

National Park Service
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Natural Resource Program Center

Estuarine Water Quality in Parks of the Northeast Coastal and Barrier Network

*Development and Early Implementation of Vital Signs
Estuarine Nutrient-Enrichment Monitoring, 2003–06*

Natural Resource Technical Report NPS/NCBN/NRTR—2009/266



ON THE COVER

Top left: Little Pleasant Bay, Cape Cod National Seashore; photograph by Hilary Neckles.

Top right: Jamaica Bay, Gateway National Recreation Area; photograph by Blaine Kopp.

Bottom right: Back Creek, Colonial National Historic Park; courtesy of Colonial National Historic Park.

Bottom left: Great South Bay, Fire Island National Seashore; photograph by Blaine Kopp.

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Conversion Factors

SI to Inch/Pound

Multiply	By	To obtain
Length		
centimeter (cm)	0.3937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
kilometer (km)	0.5400	mile, nautical (nmi)
Area		
hectare (ha)	2.471	acre
square kilometer (km ²)	247.1	acre
Volume		
liter (L)	33.82	ounce, fluid (fl. oz)
liter (L)	0.2642	gallon (gal)
Mass		
gram (g)	0.03527	ounce, avoirdupois (oz)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:
 $^{\circ}\text{F} = (1.8 \times ^{\circ}\text{C}) + 32$

Horizontal coordinate information is referenced to the “North American Datum of 1983 (NAD 83).

Units

Specific conductance is given in millisiemens per centimeter at 25 degrees Celsius (mS/cm at 25 °C).

Concentrations of dissolved oxygen in water are given in milligrams per liter (mg/L) and as a percentage of the saturation concentration (% saturation).

Concentrations of phytoplankton chlorophyll *a* are given in micrograms per liter (µg/L).

Turbidity is reported in nephelometric turbidity units (NTU).

Photosynthetically available radiation (PAR) is measured in micromoles of photons per square meter per second (µmol photons/m²/s) and as the instantaneous ratio of underwater PAR to in-air PAR. Attenuation through the water column (K_d) is given as the log₁₀ attenuation coefficient per meter of water depth (m⁻¹).

Salinity is reported in practical salinity units (PSU).

Acronyms

ASIS	Assateague Island National Seashore
CACO	Cape Cod National Seashore
COLO.....	Colonial National Historical Park
ENE.....	Estuarine Nutrient Enrichment
FIIS	Fire Island National Seashore
GATE.....	Gateway National Recreation Area
GEWA.....	George Washington Birthplace National Monument
GIS	Geographic Information System
NCBN	NPS Northeast Coastal and Barrier Network
NER.....	NPS Northeast Region
NOAA	National Oceanic and Atmospheric Association
NPS	National Park Service
NTU	Nephelometric turbidity units
PAR.....	Photosynthetically available radiation
RTS.....	Random tessellation stratified
SAHI	Sagamore Hill National Historic Site
SAV.....	Submerged aquatic vegetation
THST.....	Thomas Stone National Historic Site
USEPA.....	United States Environmental Protection Agency

Abstract

This report documents results of pilot tests of a protocol for monitoring estuarine nutrient enrichment for the Vital Signs Monitoring Program of the National Park Service Northeast Coastal and Barrier Network. Data collected from four parks during protocol development in 2003-06 are presented: Gateway National Recreation Area, Colonial National Historic Park, Fire Island National Seashore, and Assateague Island National Seashore. The monitoring approach incorporates several spatial and temporal designs to address questions at a hierarchy of scales. Indicators of estuarine response to nutrient enrichment were sampled using a probability design within park estuaries during a late-summer index period. Monitoring variables consisted of dissolved-oxygen concentration, chlorophyll a concentration, water temperature, salinity, attenuation of downwelling photosynthetically available radiation (PAR), and turbidity. The statistical sampling design allowed the condition of unsampled locations to be inferred from the distribution of data from a set of randomly positioned “probability” stations. A subset of sampling stations was sampled repeatedly during the index period, and stations were not re-randomized in subsequent years. These “trend stations” allowed us to examine temporal variability within the index period, and to improve the sensitivity of the monitoring protocol to detecting change through time. Additionally, one index site in each park was equipped for continuous monitoring throughout the index period. Thus, the protocol includes elements of probabilistic and targeted spatial sampling, and the temporal intensity ranges from snapshot assessments to continuous monitoring.

Acknowledgments

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Introduction

This report summarizes water-quality data collected during development of an estuarine monitoring protocol for National Parks of the northeastern United States. The National Park Service (NPS) Vital Signs Monitoring Program is charged with determining the status and trends of selected indicators of ecosystem condition within biogeographic networks of parks. The NPS Northeast Coastal and Barrier Network (NCBN) includes eight coastal parks from Massachusetts to Virginia (Table 1, Figure 1) that protect extensive estuarine, bay, and lagoon habitats. In 2003, a pilot version of a protocol for monitoring nutrient enrichment within NCBN estuaries was tested at three parks, and revised protocols were tested again in 2005 and 2006 at various parks (Table 1). This report includes results of water-quality monitoring conducted at four parks during protocol development and testing in 2003-06. Subsequent monitoring followed the finalized Protocol for Monitoring Estuarine Nutrient Enrichment (ENE; Kopp and Neckles 2009) and those results are not reported here.

Table 1. Code, name, and location of the parks of the NPS Northeast Coastal and Barrier Network, and years in which pilot versions of the Estuarine Nutrient Enrichment (ENE) monitoring protocol were tested.

Park code	Park name	Location	Years of pilot testing
ASIS	Assateague Island National Seashore	Maryland and Virginia	2005
CACO	Cape Cod National Seashore	Massachusetts	
COLO	Colonial National Historic Park	Virginia	2003
FIIS	Fire Island National Seashore	New York	2003
GATE	Gateway National Recreation Area	New York and New Jersey	2003, 2005, 2006
GEWA	George Washington Birthplace National Monument	Virginia	
SAHI	Sagamore Hill National Historic Site	New York	
THST	Thomas Stone National Historic Site	Virginia	

Vital Signs Monitoring

The Organic Act of 1916 established the National Park Service and mandated that it manage park resources “unimpaired for the enjoyment of future generations.” More recently, the National Parks Omnibus Management Act of 1998 established the framework for fully integrating natural resource monitoring and other science activities into NPS management processes. The following year, NPS released an action plan, The Natural Resource Challenge, addressing the major challenges facing NPS in preserving natural resources and outlining strategic approaches to resolving them. These were the origins of the present NPS Vital Signs Monitoring Program.

The Vital Signs Monitoring Program organized 270 parks into 32 biogeographic networks that share funding and a core professional staff. Each network links parks that share similar geographic and natural resource characteristics to improve efficiency and reduce costs while still using customized and relevant monitoring approaches. The five goals for all networks are as follows:

- Determine the status of and trends in selected indicators of the condition of park ecosystems to allow managers to make better informed decisions and to work more effectively with other agencies and individuals for the benefit of park resources.
- Provide early warning of abnormal conditions of selected resources to help develop effective mitigation measures and reduce costs of management.
- Provide data to better understand the dynamic nature and condition of park ecosystems and to provide reference points for comparisons with other, altered environments.
- Provide data to meet certain legal and Congressional mandates related to natural resource protection and visitor enjoyment.
- Provide a means of measuring progress towards performance goals.

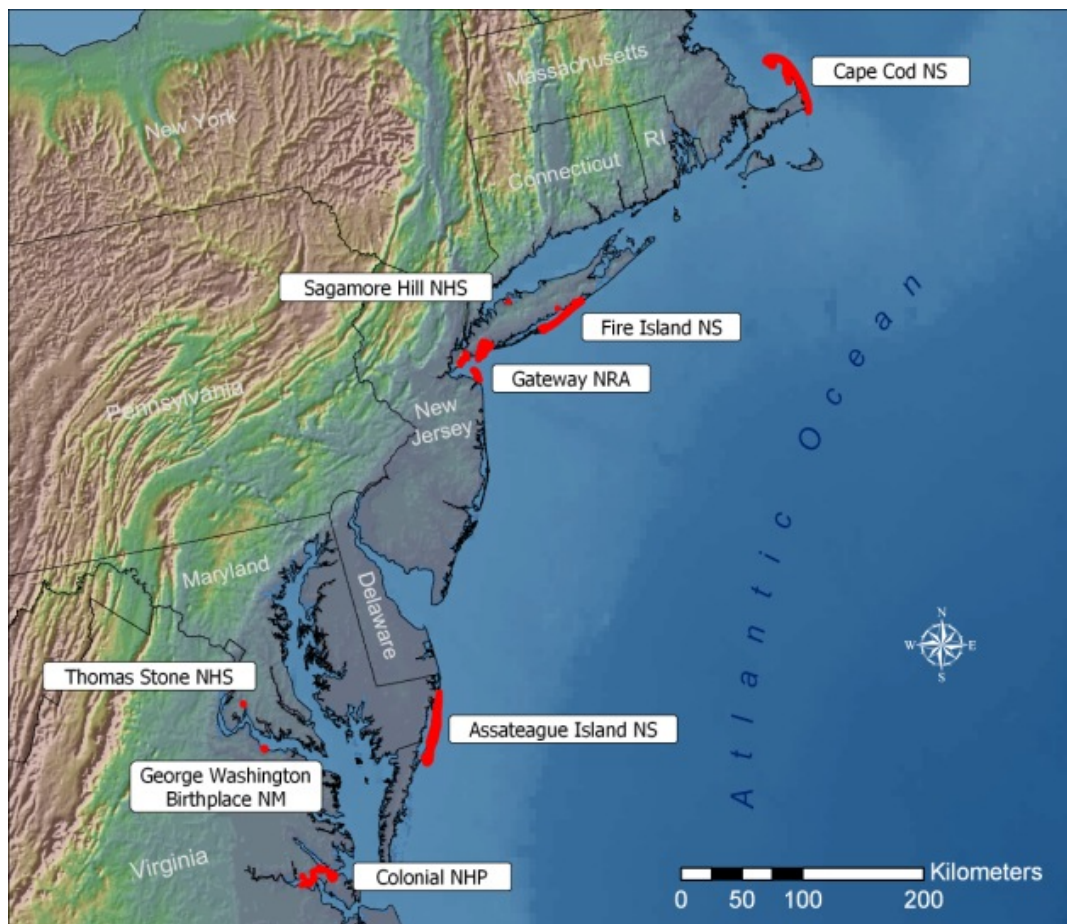


Figure 1. Map of National Parks in the Northeast Coastal and Barrier Network. Data in this report were collected during pilot tests of monitoring protocols at Fire Island National Seashore, Gateway National Recreation Area, Assateague Island National Seashore, and Colonial National Historic Park.

Goals of NCBN Estuarine Monitoring

The NCBN coastal parks are dependent on high-quality aquatic resources to sustain the complex estuarine and nearshore ecosystems they represent. Collectively, parks in the NCBN represent a wide range of sizes (33 ha to almost 20,000 ha), latitudes (37°11.3'N. to 42°05.3'N., or more than 540 km of latitude), watershed geology (shallow soils overlying granite bedrock to thick sandy glacial deposits), tidal range (microtidal to more than 3 m), and freshwater sources (surface water versus ground water) (Roman et al. 2000). Estuaries within these parks share fundamental characteristics, however, including temperate zone flora and fauna and the threat of nutrient enrichment as a primary management concern (Roman et al. 2000). Their broad similarities are the basis for development of a uniform estuarine Vital Signs monitoring protocol. Park Vital Signs are selected physical, chemical, and biological elements and processes of park ecosystems that represent the overall health or condition of the park, known or hypothesized effects of stressors, or elements that have important human values. For the NCBN, estuarine Vital Signs relate to the stressor with the greatest potential impact: nutrient enrichment (Kopp and Neckles 2009).

The specific goals of estuarine monitoring in coastal parks of the NCBN are (1) to determine whether nutrient loads to park estuaries are increasing over time, and (2) to assess how estuarine natural resources are affected by changing nutrient inputs. Two distinct monitoring protocols have been developed to achieve these monitoring goals, and the utility of the protocols and interpretability of the monitoring data from each are tightly linked. Goal 1 is addressed by an Estuarine Nitrogen Loading monitoring protocol that prescribes direct monitoring and modeling of nutrient loading to the estuaries (Stevens et al. 2005). Goal 2 is addressed by the ENE monitoring protocol, which tracks indicators of estuarine response to nutrient enrichment (Kopp and Neckles 2009). The data presented in this report result from water-column metrics of the ENE protocol.

The ENE protocol includes monitoring variables associated with six Vital Signs: water chemistry, water quality, water clarity, sediment organic carbon, seagrass distribution, and seagrass condition. An objective process was used to select and prioritize variables for monitoring, and the final suite has been scientifically justified (Kopp and Neckles 2009). Monitoring data for the following measures related to water-column Vital Signs are reported here: dissolved-oxygen concentration, chlorophyll *a* concentration, water temperature, salinity, attenuation of downwelling photosynthetically available radiation (PAR), and turbidity.

Conceptual Monitoring Approach

The ENE monitoring protocol incorporates several spatial and temporal designs to address questions at a hierarchy of scales. Characteristics that address the Vital Signs of water quality, water clarity, water chemistry, and sediment organic carbon are all sampled using a probability design within park estuaries during a late-summer index period. This statistical approach allows the condition of unsampled locations to be inferred from the distribution of data from a set of randomly positioned “probability” stations. A subset of sampling stations is sampled repeatedly during the index period, and is not re-randomized in subsequent years. These “trend stations”

allow us to examine temporal variability within the index period, and to improve the sensitivity of the monitoring protocol to detecting change through time. Additionally, one index site within each park is equipped for continuous monitoring throughout the index period. Thus, the protocol includes elements of probabilistic and targeted spatial sampling, and the temporal intensity ranges from snapshot assessments to continuous monitoring. This mixture of sampling approaches and intensities was adopted to allow for overall condition assessment while enhancing the ability to detect change in response to nutrient enrichment. The result is a geographically broad program that tracks condition in almost 500 km² of estuarine habitat. It is statistically rigorous and is designed to integrate with marine monitoring programs of the USEPA and NOAA.

Study Areas and Target Sampling Populations

The ENE protocol is implemented in all NCBN parks with estuarine resources. The four largest parks within the NCBN contain extensive estuarine habitat (Assateague Island National Seashore, Maryland/Virginia; Cape Cod National Seashore, Massachusetts; Gateway National Recreation Area, New York/New Jersey; Fire Island National Seashore, New York). Colonial National Historic Park, Virginia, is a park with a moderate amount of estuarine shoreline, and two small parks (Sagamore Hill National Historic Site, New York; George Washington Birthplace National Monument, Virginia) also include short stretches of estuarine shoreline. The eighth of the network parks, Thomas Stone National Historic Site, neither contains nor directly abuts any estuarine resources.

Probability surveys use a cost-effective, statistically based, and scientifically defensible method to determine the overall condition of estuarine waters within and among the NCBN parks and to provide estimates of uncertainty surrounding the estimates of condition. Key to the probability survey design is the site-selection process. This process requires a delineation of the estuarine area of interest within each park and a method for site selection that includes randomization. The probability sampling approach adopted for the ENE protocol includes spatial balance, and, for some parks, a stratification of effort among different estuarine components.

The ENE protocol adopts Pritchard's (1967) widely accepted definition of an estuary as a basis for identifying the target sampling populations:

“An estuary is a semi-enclosed coastal body of water which has a free connection with the open sea and within which seawater is measurably diluted with fresh water derived from land drainage.”

In no instance is an estuary wholly contained within the boundary of an NCBN park. Estuaries fall either partially within a park (sometimes predominantly within), or outside but abutting a park. NPS resource and program managers agreed that park boundaries alone were not an adequate tool for delineating target populations as resource management objectives could not be achieved by universally ignoring estuarine resources outside park boundaries. In some cases, doing so would artificially divide an estuary, and in all cases it risked ignoring resources with significant importance to, or influence upon, the parks. On the other hand, monitoring the entirety of an estuary simply because it abuts a network park may, in some instances, severely dilute the monitoring effort while not providing information most important to the monitoring objectives. To assist in selecting target populations as consistently and objectively as possible, the following selection rules were applied:

- (1) include all estuarine water falling within a park boundary;
- (2) expand the area to include non-NPS estuarine waters--both the remainder of those partially contained within park boundaries and those abutting parks when the adjacent resources are integrally connected to park estuarine waters and (or) significantly influence other natural or cultural resources of the parks;

- (3) retreat from the spatial domain identified in 1 and 2 above if necessary due to logistical constraints, feasibility, or excessive dilution of effort (particularly when considering non-NPS estuarine waters).

The application of these three selection rules is described in detail for all parks of the NCBN in the ENE protocol (Kopp and Neckles 2009). Sampling designs for several parks required revisions after their first pilot test. Descriptions and maps are provided in the following sections for all pilot data-collection efforts.

Methods

Spatial Sampling Designs

The probability survey design adopted for NER coastal park estuaries uses a grid of tessellated hexagons as the basis for sample site selection. This design was developed by the USEPA Environmental Monitoring and Assessment Program in the early 1990s, and first applied to estuaries in the Louisianan (Summers et al. 1993) and Virginian (Strobel et al. 1995) provinces. It was subsequently adopted by the USEPA National Coastal Assessment (USEPA 2001a). The hexagonal sampling grid results in a set of samples that is balanced spatially over the entire estuary of interest, but specific sampling locations are selected randomly within each hexagon. This approach combines the benefits of a systematic design with the statistical advantages of random sampling. Because this sampling protocol is consistent with that used by the USEPA National Coastal Assessment Program during the same period, the condition of NER estuaries can be evaluated within the context of other estuaries in the region, and data from NER estuaries can also contribute toward overall regional condition assessments.

During pilot implementation of the ENE sampling protocol reported here, each park's estuary was treated as a continuous resource. The spatial domain was overlaid with a grid of tessellated hexagons, and one random site was selected for monitoring within each hexagon; each point in the estuary has a known probability of being sampled. This approach is known as a random tessellation stratified (RTS) design, and was developed to permit control of the spatial dispersion of the samples with explicit recognition of the continuous nature of ecological resources (Stevens 1997, Stevens and Olsen 2003). For each assessment, these "probability" stations are each sampled once during a 4-week summer index period.

Both pilot testing and peer review of the ENE monitoring protocol necessitated revisions to some of the spatial sampling designs. Revisions are noted in the individual park sections below, and were made to address one of two problems: (1) the spatial target populations of the original design were determined to be inappropriate—either too inclusive or too exclusive—when evaluated against the objective selection criteria; or (2) the grid of tessellated hexagons used to distribute the probability stations resulted in hexagons without any (or any accessible) estuarine resource.

Trend Stations

Designs that are optimal for status estimation are generally not optimal for trend estimation (Urquhart et al. 1998). Monitoring for trends is best accomplished by revisiting one set of sites through time, whereas monitoring for status is best accomplished by obtaining the greatest overall number of random (never-revisit) sites. For the water-column measures reported here, 20 percent of the hexagons in each park were selected as "trend" stations. For parks without existing individual monitoring programs, trend stations were positioned randomly within these identified hexagons, and were resampled each week of the index period and for every subsequent year of monitoring. To the extent possible, hexagons identified for trend stations were distributed systematically throughout the spatial domain. At two NCBN parks with existing monitoring programs (GATE and ASIS) existing permanent monitoring stations could be used as Vital Signs trend stations, thereby anchoring the ENE protocol to long-standing data sources and avoiding

unnecessary redundancy. Several conditions must be met in order for these substitutions to be allowed. First, the sampling location must have been selected to be “representative” of the area from which it was selected, and must be considered representative of the hexagon within which it falls. Therefore, its location should not have been selected to target a specific area of concern (such as a waste- or stormwater discharge pipe or particular basin) unless that concern is representative of the entire hexagon. Also, trend stations must be distributed around the estuarine spatial domain. If park-based monitoring stations are clustered within one portion of the estuary, then additional trend stations must be established in other areas. At both GATE and ASIS, more than 20 percent of the hexagons already contained suitable trend-monitoring stations. In the final revision of the ENE protocol (Kopp and Neckles 2009), the number of park stations used as NCBN trend stations was capped at 20 percent of the hexagons; however, this cap was not adopted until several years into pilot testing, so the proportion of trend stations was larger in earlier years (Table 2).

The RTS sampling designs at ASIS and GATE were revised following the first year of pilot testing. Because of these revisions, the identifiers (hexagon numbers) of several of the permanent trend stations differ between the original and final designs (Table 2).

Continuous Monitoring Stations

Continuous monitoring stations are located in areas expected to represent typical conditions for the estuarine environment at each park, or that at least avoid obvious sources of bias to water quality. Continuous data are used to identify temporal variability in estuarine Vital Signs that is not captured by weekly trend monitoring. Although continuous stations do not contribute statistically to assessments of average estuarine condition, these high-resolution trend stations provide information that assists in interpreting spatial data.

Table 2. Assignment of existing park monitoring stations to NCBN estuarine monitoring hexagons. Changes in the hexagon grids following the first year of monitoring (2003 for GATE, 2005 for ASIS) resulted in the same sampling station being assigned to different hexagons in subsequent years. The finalized version of the protocol (Kopp and Neckles 2009) also capped the total number of trend stations to six per park. Stations dropped from the final protocol are identified with an asterisk (*).

Park Monitoring Program Station ID	NCBN Hexagon Assignments		
	2003	2005	2006 onward
Gateway National Recreation Area			
JB 03	3	1	1
JB 05A	5	5	5
JB 15	11	11	11
JB 07A	16	16	16
* JB 06	21	15	15
* JB 06B	28	23	23
JB 09A	29	29	29
JB 09C	24	24	24
* JB 09P	24	24	24
* JB 09E	24	18	18
Assateague Island National Seashore			
ASSA 2	-	27	27
* ASSA 3	-	27	26
ASSA 5	-	20	19
ASSA 6	-	19	18
* ASSA 8	-	10	9
* ASSA 9	-	11	10
* ASSA 11	-	6	5
ASSA 12	-	7	6
ASSA 14	-	15	14
* ASSA 15	-	13	15
* ASSA 16	-	24	26
ASSA 17	-	30	30
* ASSA 18	-	29	28

NCBN Pilot Test Parks

Fire Island National Seashore

FIIS is a 7,810-ha park on the south shore of Long Island, New York. Approximately 46 percent of this area is submerged estuarine land (Figure 2). Although FIIS owns only a minority portion of the submerged land in these bays, the area in park ownership is, nonetheless, extensive. According to the selection rules adopted for identifying ENE target populations, all of the estuarine area within the FIIS boundary is included in the monitoring design. The spatial design

for FIIS includes approximately 4,532 ha of estuarine area, which is 100 percent of the NPS estuarine resources at this park. Pilot testing of the ENE protocol at FIIS was conducted in 2003. No park water-quality monitoring program existed prior to that time, so trend stations and probability stations were selected by following the standard approach.

Gateway National Recreation Area

GATE consists of 10,783 ha of coastal uplands, freshwater ponds, marshes, bays, beaches, and mudflats. It is divided into three geographically separate units: Jamaica Bay, Staten Island, and Sandy Hook. Estuarine resources identified for ENE monitoring at GATE are fully contained within Jamaica Bay. Pilot testing at GATE was conducted in 2003, 2005, and 2006; the sampling design was revised following the 2003 and 2005 implementations. In all years, the target population included 100 percent of park estuarine holdings in Jamaica Bay, but in 2003, several tributary branches outside the park boundary were excluded, whereas others were included (Figure 3). Criteria for including or excluding non-park areas were not fully objective, so the target population was adjusted to its current extent beginning with the 2005 monitoring effort (Figure 4). In addition to the approximately 4,615 ha of estuary within the park boundary, an additional 1,257 ha within Jamaica Bay but outside the park boundary are now included in the spatial sampling design.

GATE is one of two NCBN coastal parks with a highly developed water-quality monitoring program. A spatial monitoring program has been in effect at GATE since 1977, and 13 permanent trend stations are currently part of the Jamaica Bay water-quality sampling program. For the 2003 design, the 13 park monitoring stations fell within 9 of the 30 original ENE sampling hexagons (Figure 3). In addition to the expansion of the spatial design in 2005, a reevaluation of park stations resulted in the use of 10 GATE monitoring stations as NCBN trend stations for 10 sampling hexagons (Figure 4). In the final ENE protocol, however, the number of existing park monitoring stations that could be used for network condition assessments was capped at no more than 20 percent of the sampling hexagons. The 2006 sampling design (Figure 5) includes six GATE monitoring stations within the ENE sampling design, and represents the final version adopted for the protocol (Kopp and Neckles 2009).

Assateague Island National Seashore

The boundary of ASIS encompasses more than 19,400 ha, with more than 60 percent of the area submerged as oceanic and estuarine habitat. The management and monitoring of estuarine natural resources at the park is a joint effort among many federal and state partners. The boundary of ASIS encircles NPS land holdings, as well as those of the U.S. Fish and Wildlife Service and Maryland's Assateague State Park; the Maryland portion of the system is managed under the Maryland Coastal Bays Program. Consequently, ASIS has natural-resource and monitoring interests that are not confined to areas within the park boundary. The spatial target population for ENE monitoring is consistent with these interests, and encompasses approximately 37,319 ha of estuary, of which approximately 6,867 ha fall inside park boundaries (Figure 6). ASIS is the second of the two NCBN parks with a highly developed estuarine water-quality monitoring program, and some of the ASIS permanent stations have been adopted as NCBN trend stations. During pilot testing, 13 ASIS stations within 12 sampling hexagons were

qualified as NCBN trend stations. Following the 2005 pilot, the hexagonal sampling grid was adjusted to remove one hexagon lacking any accessible estuarine resource, and the number of park stations adopted as ENE trend stations was adjusted to accommodate the 20-percent cap. These revisions (Table 2) went into effect in 2007 and are documented in the ENE protocol (Kopp and Neckles 2009).

Colonial National Historic Park

COLO consists of two significant land holdings, the Yorktown and Jamestown units, connected by a narrow traffic corridor, the Colonial Parkway. Although the Yorktown unit and the Parkway both abut the lower York River and cross a number of tidal creek systems, park interests in estuarine condition are dominated by the area surrounding the Jamestown unit. Jamestown Island is bordered by the lower James River on one side. Whereas Jamestown Island itself is undeveloped, the Powhatan Creek watershed on the mainland is under tremendous development pressure. Identification of the spatial target population used for the 2003 sampling design predated the adoption of objective selection criteria and consequently focused exclusively on this region. The spatial extent of sampling was defined by the park boundary at Powhatan Creek, a 500-m buffer where the park boundary was coincident with the shore, and a tangent connecting the southernmost extent of this buffer at Jamestown Island and College Creek. Within this delineation, the hexagonal sampling grid encompassed approximately 1,100 ha of estuarine habitat surrounding Jamestown Island (Figure 7). This legacy design is substantively different from the current design, which has a smaller spatial extent surrounding Jamestown Island and includes the many small areas of park estuary where the Colonial Parkway passes over tidal creeks (Kopp and Neckles 2009).

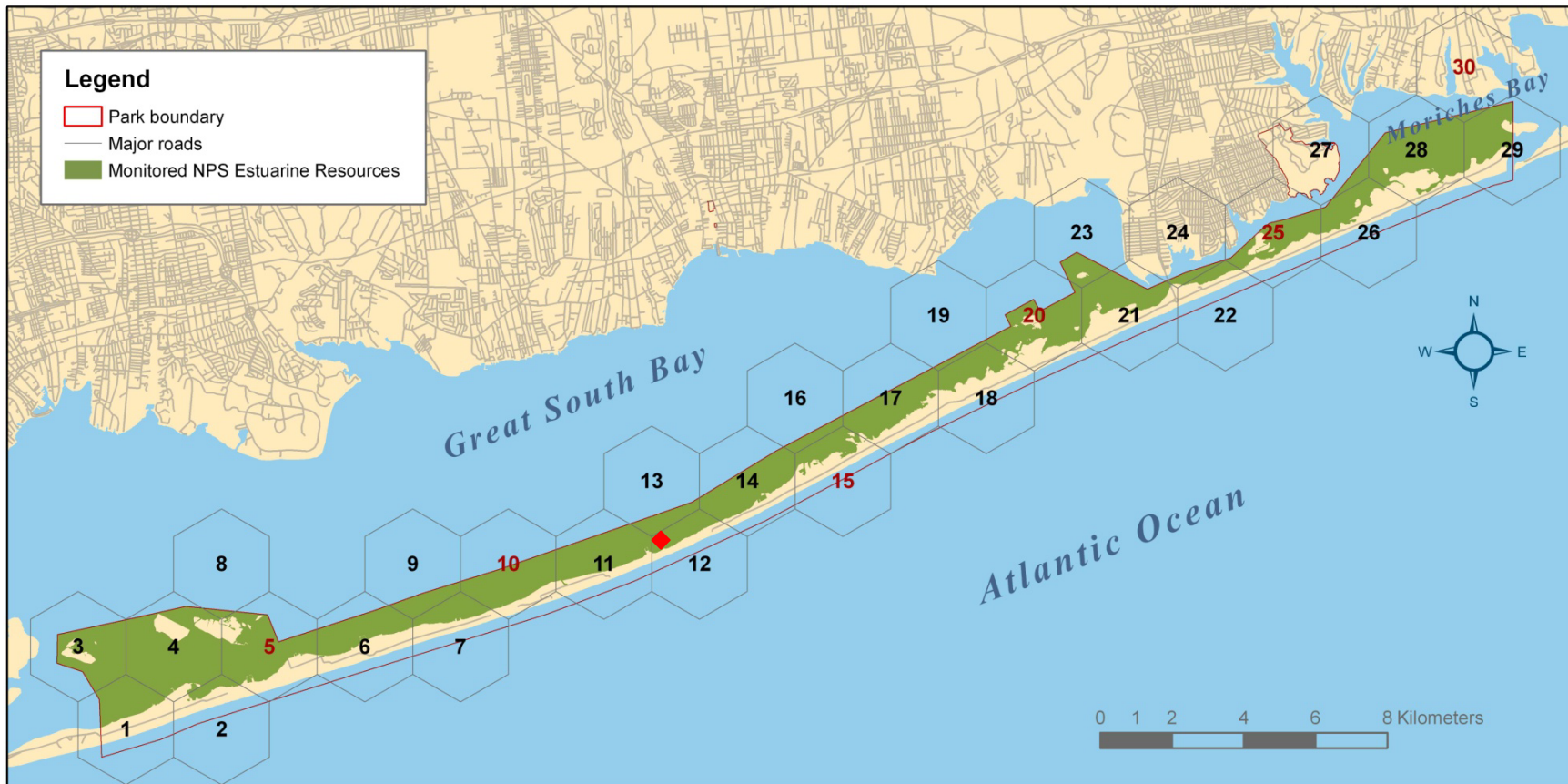


Figure 2. Spatial domain and sampling design for 2003 estuarine monitoring at Fire Island National Seashore, New York. Sampling hexagons labeled in red represent those assigned with trend stations. The red diamond in hexagon # 12 marks the location of the continuous monitoring station.

Figure 3. Spatial domain and sampling design for 2003 estuarine monitoring at Gateway National Recreation Area, Jamaica Bay unit, New York and New Jersey. Sampling hexagons labeled in red represent those assigned with trend stations. The red diamond in hexagon # 9 marks the location of the continuous monitoring station.



Figure 4. Spatial domain and sampling design for 2005 estuarine monitoring at Gateway National Recreation Area, Jamaica Bay unit, New York and New Jersey. Sampling hexagons labeled in red represent those assigned with trend stations. The red diamond in hexagon # 10 marks the location of the continuous monitoring station.



Figure 5. Spatial domain and sampling design for 2006 estuarine monitoring at Gateway National Recreation Area, Jamaica Bay unit, New York and New Jersey. Sampling hexagons labeled in red represent those assigned with trend stations. The red diamond in hexagon # 10 marks the location of the continuous monitoring station.

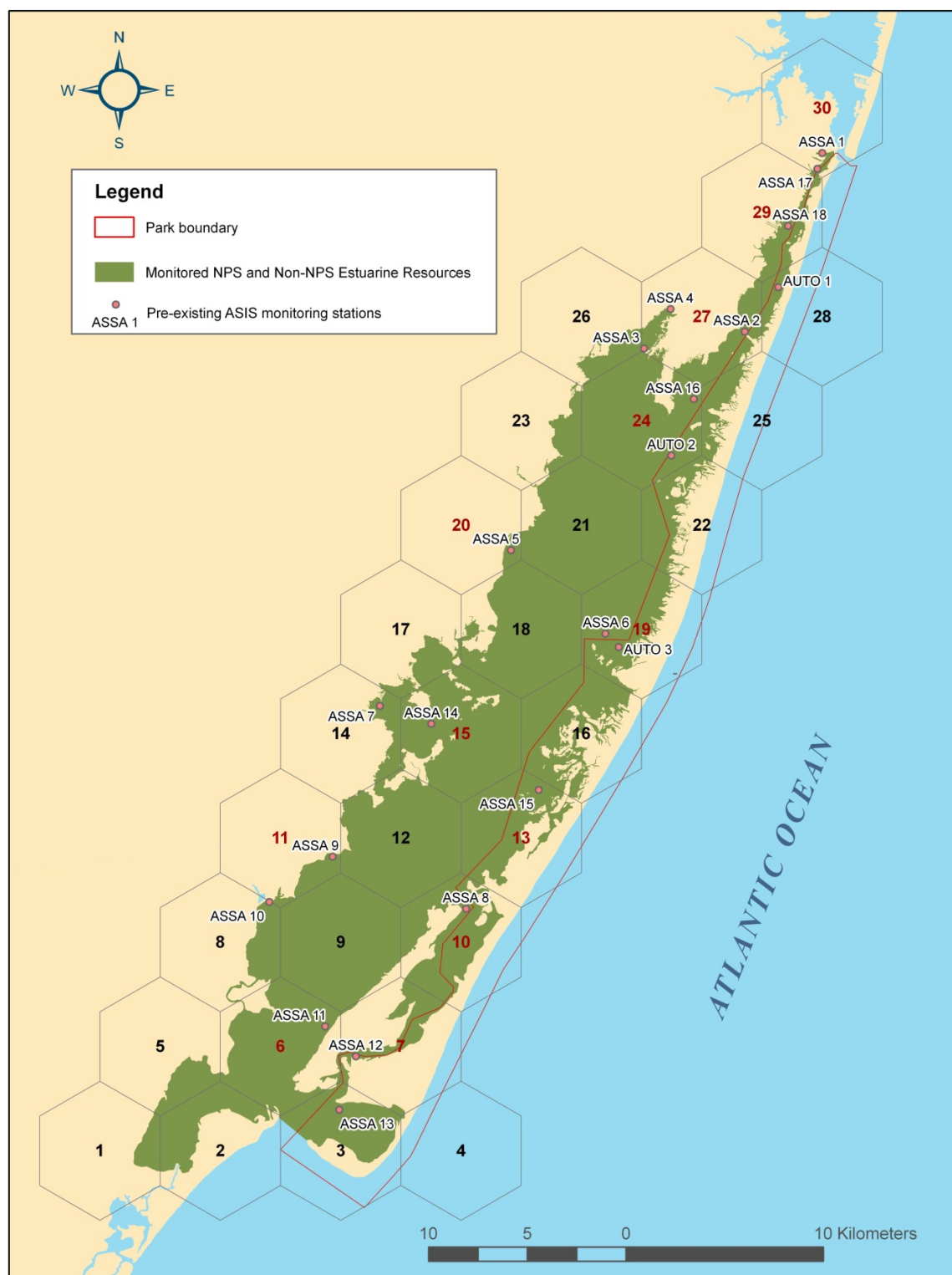


Figure 6. Spatial domain and sampling design for 2005 estuarine monitoring at Assateague Island National Seashore, Maryland and Virginia. Sampling hexagons labeled in red represent those assigned with trend stations. The continuous monitoring station was located at the point labeled AUTO 2 in hexagon # 24.

Figure 7. Spatial domain and sampling design for 2003 estuarine monitoring at Colonial National Historical Park, Jamestown Island unit, Virginia. Sampling hexagons labeled in red represent those assigned with trend stations. The red diamond in hexagon # 24 marks the location of the continuous monitoring station.

Field Methods

Methods and procedures used in this study are documented in the NCBN ENE monitoring protocol (Kopp and Neckles 2009). We provide here a brief overview of the monitoring approach and refer readers to the protocol for further detail. In some instances, however, the methods used during feasibility and pilot testing were not adopted as part of the final protocol. In these instances, additional detail is provided.

For most park assessments, all of the probability, trend, and continuous monitoring of water-quality Vital Signs occurred during a 4-week index period. This index period was scheduled for 4 consecutive weeks during mid to late summer (Table 3). All spatial sampling was to be divided evenly among four weekly survey cruises. For each cruise, all of the trend stations were sampled, as were a quarter of the remaining probability stations. Probability stations were assigned to one of the four cruises so that spatial balance was achieved for each week of sampling. At GATE in 2005 and 2006, however, this target index period was not achieved (Table 3). In both years the index period lasted longer than 4 weeks and extended into September, and the probability stations were not evenly distributed throughout the index period. Summary statistics have been calculated from these data, but should be used with caution when making comparisons with future assessments.

Sampling during the 2003 index period at FIIS included the first trial of a prototype YSI sonde for the continuous station. That sonde was equipped with two upward-facing PAR sensors with mechanical wipers. The system was subsequently adopted for network-wide application; however, the 2003 assessments at COLO and GATE were conducted using separate data loggers for PAR data, and periodic site visits were made to clean the sensors manually. No assessments were conducted in 2004 while the monitoring protocol underwent major revision, but assessments were continued in 2005 at GATE and ASIS and in 2006 at GATE.

For each probability assessment, temperature, salinity, turbidity, and dissolved oxygen were measured at the surface, at mid-depth, and near bottom at each station (probability and trend) using a YSI 6600 multi-parameter water-quality instrument (sonde). Surface grab samples were collected for extractive analysis of chlorophyll *a* concentration, and the attenuation coefficient, K_d (m^{-1}), of downwelling PAR was quantified from depth profiles of PAR obtained using LiCor quantum sensors. Because of the influence of solar angle on attenuation of downwelling PAR, all monitoring was conducted during a target sampling window of within 3 hours of local apparent noon (the time when the sun crosses the local meridian).

For assessments conducted during 2003, water-quality data were collected and logged differently from the approach documented in the ENE protocol. Instead of recording values for water-quality metrics at prescribed depths, the sonde was set to log data each second while slowly being lowered from the surface down to the bottom and back up at the rate of 10 to 20 $cm\ s^{-1}$. This approach was later abandoned. In order to make these early assessments conform to subsequent ones (and the final protocol), data from the surface, mid-depth, and near-bottom portions of each profile were extracted for reporting purposes (see below for data reduction approach). At ASIS, measurements were made at 50- to 100-cm depth increments down through the water column. This approach was consistent with the park's individual water-quality

monitoring program, but only measurements from the near surface, mid depth, and near bottom were included for NCBN Vital Signs reporting.

During the weekly sampling cruises to probability stations, samples were also collected at the continuous logging stations for quality control. At these continuous stations, temperature, salinity, turbidity, dissolved oxygen, and depth were all measured by a continuously deployed sonde using the same technologies as in the spatial assessments. The continuous sondes logged data each quarter hour. Data from quality-control visits were used to check the continuous sensors and correct for electronic drift and biofouling. Chlorophyll at the continuous station was quantified by in situ fluorescence using YSI chlorophyll sensors. During quality-control visits, discrete grab samples were collected for extractive analysis of chlorophyll *a* so that fluorometer readings could be calibrated against measurements made using the same extractive methods applied to the spatial assessments. As with the spatial assessments, continuous PAR attenuation was measured using LiCor sensors; however, it was calculated from the irradiance logged by two separate sensors at separate depths (rather than from a profile created by a single sensor). The attenuation coefficient, K_d (m^{-1}), of downwelling PAR was recorded at continuous stations using either LiCor sensors integrated with optical wipers on a YSI 6600EDS sonde, or using stand-alone LiCor logging hardware and routine (weekly) cleaning of the sensors by field crews. The integrated LiCor-YSI approach was first tested at FIIS in 2003, proved to be very effective, and was subsequently adopted for all further assessments.

Table 3. Dates of index periods for each of the NCBN monitoring assessments.

Year	Parks	Index period
2003	GATE	July 24 – August 21
	FIIS	July 28 – August 25
	COLO	July 7 – August 6
2005	ASIS	July 25 – August 22
	GATE	July 27 – September 7
2006	GATE	July 27 – September 13

[At GATE in 2003, additional data were collected prior to the index period as part of training exercises. These data are included in appendix 2 but were not used in condition assessment calculations. At GATE in 2005 and 2006, the duration of the index period extended beyond the prescribed 4 weeks and outside the July-August target window.]

Laboratory Methods

In order to achieve data-quality objectives in as cost-effective a manner as possible, the ENE protocol calls for all chlorophyll analyses to be performed at the same laboratory using the same analytical method. The Atlantic Research Center at Cape Cod National Seashore, North Truro, Massachusetts, performs this task using USEPA fluorometric method 445.0 (Arar and Collins 1997). At GATE and ASIS, NCBN monitoring has been conducted by park cooperators running independent water-quality monitoring programs. The ENE protocol allows these parks the option either to send all NCBN samples to the Atlantic Research Center at CACO or to continue to use their existing laboratories and methods while also sending a subset of samples (minimum 10 percent) to the Atlantic Research Center for laboratory comparison purposes. These requirements

were not, however, part of the pilot ENE monitoring protocols. In 2003, chlorophyll *a* analyses for FIIS and GATE were conducted by the water-quality laboratory at GATE using trichromatic spectrophotometric methods (Method 10200.H.2 in APHA 1998, 2001). In 2005, chlorophyll *a* samples from GATE were analyzed using this same method as well as a variation of USEPA fluorometric method 445.0 performed by the University of Maryland Horn Point Analytical Services Laboratory, Cambridge, Maryland. The University of Maryland laboratory analyzed all of the 2005 samples from ASIS. Samples from the 2003 assessment at COLO were analyzed by the Virginia Institute of Marine Science, Gloucester Point, Virginia, using USEPA fluorometric method 445.0 (Arar and Collins 1997).

Data Reduction and Calculation of Summary Statistics

The three components used in the analysis and reporting of water-column monitoring data are (1) the area-weighted spatial survey, (2) the trend-station data, and (3) the continuous-monitoring data. Data-quality objectives and methods for calculating summary statistics are documented in the NCBN ENE protocol (Kopp and Neckles 2009) and have been applied in preparing this data report.

Area-weighted water quality is reported in two ways for each park assessment: the mean condition and the percent of the estuarine area exceeding threshold values for selected parameters. In both cases, parameter values are weighted by the estuarine area within the tessellated hexagon from which each sample is collected (Cochran 1977, Stevens and Olsen 2003). NCBN has adopted threshold values for Vital Signs (Table 4) that are accepted by the USEPA for national coastal condition reporting (USEPA 2001b, 2004). These values also are largely consistent with the thresholds used for the NOAA National Estuarine Eutrophication Assessment (Bricker et al. 1999). The only change to these thresholds is that water clarity is expressed as K_d (m^{-1}) rather than as an index. Cutoff values of K_d have been calculated from the USEPA criteria for turbidity using the thresholds for areas with significant submerged aquatic vegetation (SAV) resources. For NPS reporting on these indicators, the proportion of the resource area that falls into each of four quality categories (good, fair, poor, or missing) is calculated for each park. The fourth (“missing”) category includes spatial elements for which data are missing for any vital sign variable.

Table 4. Critical values used to establish the portion of the estuary that falls within a given quality category.

Measure	Good	Fair	Poor
Chlorophyll <i>a</i> (surface)	< 5 $\mu g/L$	5-20 $\mu g/L$	> 20 $\mu g/L$
Dissolved oxygen (near bottom)	> 5 mg/L	2-5 mg/L	< 2 mg/L
Water clarity K_d (SAV standard)	< 0.92 m^{-1}	0.92-1.61 m^{-1}	> 1.61 m^{-1}

[These values are based on the threshold values used by both the USEPA National Coastal Assessment and the NOAA National Eutrophication Assessment (USEPA 2001b, 2002, 2004, and Bricker et al. 1999).]

Data from the trend stations serve two purposes: (1) detecting interannual change (trend analysis) and (2) evaluating variability of the metrics in time (through the index period) and through space (throughout the estuary). Spatial variability is reduced because station positions are not re-randomized each year. This makes trend stations useful for detecting interannual change and long-term trends. Trend-station data can be applied to estimating area-weighted average condition (Area-Weighted Spatial Data) without adding unnecessary bias to those estimates because 20 percent or fewer of the total number of stations in a park estuary are trend stations. And because trend stations are measured four times during each index period, we are able to interpret results of the weekly spatial survey within the context of seasonal temporal variability as well as estuary-wide spatial variability.

For reporting purposes, means and standard deviations for the index period were calculated for each of the trend stations. As explained previously, GATE and ASIS each had more than six trend stations (20 percent of total stations) during pilot testing, and data from all of them are reported here. Where more than one trend station was adopted within a single hexagon, data were averaged between the two for the spatial assessment, but were reported individually in the trend-station analyses.

The role of the continuous-monitoring data is similar to that of the trend data except that temporal resolution is further emphasized, displacing any ability to resolve spatial patterns. Estuaries are highly pulsed systems, and even the weekly sampling at trend stations may miss ecologically important events such as phytoplankton blooms, or episodes of low dissolved-oxygen concentration and high turbidity. Each logging station is sampled 96 times per day (as many as 3,000 times during the index period), so short-term events are more likely to be captured. Although not spatially representative, data from the logging station can also be used to track interannual changes. Because there is no spatial replication, we can only interpret results within the context of that one station. Data reduction and quality control for continuous-monitoring stations followed methods prescribed in the ENE protocol (Kopp and Neckles 2009). These methods are broadly compatible with records-computation guidance of the U.S. Geological Survey (Wagner et al. 2006) except that ENE procedures are slightly more conservative in retaining rather than rejecting data. This distinction is most evident in the optical parameters of turbidity and chlorophyll. While both protocols call for the removal of data spikes (generally assumed to be spurious data from larger passing objects such as detritus), noisy data are retained using the ENE procedures. The rationale for conservative data rejection is based upon the role of these data for interpreting results from weekly probability and trend sampling.

Results and Summary Statistics

Fire Island National Seashore–2003

The majority of Vital Signs water-column measures are sampled at surface, mid-, and near-bottom water depths (dissolved-oxygen concentration, turbidity, salinity, temperature). For these measures, area-weighted average condition is calculated for each sampling depth. Chlorophyll *a* is measured from surface grab samples and PAR attenuation is calculated from a profile of PAR through the water column; for each of these measures, a single area-weighted average condition value is calculated (Table 5). The area-weighted average chlorophyll *a* concentration in the surface waters at FIIS was 1.23 µg/L (Table 5), with all of the park (except for one missing datum) falling within the “good” condition category for this metric (Figure 8, Table 4).

Dissolved-oxygen concentration was high throughout the park, with an area-weighted average near-bottom concentration of 10.0 mg/L, or 140 percent of the saturation concentration (Table 5). All sampled areas of the park where sampling was successful (all but one station) fell into the “good” condition category for this metric as well (Figure 9, Table 4). The condition of the park in relation to water clarity was not as good, however. The area-weighted average attenuation coefficient of PAR (K_d) was 1.43 m⁻¹ (Table 5). PAR sampling was less successful than the sampling for the other measures, with 28 percent of the park area (33 percent of the stations) not being successfully sampled, largely because sampling occurred outside the prescribed daytime window (Figure 10). Of the remaining 72 percent, most fell into the “fair” condition category, and less than 5 percent of the monitored estuarine resources could be characterized as “good” (Figure 10). Continuous monitoring at the logging station was very successful, and showed characteristic conditions for all metrics (Figure 11). Of particular interest, however, are the continuous dissolved oxygen data. Whereas daytime measurements of dissolved oxygen all yielded a very favorable condition assessment, night-time dissolved-oxygen concentrations during mid-August fell regularly below 6 mg/L, and one night fell below 5 mg/L, which falls in the “fair” condition category. Variability within the index period is shown for each of the trend stations from measurements made during the repeat weekly visits (Table 6).

Table 5. Area-weighted average water-quality condition at FIIS during the 2003 index period.

Measure	Water column	Surface	Mid-depth	Bottom
PAR attenuation (K_d) (m ⁻¹)	1.43	--	--	--
Dissolved oxygen (mg/L)	--	10.1	10.0	10.1
Dissolved oxygen (% saturation)	--	141	140	140
Chlorophyll <i>a</i> (µg/L)	--	1.23	--	--
Turbidity (NTU)	--	8.2	8.0	16.2
Temperature (°C)	--	25.44	25.41	25.39
Salinity (psu)	--	23.82	23.99	23.98

[Reported values are means of measurements from 24 probability and 6 trend stations located within 30 tessellated hexagons. Each measure is weighted by the estuarine area within the respective hexagon. For trend stations, only the first data set (one date) that met data-quality objectives of the ENE protocol was used for these calculations. “--”, not applicable.]

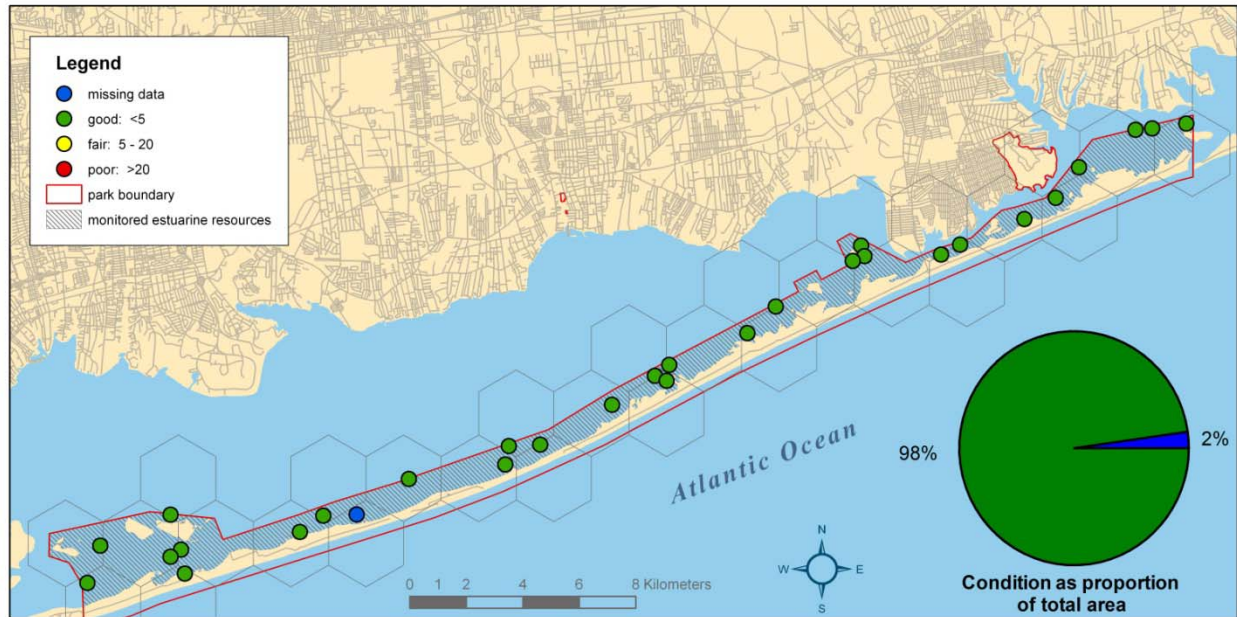


Figure 8. Chlorophyll *a* ($\mu\text{g/L}$) concentration in surface samples from the 2003 assessment at FIIS. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

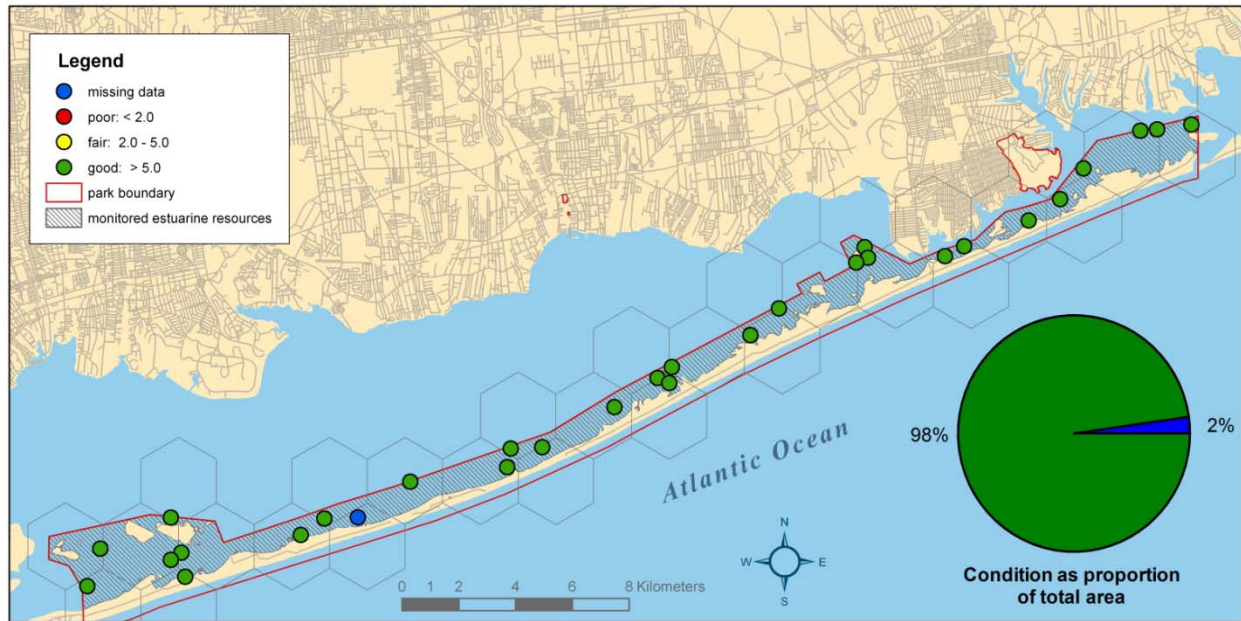


Figure 9. Dissolved-oxygen concentration (mg/L) in bottom water from the 2003 assessment at FIIS. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

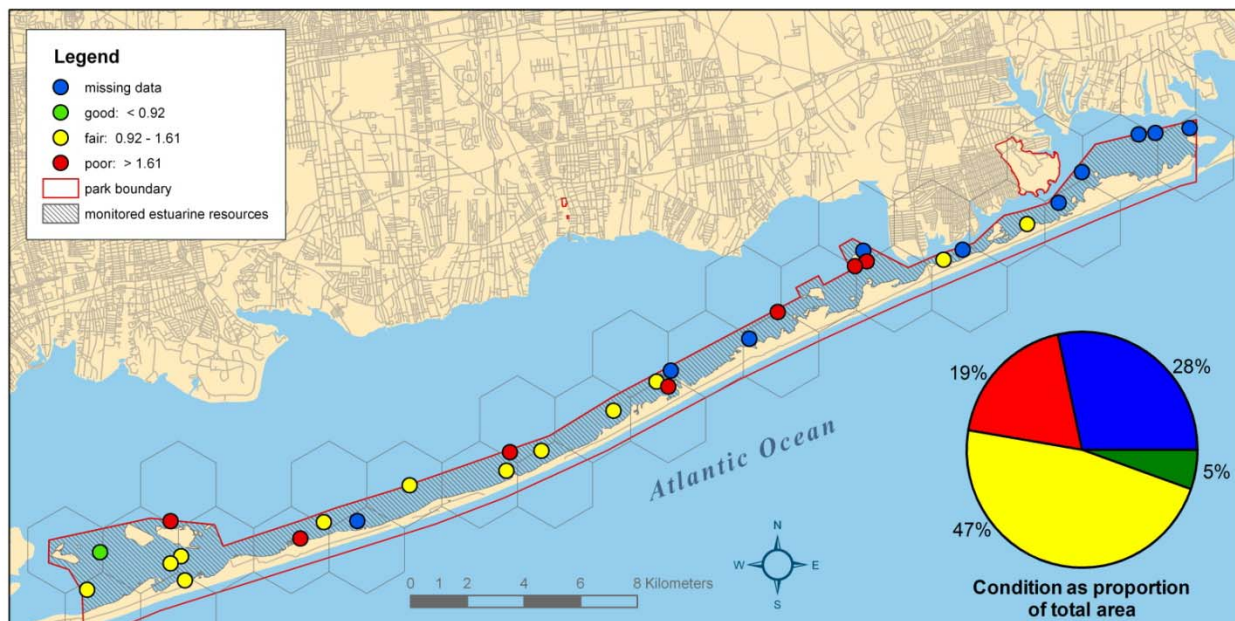


Figure 10. Attenuation coefficient of PAR, K_d (m^{-1}), from the 2003 assessment at FIIS. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

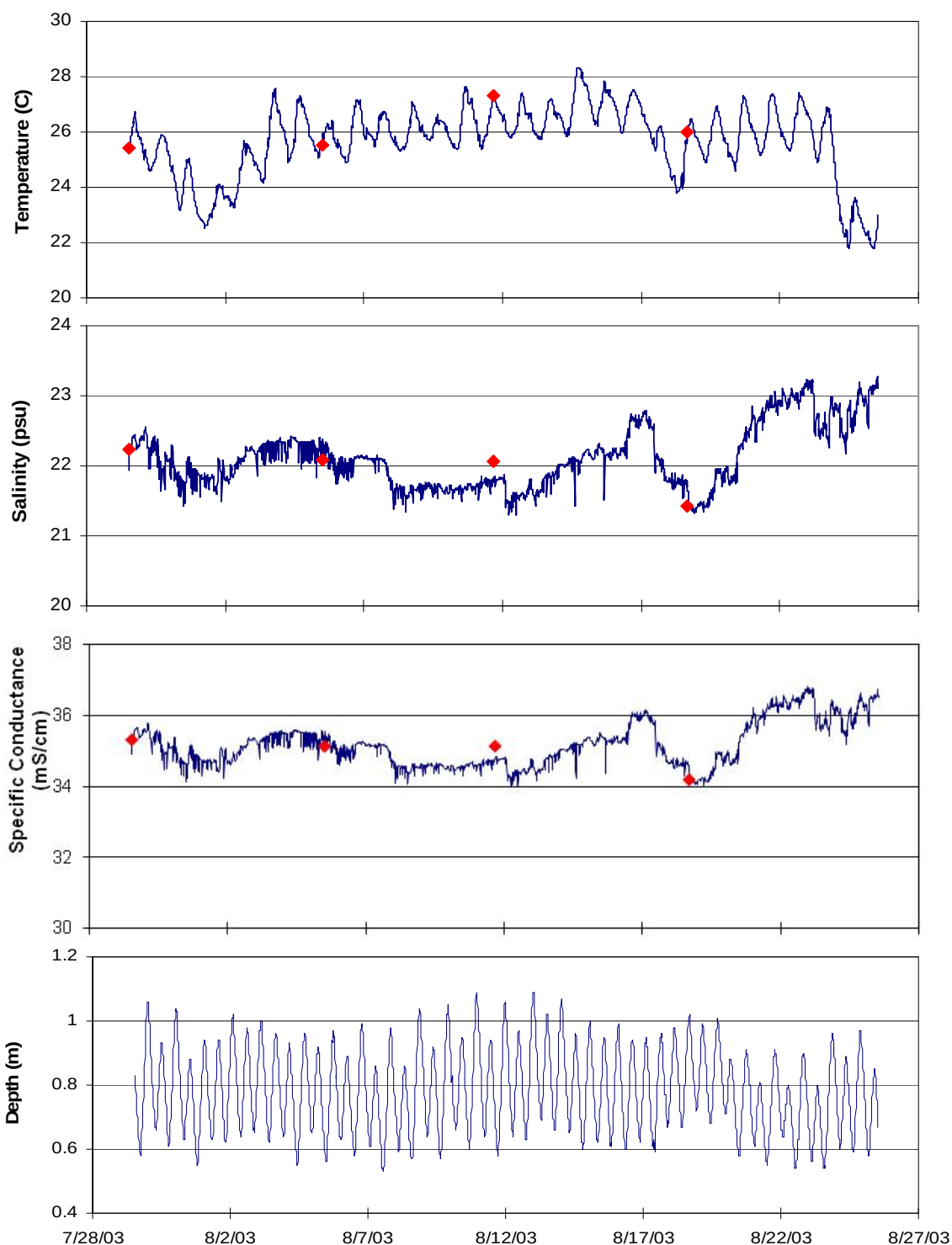


Figure 11. Continuous water-quality data from the 2003 assessment at FIIS. All measurements were made using a YSI6600EDS multiparameter sonde with wiped LiCor PAR sensors following the NCBN ENE protocol (Kopp and Neckles 2009). Data were recorded every 15 minutes (solid blue traces). Daily K_d (♦) was calculated using integrated irradiance for the period within 3 hours of local apparent noon. Data were corrected for drift using post-deployment calibration checks and independent measurements made during site visits (♦).

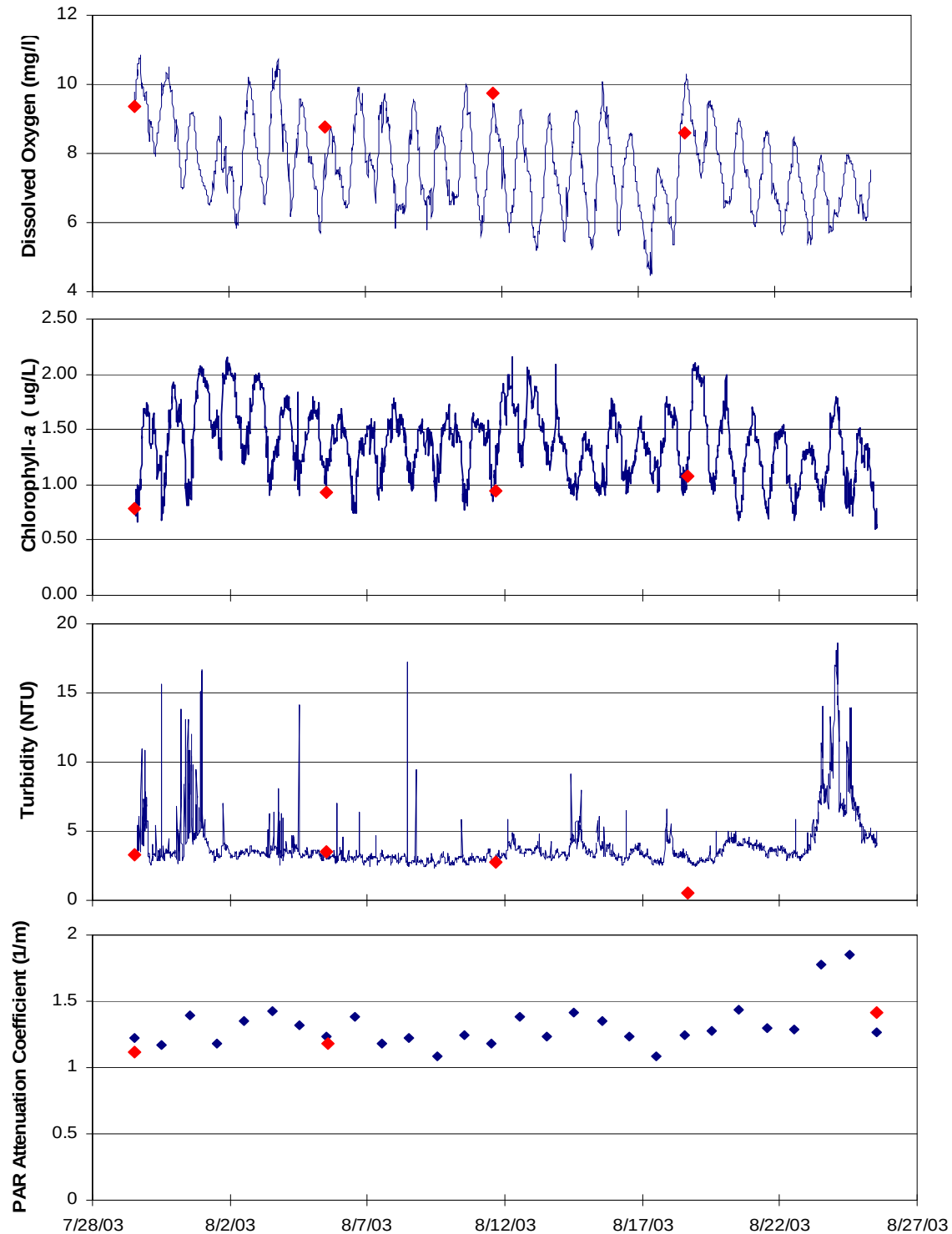


Figure 11 (continued). Continuous water-quality data from the 2003 assessment at FIIS. All measurements were made using a YSI6600EDS multiparameter sonde with wiped LiCor PAR sensors following the NCBN ENE protocol (Kopp and Neckles 2009). Data were recorded every 15 minutes (solid blue traces). Daily K_d (♦) was calculated using integrated irradiance for the period within 3 hours of local apparent noon. Data were corrected for drift using post-deployment calibration checks and independent measurements made during site visits (♦).

Table 6. Trend-station water-quality data from the 2003 assessment at FIIS.

Measure	Statistic	Trend station (hexagon)					
		5	10	15	20	25	30
PAR attenuation K_d (m^{-1})	mean	1.15	1.39	1.68	1.51	1.09	--
	std.dev.	0.10	0.11	--	1.03	--	--
	n	4	4	1	2	1	--
Temperature (°C)	mean	25.29	26.02	26.97	27.49	27.16	18.15
	std.dev.	0.19	0.17	0.83	0.53	0.40	0.94
	n	4	4	2	2	3	3
Specific conductance (mS/cm)	mean	40.47	36.09	33.49	29.58	34.11	47.05
	std.dev.	1.02	0.40	0.63	2.21	3.10	0.44
	n	4	4	2	2	3	3
Salinity (psu)	mean	25.88	22.75	20.93	18.26	21.43	30.65
	std.dev.	0.74	0.28	0.42	1.48	2.06	0.32
	n	4	4	2	2	3	3
Dissolved oxygen (% saturation)	mean	129	159	151	163	146	127
	std.dev.	25	42	12	9	4	15
	n	4	4	2	2	3	3
Dissolved oxygen (mg/L)	mean	9.1	11.4	10.7	11.6	10.3	9.8
	std.dev.	1.7	3.0	0.7	0.5	0.4	1.1
	n	4	4	2	2	3	3
Turbidity (NTU)	mean	3.0	4.1	9.3	10.2	46.7	23.0
	std.dev.	0.3	1.8	7.8	4.3	53.5	29.0
	n	4	4	2	2	3	3
Chlorophyll <i>a</i> ($\mu g/L$)	mean	1.1	1.0	1.3	1.0	1.8	0.53
	std.dev.	0.1	0.2	0.7	0.1	0.7	0.1
	n	4	4	2	2	3	3

[Values are means, standard deviations (std.dev.), and number of measurements (n) for all monitoring events at each trend station. K_d values are from water column profiles and chlorophyll *a* is from discrete water grab samples. Temperature, specific conductance, salinity, and turbidity are from near-surface readings of the sonde, whereas dissolved-oxygen readings were from the near-bottom. Location of hexagons with trend stations shown in Figure 2. --, no data.]

Gateway National Recreation Area–2003

The majority of Vital Signs water-column measures are sampled at surface, mid-, and near-bottom water depths (dissolved-oxygen concentration, turbidity, salinity, temperature). For these measures, area-weighted average condition is calculated for each sampling depth. Chlorophyll *a* is measured from surface grab samples and PAR attenuation is calculated from a profile of PAR through the water column; for each of these measures, a single area-weighted average condition value is calculated (Table 7). For one hexagon (# 24; Figure 3) containing three trend stations, all were used in the spatially weighted average, with each receiving an equal portion of the hexagon area-weight. The area-weighted average chlorophyll *a* concentration in the surface waters at GATE was 21.7 µg/L (Table 7). Chlorophyll *a* sampling was unsuccessful for 8 percent of the estuarine area, conditions were “good” for 26 percent, and “fair” for 42 percent (Figure 12, Table 4). Dissolved-oxygen concentration was high throughout the park, with an area-weighted average near-bottom concentration of 11.0 mg/L, or 151 percent of the saturation concentration (Table 7). Where dissolved-oxygen data met data-quality objectives most conditions were “good”, with only two stations, representing less than 1 percent of the estuarine area, falling into the “fair” condition category (Figure 13, Table 4). The area-weighted average attenuation coefficient of PAR (K_d) was 1.16 m⁻¹ (Table 7). PAR sampling was successful for 83 percent of the estuarine area, and most (52 percent of the total area) fell into the “fair” condition class (Figure 14). Continuous monitoring at the logging station was very successful in capturing temporal events not detected as well by the spatial assessment. These monitoring results showed routine decreases in dissolved-oxygen concentrations to less than 5 mg/L during the mid-index period, chlorophyll *a* concentrations that tracked dissolved-oxygen concentrations, and phytoplankton blooms occurring early and late in the index period (Figure 15). Variability within the index period determined from the repeat weekly visits is shown for each of the trend stations in Table 8. During 2003 feasibility testing at GATE, the sampling window was extended beyond the index period, resulting in more than four trend-station visits.

Table 7. Area-weighted average water-quality condition at GATE during the 2003 index period.

Measure	Water column	Surface	Mid-depth	Bottom
PAR attenuation (K_d)(m ⁻¹)	1.16	--	--	--
Dissolved oxygen (mg/L)	--	10.9	10.1	11.0
Dissolved oxygen (% saturation)	--	151.	139	151
Chlorophyll <i>a</i> (µg/L)	--	21.7	--	--
Turbidity (NTU)	--	8.1	4.1	15.8
Temperature (°C)	--	24.11	23.79	23.07
Salinity (psu)	--	25.57	27.00	27.47

[Reported values are means of measurements from 24 probability and 6 trend stations located within 30 tessellated hexagons. Each measure is weighted by the estuarine area within the respective hexagon. For trend stations, only one set of data (one date) that met data-quality objectives of the ENE protocol was used in these calculations. For one hexagon containing three trend stations, all were used in the spatially weighted average, with each receiving an equal portion of the hexagon area-weight. This was always the first date generating data that met the data-quality objectives of the ENE protocol. “--”, not applicable.]

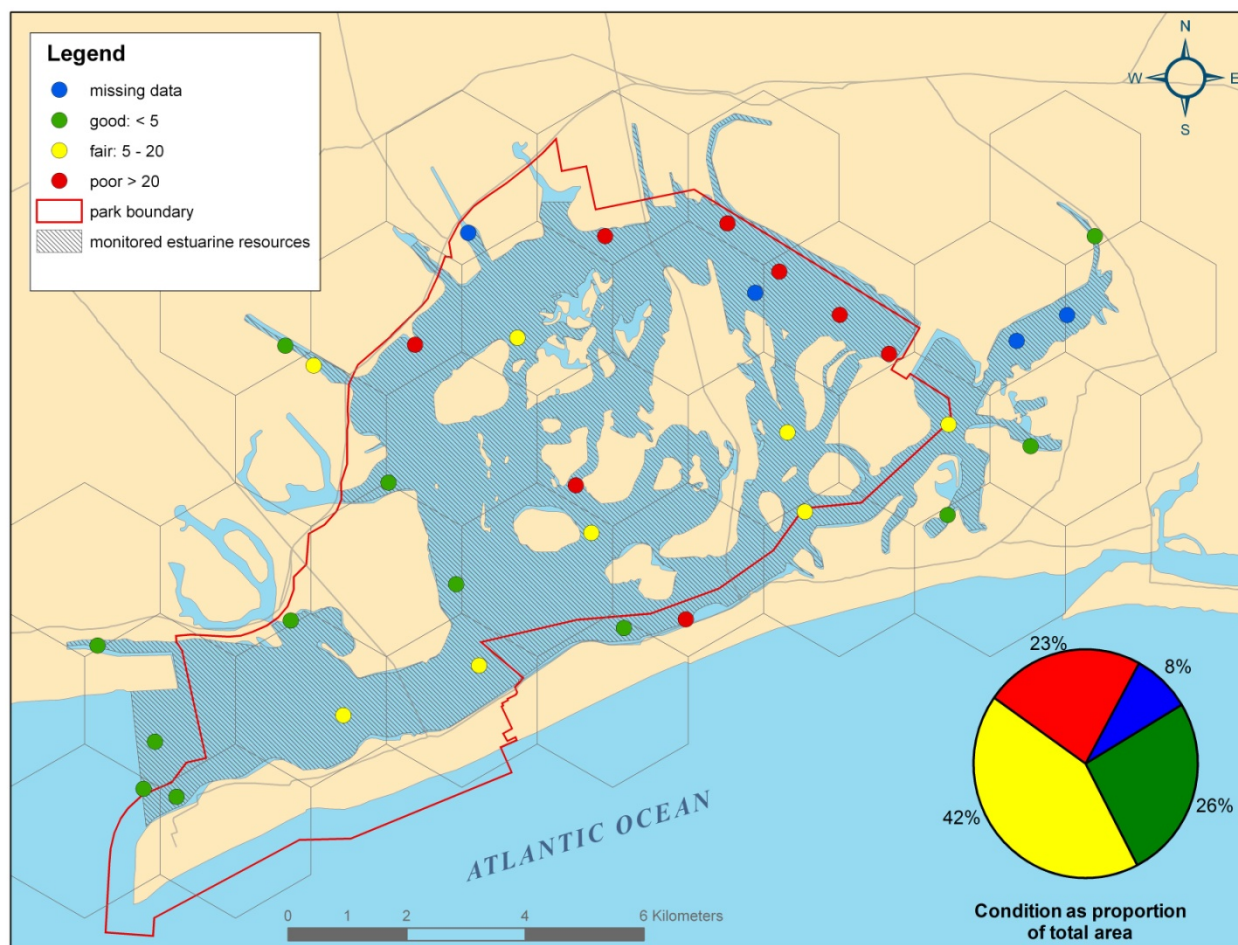


Figure 12. Chlorophyll *a* ($\mu\text{g/L}$) concentration in surface samples from the 2003 assessment at GATE. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.



Figure 13. Dissolved-oxygen concentration (mg/L) in bottom water from the 2003 assessment at GATE. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

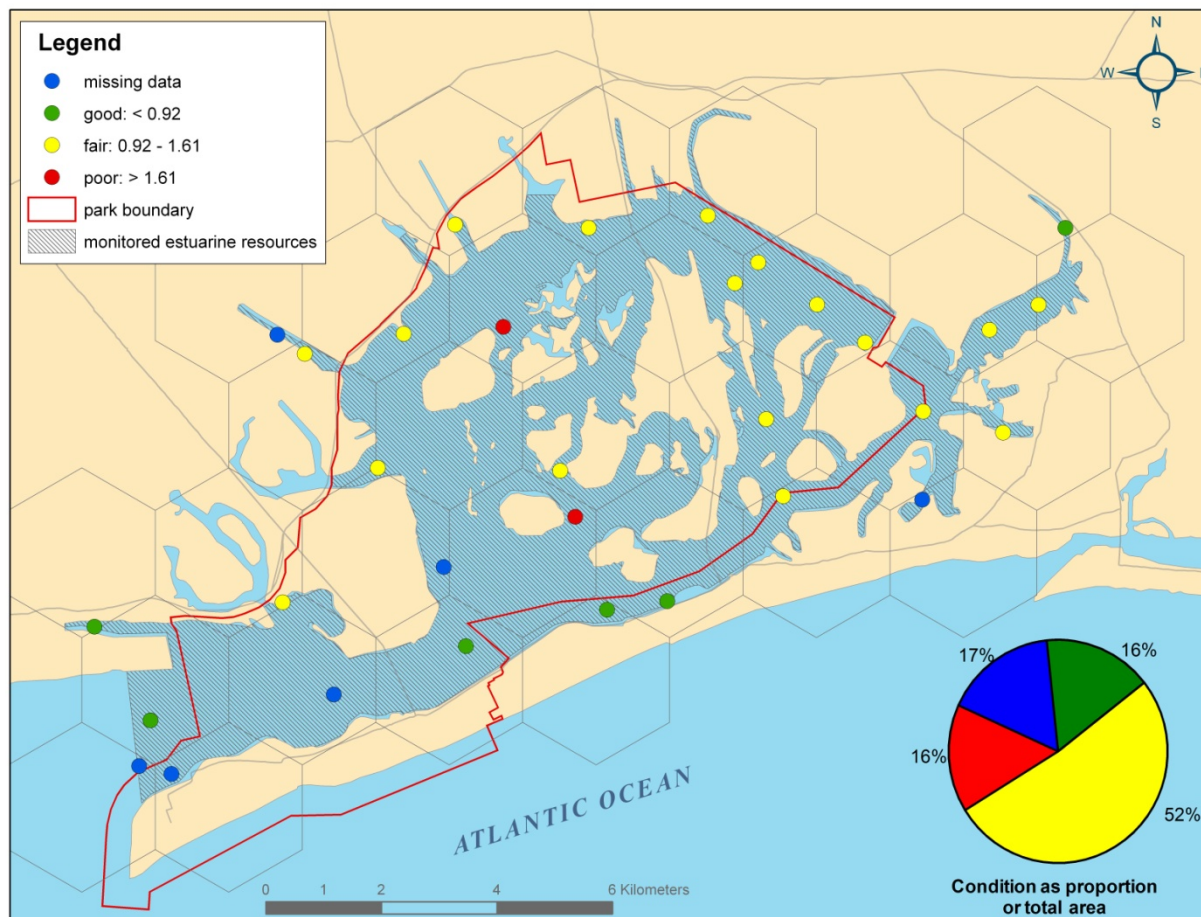


Figure 14. Attenuation coefficient of PAR, K_d (m^{-1}), from the 2003 assessment at GATE. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

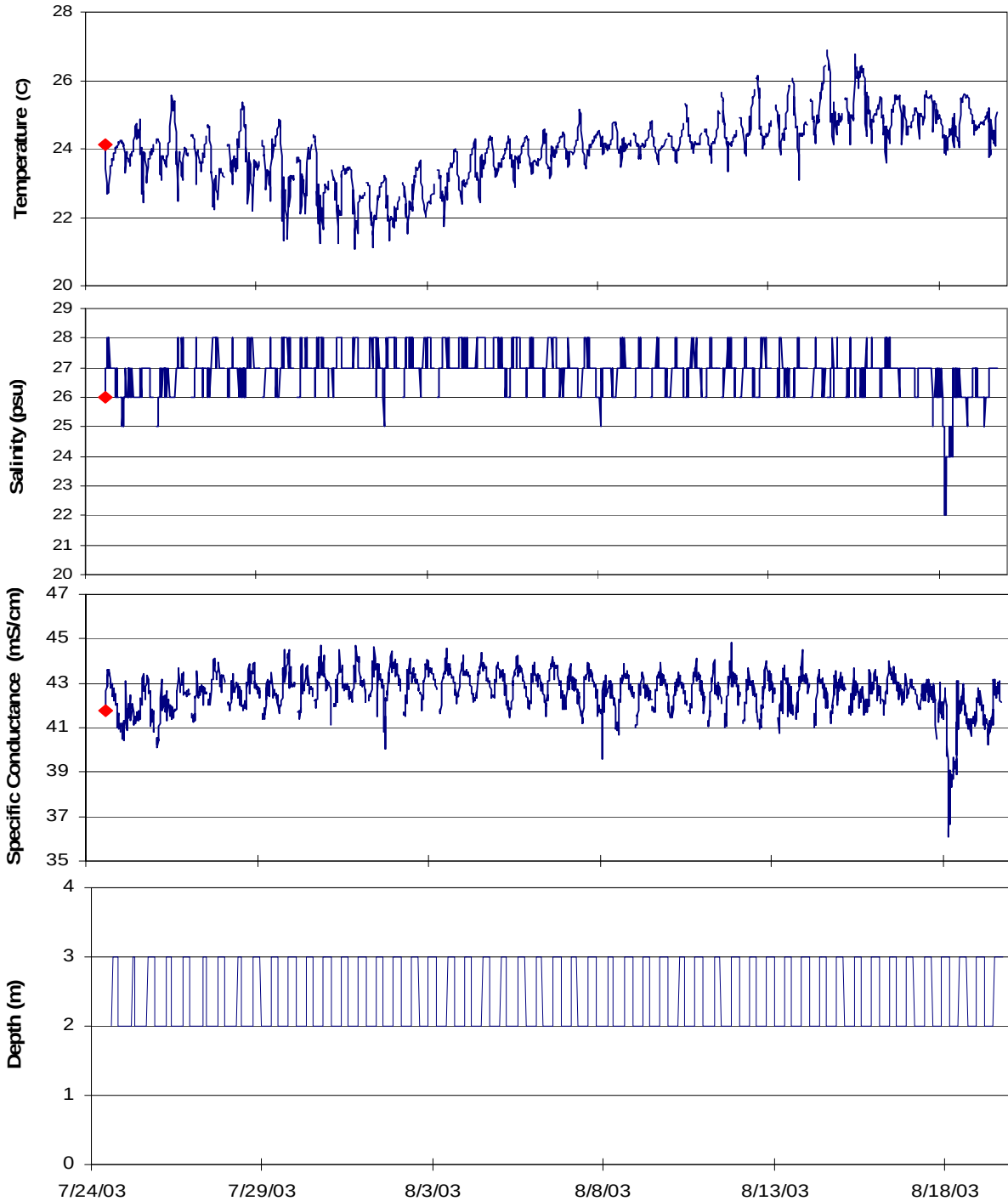


Figure 15. Continuous water-quality data from the 2003 assessment at GATE. PAR was logged using LiCor sensors and a Li-1400 data logger; all other values were collected using a YSI6600EDS multiparameter sonde. Data were recorded every 15 minutes (solid blue traces). Daily K_d (♦) was calculated using integrated irradiance for the period within 3 hours of local apparent noon. Data were corrected for drift using post-deployment calibration checks and independent measurements made during site visits (♦). A data processing error resulted in loss of decimal-place digits from the salinity and depth data.

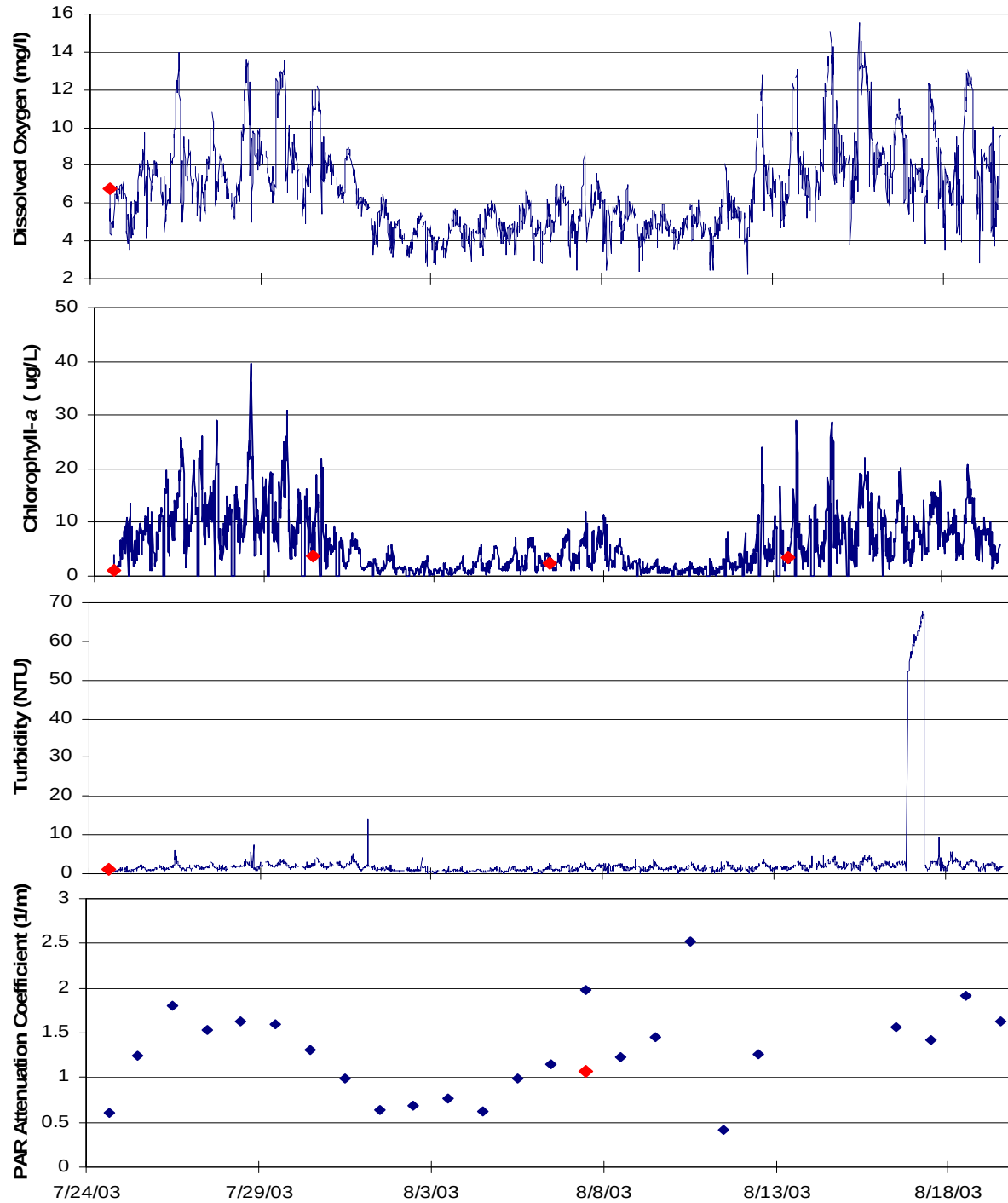


Figure 15 (continued). Continuous water-quality data from the 2003 assessment at GATE. PAR was logged using LiCor sensors and a Li-1400 data logger; all other values were collected using a YSI6600EDS multiparameter sonde. Data were recorded every 15 minutes (solid blue traces). Daily K_d (♦) was calculated using integrated irradiance for the period within 3 hours of local apparent noon. Data were corrected for drift using post-deployment calibration checks and independent measurements made during site visits (♦). A data processing error resulted in loss of decimal-place digits from the salinity and depth data.

Table 8. Trend-station water-quality data from the 2003 assessment at GATE.

Measure	Statistic	Trend station (hexagon)									
		3	5	11	16	21	24a	24b	24c	28	29
PAR attenuation K_d (m^{-1})	mean	0.44	0.71	0.98	1.32	1.13	1.19	1.42	1.21	1.21	1.32
	std.dev.	0.12	0.23	0.17	0.48	0.35	0.34	0.17	0.19	0.27	0.36
	n	5	5	5	5	5	5	5	5	5	5
Temperature (°C)	mean	18.42	19.68	20.87	21.58	21.02	21.65	21.25	22.06	21.30	21.65
	std.dev.	3.46	3.36	3.67	3.50	3.40	3.53	3.52	3.67	3.49	3.54
	n	6	7	7	7	7	7	6	7	7	7
Specific conductance (mS/cm)	mean	40.47	41.31	39.08	38.61	38.68	37.25	36.82	37.78	37.33	35.78
	std.dev.	5.27	2.41	2.92	3.16	2.03	2.11	2.08	2.05	2.12	1.96
	n	6	7	7	7	7	7	6	7	7	7
Salinity (psu)	mean	26.09	26.52	24.96	24.68	24.64	23.62	23.34	23.99	23.69	22.60
	std.dev.	3.54	1.71	1.99	2.03	1.42	1.45	1.41	1.41	1.47	1.34
	n	6	7	7	7	7	7	6	7	7	7
Dissolved oxygen (% saturation)	mean	118	125	138	175	121	104	85	137	108	108.89
	std.dev.	36	50	67	68	51	44	28	40	52	53.98
	n	5	7	7	7	7	7	6	7	7	7
Dissolved oxygen (mg/L)	mean	9.2	9.8	10.5	13.1	9.3	8.0	6.8	10.5	8.2	8.3
	std.dev.	2.5	3.4	4.5	4.3	3.5	3.1	2.4	2.8	3.6	3.8
	n	5	7	7	7	7	7	6	7	7	7
Turbidity (NTU)	mean	1.2	2.3	2.6	4.4	3.6	3.4	3.9	3.0	3.7	6.1
	std.dev.	1.0	1.6	1.8	1.7	1.9	1.35	1.6	1.5	1.1	4.2
	n	5	6	6	6	6	6	5	7	6	6
Chlorophyll <i>a</i> ($\mu g/L$)	mean	4.0	14.1	28.8	44.5	39.8	49.7	77.3	71.4	47.5	63.9
	std.dev.	3.0	5.5	14.3	21.6	17.3	22.9	11.2	35.3	16.6	46.5
	n	6	7	7	6	7	7	6	7	7	7

[Values are means, standard deviations (std.dev.), and number of measurements (n) for all monitoring events at each trend station. K_d values are from water column profiles and chlorophyll *a* is from discrete water grab samples. Temperature, specific conductance, salinity, and turbidity are from near-surface readings of the sonde, whereas dissolved-oxygen readings were from the near-bottom. Location of hexagons with trend stations shown in Figure 3.]

Gateway National Recreation Area–2005

The draft monitoring protocol was revised to accommodate inclusion of additional estuarine resource areas in the target sampling populations and a new hexagon sampling design was generated for GATE. This new design resulted in several trend stations being associated with new hexagon numbers (although the stations themselves were unchanged). The majority of Vital Signs water-column measures are sampled at surface, mid-, and near-bottom water depths (dissolved-oxygen concentration, turbidity, salinity, temperature). For these measures, area-weighted average condition is calculated for each sampling depth. Chlorophyll *a* is measured from surface grab samples and PAR attenuation is calculated from a profile of PAR through the water column; for each of these measures, a single area-weighted average condition value is calculated (Table 9). For one hexagon (# 24; Figure 4) containing two trend stations, both were used in the spatially weighted average, with each receiving an equal portion of the hexagon area-weight. The area-weighted average chlorophyll *a* concentration in the surface waters at GATE was 54.2 µg/L (Table 9), with most of the park (71 percent) falling within the “poor” condition category for this metric (Figure 16, Table 4). Dissolved-oxygen concentration was marginal throughout the park, with an area-weighted average near-bottom concentration of 6.1 mg/L, or only 83 percent of the saturation concentration (Table 9). Although 58 percent of the estuarine resource area fell into the “good” condition class for dissolved oxygen, 35 percent was ranked only as “fair” (Figure 17, Table 4). The condition of the park in relation to water clarity was similarly marginal, with an area-weighted average attenuation coefficient for PAR (K_d) of 1.07 m⁻¹ (Table 9). Ninety-three percent of the estuarine resource area was successfully sampled for PAR attenuation; 51 percent fell into the “fair” condition category, and only 36 percent could be characterized as “good” (Figure 18). The proportion of the estuary achieving threshold condition criteria dropped notably in the two year period from 2003 to 2005. An explanation for this drop, which is also evident in the trend station data (Table 8 and Table 10), is not immediately evident. Continuous monitoring at the logging station ran only 9 days before the dissolved-oxygen sensor could no longer produce data meeting data-quality objectives (Figure 19). Problems were also experienced with the pressure (depth) sensor throughout the index period. The remaining sonde parameters showed characteristic estuarine patterns of variability. High temporal variability of these metrics was also observed at the trend stations (Table 10).

Table 9. Area-weighted average water-quality condition at GATE during the 2005 index period.

Measure	Water column	Surface	Mid-depth	Bottom
PAR attenuation (K_d)(m^{-1})	1.07	--	--	--
Dissolved oxygen (mg/L)	--	8.2	6.2	6.1
Dissolved oxygen (% saturation)	--	101	82	83
Chlorophyll <i>a</i> ($\mu g/L$)	--	54.2	--	--
Turbidity (NTU)	--	16.6	7.3	6.4
Temperature ($^{\circ}C$)	--	24.18	24.87	24.95
Salinity (psu)	--	6.11	20.37	22.51

[Reported values are means of measurements from 24 probability and 6 trend stations located within 30 tessellated hexagons. Each measure is weighted by the estuarine area within the respective hexagon. For trend stations, only the first data set (one date) that met data-quality objectives of the ENE protocol was used for these calculations. For one hexagon containing two trend stations, both were used in the spatially weighted average, with each receiving an equal portion of the hexagon area-weight. "--", not applicable.]

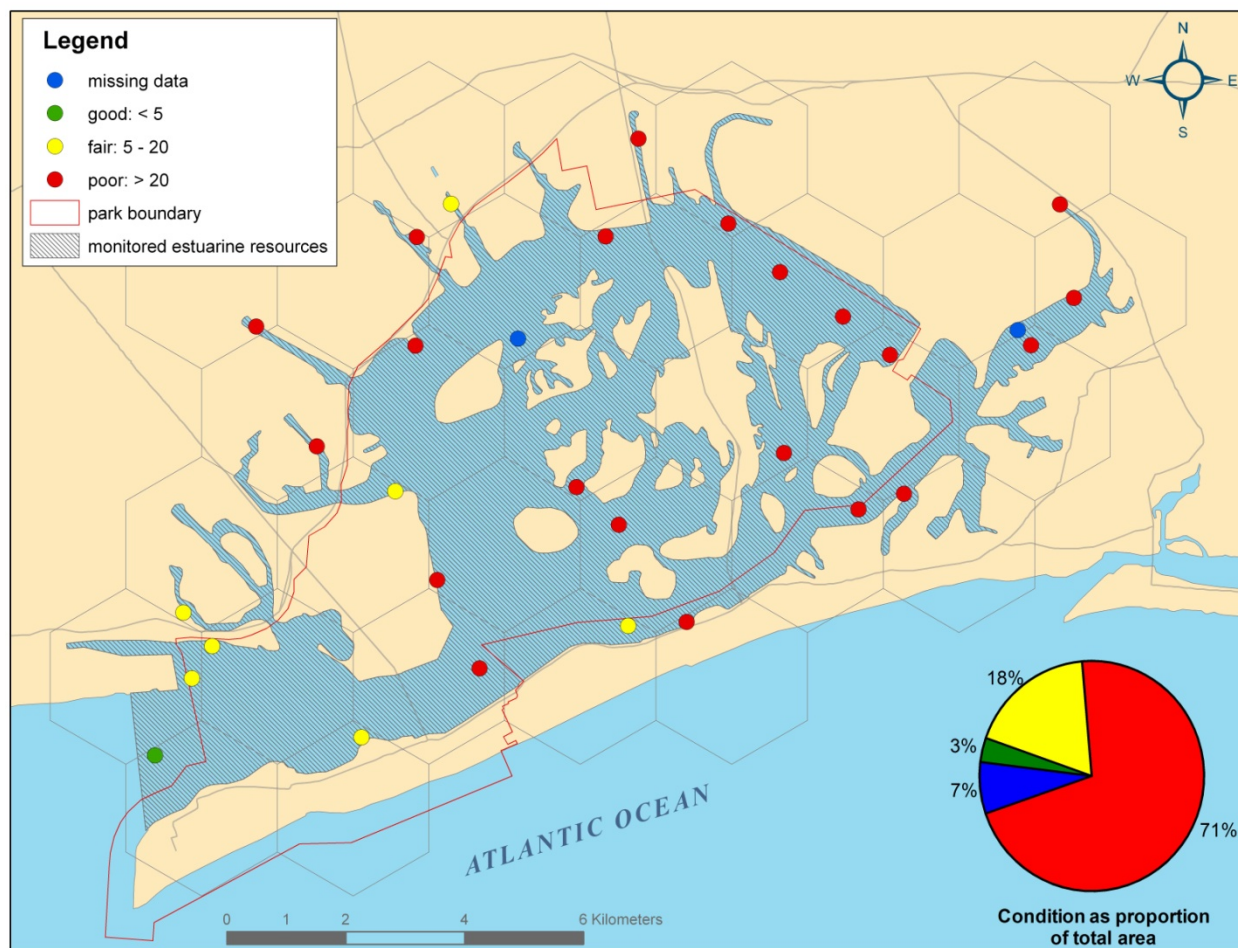


Figure 16. Chlorophyll *a* ($\mu\text{g/L}$) concentration in surface samples from the 2005 assessment at GATE. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

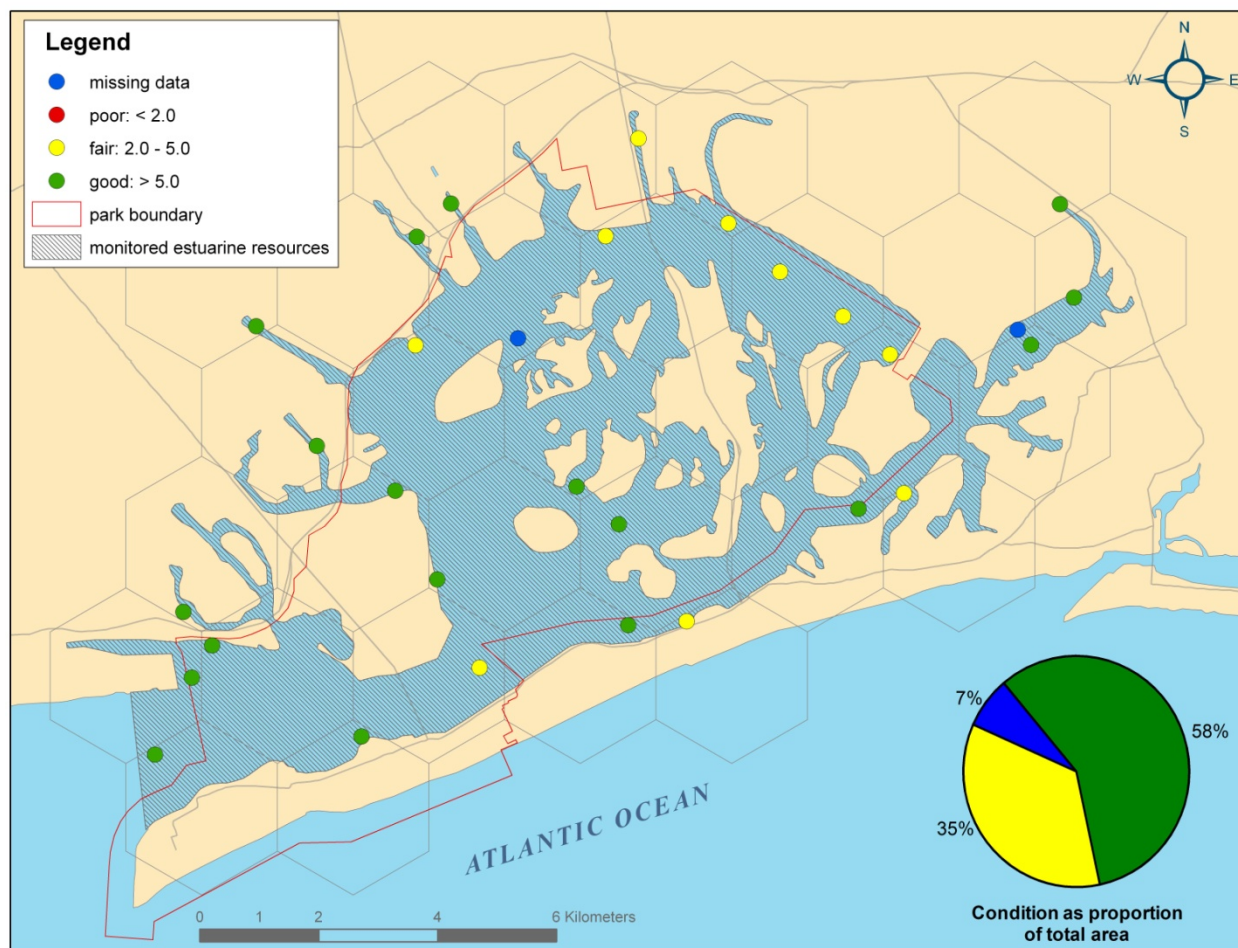


Figure 17. Dissolved-oxygen concentration (mg/L) in bottom water from the 2005 assessment at GATE. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

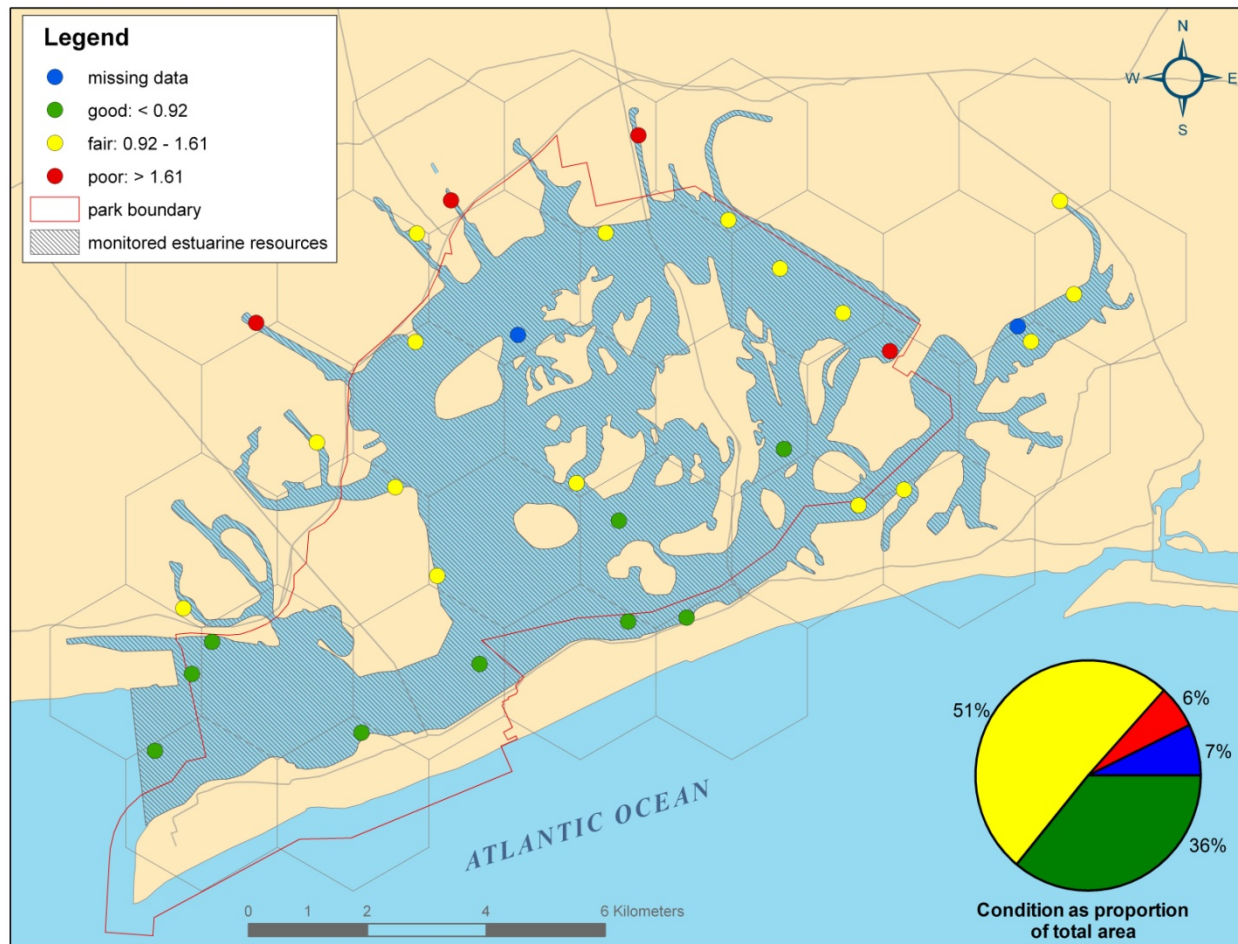


Figure 18. Attenuation coefficient of PAR, K_d (m^{-1}), from the 2005 assessment at GATE. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

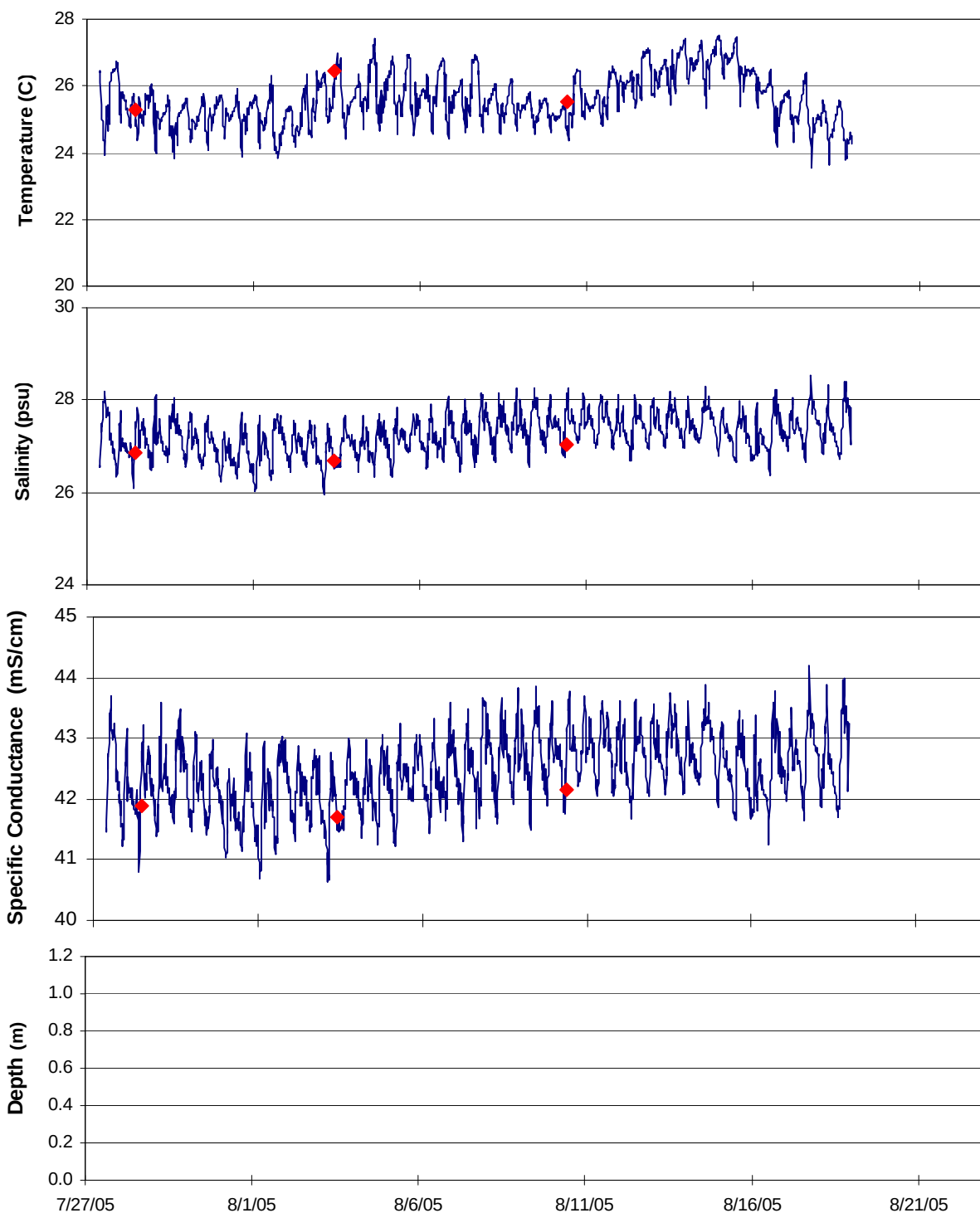


Figure 19. Continuous water-quality data from the 2005 assessment at GATE. All measurements were made using a YSI6600EDS multiparameter sonde with wiped LiCor PAR sensors following the NCBN ENE protocol (Kopp and Neckles 2009). Data were recorded every 15 minutes (solid blue traces). Daily K_d (◆) was calculated using integrated irradiance for the period within 3 hours of local apparent noon. Data were corrected for drift using post-deployment calibration checks and independent measurements made during site visits (♦).

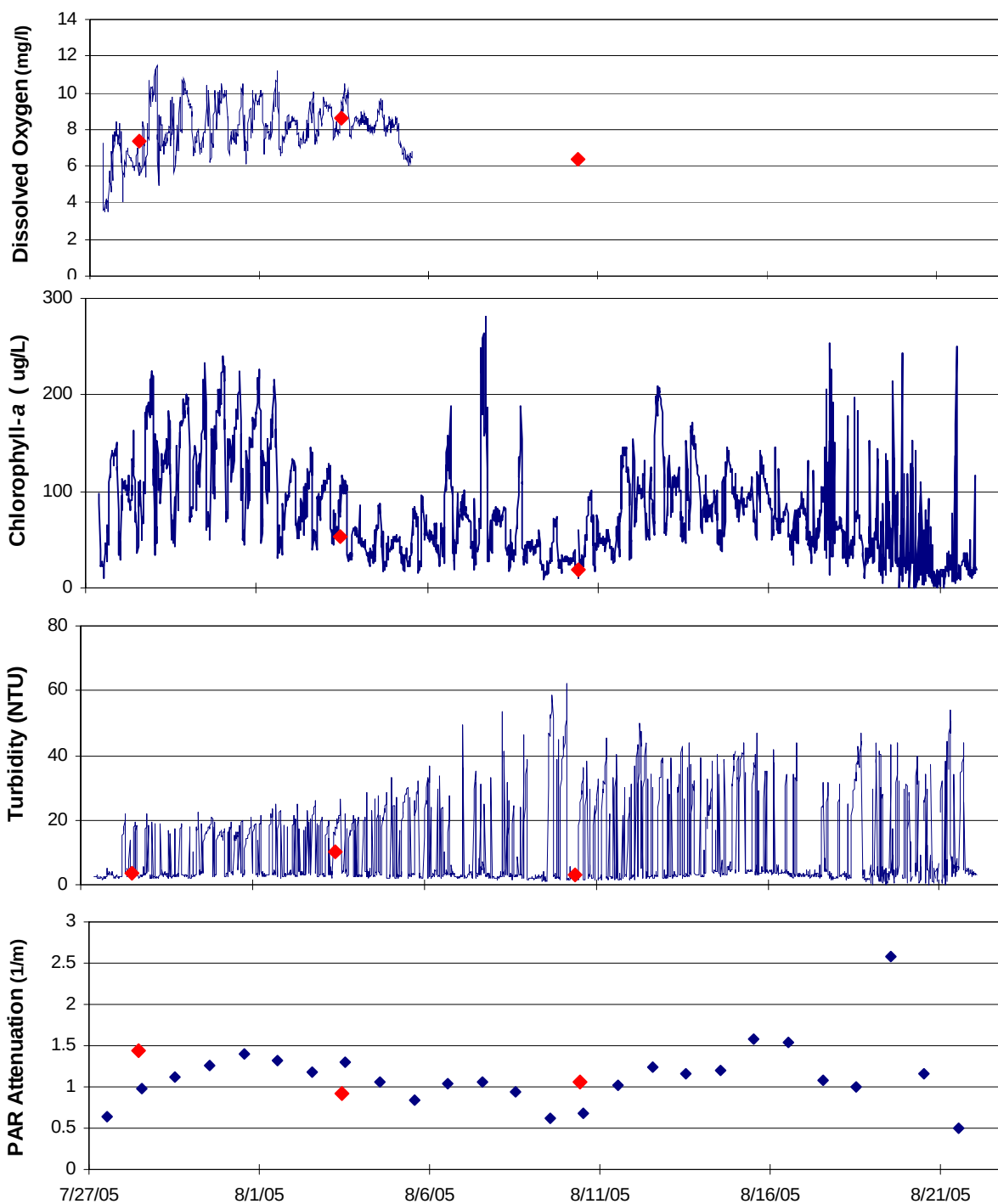


Figure 19 (continued). Continuous water-quality data from the 2005 assessment at GATE. All measurements were made using a YSI6600EDS multiparameter sonde with wiped LiCor PAR sensors following the NCBN ENE protocol (Kopp and Neckles 2009). Data were recorded every 15 minutes (solid blue traces). Daily K_d (♦) was calculated using integrated irradiance for the period within 3 hours of local apparent noon. Data were corrected for drift using post-deployment calibration checks and independent measurements made during site visits (♦).

Table 10. Trend station water-quality data from the 2005 assessment at GATE.

Measure	Statistic	Trend stations (hexagons)										
		1	5	7	10	15	16	18	23	24a	24b	29
PAR	mean	0.32	0.70	0.85	1.28	1.43	1.21	1.47	1.58	1.07	1.28	1.27
Attenuation	std.dev.	0.16	0.11	0.28	0.29	0.48	0.37	0.23	0.93	0.33	0.30	0.23
K_d (m^{-1})	n	4	5	5	5	5	5	5	5	5	5	5
Temperature	mean	21.72	22.35	23.78	22.76	22.84	23.57	24.35	23.13	24.38	24.74	24.42
(°C)	std.dev.	0.91	1.67	2.15	2.11	1.34	1.95	1.90	1.51	2.11	1.65	1.45
	n	5	5	5	5	5	5	5	4	5	5	5
Specific	mean	12.30	12.96	13.78	10.26	11.93	12.05	13.23	16.14	16.08	17.17	12.65
Conductance	std.dev.	4.14	7.29	7.70	6.99	7.34	6.44	7.61	7.01	8.65	10.70	7.55
(mS/cm)	n	5	5	5	5	5	5	5	4	5	5	5.00
Salinity	mean	7.89	8.27	8.78	6.54	7.55	7.69	8.29	10.29	10.17	10.89	8.00
(psu)	std.dev.	2.69	4.78	4.96	4.50	4.80	4.15	4.96	4.51	5.51	6.81	4.82
	n	5	5	5	5	5	5	5	4	5	5	5
Dissolved	mean	83	81	85	106	82	105	89	68	53	56	62
Oxygen	std.dev.	7	14	22	17	20	4	36	16	14	28	16
(% saturation)	n	5	5	5	5	5	5	5	4	5	5	5
Dissolved	mean	6.1	5.8	6.1	7.9	5.8	8.3	6.3	4.9	3.8	4.0	4.4
Oxygen	std.dev.	0.5	1.0	1.5	1.2	1.4	0.4	2.5	1.2	1.1	2.0	1.1
(mg/L)	n	5	5	5	5	5	5	5	4	5	5	5
Turbidity	mean	8.9	20.0	61.8	27.5	12.6	12.1	16.8	11.6	8.3	11.6	11.5
(NTU)	std.dev.	4.2	16.0	119.5	39.9	5.4	7.7	19.3	9.9	4.0	6.9	7.9
	n	5	5	5	5	5	5	5	4	5	5	5
Chlorophyll <i>a</i>	mean	2.8	9.7	22.6	21.0	22.0	32.1	95.6	23.7	26.1	33.1	35.6
(µg/L)	std.dev.	2.8	15.1	21.4	15.9	19.8	24.1	137.3	22.0	20.7	27.1	28.8
	n	5	5	5	5	5	5	5	4	5	5	5

[Values are means, standard deviations (std.dev.), and number of measurements (n) for all monitoring events at each trend station. K_d values are from water column profiles and chlorophyll *a* is from discrete water grab samples. Temperature, specific conductance, salinity, and turbidity are from near-surface readings of the sonde, whereas dissolved-oxygen readings were from the near-bottom. Location of hexagons with trend stations shown in Figure 4.]

Gateway National Recreation Area–2006

The majority of Vital Signs water-column measures are sampled at surface, mid-, and near-bottom water depths (dissolved-oxygen concentration, turbidity, salinity, temperature). For these measures, area-weighted average condition is calculated for each sampling depth. Chlorophyll *a* is measured from surface grab samples and PAR attenuation is calculated from a profile of PAR through the water column; for each of these measures, a single area-weighted average condition value is calculated (Table 11). For the hexagon containing more than one trend station (# 24; Figure 5), both values were used in the area-weighted condition assessment, with each receiving an equal portion of the hexagon area-weight. The area-weighted average chlorophyll *a* concentration in the surface waters at GATE was 47.2 µg/L (Table 11), with much of the park falling within the “poor” (56 percent) or “fair” (33 percent) condition categories (Figure 20, Table 4). Dissolved-oxygen concentration was marginal throughout the park, with an area-weighted average near-bottom concentration of 5.7 mg/L, or only 79 percent of the saturation concentration (Table 11). Although 47 percent of the estuarine resource area fell into the “good” condition class for dissolved oxygen, 42 percent was ranked only as “fair” (Figure 21, Table 4). The condition of the park in relation to water clarity was largely fair to poor, with an area-weighted average attenuation coefficient for PAR (K_d) of 1.40 m⁻¹ (Table 11). Ninety three percent of the estuarine resource area was successfully sampled for PAR attenuation, but only 25 percent of the area fell in the “good” condition category. Of the remainder, 35 percent was “fair” and a full third of the estuarine area fell in the “poor” condition class (Figure 22). Continuous monitoring at the logging station yielded data for only 9 days before none of the sensors could generate data meeting data-quality objectives (Figure 23). This was largely due to inadequate success of anti-biofouling efforts. For the period of record with good data, all sonde metrics showed daily variability characteristic of estuaries and consistent with the spatial assessment data. Characteristic temporal variability was observed for the repeat visits to trend stations (Table 12).

Table 11. Area-weighted average water quality condition at GATE during the 2006 index period.

Measure	Water column	Surface	Mid-depth	Bottom
PAR attenuation (K_d m ⁻¹)	1.40	--	--	--
Dissolved oxygen (mg/L)	--	7.0	6.0	5.7
Dissolved oxygen (% saturation)	--	98	82	79
Chlorophyll <i>a</i> (µg/L)	--	42.8	--	--
Turbidity (NTU)	--	2.9	2.9	2.9
Temperature (°C)	--	23.80	23.45	23.33
Salinity (psu)	--	26.74	27.06	27.29

[Reported values are means of measurements from probability and trend stations located within 30 tessellated hexagons. Each measure is weighted by the estuarine area within the respective hexagon. For trend stations, only the first data set (one date) that met data-quality objectives of the ENE protocol was used for these calculations. For the hexagon containing more than one trend station, both values were used in the spatially weighted average, with each receiving an equal portion of the hexagon area-weight. “--”, not applicable.]

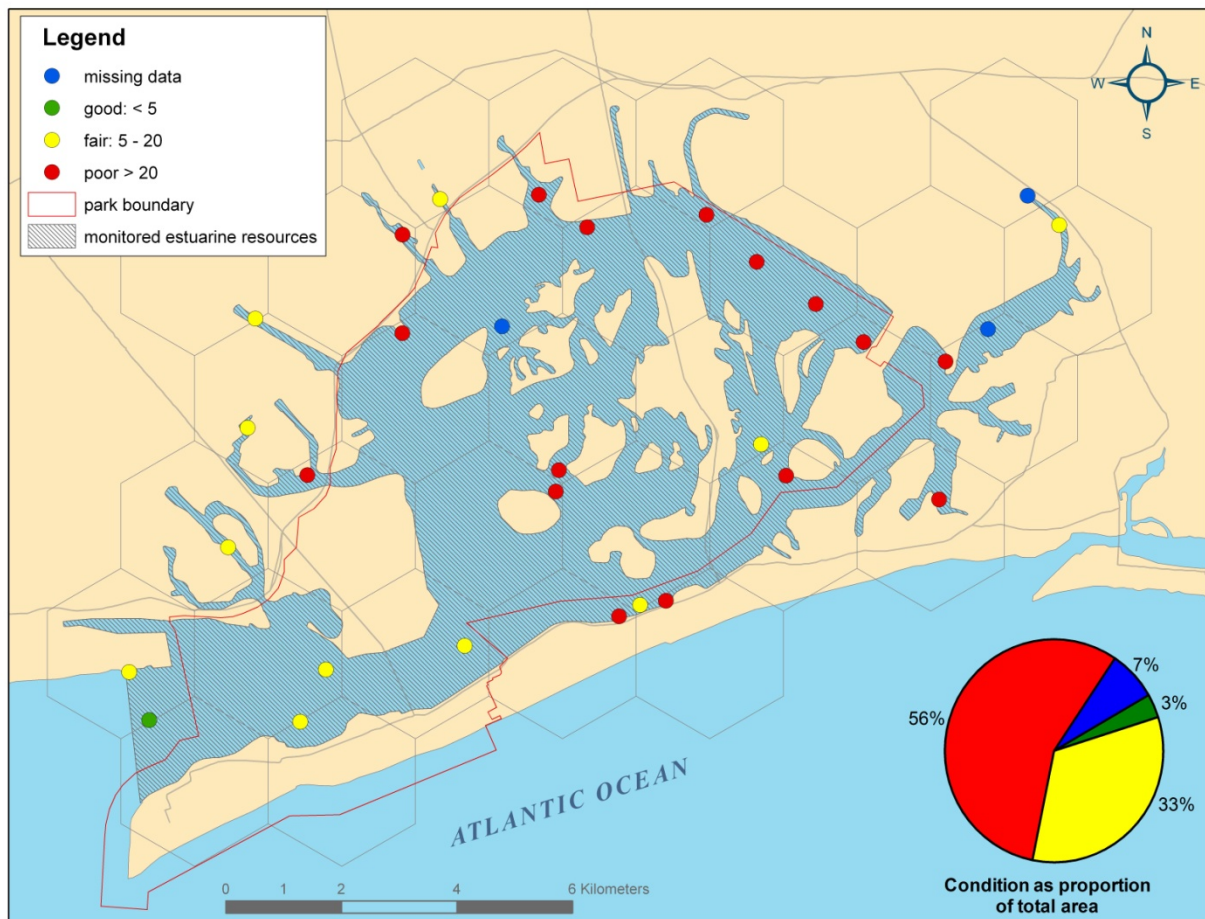


Figure 20. Chlorophyll *a* ($\mu\text{g/L}$) concentration in surface samples from the 2006 assessment at GATE. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

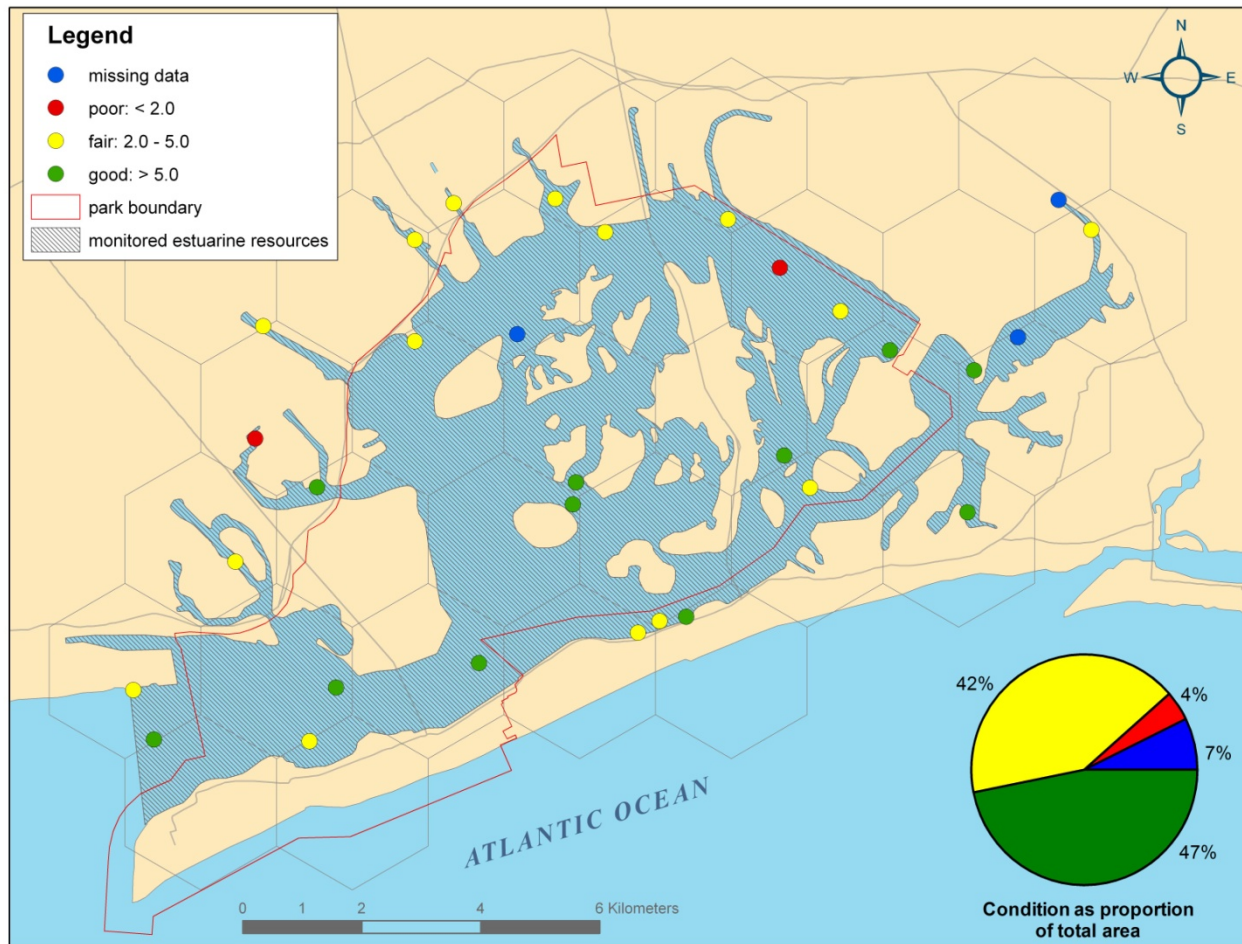


Figure 21. Dissolved-oxygen concentration (mg/L) in bottom water from the 2006 assessment at GATE. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

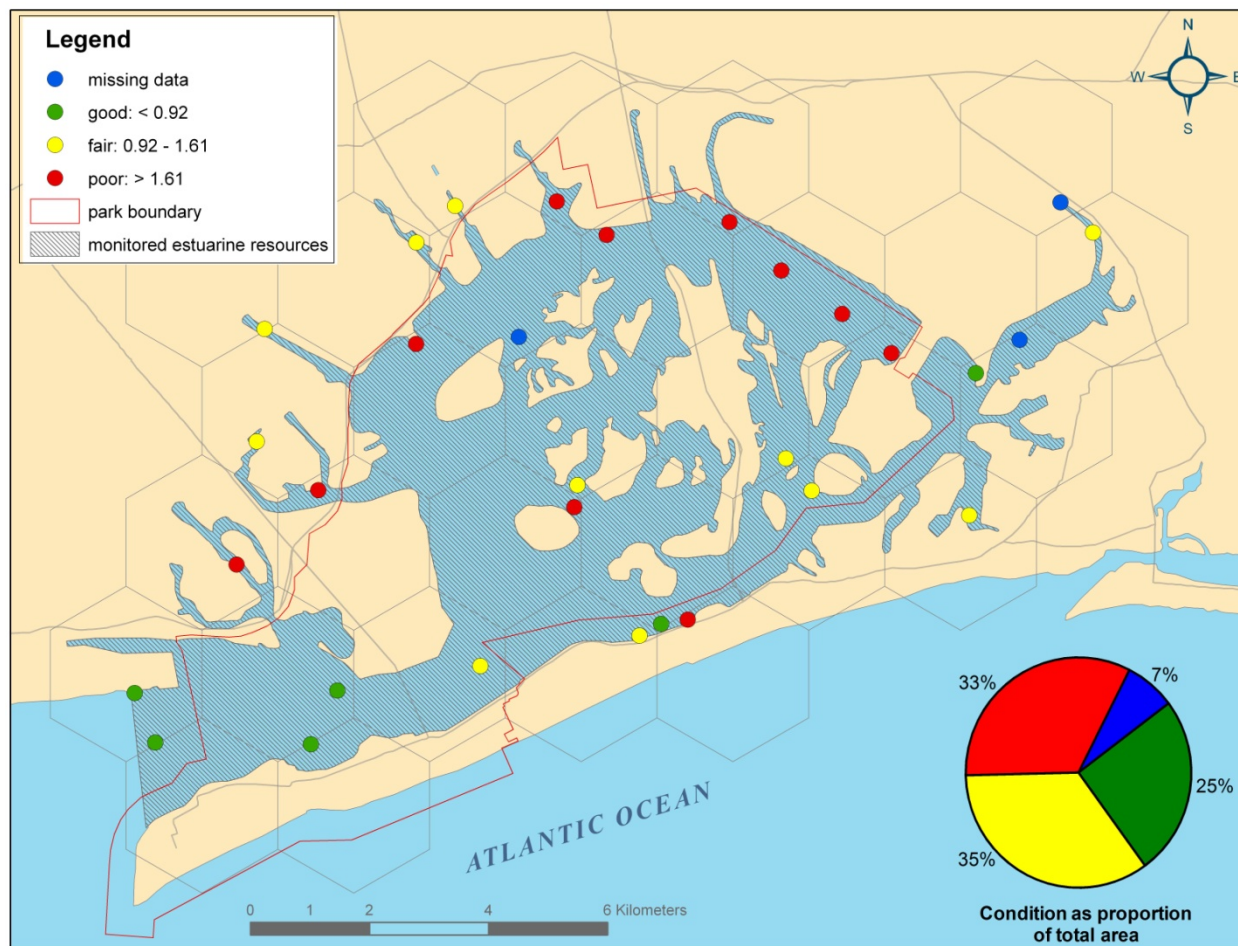


Figure 22. Attenuation coefficient of PAR, K_d (m^{-1}), from the 2006 assessment at GATE. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

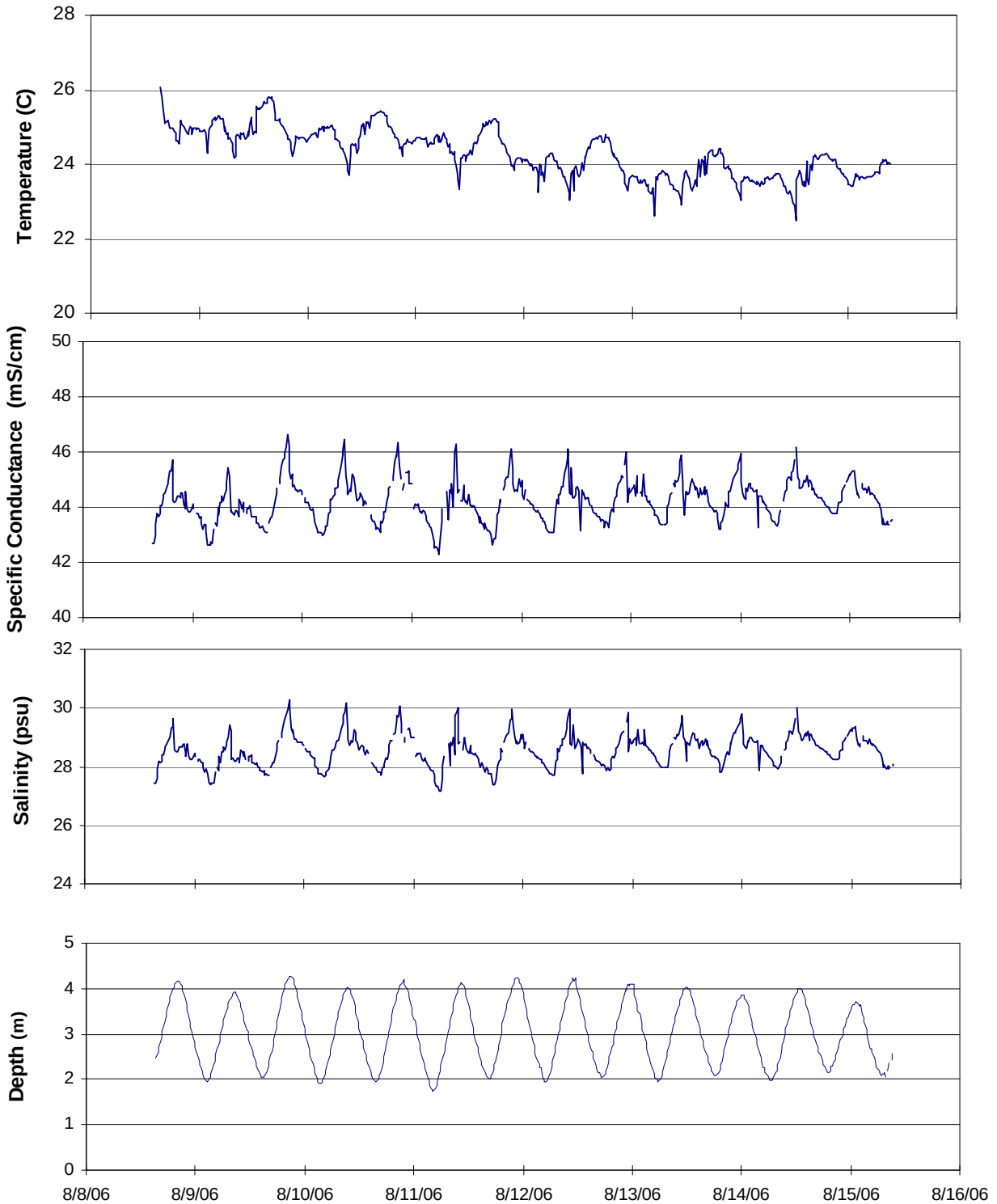


Figure 23. Continuous water-quality data from the 2006 assessment at GATE. All measurements were made using a YSI6600EDS multiparameter sonde with wiped LiCor PAR sensors following the NCBN ENE protocol (Kopp and Neckles 2009). Data were recorded every 15 minutes (solid blue traces). Daily K_d (◆) was calculated using integrated irradiance for the period within 3 hours of local apparent noon. Data from site visit for chlorophyll *a* and PAR attenuation (◆).

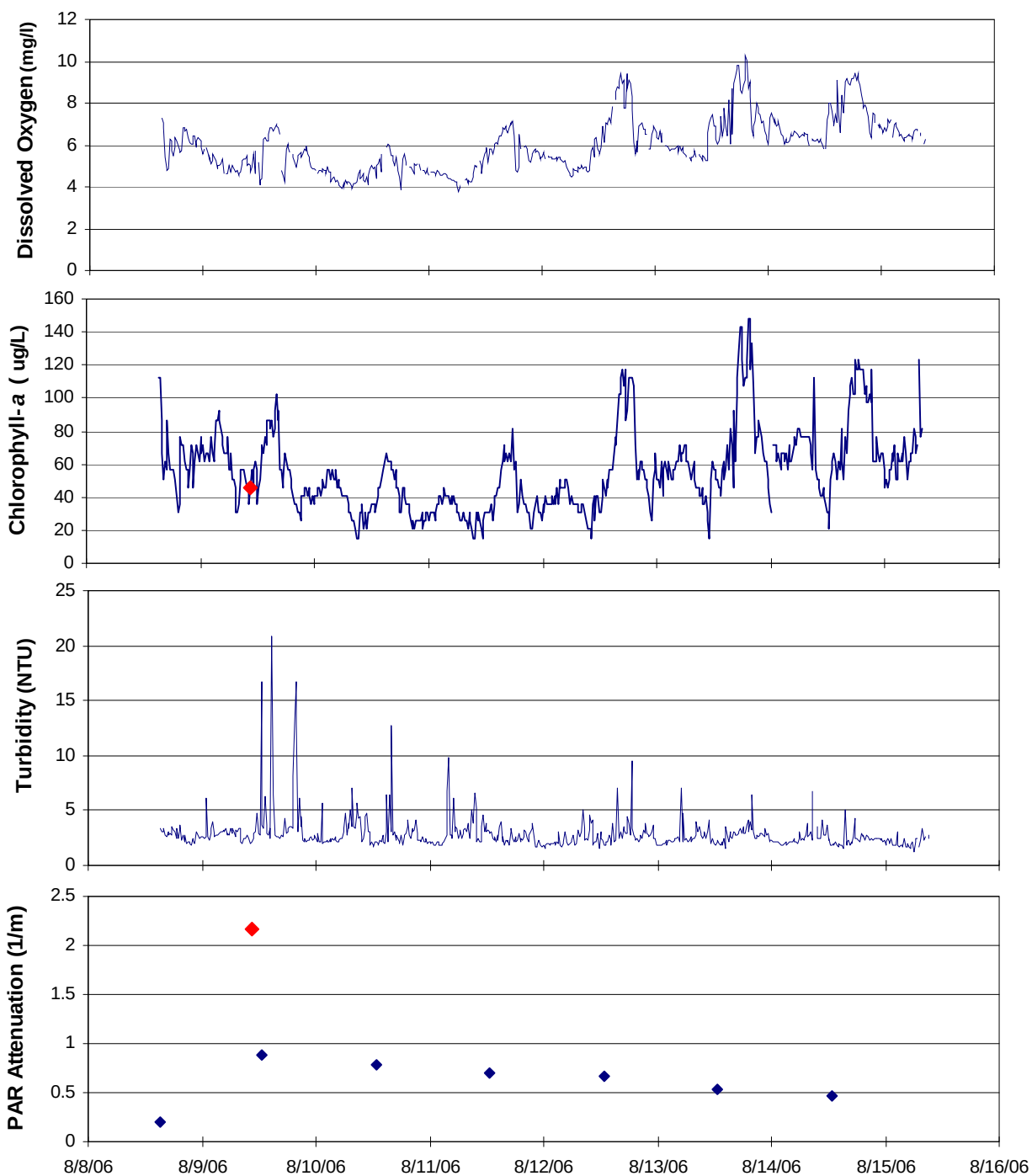


Figure 23 (continued). Continuous water-quality data from the 2006 assessment at GATE. All measurements were made using a YSI6600EDS multiparameter sonde with wiped LiCor PAR sensors following the NCBN ENE protocol (Kopp and Neckles 2009). Data were recorded every 15 minutes (solid blue traces). Daily K_d (♦) was calculated using integrated irradiance for the period within 3 hours of local apparent noon. Data from site visit for chlorophyll *a* and PAR attenuation (♦).

Table 12. Trend station water-quality data from the 2006 assessment at GATE.

Measure	Statistic	Trend stations (hexagons)										
		1	5	7	10	15	16	18	23	24a	24b	29
PAR	mean	0.69	1.06	1.15	2.95	1.51	1.68	2.01	1.81	3.16	1.72	1.36
Attenuation	std.dev.	0.26	0.53	0.47	2.77	0.43	0.72	1.07	0.71	3.47	0.55	0.64
K_d (m^{-1})	n	4	5	5	7	4	4	5	5	5	5	5
Temperature	mean	22.61	23.96	24.75	23.26	24.95	25.82	26.40	25.49	26.36	26.35	26.09
(°C)	std.dev.	1.50	1.90	1.89	2.75	2.20	3.13	3.09	2.48	2.81	2.76	2.75
	n	4	5	4	6	4	4	4	4	4	4	4
Specific	mean	45.04	44.41	42.18	42.81	42.31	42.47	40.43	41.27	39.49	40.47	38.88
Conductance	std.dev.	0.97	0.86	0.64	0.58	0.58	0.59	1.31	0.90	1.64	1.26	1.36
(mS/cm)	n	3	4	3	5	3	3	3	3	3	3	3
Salinity	mean	28.59	28.34	27.13	27.40	26.82	3.00	25.28	26.03	24.58	25.18	24.47
(psu)	std.dev.	1.30	0.97	0.41	0.55	0.80	0.43	1.34	0.96	1.51	1.53	0.97
	n	4	5	4	6	4	4	4	4	4	4	4
Dissolved	mean	80	83	59	66	61	104	60	49	24	36	45
Oxygen	std.dev.	17	13	41	27	14	38	34	15	8	19	20
(% saturation)	n	4	5	4	6	4	4	4	4	4	4	4
Dissolved	mean	5.8	6.0	5.8	6.0	4.3	7.3	4.0	3.5	1.7	2.6	3.2
Oxygen	std.dev.	1.2	0.8	1.8	1.8	1.0	2.5	2.8	1.1	0.6	1.4	1.4
(mg/L)	n	4	5	4	6	4	4	4	4	4	4	4
Turbidity	mean	1.3	2.0	2.1	2.5	2.6	4.1	2.9	58.5	3.2	2.9	3.1
(NTU)	std.dev.	0.6	0.7	1.3	0.7	0.7	1.4	1.4	110.5	1.6	1.4	1.1
	n	4	5	4	6	4	4	4	4	4	4	4
Chlorophyll <i>a</i>	mean	5.0	11.6	28.4	13.5	57.2	31.6	101.5	46.8	69.0	120.5	54.6
($\mu g/L$)	std.dev.	4.5	1.8	6.9	4.1	11.3	32.6	87.9	27.7	49.8	108.7	31.9
	n	2	2	2	4	2	2	2	2	2	2	2

[Values are means, standard deviations (std.dev.), and number of measurements (n) for all monitoring events at each trend station. K_d values are from water column profiles and chlorophyll *a* is from discrete water grab samples. Temperature, specific conductance, salinity, and turbidity are from near-surface readings of the sonde, whereas dissolved-oxygen readings were from the near-bottom. Location of hexagons with trend stations shown in Figure 5.]

Assateague Island National Seashore–2005

The majority of Vital Signs water-column measures are sampled at surface, mid-, and near-bottom water depths (dissolved-oxygen concentration, turbidity, salinity, temperature). For these measures, area-weighted average condition is calculated for each sampling depth. Chlorophyll *a* is measured from surface grab samples and PAR attenuation is calculated from a profile of PAR through the water column; for each of these measures, a single area-weighted average condition value is calculated (Table 13). For the hexagon containing two trend stations (# 27; Figure 6), both were used in the spatially weighted average, with each receiving an equal portion of the hexagon area-weight. The area-weighted average chlorophyll *a* concentration in the surface waters at ASIS was 20.8 µg/L (Table 13), with comparable proportions of the estuarine resource area falling into each of the “fair” (52 percent) and “poor” (46 percent) condition categories (Figure 24, Table 4). The area-weighted average near-bottom concentration of dissolved oxygen was 6.3 mg/L, or 93 percent of the saturation concentration (Table 13). Most (79 percent) of the estuarine resource area fell into the “good” condition class for dissolved oxygen, but a sizable portion (19 percent) was ranked only as “fair” (Figure 25, Table 4). PAR was very severely attenuated through the water column, with an area-weighted average attenuation coefficient (K_d) of 3.17 m⁻¹ (Table 13). For most of the estuarine resource area (95 percent), K_d fell into the “poor” condition classification (Figure 26). For the period of record with good data, all sonde metrics showed daily variability characteristic of estuaries and consistent with the spatial assessment data (Figure 27). Diurnal swings in dissolved-oxygen concentration showed, however, that routine pre-dawn decreases approached concentrations that may be stressful to some organisms. Characteristic temporal variability was observed for the repeat visits to trend stations (Table 14).

Table 13. Area-weighted average water quality condition at ASIS during the 2005 index period.

Measure	Water column	Surface	Mid-depth	Bottom
PAR attenuation (K_d)(m ⁻¹)	3.17	--	--	--
Dissolved oxygen (mg/L)	--	6.8	6.9	6.3
Dissolved oxygen (% saturation)	--	102	103	93
Chlorophyll <i>a</i> (µg/L)	--	20.8	--	--
Turbidity (NTU)	--	19.0	22.6	32.5
Temperature (°C)	--	28.94	28.20	27.95
Salinity (psu)	--	26.62	26.57	26.71

[Reported values are means of measurements from probability and trend stations located within 30 tessellated hexagons. Each measure is weighted by the estuarine area within the respective hexagon. For trend stations, only the first data set (one date) that met data-quality objectives of the ENE protocol was used for these calculations. “--”, not applicable.]

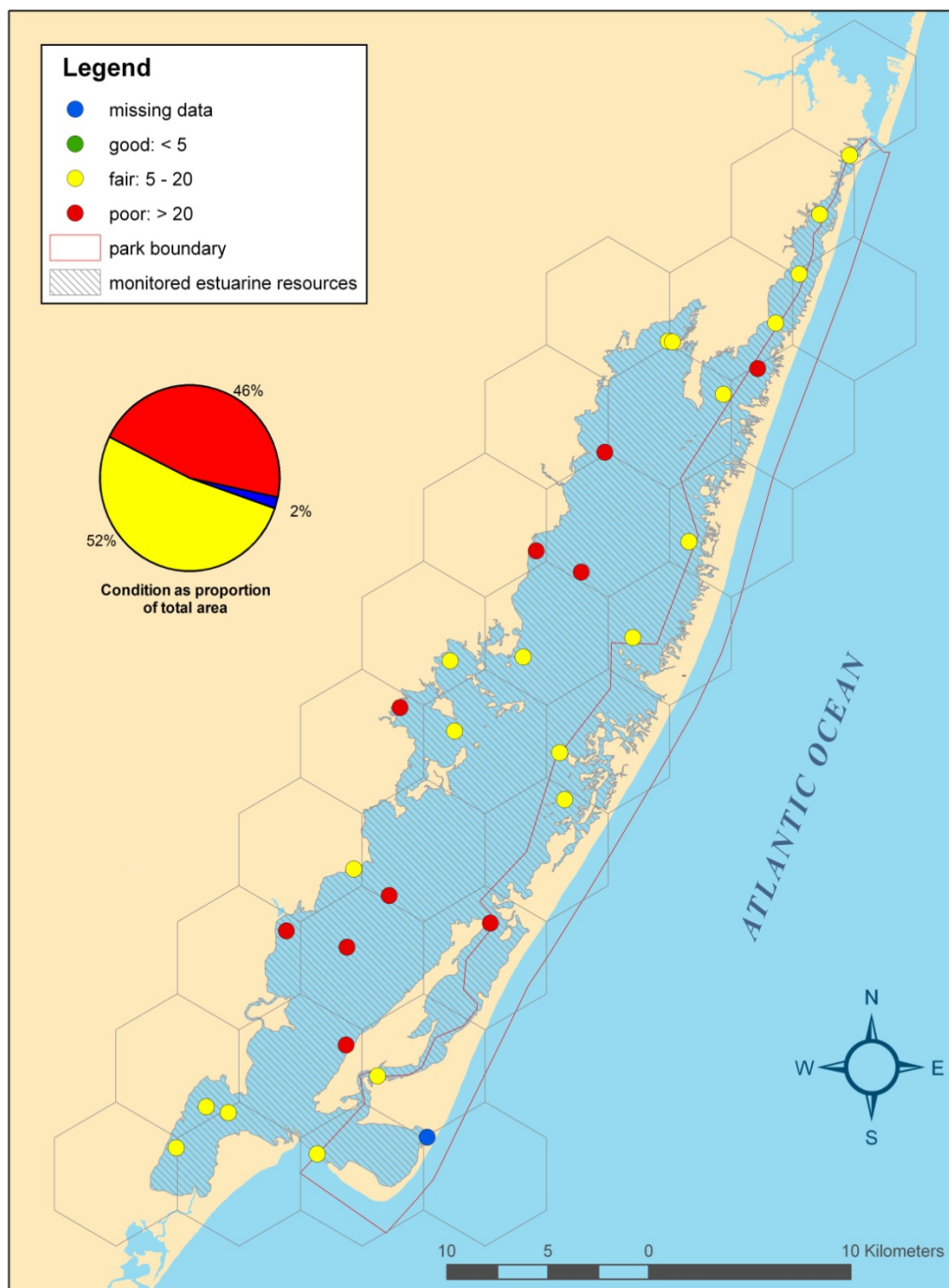


Figure 24. Chlorophyll *a* ($\mu\text{g/L}$) concentration in surface samples from the 2005 assessment at ASIS. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

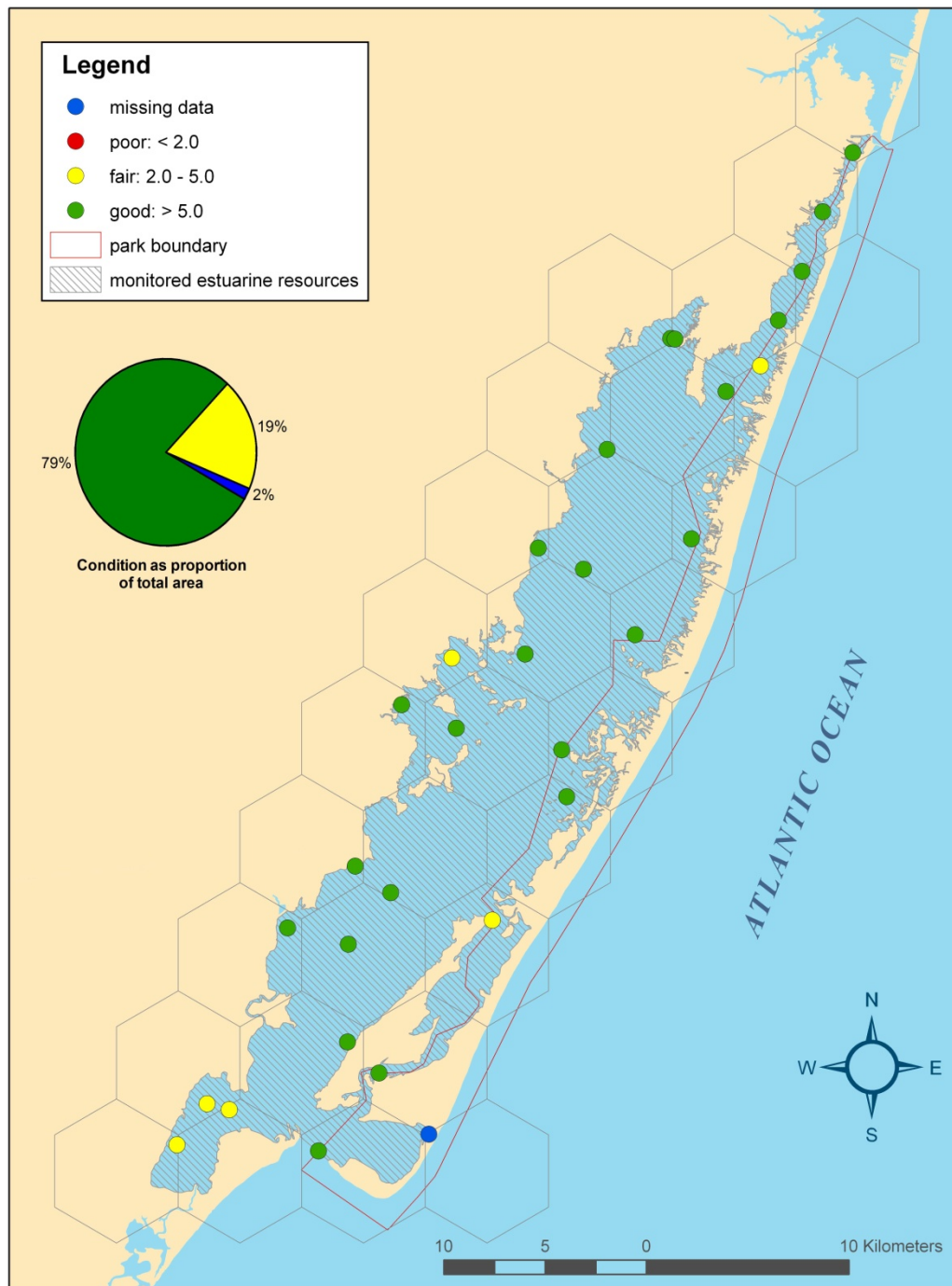


Figure 25. Dissolved-oxygen concentration (mg/L) in bottom water from the 2005 assessment at ASIS. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

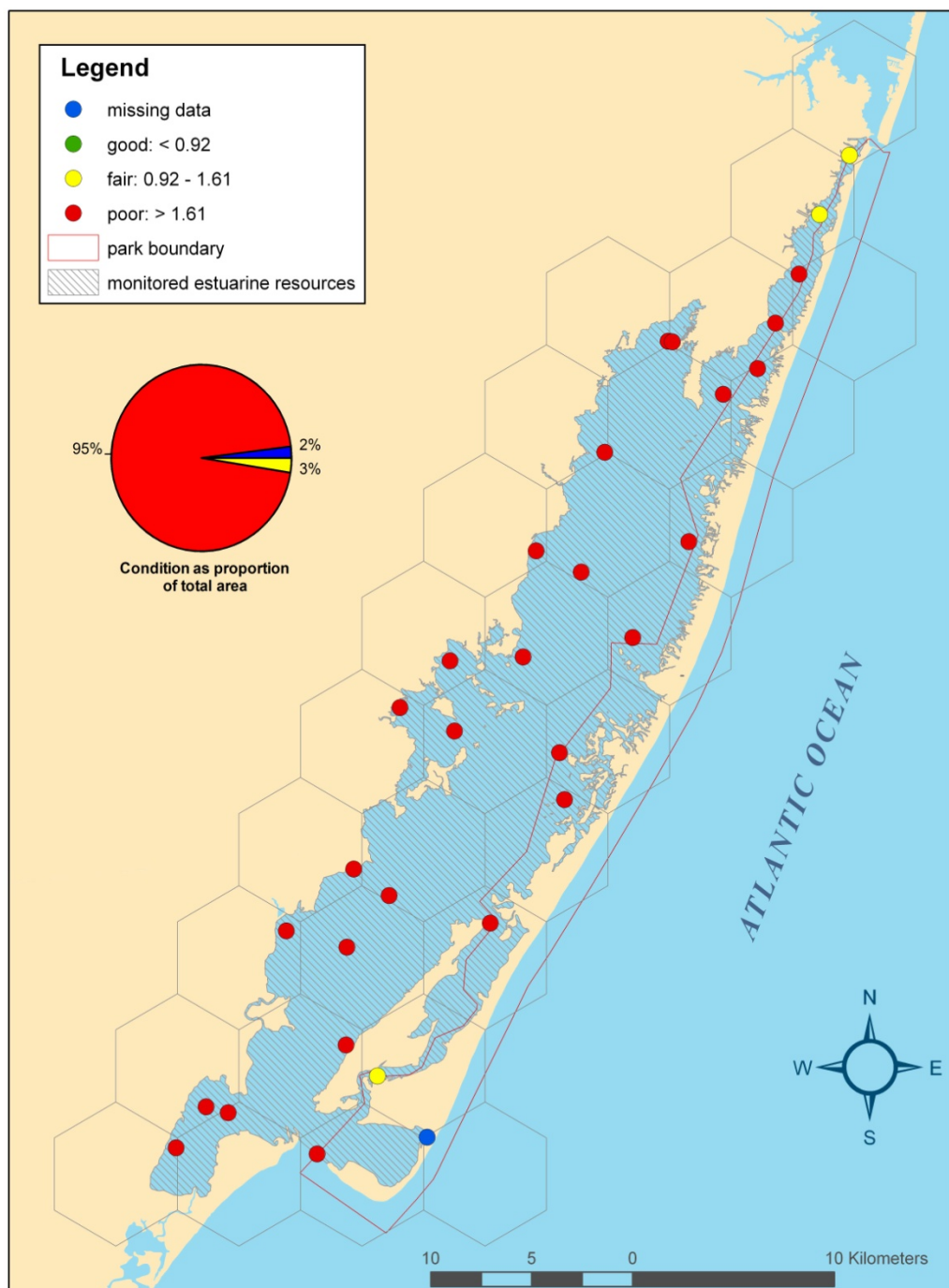


Figure 26. Attenuation coefficient of PAR, K_d (m^{-1}), from the 2005 assessment at ASIS. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

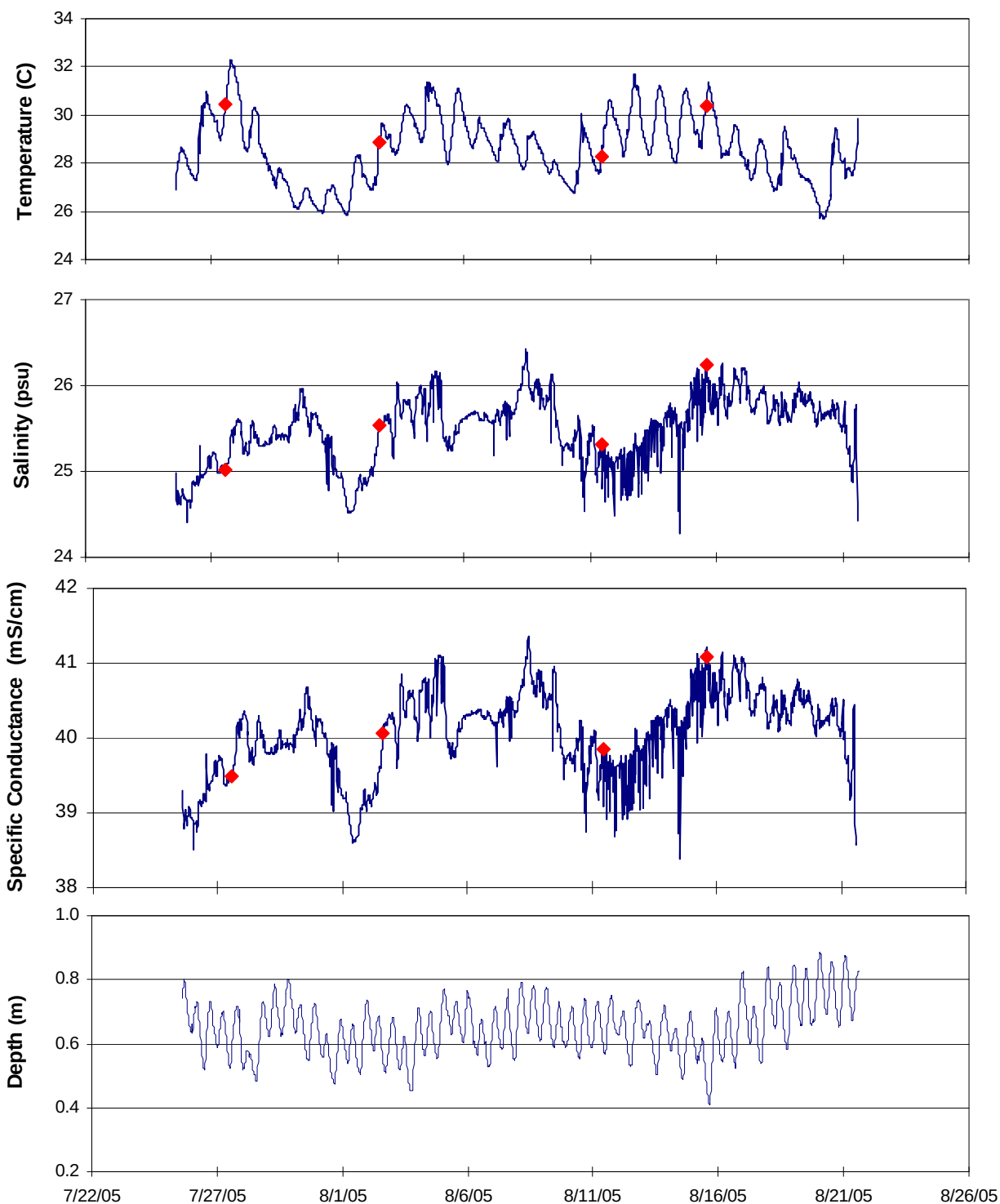


Figure 27. Continuous water-quality data from the 2005 assessment at ASIS. All measurements were made using a YSI6600EDS multiparameter sonde with wiped LiCor PAR sensors following the NCBN ENE protocol (Kopp and Neckles 2009). Data were recorded every 15 minutes (solid blue traces). Daily K_d (◆) was calculated using integrated irradiance for the period within 3 hours of local apparent noon. Data were corrected for drift using post-deployment calibration checks and independent measurements made during site visits (♦).

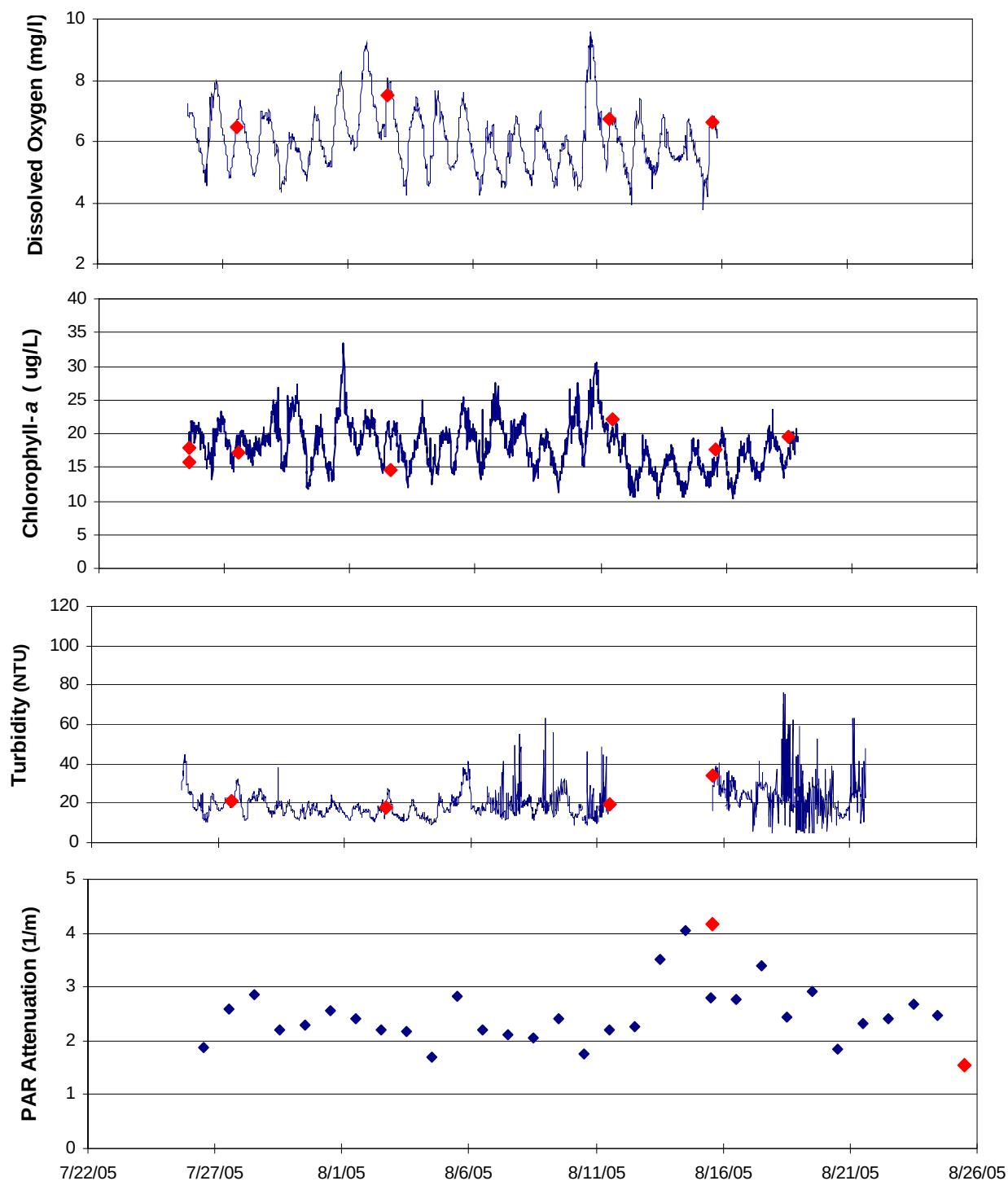


Figure 27 (continued). Continuous water-quality data from the 2005 assessment at ASIS. All measurements were made using a YSI6600EDS multiparameter sonde with wiped LiCor PAR sensors following the NCBN ENE protocol (Kopp and Neckles 2009). Data were recorded every 15 minutes (solid blue traces). Daily K_d (♦) was calculated using integrated irradiance for the period within 3 hours of local apparent noon. Data were corrected for drift using post-deployment calibration checks and independent measurements made during site visits (♦).

Table 14. Trend-station water-quality data from the 2005 assessment at ASIS.

Measure	Statistic	Trend stations (hexagons)												
		6	7	10	11	13	15	19	20	24	27a	27b	29	30
PAR Attenuation K_d (m^{-1})	mean	2.77	2.42	4.05	4.35	2.23	4.03	2.00	4.76	2.96	2.64	3.34	1.75	1.64
	std.dev.	0.40	0.95	0.99	0.68	0.12	1.16	0.21	0.40	0.58	0.58	0.53	0.94	1.10
	n	4	4	4	4	3	4	4	3	4	4	3	3	3
Temperature (°C)	mean	26.79	28.17	29.45	29.19	28.75	28.63	29.09	29.46	29.62	28.60	29.80	27.87	25.49
	std.dev.	0.28	1.19	0.51	0.55	0.90	0.98	0.95	1.57	0.92	1.08	1.41	1.35	2.59
	n	4	4	4	4	4	4	4	4	4	4	4	4	4
Specific Conductance ($mS\ cm^{-1}$)	mean	45.65	45.84	46.26	43.91	42.88	40.79	40.71	36.96	39.31	40.34	34.50	42.28	43.94
	std.dev.	0.81	0.75	0.82	0.47	0.87	1.13	0.35	1.39	0.68	1.15	1.95	2.14	2.35
	n	4	4	4	4	4	4	4	4	4	4	4	4	4
Salinity (psu)	mean	29.53	29.63	29.89	28.20	27.48	26.00	25.92	23.28	24.93	25.68	21.60	27.08	28.32
	std.dev.	0.59	0.54	0.58	0.35	0.61	0.81	0.22	0.95	0.47	0.84	1.30	1.56	1.74
	n	4	4	4	4	4	4	4	4	4	4	4	4	4
Dissolved Oxygen (% saturation)	mean	86	88	69	98	92	84	93	84	77	95	88	96	90
	std.dev.	14	10	11	16	17	17	13	15	16	12	46	11	15
	n	3	3	3	3	3	3	3	3	3	3	3	3	3
Dissolved Oxygen (mg/L)	mean	5.8	5.9	4.5	6.4	6.2	5.7	6.2	5.7	5.2	6.4	6.0	6.5	6.2
	std.dev.	0.9	0.7	0.7	1.0	1.3	1.2	0.7	1.0	1.1	0.9	3.1	0.9	1.2
	n	3	3	3	3	3	3	3	3	3	3	3	3	3
Turbidity (NTU)	mean	26.9	16.0	25.5	32.6	11.3	25.6	9.7	27.2	15.8	13.7	19.0	9.9	7.4
	std.dev.	8.3	8.2	7.8	6.4	1.7	11.1	1.0	4.4	2.8	4.4	5.8	4.2	6.9
	n	4	4	4	4	4	4	4	4	4	4	4	4	4
Chlorophyll <i>a</i> ($\mu g/L$)	mean	18.2	15.2	22.4	24.2	11.5	22.4	10.2	21.7	20.1	19.0	24.2	12.1	8.4
	std.dev.	3.4	3.2	11.7	6.2	2.4	5.6	1.3	5.1	3.4	8.2	13.7	5.3	6.2
	n	4	4	4	4	4	4	4	4	9		9	5	5

[Values are means, standard deviations (std.dev.), and number of measurements (n) for all monitoring events at each trend station. K_d values are from water column profiles and chlorophyll *a* is from discrete water grab samples. Temperature, specific conductance, salinity, and turbidity are from near-surface readings of the sonde, whereas dissolved-oxygen readings were from the near-bottom. Location of hexagons with trend stations shown in Figure 6.]

Colonial National Historic Park–2003

The majority of Vital Signs water-column measures are sampled at surface, mid-, and near-bottom water depths (dissolved-oxygen concentration, turbidity, salinity, temperature). For these measures, area-weighted average condition is calculated for each sampling depth. Chlorophyll *a* is measured from surface grab samples and PAR attenuation is calculated from a profile of PAR through the water column; for each of these measures, a single area-weighted average condition value is calculated (Table 15). The area-weighted average chlorophyll *a* concentration in the surface waters at COLO was 32.2 µg/L (Table 15), with all of the estuarine resource area falling into the “poor” (85 percent) and “fair” (15 percent) condition categories (Figure 28, Table 4). The area-weighted average near-bottom concentration of dissolved oxygen was 7.6 mg/L, or 99 percent of the saturation concentration (Table 15); all (100 percent) of the estuarine resource area fell into the “good” condition class for this metric (Figure 29, Table 4). PAR was very severely attenuated through the water column, with an area-weighted average attenuation coefficient (K_d) of 3.36 m⁻¹ (Table 15). For 6 percent of the estuarine resource area, K_d either was not successfully measured, or the values obtained did not meet the data-quality objective of the protocol. Of the remaining 94 percent, all fell into the “poor” condition classification (Figure 30). Continuous monitoring at the logging station yielded very good data except for a few periods when the chlorophyll sensor became severely biofouled (Figure 31). For the period of record, all sonde metrics showed daily variability characteristic of estuaries and consistent with the spatial assessment data. Characteristic temporal variability was also observed for the repeat visits to trend stations (Table 16).

Table 15. Area-weighted average water quality condition at COLO during the 2003 index period.

Measure	Water column	Surface	Mid-depth	Bottom
PAR attenuation (K_d m ⁻¹)	3.36	--	--	--
Dissolved oxygen (mg/L)	--	7.7	7.7	7.6
Dissolved oxygen (% saturation)	--	101	100	99
Chlorophyll <i>a</i> (µg/L)	--	32.2	--	--
Turbidity (NTU)	--	33.1	37.2	41.1
Temperature (°C)	--	28.81	28.64	28.36
Salinity (psu)	--	0.35	0.38	0.43

[Reported values are means of measurements from 24 probability and 6 trend stations located within 30 tessellated hexagons. Each measure is weighted by the estuarine area within the respective hexagon. For trend stations, only the first data set (one date) that met data-quality objectives of the ENE protocol was used for these calculations. “--”, not applicable.]

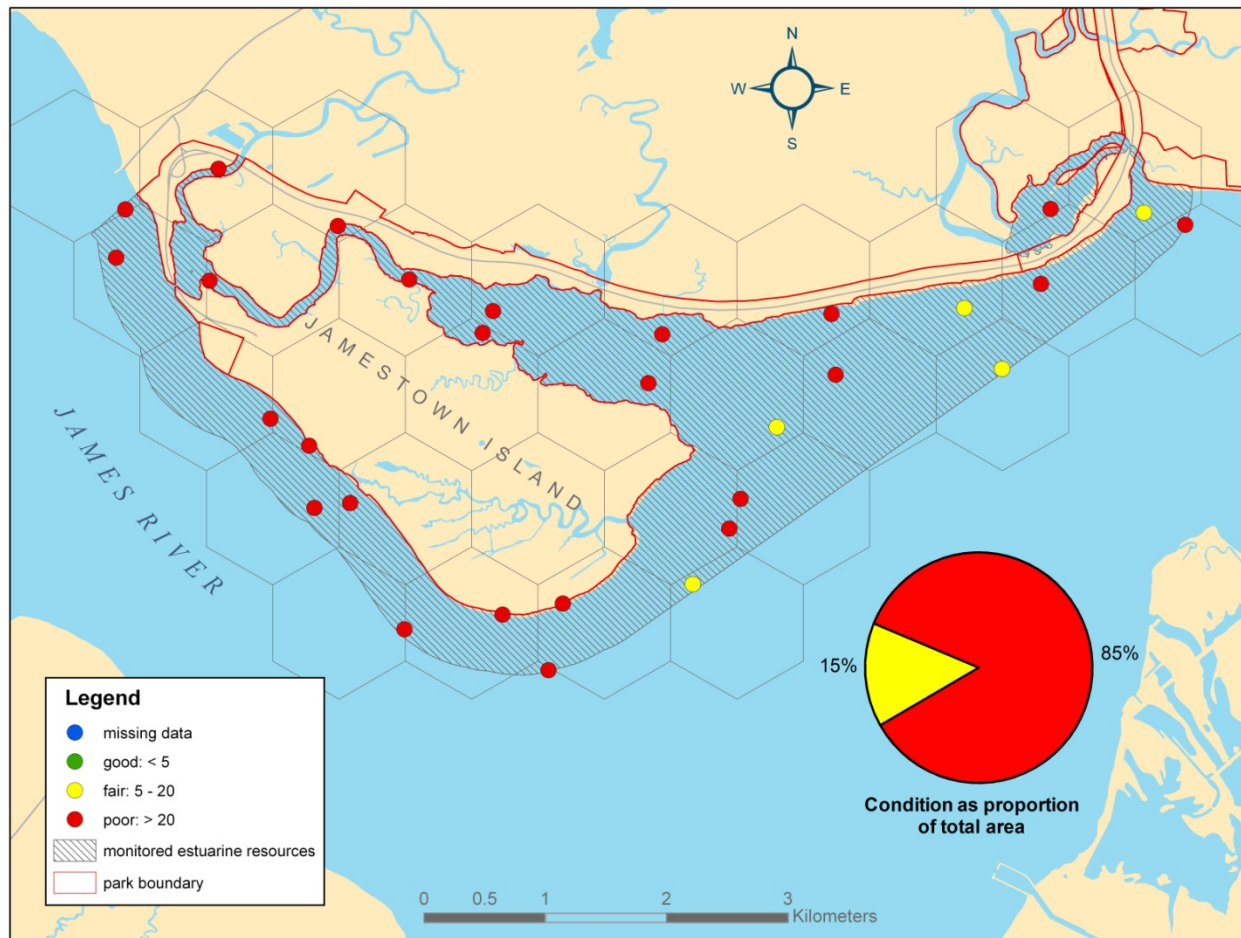


Figure 28. Chlorophyll *a* ($\mu\text{g/L}$) concentration in surface samples from the 2003 assessment at COLO. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

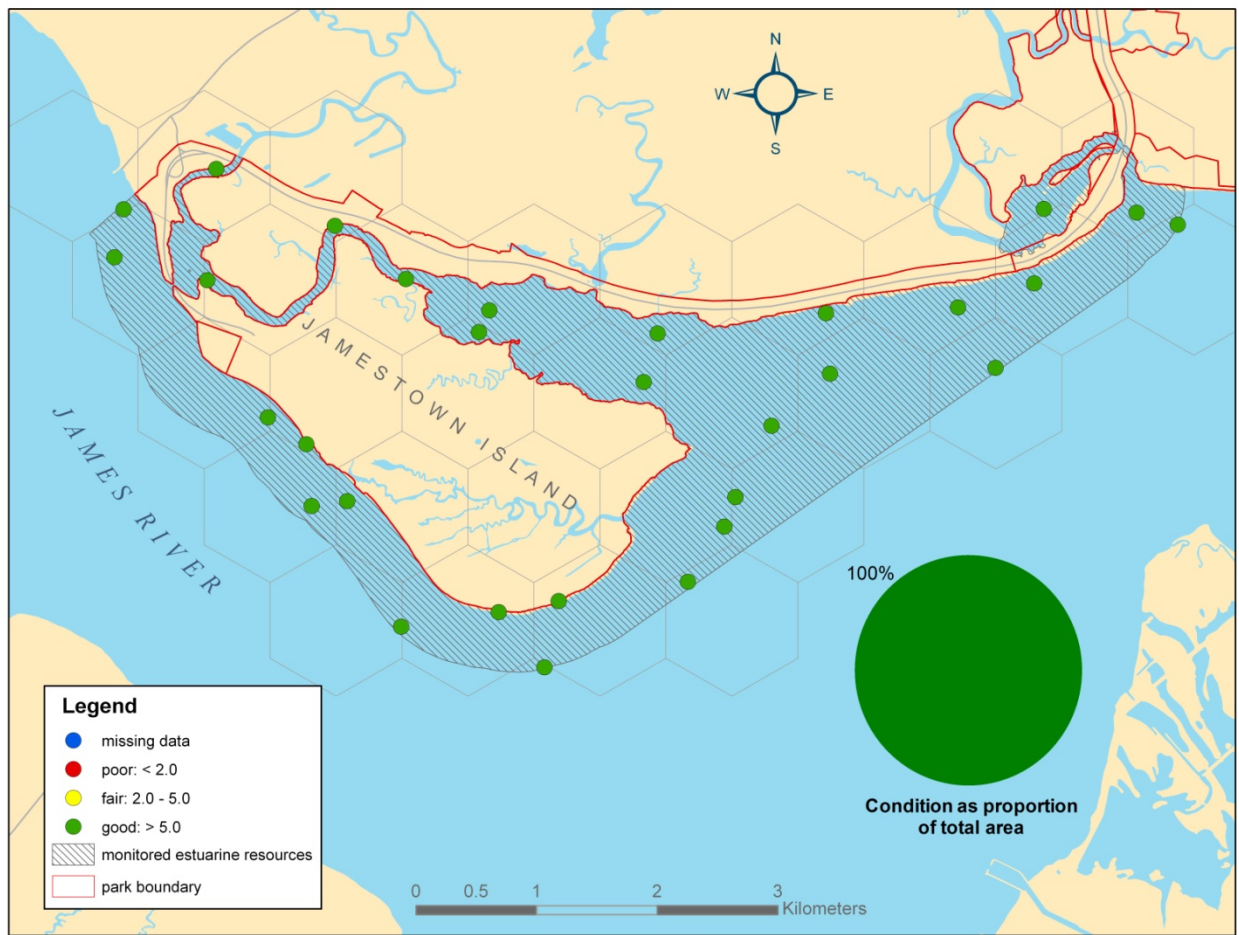


Figure 29. Dissolved-oxygen concentration (mg/L) in bottom water from the 2003 assessment at COLO. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

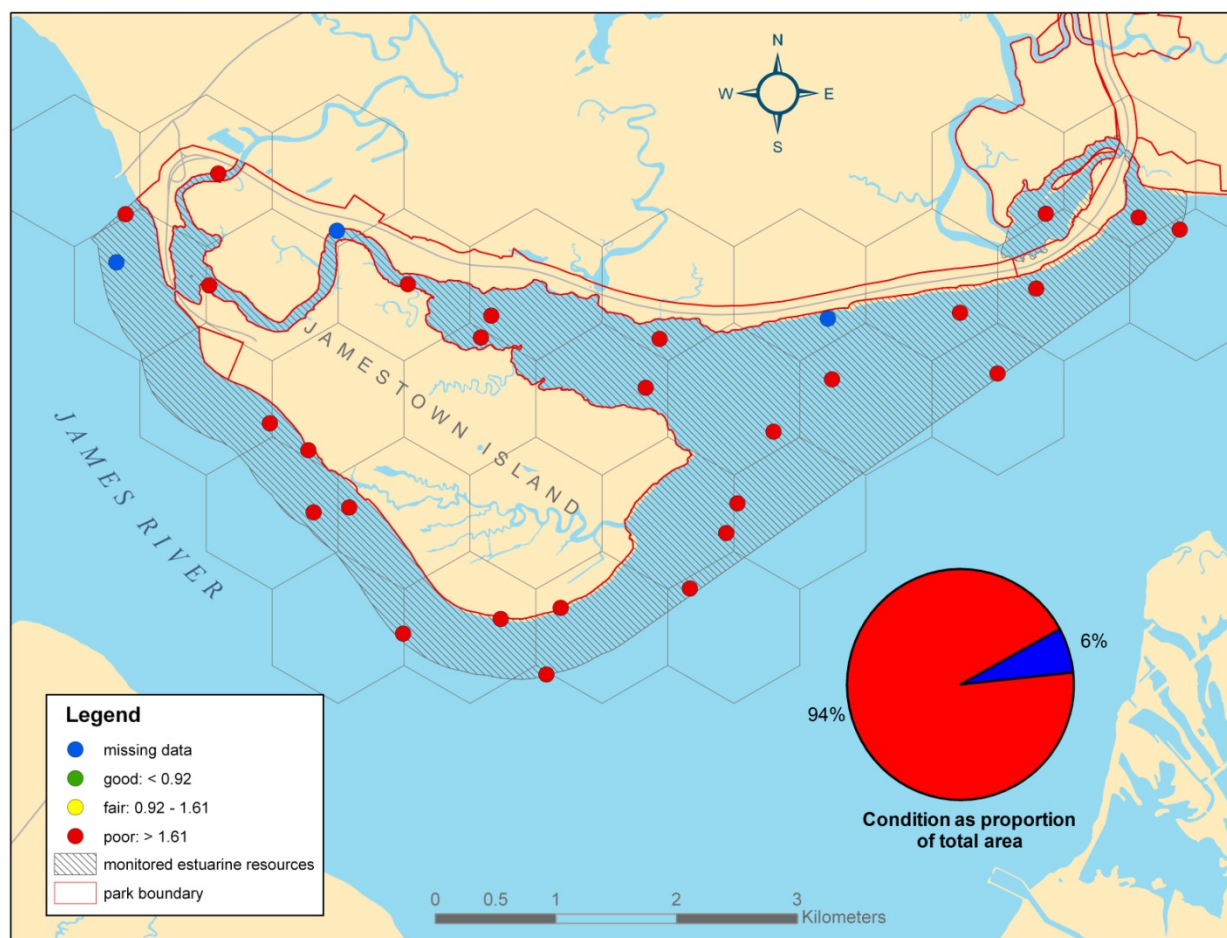


Figure 30. Attenuation coefficient of PAR, K_d (m^{-1}), from the 2003 assessment at COLO. Station icons are color coded based on threshold criteria for good (green), fair (yellow), or poor (red) conditions (see Table 4) as adopted by the NPS NCBN. For trend stations, the value reported is from the first visit generating data meeting ENE data-quality objectives. Missing values (blue) either were never measured or were rejected during data-reduction steps because they failed to meet data-quality objectives. The pie chart shows the proportion (area) of monitored estuarine resources falling into each category.

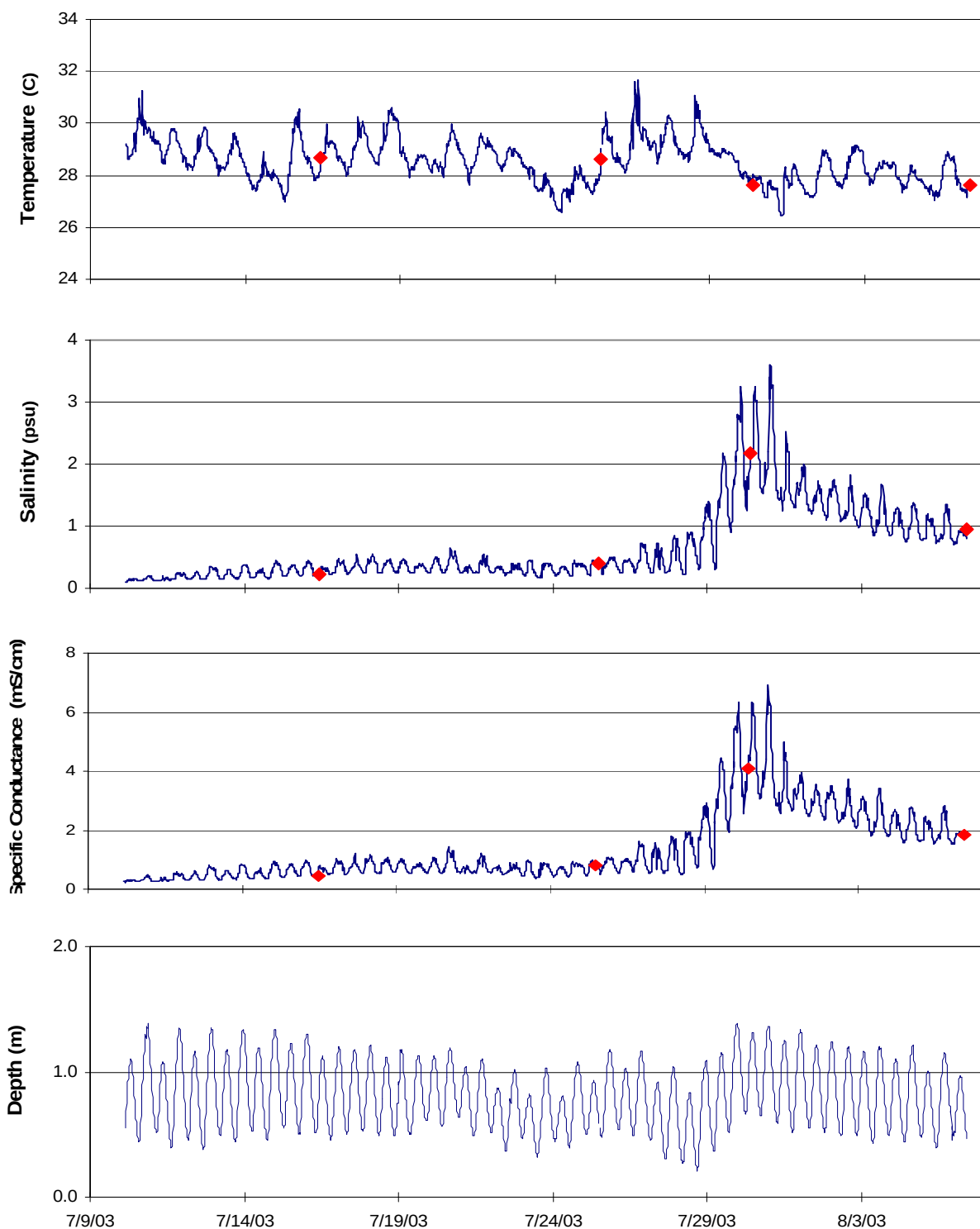


Figure 31. Continuous water-quality data from the 2003 assessment at COLO. PAR was logged using LiCor sensors and a Li-1400 data logger; all other values were collected using a YSI6600EDS multiparameter sonde. Data were recorded every 15 minutes (solid blue traces). Daily K_d (◆) was calculated using integrated irradiance for the period within 3 hours of local apparent noon. Data were corrected for drift using post-deployment calibration checks and independent measurements made during site visits (◆).

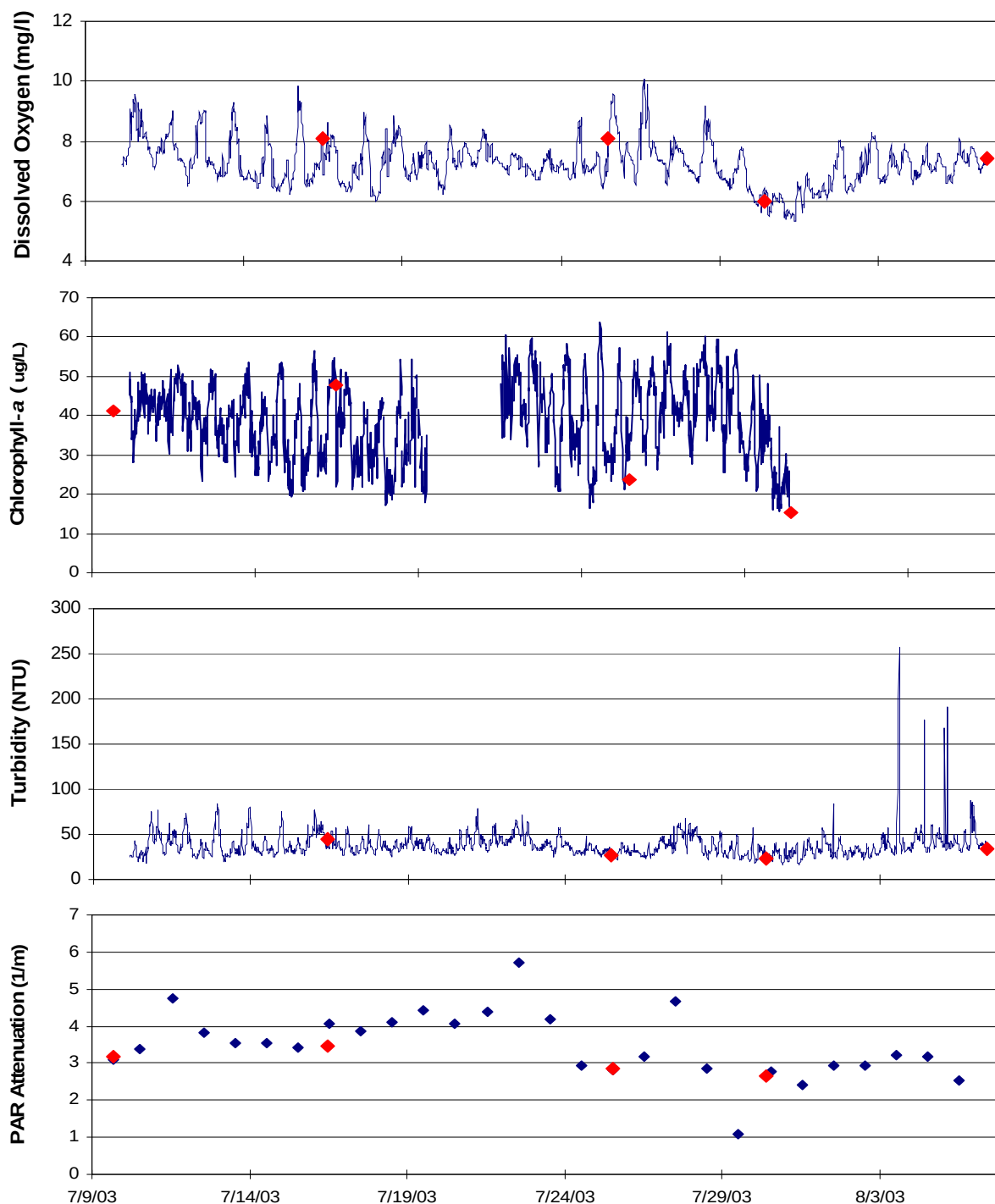


Figure 31 (continued). Continuous water-quality data from the 2003 assessment at COLO. PAR was logged using LiCor sensors and a Li-1400 data logger; all other values were collected using a YSI6600EDS multiparameter sonde. Data were recorded every 15 minutes (solid blue traces). Daily K_d (◆) was calculated using integrated irradiance for the period within 3 hours of local apparent noon. Data were corrected for drift using post-deployment calibration checks and independent measurements made during site visits (◆).

Table 16. Trend station water-quality data from the 2003 assessment at COLO.

Measure	Statistic	Trend stations (hexagons)					
		1	10	15	18	20	29
PAR attenuation K_d (m^{-1})	mean	3.95	2.87	2.95	3.44	3.34	3.61
	std.dev.	1.11	0.29	0.33	0.34	0.56	0.37
	n	4	4	4	4	4	4
Temperature (°C)	mean	28.44	28.20	28.87	27.76	28.50	28.66
	std.dev.	0.40	0.55	0.66	0.98	1.22	1.16
	n	4	4	4	4	4	4
Specific conductance (mS/cm)	mean	1.10	0.58	1.35	0.30	0.28	1.09
	std.dev.	1.47	0.76	1.64	0.24	0.11	1.47
	n	4	4	4	4	4	4
Salinity (psu)	mean	0.56	0.29	0.69	0.14	0.13	0.56
	std.dev.	0.77	0.39	0.87	0.12	0.05	0.77
	n	4	4	4	4	4	4
Dissolved oxygen (% saturation)	mean	90	96	94	97	99	95
	std.dev.	12	16	16	21	19	16
	n	4	4	4	4	4	4
Dissolved oxygen (mg/L)	mean	7.0	7.5	7.3	7.6	7.7	7.3
	std.dev.	1.0	1.2	1.2	1.5	1.3	1.2
	n	4	4	4	4	4	4
Turbidity (NTU)	mean	45.2	38.4	43.5	107.6	26.2	42.6
	std.dev.	14.4	30.1	39.1	163.0	8.2	17.8
	n	4	4	4	4	4	4
Chlorophyll <i>a</i> ($\mu g/L$)	mean	25.5	29.7	21.7	43.7	44.3	38.8
	std.dev.	9.5	7.3	5.1	3.3	5.3	10.2
	n	4	4	4	4	4	4

[Values are means, standard deviations (std.dev.), and number of measurements (n) for all monitoring events at each trend station. K_d values are from water column profiles and chlorophyll *a* is from discrete water grab samples. Temperature, specific conductance, salinity, and turbidity are from near-surface readings of the sonde, whereas dissolved-oxygen readings were from the near-bottom. Location of hexagons with trend stations shown in Figure 7.]

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Appendixes

Appendix 1. FIIS station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
1	7/28/2003	12:11	1.0~	40.6398	-73.2210	1.36	0.99 ^d	1.3	s	22.95	43.86	28.31	116.7	8.51	3.2
									m	22.95	43.87	28.32	110.3	8.05	3.0
									b	22.94	43.87	28.32	109.1	7.96	3.1
2	8/5/2003	11:20	3.0~	40.6422	-73.1801	1.12	0.99		s	25.80	41.08	26.27	245.7	17.25	2.1
									m	24.74	43.15	27.77	172.0	12.19	5.9
									b	24.91	42.95	27.62	216.5	15.32	5.7
3	8/11/2003	12:11	0.5~	40.6518	-73.2142	0.82	0.90	2.1	smb	24.94	29.04	18.61	127.7	9.44	4.1
4	8/18/2003	13:15	1.2~	40.6476	-73.1860	1.08	0.99	0.9	smb	24.84	42.99	27.65	121.1	8.58	0.2
6	7/28/2003	13:33	0.7~	40.6547	-73.1316	1.85	0.98 ^c	0.3	smb	26.59	39.39	25.06	144.4	10.07	5.0
8	8/11/2003	13:11	0.7~	40.6610	-73.1857	2.23	0.94	0.9	smb	26.10	40.59	25.92	166.1	11.63	13.1
9	8/18/2003	14:21	3.0~	40.6597	-73.1217	1.32	0.98	1.1	s	25.68	36.85	23.47	148.0	10.57	22.9
									m	25.63	39.89	25.43	147.5	10.44	4.9
									b	25.61	39.93	25.46	149.7	10.59	7.0

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 1 (continued). FIIS station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
11	7/28/2003	14:08	1.0~	40.6747	-73.0450	1.52	0.95 ^b	1.1	smb	25.73	35.37	22.26	121.8	8.76	7.8
12	8/5/2003	12:15	1.5~	40.6809	-73.0302	1.19	0.99 ^c		smb	25.52	35.13	22.09	229.4	16.57	3.5
13	8/11/2003	14:00	1.7~	40.6806	-73.0433	1.65	0.99	1.7	s	26.68	34.95	21.95	165.9	11.75	8.2
									m	26.45	34.98	21.97	163.4	11.62	13.0
									b	26.27	34.99	21.98	157.8	11.26	9.1
14	8/19/2003	12:45	1.0~	40.6930	-72.9997	1.50	0.97	0.6	smb	26.27	33.87	21.20	133.2	9.54	6.7
15	7/28/2003	14:41	0.7~	40.7003	-72.9766	-	- ^e	1.0	smb	25.95	34.36	21.55	124.0	8.91	3.0
16	7/28/2003	15:04	1.0~	40.7020	-72.9815	1.60	1.00	0.5	smb	26.02	34.58	21.70	124.2	8.91	4.0
17	8/11/2003	17:16	0.7~	40.7054	-72.9754			1.1	smb	27.45	34.07	21.33	158.0	11.09	15.0

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 1 (continued). FIIS station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
18	8/11/2003	20:01	1.0~	40.7149	-72.9423			0.6	smb	27.58	34.14	21.37	163.8	11.46	4.3
19	8/19/2003	13:50	0.7~	40.7232	-72.9302	1.62	0.94 ^d	1.1	smb	26.14	31.02	19.25	146.3	10.62	1.5
21	7/28/2003	16:00	0.5~	40.7386	-72.8925	2.07	1.00 ^a	2.0	smb	27.38	28.90	17.78	159.3	11.42	5.5
22	8/11/2003	19:30	4.5~	40.7415	-72.8523			2.3	s	27.09	32.15	20.01	155.1	11.03	6.6
									m	27.10	32.13	20.00	155.2	11.04	6.8
									b	27.11	32.04	19.93	151.3	10.76	262.9
23	8/11/2003	19:40	1.0~	40.7419	-72.8938			2.3	smb	27.39	30.10	18.60	151.4	10.80	98.9
24	8/19/2003	15:13	2.5~	40.7385	-72.8604	1.50	0.99	1.2	s	26.46	31.87	19.82	134.6	9.69	1.0
									m	25.78	34.46	21.62	120.7	8.70	22.1
									b	25.94	34.36	21.55	128.8	9.26	16.7
26	7/28/2003	16:41	0.7~	40.7556	-72.8117	2.78	0.99 ^a	1.2	smb	27.09	32.74	20.41	158.84	11.27	11.44

~ Depth approximated from chart and/or sonde data.

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^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 1 (continued). FIIS station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
27	8/11/2003	18:42	0.7 [~]	40.7652	-72.8017	-	- ^{ac}	1.6	smb	26.41	39.16	24.90	120.35	8.43	56.64
28	8/11/2003	18:21	3.5 [~]	40.7767	-72.7775	-	- ^{ac}	0.4	s	18.84	47.29	30.83	110.08	8.53	2.26
									m	18.84	47.28	30.83	109.80	8.51	2.85
									b	18.84	47.20	30.76	109.94	8.52	73.21
29	8/19/2003	16:37	0.5 [~]	40.7783	-72.7562	0.48	1.00 ^{ad}	0.3	smb	24.63	46.86	30.45	137.05	9.59	1.00

[~] Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 1 (continued). FIIS station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
5	8/5/2003	10:32	5.5 [~]	40.6498	-73.1816	1.21	0.99		s	25.46	38.73	24.62	167.2	11.92	3.0
									m	25.44	39.85	25.40	198.8	14.11	2.7
									b	25.33	40.97	26.20	160.4	11.36	6.3
5	8/11/2003	12:34	6.3 [~]	40.6498	-73.1816	1.16	0.99	1.0	s	25.45	41.32	26.45	150.4	10.61	3.0
									m	25.26	41.51	26.59	148.2	10.48	3.4
									b	25.10	41.63	26.68	145.1	10.29	111.3
5	8/18/2003	13:38	6.0 [~]	40.6498	-73.1816	0.98	1.00	2.1	s	25.00	40.89	26.29	101.3	7.21	2.5
									m	24.82	43.21	27.82	102.1	7.23	0.5
									b	24.78	43.27	27.86	102.7	7.27	1.0
5	7/28/2003	12:51	6.2 [~]	40.6498	-73.1816	1.23	0.96	1.1	s	25.24	40.92	26.17	120.9	8.57	3.4
									m	24.60	41.25	26.41	115.1	8.24	3.9
									b	24.16	41.62	26.69	106.2	7.65	32.8
10	8/5/2003	11:48	2.5 [~]	40.6708	-73.0855	1.37	0.98		s	26.10	35.71	22.49	207.1	14.77	3.7
									m	25.57	36.65	23.15	197.7	14.18	4.6
									b	25.67	36.54	23.07	221.7	15.88	4.5
10	8/11/2003	13:44	2.5 [~]	40.6708	-73.0855	1.22	0.99	2.0	s	26.25	36.76	23.21	174.0	12.33	6.1
									m	26.26	36.72	23.19	175.3	12.42	6.0
									b	26.03	36.74	23.20	168.1	11.96	7.2
10	8/18/2003	15:10	2.8 [~]	40.6708	-73.0855	1.50	0.99	1.1	s	25.81	36.04	22.72	163.1	11.68	1.4
									m	25.62	36.22	22.85	140.2	10.07	3.0
									b	25.48	36.41	22.98	136.7	9.83	7.4

[~] Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 1 (continued). FIIS station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
10	7/28/2003	13:51	2.5~	40.6708	-73.0855	1.45	0.97	1.1	s	25.90	35.86	22.59	113.2	8.10	5.1
									m	25.84	35.90	22.62	114.5	8.20	4.7
									b	25.06	36.73	23.22	109.7	7.94	27.3
15	8/11/2003	17:10	0.7~	40.7003	-72.9766	0.17	0.95 ^a	0.5	smb	27.80	34.12	21.34	163.2	11.38	17.1
15	8/19/2003	13:16	0.7~	40.7003	-72.9766	1.68	0.99 ^{bd}	0.6	smb	26.14	32.85	20.51	139.3	10.04	1.5
20	7/28/2003	15:43	0.5~	40.7371	-72.7371	2.55	0.99	1.2	smb	26.96	27.37	16.78	153.5	11.14	5.9
20	8/19/2003	14:22	0.4~	40.7310	-72.9120	0.48	1.00 ^d	1.0	smb	28.02	31.79	19.74	172.0	12.06	14.5
25	7/28/2003	16:25	0.5~	40.7491	-72.8251	2.46	1.00 ^a	1.8	smb	27.15	29.92	18.65	150.1	10.74	5.6
25	8/11/2003	19:04	1.5~	40.7491	-72.8251			2.1	smb	27.66	35.11	22.04	147.8	10.29	122.2

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 1 (continued). FIIS station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
25	8/19/2003	15:55	1.0~	40.7491	-72.8251	1.09	1.00	1.1	smb	26.68	37.31	23.59	140.1	9.84	12.3
30	7/28/2003	17:02	2.5~	40.7770	-72.7705	0.98	0.99 ^a	0.8	s	16.82	46.43	30.19	113.7	9.19	3.6
									m	16.77	46.47	30.23	112.4	9.10	3.9
									b	16.74	46.48	30.23	111.8	9.05	4.7
30	8/11/2003	18:11	3.3~	40.7770	-72.7705	0.06	0.97 ^a	0.0	s	18.80	47.38	30.89	146.3	11.33	1.4
									m	18.81	47.37	30.89	146.8	11.37	1.6
									b	18.81	47.34	30.87	144.9	11.23	64.0
30	8/19/2003	16:18	3.2~	40.7770	-72.7705	0.47	0.97 ^a	0.1	s	22.12	46.74	30.41	123.4	9.02	6.3
									m						
									b	22.11	46.74	30.40	122.9	8.99	8.4

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2. GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
1	7/24/2003	9:15	8.2	40.5604	-73.9383	0.57	0.99 ^a	0.5	s	22.23	40.31	26.06	98.0	7.34	1.6
									m	21.36	45.07	29.20	96.8	7.23	0.4
									b	20.33	45.83	29.77	85.4	6.47	0.4
2	7/30/2003	9:44	12.5	40.5591	-73.9317	0.35	0.98 ^a	0.7	s	17.24	46.58	30.31	127.2	10.19	0.6
									m	16.90	47.38	30.88	136.2	10.95	0.2
									b	16.29	47.68	31.09	149.1	12.11	0.1
4	8/13/2003	15:15	-	40.5712	-73.8983			10.3	s						
6	8/6/2003	12:03	7.2	40.5839	-73.8422	0.84	1.0	1.0	s	23.84	43.21	27.83	240.7	17.32	1.8
									m	23.69	43.23	27.85	253.9	18.32	2.3
									b	23.60	43.26	27.87	244.2	17.65	2.7
7	7/24/2003	14:27	7.5	40.5823	-73.9471	0.71	0.97 ^c	3.2	s	25.20	38.89	24.74	145.3	10.39	5.2
									m	22.82	44.41	28.71	99.9	7.28	2.4
									b	21.36	45.04	29.19	54.4	4.07	9.6
8	7/30/2003	10:20	1.7	40.5857	-73.9085	0.97	1.00	4.6	s	22.13	43.96	28.40	187.8	13.89	3.2
									m	21.90	44.06	28.48	184.3	13.68	3.5
									b	21.41	44.40	28.72	200.1	14.96	14.5
9	8/6/2003	9:47	11.5	40.5909	-73.8755	1.15	0.99 ^a	2.7	s	24.31	41.59	26.67	217.4	15.62	2.3
									m	23.86	42.74	27.49	216.8	15.63	2.3
									b	23.50	43.23	27.85	200.8	14.54	1.8

~ Depth approximated from chart and/or sonde data.

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^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
10	8/13/2003	14:20	-	40.5985	-73.8484	1.66	1.00	10.1							
12	7/30/2003	12:23	4.2	40.6012	-73.8058	1.15	0.99	5.4	s	24.73	41.20	26.38	144.9	10.35	4.4
									m	24.70	41.21	26.39	175.2	12.53	3.8
									b	24.60	41.25	26.42	153.1	10.96	40.6
13	8/6/2003	14:10	0.5	40.5995	-73.7772	1.13	0.98	1.5	smb	25.66	41.60	26.64	258.5	18.15	0.5
14	8/13/2003	11:30	-	40.6244	-73.9033	1.37	0.96	15.2	s						
15	8/6/2003	9:57	10.2	40.6065	-73.8887	0.99	0.99	2.1	s	24.18	41.64	26.71	228.7	16.47	2.4
									m	23.57	42.96	27.66	185.8	13.45	4.3
									b	23.23	43.41	27.98	220.7	16.05	22.6
17	7/30/2003	12:14	4.7	40.6133	-73.8091	1.57	0.99	8.4	s	25.28	39.56	25.20	187.8	13.37	8.4
									m	25.01	39.88	25.43	220.7	15.77	8.4
									b	24.15	41.44	26.56	176.7	12.74	41.5
18	7/24/2003	11:03	11	40.6142	-73.7769	1.17	1.00	5.4	s	24.87	39.79	25.38	112.0	8.03	1.1
									m	24.32	41.52	26.62	77.1	5.54	1.9
									b	24.15	42.11	27.04	76.2	5.48	8.4

~ Depth approximated from chart and/or sonde data.

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^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
19	8/13/2003	13:51	-	40.6113	-73.7600	1.59	1.00	4.9							
20	7/24/2003	15:23	1	40.6275	-73.9089			1.8	s	24.04	12.19	7.21	95.6	7.74	1718.7
									m	24.18	22.32	13.45	60.8	4.72	16.8
									b	24.05	31.80	19.82	61.7	4.63	20.8
22	7/30/2003	11:06	2	40.6282	-73.8626	1.70	1.00	8.6	s	24.69	38.33	24.48	123.0	8.91	4.2
									m	24.35	41.14	26.35	127.2	9.15	4.8
									b	24.15	41.58	26.66	132.6	9.55	18.1
23	8/6/2003	10:55	9.5	40.6346	-73.8151	1.10	0.99		s	24.97	40.10	25.59	264.2	18.89	2.9
									m	24.76	40.73	26.04	192.8	13.80	9.0
									b	24.43	41.08	26.30	218.1	15.67	21.1
25	8/13/2003	13:32	-	40.6267	-73.7631	1.25	0.98	10.0							
26	7/24/2003	11:22	6.2	40.6306	-73.7530	0.95	1.00		s	25.22	35.27	22.20	98.6	7.16	1.0
									m	24.86	40.23	25.69	91.3	6.53	2.1
									b	24.62	41.04	26.27	99.7	7.15	4.0
27	8/13/2003	12:00	-	40.6443	-73.8722	1.23	0.99								

~ Depth approximated from chart and/or sonde data.

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^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
30	7/30/2003	13:00	5	40.6429	-73.7479	0.83	0.97 ^b	3.5	s	26.10	38.42	24.38	129.7	9.15	6.5
									m	25.82	39.00	24.80	120.6	8.52	13.1
									b	25.52	39.74	25.32	137.4	9.74	26.2

[~] Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
3	6/5/2003	9:28	6.5	40.5675	-73.9359	0.50	1.00 ^a	5.76	s	13.55	32.65	20.79	99.2	9.09	0.9
									m	13.40	39.18	24.96	100.4	8.98	0.6
									b	13.39	39.16	24.95	100.7	9.01	0.7
3	6/11/2003	9:22	4.5	40.5675	-73.9359	0.57	0.99 ^a	1.19	s	15.92	42.18	27.13	109.4	9.17	
									m	15.77	42.57	27.41	109.5	9.19	
									b	15.61	43.01	27.72	108.6	9.13	
3	6/25/2003	9:40	6.0	40.5675	-73.9359	0.26	0.86 ^c	1.19	s	19.01	41.15	26.41	89.0	7.06	0.2
									m	18.98	41.15	26.41	93.8	7.44	0.2
									b	18.86	41.46	26.63	89.1	7.07	0.2
3	7/24/2003	9:08	5.2	40.5675	-73.9359	0.42	0.99 ^a	2.21	s	21.91	35.85	23.14	91.8	7.04	2.7
									m	21.91	44.59	28.85	86.8	6.43	2.4
									b	21.89	44.60	28.86	91.5	6.78	4.5
3	7/30/2003	9:33	5.7	40.5675	-73.9359	0.43	1.00 ^a	8.84	s	17.61	46.57	30.30	114.8	9.13	0.5
									m	16.84	47.21	30.76	135.2	10.89	1.0
									b	16.56	47.51	30.97	121.9	9.86	4.6
3	8/6/2003	9:10	4.7	40.5675	-73.9359	0.55	1.00 ^a	4.59	s	22.53	44.43	28.73	196.4	14.40	1.4
									m	22.51	44.46	28.75	214.8	15.75	1.3
									b	22.29	44.72	28.94	177.0	13.01	17.6
3	8/13/2003	11:07	-	40.5675	-73.9359	0.53	1.00								

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
5	6/5/2003	9:54	6.5	40.5785	-73.8711	0.72	1.00 ^a	9.32	s	14.52	39.20	25.00	91.9	8.02	1.1
									m	14.51	39.32	25.09	91.6	8.00	1.3
									b	14.50	39.40	25.14	91.7	8.00	1.2
5	6/11/2003	9:39	5.5	40.5785	-73.8711	0.88	1.00 ^a	22.62	s	17.42	39.12	24.97	117.9	9.72	
									m	17.32	39.28	25.09	117.8	9.73	
									b	17.29	39.34	25.13	117.8	9.72	
5	6/20/2003	11:37	8.7	40.5785	-73.8711	0.57	0.99	12.25	s	18.27	41.35	26.56	94.6	7.60	3.6
									m	18.23	41.46	26.63	94.6	7.60	4.5
									b	18.20	41.51	26.67	94.6	7.61	5.0
5	6/25/2003	9:51	9.5	40.5785	-73.8711	0.54	0.36 ^a	11.53	s	20.27	38.73	24.69	100.6	7.87	1.1
									m	19.83	39.39	25.16	98.1	7.72	1.2
									b	18.88	41.16	26.42	96.3	7.65	3.3
5	7/24/2003	9:32	8.7	40.5785	-73.8711	0.84	0.99 ^a	12.41	s	23.53	43.28	27.89	96.2	6.96	1.3
									m	23.19	43.55	28.09	105.2	7.65	3.4
									b	22.50	44.26	28.61	98.6	7.24	42.0
5	7/30/2003	10:32	10.2	40.5785	-73.8711	0.55	1.00 ^c	9.16	s	19.72	45.00	29.17	139.3	10.72	4.8
									m	18.80	45.54	29.56	148.4	11.58	4.0
									b	18.18	46.29	30.10	147.0	11.58	3.9
5	8/6/2003	9:35	8.2	40.5785	-73.8711	1.05	0.93 ^{ac}	21.13	s	24.03	42.52	27.33	240.6	17.31	1.8
									m	23.94	42.70	27.46	254.0	18.30	1.8
									b	23.32	43.37	27.95	229.0	16.63	2.9

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phyt pigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
5	8/13/2003	14:54	-	40.5785	-73.8711	0.58	0.99								
11	6/5/2003	12:29	6.5	40.5851	-73.8298	0.86	1.00	12.41	s	14.88	35.23	22.47	92.4	8.15	2.0
									m	14.84	39.20	25.00	91.5	7.94	1.8
									b	14.83	39.24	25.03	91.4	7.93	1.8
11	6/11/2003	11:50	6.5	40.5851	-73.8298	1.03	0.99	36.58	s	18.09	37.86	24.09	116.4	9.53	
									m	18.06	37.89	24.11	115.9	9.49	
									b	18.06	37.90	24.11	116.0	9.49	
11	6/20/2003	11:15	9.5	40.5851	-73.8298	1.03	1.00	25.45	s	19.13	37.77	24.04	106.2	8.52	5.9
									m	19.11	38.70	24.68	104.1	8.33	5.5
									b	18.86	39.54	25.27	105.8	8.47	5.4
11	6/25/2003	12:00	8.2	40.5851	-73.8298	0.91	0.98	23.95	s	21.32	36.62	23.20	113.3	8.76	1.6
									m	20.68	37.36	23.72	116.9	9.12	1.7
									b	20.55	37.51	23.83	104.6	8.18	2.8
11	7/24/2003	11:39	7.5	40.5851	-73.8298	0.83	0.99	32.76	s	24.13	41.65	26.72	98.8	7.12	1.1
									m	24.10	41.78	26.80	93.8	6.76	1.3
									b	24.09	41.84	26.85	96.7	6.97	1.5
11	7/30/2003	13:23	10.0	40.5851	-73.8298	1.26	1.00	34.81	s	24.49	41.42	26.54	151.5	10.86	3.0
									m	24.35	41.57	26.65	172.5	12.39	3.0
									b	24.22	41.72	26.76	170.6	12.27	3.5

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
11	8/6/2003	11:55	11.5	40.5851	-73.8298	0.88	1.00	15.82	s	24.06	42.98	27.66	276.2	19.83	1.9
									m	24.00	42.97	27.65	262.8	18.88	1.7
									b	23.96	42.99	27.67	278.0	19.99	1.8
11	8/13/2003	14:12	-	40.5851	-73.8298	1.02	0.98								
16	6/5/2003	12:43	3.0	40.6057	-73.8514	0.94	1.00	22.11	s	15.56	38.22	24.33	102.6	8.82	2.2
									m	15.48	38.31	24.39	103.3	8.88	2.2
									b	15.39	38.48	24.51	103.3	8.89	2.1
16	6/11/2003	12:11	0.9	40.6057	-73.8514	-	-	25.15	s	19.78	38.22	24.34	147.3	11.65	
									m	19.77	38.22	24.33	149.5	11.82	
									b	19.77	38.21	24.33	150.4	11.90	32.5
16	6/20/2003	11:26	3.0	40.6057	-73.8514	1.03	1.00	35.16	s	19.08	38.91	24.82	114.2	9.13	6.2
									m	19.07	39.06	24.93	115.7	9.24	6.9
									b	19.07	38.94	24.85	117.0	9.35	67.9
16	6/25/2003	12:17	1.5	40.6057	-73.8514	0.77	0.99		s	23.42	38.27	24.33	157.6	11.66	4.4
									m	22.81	38.59	24.57	154.4	11.54	3.1
									b	22.18	38.86	24.76	166.1	12.54	40.4
16	7/24/2003	12:01	2.0	40.6057	-73.8514	1.47	1.00	55.05	s	24.33	42.12	27.04	150.0	10.75	5.1
									m	24.32	42.13	27.05	151.1	10.83	5.4
									b	24.31	42.14	27.05	152.5	10.93	13.5

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
16	7/30/2003	13:37	1.5	40.6057	-73.8514	2.05	0.95	79.51	s	24.76	41.94	26.91	214.8	15.30	5.8
									m	24.75	41.94	26.91	222.5	15.85	6.1
									b	24.75	41.94	26.91	248.0	17.67	5.6
16	8/6/2003	12:15	2.5	40.6057	-73.8514	1.14	0.99	49.94	s	24.14	32.61	20.98	260.0	19.47	2.6
									b	24.50	42.74	27.48	286.0	20.39	72.2
16	8/13/2003	14:33	1.2	40.6057	-73.8514	1.19	0.96								
21	6/5/2003	10:12	7.0	40.6274	-73.8830	0.98	1.00	23.10	s	15.69	36.88	23.39	88.0	7.58	2.7
									m	15.56	38.22	24.33	87.4	7.51	2.5
									b	15.41	39.00	24.87	85.7	7.36	2.3
21	6/11/2003	9:58	5.5	40.6274	-73.8830	1.10	1.00	32.97	s	18.43	37.98	24.17	123.5	10.03	
									m	18.40	37.99	24.17	123.3	10.02	
									b	18.39	38.00	24.18	123.3	10.03	
21	6/20/2003	9:48	8.5	40.6274	-73.8830	1.06	0.99 ^a	45.82	s	19.39	37.32	23.70	106.6	8.52	5.7
									m	19.38	37.45	23.79	103.6	8.28	5.3
									b	19.02	39.17	25.01	103.1	8.24	5.2
21	6/25/2003	10:10	11.2	40.6274	-73.8830	0.90	0.99	19.90	s	21.05	37.41	23.76	90.0	6.97	1.7
									m	20.02	38.42	24.47	84.0	6.60	1.7
									b	19.42	39.05	24.92	83.9	6.66	1.8

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
21	7/24/2003	9:44	11.7	40.6274	-73.8830	1.27	0.98 ^a	56.80	s	24.59	38.38	24.39	99.0	7.18	2.3
									m	24.21	42.19	27.10	90.4	6.49	2.4
									b	23.97	42.76	27.50	75.4	5.42	6.7
21	7/30/2003	10:49	12.0	40.6274	-73.8830	1.28	0.98	66.57	s	23.34	42.55	27.37	153.3	11.15	6.2
									m	22.35	43.51	28.07	159.1	11.74	3.5
									b	22.16	43.69	28.20	166.3	12.31	41.9
21	8/6/2003	10:07	11.0	40.6274	-73.8830	0.73	0.97	33.70	s	24.69	40.23	25.69	237.4	17.04	2.9
									m	24.43	41.18	26.38	230.2	16.54	3.5
									b	24.20	42.17	27.08	211.8	15.22	4.5
21	8/13/2003	11:44	-	40.6274	-73.8830	1.48	0.98								
24a	6/5/2003	11:22	6.5	40.6377	-73.8103	1.15	0.99	42.96	s	16.39	35.61	22.50	88.6	7.57	2.7
									m	16.26	37.11	23.55	84.4	7.18	2.5
									b	16.31	37.44	23.78	82.8	7.03	2.5
24a	6/11/2003	10:52	5.0	40.6377	-73.8103	1.43	0.99	87.85	s	18.85	36.31	23.00	127.6	10.35	
									m	18.72	36.87	23.39	128.0	10.39	
									b	18.58	37.17	23.60	137.6	11.18	
24a	6/20/2003	10:24	11.5	40.6377	-73.8103	1.07	1.00	47.51	s	19.74	35.64	22.52	89.3	7.15	5.8
									m	19.47	36.65	23.23	77.0	6.17	8.4
									b	17.96	37.76	24.02	67.4	5.52	28.7

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
24a	6/25/2003	11:03	7.0	40.6377	-73.8103	0.80	0.99	10.67	s	21.34	35.06	22.11	79.0	6.13	1.8
									m	20.20	36.85	23.37	84.2	6.61	1.5
									b	19.02	37.67	23.95	55.9	4.49	32.6
24a	7/24/2003	10:29	7.0	40.6377	-73.8103	1.26	0.98	58.28	s	24.72	38.15	24.22	113.1	8.18	2.8
									m	24.44	40.25	25.71	89.6	6.46	4.9
									b	24.21	40.98	26.23	86.6	6.25	6.2
24a	7/30/2003	11:43	9.0	40.6377	-73.8103	1.04	0.95	54.90	s	25.48	40.04	25.54	95.6	6.78	3.4
									m	24.85	40.39	25.80	101.0	7.22	3.6
									b	24.65	40.75	26.06	119.0	8.54	3.5
24a	8/6/2003	10:59	10.0	40.6377	-73.8103	1.12	0.98	45.51	s	25.02	39.92	25.47	188.2	13.45	3.8
									m	24.87	40.40	25.81	198.9	14.23	5.8
									b	24.36	41.15	26.35	182.1	13.10	10.2
24a	8/13/2003	12:40	-	40.6377	-73.8103	1.73	0.97	213.81							
24b	6/5/2003	11:36	6.2	40.6310	-73.7983	1.52	1.00	76.99	s	16.35	34.48	21.80	114.6	9.84	3.2
									m	16.38	37.27	23.67	102.5	8.69	2.6
									b	16.49	37.66	23.94	93.2	7.88	2.4
24b	6/11/2003	11:02	5.5	40.6310	-73.7983	1.29	1.00	64.55	s	18.75	36.95	23.45	124.4	10.08	
									m	18.58	37.06	23.52	127.7	10.38	
									b	18.28	37.24	23.65	135.2	11.05	

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
24b	6/20/2003	10:34	9.0	40.6310	-73.7983	1.16	0.99	72.52	s	19.95	35.74	22.59	117.5	9.36	5.8
									m	19.66	36.26	22.96	75.5	6.02	11.4
									b	18.62	37.12	23.57	65.6	5.32	45.2
24b	6/25/2003	11:11	8.5	40.6310	-73.7983	1.54	0.99	95.99	s	22.40	35.25	22.23	92.4	7.00	2.3
									m	19.58	37.28	23.67	79.0	6.22	56.0
									b	18.71	37.87	24.09	58.7	4.74	45.0
24b	7/24/2003	10:37	8.2	40.6310	-73.7983	1.34	0.98	83.93	s	24.69	38.78	24.67	133.7	9.65	2.7
									m	24.52	40.35	25.78	121.8	8.76	3.2
									b	23.73	40.99	26.25	70.9	5.16	11.4
24b	7/30/2003	11:51	9.2	40.6310	-73.7983	1.34	0.99	69.95	s	25.37	39.74	25.33	101.5	7.21	5.4
									m	24.89	40.34	25.76	130.6	9.33	7.1
									b	24.36	40.57	25.94	88.1	6.35	26.2
24b	8/6/2003	11:10	-	40.6310	-73.7983	1.23	0.99	47.00							
24b	8/13/2003	12:51	-	40.6310	-73.7983	1.66	0.99	185.76							
24c	6/5/2003	11:49	5.0	40.6250	-73.7886	1.22	0.99	61.81	s	16.40	36.50	23.13	109.7	9.34	2.6
									m	16.28	37.01	23.49	99.7	8.48	2.4
									b	16.42	37.60	23.90	105.4	8.92	2.4

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
24c	6/11/2003	11:10	3.5	40.6250	-73.7886	1.10	1.00	44.65	s	18.58	36.71	23.28	117.1	9.53	0.2
									m	18.42	36.83	23.36	118.1	9.64	2.1
									b	18.32	36.90	23.41	122.5	10.02	2.6
24c	6/20/2003	10:44	3.7	40.6250	-73.7886	1.03	0.99	45.32	s	19.91	35.75	22.60	142.0	11.32	5.0
									m	19.90	35.77	22.61	144.7	11.54	4.8
									b	19.89	35.79	22.63	139.2	11.10	107.5
24c	6/25/2003	11:20	2.5	40.6250	-73.7886	1.32	0.97	145.10	s	24.52	35.72	22.52	130.2	9.51	3.0
									m	22.79	35.42	22.34	184.1	13.74	2.8
									b	19.80	36.58	23.18	151.8	12.07	30.9
24c	7/24/2003	10:45	4.5	40.6250	-73.7886	1.49	0.98	86.31	b	24.34	40.58	25.95	118.3	8.53	13.3
									s	24.81	39.73	25.34	140.4	10.08	3.4
									m	24.54	40.52	25.90	133.0	9.56	5.4
24c	7/30/2003	12:00	5.0	40.6250	-73.7886	1.14	0.99	57.23	s	25.08	39.66	25.28	100.2	7.16	3.9
									m	24.92	39.90	25.45	103.8	7.42	5.1
									b	24.61	40.32	25.76	102.0	7.33	49.4
24c	8/6/2003	11:16	4.0	40.6250	-73.7886	1.01	0.98	59.37	s	25.11	40.37	25.78	350.9	25.00	2.6
									m	24.84	40.47	25.85	253.6	18.13	3.1
									b	24.56	40.50	25.89	218.1	15.68	103.6
24c	8/13/2003	12:58	-	40.6250	-73.7886	1.11	0.99	61.85							

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
28	6/5/2003	10:39	6.0	40.6435	-73.8449	1.59	0.98	21.24	s	16.09	36.47	23.10	85.1	7.28	2.7
									m	16.10	36.99	23.47	76.4	6.53	2.7
									b	15.89	38.11	24.25	77.8	6.64	2.7
28	6/11/2003	10:24	5.5	40.6435	-73.8449	1.32	0.99	43.47	s	18.61	36.59	23.19	115.8	9.43	
									m	18.54	36.79	23.33	115.0	9.37	
									b	18.53	36.89	23.40	115.6	9.42	
28	6/20/2003	9:59	10.5	40.6435	-73.8449	1.03	0.98	70.10	s	19.62	36.33	23.01	96.4	7.70	5.7
									m	19.37	37.70	23.97	95.0	7.59	5.9
									b	19.16	38.69	24.67	92.4	7.37	6.5
28	6/25/2003	10:32	9.5	40.6435	-73.8449	0.74	0.96	35.73	s	20.61	36.73	23.28	68.2	5.34	3.5
									m	19.93	37.58	23.88	68.9	5.45	10.1
									b	19.68	38.06	24.22	60.7	4.81	22.3
28	7/24/2003	10:01	8.0	40.6435	-73.8449	1.33	0.99	56.62	s	24.55	34.79	21.88	103.7	7.63	2.8
									m	24.56	39.66	25.29	93.3	6.73	3.0
									b	24.40	41.05	26.28	75.5	5.43	6.9
28	7/30/2003	11:15	3.0	40.6435	-73.8449	1.37	1.00	61.83	s	24.69	41.01	26.25	124.5	8.91	4.1
									m	23.98	41.76	26.79	114.3	8.25	4.7
									b	23.65	42.15	27.07	117.9	8.55	30.6
28	8/6/2003	10:28	8.5	40.6435	-73.8449	1.28	0.99	43.60	s	24.93	39.40	25.10	254.7	18.27	3.5
									m	24.69	40.38	25.79	232.2	16.66	6.1
									b	24.46	41.59	26.66	214.7	15.40	11.4

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
28	8/13/2003	12:15	-	40.6435	-73.8449	1.34	0.96	111.04							
29	6/5/2003	11:11	6.2	40.6452	-73.8204	1.11	0.99	43.17	s	16.32	35.59	22.49	84.3	7.21	3.0
									m	16.25	37.17	23.60	76.4	6.50	2.9
									b	16.24	37.53	23.85	74.4	6.33	2.8
29	6/11/2003	10:44	5.5	40.6452	-73.8204	1.63	1.00	68.64	s	18.90	35.05	22.12	133.0	10.84	
									m	18.79	35.52	22.45	138.8	11.32	
									b	18.55	36.56	23.17	140.8	11.48	
29	6/20/2003	10:16	8.0	40.6452	-73.8204	1.14	0.98	54.11	s	19.73	34.63	21.82	80.6	6.48	7.8
									m	19.60	35.87	22.69	80.4	6.44	9.2
									b	19.49	36.45	23.09	75.9	6.08	27.3
29	6/25/2003	10:54	7.7	40.6452	-73.8204	0.81	0.95	8.32	s	21.43	33.01	20.70	65.7	5.14	13.7
									m	19.72	37.40	23.76	56.1	4.45	27.5
									b	19.31	37.73	23.99	57.4	4.59	22.7
29	7/24/2003	10:20	7.7	40.6452	-73.8204	1.19	1.00	43.36	s	24.55	35.88	22.63	93.6	6.86	2.1
									m	24.56	40.08	25.59	89.2	6.42	1.8
									b	24.32	41.35	26.49	69.4	4.99	59.1
29	7/30/2003	11:34	8.7	40.6452	-73.8204	1.60	1.00	158.82	s	25.54	39.22	24.96	117.0	8.31	4.9
									m	24.88	40.18	25.65	133.6	9.55	4.5
									b	24.50	40.83	26.12	140.8	10.12	5.0

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 2 (continued). GATE station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
29	8/6/2003	10:44	8.0	40.6452	-73.8204	1.27	0.94	69.68	s	25.12	37.05	23.44	276.5	19.96	4.9
									m	24.90	39.94	25.48	245.0	17.55	8.6
									b	24.62	40.69	26.02	203.5	14.60	24.3
29	8/13/2003	12:33	-	40.6452	-73.8204	1.72	0.97	238.30							

[~] Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3. GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
2	7/29/2005	12:00	4.2	40.5684	-73.8947	0.51	1.00		s	23.46	29.51	18.97	95.8	7.32	5.5
									m	23.36	43.45	28.01	94.5	6.85	3.1
									b	23.34	43.46	28.02	92.4	6.70	2.3
2	8/24/2005	13:30	4.4	40.5683	-73.8948	0.24	0.99	5.93 7.28	s	21.30	18.56	11.90	93.1	7.80	6.6
									m	22.82	45.53	29.52	81.4	5.91	2.0
									b	22.58	45.75	29.68	83.1	6.05	1.9
3	8/4/2005	12:35	2.4	40.5775	-73.9283	0.50	0.96 ^b	18.30 17.25	smb	26.21	5.63	3.56	105.1	8.34	23.6
4	7/29/2005	15:24	1.3	40.5824	-73.9243	0.81	0.99 ^d		smb	23.19	24.54	15.75	103.4	8.10	1.9
4	8/24/2005	13:55	1.3	40.5824	-73.9242	0.83	1.00	13.35 10.67	smb	20.94	7.73	4.78	109.6	9.57	9.5
6	8/4/2005	11:56	6.4	40.5846	-73.8416	0.64	0.97 ^b	21.13 18.99	s	25.73	7.59	4.82	97.8	7.79	8.5
									m	26.20	41.62	26.64	84.6	5.89	3.7
									b	25.99	41.75	26.74	81.1	5.66	3.6
8	8/4/2005	13:10	1.5	40.5874	-73.9298	1.01	1.00 ^c	19.72 14.02	smb	26.99	5.21	3.27	107.1	8.39	28.6

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3 (continued). GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phyt pigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
9	7/29/2005	14:31	1.5	40.6054	-73.8875	1.71	1.00 ^d		smb	24.58	23.19	14.80	107.6	8.27	22.3
9	8/24/2005	10:05	2.1	40.6056	-73.8875	0.99	0.98	17.78 16.69	smb	20.40	10.41	6.64	95.6	8.41	12.4
11	8/4/2005	12:09	0.9	40.5999	-73.8431	0.72	0.95 ^b	30.35 45.31	smb	26.07	5.28	3.32	103.0	8.21	27.0
12	7/29/2005	13:45	10.3	40.6019	-73.7952	1.46	1.00		s	25.40	28.18	17.93	103.0	7.67	1.9
									m	25.99	40.78	26.05	110.0	7.70	2.4
									b	25.63	41.16	26.33	105.2	7.40	2.9
12	8/24/2005	12:06	10.3	40.6016	-73.7953	1.31	0.97	36.41 27.09	s	22.70	20.97	13.39	94.5	7.68	5.3
									m	25.16	42.40	27.23	82.5	5.82	2.7
									b	24.87	42.79	27.51	80.8	5.72	2.8
13	8/4/2005	11:33	8.5	40.6041	-73.7861	1.12	0.96	32.08 32.06	s	25.09	6.39	4.02	97.9	7.93	6.4
									m	26.47	41.11	26.28	80.2	5.57	3.2
									b	26.35	41.18	26.33	70.9	4.93	3.2
14	8/10/2005	10:11	1.5	40.6124	-73.9030	1.17	0.98	20.15 29.87	smb	23.32	6.66	4.18	100.9	8.44	22.7

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3 (continued). GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phyt pigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
17	8/4/2005	11:12	1.8	40.6103	-73.8101	0.91	1.00		smb	26.01	9.63	6.06	104.2	8.20	6.7
17	9/7/2005	11:55	2.6	40.6104	-73.8099	1.72	1.00	131.78 102.74	s	22.64	23.60	15.06	132.6	10.47	22.5
									b	23.90	41.91	26.90	159.6	11.54	4.8
19	7/29/2005	13:19	7.6	40.6263	-73.7605	1.30	1.00		s	25.13	19.99	12.67	103.8	8.02	34.9
									m	26.57	40.08	25.54	111.7	7.77	3.3
									b	26.52	40.22	25.64	109.5	7.62	2.5
19	8/24/2005	11:51	8.2	40.6261	-73.7605	1.62	0.95	55.13 42.92	s	21.43	12.09	7.67	98.7	8.48	5.5
									m	25.64	41.89	26.85	80.9	5.68	2.2
									b	25.58	42.03	26.95	79.6	5.59	2.1
20	8/4/2005	9:48	2.6	40.6298	-73.9131	2.50	1.00	129.43 86.70	smb	22.34	1.44	0.84	99.3	8.60	4.3
21	8/10/2005	10:58	1.7	40.6433	-73.8828	1.29	0.96 ^b	47.69 40.29	smb	23.77	5.35	3.32	101.6	8.45	10.8
26	9/7/2005	12:27	6.0	40.6333	-73.7518	1.26	0.96	72.82 61.56	s	23.03	18.96	12.07	111.7	8.96	7.4
									m	24.72	41.70	26.73	101.6	7.24	3.2
									b	24.43	42.04	26.98	88.2	6.32	3.3

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3 (continued). GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
27	8/4/2005	10:45	0.7	40.6488	-73.8756	2.46	1.00	4.85 7.28	smb	23.68	3.10	1.84	95.6	8.04	7.5
28	8/10/2005	11:36	6.7	40.6582	-73.8383	1.88	0.97	101.96 97.54	s	24.89	7.13	4.47	90.0	7.35	5.0
									m	26.49	39.43	25.09	47.3	3.30	2.9
									b	26.52	39.75	25.31	50.2	3.50	3.8
30	9/7/2005	12:43	6.0	40.6415	-73.7469	1.02	1.00	34.68 36.74	s	22.85	19.29	12.30	97.2	7.87	3.7
									m	24.48	41.89	26.88	82.1	5.87	3.6
									b	24.44	41.98	26.94	71.4	5.11	4.0

[~] Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3 (continued). GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
1	7/28/2005	10:33	3.0	40.5675	-73.9347				s	22.39	12.18	7.83	90.4	7.54	3.7
									m	22.29	44.08	28.48	88.0	6.49	5.1
									b	22.31	44.06	28.47	81.6	6.01	2.9
1	8/3/2005	9:17	4.8	40.5674	-73.9355	0.31	0.99 ^b	7.34 2.47	s	22.70	10.89	6.95	95.1	7.90	5.6
									m	22.54	43.53	28.08	95.6	7.03	4.2
									b	22.43	43.59	28.12	88.6	6.53	2.4
1	8/10/2005	9:18	4.4	40.5674	-73.9352	0.34	0.99 ^b	0.00 1.52	s	21.88	6.87	4.40	96.2	8.27	9.3
									m	23.25	44.79	28.98	81.8	5.91	2.7
									b	23.25	44.79	28.98	78.0	5.64	2.1
1	8/24/2005	13:07	5.1	40.5675	-73.9352	0.12	0.86	3.21 1.19	s	21.20	13.27	8.41	96.6	8.26	12.9
									m	23.01	45.55	29.53	78.1	5.65	1.1
									b	22.98	45.57	29.55	77.1	5.58	0.9
1	9/7/2005	8:50	4.8	40.5674	-73.9351	0.50	0.73 ^c	0.00 1.99	s	20.45	18.31	11.85	98.0	8.31	13.0
									m	21.98	45.70	29.65	92.2	6.78	2.0
									b	21.98	45.70	29.65	92.1	6.78	2.0
5	7/28/2005	11:00	8.5	40.5782	-73.8696	0.64	0.96		s	24.16	13.04	8.37	94.9	7.64	3.4
									m	24.03	42.97	27.66	86.8	6.23	1.7
									b	23.97	43.01	27.69	84.0	6.04	1.3
5	8/3/2005	10:15	8.5	40.5779	-73.8699	0.84	1.00 ^c	36.41 36.73	s	24.15	15.18	9.65	108.5	8.62	39.5
									m	24.74	42.63	27.40	110.3	7.83	3.3
									b	24.11	42.95	27.64	97.8	7.01	1.8

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3 (continued). GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytoplankton			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
5	8/10/2005	9:36	8.8	40.5782	-73.8702	0.56	1.00 ^c	0.00 3.03	s	20.74	2.32	1.27	97.8	8.71	34.2
									m	24.05	43.84	28.28	69.6	4.98	1.3
									b	24.04	43.86	28.29	65.4	4.67	1.2
5	8/24/2005	9:35	8.5	40.5784	-73.8694	0.76	0.99	4.74 5.55	s	21.41	11.67	7.47	89.5	7.67	14.6
									m	24.11	44.07	28.44	69.0	4.92	2.5
									b	24.11	44.07	28.45	67.0	4.79	2.6
5	9/7/2005	9:42	9.1	40.5781	-73.8700	0.69	0.99	0.00 3.55	s	21.27	22.58	14.59	94.1	7.75	8.4
									m	22.06	45.13	29.24	88.0	6.49	2.8
									b	22.05	45.20	29.29	88.6	6.53	3.0
7	7/28/2005	14:03	9.1	40.5850	-73.8296	0.84	1.00		s	24.77	23.79	15.22	93.9	7.17	7.6
									m	24.82	42.49	27.30	88.1	6.25	4.7
									b	24.81	42.49	27.30	87.0	6.18	4.4
7	8/3/2005	12:39	7.9	40.5851	-73.8299	1.32	1.00	71.19 54.19	s	26.00	3.74	2.36	108.6	8.72	5.7
									m	26.55	41.05	26.23	112.6	7.81	3.5
									b	26.45	41.13	26.29	113.6	7.88	3.5
7	8/10/2005	13:21	9.1	40.5849	-73.8300	0.66	0.96	2.37 9.54	s	25.18	9.62	6.03	88.5	7.07	275.6
									m	24.88	43.12	27.75	57.6	4.07	1.7
									b	24.83	43.17	27.78	58.1	4.11	1.8
7	8/24/2005	12:20	8.2	40.5849	-73.8297	0.61	0.98	21.33 16.47	s	21.48	13.65	8.68	93.3	7.94	9.3
									m	24.34	43.85	28.28	71.6	5.10	2.4
									b	24.23	43.99	28.38	68.8	4.90	2.1

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3 (continued). GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
7	9/7/2005	13:02	10.0	40.5849	-73.8300	0.84	0.98	33.18 32.95	s	21.47	18.13	11.61	102.0	8.50	10.7
									m	23.08	43.39	27.97	96.4	7.02	4.0
									b	23.03	43.44	28.01	96.1	7.01	4.0
10	7/28/2005	11:24	3.8	40.5921	-73.8794	1.45	0.98		s	23.91	19.45	12.44	105.0	8.33	98.7
									m	25.28	41.89	26.86	104.5	7.38	3.4
									b	25.24	41.93	26.89	111.8	7.90	3.4
10	8/3/2005	10:06	3.6	40.5921	-73.8794	1.70	0.99	41.18 61.56	s	25.61	5.65	3.57	110.2	8.83	9.9
									m	26.47	41.71	26.70	124.7	8.63	10.1
									b	26.50	41.69	26.69	131.9	9.13	6.8
10	8/10/2005	9:48	4.1	40.5921	-73.8794	1.07	1.00	22.52 22.07	s	22.68	4.48	2.83	95.7	8.18	4.6
									m	25.53	42.16	27.05	90.7	6.36	3.0
									b	25.25	42.49	27.29	86.0	6.06	2.8
10	8/24/2005	9:55	2.1	40.5921	-73.8795	-	- ^e	15.41 12.22	smb	20.28	5.58	3.52	99.6	8.87	9.7
10	9/7/2005	9:54	4.1	40.5921	-73.8794	1.14	0.99	29.91 27.26	s	21.30	16.13	10.35	102.9	8.64	14.7
									m	22.90	43.63	28.15	102.9	7.52	3.4
									b	22.76	43.78	28.26	103.0	7.54	3.4
15	7/28/2005	11:46	10.3	40.6291	-73.8814	1.28	1.00		s	23.86	19.87	12.70	99.6	7.90	6.5
									m	25.62	41.37	26.48	95.1	6.69	3.9
									b	25.46	41.55	26.61	94.0	6.62	3.6

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3 (continued). GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
15	8/3/2005	10:55	9.5	40.6273	-73.8829	2.08	0.98	53.32 84.36	s	24.27	3.92	2.19	86.0	7.09	9.9
									m	25.83	41.42	26.51	106.4	7.45	3.2
									b	25.37	41.98	26.92	97.3	6.86	3.2
15	8/10/2005	10:27	11.8	40.6276	-73.8826	0.82	0.99	18.47 14.22	s	23.23	4.93	3.09	95.3	8.05	17.9
									m	25.27	42.31	27.16	61.7	4.35	2.9
									b	25.14	42.54	27.33	53.5	3.78	3.1
15	8/24/2005	9:48	11.5	40.6274	-73.8823	1.25	0.99	13.14 14.22	s	21.43	12.81	8.16	91.7	7.84	10.1
									m	24.62	42.90	27.60	68.0	4.84	3.0
									b	24.58	43.02	27.68	68.0	4.84	3.3
15	9/7/2005	10:23	11.8	40.6274	-73.8827	1.72	0.99	22.52 25.36	s	21.43	18.13	11.62	101.6	8.47	18.8
									m	23.25	43.04	27.72	96.9	7.05	4.4
									b	23.10	43.28	27.89	95.4	6.95	4.6
16	7/28/2005	14:19	2.6	40.6058	-73.8514	1.19	0.99		s	23.63	15.01	9.57	104.1	8.40	2.0
									b	25.57	42.13	27.02	110.5	7.76	1.8
16	8/3/2005	12:56	1.0	40.6056	-73.8516	-	- ^e	66.33 95.98	smb	25.86	3.28	2.05	107.8	8.69	17.9
16	8/10/2005	13:34	2.3	40.6057	-73.8514	1.13	1.00	28.44 32.51	smb	25.11	7.44	4.70	101.9	8.20	8.0

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3 (continued). GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
16	8/24/2005	12:33	3.0	40.6059	-73.8514	0.65	0.98	23.24 30.50	smb	21.47	15.76	10.09	99.5	8.40	11.5
16	9/7/2005	9:41	1.6	40.6058	-73.8525	1.49	0.99	38.58 27.26	smb	21.80	18.76	12.04	104.0	8.56	21.3
18	7/28/2005	13:47	6.4	40.6248	-73.7896	1.83	1.00		s	25.45	24.39	15.46	96.5	7.27	4.1
									m	26.53	38.94	24.74	110.0	7.69	2.9
									b	26.45	39.09	24.85	93.7	6.55	3.1
18	8/3/2005	12:00	5.1	40.6249	-73.7895	1.50	0.97	436.36 334.67	s	26.39	4.93	2.70	85.1	6.76	51.0
									m	26.40	39.32	25.01	115.0	8.03	3.6
									b	26.16	39.47	25.12	132.6	9.31	3.1
18	8/10/2005	12:45	6.0	40.6250	-73.7886	1.21	0.95	10.67 18.077	s	25.25	7.92	4.95	80.3	6.55	11.6
									m	26.43	40.28	25.69	46.7	3.25	14.9
									b	26.30	40.28	25.70	36.0	2.52	12.3
18	8/24/2005	11:20	6.0	40.6246	-73.7899	1.32	0.99	109.14 83.67	s	22.18	12.55	7.94	105.4	8.83	7.7
									m	25.50	40.82	26.09	108.8	7.69	3.5
									b	25.43	40.85	26.12	107.4	7.59	3.7
18	9/7/2005	11:30	5.7	40.6246	-73.7897	1.47	1.00	39.11 41.62	s	22.48	16.34	10.42	95.6	7.90	9.5
									m	24.32	41.55	26.64	81.5	5.85	3.1
									b	24.16	41.54	26.63	75.8	5.46	3.2

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3 (continued). GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
23	7/28/2005	12:20	9.7	40.6434	-73.8446	1.15	0.99		s	24.77	24.51	15.65	94.6	7.27	3.2
									m	26.00	40.99	26.20	80.3	5.62	3.1
									b	25.98	41.01	26.22	76.6	5.36	3.1
23	8/3/2005	-	-	40.6435	-73.8449	1.57	1.00	55.97 37.72							
23	8/10/2005	11:16	5.4	40.6437	-73.8446	1.12	0.96	48.08 44.22	s	24.05	7.52	4.71	88.9	7.34	25.7
									m	25.82	41.27	26.41	68.4	4.79	2.6
									b	25.63	41.53	26.59	54.5	3.83	2.4
23	8/24/2005	10:17	10.0	40.6435	-73.8446	0.87	0.97	10.06 17.78	s	21.76	15.02	9.60	86.3	7.32	6.4
									m	24.79	42.27	27.14	54.5	3.87	3.5
									b	24.77	42.33	27.19	55.0	3.91	3.5
23	9/7/2005	10:45	9.1	40.6436	-73.8447	3.17	0.95	42.66 40.32	s	21.92	17.52	11.20	102.4	8.47	11.0
									m	23.71	42.39	27.25	91.7	6.64	5.3
									b	23.61	42.47	27.30	86.8	6.29	5.6
24a	7/28/2005	13:20	8.5	40.6381	-73.8107	1.42	0.98		s	25.49	28.65	18.16	115.0	8.49	3.4
									m	26.58	39.18	24.90	79.3	5.53	5.5
									b	26.53	39.52	25.15	59.3	4.14	3.4
24a	8/3/2005	11:36	10.3	40.6378	-73.8106	1.11	1.00	43.91 24.71	s	26.80	10.30	6.47	90.4	7.04	6.0
									m	26.16	40.12	25.58	54.8	3.83	3.1
									b	25.85	40.37	25.77	44.3	3.12	3.1

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3 (continued). GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
24a	8/10/2005	12:21	7.9	40.6377	-73.8103	1.05	0.99	44.65	s	25.12	8.08	5.05	93.5	7.56	7.6
								55.58	m	26.24	40.35	25.74	55.7	3.89	2.9
									b	26.13	40.48	25.84	40.9	2.86	2.8
24a	8/24/2005	10:57	11.2	40.6377	-73.8107	0.54	0.99 ^b	12.53	s	21.46	12.04	7.62	88.0	7.59	11.0
								22.36	m	25.27	41.05	26.26	47.0	3.33	2.2
									b	25.36	41.59	26.64	45.0	3.17	2.1
24a	9/7/2005	10:47	8.2	40.6384	-73.8103	1.23	1.00	48.43	s	23.06	21.32	13.54	99.6	7.97	13.5
								48.99	m	23.97	41.41	26.54	82.5	5.97	4.4
									b	23.94	41.45	26.57	76.1	5.51	4.9
24b	7/28/2005	13:31	9.1	40.6271	-73.7928	1.74	0.99		s	25.28	31.67	20.08	118.3	8.67	4.1
									m	26.66	39.00	24.78	112.0	7.81	3.7
									b	26.54	39.09	24.84	93.2	6.51	3.0
24b	8/3/2005	11:48	8.2	40.6311	-73.7985	1.22	1.00	45.25	s	27.05	6.58	4.14	98.3	7.68	8.0
								33.81	m	26.14	39.92	25.44	49.4	3.45	3.6
									b	25.84	39.99	25.49	51.6	3.63	3.5
24b	8/10/2005	12:33	9.4	40.6310	-73.7983	1.25	1.00	33.38	s	25.10	6.55	4.10	91.6	7.46	18.8
								35.55	m	26.51	40.30	25.70	39.4	2.74	2.8
									b	26.45	40.65	25.95	20.9	1.45	4.6
24b	8/24/2005	11:10	9.7	40.6309	-73.7983	0.89	0.98	20.15	s	23.01	20.13	12.80	90.5	7.33	7.9
								23.50	m	25.30	40.82	26.10	50.9	3.61	1.7
									b	25.51	41.47	26.56	44.7	3.15	2.0

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3 (continued). GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
24b	9/7/2005	11:30	9.7	40.6311	-73.7985	1.31	0.97	77.57 75.00	s	23.25	20.91	13.32	115.9	9.11	19.2
									m	24.13	41.46	26.57	92.6	6.69	3.4
									b	24.08	41.55	26.64	72.5	5.24	3.6
29	7/28/2005	12:49	8.5	40.6450	-73.8206	1.39	0.99		s	23.78	10.27	6.46	91.6	7.60	23.8
									s	24.34	11.75	7.40	88.3	7.22	2.9
									m	26.60	39.85	25.38	73.8	5.14	3.2
									m	26.59	39.19	24.92	66.6	4.64	3.6
									b	26.54	40.06	25.53	71.4	4.97	3.8
									b	26.56	39.32	25.01	77.6	5.42	4.0
29	8/3/2005	11:22	7.3	40.6453	-73.8204	1.27	0.99	38.15 56.67	s	26.72	4.13	2.58	100.3	7.95	20.5
									s	26.64	4.12	2.57	96.7	7.69	33.7
									m	26.35	39.99	25.48	68.2	4.76	2.7
									m	26.44	39.82	25.36	61.0	4.24	3.1
									b	26.24	40.13	25.59	60.9	4.26	2.6
									b	26.16	39.99	25.49	42.8	3.00	3.1
29	8/10/2005	12:10	8.8	40.6452	-73.8204	1.17	0.96	65.70 61.12	s	24.56	5.24	3.27	94.9	7.82	6.0
									s	24.67	6.66	4.16	96.3	7.87	19.3
									m	26.43	40.15	25.59	63.7	4.44	3.0
									m	26.42	40.09	25.56	79.3	5.53	3.2
									b	26.13	40.69	25.99	49.2	3.44	2.5
									b	26.40	40.32	25.72	72.0	5.01	3.0

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 3 (continued). GATE station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
29	8/24/2005	10:45	9.4	40.6449	-73.8205	0.94	0.99	13.18	s	23.22	20.50	13.02	66.7	5.46	7.7
								14.22	m	25.03	41.43	26.54	49.7	3.53	2.9
									b	25.00	41.52	26.60	49.1	3.49	3.0
29	9/7/2005	10:37	8.5	40.6451	-73.8206	1.56	0.97	65.46	s	23.15	20.21	12.82	108.9	8.66	7.0
								72.18	s	22.97	16.40	10.29	99.4	8.11	13.0
									m	24.01	41.65	26.71	88.2	6.37	4.9
									m	24.21	41.21	26.40	79.5	5.73	4.0
									b	23.93	41.81	26.82	82.0	5.93	4.8
									b	24.28	41.32	26.47	71.0	5.11	4.3

[~] Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 4. GATE station information and water-quality data, 2006. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
2	9/7/2006	12:38	8.5	40.5670	-73.9052	0.45	0.99 ^b	8.09	s	20.81	42.94	27.68	51.6	3.93	2.1
								7.70	m	20.75	42.98	27.71	54.2	4.13	2.3
									b	20.73	43.04	27.75	52.2	3.98	2.5
3	8/23/2006	9:38	2.7	40.5750	-73.9400	0.86	0.98	14.76	s	22.44	45.62	29.59	67.0	4.89	2.8
								15.65	m	22.38	45.66	29.62	68.9	5.04	2.4
									b	22.29	45.72	29.67	67.7	4.96	2.7
4	9/13/2006	13:01	8.2	40.5751	-73.8993	0.86	0.99	13.16	s	19.94	44.09	28.51	90.8	6.99	1.8
								12.84	m	19.84	44.30	28.66	88.0	6.78	2.0
									b	19.72	45.47	29.50	90.6	6.96	4.3
6	8/23/2006	13:47	5.8	40.5827	-73.8396	1.48	0.96 ^b	24.88	s	25.26	42.43	27.25	57.9	4.08	2.6
								23.96	m	25.26	42.59	27.36	58.5	4.12	2.9
									b	25.23	42.84	27.54	58.1	4.09	2.9
8	9/7/2006	9:47	4.3	40.5943	-73.9193	1.72	0.98 ^c	11.17	s	21.09	43.13	27.81	60.2	4.55	1.3
								11.91	m	20.83	43.34	27.97	64.3	4.89	1.6
									b	20.56	43.60	28.15	58.2	4.43	2.4
9	9/13/2006	10:43	3.3	40.6054	-73.9027	1.69	0.96	19.02	s	20.42	42.37	27.27	79.7	6.12	1.1
								21.07	m	20.43	42.58	27.42	75.5	5.79	1.0
									b	20.41	42.57	27.42	75.4	5.79	1.0
10	7/27/2006	10:34	1.3	40.6023	-73.8521	1.09	1.00	18.39	smb	24.68	42.55	27.35	106.1	7.55	2.7
								18.63							

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 4 (continued). GATE station information and water-quality data, 2006. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytoplankton			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
11	9/7/2006	12:14	9.1	40.5844	-73.8354	0.44	0.97 ^c	13.40 13.61	s	21.22	40.96	26.26	56.2	4.28	2.4
									m	21.07	41.41	26.58	58.3	4.44	2.7
									b	21.04	41.59	26.71	54.3	4.14	3.1
12	8/23/2006	13:19	4.9	40.6043	-73.8048	1.44	0.96 ^b	24.78 25.39	s	26.29	40.49	25.84	83.8	5.89	2.6
									m	25.17	42.27	27.14	71.1	5.02	3.1
									b	24.61	43.04	27.70	65.0	4.62	2.7
13	9/13/2006	12:06	9.1	40.6004	-73.7736	1.03	0.99	27.71 28.87	s	20.99	41.56	26.69	93.7	7.14	1.1
									m	20.90	41.62	26.74	70.1	5.35	0.8
									b	21.00	41.69	26.79	79.3	6.04	1.1
14	9/13/2006	10:19	5.8	40.6129	-73.9150	1.14	0.98	3.46 19.35	s	20.35	41.93	26.97	65.1	5.01	0.7
									m	20.72	42.48	27.35	14.5	1.11	0.9
									b	20.78	42.74	27.53	23.9	1.82	0.0
17	9/13/2006	12:37	2.6	40.6093	-73.8100	1.06	0.98 ^b	14.67 19.62	s	20.27	42.03	27.03	92.1	7.10	1.4
									m	20.18	42.24	27.18	88.3	6.82	1.4
									b	20.15	42.39	27.29	87.3	6.74	1.5
19	9/13/2006	11:51	1.9	40.6219	-73.7719	0.86	0.96 ^b	22.08 20.42	s	21.13	41.87	26.92	96.3	7.31	0.9
									m	21.11	41.88	26.92	93.5	7.11	0.9
									b	21.03	41.89	26.93	90.0	6.85	0.8
20	9/7/2006	10:48	2.2	40.6300	-73.9132	1.23	0.99	18.22 17.69	s	21.44	39.43	25.17	24.3	1.85	10.8
									m	21.29	40.80	26.15	59.1	4.50	4.7
									b	20.82	41.04	26.33	55.6	4.26	2.6

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 4 (continued). GATE station information and water-quality data, 2006. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
21	8/23/2006	10:55	1.0	40.6427	-73.8827	1.11	0.94 ^b	87.08	s	25.58	41.69	26.71	89.2	6.27	5.1
								88.95	m	25.03	42.06	26.98	67.2	4.76	2.9
									b	24.82	42.42	27.25	50.5	3.58	3.9
26	9/7/2006	11:49	4.0	40.6336	-73.7512			9.25	s	22.10	39.07	24.91	63.1	4.77	1.4
								8.75	m	21.62	39.70	25.36	59.2	4.50	1.8
									b	21.55	39.82	25.45	56.1	4.26	1.7
27	9/7/2006	11:11	1.0	40.6481	-73.8749	1.51	0.99	4.98	s	22.57	21.98	13.24	53.5	4.28	5.3
								5.30	b	21.93	28.43	17.55	52.4	4.14	5.4
28	8/23/2006	11:15	1.6	40.6486	-73.8547	2.10	0.94 ^b	32.73	s	25.19	41.48	26.57	65.8	4.66*	7.5
								33.36	m	25.15	41.56	26.63	75.9	5.38*	7.0
									b	25.10	41.68	26.71	69.1	4.90*	5.5

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 4 (continued). GATE station information and water-quality data, 2006. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
1	7/27/2006	14:54	3.6	40.5675	-73.9351	0.66	0.97 ^b	1.82	s	21.92	44.63	28.88	100.0	7.40	0.9
									m	21.47	45.20	29.30	103.5	7.71	2.3
									b	21.39	45.35	29.40	99.5	7.41	0.8
1	8/2/2006	9:15	4.1	40.5675	-73.9359	1.06	0.98		s	24.86		26.84	97.6	7.11	1.7
									m	23.46		26.20	101.5	7.21	1.5
									b	23.92		27.98	82.9	5.88	1.7
1	8/23/2006	9:12	5.2	40.5676	-73.9353	0.51	0.97 ^b	8.64 7.64	s	21.91	46.14	29.98	75.6	5.57	0.7
									m	21.86	46.24	30.05	79.9	5.88	1.0
									b	21.76	46.38	30.15	76.5	5.64	1.0
1	8/30/2006	9:35	4.9	40.5675	-73.9352	0.52	0.96		s	21.75	44.34	28.67	59.3	4.41	1.8
									m	21.76	44.37	28.70	61.6	4.58	2.1
									b	21.77	44.45	28.75	59.2	4.40	2.6
5	7/27/2006	10:12	9.4	40.5780	-73.8698	1.37	1.00	10.27	s	22.88	43.21	27.85	85.8	6.28	1.5
									m	22.32	44.11	28.50	86.1	6.34	1.6
									b	22.14	44.47	28.76	90.0	6.64	2.2
5	8/2/2006	9:31	8.8	40.5785	-73.8711	1.84	0.99		s	26.96		26.87	124.4	8.16*	3.1
									m	25.21		27.47	93.8	6.40*	1.6
									b	24.27		27.90	89.5	6.39*	1.3
5	8/9/2006	10:01	9.1	40.5779	-73.8700	0.76	0.99 ^b		s	24.53	44.98	29.09	104.6	7.38*	2.2
									m	23.99	45.77	29.68	95.7	6.80*	2.5
									b	23.66	46.49	30.20	95.6	6.81*	2.5

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 4 (continued). GATE station information and water-quality data, 2006. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
5	8/23/2006	9:55	9.1	40.5779	-73.8700	0.61	0.98	13.89 11.83	s	23.35	45.07	29.18	68.2	4.91	1.3
									m	22.59	45.20	29.29	79.7	5.82	1.7
									b	22.32	45.47	29.48	75.0	5.50	1.7
5	8/30/2006	9:56	9.1	40.5780	-73.8700	0.71	0.98 ^c		s	22.07	44.36	28.69	60.7	4.48	1.8
									m	22.09	44.47	28.77	73.0	5.39	2.2
									b	22.08	44.46	28.75	65.1	4.81	2.3
7	7/27/2006	13:55	8.5	40.5849	-73.8301	1.80	0.99 ^c	33.30	s	25.62	41.44	26.53	116.1	8.16	3.2
									m	25.58	41.50	26.57	110.3	7.76	3.3
									b	25.65	41.38	26.49	109.6	7.70	3.4
7	8/2/2006	13:11	9.1	40.5851	-73.8298	1.47	0.98		s	26.17		27.26	120.2	8.47	0.3
									m	25.62		27.48	14.7	8.01	2.0
									b	25.25		27.53	10.2	7.16	2.0
7	8/9/2006	12:24	-	40.5851	-73.8298	1.01	0.97								
7	8/23/2006	13:34	8.2	40.5850	-73.8296	0.69	0.98 ^{bc}	25.63 21.35	s	25.24	42.49	27.29	60.1	4.23	2.9
									m	25.23	42.49	27.29	67.1	4.73	2.6
									b	25.19	42.52	27.31	61.0	4.30	2.7
7	8/30/2006	13:03	8.2	40.5849	-73.8298	0.78	1.00		s	21.98	42.61	27.43	59.9	4.47	1.9
									m	22.10	43.66	28.18	60.7	4.50	2.0
									b	22.10	43.69	28.20	57.1	4.23	2.2

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 4 (continued). GATE station information and water-quality data, 2006. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
10	7/27/2006	10:34	5.9	40.5920	-73.8794	2.62	0.97 ^c	-	smb	24.68	42.55	27.35	106.1	7.55	2.7
10	8/2/2006	9:49	3.8	40.5919	-73.8793	2.01	0.95 ^{ba}		s	27.35		26.56	144.5	9.93	2.8
									m	26.59		26.70	103.0	6.99	2.3
									b	27.00		26.57	24.7	8.50	2.4
10	8/9/2006	10:31	3.9	40.5919	-73.8793	2.17	0.96 ^c	44.17 47.90							
10	8/23/2006	10:10	4.1	40.5921	-73.8794	0.74	0.99 ^b	17.24	s	24.64	43.72	28.19	76.5	5.42	2.0
								19.92	m	24.21	43.98	28.38	75.7	5.39	2.3
									b	24.17	44.00	28.39	68.3	4.88	2.2
10	8/30/2006	10:18	3.7	40.5921	-73.8794	3.46	0.97 ^{bc}	11.30	s	21.84	42.31	27.22	57.8	4.33	2.2
								11.70	m	21.89	42.40	27.28	69.9	5.22	2.2
									b	21.97	43.06	27.75	61.0	4.54	2.2
10	9/7/2006	10:21	3.8	40.5921	-73.8794	0.81	0.98 ^b	9.06	s	20.81	42.44	27.32	54.0	4.12	3.6
								9.22	m	20.65	42.72	27.52	62.6	4.78	3.0
									b	20.58	42.79	27.58	54.9	4.20	3.2
10	9/13/2006	9:35	3.9	40.5921	-73.8794	8.83	1.00 ^{bcd}	14.57	s	20.22	43.03	27.75	84.9	6.53	1.8
								15.01	m	20.21	43.38	28.00	81.8	6.28	2.5
									b	20.21	43.44	28.04	82.3	6.31	2.2

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 4 (continued). GATE station information and water-quality data, 2006. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
15	7/27/2006	10:54	12.2	40.6277	-73.8828	1.86	0.99 ^c	65.24	s	25.28	41.74	26.75	81.1	5.73	3.7
									m	25.03	41.98	26.93	75.7	5.37	4.2
									b	24.76	42.34	27.19	76.9	5.46	3.4
15	8/2/2006	10:10	11.0	40.6274	-73.8830	1.57	0.96 ^{bc}		s	27.43		25.73	106.1	7.57*	2.4
									m	25.37		27.21	51.0	3.63*	1.0
									b	24.64		27.65	43.6	3.05*	0.9
15	8/9/2006	0:00	12.2	40.6274	-73.8830	1.73	0.98 ^c								
15	8/23/2006	10:28	11.3	40.6272	-73.8832	0.89	1.00	51.29	s	25.00	42.89	27.58	66.2	4.68	2.2
								47.21	m	24.74	43.27	27.86	75.1	5.32	2.4
									b	24.63	43.49	28.01	65.8	4.67	2.3
15	8/30/2006	10:37	11.6	40.6275	-73.8825				s	22.08	42.31	27.22	54.5	4.06	2.1
									m	22.22	43.10	27.78	69.4	5.14	2.4
									b	22.29	43.33	27.94	56.1	4.15	2.7
16	7/27/2006	14:18	1.2	40.6048	-73.8511	1.34	1.00	54.68	s	26.56	41.80	26.77	147.4	10.18	5.8
									m	26.56	41.79	26.76	147.1	10.16	5.6
									b	26.53	41.80	26.77	143.6	9.93	5.8
16	8/2/2006	13:29	2.8	40.6057	-73.8514	1.59	0.98 ^c		s	29.13		26.80	158.5	10.78	3.9
									m	28.76		26.91	140.7	9.45	3.6
									b	27.42		27.03	124.9	8.86	3.0

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 4 (continued). GATE station information and water-quality data, 2006. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
16	8/23/2006	14:03	1.0	40.6051	-73.8511	2.72	0.98 ^b	8.27 8.87	s	25.97	42.90	27.56	86.7	6.02	4.2
									b	25.88	42.90	27.57	87.0	6.05	4.6
16	8/30/2006	13:21	2.8	40.6057	-73.8516	1.08	0.99		s	21.60	42.70	27.50	59.9	4.49	2.5
									m	21.62	42.77	27.55	65.0	4.88	2.6
									b	21.78	43.09	27.78	59.3	4.43	2.4
18	7/27/2006	13:04	5.5	40.6248	-73.7894	1.90	0.99 ^c	163.65	s	26.38	39.06	24.83	113.1	7.92	2.6
									m	25.42	39.19	24.94	65.4	4.66	3.5
									b	26.01	39.05	24.83	106.8	7.53	2.8
18	8/2/2006	12:17	4.9	40.6250	-73.7886	3.56	0.99 ^c		s	30.33		23.64	159.3	10.81	4.9
									m	29.32		24.00	146.9	9.75	4.2
									b	26.72		24.97	31.8	1.02	1.3
18	8/9/2006	12:04	4.0	40.6250	-73.7886	1.07	0.99								
18	8/23/2006	12:42	3.7	40.6250	-73.7892	0.99	0.99	39.43 39.25	s	26.09	40.55	25.89	82.9	5.80	2.2
									m	25.89	40.54	25.89	81.3	5.71	1.8
									b	24.90	41.20	26.38	63.3	4.51	3.0
18	8/30/2006	12:22	5.2	40.6251	-73.7891	2.52	0.99 ^c		s	22.78	41.67	26.75	39.4	2.91	1.7
									m	22.79	41.67	26.75	41.2	3.04	1.8
									b	22.79	41.67	26.75	39.1	2.89	1.7

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 4 (continued). GATE station information and water-quality data, 2006. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
23	7/27/2006	11:30	7.6	40.6436	-73.8448	1.72	0.99 ^c	66.32	s	26.32	40.24	25.66	125.1	8.73	4.3
									m	25.72	40.50	25.86	73.3	5.17	4.2
									b	25.65	40.65	25.97	70.8	4.99	4.4
23	8/2/2006	10:47	8.8	40.6435	-73.8449	1.58	0.99 ^b		s	28.09		24.85	100.9	7.1	3.2
									m	26.49		26.11	38.1	2.7	1.5
									b	25.33		27.15	35.3	2.4	1.1
23	8/9/2006	11:15	9.1	40.6435	-73.8449	1.82	0.97 ^b								
23	8/23/2006	11:30	8.5	40.6435	-73.8449	0.98	0.98	26.80	s	25.36	41.64	26.68	55.6	3.92	224.2
								27.58	m	25.00	42.02	26.95	55.6	3.94	2.1
									b	24.89	42.37	27.21	47.9	3.40	2.6
23	8/30/2006	11:06	10.1	40.6434	-73.8448	2.94	0.97 ^c		s	22.18	41.92	26.94	46.2	3.44*	2.3
									m	22.32	42.41	27.29	47.7	3.54*	2.6
									b	22.38	42.66	27.46	43.7	3.24*	2.9
24a	7/27/2006	12:29	11.6	40.6379	-73.8104	3.28	0.99 ^c	104.24	s	27.34	37.66	23.82	170.7	11.84	5.2
									m	25.94	39.73	25.31	58.5	4.12	4.6
									b	25.39	39.98	25.50	15.6	1.11	3.9
24a	8/2/2006	11:41	11.3	40.6377	-73.8103	1.49	0.97		s	29.41		22.86	173.7	11.42	3.7
									m	26.97		25.33	38.9	2.68	1.6
									b	26.10		25.82	19.0	1.28	4.7

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 4 (continued). GATE station information and water-quality data, 2006. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
24a	8/9/2006	11:44	10.4	40.6377	-73.8103	1.15	0.98 ^b								
24a	8/23/2006	12:15	10.7	40.6377	-73.8108	1.13	0.98	34.22 33.37	s	25.98	39.99	25.49	64.3	4.52	2.2
									m	24.93	41.79	26.79	40.2	2.86	1.9
									b	24.91	42.13	27.04	33.8	2.40	2.2
24a	8/30/2006	11:49	11.9	40.6377	-73.8109	9.12	1.00 ^{cd}		s	22.72	40.83	26.15	46.8	3.47	1.5
									m	22.79	41.50	26.62	44.0	3.25	1.5
									b	22.92	41.99	26.97	29.7	2.18	1.9
24b	7/27/2006	12:44	7.5	40.6311	-73.7983	2.42	1.00 ^c	197.36	s	26.90	39.02	24.78	135.4	9.40	4.5
									m	26.03		25.15	79.5	5.61	3.0
									b	25.51	39.86	25.41	59.2	4.19	3.5
24b	8/2/2006	11:58	8.8	40.6310	-73.7983	1.61	0.95		s	29.46		23.18	16.4	11.16	3.6
									m	26.50		25.10	12.9	0.90	0.6
									b	25.81		25.44	13.2	0.97	4.7
24b	8/9/2006	11:26	8.2	40.6310	-73.7983	0.79	0.97								
24b	8/23/2006	12:30	8.2	40.6310	-73.7983	1.26	0.99	43.90 43.31	s	26.25	41.02	26.22	84.4	5.88	1.9
									m	24.90	41.56	26.63	39.5	2.81	1.7
									b	24.87	41.96	26.92	30.7	2.18	1.0

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 4 (continued). GATE station information and water-quality data, 2006. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
24b	8/30/2006	12:04	9.8	40.6311	-73.7985	2.16	0.96 ^c		s	22.77	41.36	26.53	49.6	3.67	1.4
									m	22.77	41.39	26.55	50.6	3.74	1.4
									b	22.81	41.62	26.71	42.7	3.15	1.7
29	7/27/2006	12:15	8.2	40.6452	-73.8205	2.08	0.98 ^{bc}	77.18	s	27.44	37.32	23.58	177.3	12.28	4.6
									m	26.02	39.54	25.17	68.7	4.84	4.6
									b	25.89	39.96	25.48	71.0	5.00	4.8
29	8/2/2006	11:22	-	40.6452	-73.8204	1.92	0.99		s	28.60		23.69	116.3	7.91	3.3
									m	27.68		25.09	74.4	5.22	2.5
									b	26.65		25.63	21.8	1.51	4.3
29	8/9/2006	0:00	-	40.6452	-73.8204	1.37	1.00								
29	8/23/2006	12:03	7.3	40.6453	-73.8206	0.82	0.99 ^{bc}	32.20	s	26.02	39.48	25.13	69.5	4.89	2.4
								32.01	m	25.09	41.43	26.54	54.2	3.85	1.9
									b	24.93	41.99	26.94	45.6	3.24	2.0
29	8/30/2006	11:35	8.5	40.6455	-73.8211	0.63	0.95 ^{bc}		s	22.28	39.84	25.46	47.5	3.56	2.1
									m	22.39	41.58	26.69	39.8	2.96	2.0
									b	22.40	41.93	26.94	39.7	2.95	2.3

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 5. ASIS station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
1	8/10/2005	11:43	0.4	37.8821	-75.4858	5.38	1.00 ^b	7.15	smb	27.72	45.30	29.25	47.0	3.14	22.6
2	8/10/2005	10:47	4.6	37.8981	-75.4565	2.48	1.00	12.25	s	26.89	44.58	28.76	68.6	4.66	14.1
									m	26.85	44.56	28.74	67.8	4.61	18.8
									b	26.82	44.62	28.78	66.8	4.54	28.0
3	8/10/2005	14:04	1.4	37.8797	-75.4070	1.75	0.98	10.40	s	25.49	45.31	29.31	105.5	7.32	11.9
									m	25.43	45.32	29.32	104.7	7.27	13.9
									b	25.42	45.32	29.32	104.3	7.24	15.3
5	8/10/2005	11:13	2.7	37.9006	-75.4683	2.73	0.99	10.78	s	27.11	44.57	28.74	64.0	4.33	19.5
									m	27.06	44.28	28.53	63.3	4.29	21.8
									b	27.07	44.27	28.53	63.1	4.28	22.1
8	8/16/2005	12:03	1.6	37.9776	-75.4243	3.20	0.98	32.95	s	29.74	43.81	28.12	105.2	6.84	19.9
									m	29.75	43.81	28.12	107.2	6.97	19.5
									b	29.59	43.79	28.11	97.1	6.34	23.2
9	8/3/2005	13:43	1.9	37.9706	-75.3897	4.14	1.00	23.57	s	28.93	46.08	29.78	111.3	7.27	29.5
									m	28.89	46.07	29.77	110.3	7.21	33.2
									b	28.86	46.06	29.77	109.0	7.13	39.9
12	7/26/2005	12:56	2.5	37.9937	-75.3663	3.44	1.00	22.00	s	28.95	45.99	29.71	94.7	6.18	21.2
									m	28.86	45.98	29.71	94.2	6.16	25.0
									b	28.87	46.01	29.73	93.2	6.09	25.4

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 5 (continued). ASIS station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
12	8/3/2005	14:21	1.8	37.9939	-75.3672	3.83	0.99	20.92	s	29.31	46.45	30.03	110.6	7.17	28.9
									m	29.31	46.45	30.03	110.5	7.16	29.6
									b	29.30	46.45	30.03	109.6	7.11	33.6
14	8/11/2005	13:16	1.2	38.0759	-75.3607	3.61	0.99	49.31	s	29.44	40.66	25.88	181.5	12.01	18.0
									m	28.42	40.91	26.09	130.2	8.76	28.1
									b	28.08	40.93	26.11	100.7	6.81	102.1
16	8/1/2005	14:49	2.2	38.0565	-75.2709	1.85	0.99	8.89	s	27.63	42.29	27.09	111.6	7.56	7.0
									m	27.44	42.41	27.19	110.3	7.49	9.6
									b	27.20	42.56	27.29	107.8	7.35	14.1
17	8/9/2005	11:30	1.0	38.0968	-75.3322	3.44	1.00	15.71	s	28.12	40.50	25.81	62.7	4.24	22.6
									m	28.15	40.54	25.83	64.3	4.35	22.4
									b	28.13	40.53	25.83	64.3	4.35	23.4
18	8/9/2005	10:50	2.1	38.0985	-75.2900	2.74	0.98	8.67	s	28.16	39.57	25.15	76.5	5.19	17.8
									m	28.15	39.57	25.14	76.0	5.16	19.1
									b	28.13	39.54	25.12	75.3	5.12	19.5
21	7/27/2005	11:39	1.9	38.1363	-75.2584	3.11	0.98	21.73	s	29.69	38.40	24.28	108.9	7.24	17.4
									m	29.14	38.37	24.27	104.4	7.01	27.2
									b	29.31	38.48	24.35	91.5	6.12	30.0
21	8/2/2005	13:24	2.4	38.1361	-75.2579	2.48	1.00	26.82	s	28.82	37.77	23.86	142.9	9.66	13.1
									m	28.06	38.23	24.20	135.1	9.24	14.1
									b	27.18	38.70	24.56	106.8	7.39	23.9

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 5 (continued). ASIS station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
22	8/9/2005	13:35	0.5	38.1511	-75.2025	3.52	0.98b	12.73	smb	28.06	40.27	25.64	88.2	5.98	21.3
23	8/2/2005	13:58	1.9	38.1883	-75.2457	3.31	0.99c	23.90	s	28.85	36.93	23.28	139.8	9.48	12.3
									m	27.86	37.32	23.58	126.8	8.73	15.4
									b	26.94	38.11	24.15	89.3	6.22	28.5
25	8/4/2005	10:38	1.4	38.2262	-75.1591	2.26	0.98	50.40	s	29.55	40.66	25.88	93.1	6.15	5.5
									m	29.39	40.94	26.08	81.7	5.40	6.7
									b	29.21	41.20	26.27	70.1	4.65	7.4
26	7/27/2005	13:57	1.0	38.2380	-75.2096	2.74	0.98	19.40	s	30.78	37.08	23.33	115.9	7.61	18.2
									m	30.78	37.07	23.32	116.0	7.61	18.0
									b	30.77	37.07	23.32	115.9	7.61	18.1
26	8/2/2005	14:32	1.3	38.2379	-75.2095	3.05	0.95	29.91	s	29.45	35.25	22.09	145.5	9.83	11.2
									m	29.31	35.26	22.10	146.3	9.91	11.5
									b	28.95	35.40	22.21	141.6	9.64	12.5
28	8/8/2005	14:05	1.2	38.2678	-75.1355	2.21	0.99	13.71	s	27.63	43.45	27.92	100.2	6.75	10.4
									m	27.63	43.45	27.92	100.2	6.75	11.2
									b	27.62	43.45	27.92	100.2	6.75	12.6

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 5 (continued). ASIS station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
6	7/26/2005	13:56	3.0	37.9293	-75.3908	3.10	0.99	20.48	s	26.58	46.18	29.91	89.6	6.08	24.1
									m	26.56	46.20	29.93	89.6	6.08	24.0
									b	26.54	46.20	29.93	89.4	6.07	24.0
6	8/3/2005	12:10	1.8	37.9292	-75.3909	2.42	1.00	14.25	s	27.11	46.21	29.92	98.2	6.60	37.2
									m	27.09	46.24	29.95	98.3	6.61	19.8
									b	27.11	46.25	29.95	98.0	6.59	19.8
6	8/10/2005	10:10	2.8	37.9293	-75.3912	2.43	1.00	16.74	s	26.93	44.48	28.68	70.6	4.79	17.5
									m	26.90	44.49	28.68	71.0	4.83	19.9
									b	26.90	44.45	28.65	70.7	4.81	21.1
6	8/16/2005	11:25	2.0	37.9291	-75.3909	3.13	0.98	21.51	s	26.52	45.73	29.59	90.0	6.13	28.8
									m	26.53	45.76	29.61	89.9	6.12	33.1
									b	26.52	45.76	29.61	89.8	6.11	38.5
7	7/26/2005	14:27	2.3	37.9148	-75.3807	1.50	0.97	16.15	s	29.78	46.42	30.00	121.1	7.79	9.0
									m	28.88	46.31	29.94	121.7	7.95	9.6
									b	28.65	46.46	30.06	117.7	7.71	10.1
7	8/3/2005	11:34	1.7	37.9147	-75.3806	2.41	1.00	10.51	s	27.41	46.36	30.02	90.6	6.06	17.0
									m	27.39	46.29	29.98	90.0	6.02	19.0
									b	27.39	46.27	29.96	89.5	5.99	22.2
7	8/10/2005	14:25	2.4	37.9146	-75.3808	2.03	1.00	17.94	s	28.34	44.79	28.86	95.9	6.35	11.0
									m	27.83	44.84	28.92	98.8	6.61	10.8
									b	27.38	44.83	28.92	97.3	6.55	12.3

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 5 (continued). ASIS station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
7	8/16/2005	10:56	1.9	37.9146	-75.3812	3.72	0.99	16.09	s	27.16	45.79	29.62	78.2	5.26	27.2
									m	27.15	45.81	29.63	77.9	5.24	30.2
									b	27.19	45.86	29.67	77.3	5.20	34.6
10	7/26/2005	14:55	1.4	37.9780	-75.3107	4.30	0.99	25.74	s	30.14	46.94	30.36	95.7	6.11	30.2
									m	30.14	46.93	30.36	95.8	6.11	30.8
									b	30.12	46.94	30.36	95.8	6.12	33.6
10	8/3/2005	10:53	1.2	37.9775	-75.3109	2.59	0.99	12.03	s	29.05	46.92	30.38	73.8	4.79	14.0
									m	28.68	46.96	30.42	68.7	4.49	18.2
									b	28.66	46.95	30.41	65.8	4.30	21.7
10	8/10/2005	14:53	1.4	37.9777	-75.3109	4.66	0.98	14.36	s	29.10	45.27	29.18	60.0	3.92	30.2
									m	29.11	45.15	29.10	59.6	3.90	35.1
									b	29.11	45.13	29.09	59.3	3.88	40.4
10	8/16/2005	10:25	1.3	37.9774	-75.3116	4.66	0.98	37.39	s	29.51	45.90	29.63	82.1	5.31	27.8
									m	29.53	45.90	29.63	81.8	5.29	31.0
									b	29.53	45.90	29.63	81.5	5.28	31.9
11	7/26/2005	13:18	2.5	38.0004	-75.3843	3.50	0.99	15.28	s	29.22	43.91	28.21	90.9	5.96	25.3
									m	29.11	43.90	28.20	90.5	5.94	26.4
									b	29.10	43.94	28.23	89.4	5.87	26.9
11	8/3/2005	14:03	1.6	38.0007	-75.3848	4.87	1.00	24.76	s	29.26	44.21	28.42	116.4	7.62	34.4
									m	29.26	44.26	28.46	116.6	7.63	35.8
									b	29.26	44.26	28.46	116.3	7.61	43.3

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 5 (continued). ASIS station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
11	8/9/2005	12:00	2.1	38.0004	-75.3845	4.10	0.99	29.32	s	28.47	44.26	28.48	88.6	5.87	30.3
									m	28.46	44.28	28.49	87.0	5.77	35.5
									b	28.45	44.28	28.49	85.5	5.67	43.9
11	8/16/2005	12:42	1.9	38.0006	-75.3849	4.92	1.00	27.31	s	29.82	43.24	27.71	92.9	6.05	40.3
									m	29.82	43.28	27.74	92.7	6.03	42.4
									b	29.81	43.29	27.74	92.0	5.99	46.9
13	7/27/2005	10:35	2.0	38.0364	-75.2719	2.33	0.99 ^c	9.75	s	29.69	42.50	27.19	99.8	6.53	9.7
									m	29.43	42.47	27.17	99.7	6.56	12.4
									b	29.27	17.53	11.15	93.3	6.72	14.1
13	8/1/2005	2:32	1.8	38.0362	-75.2726	2.27	1.00	14.90	s	27.68	41.96	26.86	113.5	7.69	11.4
									m	27.61	41.93	26.84	113.7	7.72	11.7
									b	27.51	41.92	26.83	111.9	7.61	12.9
13	8/9/2005	12:49	1.6	38.0359	-75.2730	2.10	0.99	11.65	s	28.36	43.03	27.60	79.4	5.30	10.7
									m	28.37	43.03	27.60	79.5	5.31	10.9
									b	28.35	43.12	27.67	79.0	5.27	11.5
13	8/16/2005	9:50	2.0	38.0359	-75.2727	2.40	1.00 ^a	9.81	s	29.26	44.01	28.27	87.2	5.72	13.7
									m	29.24	44.16	28.39	87.0	5.70	13.9
									b	29.21	44.33	28.51	86.0	5.63	15.0
15	7/26/2005	11:52	1.4	38.0672	-75.3313	2.70	0.98	14.14	s	29.56	39.29	24.91	98.7	6.56	11.9
									m	28.65	39.69	25.22	99.7	6.71	16.5
									b	28.59	39.78	25.28	91.9	6.19	14.4

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 5 (continued). ASIS station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
15	8/1/2005	13:56	1.5	38.0670	-75.3312	3.88	0.99	25.25	s	27.61	40.65	25.92	105.8	7.22	26.0
									m	27.60	40.64	25.92	104.6	7.14	30.3
									b	27.50	40.67	25.94	103.7	7.09	35.8
15	8/9/2005	11:07	1.2	38.0671	-75.3313	4.02	0.97	23.79	s	27.97	41.29	26.37	78.2	5.29	25.4
									m	27.96	41.33	26.40	77.9	5.27	26.4
									b	27.94	41.34	26.41	77.3	5.23	26.0
15	8/16/2005	13:11	1.5	38.0669	-75.3312	5.53	0.98	26.55	s	29.37	41.94	26.79	78.4	5.17	39.0
									m	29.36	42.20	26.98	76.8	5.06	40.2
									b	29.30	42.26	27.02	71.8	4.74	44.9
19	7/27/2005	11:19	1.2	38.1051	-75.2343	2.21	1.00	9.59	s	29.42	40.99	26.11	97.7	6.46	10.5
									m	29.41	41.05	26.16	97.6	6.45	10.3
									b	29.37	41.00	26.12	97.0	6.42	10.7
19	8/3/2005	10:02	1.6	38.1044	-75.2343	1.75	0.96 ^b	8.62	s	28.58	40.56	25.83	101.1	6.79	8.4
									m	28.47	40.82	26.02	96.4	6.48	7.9
									b	28.42	40.86	26.06	92.0	6.18	9.1
19	8/9/2005	10:20	1.1	38.1048	-75.2352	2.13	0.99	11.11	s	28.10	40.28	25.65	80.6	5.46	9.4
									m	28.10	40.28	25.65	80.5	5.45	9.7
									b	28.10	40.30	25.66	80.7	5.47	9.3
19	8/15/2005	13:25	1.7	38.1059	-75.2353	1.90	0.99	11.43	s	30.26	41.00	26.10	105.7	6.89	10.5
									m	30.27	41.00	26.10	105.9	6.90	10.1
									b	30.26	41.00	26.10	105.8	6.90	10.4

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 5 (continued). ASIS station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
20	7/27/2005	11:56	0.5	38.1453	-75.2864	4.31	1.00 ^b	20.05	s	30.99	37.94	23.92	94.6	6.16	28.1
									m	31.00	37.94	23.93	94.5	6.16	28.3
									b	31.00	37.95	23.93	94.5	6.16	28.3
20	8/2/2005	13:39	1.0	38.1451	-75.2860	5.07	0.99	27.37	s	28.89	34.97	21.91	124.3	8.48	23.3
									m	28.05	35.73	22.45	107.1	7.38	33.5
									b	27.20	36.60	23.08	89.5	6.24	41.7
20	8/9/2005	9:59	0.9	38.1453	-75.2866	3.90	0.99 ^a	15.44	s	27.52	37.02	23.37	63.2	4.38	24.4
									m	27.59	37.35	23.60	64.7	4.47	24.3
									b	27.63	37.52	23.72	66.3	4.57	24.1
20	8/15/2005	12:36	0.9	38.1454	-75.2863	4.91	1.00 ^c	23.99	s	30.44	37.90	23.91	95.3	6.27	33.0
									m	30.42	37.90	23.91	95.3	6.27	35.3
									b	30.41	37.88	23.90	95.1	6.26	35.5
24	7/27/2005	13:32	1.5	38.2144	-75.1809	2.32	0.95	17.12	s	30.64	39.19	24.81	102.8	6.71	15.5
									m	30.27	39.16	24.80	102.6	6.74	35.5
									b	30.41	39.25	24.86	95.6	6.26	18.5
24	8/2/2005	12:52	2.0	38.2143	-75.1808	2.86	0.99	21.08	s	28.49	38.43	24.34	119.4	8.09	13.8
									m	27.91	38.71	24.55	108.5	7.42	15.0
									b	27.06	40.22	25.63	75.3	5.19	21.0
24	8/8/2005	14:42	2.1	38.2146	-75.1809	2.93	0.99	24.49	s	29.35	40.03	25.44	108.7	7.22	14.0
									m	29.30	40.02	25.44	107.8	7.17	15.1
									b	28.96	40.04	25.45	94.2	6.30	20.5

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 5 (continued). ASIS station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
24	8/15/2005	11:41	1.8	38.2143	-75.1812	3.72	0.98	17.56	s	30.00	39.60	25.11	95.4	6.28	19.8
									m	29.56	39.70	25.20	84.1	5.57	24.9
									b	28.96	40.10	25.50	62.0	4.15	43.6
27a	7/27/2005	14:06	1.1	38.2395	-75.2084	3.35	0.98 ^b	18.70	s	30.62	36.58	22.98	114.3	7.53	25.1
									m	30.59	36.58	22.98	113.8	7.51	31.9
									b	30.56	36.60	23.00	112.6	7.43	35.0
27a	8/2/2005	14:18	1.5	38.2395	-75.2081	2.81	0.98	28.77	s	29.46	35.23	22.08	145.1	9.80	11.7
									m	29.39	35.27	22.11	145.4	9.84	11.8
									b	28.78	35.47	22.26	140.8	9.61	12.5
27a	8/9/2005	9:17	1.2	38.2388	-75.2085	3.25	1.00 ^a	21.68	s	27.96	34.24	21.42	74.0	5.14	17.1
									m	28.02	34.28	21.45	72.4	5.03	17.5
									b	28.25	35.40	22.22	67.5	4.65	24.3
27a	8/15/2005	12:03	1.9	38.2392	-75.2083	3.86	1.00	43.89	s	31.14	31.95	19.91	110.0	7.32	22.0
									m	30.36	35.54	22.27	102.8	6.84	22.7
									b	29.29	38.74	24.53	57.2	3.82	31.3
27b	7/28/2005	10:21	1.6	38.2460	-75.1487	2.67	1.00	14.85	s	28.83	39.49	25.07	81.0	5.44	13.2
								14.63	m	28.85	39.53	25.10	80.6	5.41	13.2
									b	28.85	39.54	25.11	80.1	5.38	13.7
27b	8/2/2005	11:34	2.1	38.2461	-75.1486	2.21	0.99	12.41	s	27.03	41.77	26.74	106.6	7.31	11.3
									m	27.02	41.72	26.70	107.0	7.34	12.2
									b	27.02	41.68	26.67	107.5	7.37	12.7

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 5 (continued). ASIS station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
27b	8/8/2005	14:21	2.5	38.2461	-75.1488	2.24	1.00	30.89	s	29.08	40.76	25.97	94.4	6.28	10.3
									m	29.02	40.79	25.99	93.7	6.25	11.0
									b	28.90	40.77	25.97	93.2	6.22	13.2
27b	8/15/2005	11:20	1.9	38.2461	-75.1487	3.45	1.00	17.67	s	29.44	39.34	24.95	89.0	5.92	20.1
									m	29.37	39.52	25.08	85.9	5.72	22.8
									b	29.34	39.59	25.13	83.4	5.55	24.6
29	7/28/2005	9:55	1.2	38.2850	-75.1303	1.91	0.98 ^a	13.55 13.98	s	28.09	40.16	25.57	79.8	5.41	10.0
									m	27.68	40.33	25.69	78.4	5.35	8.7
									b	27.85	40.30	25.67	75.6	5.14	8.9
29	8/2/2005	11:14	1.9	38.2852	-75.1304	1.38	0.99	5.15	s	26.51	44.45	28.67	103.3	7.07	6.7
									m	26.46	44.46	28.67	104.0	7.13	7.4
									b	26.43	44.44	28.66	104.5	7.16	8.1
29	8/8/2005	13:48	2.1	38.2852	-75.1304	1.05	0.95 ^c	11.38	s	27.24	43.76	28.15	104.6	7.09	7.1
									m	26.58	44.10	28.41	101.4	6.94	5.7
									b	25.83	44.42	28.66	98.7	6.83	3.8
29	8/15/2005	11:01	1.8	38.2851	-75.1306	2.81	1.00	17.83	s	29.64	40.74	25.93	85.3	5.63	15.8
									m	29.64	40.74	25.94	84.6	5.58	17.2
									b	29.64	40.74	25.93	83.8	5.53	18.5
30	7/28/2005	9:26	2.0	38.3251	-75.0993	1.16	0.98 ^a	6.67 6.94	s	23.04	44.86	29.03	87.7	6.36	4.3
									m	22.97	44.88	29.05	87.4	6.34	5.1
									b	23.00	44.87	29.04	87.3	6.33	5.1

~ Depth approximated from chart and/or sonde data.

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^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 5 (continued). ASIS station information and water-quality data, 2005. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
30	8/2/2005	10:47	2.2	38.3252	-75.0990	1.03	0.99	4.82	s	24.73	45.18	29.24	99.5	6.99	2.3
									m	25.03	45.28	29.30	97.4	6.81	6.2
									b	25.03	45.28	29.30	97.3	6.81	7.2
30	8/8/2005	13:22	1.5	38.3254	-75.0990	0.97	0.99	4.50	s	29.13	40.42	25.72	73.6	4.90	17.6
									m	24.69	45.18	29.24	99.5	7.00	2.5
									b	24.68	45.22	29.26	99.5	7.00	2.8
30	8/15/2005	10:30	2.8	38.3252	-75.0990	2.91	0.98	17.56	s	25.04	45.29	29.30	97.2	6.79	5.4
									m	29.12	40.39	25.70	73.5	4.90	20.2
									b	29.12	40.42	25.72	73.3	4.88	32.2

[~] Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 6. COLO station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
2	7/9/2003	11:30	8.0	37.1891	-76.7614	2.38	1.00	34.08	s	29.43	0.22	0.10	127.2	9.70	15.2
									m	28.63	0.21	0.10	111.4	8.62	22.5
									b	28.59	0.21	0.10	105.1	8.14	31.7
3	7/16/2003	10:25	0.5	37.1904	-76.7523	5.16	0.97 ^b	47.60							
3	7/25/2003	10:40	1.2	37.1904	-76.7523	2.91	0.99	29.28	s	27.91	0.37	0.17	100.2	7.85	24.1
									m	27.65	0.37	0.17	99.1	7.80	26.0
									b	27.53	0.37	0.18	98.2	7.74	27.5
4	7/25/2003	11:03	0.7	37.1913	-76.7467	2.92	1.00	24.88	s	28.29	0.39	0.19	107.5	8.37	28.5
									m	28.23	0.39	0.19	107.6	8.38	29.2
									b	28.19	0.39	0.19	108.1	8.42	29.0
5	7/30/2003	11:17	3.3	37.1929	-76.7347	2.41	1.00	15.97	s	28.15	3.04	1.59	78.3	6.06	28.5
									m	28.20	3.80	1.99	78.4	6.05	28.9
									b	28.14	4.05	2.14	78.0	6.02	35.2
6	7/30/2003	11:48	9.0	37.1981	-76.7700	2.63	1.00	21.12	s	28.17	1.21	0.60	78.9	6.14	23.0
									m	28.24	1.57	0.79	78.5	6.10	24.6
									b	28.22	2.56	1.31	78.4	6.07	27.6
7	7/25/2003	10:25	2.4	37.1985	-76.7666	3.86	0.96	32.08	s	27.99	0.32	0.15	95.2	7.44	22.0
									m	27.70	0.29	0.13	94.0	7.39	23.6
									b	27.55	0.26	0.12	93.1	7.34	24.4

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 6 (continued). COLO station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
8	7/16/2003	10:45	2.4	37.1971	-76.7314	3.94	0.99	25.60	s	28.47	0.36	0.17	88.1	6.84	35.4
									m	28.45	0.36	0.17	87.6	6.80	35.0
									b	28.42	0.36	0.17	87.2	6.77	132.9
9	7/9/2003	12:02	2.0	37.1993	-76.7304	4.63	0.99	34.48	s	28.98	0.23	0.11	106.2	8.17	38.5
									m	28.94	0.23	0.11	105.7	8.14	51.0
									b	28.93	0.23	0.11	105.6	8.13	61.2
11	7/30/2003	11:55	1.2	37.2027	-76.7706	3.62	0.99	27.28	s	27.87	1.81	0.91	77.2	6.03	37.8
									m	27.89	1.90	0.96	77.1	6.01	39.7
									b	27.92	1.92	0.97	77.1	6.01	41.0
12	7/9/2003	14:30	0.3	37.2119	-76.7544	4.10	0.98	41.20	smb	31.64	0.22	0.10	116.9	8.59	97.5
13	7/16/2003	12:29	1.6	37.2078	-76.7391	3.55	0.99	38.32	s	29.28	0.47	0.22	101.5	7.76	36.5
									m	28.92	0.57	0.27	99.9	7.69	40.2
									b	28.76	0.61	0.29	97.0	7.48	42.9
14	7/25/2003	11:16	1.5	37.2047	-76.7271	2.69	1.00	16.13	s	28.69	0.70	0.34	96.6	7.46	23.4
									m	28.16	0.74	0.36	93.7	7.29	27.5
									b	27.86	0.77	0.38	94.5	7.40	30.3
16	7/30/2003	10:58	9.0	37.2094	-76.7063	2.44	1.00	12.73	s	28.11	4.36	2.31	77.8	6.00	26.6
									m	28.13	4.91	2.62	75.7	5.82	33.6
									b	28.52	6.16	3.33	75.1	5.72	35.2

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 6 (continued). COLO station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
17	7/25/2003	9:55	3.3	37.2165	-76.7889	2.78	0.99 ^a	41.04	s	27.23	0.17	0.08	95.2	7.55	23.8
									m	27.12	0.17	0.08	94.1	7.48	27.1
									b	27.12	0.17	0.08	94.0	7.47	28.1
19	7/16/2003	12:52	6.0	37.2153	-76.7616	4.26	0.99	42.00	s	29.02	0.30	0.14	104.3	8.01	47.0
									m	28.93	0.29	0.14	104.1	8.01	74.5
									b	28.77	0.29	0.14	102.2	7.89	57.4
21	7/9/2003	13:56	0.7	37.2115	-76.7379	3.94	0.98	42.00	s	31.63	0.30	0.14	106.4	7.82	28.1
									m	31.20	0.29	0.13	107.0	7.92	33.5
									b	31.17	0.27	0.13	107.6	7.96	29.5
22	7/30/2003	9:35	0.6	37.2133	-76.7222	3.64	0.99 ^a	26.40	s	27.21	2.10	1.07	77.7	6.13	29.0
									m	27.29	2.62	1.34	76.4	6.02	32.3
									b	27.42	3.06	1.59	76.5	6.00	34.0
23	7/25/2003	11:39	1.2	37.2139	-76.7099	3.19	1.00	16.80	s	28.78	0.87	0.43	94.1	7.25	25.3
									m	28.21	0.86	0.42	92.0	7.16	28.6
									b	27.91	0.85	0.42	91.1	7.13	30.7
24	7/16/2003	11:13	1.0	37.2158	-76.7028	4.43	1.00	50.00	s	28.37	0.41	0.20	100.5	7.81	39.3
									m	28.35	0.41	0.20	100.4	7.80	42.3
									b	28.34	0.41	0.20	100.5	7.81	44.2
25	7/9/2003	12:51	1.2	37.2204	-76.6895	2.54	0.97 ^b	36.64	s	30.39	0.27	0.13	119.9	9.00	18.9
									m	30.02	0.27	0.12	121.2	9.15	20.1
									b	29.81	0.26	0.12	122.8	9.31	21.1

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 6 (continued). COLO station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
26	7/9/2003	11:04	1.5	37.2201	-76.7881	2.29	0.99	50.48	s	29.10	0.17	0.08	136.9	10.51	11.3
									m	29.08	0.17	0.08	137.6	10.57	12.7
									b	29.06	0.17	0.08	137.9	10.59	13.1
27	7/16/2003	13:10	1.4	37.2233	-76.7795	3.24	0.99	51.20	s	28.66	0.21	0.10	105.0	8.12	34.4
									m	28.66	0.21	0.10	105.1	8.13	34.8
									b	28.65	0.21	0.10	104.8	8.11	35.5
28	7/25/2003	13:46	0.7	37.2192	-76.7683			52.96	smb	28.36	0.16	0.07	116.7	9.07	42.3
30	7/30/2003	10:43	1.0	37.2213	-76.6933	2.56	1.00	14.68	s	27.85	4.76	2.54	78.4	6.06	21.7
									m	27.86	4.77	2.54	78.3	6.06	21.7
									b	27.87	4.77	2.54	78.4	6.06	21.9

[~] Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 6 (continued). COLO station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
1	7/9/2003	11:50	4.3	37.1863	-76.7479	5.52	0.99	35.60	s	29.04	0.23	0.11	113.9	8.75	39.6
									m	28.75	0.23	0.11	108.9	8.40	57.8
									b	28.69	0.23	0.11	107.0	8.27	64.2
1	7/16/2003	10:36	3.0	37.1863	-76.7479	3.22	1.00	31.52	s	28.21	0.24	0.11	91.3	7.12	65.5
									m	28.19	0.23	0.11	89.1	6.95	127.5
									b	28.18	0.23	0.11	88.7	6.92	48.5
1	7/25/2003	10:54	4.3	37.1863	-76.7479	3.10	1.00	18.08	s	28.21	0.65	0.31	85.5	6.66	32.0
									m	28.16	0.64	0.31	84.9	6.62	34.2
									b	28.16	0.64	0.31	84.8	6.61	35.0
1	7/30/2003	11:23	4.5	37.1863	-76.7479	3.95	0.99	16.64	s	28.31	3.28	1.71	78.3	6.04	43.6
									m	28.31	3.28	1.71	78.3	6.04	45.9
									b	28.32	3.28	1.71	78.3	6.04	47.5
10	7/9/2003	11:17	2.0	37.2047	-76.7742	2.84	1.00	36.72	s	28.97	0.19	0.09	118.8	9.14	15.7
									m	28.87	0.19	0.09	117.9	9.08	17.9
									b	28.83	0.19	0.09	117.1	9.03	20.1
10	7/16/2003	10:15	1.4	37.2047	-76.7742	2.59	0.99	30.72	s	28.09	0.21	0.10	95.0	7.42	82.2
									m	28.08	0.21	0.10	94.6	7.39	113.5
									b	28.08	0.21	0.10	94.6	7.39	134.2
10	7/25/2003	10:10	1.6	37.2047	-76.7742	2.77	0.99	31.84	s	27.65	0.22	0.10	94.1	7.41	22.1
									m	27.52	0.21	0.10	93.7	7.39	23.4
									b	27.43	0.21	0.10	93.6	7.40	25.2

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 6 (continued). COLO station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
10	7/30/2003	12:04	2.1	37.2047	-76.7742	3.28	0.99	19.36	s	28.10	1.73	0.87	77.9	6.06	33.8
									m	28.11	1.91	0.96	78.0	6.06	33.2
									b	28.10	1.94	0.98	77.9	6.05	37.8
15	7/9/2003	12:15	2.0	37.2087	-76.7218	3.26	1.00	26.56	s	29.74	0.23	0.11	117.7	8.93	25.3
									m	29.16	0.23	0.11	115.8	8.88	32.3
									b	29.10	0.23	0.11	116.1	8.91	33.5
15	7/16/2003	11:01	2.0	37.2087	-76.7218	3.18	0.98	24.96	s	28.63	0.58	0.28	89.8	6.94	102.1
									m	28.60	0.62	0.30	89.6	6.93	39.4
									b	28.55	0.64	0.31	88.6	6.86	129.9
15	7/25/2003	11:27	2.1	37.2087	-76.7218	2.79	1.00	20.00	s	28.94	0.80	0.39	94.8	7.28	24.5
									m	28.28	0.78	0.38	93.6	7.27	27.5
									b	27.64	0.67	0.32	91.0	7.16	33.4
15	7/30/2003	11:04	2.4	37.2087	-76.7218	2.56	0.99	15.22	s	28.19	3.79	1.99	79.4	6.13	22.0
									m	28.18	4.08	2.15	79.1	6.10	23.4
									b	28.15	4.25	2.24	78.9	6.08	30.5
18	7/9/2003	10:44	2.0	37.2149	-76.7801	2.96	0.99	48.08	s	29.07	0.18	0.08	123.2	9.46	17.4
									m	29.06	0.18	0.08	123.1	9.46	18.9
									b	29.06	0.18	0.08	122.8	9.44	20.1
18	7/16/2003	9:56	2.0	37.2149	-76.7801	3.43	0.98	40.56	s	27.93	0.19	0.09	100.1	7.84	351.9
									m	27.91	0.19	0.09	99.8	7.82	34.2
									b	27.90	0.19	0.09	99.6	7.81	32.3

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

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^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 6 (continued). COLO station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
18	7/25/2003	9:40	1.0	37.2149	-76.7801	3.71	1.00 ^a	42.00	s	27.06	0.17	0.08	93.3	7.42	26.4
									m	27.02	0.17	0.08	93.0	7.41	27.0
									b	27.01	0.17	0.08	92.4	7.36	27.0
18	7/30/2003	12:15	1.8	37.2149	-76.7801	3.67	0.99	44.08	s	26.96	0.65	0.32	72.2	5.75	34.9
									m	26.97	0.65	0.31	71.7	5.71	37.1
									b	26.97	0.65	0.31	71.8	5.71	38.0
20	7/9/2003	14:11	1.8	37.2130	-76.7537	2.87	1.00	49.52	s	30.01	0.19	0.09	120.4	9.10	17.9
									m	29.76	0.19	0.09	119.0	9.03	21.8
									b	29.65	0.19	0.09	118.9	9.04	33.9
20	7/16/2003	12:41	2.3	37.2130	-76.7537	3.97	0.99	41.44	s	28.94	0.32	0.15	106.2	8.17	36.8
									m	28.78	0.32	0.15	105.5	8.14	40.1
									b	28.71	0.32	0.15	103.8	8.02	178.8
20	7/25/2003	13:32	1.8	37.2130	-76.7537	3.66	1.00	47.92	s	27.81	0.18	0.09	101.7	7.98	28.1
									m	27.53	0.18	0.09	102.7	8.11	29.5
									b	27.38	0.18	0.09	99.4	7.86	33.1
20	7/30/2003	9:20	2.1	37.2130	-76.7537	2.87	1.00 ^a	38.40	s	27.25	0.42	0.20	76.4	6.06	22.0
									m	27.21	0.50	0.24	75.1	5.95	23.9
									b	27.07	0.72	0.35	74.4	5.91	29.5
29	7/9/2003	13:06	0.6	37.2214	-76.7020	3.57	0.98	49.68	s	29.96	0.08	0.04	99.7	7.54	41.3
									m	30.49	0.31	0.14	96.8	7.25	50.7
									b	30.49	0.41	0.19	96.9	7.25	51.1

~ Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

Appendix 6 (continued). COLO station information and water-quality data, 2003. Data collected with multi-parameter sondes represent sampling depths of surface (s), mid-depth (m), near-bottom (b), or a single sampling depth (smb) for very shallow stations. Probability stations are presented first (by sequential hexagon number), followed by trend stations.

Station Information						PAR & Phytopigment			Sonde Data						
Hexagon	Date	Time	Depth (m)	Latitude	Longitude	K_d (m^{-1})	R^2 of K_d	Chl a ($\mu g/L$)	Sample depth	Temp. ($^{\circ}C$)	Specific cond. (mS/cm)	Salinity (psu)	DO (% saturation)	DO (mg/L)	Turbidity (NTU)
29	7/16/2003	11:33	1.2	37.2214	-76.7020	3.73	0.99	41.76	s	28.78	0.50	0.24	98.9	7.62	68.0
									m	28.69	0.50	0.24	98.5	7.61	213.6
									b	28.66	0.50	0.24	98.8	7.64	220.1
29	7/25/2003	12:03	0.7	37.2214	-76.7020	4.03	1.00	38.72	s	28.74	0.52	0.25	113.7	8.77	27.4
									m	28.13	0.43	0.21	106.8	8.33	32.8
									b	27.67	0.55	0.26	110.3	8.67	34.9
29	7/30/2003	10:28	1.0	37.2214	-76.7020	3.13	0.99	25.12	s	27.14	3.28	1.70	73.8	5.81	33.9
									m	27.14	3.28	1.71	73.4	5.78	37.0
									b	27.14	3.29	1.71	73.2	5.76	57.2

[~] Depth approximated from chart and/or sonde data.

^a PAR data collected outside prescribed time window and not used for analysis.

^b Underwater photosynthetic photon flux density (PPFD) used to calculate K_d instead of the ratio of underwater to in-air PPFD.

^c Data outliers excluded in the calculation of K_d .

^d Only three data points used to generate K_d .

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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