



Assessment of Estuarine Water and Sediment Quality at Cumberland Island National Seashore

2017 Data Summary—Version 1.1



View of the Cumberland River at site 05 near Cumberland Island National Seashore, August 2017.
NPS / SECN STAFF

Assessment of estuarine water and sediment quality at Cumberland Island National Seashore: 2017 data summary—version 1.1

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Revision Log

Table 1 shows the revision log for all published versions of this document.

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Revision Date	Author	Changes Made	Reason for Change	New Version #
05/15/2024	E. Starkey	Minor text edits. Updated site map and maps in results	Correction to citation(s) Corrected water clarity constant.	1.1

Abstract

To effectively monitor a diverse and dynamic set of estuarine water resources, the NPS Southeast Coast I&M Network (SECN) implemented a two-pronged monitoring approach, which consists of collecting periodic discrete and continuously recorded data from fixed stations located in SECN National Park units combined with periodic synoptic assessments of water quality at a larger spatial scale in the waters surrounding park areas. This report summarizes parkwide water-quality monitoring data collected during an assessment at Cumberland Island National Seashore in August 2017. The intent of this report is to provide water-quality monitoring data to managers as a concise summary in the context of condition criteria developed by the Environmental Protection Agency.

Summary and Key Findings

In August 2017 the Southeast Coast Network conducted an assessment of water quality at Cumberland Island National Seashore as part of the National Park Service Vital Signs Monitoring Program.

Monitoring was conducted following methods developed by the Environmental Protection Agency (EPA) as part of the National Coastal Assessment Program (EPA 2009). Laboratory analysis measured chlorophyll *a* and total and dissolved concentrations of nitrogen and phosphorous. Field measurements included water temperature, pH, dissolved oxygen, and salinity. Water clarity, which requires a Secchi depth measurement, was calculated when possible. All measured parameters were rated as good, fair, or poor based on thresholds set by the EPA (2012).

- Water clarity was rated good at all thirty sites.
- Chlorophyll *a* concentration was rated good at eleven sites (37%) and fair at nineteen sites (63%) sampled in 2017.
- Dissolved inorganic nitrogen concentration was good at fourteen sites (47%), and fair at the remaining eleven sites (53%).
- Dissolved inorganic phosphorus concentration was fair at twenty-nine sites (97%) and poor at one site (3%).
- Dissolved oxygen concentration was rated good at twenty-three sites (77%) and fair at seven (23%).
- A water-quality condition summary index was calculated for each site sampled in Cumberland Island National Seashore based on the categorical assessments of chlorophyll *a*, DIN and DIP concentrations, and dissolved oxygen. This summary index indicated fair water-quality conditions at all thirty sites.
- Based on the summary water-quality index rating for the seashore, overall water-quality conditions at Cumberland Island National Seashore in 2017 were fair.
- For sediment, ecological condition was ranked as good at twenty-nine sites (97%) and fair at one site (3%). As a result, no adverse impacts to benthic organisms due to sediment contamination are anticipated at any of the thirty sample sites. These rankings were assigned according to the 2010 Environmental Protection Agency, National Coastal Condition Assessment (NCCA) thresholds for sediment chemistry.

Introduction

Water resources are important to park management from ecological, regulatory, and visitor experience perspectives; therefore, 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 around parks and contribute to a better understanding of park ecological processes and physical systems (Gregory et al. 2013).

To effectively monitor a diverse and dynamic set of estuarine water resources, the NPS Southeast Coast I&M Network (SECN) implemented a two-pronged monitoring approach, which consists of collecting periodic discrete and continuously recorded data from fixed stations located in each park combined with periodic synoptic assessments of water quality at a larger spatial scale in the waters surrounding park areas (Gregory et al. 2013). When implemented together, these approaches give a more complete picture of physical processes, diurnal and seasonal variations, and spatial patterns during critical portions of the year.

The network identified four specific monitoring objectives for which data are collected and analyzed as part of this effort (Gregory et al. 2013):

- 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 nutrient concentrations (nitrogen, phosphorus, and chlorophyll *a*) 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) in estuarine waters every ten years.

This report summarizes coastal water-quality monitoring data collected during a synoptic assessment to address objectives 3 and 4 at Cumberland Island National Seashore. Data was gathered from 1 August to 4 August 2017. The purpose of this document is to report the most recently collected data from within the seashore as part of an ongoing long-term water-quality monitoring program. This report was designed to provide water-quality monitoring data to managers as a concise summary in the context of applicable federal standards developed by the EPA. A previous synoptic assessment of water-quality conditions at Cumberland Island National Seashore was conducted in July and August 2012 as part of I&M monitoring efforts (Wright et al. 2013).

Study Area

Cumberland Island National Seashore

Cumberland Island National Seashore (CUIS) is the southern-most barrier island on the Georgia coast (Figure 1, Table 2). It is 17.5 miles (28.2 kilometers) long and is one of the larger and more diverse barrier islands on the Atlantic Coast encompassing 36,415 acres (57 square miles), of which 16,850 acres (26 square miles) are estuarine. A *Spartina* grass dominated salt-marsh, oyster mud flats, and six tidal creeks provide the habitat for a diverse marine-based fauna. The remaining terrestrial habitats are dominated by a live oak-palmetto dominated forest backed by an extensive dune system. As the elevation of the island rises on the northwest, a mixed pine-deciduous forest can be encountered. The island is known for nesting loggerhead sea turtles, abundant shore birds, undeveloped dune fields, maritime forest ecosystems, and historic structures in five districts on the National Register of Historic Places. Cumberland Island and its surrounding waters provide habitat for at least 13 federally listed threatened or endangered species.

Many of the resource issues at Cumberland Island National Seashore stem from either external development pressures or past human uses of the island. The Georgia coast is going through profound growth in new, residential communities, many of which incorporate marinas. Recreational pressure will in turn increase on the island and on the waters around the island—much of it uncontrolled—and the threat to resources and critical habitat will intensify. The dredging and maintenance of the adjacent Intracoastal Waterway and St. Marys Inlet complicate the natural processes of sand budgets and tidal flow, which are key components in the island's stability and ecology. Boat wakes might be contributing to erosion on the back-barrier (west) side of the island.

The nearby urban centers of St. Marys, Fernandina Beach, Brunswick, and Jacksonville potentially contribute to a range of management issues, from air and water quality to light pollution. Kings Bay Naval Submarine Base is located immediately across the Cumberland Sound from the park and maintains a 200-ft (61-meter) wide channel around the southern tip of the island. Regional industries, such as commercial fishing and paper mills also have the potential to impact Cumberland Island's resources.



Figure 1. Location of continuous water-quality monitoring station at Cumberland Island National Seashore Sea Camp dock (CUIS03). Map shows estuarine and marine water resources in the vicinity of Cumberland Island National Seashore in Georgia. Map indicates areas of salt marsh (USFWS 2024), urbanization (USCB 2019), 303(d) listed water bodies (EPA 2019), and areas designated as having special uses or restrictions.

Table 2. Map ID, waterbody name and location, depth, coordinates, and chemical and physical attributes of sampling sites at Cumberland Island National Seashore, August 2017. The table references Map ID numbers used to present data in this report (Figure 2). All coordinates are in NAD83 Datum, in UTM zone 18. Salinity, pH, and water temperature were measured at a depth of 0.5 meters [SAV—sub-aquatic vegetation; m—meters].

ID	Water Body	Site Depth (m)	UTMX	UTMY	Site Name	Water Temp (°C)	SAV	Debris	pH	Salinity (ppt)
01	Cumberland River	6.9	457583	3422629	CUIS-01	27.9	No	No	7.79	33.4
02	Mud Creek	1.5	454377	3418467	CUIS-02	27.6	No	No	7.44	32.7
03	Cumberland River	0.7	452794	3419669	CUIS-03	27.9	No	No	7.69	32.8
04	Cumberland Sound	3.1	453864	3400771	CUIS-04	27.4	No	No	7.7	30.5
05	Cumberland River	1.3	453371	3410645	CUIS-05	27.6	No	No	7.65	33.0
06	Cumberland River	3.4	455347	3421007	CUIS-06	28.2	No	No	7.75	31.4
07	Cumberland Sound	5.1	452736	3398791	CUIS-07	27.5	No	No	7.73	31.5
08	Cumberland Sound	3.1	454231	3402981	CUIS-08	27.9	No	No	7.73	31.9
09	Cumberland River	1.7	454510	3408814	CUIS-09	27.7	No	No	7.64	32.3
10	Brickhill River	5.9	455344	3417179	CUIS-10	28.5	No	No	7.71	33.2
11	Cumberland Sound	0.9	455011	3396767	CUIS-11	28.2	No	No	7.61	30.5
12	Cumberland River	3.9	453204	3407330	CUIS-12	27.6	No	No	7.63	32.2
13	Brickhill River	10.0	455098	3416011	CUIS-13	28.1	No	No	7.67	33.2
14	Cumberland River	5.6	454055	3419920	CUIS-14	27.9	No	No	7.67	32.9
15	Cumberland Sound	5.1	453826	3402703	CUIS-15	28.3	No	No	7.58	29.4
16	Cumberland Sound	0.6	453775	3405143	CUIS-16	27.9	No	No	7.7	32.6
17	Cumberland River	6.6	457469	3422800	CUIS-17	28.0	No	No	7.79	32.9
18	Cumberland River	3.9	458658	3423038	CUIS-18	27.7	No	No	7.83	33.5
19	Cumberland River	2.1	451514	3417680	CUIS-19	28.0	No	No	7.67	32.9
20	Jolly River	2.9	452338	3398301	CUIS-20	27.6	No	No	7.57	28.8
21	Cumberland River	2.4	453640	3411526	CUIS-21	27.4	No	No	7.66	32.8

Table 2 (continued). Map ID, waterbody name and location, depth, coordinates, and chemical and physical attributes of sampling sites at Cumberland Island National Seashore, August 2017. The table references Map ID numbers used to present data in this report (Figure 2). All coordinates are in NAD83 Datum, in UTM zone 18. Salinity, pH, and water temperature were measured at a depth of 0.5 meters [SAV—sub-aquatic vegetation; m—meters].

ID	Water Body	Site Depth (m)	UTMX	UTMY	Site Name	Water Temp (°C)	SAV	Debris	pH	Salinity (ppt)
22	Cumberland River	3.8	457050	3423208	CUIS-22	28.2	No	No	7.83	33.1
23	Cumberland Sound	1.1	454306	3397120	CUIS-23	27.4	No	No	7.48	30.0
24	Cumberland Sound	6.1	453477	3401727	CUIS-24	27.5	No	No	7.75	32.2
25	Cumberland River	2.7	454002	3410373	CUIS-25	27.8	No	No	7.65	32.5
26	Brickhill River	2.0	457059	3417123	CUIS-26	28.2	No	No	7.7	33.3
27	Cumberland Sound	1.9	454783	3398713	CUIS-27	28.4	No	No	7.43	23.5
28	Cumberland Sound	2.0	454565	3404492	CUIS-28	27.3	No	No	7.59	32.4
29	Brickhill River	4.6	454297	3415523	CUIS-29	28.1	No	No	7.64	33.1
30	Brickhill River	7.1	457428	3418329	CUIS-30	28.0	No	No	7.73	33.2

Cumberland Island National Seashore
2017 Parkwide Assessment Sampling Sites

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Figure 2. Map showing the location of park-wide assessment sites sampled in August 2017 at Cumberland Island National Seashore.

Methods

The water-quality assessment was conducted in estuarine and tidal creek waters in the vicinity of the seashore, following the methods developed by the Environmental Protection Agency (EPA) National Coastal Assessment Program (EPA 2009). Descriptions of the water-quality parameters and the assessment criteria are from the EPA National Coastal Assessment IV Report (EPA 2012). Methods used for these assessments were partially adapted and integrated into protocols tailored specifically to parks in the Southeast Coast Network (Gregory et al. 2013). Site selection and sampling methodology are briefly outlined in the following sections.

Thirty sites in the seashore's waters were randomly selected for monitoring following methods developed by the EPA (Table 2, Figure 2; Stevens 1997; Stevens and Olsen 1999; Stevens and Olsen 2004). A pool of alternate sites was selected in case any of the original sites were not accessible. This method of randomly selecting spatially-balanced sites provides managers with a statistically valid estimate of the overall conditions of the assessed resource within or around the park.

Water-Quality Data Collection

The water-quality assessment conducted during this sampling period incorporated hydrographic profiles at 0.5–1.0 meter (1.6–3.3 feet) intervals at each site, to measure temperature, pH, dissolved oxygen, and salinity. Chlorophyll *a* levels were measured concurrently, and total and dissolved nutrient samples were collected from 0.5 meters (1.6 feet) below the surface. Chlorophyll *a* samples were processed using known volumes of water samples that were filtered onto glass-fiber filters then refrigerated and submitted for laboratory analysis. Water clarity was estimated at each site using a Secchi disk to estimate light extinction depths, which were converted to light attenuation coefficients and corrected for naturally occurring turbidity conditions (Smith et al. 2006). In this report, water clarity estimates are calculated using EPA methods (EPA 2016), and water clarity values from the 2013 coastal assessment may not be equivalent. Water clarity was not assessed at sites too shallow to ascertain an accurate Secchi depth measurement. When sites were too shallow to access by boat, alternate sites were used.

Water-Quality Assessment Criteria

The categorical assessments (e.g., good, fair, poor) use measurements of chlorophyll *a*, nutrients, bottom dissolved oxygen, and water clarity (Table 3) and are intended to characterize acutely degraded water-quality conditions. The assessments do not consistently identify sites that experience occasional or infrequent hypoxia, nutrient enrichment, or decreased water clarity. Therefore, a rating of poor for the water-quality index means that the site likely exhibited consistently poor conditions before or after the assessment period. If a site is designated fair or good, the site did not experience poor conditions on the date of sampling; however, the site could be characterized by poor conditions for short time periods.

Site assessments were also made using an index that combines the ratings for each parameter into a site-specific water-quality index rating. This index allows for general comparisons between sites in a park (Table 4) and can be used to summarize overall conditions in the waters around a park. This

rating also allows general comparisons between parks based on the percentage of sites that fall within the good, fair, or poor categories.

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) [$\mu\text{g/L}$ —micrograms per liter; mg/L —milligrams per liter].

Rating	Water Clarity (k) ^A	Chlorophyll a ($\mu\text{g/L}$)	Dissolved Inorganic Nitrogen (DIN; mg/L)	Dissolved Inorganic Phosphorus (DIP; mg/L)	Dissolved Oxygen (DO; mg/L)
Good	< 2.30	< 5	< 0.1	< 0.01	> 5
Fair	2.30–2.99	5–20	0.1–0.5	0.01–0.05	2–5
Poor	> 2.99	> 20	> 0.5	> 0.05	< 2

^A Light attenuation coefficients (k) were used to assess water-clarity conditions using criteria categories in Smith et al. (2006) which are comparable to the EPA (2012) criteria for the assessed water bodies.

Table 4. Condition criteria used for water-quality assessment summaries at individual sampling sites and parks.

Rating	Site Water-Quality Index Rating	Park Water-Quality Index Rating
Good	A maximum of one indicator is rated fair, and no indicators are rated poor.	Less than 10% of sites are in poor condition, and less than 50% of sites are in combined poor and fair condition.
Fair	One indicator is rated poor, or two or more indicators are rated fair	10% to 20% of sites are in poor condition, or more than 50% of sites are in combined poor and fair condition.
Poor	Two or more of the five indicators are rated poor	More than 20% of sites are in poor condition.
Missing	Two components of the indicator are missing and the available indicators do not suggest a fair or poor rating.	N/A

Sediment Data Collection

Sediment samples were collected by taking multiple grabs at each site using a 6.8 kilogram (kg; 24 pound [lbs]) Ponar Sampler with a sample area of 152×152 millimeter (mm; 6×6 inches [in]). The top 23 centimeters (cm; 0.78–1.2 in) from each sample were composited and split into three separate samples that were analyzed for organic contaminants, metals, total organic carbon (TOC), and grain size. Samples were stored on wet ice or in a refrigerator until completion of analysis by the contracted laboratory.

Sediment Assessment Criteria

The Southeast Coast Network uses Environmental Protection Agency (EPA) National Coastal Condition Assessment (NCCA) sediment quality guidelines (SQG) for estuarine waters to assess the degree of sediment contamination. These SQGs include the mean Effects-Range Median Quotient

(mERM-Q) and Logistic Regression Model (LRM). Together, the mERM-Q and LRM provide a holistic interpretation of sediment chemistry and its effects on benthic organisms.

The mERM-Q approach assesses the relative degree of sediment contamination and estimates the probability of toxicity to benthic organisms from sediment contaminants (EPA 2016). Calculation of mERM-Q relies upon the Effects Range Low (ERL) and Effects Range Median (ERM) values shown in Table 5. ERM is the median concentration of a contaminant observed to have adverse biological effects in the literature studies examined. While ERL is the 10th percentile concentration of a contaminant represented by studies demonstrating adverse biological effects in the literature. Ecological effects are not likely to occur at contaminate concentrations below the ERL criterion.

Table 5. Condition Thresholds for sediment chemistry used to determine ecological condition by site (U.S. EPA 2010) [mERM-Q— mean Effects-Range Median Quotient; LRM— Logistic Regression Model; Pmax—maximum probability].

Rank	Threshold
Good	mERM-Q < 0.1 and LRM Pmax ≤ 0.5
Fair	mERM-Q ≥ 0.1 - ≤ 0.5 or LRM Pmax > 0.5 – < 0.75 mERM-Q > 0.5 or LRM Pmax ≥ 0.75
Poor	mERM-Q < 0.1 and LRM Pmax ≤ 0.5

The LRM approach calculates the probability of observing a toxic effect based on individual contaminant concentrations and the maximum probability (Pmax) of observing toxicity from all contaminants in a sample (EPA 2016). Values used in the LRM-Pmax calculation (B₀ and B₁) can be found in Table 6.

Table 6. Sediment quality guideline values used to calculate mERM-Q and LRM-Pmax (EPA 2016).

Sediment Chemicals Analyzed	Units	ERL	ERM	Used to calculate mERM-Q ^A	B ₀	B ₁	Used to calculate LRM-Pmax
Antimony	µg/g	–	–	–	-0.9005	2.4110	X
Arsenic	µg/g	8.20	70.00	X	-4.1407	3.1674	X
Cadmium	µg/g	1.20	9.60	X	-0.3400	2.5073	X
Chromium	µg/g	81.00	370.00	X	-6.4395	2.9952	X
Copper	µg/g	34.00	270.00	X	-5.7878	2.9325	X
Lead	µg/g	46.70	218.00	X	-5.4523	2.7662	X
Mercury	µg/g	0.15	0.71	X	0.8041	2.5461	X
Nickel	µg/g	20.90	51.60	–	-4.6119	2.7658	X
Silver	µg/g	1.00	3.70	X	-0.1117	1.9684	X
Zinc	µg/g	150.00	410.00	X	-7.9834	3.3420	X
Acenaphthene	ng/g	16.00	500.00	X	-3.6165	1.7532	X
Acenaphthylene	ng/g	44.00	640.00	X	-2.9620	1.3797	X

^A An “X” denotes the parameters used in the calculation of the mean Effects Range Median quotient (ERM-Q).

Table 6 (continued). Sediment quality guideline values used to calculate mERM-Q and LRM-Pmax (EPA 2016).

Sediment Chemicals Analyzed	Units	ERL	ERM	Used to calculate mERM-Q ^A	B0	B1	Used to calculate LRM-Pmax
Anthracene	ng/g	85.30	1100.00	X	-3.6574	1.4854	X
Fluorene	ng/g	19.00	540.00	X	-3.7146	1.8071	X
2-methylnaphthalene	ng/g	70.00	670.00	X	-3.7579	1.7833	X
Napthalene	ng/g	160.00	2100.00	X	-3.7753	1.6152	X
Phenanthrene	ng/g	240.00	1500.00	X	-4.4576	1.6768	X
Benz(a)anthracene	ng/g	261.00	1600.00	X	-4.2013	1.5747	X
Benzo(a)pyrene	ng/g	430.00	1600.00	X	-4.3005	1.5832	X
Chrysene	ng/g	384.00	2800.00	X	-4.3241	1.5372	X
Dibenz(a,h)anthracene	ng/g	63.40	260.00	X	-3.6308	1.7692	X
Fluoranthene	ng/g	600.00	5100.00	X	-4.4574	1.4787	X
Pyrene	ng/g	665.00	2600.00	X	-4.7080	1.5854	X
Total DDT	ng/g	1.60	46.10	X	–	–	–
Total PCB congeners	ng/g	22.70	180.00	X	-3.4613	1.3488	X
Total PAHs*	ng/g	4020.00	44800.00	–	–	–	–

^A An "X" denotes the parameters used in the calculation of the mean Effects Range Median quotient (ERM-Q).

Previous coastal assessments conducted by the network and the EPA used % Total Organic Carbon (TOC) as a rating factor for sediment quality. However, in 2010, the EPA updated its methods to reflect current practices and %TOC is no longer a component of the sediment quality index. As a result, %TOC has been reported below for comparison with past reports, but was not used in determination of ecological condition by site.

Results

Parameter-Based Water Condition Assessments

Figures 3–7 illustrate the spatial distribution of sampling sites and the corresponding ratings for turbidity, chlorophyll *a*, dissolved inorganic nitrogen (DIN), dissolved inorganic phosphorus (DIP), and bottom-reading dissolved oxygen (DO) based on each parameter's corresponding condition category. Inset graphs on Figures 3–7 show the proportion of sites in the assessed area that were placed in each rating category. The map and graph in Figure 8 summarize seashore-wide water quality. Site-specific water-quality data for each parameter are also presented in Table 7.

Water clarity was rated good at all thirty sites.

Chlorophyll *a* concentration was rated good at eleven sites (37%) and fair at nineteen sites (63%) sampled in 2017.

Dissolved inorganic nitrogen concentration was good at fourteen sites (47%), and fair at the remaining eleven sites (53%).

Dissolved inorganic phosphorus concentration was fair at twenty-nine sites (97%) and poor at one site (3%).

Dissolved oxygen concentration was rated good at twenty-three sites (77%) and fair at seven (23%).

A water-quality condition summary index was calculated for each site sampled in Cumberland National Seashore based on the categorical assessments of chlorophyll *a*, DIN and DIP concentrations, and dissolved oxygen. This summary index indicated fair water-quality conditions at all thirty sites.

Based on the summary water-quality index rating for the seashore, overall water-quality conditions at Cumberland Island National Seashore in 2017 were fair.

For sediment, ecological condition was ranked as good at twenty-nine sites (97%) and fair at one site (3%). As a result, no adverse impacts to benthic organisms due to sediment contamination are anticipated at any of the thirty sample sites. These rankings were assigned according to the 2010 Environmental Protection Agency, National Coastal Condition Assessment (NCCA) thresholds for sediment chemistry.

Cumberland Island National Seashore
2017 Water Clarity (k)

Southeast Coast Network
National Park Service
U.S. Department of the Interior



Figure 3. Water clarity ratings at sampling sites at Cumberland Island National Seashore August 1–4, 2017. Inset graph shows the percent of sites in each condition category [Green—good].

Cumberland Island National Seashore 2017 Chlorophyll a

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Figure 4. Chlorophyll a concentrations at Cumberland Island National Seashore August 1–4, 2017. Inset graph shows the percent of sites in each condition category [Green—good; yellow—fair].

Cumberland Island National Seashore
2017 Dissolved Inorganic Nitrogen

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National Park Service
U.S. Department of the Interior



Figure 5. Dissolved inorganic nitrogen concentrations at sampling sites at Cumberland Island National Seashore August 1–4, 2017. Inset graph shows the percent of sites in each condition category [Green—good; yellow—fair].

Cumberland Island National Seashore
2017 Dissolved Inorganic Phosphorus

Southeast Coast Network
National Park Service
U.S. Department of the Interior



Figure 6. Dissolved inorganic phosphorus concentrations at sampling sites at Cumberland Island National Seashore August 1–4, 2017. Inset graph shows the percent of sites in each condition category [Yellow—fair; Red—poor].

Cumberland Island National Seashore 2017 Dissolved Oxygen

Southeast Coast Network
National Park Service
U.S. Department of the Interior



Figure 7. Dissolved oxygen concentrations at sampling sites at Cumberland Island National Seashore August 1–4, 2017. Inset graph shows the proportion of sites in each condition category [Green—good; yellow—fair].

Cumberland Island National Seashore 2017 Site Water Quality Rating

Southeast Coast Network
National Park Service
U.S. Department of the Interior



Figure 8. Water-quality index rating at sampling sites at Cumberland Island National Seashore August 1–4, 2017. Inset graph shows the proportion of sites in each condition category [Yellow—fair].

Cumberland Island National Seashore 2017 Ecological Condition

Southeast Coast Network
National Park Service
U.S. Department of the Interior



Figure 9. Spatial distribution of sampling sites and the corresponding ratings for ecological condition based on sediment chemistry. Inset graph shows the proportion of sites in each condition category [Green—good; yellow—fair].

Table 7. Water-quality parameter values and assessment conditions for sampling sites at Cumberland Island National Seashore in August 2017. Conditions of assessed parameters are from the EPA (2012). Dissolved oxygen concentrations are taken from the estuary bottom (deepest reading).

Map ID	Water Clarity (k) ^A	Chlorophyll a (µg/L) ^B	Dissolved Oxygen (DO, mg/L) ^B	Dissolved Inorganic Nitrogen (DIN, mg/L) ^B	Dissolved Inorganic Phosphorous (DIP, mg/L) ^B	Total Dissolved Nitrogen (mg/L) ^{B, C}	Total Dissolved Phosphorus (mg/L) ^{B, C}
01	1.33 ^D	5.1 ^E	5.6 ^D	0.1010 ^E	0.0295 ^E	0.36	0.0496
02	1.25 ^D	5.7 ^E	3.5 ^E	0.0953 ^D	0.0272 ^E	0.42	0.0531
03	1.67 ^D	5.2 ^E	5.1 ^D	0.1023 ^E	0.0316 ^E	0.33	0.0529
04	1.00 ^D	2.3 ^D	5.0 ^D	0.1290 ^E	0.0211 ^E	0.45	0.0404
05	2.00 ^D	4.3 ^D	5.3 ^D	0.1150 ^E	0.0262 ^E	0.39	0.0505
06	1.33 ^D	11.8 ^E	5.8 ^D	0.0858 ^D	0.3020 ^F	0.38	0.0525
07	2.00 ^D	2.8 ^D	4.9 ^E	0.1390 ^E	0.0197 ^E	0.46	0.0387
08	0.80 ^D	6.9 ^E	6.3 ^D	0.1050 ^E	0.0206 ^E	0.38	0.0416
09	1.33 ^D	8.7 ^E	5.8 ^D	0.0898 ^D	0.0205 ^E	0.37	0.0435
10	0.80 ^D	6.2 ^E	5.0 ^D	0.0819 ^D	0.0249 ^E	0.34	0.0474
11	1.25 ^D	3.5 ^D	5.0 ^D	0.1570 ^E	0.0166 ^E	0.45	0.0346
12	1.25 ^D	5.6 ^E	5.4 ^D	0.1230 ^E	0.0225 ^E	0.40	0.0506
13	1.33 ^D	5.2 ^E	5.0 ^D	0.0981 ^D	0.0280 ^E	0.33	0.0493
14	1.25 ^D	6.1 ^E	4.9 ^E	0.0954 ^D	0.0305 ^E	0.35	0.0544
15	1.25 ^D	6.7 ^E	5.1 ^D	0.1480 ^E	0.0202 ^E	0.50	0.0385
16	1.67 ^D	8.2 ^E	6.2 ^D	0.0951 ^D	0.0253 ^E	0.35	0.0423
17	1.00 ^D	6.3 ^E	5.6 ^D	0.0836 ^D	0.0273 ^E	0.30	0.0468

^A Light attenuation coefficients (k) were used to assess water-clarity conditions using criteria categories in Smith et al. (2006) which are comparable to the EPA (2012) criteria for the assessed water bodies.

^B Where µg/L = micrograms per liter, N = Nitrogen; mg/L = milligrams per liter; P = Phosphorous.

^C There are no EPA condition criteria for TDN and TDP.

^D Conditions are assessed as good using parameters from the EPA (2012) (also with a green background).

^E Conditions are assessed as fair using parameters from the EPA (2012) (also with a yellow background).

^F Conditions are assessed as poor using parameters from the EPA (2012) (also with a red background).

Table 7 (continued). Water-quality parameter values and assessment conditions for sampling sites at Cumberland Island National Seashore in August 2017. Conditions of assessed parameters are from the EPA (2012). Dissolved oxygen concentrations are taken from the estuary bottom (deepest reading).

Map ID	Water Clarity (k) ^A	Chlorophyll a (µg/L) ^B	Dissolved Oxygen (DO, mg/L) ^B	Dissolved Inorganic Nitrogen (DIN, mg/L) ^B	Dissolved Inorganic Phosphorous (DIP, mg/L) ^B	Total Dissolved Nitrogen (mg/L) ^{B, C}	Total Dissolved Phosphorus (mg/L) ^{B, C}
18	1.33 ^D	5.1 ^E	5.7 ^D	0.0803 ^D	0.0291 ^E	0.28	0.0510
19	1.33 ^D	4.9 ^D	5.1 ^D	0.1078 ^E	0.0285 ^E	0.34	0.0508
20	1.33 ^D	3.0 ^D	4.6 ^E	0.1470 ^E	0.0208 ^E	0.44	0.0381
21	1.33 ^D	4.9 ^D	5.3 ^D	0.1098 ^E	0.0278 ^E	0.38	0.0688
22	1.00 ^D	7.4 ^E	5.8 ^D	0.0780 ^D	0.0244 ^E	0.33	0.0490
23	1.67 ^D	2.5 ^D	4.2 ^E	0.1880 ^E	0.0176 ^E	0.52	0.0350
24	1.00 ^D	2.1 ^D	5.2 ^D	0.1282 ^E	0.0202 ^E	0.47	0.0456
25	1.25 ^D	8.4 ^E	6.0 ^D	0.0758 ^D	0.0183 ^E	0.35	0.0409
26	1.33 ^D	6.1 ^E	5.4 ^D	0.0907 ^D	0.0230 ^E	0.34	0.0480
27	1.67 ^D	3.4 ^D	4.8 ^E	0.1420 ^E	0.0185 ^E	0.61	0.0410
28	1.11 ^D	5.4 ^E	5.2 ^D	0.1118 ^E	0.0190 ^E	0.40	0.0422
29	1.25 ^D	4.0 ^D	4.9 ^E	0.0968 ^D	0.0242 ^E	0.33	0.0451
30	1.00 ^D	6.5 ^E	5.3 ^D	0.0935 ^D	0.0259 ^E	0.33	0.0470

^A Light attenuation coefficients (k) were used to assess water-clarity conditions using criteria categories in Smith et al. (2006) which are comparable to the EPA (2012) criteria for the assessed water bodies.

^B Where µg/L = micrograms per liter, N = Nitrogen; mg/L = milligrams per liter; P = Phosphorous.

^C There are no EPA condition criteria for TDN and TDP.

^D Conditions are assessed as good using parameters from the EPA (2012) (also with a green background).

^E Conditions are assessed as fair using parameters from the EPA (2012) (also with a yellow background).

^F Conditions are assessed as poor using parameters from the EPA (2012) (also with a red background).

Sediment Condition Assessments

Metal and organic contaminant concentration data is provided in Tables 8–11. Figure 9 is a map which show the spatial distribution of sampling sites and the corresponding ratings for ecological condition based on sediment chemistry. The inset graph shows the percentage of sites in each ecological condition-rating category (good, fair, poor). Data used to make the map and graph are shown in Table 10. Ecological condition based on sediment chemistry was rated good at 97% of sites and fair at 3%.

Table 8. Concentrations of select metals for sites sampled at Cumberland Island National Seashore, August 1–4, 2017. All results are presented in mg/kg

Site Name	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
CUIS-01	0.16 ^B	0.63	0.040 ^B	1.60	0.068 ^B	0.610	0.00160 ^A	0.48	1.30
CUIS-02	0.25 ^B	1.80	0.097 ^A	19.00	2.000	5.900	0.02000	6.90	13.00
CUIS-03	0.21 ^B	1.90	0.091 ^A	16.00	1.300	4.700	0.01800	5.80	9.80
CUIS-04	0.21 ^B	0.52	0.070 ^A	12.00	0.610	3.000	0.00630 ^A	3.90	5.70
CUIS-05	0.19 ^B	0.52	0.055 ^A	7.80	0.750	2.600	0.00860	2.60	5.40
CUIS-06	0.19 ^B	1.00	0.066 ^A	9.80	0.870	3.100	0.01300	3.50	6.50
CUIS-07	0.16 ^B	0.30 ^B	0.050 ^A	11.00	0.560	2.600	0.00700	3.50	4.70
CUIS-08	0.21 ^B	1.30	0.063 ^A	15.00	1.600	4.800	0.01400	5.10	11.00
CUIS-09	0.18 ^B	0.42	0.047 ^B	7.60	0.800	2.800	0.00840	2.60	6.00
CUIS-10	0.18 ^B	0.34 ^B	0.110 ^A	6.60	0.800	0.340	0.00880	2.40	5.20
CUIS-11	0.15 ^B	0.28 ^B	0.039 ^B	3.50	0.260	0.800	0.00310 ^A	0.89	2.30
CUIS-12	0.15 ^B	0.28 ^B	0.038 ^B	0.67	0.072 ^A	0.062 ^B	0.00081 ^B	0.10 ^A	0.44
CUIS-13	0.29 ^B	2.20	0.097 ^A	21.00	1.900	6.300	0.02000	7.50	13.00
CUIS-14	0.18 ^B	0.32 ^B	0.056 ^A	9.20	0.990	2.500	0.00560 ^A	3.10	6.00
CUIS-15	0.20 ^B	0.72	0.076 ^A	13.00	0.630	3.300	0.00480 ^A	4.60	6.40
CUIS-16	0.16 ^B	0.29 ^B	0.040 ^B	1.60	0.270	0.740	0.00230 ^A	0.33	1.20
CUIS-17	0.16 ^B	1.50	0.042 ^A	7.50	0.570	2.600	0.00370 ^A	2.80	6.40
CUIS-18	0.30 ^B	2.30	0.160 ^A	24.00	2.500	5.800	0.02800	8.80	16.00
CUIS-19	0.22 ^B	0.74	0.077 ^A	15.00	1.400	4.900	0.01700	5.30	10.00
CUIS-20	0.16 ^B	0.30 ^B	0.041 ^B	1.90	0.130	0.790	0.00160 ^A	0.42	1.10
CUIS-21	0.18 ^B	0.84	0.060 ^A	8.10	0.790	2.700	0.00970	2.80	5.60
CUIS-22	0.38 ^B	2.90	0.180 ^A	36.00	4.300	11.000	0.04400	14.00	28.00
CUIS-23	0.16 ^B	0.30 ^B	0.042 ^B	1.70	0.090 ^A	0.092 ^A	0.00130 ^A	0.51	0.86

^A Result was greater than or equal to the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL)

^B Result was less than the Method Detection Limit].

Table 8 (continued). Concentrations of select metals for sites sampled at Cumberland Island National Seashore, August 1–4, 2017. All results are presented in mg/kg

Site Name	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
CUIS-24	0.16 ^B	0.76	0.042 ^B	7.10	0.470	1.600	0.00460 ^A	2.40	3.70
CUIS-25	0.19 ^B	1.30	0.062 ^A	10.00	0.990	3.300	0.01100	3.50	8.40
CUIS-26	0.24 ^B	2.30	0.100 ^A	19.00	2.100	6.200	0.02000	7.00	13.00
CUIS-27	0.20 ^B	0.87	0.070 ^A	13.00	1.400	3.700	0.01100	4.70	8.40
CUIS-28	0.19 ^B	0.62	0.068 ^A	7.20	0.640	2.400	0.00780	2.50	5.20
CUIS-29	0.22 ^B	3.70	0.160 ^A	21.00	1.300	4.200	0.01600	7.40	11.00
CUIS-30	0.16 ^B	0.30 ^B	0.050 ^A	8.20	0.330	1.800	0.00590 ^A	2.20	4.10

^A Result was greater than or equal to the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL)

^B Result was less than the Method Detection Limit.

Table 9. Organic contaminant concentrations (Acenaphthene–Chrysene) for sites sampled at Cumberland Island National Seashore, August 1–14, 2017. All results are presented in mg/kg.

Site Name	Acenaph-thene	Acenaph-thylene	Anthracene	Fluorene	2-Methyl-naphthalene	Naphthalene	Phenan-threne	Benzo(A) Anthracene	Benzo(A) Pyrene	Chrysene
CUIS-01	0.015 ^B	0.020 ^B	0.021 ^B	0.017 ^B	0.016 ^B	0.012 ^B	0.016 ^B	0.017 ^B	0.034 ^B	0.020 ^B
CUIS-02	0.026 ^B	0.035 ^B	0.036 ^B	0.030 ^B	0.027 ^B	0.021 ^B	0.028 ^B	0.029 ^B	0.059 ^B	0.035 ^B
CUIS-03	0.022 ^B	0.029 ^B	0.030 ^B	0.025 ^B	0.023 ^B	0.017 ^B	0.023 ^B	0.024 ^B	0.049 ^B	0.029 ^B
CUIS-04	0.022 ^B	0.029 ^B	0.030 ^B	0.025 ^B	0.023 ^B	0.018 ^B	0.023 ^B	0.024 ^B	0.049 ^B	0.029 ^B
CUIS-05	0.019 ^B	0.025 ^B	0.026 ^B	0.021 ^B	0.020 ^B	0.015 ^B	0.020 ^B	0.021 ^B	0.042 ^B	0.025 ^B
CUIS-06	0.020 ^B	0.026 ^B	0.027 ^B	0.023 ^B	0.021 ^B	0.016 ^B	0.021 ^B	0.022 ^B	0.045 ^B	0.027 ^B
CUIS-07	0.016 ^B	0.022 ^B	0.023 ^B	0.019 ^B	0.017 ^B	0.013 ^B	0.017 ^B	0.018 ^B	0.037 ^B	0.022 ^B
CUIS-08	0.022 ^B	0.030 ^B	0.031 ^B	0.025 ^B	0.023 ^B	0.018 ^B	0.024 ^B	0.024 ^B	0.051 ^B	0.030 ^B
CUIS-09	0.019 ^B	0.025 ^B	0.026 ^B	0.021 ^B	0.020 ^B	0.015 ^B	0.020 ^B	0.021 ^B	0.043 ^B	0.025 ^B

^A Result was greater than or equal to the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL)

^B Result was less than the Method Detection Limit.

Table 9 (continued). Organic contaminant concentrations (Acenaphthene–Chrysene) for sites sampled at Cumberland Island National Seashore, August 1–14, 2017. All results are presented in mg/kg.

Site Name	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Benzo(A) Anthracene	Benzo(A) Pyrene	Chrysene
CUIS-10	0.017 ^B	0.023 ^B	0.023 ^B	0.019 ^B	0.018 ^B	0.014 ^B	0.018 ^B	0.019 ^B	0.039 ^B	0.023 ^B
CUIS-11	0.015 ^B	0.020 ^B	0.021 ^B	0.017 ^B	0.016 ^B	0.012 ^B	0.016 ^B	0.017 ^B	0.034 ^B	0.020 ^B
CUIS-12	0.015 ^B	0.020 ^B	0.021 ^B	0.017 ^B	0.016 ^B	0.012 ^B	0.016 ^B	0.017 ^B	0.035 ^B	0.021 ^B
CUIS-13	0.029 ^B	0.038 ^B	0.040 ^B	0.033 ^B	0.030 ^B	0.023 ^B	0.031 ^B	0.032 ^B	0.066 ^B	0.039 ^B
CUIS-14	0.017 ^B	0.023 ^B	0.024 ^B	0.020 ^B	0.018 ^B	0.014 ^B	0.018 ^B	0.019 ^B	0.039 ^B	0.023 ^B
CUIS-15	0.020 ^B	0.026 ^B	0.027 ^B	0.023 ^B	0.021 ^B	0.016 ^B	0.021 ^B	0.022 ^B	0.045 ^B	0.027 ^B
CUIS-16	0.017 ^B	0.022 ^B	0.023 ^B	0.019 ^B	0.017 ^B	0.014 ^B	0.018 ^B	0.018 ^B	0.038 ^B	0.023 ^B
CUIS-17	0.016 ^B	0.022 ^B	0.022 ^B	0.019 ^B	0.017 ^B	0.013 ^B	0.017 ^B	0.018 ^B	0.037 ^B	0.022 ^B
CUIS-18	0.031 ^B	0.041 ^B	0.042 ^B	0.035 ^B	0.032 ^B	0.025 ^B	0.033 ^B	0.034 ^B	0.069 ^B	0.041 ^B
CUIS-19	0.023 ^B	0.030 ^B	0.031 ^B	0.026 ^B	0.024 ^B	0.018 ^B	0.024 ^B	0.025 ^B	0.051 ^B	0.030 ^B
CUIS-20	0.017 ^B	0.023 ^B	0.023 ^B	0.019 ^B	0.018 ^B	0.014 ^B	0.018 ^B	0.019 ^B	0.039 ^B	0.023 ^B
CUIS-21	0.019 ^B	0.025 ^B	0.026 ^B	0.021 ^B	0.019 ^B	0.015 ^B	0.020 ^B	0.020 ^B	0.042 ^B	0.025 ^B
CUIS-22	0.037 ^B	0.048 ^B	0.050 ^B	0.042 ^B	0.038 ^B	0.030 ^B	0.039 ^B	0.040 ^B	0.083 ^B	0.050 ^B
CUIS-23	0.016 ^B	0.021 ^B	0.022 ^B	0.018 ^B	0.017 ^B	0.013 ^B	0.017 ^B	0.018 ^B	0.036 ^B	0.022 ^B
CUIS-24	0.017 ^B	0.023 ^B	0.023 ^B	0.019 ^B	0.018 ^B	0.014 ^B	0.018 ^B	0.019 ^B	0.039 ^B	0.023 ^B
CUIS-25	0.020 ^B	0.027 ^B	0.028 ^B	0.023 ^B	0.021 ^B	0.016 ^B	0.021 ^B	0.022 ^B	0.046 ^B	0.027 ^B
CUIS-26	0.025 ^B	0.033 ^B	0.034 ^B	0.028 ^B	0.026 ^B	0.020 ^B	0.027 ^B	0.027 ^B	0.057 ^B	0.034 ^B
CUIS-27	0.020 ^B	0.027 ^B	0.028 ^B	0.023 ^B	0.021 ^B	0.016 ^B	0.022 ^B	0.022 ^B	0.046 ^B	0.027 ^B
CUIS-28	0.019 ^B	0.026 ^B	0.027 ^B	0.022 ^B	0.020 ^B	0.016 ^B	0.021 ^B	0.021 ^B	0.044 ^B	0.026 ^B
CUIS-29	0.022 ^B	0.030 ^B	0.031 ^B	0.026 ^B	0.023 ^B	0.018 ^B	0.024 ^B	0.025 ^B	0.051 ^B	0.030 ^B
CUIS-30	0.016 ^B	0.021 ^B	0.022 ^B	0.018 ^B	0.017 ^B	0.013 ^B	0.017 ^B	0.017 ^B	0.036 ^B	0.022 ^B

^A Result was greater than or equal to the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL)

^B Result was less than the Method Detection Limit.

Table 10. Organic contaminant concentrations (Dibenz(A,H)Anthracene – Total PCBs) for sites sampled at Cumberland Island National Seashore, August 1–4, 2017. All results are presented in mg/kg.

Site Name	Dibenz(A,H) Anthracene	Fluoranthene	Pyrene	Low Molecular Weight PAH	High Molecular Weight PAH	Total PAHs	P,P-DDE	P,P-DDT	Total PCBs
CUIS-01	0.019 ^B	0.026 ^B	0.014 ^B	0.12	0.13	0.3687350	0.00052 ^B	0.0012 ^B	0.0077 ^B
CUIS-02	0.032 ^B	0.045 ^B	0.024 ^B	0.20	0.22	0.6390875	0.00084 ^B	0.0370 ^B	0.0120 ^B
CUIS-03	0.027 ^B	0.037 ^B	0.020 ^B	0.17	0.19	0.5306445	0.00070 ^B	0.0310 ^B	0.0100 ^B
CUIS-04	0.027 ^B	0.037 ^B	0.020 ^B	0.17	0.19	0.5316445	0.00071 ^B	0.0310 ^B	0.0110 ^B
CUIS-05	0.023 ^B	0.032 ^B	0.017 ^B	0.15	0.16	0.4565175	0.00062 ^B	0.0014 ^B	0.0092 ^B
CUIS-06	0.025 ^B	0.034 ^B	0.019 ^B	0.15	0.17	0.4882785	0.00065 ^B	0.0290 ^B	0.0097 ^B
CUIS-07	0.020 ^B	0.028 ^B	0.015 ^B	0.13	0.14	0.4000010	0.00055 ^B	0.0240 ^B	0.0081 ^B
CUIS-08	0.028 ^B	0.038 ^B	0.021 ^B	0.17	0.19	0.5472500	0.00069 ^B	0.0015 ^B	0.0100 ^B
CUIS-09	0.023 ^B	0.032 ^B	0.017 ^B	0.15	0.16	0.4580175	0.00061 ^B	0.0014 ^B	0.0091 ^B
CUIS-10	0.021 ^B	0.029 ^B	0.016 ^B	0.13	0.15	0.4166515	0.00062 ^B	0.0270 ^B	0.0092 ^B
CUIS-11	0.019 ^B	0.026 ^B	0.014 ^B	0.12	0.13	0.3687350	0.00051 ^B	0.0230 ^B	0.0075 ^B
CUIS-12	0.019 ^B	0.026 ^B	0.014 ^B	0.12	0.13	0.3732905	0.00049 ^B	0.0011 ^B	0.0073 ^B
CUIS-13	0.036 ^B	0.050 ^B	0.027 ^B	0.22	0.25	0.7102145	0.00100 ^B	0.0440 ^B	0.0150 ^B
CUIS-14	0.021 ^B	0.030 ^B	0.016 ^B	0.13	0.15	0.4216565	0.00057 ^B	0.0013 ^B	0.0085 ^B
CUIS-15	0.024 ^B	0.034 ^B	0.018 ^B	0.15	0.17	0.4837285	0.00066 ^B	0.0290 ^B	0.0098 ^B
CUIS-16	0.021 ^B	0.029 ^B	0.016 ^B	0.13	0.15	0.4110515	0.00052 ^B	0.0011 ^B	0.0077 ^B
CUIS-17	0.020 ^B	0.028 ^B	0.015 ^B	0.13	0.14	0.3979960	0.00054 ^B	0.0240 ^B	0.0080 ^B
CUIS-18	0.038 ^B	0.052 ^B	0.028 ^B	0.24	0.26	0.7480255	0.00097 ^B	0.0022 ^B	0.0140 ^B
CUIS-19	0.028 ^B	0.038 ^B	0.021 ^B	0.18	0.19	0.5513050	0.00074 ^B	0.0330 ^B	0.0110 ^B
CUIS-20	0.021 ^B	0.029 ^B	0.016 ^B	0.13	0.15	0.4176565	0.00052 ^B	0.0230 ^B	0.0077 ^B
CUIS-21	0.023 ^B	0.032 ^B	0.017 ^B	0.15	0.16	0.4554675	0.00062 ^B	0.0014 ^B	0.0091 ^B
CUIS-22	0.045 ^B	0.063 ^B	0.034 ^B	0.28	0.32	0.894780	0.00130 ^B	0.0570 ^B	0.0190 ^B

^A Result was greater than or equal to the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL)

^B Result was less than the Method Detection Limit.

Table 10 (continued). Organic contaminant concentrations (Dibenz(A,H)Anthracene – Total PCBs) for sites sampled at Cumberland Island National Seashore, August 1–4, 2017. All results are presented in mg/kg.

Site Name	Dibenz(A,H) Anthracene	Fluoranthene	Pyrene	Low Molecular Weight PAH	High Molecular Weight PAH	Total PAHs	P,P-DDE	P,P-DDT	Total PCBs
CUIS-23	0.020 ^B	0.027 ^B	0.015 ^B	0.12	0.14	0.3914460	0.00054 ^B	0.0240 ^B	0.0080 ^B
CUIS-24	0.021 ^B	0.029 ^B	0.016 ^B	0.13	0.15	0.4176565	0.00053 ^B	0.0240 ^B	0.0079 ^B
CUIS-25	0.025 ^B	0.034 ^B	0.019 ^B	0.16	0.17	0.4927835	0.00063 ^B	0.0014 ^B	0.0093 ^B
CUIS-26	0.031 ^B	0.043 ^B	0.023 ^B	0.19	0.22	0.6123270	0.00080 ^B	0.0350 ^B	0.0120 ^B
CUIS-27	0.025 ^B	0.035 ^B	0.019 ^B	0.16	0.17	0.4947835	0.00067 ^B	0.0290 ^B	0.0099 ^B
CUIS-28	0.024 ^B	0.033 ^B	0.018 ^B	0.15	0.17	0.4741230	0.00062 ^B	0.0014 ^B	0.0092 ^B
CUIS-29	0.028 ^B	0.038 ^B	0.021 ^B	0.17	0.19	0.5483000	0.00072 ^B	0.0320 ^B	0.0110 ^B
CUIS-30	0.020 ^B	0.027 ^B	0.015 ^B	0.12	0.14	0.3903460	0.00055 ^B	0.0240 ^B	0.0081 ^B

^A Result was greater than or equal to the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL)

^B Result was less than the Method Detection Limit.

Table 11. Ecological condition for sites sampled at Cumberland Island National Seashore, August 1–4, 2017. Ecological condition was determined using the thresholds for sediment chemistry in U.S. EPA NCCA 2010. Total Organic Carbon % is presented for comparison with previous coastal assessments

Site Name	Ecological Condition by Site	Total Organic Carbon %
CUIS-01	Good ^A	0.120
CUIS-02	Good ^A	1.200
CUIS-03	Good ^A	0.580
CUIS-04	Good ^A	0.850
CUIS-05	Good ^A	0.410
CUIS-06	Good ^A	0.210
CUIS-07	Good ^A	1.300
CUIS-08	Good ^A	0.630
CUIS-09	Good ^A	0.470
CUIS-10	Good ^A	0.420
CUIS-11	Good ^A	0.140
CUIS-12	Good ^A	0.094
CUIS-13	Good ^A	0.740
CUIS-14	Good ^A	1.000
CUIS-15	Good ^A	0.140
CUIS-16	Good ^A	0.120
CUIS-17	Good ^A	0.400
CUIS-18	Good ^A	1.200
CUIS-19	Good ^A	0.610
CUIS-20	Good ^A	0.065
CUIS-21	Good ^A	0.450
CUIS-22	Fair ^B	1.300
CUIS-23	Good ^A	0.071
CUIS-24	Good ^A	0.086
CUIS-25	Good ^A	0.500
CUIS-26	Good ^A	0.790
CUIS-27	Good ^A	0.670
CUIS-28	Good ^A	0.410
CUIS-29	Good ^A	0.770
CUIS-30	Good ^A	0.510

^A Conditions are assessed as good using parameters from the EPA (2012) (also with a green background).

^B Conditions are assessed as fair using parameters from the EPA (2012) (also with a yellow background).

^C Conditions are assessed as poor using parameters from the EPA (2012) (also with a red background).

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