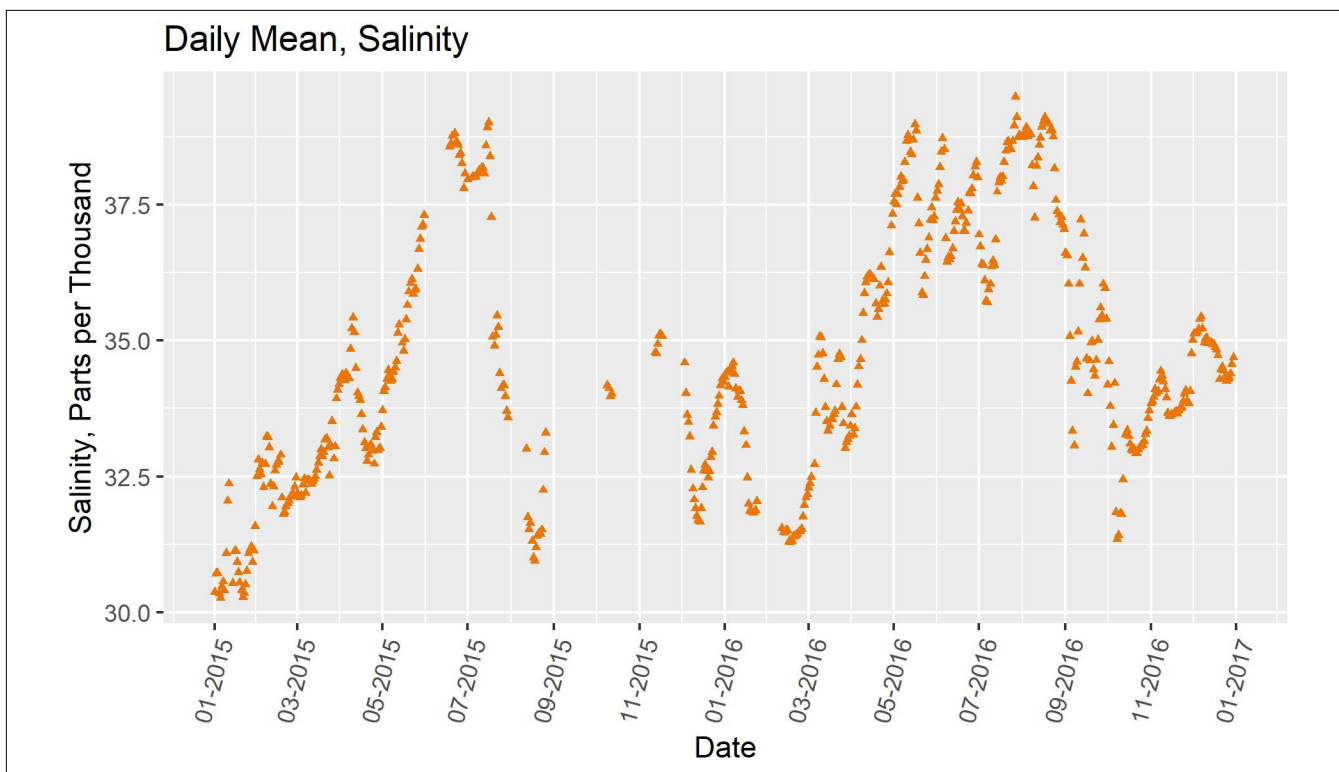


Figure 5. Mean daily values for salinity at Canaveral National Seashore during 2015–2016. Breaks in data record indicate missing and/or flagged data.

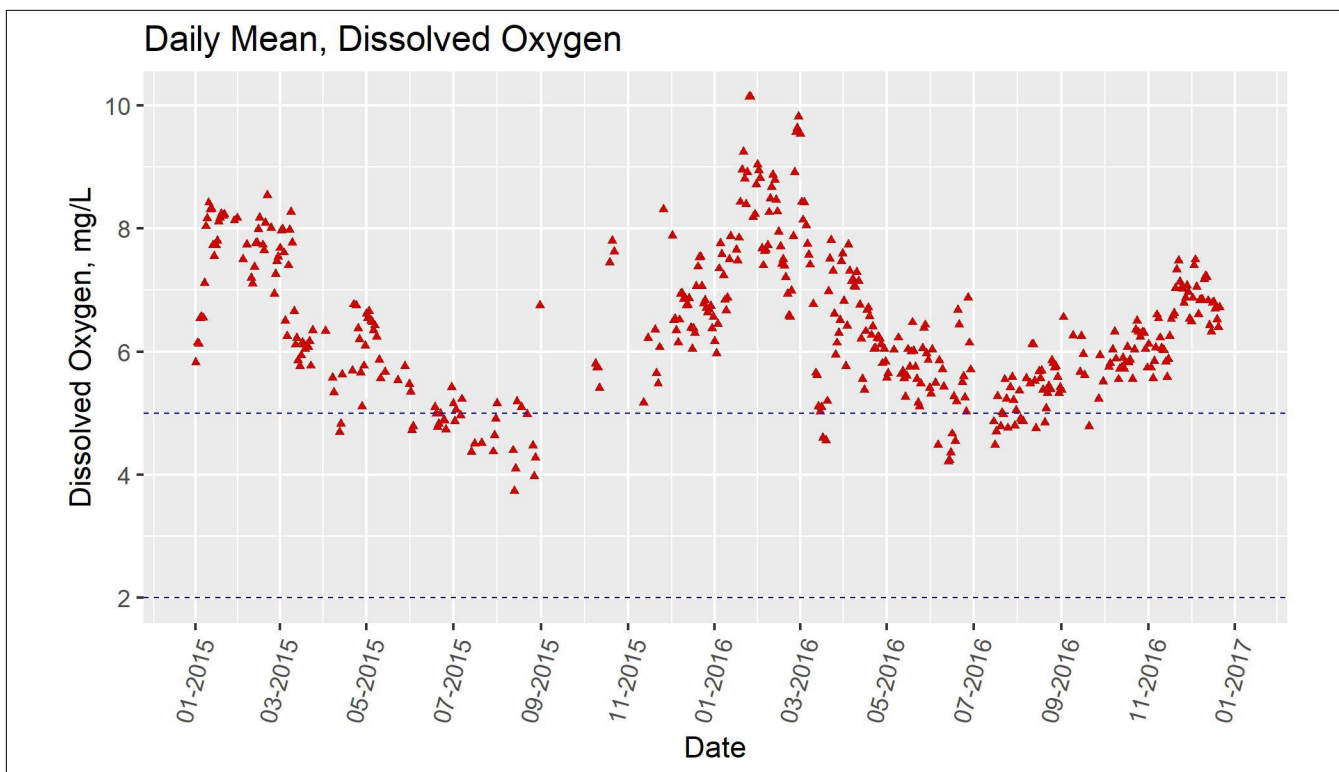


Figure 6. Mean daily values for dissolved oxygen at Canaveral National Seashore during 2015–2016. Breaks in data record indicate missing and/or flagged data. Dashed lines indicate thresholds for good (above 5 mg/L), fair (2–5 mg/L), and poor (less than 2 mg/l) criteria (EPA 2012).

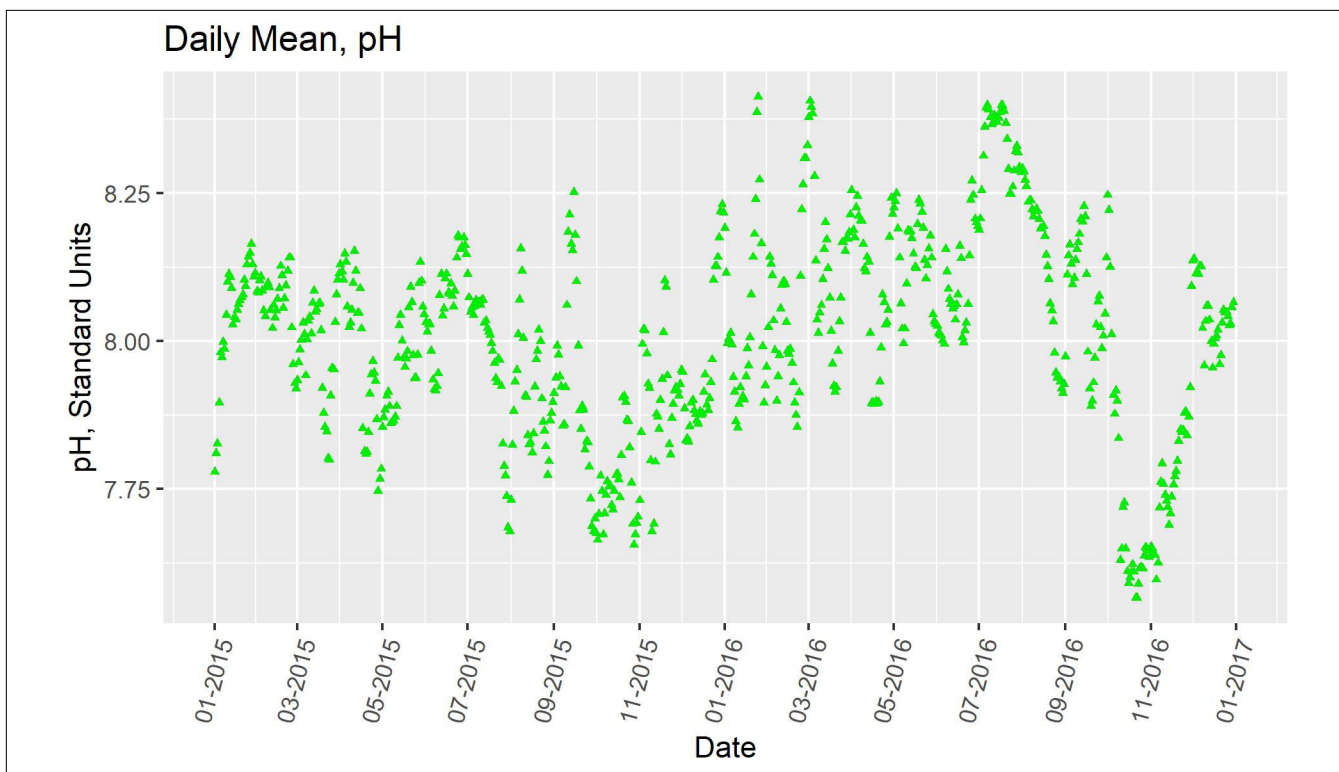


Figure 7. Mean daily pH at Canaveral National Seashore during 2015–2016. Breaks in data record indicate missing and/or flagged data.

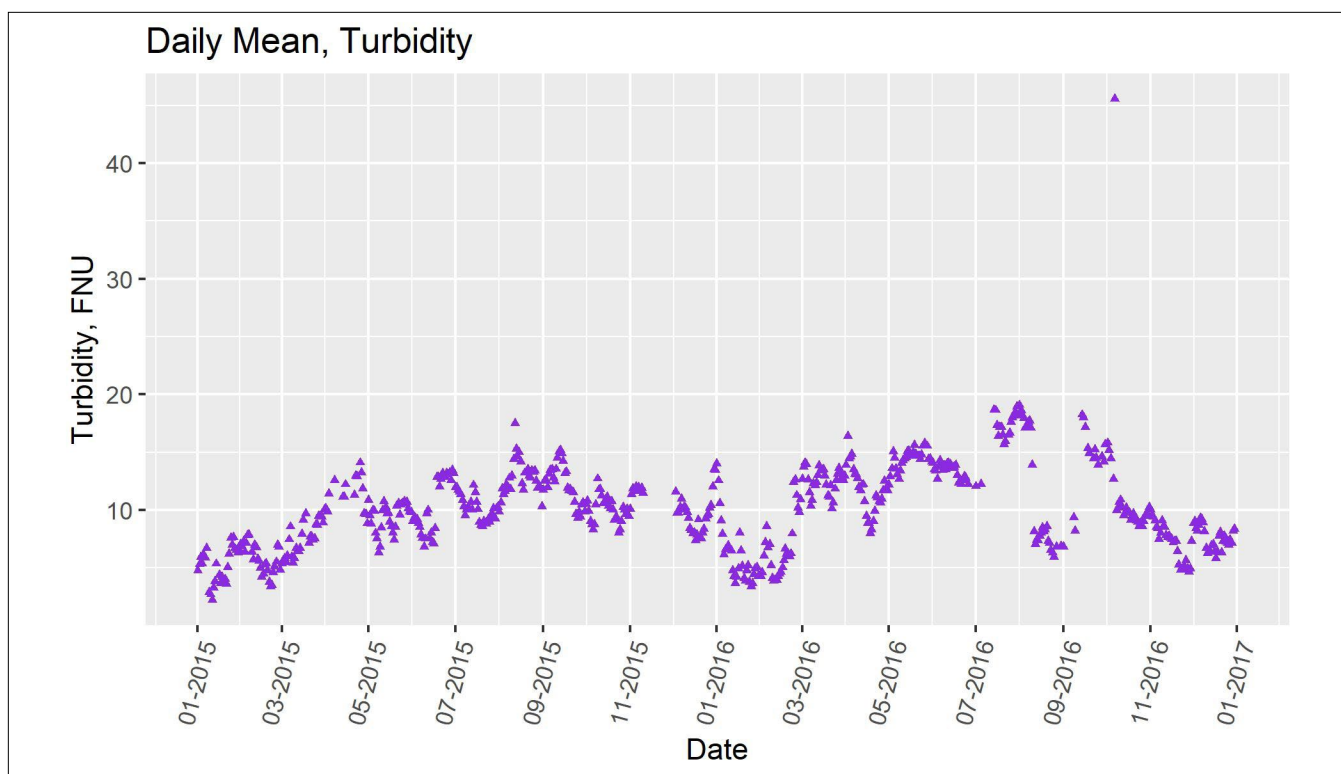


Figure 8. Mean daily turbidity at Canaveral National Seashore during 2015–2016. Breaks in data record indicate missing and/or flagged data.

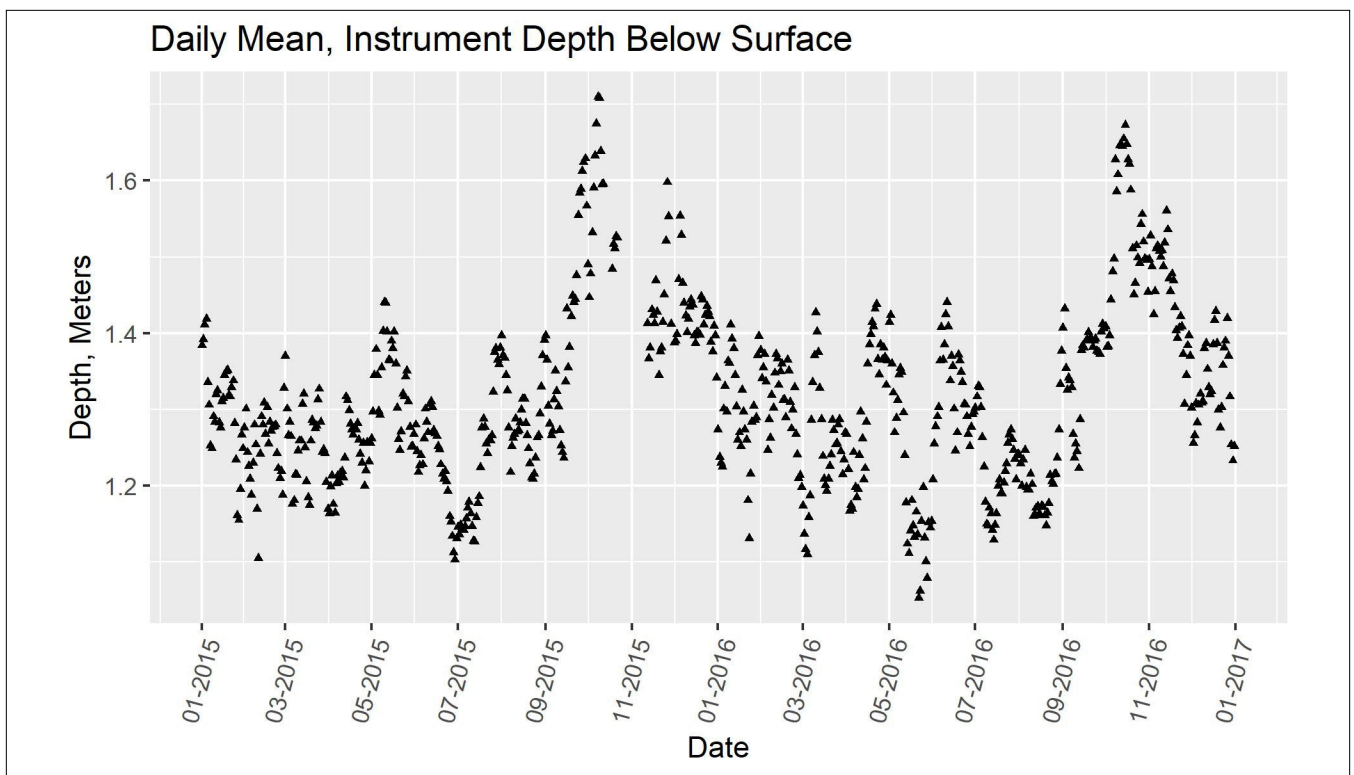


Figure 9. Mean daily depth at Canaveral National Seashore during 2015–2016. Breaks in data record indicate missing and/or flagged data.

Table 4. Monthly minimum, maximum, and mean values for parameters collected by the YSI datasondes at Canaveral National Seashore during 2015–2016. Percent of values for each month indicates the number of data points collected during one calendar month of data collection / total number of expected points for a complete month of data [PPT—parts per thousand; mg/L—milligrams per liter; m—meter; FNU—formazin nephelometric turbidity unit; SD—standard deviation].

Month / Expected count	Metric	Temperature, °C	Salinity, PPT	Dissolved Oxygen, mg/L	Depth, meters	pH	Turbidity, FNU
January 2015 (Expected count 1488)	Actual Count	1488	1385	1315	1488	1481	1317
	Minimum	12.7	29.9	4.9	1.07	7.7	1.5
	Maximum	23.6	32.9	9.2	1.52	8.2	15.3
	Mean	17.1	30.9	7.6	1.3	8.0	5.3
	Standard Deviation	2.4	0.6	0.9	0.1	0.1	2.0
	Percent	100%	93%	88%	100%	100%	89%
February 2015 (Expected count 1344)	Actual Count	1344	1344	1041	1344	1337	1243
	Minimum	9.3	31.6	6.0	1.02	7.9	3.0
	Maximum	20.2	33.4	9.1	1.42	8.2	13.8
	Mean	16.1	32.5	7.7	1.25	8.1	5.7
	Standard Deviation	2.0	0.4	0.5	0.1	0.06	1.7
	Percent	100%	100%	77%	100%	99%	92%
March 2015 (Expected count 1488)	Actual Count	1488	1488	1265	1488	1488	1286
	Minimum	15.9	32.1	4.5	1.05	7.7	3.5
	Maximum	27.5	34.2	9.6	1.48	8.2	16.2
	Mean	22.4	32.8	6.7	1.25	8.0	7.5
	Standard Deviation	2.7	0.6	1.0	0.1	0.09	2.1
	Percent	100%	100%	85%	100%	100%	86%
April 2015 (Expected count 1440)	Actual Count	1440	1439	1053	1440	1402	1100
	Minimum	21	32	3.7	1.05	7.7	5.6
	Maximum	29.1	35.6	9.0	1.41	8.2	22.2
	Mean	26.5	33.8	5.8	1.24	8.0	11.7
	Standard Deviation	1.4	0.8	1.0	0.1	0.14	2.6
	Percent	100%	100%	73%	100%	97%	76%
May 2015 (Expected count 1488)	Actual Count	1488	1442	1130	1488	1488	1414
	Minimum	22.5	33.5	3.7	1.15	7.8	2.9
	Maximum	31.6	37.5	7.8	1.51	8.2	18.9
	Mean	27.7	35.3	5.9	1.33	8.0	9.4
	Standard Deviation	2.1	1.0	0.9	0.1	0.09	2.5
	Percent	100%	97%	76%	100%	100%	95%
June 2015 (Expected count 1440)	Actual Count	1440	623	971	1440	1440	1346
	Minimum	26.9	37.3	1.3	1.0	7.8	1.9
	Maximum	33.1	39	8.0	1.43	8.3	20.6
	Mean	30.1	38.5	4.9	1.23	8.1	10.5
	Standard Deviation	1.4	0.4	1.2	0.1	0.09	3.2
	Percent	100%	43%	67%	100%	100%	93%

Table 4 (continued). Monthly minimum, maximum, and mean values for parameters collected by the YSI datasondes at Canaveral National Seashore during 2015–2016. Percent of values for each month indicates the number of data points collected during one calendar month of data collection / total number of expected points for a complete month of data [PPT—parts per thousand; mg/L—milligrams per liter; m—meter; FNU— formazin nephelometric turbidity unit; SD— standard deviation].

Month / Expected count	Metric	Temperature, °C	Salinity, PPT	Dissolved Oxygen, mg/L	Depth, meters	pH	Turbidity, FNU
July 2015 (Expected count 1488)	Actual Count	1437	1368	1066	1488	1485	1442
	Minimum	27.5	33.4	2.4	1.02	7.6	4.6
	Maximum	33.6	39.5	7.8	1.5	8.2	20.6
	Mean	30.3	36.6	4.7	1.23	8.0	10.1
	Standard Deviation	1.2	1.9	1.1	0.1	0.13	2.3
	Percent	97%	92%	72%	100%	100%	97%
August 2015 (Expected count 1488)	Actual Count	726	717	765	1485	1483	1371
	Minimum	28.2	30.8	1.9	1.11	7.6	6.7
	Maximum	33.6	33.8	9.1	1.5	8.3	23.7
	Mean	30.9	31.8	4.8	1.29	7.9	12.8
	Standard Deviation	1.1	0.8	1.4	0.1	0.12	2.7
	Percent	49%	48%	51%	100%	100%	92%
September 2015 (Expected count 1440)	Actual Count	0	0	248	1420	1431	1279
	Minimum	NA	NA	2.8	1.14	7.6	5.2
	Maximum	NA	NA	8.0	1.75	8.5	25.5
	Mean	NA	NA	5.1	1.4	7.9	12.3
	Standard Deviation	NA	NA	1.2	0.1	0.18	3.0
	Percent	0%	0%	17%	99%	99%	89%
October 2015 (Expected count 1488)	Actual Count	1039	221	496	922	1487	1408
	Minimum	21.7	33.7	4.6	1.37	7.6	5.0
	Maximum	28.1	34.2	9.0	1.79	8.0	21.4
	Mean	25	34.1	6.6	1.56	7.8	10
	Standard Deviation	1.2	0.1	1.1	0.1	0.08	2.2
	Percent	70%	15%	33%	62%	100%	95%
November 2015 (Expected count 1440)	Actual Count	1428	342	596	894	1440	442
	Minimum	18.5	34.6	3.7	1.25	7.6	6.2
	Maximum	29.2	35.2	11.4	1.72	8.2	20.2
	Mean	24.5	35.0	6.4	1.44	7.9	11.6
	Standard Deviation	2.9	0.2	1.2	0.1	0.11	2.2
	Percent	99%	24%	41%	62%	100%	31%
December 2015 (Expected count 1488)	Actual Count	1423	1415	1394	1488	1488	1410
	Minimum	17.8	31.5	4.6	1.26	7.7	5.0
	Maximum	26.0	34.9	13.1	1.62	8.3	16.0
	Mean	22.5	33	6.8	1.42	8.0	9.6
	Standard Deviation	2.0	0.9	1.0	0.1	0.13	2.1
	Percent	96%	95%	94%	100%	100%	95%

Table 4 (continued). Monthly minimum, maximum, and mean values for parameters collected by the YSI datasondes at Canaveral National Seashore during 2015–2016. Percent of values for each month indicates the number of data points collected during one calendar month of data collection / total number of expected points for a complete month of data [PPT—parts per thousand; mg/L—milligrams per liter; m—meter; FNU— formazin nephelometric turbidity unit; SD— standard deviation].

Month / Expected count	Metric	Temperature, °C	Salinity, PPT	Dissolved Oxygen, mg/L	Depth, meters	pH	Turbidity, FNU
January 2016 (Expected count 1488)	Actual Count	1488	1151	1303	1488	1488	1482
	Minimum	9.5	31.4	4.4	1.04	7.8	3.0
	Maximum	26.2	34.6	10.9	1.5	8.5	18.5
	Mean	16.5	33.4	7.9	1.3	8.0	6.0
	Standard Deviation	3.1	1.1	1.1	0.1	0.15	2.7
	Percent	100%	77%	88%	100%	100%	100%
February 2016 (Expected count 1392)	Actual Count	1392	942	1344	1392	1392	1383
	Minimum	10.5	31.2	5.7	1.13	7.8	3.0
	Maximum	23.7	32.5	10.8	1.47	8.4	21.2
	Mean	17.6	31.6	8.1	1.31	8.1	6.7
	Standard Deviation	2.9	0.3	1.0	0.1	0.14	2.8
	Percent	100%	68%	97%	100%	100%	99%
March 2016 (Expected count 1488)	Actual Count	1488	1447	1317	1488	1468	1470
	Minimum	17.5	32.2	3.1	1.0	7.8	8.1
	Maximum	26.8	35.2	10.8	1.52	8.4	18.2
	Mean	22.7	33.7	6.8	1.25	8.1	12.5
	Standard Deviation	2.3	0.8	1.5	0.1	0.14	1.7
	Percent	100%	97%	89%	100%	99%	99%
April 2016 (Expected count 1440)	Actual Count	1440	1431	1333	1440	1439	1417
	Minimum	20.1	33.1	4.2	1.04	7.8	5.7
	Maximum	29.1	37.5	9.1	1.54	8.3	31.1
	Mean	24.5	35.5	6.5	1.3	8.1	11.7
	Standard Deviation	1.9	1.0	0.9	0.1	0.13	2.6
	Percent	100%	99%	93%	100%	100%	98%
May 2016 (Expected count 1488)	Actual Count	1488	1480	1167	1488	1435	1455
	Minimum	21.8	35.5	3.2	0.91	7.9	9.5
	Maximum	30.9	39.2	8.8	1.5	8.3	21.6
	Mean	27.2	37.6	5.7	1.21	8.1	14.4
	Standard Deviation	1.8	0.9	1.1	0.1	0.08	1.9
	Percent	100%	99%	78%	100%	96%	98%
June 2016 (Expected count 1440)	Actual Count	1440	1421	1151	1440	1416	1287
	Minimum	26.3	36.1	2.5	1.09	7.9	8.6
	Maximum	33.0	39.2	9.6	1.56	8.3	19.7
	Mean	29.9	37.5	5.4	1.32	8.1	13.2
	Standard Deviation	1.3	0.7	1.3	0.1	0.09	1.9
	Percent	100%	99%	80%	100%	98%	89%

Table 4 (continued). Monthly minimum, maximum, and mean values for parameters collected by the YSI datasondes at Canaveral National Seashore during 2015–2016. Percent of values for each month indicates the number of data points collected during one calendar month of data collection / total number of expected points for a complete month of data [PPT—parts per thousand; mg/L—milligrams per liter; m—meter; FNU— formazin nephelometric turbidity unit; SD— standard deviation].

Month / Expected count	Metric	Temperature, °C	Salinity, PPT	Dissolved Oxygen, mg/L	Depth, meters	pH	Turbidity, FNU
July 2016 (Expected count 1488)	Actual Count	1488	1438	695	1488	1460	1180
	Minimum	29.0	34.2	2.1	1.02	8.1	9.7
	Maximum	34.7	39.7	8.2	1.45	8.5	25.5
	Mean	31.9	37.7	5.0	1.22	8.3	16.1
	Standard Deviation	1.1	1.2	1.6	0.1	0.07	3.2
	Percent	100%	97%	47%	100%	98%	79%
August 2016 (Expected count 1488)	Actual Count	1487	1487	1210	1487	1481	1324
	Minimum	27.0	36.5	2.0	1.05	7.8	1.9
	Maximum	34.4	39.6	8.7	1.48	8.4	27.8
	Mean	31.0	38.3	5.5	1.21	8.1	10.8
	Standard Deviation	1.5	0.7	1.4	0.1	0.13	5.3
	Percent	100%	100%	81%	100%	100%	89%
September 2016 (Expected count 1440)	Actual Count	1440	1380	1052	1440	1440	1054
	Minimum	26.7	31.6	3.1	1.13	7.8	2.5
	Maximum	32.4	38.0	8.9	1.52	8.3	25.7
	Mean	29.4	35.3	5.9	1.36	8.1	13.1
	Standard Deviation	1.2	1.1	1.3	0.1	0.11	4.4
	Percent	100%	96%	73%	100%	100%	73%
October 2016 (Expected count 1488)	Actual Count	1487	1425	1217	1487	1487	1393
	Minimum	21.3	30.4	3.8	1.0	7.5	6.4
	Maximum	29.9	35.0	8.5	1.85	8.4	156.2
	Mean	25.4	33.0	6.0	1.53	7.7	11.6
	Standard Deviation	2.0	0.8	0.7	0.1	0.2	9.6
	Percent	100%	96%	82%	100%	100%	94%
November 2016 (Expected count 1440)	Actual Count	1440	1437	1330	1440	1440	1427
	Minimum	16.3	33.4	4.5	1.21	7.5	3.0
	Maximum	26.4	34.9	8.1	1.66	8.2	13.9
	Mean	21.7	33.9	6.5	1.45	7.8	7.2
	Standard Deviation	2.1	0.3	0.7	0.1	0.11	2.0
	Percent	100%	100%	92%	100%	100%	99%
December 2016 (Expected count 1488)	Actual Count	1488	1486	939	1488	1488	1466
	Minimum	13.9	34.1	5.5	1.08	7.9	4.1
	Maximum	24.4	35.7	8.4	1.51	8.2	13.5
	Mean	20.8	34.8	6.8	1.33	8.0	7.5
	Standard Deviation	1.9	0.3	0.6	0.1	0.06	1.6
	Percent	100%	100%	63%	100%	100%	99%

Table 5. Monthly water-quality data collected by St. Johns River Water Management District at fixed sites in Mosquito Lagoon during 2015–2016. Water clarity condition was assessed using % transmittance at one meter. Percent transmittance at one meter was calculated using methods from EPA (2016), where the light attenuation coefficient (K_d) is estimated from Secchi depths and a constant for estuarine waters supporting submerged aquatic vegetation restoration ($c=1.7$). Condition of other assessed parameters are based on EPA (2012). [^aGreen—good; ^byellow—fair; ^cred—poor; —% transmittance; $\mu\text{g/L}$ —micrograms per liter; mg/L —milligrams per liter; – data not collected; BDL—below detection limit].

Site	Date	Water Clarity (K_d)	% Transmittance at 1 m	Chlorophyll <i>a</i> ($\mu\text{g/L}$)	Dissolved Oxygen (mg/L)	Dissolved Inorganic Nitrogen (mg/L)	Dissolved Inorganic Phosphorus (mg/L)	Total Phosphorus (mg/L) ¹	Total Nitrogen (mg/L) ¹
IRLML02 (2015)	1/6/2015	3.40	3.34 ^c	18.29 ^b	7.6 ^a	0.007 ^a	0.0041 ^a	0.099	1.14
	1/13/2015	–	–	12.71 ^b	–	0.006 ^a	0.0071 ^a	0.052	1.10
	2/3/2015	4.25	1.43 ^c	18.29 ^b	8.0 ^a	0.009 ^a	0.0064 ^a	0.079	1.59
	3/2/2015	1.89	15.12 ^c	12.99 ^b	8.4 ^a	0.001 ^a	0.0020 ^a	0.075	0.93
	3/4/2015	2.43	8.82 ^c	13.62 ^b	8.9 ^a	0.013 ^a	0.0067 ^a	0.048	0.90
	4/6/2015	4.25	1.43 ^c	21.20 ^c	6.6 ^a	0.016 ^a	0.0068 ^a	0.090	1.43
	4/23/2015	4.25	1.43 ^c	20.02 ^c	6.3 ^a	0.008 ^a	0.0046 ^a	0.080	1.50
	5/6/2015	2.83	5.88 ^c	21.09 ^c	6.5 ^a	0.010 ^a	0.0065 ^a	0.098	1.96
	5/19/2015	4.86	0.78 ^c	19.76 ^b	6.2 ^a	0.009 ^a	0.0114 ^b	0.130	2.16
	6/1/2015	5.67	0.35 ^c	16.29 ^b	6.5 ^a	0.010 ^a	0.0060 ^a	0.095	1.89
	6/9/2015	3.40	3.34 ^c	15.55 ^b	4.2 ^b	0.008 ^a	0.0091 ^a	0.114	2.28
	7/1/2015	3.40	3.34 ^c	20.36 ^c	7.0 ^a	0.012 ^a	0.0059 ^a	0.071	1.74
	7/6/2015	4.86	0.78 ^c	20.56 ^c	5.8 ^a	0.013 ^a	0.0058 ^a	0.111	1.94
	7/28/2015	3.40	3.34 ^c	18.16 ^b	5.6 ^a	0.009 ^a	0.0021 ^a	0.082	2.29
	8/3/2015	4.25	1.43 ^c	21.23 ^c	6.1 ^a	0.010 ^a	0.0012 ^a	0.083	2.14
	8/27/2015	4.25	1.43 ^c	30.88 ^c	3.7 ^b	0.007 ^a	0.0008 ^a	0.091	2.03
	9/8/2015	3.40	3.34 ^c	24.65 ^c	5.4 ^a	0.004 ^a	0.0026 ^a	0.086	2.04
	9/21/2015	3.40	3.34 ^c	24.39 ^c	5.9 ^a	0.015 ^a	0.0005 ^a	0.100	2.03
	10/5/2015	3.40	3.34 ^c	28.48 ^c	6.8 ^a	0.009 ^a	0.0050 ^a	0.121	1.56
	10/14/2015	4.25	1.43 ^c	21.45 ^c	6.2 ^a	0.007 ^a	BDL ^a	0.181	1.63
	11/2/2015	4.25	1.43 ^c	26.34 ^c	6.3 ^a	0.013 ^a	0.0078 ^a	0.122	1.94
	11/9/2015	3.40	3.34 ^c	33.71 ^c	6.2 ^a	0.019 ^a	0.0102 ^b	0.041	1.91
	12/2/2015	5.67	0.35 ^c	36.58 ^c	7.3 ^a	0.011 ^a	0.0051 ^a	0.099	1.60
	12/9/2015	5.67	0.35 ^c	36.80 ^c	6.8 ^a	0.017 ^a	0.0065 ^a	0.102	1.94

¹ There are no EPA condition criteria for TDN and TDP.

Table 5 (continued). Monthly water-quality data collected by St. Johns River Water Management District at fixed sites in Mosquito Lagoon during 2015–2016. Water clarity condition was assessed using % transmittance at one meter. Percent transmittance at one meter was calculated using methods from EPA (2016), where the light attenuation coefficient (K_d) is estimated from Secchi depths and a constant for estuarine waters supporting submerged aquatic vegetation restoration ($c=1.7$). Condition of other assessed parameters are based on EPA (2012). [^aGreen—good; ^byellow—fair; ^cred—poor; —% transmittance; $\mu\text{g/L}$ —micrograms per liter; mg/L —milligrams per liter; – data not collected; BDL—below detection limit].

Site	Date	Water Clarity (K_d)	% Transmittance at 1 m	Chlorophyll <i>a</i> ($\mu\text{g/L}$)	Dissolved Oxygen (mg/L)	Dissolved Inorganic Nitrogen (mg/L)	Dissolved Inorganic Phosphorus (mg/L)	Total Phosphorus (mg/L) ¹	Total Nitrogen (mg/L) ¹
IRLML02 (2016)	1/4/2016	8.50	0.02 ^c	58.12 ^c	7.0 ^a	0.014 ^a	0.0117 ^b	0.078	1.63
	1/12/2016	6.80	0.11 ^c	60.88 ^c	8.1 ^a	0.007 ^a	0.0087 ^a	0.093	1.72
	1/25/2016	6.80	0.11 ^c	47.33 ^c	8.7 ^a	0.009 ^a	0.0040 ^a	0.088	1.63
	2/3/2016	2.83	5.88 ^c	38.13 ^c	9.5 ^a	0.012 ^a	0.0063 ^a	0.095	1.27
	3/22/2016	8.50	0.02 ^c	28.30 ^c	6.7 ^a	0.007 ^a	0.0047 ^a	0.109	1.51
	4/4/2016	5.67	0.35 ^c	25.23 ^c	6.7 ^a	0.018 ^a	0.0137 ^b	0.112	1.72
	4/19/2016	4.86	0.78 ^c	21.09 ^c	7.3 ^a	0.009 ^a	0.0105 ^b	0.100	1.63
	5/2/2016	5.67	0.35 ^c	26.97 ^c	6.1 ^a	0.013 ^a	0.0051 ^a	0.135	1.99
	5/11/2016	4.86	0.78 ^c	20.29 ^c	5.6 ^a	0.014 ^a	0.0116 ^b	0.121	1.86
	6/9/2016	4.86	0.78 ^c	35.11 ^c	5.9 ^a	0.014 ^a	0.0050 ^a	0.108	2.03
	6/15/2016	5.67	0.35 ^c	29.77 ^c	6.1 ^a	0.011 ^a	0.0027 ^a	0.104	1.92
	7/5/2016	4.25	1.43 ^c	22.96 ^c	5.7 ^a	0.031 ^a	0.0065 ^a	0.200	2.00
	7/19/2016	4.25	1.43 ^c	30.17 ^c	3.8 ^b	0.013 ^a	0.0048 ^a	0.087	2.12
	8/1/2016	3.40	3.34 ^c	26.70 ^c	6.1 ^a	0.016 ^a	0.0127 ^b	0.110	2.31
	8/11/2016	4.86	0.78 ^c	34.71 ^c	6.3 ^a	–	NA	NA	NA
	9/6/2016	4.86	0.78 ^c	33.64 ^c	7.0 ^a	0.037 ^a	-0.0004 ^a	0.105	2.46
	9/15/2016	5.67	0.35 ^c	40.85 ^c	6.5 ^a	0.034 ^a	0.0041 ^a	0.110	2.18
	10/13/2016	4.25	1.43 ^c	40.98 ^c	7.1 ^a	–	NA	NA	NA
	10/17/2016	3.40	3.34 ^c	39.25 ^c	6.9 ^a	0.016 ^a	0.0054 ^a	0.088	1.87
	11/3/2016	5.67	0.35 ^c	27.50 ^c	6.4 ^a	0.019 ^a	0.0040 ^a	0.157	1.83
	11/15/2016	4.86	0.78 ^c	23.23 ^c	7.3 ^a	–	NA	NA	NA
	12/1/2016	4.25	1.43 ^c	26.43 ^c	6.4 ^a	–	NA	NA	NA
	12/5/2016	5.67	0.35 ^c	25.10 ^c	7.7 ^a	0.015 ^a	0.0030 ^a	0.086	1.84
	12/22/2016	4.25	1.43 ^c	24.70 ^c	7.2 ^a	–	NA	NA	NA
IRLML169 (2015)	1/6/2015	0.89	40.87 ^a	5.21 ^b	7.4 ^a	0.003 ^a	0.0020 ^a	0.071	0.52
	2/4/2015	0.65	52.00 ^a	1.25 ^a	7.8 ^a	0.000 ^a	0.0121 ^b	0.022	0.34
	3/3/2015	0.68	50.66 ^a	1.92 ^a	7.8 ^a	0.013 ^a	0.0148 ^b	0.040	0.37
	4/7/2015	1.70	18.27 ^c	5.85 ^b	7.1 ^a	0.011 ^a	0.0085 ^a	0.070	0.65
	5/5/2015	1.21	29.69 ^b	3.02 ^a	6.6 ^a	0.003 ^a	0.0030 ^a	0.051	0.56
	6/3/2015	2.43	8.82 ^c	10.25 ^b	5.6 ^a	0.004 ^a	0.0044 ^a	0.092	1.21
	7/7/2015	2.13	11.94 ^c	14.06 ^b	5.6 ^a	0.008 ^a	0.0082 ^a	0.075	1.67
	8/5/2015	2.83	5.88 ^c	16.42 ^b	8.4 ^a	0.005 ^a	0.0051 ^a	0.088	1.73
	9/1/2015	2.83	5.88 ^c	25.70 ^c	6.9 ^a	0.007 ^a	0.0045 ^a	0.116	1.59
	10/12/2015	1.70	18.27 ^c	6.67 ^b	6.5 ^a	0.005 ^a	0.0017 ^a	0.128	0.51
	11/4/2015	4.25	1.43 ^c	NA	7.9 ^a	0.010 ^a	0.0034 ^a	0.073	0.84
	12/1/2015	2.43	8.82 ^c	12.78 ^b	7.8 ^a	0.005 ^a	0.0038 ^a	0.096	0.55

¹ There are no EPA condition criteria for TDN and TDP.

Table 5 (continued). Monthly water-quality data collected by St. Johns River Water Management District at fixed sites in Mosquito Lagoon during 2015–2016. Water clarity condition was assessed using % transmittance at one meter. Percent transmittance at one meter was calculated using methods from EPA (2016), where the light attenuation coefficient (K_d) is estimated from Secchi depths and a constant for estuarine waters supporting submerged aquatic vegetation restoration ($c=1.7$). Condition of other assessed parameters are based on EPA (2012). [^aGreen—good; ^byellow—fair; ^cred—poor; —% transmittance; $\mu\text{g/L}$ —micrograms per liter; mg/L —milligrams per liter; – data not collected; BDL—below detection limit].

Site	Date	Water Clarity (K_d)	% Transmittance at 1 m	Chlorophyll <i>a</i> ($\mu\text{g/L}$)	Dissolved Oxygen (mg/L)	Dissolved Inorganic Nitrogen (mg/L)	Dissolved Inorganic Phosphorus (mg/L)	Total Phosphorus (mg/L) ¹	Total Nitrogen (mg/L) ¹
IRLML169 (2016)	1/5/2016	5.67	0.35 ^c	33.91 ^c	8.2 ^a	0.006 ^a	0.0043 ^a	0.121	1.31
	2/2/2016	1.13	32.20 ^b	2.35 ^a	9.3 ^a	0.010 ^a	0.0040 ^a	0.048	0.02
	3/1/2016	5.67	0.35 ^c	26.86 ^c	10.5 ^a	0.013 ^a	0.0033 ^a	0.066	1.03
	4/5/2016	4.25	1.43 ^c	27.77 ^c	8.3 ^a	0.012 ^a	0.0077 ^a	0.147	1.35
	5/3/2016	4.25	1.43 ^c	23.14 ^c	5.9 ^a	0.010 ^a	0.0057 ^a	0.094	1.14
	6/8/2016	4.25	1.43 ^c	21.89 ^c	7.7 ^a	0.012 ^a	0.0023 ^a	0.127	1.80
	7/5/2016	4.25	1.43 ^c	26.25 ^c	5.6 ^a	0.017 ^a	0.0099 ^a	0.083	1.61
	8/2/2016	4.25	1.43 ^c	41.12 ^c	5.4 ^a	0.013 ^a	0.0048 ^a	0.138	2.15
	9/8/2016	4.25	1.43 ^c	33.11 ^c	6.8 ^a	0.015 ^a	0.0052 ^a	0.088	1.61
	10/18/2016	2.13	11.94 ^c	11.57 ^b	6.7 ^a	0.041 ^a	0.0022 ^a	0.037	0.36
	11/1/2016	4.25	1.43 ^c	15.93 ^b	6.5 ^a	0.018 ^a	0.0168 ^b	0.068	0.81
	12/6/2016	3.40	3.34 ^c	18.78 ^b	7.3 ^a	0.012 ^a	0.0024 ^a	0.106	0.98
IRLV05 (2015)	1/6/2015	2.43	8.82 ^c	3.76 ^a	7.1 ^a	0.105 ^b	0.0271 ^b	0.123	0.54
	2/4/2015	1.70	18.27 ^c	3.20 ^a	7.8 ^a	0.015 ^a	0.0168 ^b	0.070	0.41
	3/3/2015	1.31	27.04 ^b	3.52 ^a	8.3 ^a	0.005 ^a	0.0174 ^b	0.060	0.30
	4/7/2015	1.89	15.12 ^c	3.18 ^a	7.3 ^a	0.009 ^a	0.0071 ^a	0.070	0.38
	5/5/2015	1.89	15.12 ^c	4.73 ^a	7.0 ^a	0.003 ^a	0.0058 ^a	0.078	0.44
	6/3/2015	2.83	5.88 ^c	8.99 ^b	5.9 ^a	0.003 ^a	0.0076 ^a	0.103	0.66
	7/7/2015	2.13	11.94 ^c	11.44 ^b	5.9 ^a	0.002 ^a	0.0175 ^b	0.146	1.05
	8/5/2015	2.43	8.82 ^c	14.68 ^b	6.3 ^a	0.004 ^a	0.0063 ^a	0.106	1.45
	9/1/2015	2.43	8.82 ^c	7.32 ^b	6.1 ^a	0.010 ^a	0.0079 ^a	0.055	0.45
	10/12/2015	1.89	15.12 ^c	7.26 ^b	5.6 ^a	0.026 ^a	0.0188 ^b	0.122	0.41
	11/4/2015	2.83	5.88 ^c	13.72 ^b	5.7 ^a	0.008 ^a	0.0013 ^a	0.108	0.76
	12/1/2015	1.55	21.32 ^b	7.16 ^b	7.2 ^a	0.013 ^a	0.0115 ^b	0.070	0.16
IRLV05 (2016)	1/5/2016	1.55	21.32 ^b	3.34 ^a	8.3 ^a	0.005 ^a	0.0087 ^a	0.053	0.32
	2/2/2016	1.55	21.32 ^b	4.86 ^a	8.8 ^a	0.014 ^a	0.0084 ^a	0.041	0.06
	3/1/2016	4.25	1.43 ^c	18.20 ^b	9.6 ^a	0.007 ^a	0.0081 ^a	0.073	0.58
	4/5/2016	5.67	0.35 ^c	17.30 ^b	8.1 ^a	0.007 ^a	0.0077 ^a	0.118	0.69
	5/3/2016	4.86	0.78 ^c	20.51 ^c	6.0 ^a	0.006 ^a	0.0034 ^a	0.123	1.06
	6/8/2016	2.62	7.31 ^c	17.19 ^b	5.8 ^a	0.006 ^a	0.0001 ^a	0.088	0.77
	7/5/2016	4.25	1.43 ^c	24.16 ^c	4.1	0.017 ^a	0.0162 ^b	0.080	1.17
	8/2/2016	4.25	1.43 ^c	27.37 ^c	5.4 ^a	0.010 ^a	0.0051 ^a	0.140	1.34
	9/8/2016	2.62	7.31 ^c	19.76 ^b	6.9 ^a	0.009 ^a	0.0040 ^a	0.099	0.89
	10/18/2016	1.70	18.27 ^c	6.81 ^b	6.4 ^a	0.020 ^a	0.0125 ^b	0.043	0.16
	11/1/2016	2.13	11.94 ^c	0.53 ^a	6.7 ^a	0.032 ^a	0.0182 ^b	0.075	0.43
	12/6/2016	2.13	11.94 ^c	6.01 ^b	6.4 ^a	0.013 ^a	0.0078 ^a	0.077	0.45

¹ There are no EPA condition criteria for TDN and TDP.

Table 5 (continued). Monthly water-quality data collected by St. Johns River Water Management District at fixed sites in Mosquito Lagoon during 2015–2016. Water clarity condition was assessed using % transmittance at one meter. Percent transmittance at one meter was calculated using methods from EPA (2016), where the light attenuation coefficient (K_d) is estimated from Secchi depths and a constant for estuarine waters supporting submerged aquatic vegetation restoration ($c=1.7$). Condition of other assessed parameters are based on EPA (2012). [^aGreen—good; ^byellow—fair; ^cred—poor; —% transmittance; $\mu\text{g/L}$ —micrograms per liter; mg/L —milligrams per liter; – data not collected; BDL—below detection limit].

Site	Date	Water Clarity (K_d)	% Transmittance at 1 m	Chlorophyll ^a ($\mu\text{g/L}$)	Dissolved Oxygen (mg/L)	Dissolved Inorganic Nitrogen (mg/L)	Dissolved Inorganic Phosphorus (mg/L)	Total Phosphorus (mg/L) ¹	Total Nitrogen (mg/L) ¹
IRLV11 (2015)	1/6/2015	1.70	18.27 ^c	2.03 ^a	6.9 ^a	0.111 ^b	0.0180 ^b	0.111	0.51
	2/4/2015	1.70	18.27 ^c	1.44 ^a	6.7 ^a	0.015 ^a	0.0230 ^b	0.056	0.38
	3/3/2015	1.70	18.27 ^c	1.71 ^a	6.8 ^a	0.017 ^a	0.0277 ^b	0.074	0.45
	4/7/2015	2.13	11.94 ^c	4.22 ^a	6.6 ^a	0.017 ^a	0.0058 ^a	0.099	0.65
	5/5/2015	1.70	18.27 ^c	4.33 ^a	6.7 ^a	0.003 ^a	0.0058 ^a	0.081	0.53
	6/3/2015	2.43	8.82 ^c	7.59 ^b	5.2 ^a	0.004 ^a	0.0074 ^a	0.096	0.92
	7/7/2015	3.40	3.34 ^c	17.68 ^b	5.9 ^a	0.007 ^a	0.0049 ^a	0.136	1.67
	8/5/2015	3.40	3.34 ^c	19.58 ^b	7.5 ^a	0.005 ^a	0.0132 ^b	0.119	1.93
	9/1/2015	2.83	5.88 ^c	13.88 ^b	6.1 ^a	0.008 ^a	0.0098 ^a	0.117	1.20
	10/12/2015	2.13	11.94 ^c	5.31 ^b	4.0 ^b	0.007 ^a	0.0210 ^b	0.102	0.41
	11/4/2015	4.25	1.43 ^c	26.85 ^c	7.4 ^a	0.010 ^a	0.0023 ^a	0.093	0.76
	12/1/2015	2.00	13.53 ^c	8.41 ^b	7.5 ^a	0.011 ^a	0.0044 ^a	0.062	0.24
IRLV11 (2016)	1/6/2016	2.13	11.94 ^c	7.40 ^b	7.5 ^a	0.003 ^a	0.0102 ^b	0.056	0.37
	2/2/2016	1.48	22.80 ^b	2.51 ^a	8.8 ^a	0.013 ^a	0.0054 ^a	0.011	0.22
	3/1/2016	5.67	0.35 ^c	27.73 ^c	10.2 ^a	0.007 ^a	0.0150 ^b	0.108	1.04
	4/5/2016	5.67	0.35 ^c	24.56 ^c	7.7 ^a	0.009 ^a	0.0073 ^a	0.164	1.33
	5/3/2016	4.86	0.78 ^c	24.83 ^c	5.8 ^a	0.008 ^a	0.0053 ^a	0.138	1.29
	6/8/2016	4.86	0.78 ^c	20.29 ^c	6.7 ^a	0.010 ^a	0.0055 ^a	0.141	1.70
	7/5/2016	5.67	0.35 ^c	29.64 ^c	5.8 ^a	0.029 ^a	0.0229 ^b	0.106	1.74
	8/2/2016	5.67	0.35 ^c	38.77 ^c	5.3 ^a	0.012 ^a	0.0044 ^a	0.162	2.20
	9/8/2016	4.25	1.43 ^c	32.44 ^c	7.0 ^a	0.014 ^a	0.0080 ^a	0.111	1.35
	10/18/2016	2.13	11.94 ^c	7.61 ^b	6.1 ^a	0.042 ^a	0.0022 ^a	0.039	0.28
	11/1/2016	2.43	8.82 ^c	7.48 ^b	6.0 ^a	0.008 ^a	0.0097 ^a	0.070	0.54
	12/6/2016	3.40	3.34 ^c	14.28 ^b	7.2 ^a	0.011 ^a	0.0045 ^a	0.121	0.97
IRLV17 (2015)	1/6/2015	1.70	18.27 ^c	3.66 ^a	6.9 ^a	0.068 ^a	0.0051 ^a	0.107	0.54
	2/4/2015	1.42	24.25 ^b	2.51 ^a	7.5 ^a	0.004 ^a	0.0127 ^b	0.064	0.39
	3/3/2015	1.42	24.25 ^b	1.39 ^a	7.7 ^a	0.025 ^a	0.0156 ^b	0.057	0.39
	4/7/2015	2.00	13.53 ^c	5.63 ^b	5.9 ^a	0.012 ^a	0.0016 ^a	0.083	0.65
	5/5/2015	2.43	8.82 ^c	4.73 ^a	6.6 ^a	0.004 ^a	0.0053 ^a	0.091	0.71
	6/3/2015	2.83	5.88 ^c	11.30 ^b	5.1 ^a	0.005 ^a	0.0044 ^a	0.102	1.17
	7/7/2015	4.25	1.43 ^c	19.82 ^b	5.2 ^a	0.007 ^a	0.0039 ^a	0.131	1.77
	8/5/2015	3.40	3.34 ^c	15.22 ^b	7.2 ^a	0.005 ^a	0.0085 ^a	0.115	1.73
	9/1/2015	4.25	1.43 ^c	20.96 ^c	4.9 ^b	0.010 ^a	0.0053 ^a	0.111	1.35
	10/12/2015	2.13	11.94 ^c	8.20 ^b	5.4 ^a	0.003 ^a	0.0040 ^a	0.081	0.47
	11/4/2015	4.25	1.43 ^c	23.94 ^c	7.4 ^a	0.010 ^a	0.0064 ^a	0.090	0.73
	12/1/2015	2.27	10.37 ^c	6.73 ^b	6.7 ^a	0.005 ^a	0.0061 ^a	0.066	0.30

¹ There are no EPA condition criteria for TDN and TDP.

Table 5 (continued). Monthly water-quality data collected by St. Johns River Water Management District at fixed sites in Mosquito Lagoon during 2015–2016. Water clarity condition was assessed using % transmittance at one meter. Percent transmittance at one meter was calculated using methods from EPA (2016), where the light attenuation coefficient (K_d) is estimated from Secchi depths and a constant for estuarine waters supporting submerged aquatic vegetation restoration ($c=1.7$). Condition of other assessed parameters are based on EPA (2012). [^aGreen—good; ^byellow—fair; ^cred—poor; —% transmittance; $\mu\text{g/L}$ —micrograms per liter; mg/L —milligrams per liter; – data not collected; BDL—below detection limit].

Site	Date	Water Clarity (K_d)	% Transmittance at 1 m	Chlorophyll <i>a</i> ($\mu\text{g/L}$)	Dissolved Oxygen (mg/L)	Dissolved Inorganic Nitrogen (mg/L)	Dissolved Inorganic Phosphorus (mg/L)	Total Phosphorus (mg/L) ¹	Total Nitrogen (mg/L) ¹
IRLV17 (2016)	1/5/2016	1.89	15.12 ^c	6.94 ^b	7.67 ^a	0.005 ^a	0.0090 ^a	0.040	0.31
	2/2/2016	1.13	32.20 ^b	2.48 ^a	8.41 ^a	0.013 ^a	0.0055 ^a	0.080	0.25
	3/1/2016	5.67	0.35 ^c	24.86 ^c	9.62 ^a	0.008 ^a	0.0071 ^a	0.073	0.76
	4/5/2016	5.67	0.35 ^c	29.19 ^c	6.96 ^a	0.010 ^a	0.0156 ^b	0.140	1.39
	5/3/2016	4.25	1.43 ^c	19.31 ^b	5.39 ^a	0.011 ^a	0.0085 ^a	0.100	1.120
	6/8/2016	4.25	1.43 ^c	30.17 ^c	5.89 ^a	0.010 ^a	0.0066 ^a	0.127	1.68
	7/5/2016	4.25	1.43 ^c	27.50 ^c	4.22 ^b	0.017 ^a	0.0205 ^b	0.113	1.62
	8/2/2016	5.67	0.35 ^c	31.86 ^c	5.44 ^a	0.012 ^a	0.0048 ^a	0.145	2.07
	9/8/2016	4.86	0.78 ^c	27.86 ^c	6.66 ^a	0.017 ^a	0.0077 ^a	0.088	1.35
	10/18/2016	2.43	8.82 ^c	7.03 ^b	6.00 ^a	0.094 ^a	0.0026 ^a	0.057	0.51
	11/1/2016	2.83	5.88 ^c	10.06 ^b	6.15 ^a	0.006 ^a	0.0126 ^b	0.080	0.64
	12/6/2016	3.09	4.55 ^c	14.51 ^b	6.69 ^a	0.012 ^a	0.0137 ^b	0.130	1.07

¹ There are no EPA condition criteria for TDN and TDP.

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1201 Oak Ridge Drive, Suite 150
Fort Collins, Colorado 80525