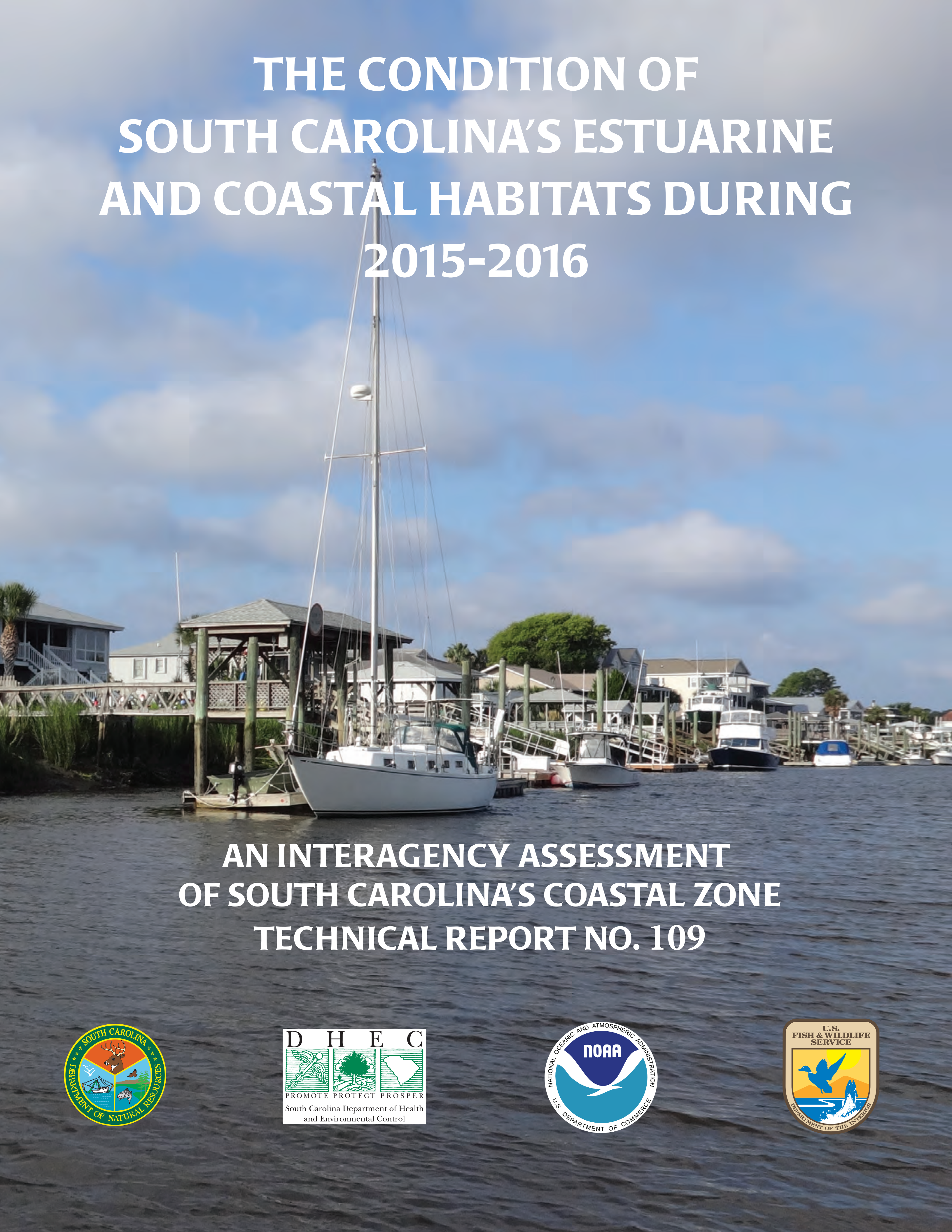
THE CONDITION OF SOUTH CAROLINA'S ESTUARINE AND COASTAL HABITATS DURING 2015-2016



AN INTERAGENCY ASSESSMENT OF SOUTH CAROLINA'S COASTAL ZONE

TECHNICAL REPORT NO. 109

The Condition of South Carolina's Estuarine and Coastal Habitats During 2015-2016

Technical Report

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INTRODUCTION

South Carolina's extensive coastal zone provides a setting for residents and tourists to enjoy and supports an abundance of natural resources. In 2016, tourism expenditures in South Carolina's eight coastal counties exceeded 8.4 billion dollars (U.S. Travel Association, 2017). In 2011, a total of 305,063 anglers collectively spent over 2 million days saltwater fishing in our state (Southwick Associates, 2012). South Carolina's most economically important fishery species rely upon a variety of sensitive coastal habitat types that serve as nursery or primary habitat during one or more life stages. Thus, it is critical to protect our coastal habitats from degradation.

As in most coastal states, the population in the coastal counties of South Carolina has been rapidly increasing in recent years. It is estimated that almost 1.4 million people are living in South Carolina's eight coastal counties in 2017 (U.S. Census Bureau, 2018). This number is expected to increase by another 9.5% by 2030 (South Carolina Budget and Control Board, 2018). The associated expansion of housing, roads, and commercial and industrial infrastructure, combined with increased recreational utilization of our coastal waters, may result in increased risk for serious impacts to South Carolina's coastal habitats.

The South Carolina Estuarine and Coastal Assessment Program (SCECAP) was established in 1999 to begin evaluating the overall health of the state's estuarine habitats on a periodic basis using a combination of water quality, sediment quality, and biotic condition measures. This collaborative program involves the South Carolina Department of Natural Resources (SCDNR) and the South Carolina Department of Health and Environmental Control (SCDHEC) as the two lead state agencies, as well as the National Oceanic and Atmospheric Administration's National Ocean Service (NOAA/NOS) laboratories located in Charleston (National Centers for Coastal Ocean Sciences Charleston Laboratory and the Hollings Marine Laboratory). The U.S. Environmental Protection Agency (USEPA) Gulf Ecology Division in Gulf Breeze, FL became actively involved in SCECAP shortly after the inception of the program, and utilized SCECAP data from 2000-2006 and again in 2010 in their National Coastal Condition Assessment (NCCA) Program.

Urban sprawl is one of the primary threats to the quality of South Carolina's estuarine habitats.

SCECAP represents an expansion of ongoing monitoring programs being conducted by both state and federal agencies, and ranks among the first in the country to apply a comprehensive, ecosystem-based assessment approach for evaluating coastal habitat condition. While the NCCA Program provides useful information at the national and regional scale through their National Coastal Condition Reports (NCCR) *(https://www.epa.gov/national-aquatic-*

resource-surveys/national-coastal-condition-reports), many of the thresholds used for the national report are not as appropriate as thresholds developed specifically for South Carolina. Additionally, the SCECAP initiative collects data for parameters that are not collected by NCCA, collects data on a yearly basis, and provides data on multiple species of young of year fish that are used in stock assessments.

There are several critical attributes of the SCECAP initiative that set it apart from other ongoing monitoring programs being conducted in South Carolina by SCDHEC (primarily focused on water quality) and SCDNR (primarily focused on fishery stock assessments). These include: (1) sampling sites throughout the state's estuarine habitats using a random, probability-based approach that complements both agencies' ongoing programs involving fixed station monitoring networks, (2) using integrated measures of environmental and biological condition that provide a more complete evaluation of overall habitat quality, and (3) monitoring tidal creek habitats in addition to the larger open water bodies that have been sampled traditionally by both agencies. This last component is of particular importance because tidal creek habitats serve as important nursery areas for most of the state's economically valuable species and often represent the first point of entry for runoff from upland areas. Thus, tidal creek systems can provide an early indication of anthropogenic stress (Sanger et al., 1999a, b; Lerberg et al., 2000; Van Dolah et al., 2000; 2002; 2004; Holland et al., 2004; Sanger et al., 2015a).

This technical report is part of a series of bi-annual reports describing the status of South Carolina's estuarine habitats. The 2015-2016 SCECAP report, as well as all reports for previous survey periods, can be obtained from the SCECAP web site at *http://www.dnr.sc.gov/marine/scecap/*. Raw and summarized data from these surveys can be can be requested by contacting the Principal Investigator (Denise Sanger; SangerD@dnr.sc.gov).

METHODS

The sampling and analytical methods used for SCECAP are fully described in the first SCECAP report (Van Dolah et al., 2002). Some of the analytical methods have been modified and are fully described by Bergquist et al. (2009) and in this report. This program uses methods consistent with SCDHEC's water quality monitoring program methods in effect at the time of sample collection (SCDHEC, a-d) and the USEPA's National Coastal Condition Assessment (NCCA) Program (https://www.epa.gov/national-aquatic-resource-surveys/ncca). Long-term monitoring programs such as SCECAP must find a balance between using the same methods and measures for consistency across time, while incorporating new methods and measures as they are developed and proven.

2.1. Sampling Design

Historically, 50-60 stations were sampled annually, but a change in funding led to smaller annual sampling efforts beginning in 2007 to a total of 30 stations sampled each year. Sampling sites extend from the Little River Inlet at the South Carolina-North Carolina border to the Savannah River at the South Carolina-Georgia border, and from the saltwater-freshwater interface to near the mouth of each estuarine drainage basin. Half of the stations each year are randomly placed in tidal creeks (defined as water bodies < 100 m wide, and generally > 10 m wide, from marsh bank to marsh bank), and the other half are randomly placed in the larger open water bodies that form South Carolina's tidal rivers, bays, and sounds. Stations sampled in 2015-2016 are shown in Figure

Long-term monitoring programs such as SCECAP must find a balance between using the same methods and measures for consistency across time, and incorporating new methods and measures as they are developed and proven.

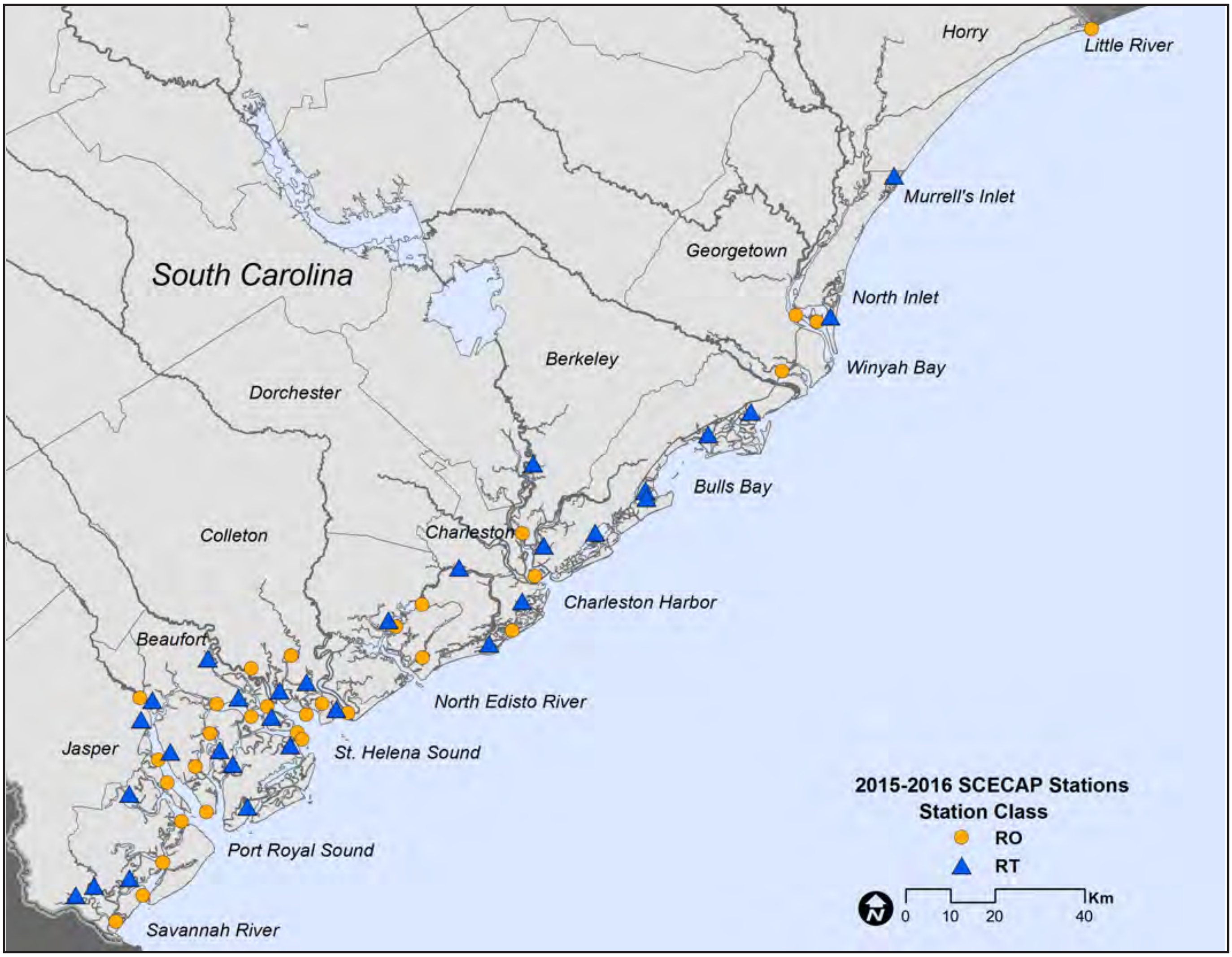


Figure 2.1.1. Locations of stations sampled during 2015 and 2016. RO = open water and RT = tidal creek.

2.1.1 and listed in Appendix 1. By surface area, approximately 17% of the state's estuarine water represents creek habitat, and the remaining 83% represents the larger open water areas (Van Dolah et al., 2002). Stations within each habitat type are selected using a probability-based, random tessellation, stratified sampling design (Stevens, 1997; Stevens and Olsen, 1999), with new station locations assigned each year.

The primary sampling period for all sampling components is during the summer (July through August). The summer period was selected because it represents a period when some water quality variables may be limiting to biota, and it is a period when many fish and crustacean species of concern utilize the estuary for nursery habitat. In addition, SCDHEC samples the same 15 tidal creek and 15 open water sites for their monthly monitoring throughout the calendar year for selected water quality measures to meet that agency's mandates (data not reported here). Most measures of water and sediment quality and biological condition are collected within a 2-3 hr time period around low tide. Observations are made at each site to document the presence of litter and to note the proximity of the site to suburban, urban and/or industrial development. All data are validated using a rigorous quality assurance process. A copy of the Quality Assurance Project Plan is maintained at the SCDNR Marine Resources Research Institute. Methods described in the following sections apply to all SCECAP survey periods.

2.2. Water Quality Measurements

Time-series measurements of temperature, salinity, dissolved oxygen (DO) and pH are obtained from the near-bottom waters of each site using YSI Model 6920 multiprobes logging at 15 min intervals for 25 hrs to assess conditions over two full tidal cycles, representing both day and night conditions. Both SCDHEC and SCDNR field staff also collect an instantaneous measure of these parameters at several depths (0.3 m beneath the surface, in the middle of the water column, and 0.3 m above the bottom) during the primary site visit. Other primary water quality measures that are collected from near-surface waters include total nitrogen (TN; sum of nitrate/nitrite and total Kjeldahl nitrogen (TKN)), total phosphorus (TP),

Deployment of a YSI data logger to collect time-series water quality data.

chlorophyll *a* (Chl-*a*), and fecal coliform bacteria. Secondary water quality measures that are also collected from near-surface waters include turbidity and water clarity based on a Secchi disk measurement. For some survey periods, dissolved nutrient concentrations, five-day biochemical oxygen demand (BOD5), total organic carbon (TOC), and total suspended solids (TSS) were collected as additional water quality measures, but these have generally been discontinued due to budget limitations. Data for the secondary water quality measures are available upon request, but are not described in this report because these measures are not included in the SCECAP Water Quality Index or have no state water quality standards.

All water quality samples for laboratory analyses are collected by inserting pre-cleaned water bottles to a depth of 0.3 m and then filling the bottle directly at that depth. The bottles are stored on ice until they are returned to the laboratory for further processing. Bacteria samples, total nutrients, and Chl-*a* are processed by SCDHEC using the standardized procedures in effect at the time of sample collection or analysis (SCDHEC b,c,d). In 2011-2016, SCDHEC TKN values sampled concurrently with SCECAP were not available for many sites, resulting in our not being able to calculate TN; therefore, 2011-2016 TN, TP, and Chl-*a* values were calculated by taking an average of the SCDHEC data that were collected at those sites during the months of June, July, and August during the same year as SCECAP sampling.

2.3. Sediment Quality Measurements

At least six bottom sediment samples are collected at each station using a stainless steel 0.04 m^2 Young grab deployed from an anchored boat that is repositioned between sample collections. The surficial sediments (upper 2 cm) of four or more grab samples are homogenized on-site in a stainless steel bowl and placed in pre-cleaned containers for analysis of silt and clay content, total organic carbon (TOC), total ammonia nitrogen, contaminants, and sediment toxicity. All sediment samples are kept on ice while in the field and then stored either at 4ºC (toxicity, porewater) or frozen (contaminants, silt and clay content, TOC) until analyzed. Particle size analyses are performed using a modification of the pipette method described by Plumb (1981). Porewater ammonia is measured using a Hach Model 700 colorimeter, and TOC is measured by GEL Laboratories. Additional contaminants measured in sediment include 22 metals, 28 polycyclic aromatic hydrocarbons (PAHs), 91 polychlorinated biphenyls (PCBs), 14 polybrominated diphenyl ethers (PBDEs) and 25 pesticides. All contaminants are analyzed by the National Oceanic and Atmospheric Administration/National Ocean Service (NOAA/NOS) National Centers for Coastal Ocean Sciences Charleston Laboratory using procedures similar to those described by Kucklick et al. (1997), Long et al. (1997), Balthis et al. (2012), and Chen et al. (2012). A subset of the sediment contaminant concentrations are used to calculate a mean Effects Range Median quotient (mERMq) which provides a convenient measure of the overall biological impact of sediment contamination based on 24 compounds for which there are biological effects guidelines (Long and Morgan, 1990; Long et al., 1995, 1997; Hyland et al., 1999).

A Young grab is used to collect samples for sediment quality and benthic biological condition.

Sediment toxicity is assessed by the Microtox® solid-phase bioassay, which uses a photoluminescent bacterium (*Vibrio fischeri*) and protocols described by the Microbics Corporation (1992). In past reports, a 7-day juvenile clam growth assay using *Mercenaria mercenaria* and protocols described by Ringwood and Keppler (1998) was also incorporated in the toxicity component of the Sediment Quality Index, but results from the clam growth assay were not robust for 2011-2016 due to supply limitations, overall low growth rate, and/or high clam mortality in the control samples. In some earlier survey periods, a 10-day whole sediment amphipod assay was performed as a third toxicity measure. The amphipod assay has generally proven to be very insensitive for South Carolina sediments and has not been retained as part of the suite of toxicity measures for the SCECAP program. The Microtox® assay may yield false positive results. To limit this effect, the assays were scored as fair for a positive toxicity result and good for a negative result in the sediment toxicity component of the Sediment Quality Index.

2.4. Biological Condition Measurements

Two whole samples collected by Young grab are washed through a 0.5 mm sieve to collect the macrobenthic invertebrate fauna, which are then preserved in a 10% formalin/seawater solution containing Rose Bengal stain. All organisms from the two grabs are identified to species level or the lowest practical taxonomic level if the specimen is too damaged or immature for accurate identification. A reference collection of all benthic species collected for this program is maintained at the SCDNR Marine Resources Research Institute. The benthic data are incorporated into a Benthic Index of Biotic Integrity (B-IBI), based on number of taxa, abundance, dominance, and percent sensitive taxa (Van Dolah et al., 1999).

Fish and large invertebrates are collected by trawl at each site following benthic sampling to evaluate near-bottom community composition. Two replicate trawl tows, pulled in the same direction as tidal flow, are made sequentially at each site using a 4-seam trawl (5.5 m foot rope, 4.6 m head rope and 1.9 cm bar mesh throughout). Trawl tow lengths are standardized to 0.5 km for open water sites and 0.25 km for creek sites. Occasionally, due to site limitations, actual tows are slightly shorter than target tow lengths; when that occurs, actual tow length is recorded, and data from that trawl are only included in analyses if the tow was at least 50% of the target tow length. Fish, squid, large crustaceans, and horseshoe crabs captured are identified to the species level, counted, and checked for gross pathologies, deformities, or external parasites. Up to 30 individuals of each species are measured to the nearest centimeter. Mean abundances are corrected for the total area swept by the two trawls using the formula described by Krebs (1972). Tissue contamination was assessed from 2000-2006 and again in 2010, but contaminant samples are no longer collected by SCECAP due to funding constraints.

2.5. Integrated Indices of Estuarine Habitat Condition

One of the primary objectives of SCECAP is to develop integrated measures of estuarine condition that synthesize the program's large and complex environmental datasets. Such measures provide natural resource managers and the general public with simplified statements about the status and trends of the condition of South Carolina's coastal zone. Similar approaches have been developed by federal agencies for their National Coastal Condition Reports (USEPA, 2001; 2004; 2006) as well as by a few states and other entities using a variety of approaches (Carlton et al., 1998; Chesapeake Bay Foundation, 2007; Partridge, 2007).

SCECAP computes four integrated indices describing different components of the estuarine ecosystem: water quality, sediment quality, biological condition and overall habitat quality. The Water Quality Index combines four measures, the Sediment Quality Index combines three measures, and the Biological Condition Index includes only the B-IBI (Table 2.5.1). These three indices are then combined into a single integrated Habitat Quality Index. The integrated indices facilitate communication of multi-variable environmental data to the public and provide a more reliable tool than individual measures (such as DO, pH, etc.) for assessing estuarine condition. For example, one location may have degraded DO but normal values for all other measures of water quality, while a second location has degraded levels for the majority of water quality measures. If DO were the only measure of water quality used, both locations would be classified as having degraded condition with no basis for distinguishing between the two locations. However, an index that integrates multiple measures would likely not classify the first location as degraded, yet detect the relatively greater degradation at the second location.

Current methods for calculating the four integrated indices are described in detail in the 2005-2006 SCECAP report (Bergquist et al., 2009). Broadly, each individual measure taken at a sampled station and used to calculate the integrated indices is given a score of "good," "fair," or "poor." The thresholds used for scoring each measure are listed in Appendix 2. In the various graphics and tables of this report, these scores are depicted as green, yellow, and red, respectively. Thresholds for defining conditions as good, fair, or poor are based on state water quality standards (SCDHEC, 2008), published findings (Hyland et al., 1999

Table 2.5.1. Individual measures comprising the integrated Water Quality, Sediment Quality, and Biological Condition indices.

Water Quality Index	Sediment Quality Index	Biological Condition Index
Dissolved Oxygen	Contaminants (mERMQ)	B-IBI
Fecal Coliform Bacteria	Toxicity	
pH (salinity-corrected)	Total Organic Carbon	
Eutrophic Index		
Total Nitrogen		
Total Phosphorus		
Chlorophyll *a*		

for mERMq; Van Dolah et al., 1999 for benthic condition; Ringwood et al., 1997 and Ringwood and Keppler, 1998 for toxicity measures), or percentiles of a historical database for the state based on SCECAP measurements collected from 1999-2006 (Bergquist et al., 2009). Each measure is given a numerical score (5, 3, and 0 for scores of good, fair, and poor, respectively) and the numerical scores of the individual measures are averaged into an integrated index value (described in general terms in Van Dolah et al., 2004). The Water Quality, Sediment Quality, and Biological Condition indices are likewise given a score of good, fair, or poor using methods described in Van Dolah et al. (2004). The resulting numerical scores for the WQI, SQI, and BCI are then averaged into an overall Habitat Quality Index as shown in Table 2.5.2.

Table 2.5.2. Summary of possible index values and scores for the integrated Habitat Quality Index, based on combinations of scores from the Water Quality Index, the Sediment Quality Index, and the Biological Condition Index.

Component Index Scores			Habitat Quality Index (Average)	HQI Score
A	B	C		
0	0	0	0.00	Poor (0)
3	0	0	1.00	Poor (0)
5	0	0	1.67	Poor (0)
3	3	0	2.00	Poor (0)
5	3	0	2.67	Fair (3)
5	5	0	3.33	Fair (3)
3	3	3	3.00	Fair (3)
5	3	3	3.67	Fair (3)
5	5	3	4.33	Good (5)
5	5	5	5.00	Good (5)

It is important to note that as new information has become available, the calculation methodology used by SCECAP has been modified. Modifications include changes in the individual measures used in the integrated indices, threshold values, scoring processes, and methods used to address missing data. While these changes often do not result in very large changes in data interpretation, the results presented in this report may not exactly match those in previous reports. However, the current report does reflect the updated data analysis approach applied to all previous survey periods.

2.6. The Presence of Litter

Litter is one of the more visible signs of habitat degradation. While the incidence of litter is not used in the overall Habitat Quality Index, the presence of litter in the trawl or on the banks for 250 meters on each side of the station is recorded.

2.7. Data Analysis

Use of the probability-based sampling design provides an opportunity to statistically estimate, with confidence limits, the proportion of South Carolina's estuarine water classified as being in good, fair, or poor condition. These estimates are obtained through analysis of the cumulative distribution function (CDF) using procedures described by Diaz-Ramos et al. (1996) and using programs developed within the R statistical software environment (http://www.R-project.org/). The percent of the state's overall estuarine habitat scoring as good, fair, or poor for individual measures and for each of the indices is calculated after weighting the analysis by the proportion of the state's estuarine habitat represented by tidal creek (17%) and open water (83%) habitat. In the past, SCECAP used continuous data in these analyses when possible, but this methodology was modified to use only categorical scores in order to improve 1) consistency with reporting by the SCDHEC Ambient Water Quality Monitoring Network, and 2) calculation of the 95% confidence limit for each estimate. Additionally, the difference in scores between tidal creek and open water habitats is now well-established in South Carolina (Van Dolah et al., 2002; 2004; 2006; 2013; Bergquist et al., 2009; 2011; Appendix 2). For brevity, graphical summaries in this report are primarily limited to overall estuarine habitat condition (tidal creek and open water combined). SCECAP data are stored in a relational database, and can be obtained by contacting the Principal Investigator (Denise Sanger; SangerD@dnr.sc.gov).

South Carolina's wildlife need good water quality.

RESULTS AND DISCUSSION

3.1. Water Quality

SCECAP collects a wide variety of water quality parameters each year as part of the overall investigation of estuarine habitat quality. Poor water quality measures, if observed repeatedly in a watershed, can provide an early warning of impaired habitat, especially related to nutrient enrichment and bacterial problems. Six parameters are considered to be the most relevant with respect to biotic health and human uses, and have been incorporated into a Water Quality Index (WQI) developed by SCECAP. These include: 1) dissolved oxygen (DO), which is critical to healthy biological communities and can reflect organic pollution; 2) pH, which measures the acidity of a water body and can indicate the influence of various kinds of human input, such as atmospheric deposition from industry and vehicle emissions, runoff from land sources, etc.; 3) fecal coliform bacteria, which are an indicator of potential human pathogens; and 4) a combined measure of total nitrogen (TN), total phosphorus (TP), and chlorophyll-*a* (Chl-*a*), which provides a composite measure of the potential for a water body to be experiencing nutrient enrichment and/or associated algal blooms. These latter three measures (TN, TP, and Chl-*a*) are combined into a Eutrophic Index, which is incorporated as one quarter of the weight of the overall WQI.

Applying the WQI to 2015-2016 survey data, 92% of the state's estuarine habitat scored as being in good condition, 7% scored as fair, and 1% scored as poor (Figure 3.1.1). For the 2015-2016 survey, none of the four component measures of the WQI had more than 5% of the coastal habitat rating as poor. The proportion of the state's overall estuarine habitat with good water quality has remained fairly constant from the 2005-2006 survey through the 2015-2016 survey, ranging from 87% to 93% (Figure 3.1.2).

As has been observed throughout the entire 1999-2016 SCECAP program, tidal creek habitat in 2015-2016 showed more variable and overall lower water quality compared to open water habitats (Table 3.1.1; Figure 3.1.3; Appendix 2). During the 2015-2016 survey, 93% and 83% of open water and tidal creek habitat, respectively, scored as good on the WQI (Appendix 2).

The distribution of stations for the 2015-2016 survey period with good, fair, or poor WQI scores are shown in Figures 3.1.4a, 3.1.5a, and 3.1.6a and in Appendix 3. Two of the 60 stations sampled in 2015-2016 had poor water quality, and both were tidal creek stations: one in Charleston County, and one in Colleton County (Appendix 3). The Charleston County station with poor water quality (RT15097), due to poor or fair scores for Chl-*a*, pH, and DO, is located in the Cape Romain National Wildlife Refuge near the Santee Coastal Reserve. Three nearby historic tidal creek stations (within 6 km of RT15097), sampled in 1999 and 2012, scored poor or fair for the WQI; the most commonly shared compromised measures included elevated TN and Chl-*a* and depressed pH. The Colleton County station with poor water quality (RT15103) was located in Rock Creek, a system connected to the Ashepoo and Combahee Rivers. All three historic tidal creek stations within 2 km of RT15103, sampled in 2003, 2004, and 2014, scored poor or fair for the WQI; the most commonly shared compromised measures included low DO (all sites) and elevated TP. In 2015-2016, 2 of the 30 open water stations and 3 of the 30 tidal creek stations had fair WQI scores.

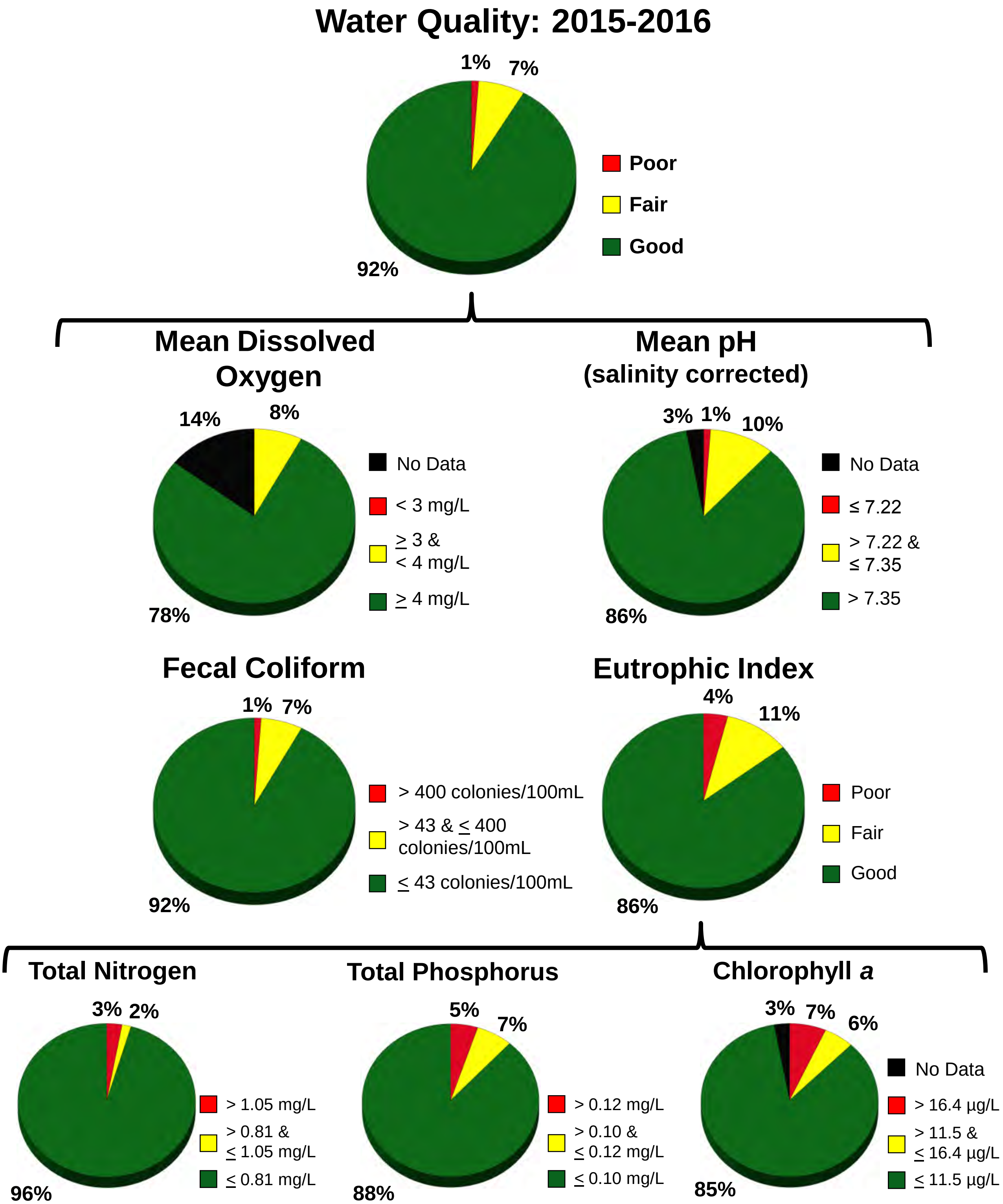


Figure 3.1.1. Percentage of the state's estuarine habitat that scored as good, fair or poor for the Water Quality Index and the component parameters that comprise the index. Percentage is based on data obtained from 30 stations for each habitat during 2015 and 2016. No Data indicates a sample was not collected or processed.

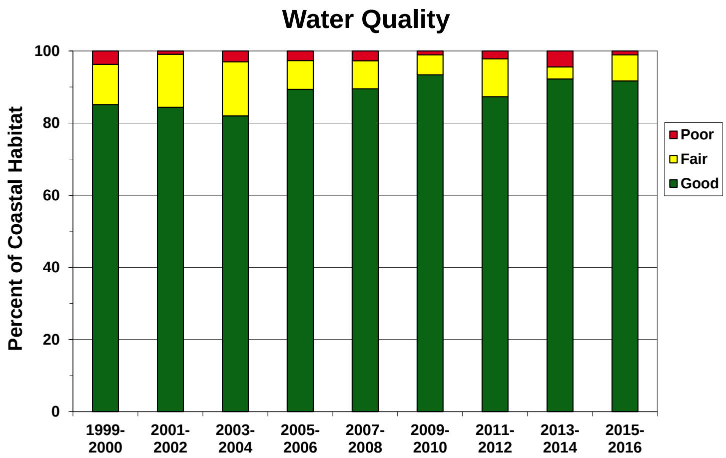


Figure 3.1.2. Percent of coastal waters corresponding to each Water Quality Index category by survey period.

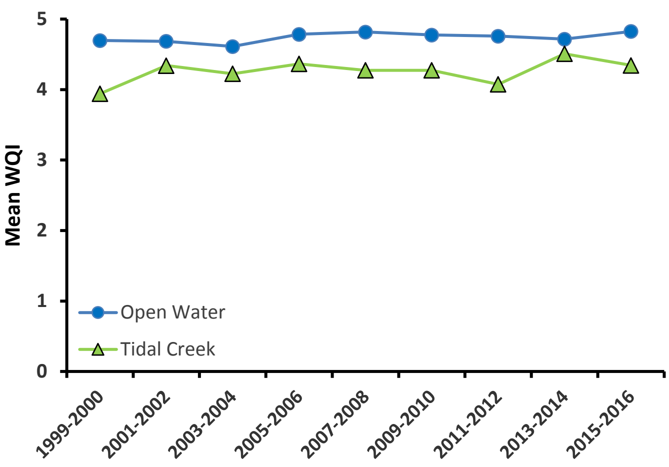


Figure 3.1.3. Water Quality Index scores observed by survey period and habitat type.

When considering all years (1999-2016), portions of the state with a relatively high incidence of fair to poor water quality are concentrated in Winyah Bay, Santee River, Ashley River, drainages in the vicinity of Dawhoo River, drainage basins associated with the Ashepoo and Combahee Rivers, New River, Coosawhatchie River, and portions of the Wright River (Figures 3.1.4b, 3.1.5b, 3.1.6b).

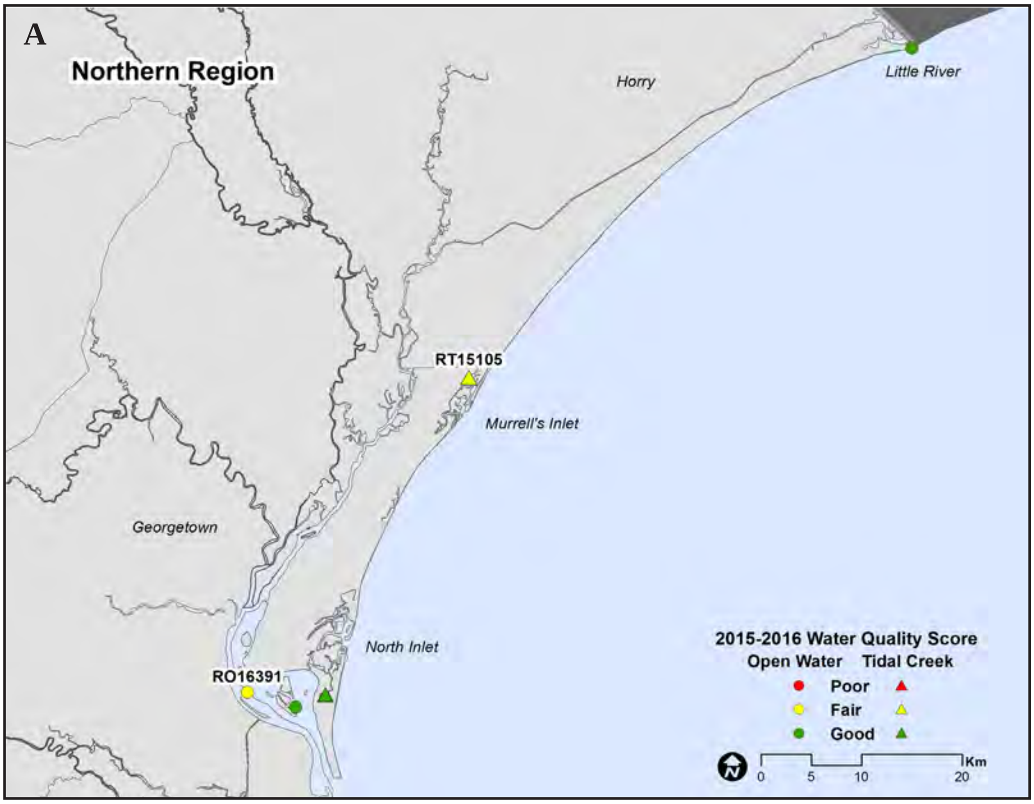
3.2. Sediment Quality

Sediment quality measurements remain an essential component of our overall estuarine habitat quality assessment because sediments: 1) support invertebrate communities that form the base of the food web for many other species of concern, 2) exchange nutrients and gases with overlying water in support of overall estuarine function, and 3) serve as a sink for many contaminants which can accumulate over time, providing a better measure of long-term exposure to contaminants in an area. Although many sediment quality measures are collected by SCECAP, the three component measures of the Sediment Quality Index (SQI) considered to be the most indicative of sediment are 1) a combined measure of 24 organic and inorganic contaminants that have published biological effects thresholds (mERMq; Long et al., 1997; Hyland et al., 1999; 2003), 2) a measure of sediment toxicity based on the Microtox® bioassay that indicates whether contaminants are present at concentrations that have adverse biological effects, and 3) total organic carbon (TOC), which can have several adverse effects on bottom-dwelling biota and provides a good predictor of benthic community condition (Hyland et al., 2005).

During the 2015-2016 survey using the SQI, 92% of South Carolina's estuarine habitat had sediment in good condition, with 6% in fair condition and 2% in poor condition (Figure 3.2.1). Throughout the 1999-2016 timeframe, the percentage of estuarine habitat with good sediment quality started high (88%) in 1999-2000, fell to its lowest levels in 2001-2004 (75-79%), and has been improving since then, with the highest percentage of habitat with good sediment quality observed in the 2015-2016 survey period (Figure 3.2.2). As observed in most years, sediment quality tended to be slightly lower in tidal creek habitats than in open water habitats for the 2015-2016 survey period (Table 3.2.1; Figure 3.2.3; Appendix 2). Among the three SQI component measures in 2015-2016, sediment contaminant (mERMq) and toxicity measures indicated that 10-12% of the state's estuarine waters were in fair condition and none were in poor condition, whereas TOC indicated that

Table 3.1.1. Summary of mean water quality measures observed in tidal creek and open water habitats during each year for the SCECAP survey. Blue highlight indicates those measures included in the Water Quality Index.

Measure	Habitat	Year																	
		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Water Quality Index	Open	4.56	4.83	4.64	4.73	4.57	4.66	4.77	4.80	4.78	4.85	4.90	4.65	4.58	4.93	4.72	4.72	4.90	4.75
	Creek	4.02	3.86	4.28	4.40	4.25	4.20	4.38	4.35	4.45	4.10	4.65	3.90	4.52	3.63	4.42	4.60	4.23	4.46
Dissolved Oxygen (mg/L)	Open	4.86	5.01	4.96	5.10	4.97	5.41	5.13	5.11	5.49	5.62	5.54	5.05	4.99	5.07	5.32	5.09	5.21	5.32
	Creek	4.00	4.12	4.45	4.51	4.58	5.10	4.12	4.33	4.53	4.50	4.41	4.12	4.59	3.40	4.40	4.65	4.51	4.83
pH	Open	7.58	7.53	7.67	7.71	7.39	7.75	7.59	7.68	7.68	7.68	7.63	7.58	7.59	7.62	7.43	7.53	7.60	7.56
	Creek	7.52	7.43	7.56	7.53	7.31	7.36	7.30	7.48	7.43	7.49	7.49	7.37	7.52	7.33	7.27	7.47	7.39	7.40
Fecal Coliform (#/100mL)	Open	47	11	14	9	25	17	12	24	17	13	19	10	23	6	21	38	3	15
	Creek	30	55	35	25	74	87	29	65	14	32	5	27	25	158	58	21	76	64
Total Nitrogen (mg/L)	Open	0.51	0.58	0.66	0.52	0.84	0.52	0.57	0.20	0.26	0.52	0.57	0.25	0.39	0.32	0.63	0.35	0.52	0.69
	Creek	0.69	0.75	0.72	0.58	0.72	0.64	0.67	0.20	0.32	0.65	0.62	0.32	0.21	0.48	0.56	0.38	0.61	0.46
Total Phosphorus (mg/L)	Open	0.08	0.06	0.06	0.05	0.06	0.08	0.08	0.07	0.06	0.05	0.07	0.09	0.09	0.05	0.06	0.07	0.06	0.08
	Creek	0.09	0.10	0.09	0.06	0.09	0.12	0.08	0.07	0.06	0.09	0.09	0.09	0.09	0.06	0.08	0.08	0.06	0.09
Chlorophyll *a* (µg/L)	Open	10.3	9.1	10.1	10.1	6.9	8.4	7.7	7.4	11.0	9.2	7.2	9.2	8.7	7.6	2.9	6.6	9.2	8.8
	Creek	12.6	12.5	10.8	9.7	11.6	12.0	8.0	10.1	10.9	8.9	7.9	12.1	9.7	8.6	4.9	5.9	9.8	12.3
Temperature (°C)	Open	30.2	29.4	29.5	29.1	28.5	29.2	30.0	29.7	29.8	29.0	28.5	30.8	30.1	29.9	28.9	29.1	29.7	30.8
	Creek	30.1	29.8	29.5	29.0	29.0	29.6	29.9	30.2	30.3	29.9	29.9	31.3	30.7	29.8	29.3	29.6	30.3	30.7
Salinity (ppt)	Open	26.2	28.1	28.2	31.0	19.9	28.5	26.0	31.1	30.3	31.3	26.4	30.8	30.5	29.1	21.1	24.6	30.4	25.9
	Creek	31.1	31.5	29.4	32.1	20.8	26.2	23.2	32.3	29.3	32.0	30.9	29.7	34.2	30.7	19.7	28.9	30.0	26.6



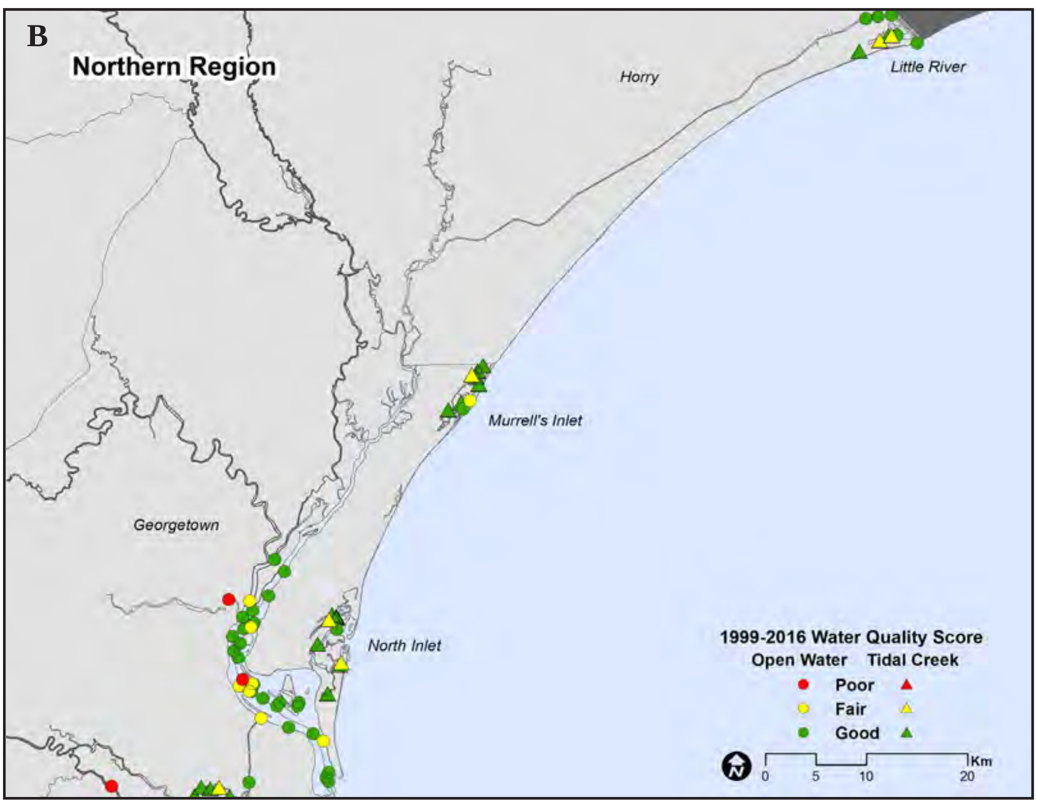


Figure 3.1.4. Distribution of stations with good, fair, or poor scores for the Water Quality Index during the 2015-2016 (A) and 1999-2016 (B) periods for the northern region of South Carolina.

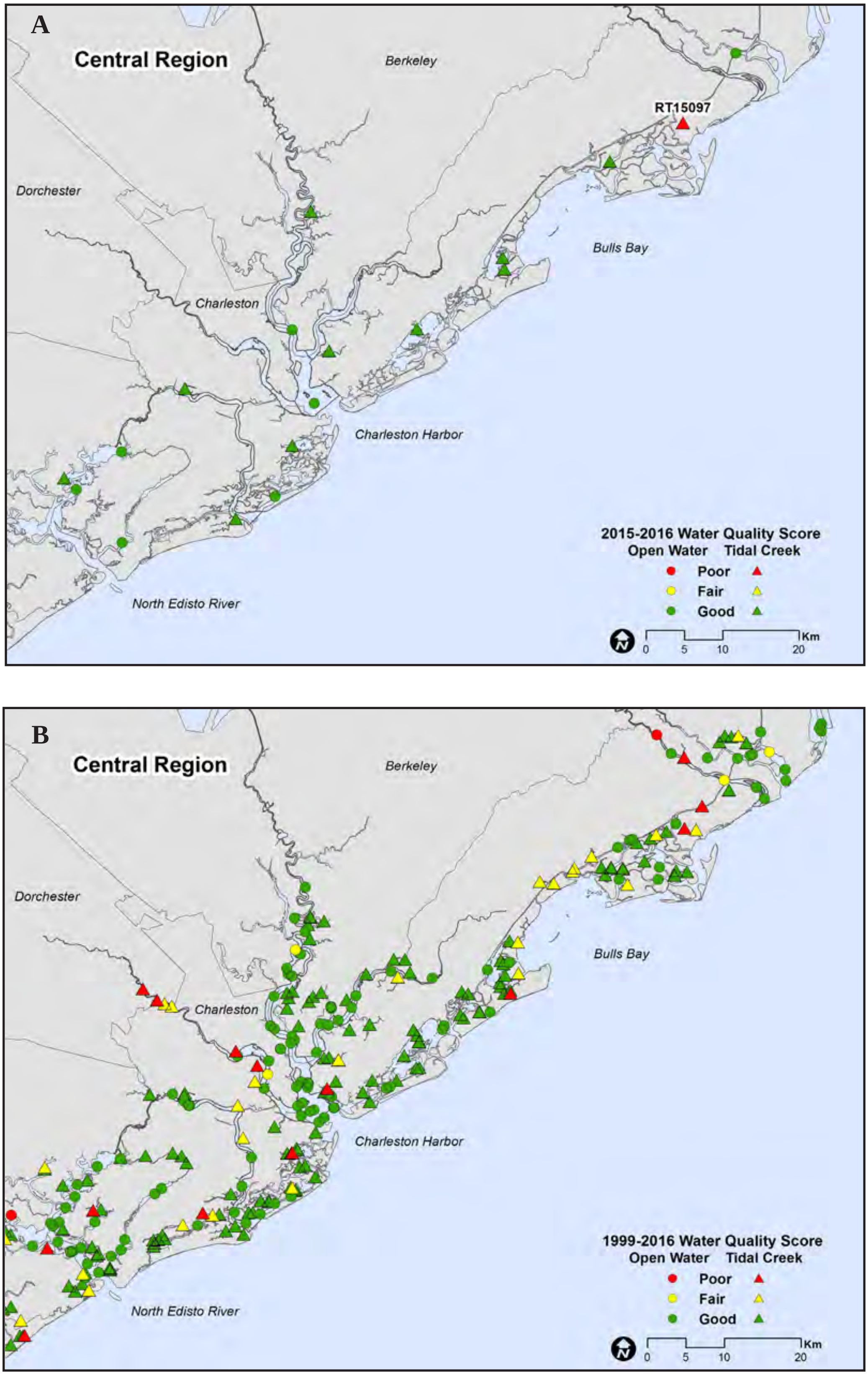
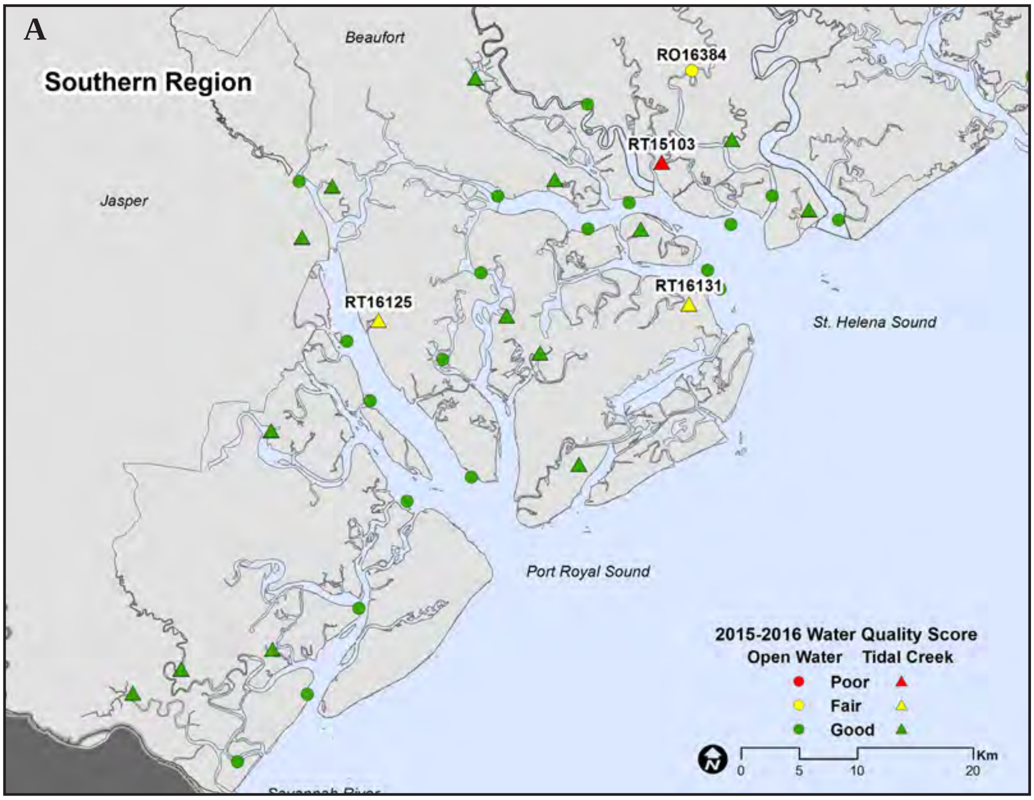


Figure 3.1.5. Distribution of stations with good, fair, or poor scores for the Water Quality Index during the 2015-2016 (A) and 1999-2016 (B) periods for the central region of South Carolina.



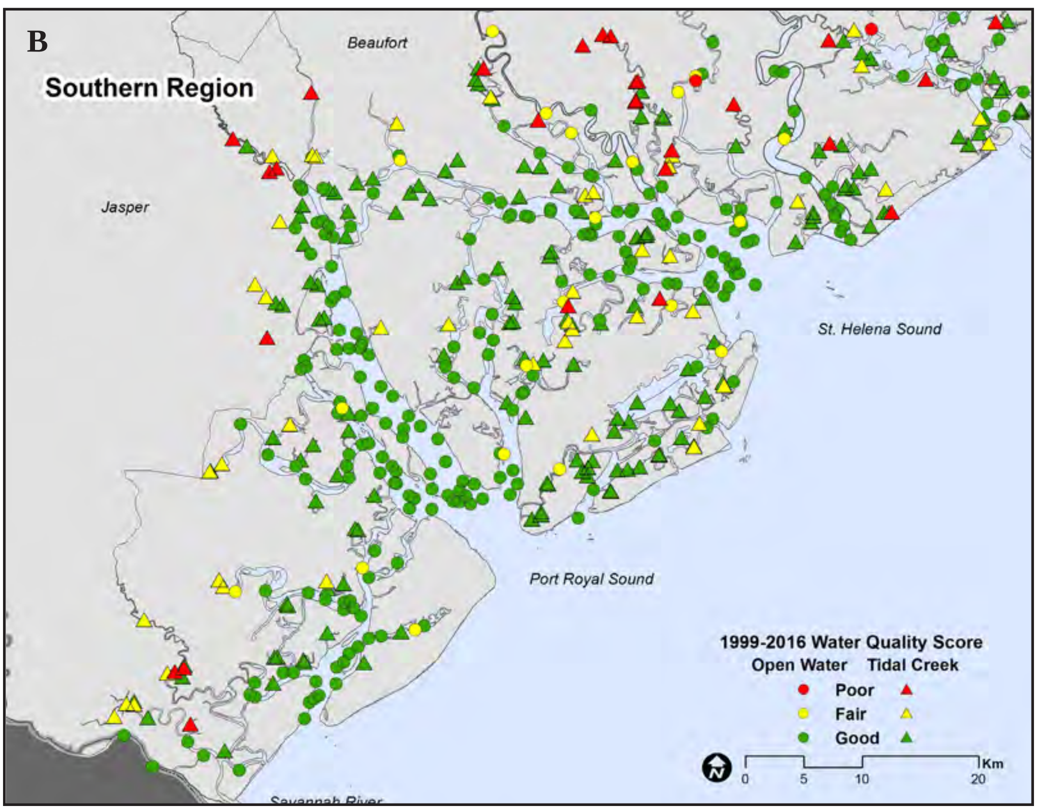


Figure 3.1.6. Distribution of stations with good, fair, or poor scores for the Water Quality Index during the 2015-2016 (A) and 1999-2016 (B) periods for the southern region of South Carolina.

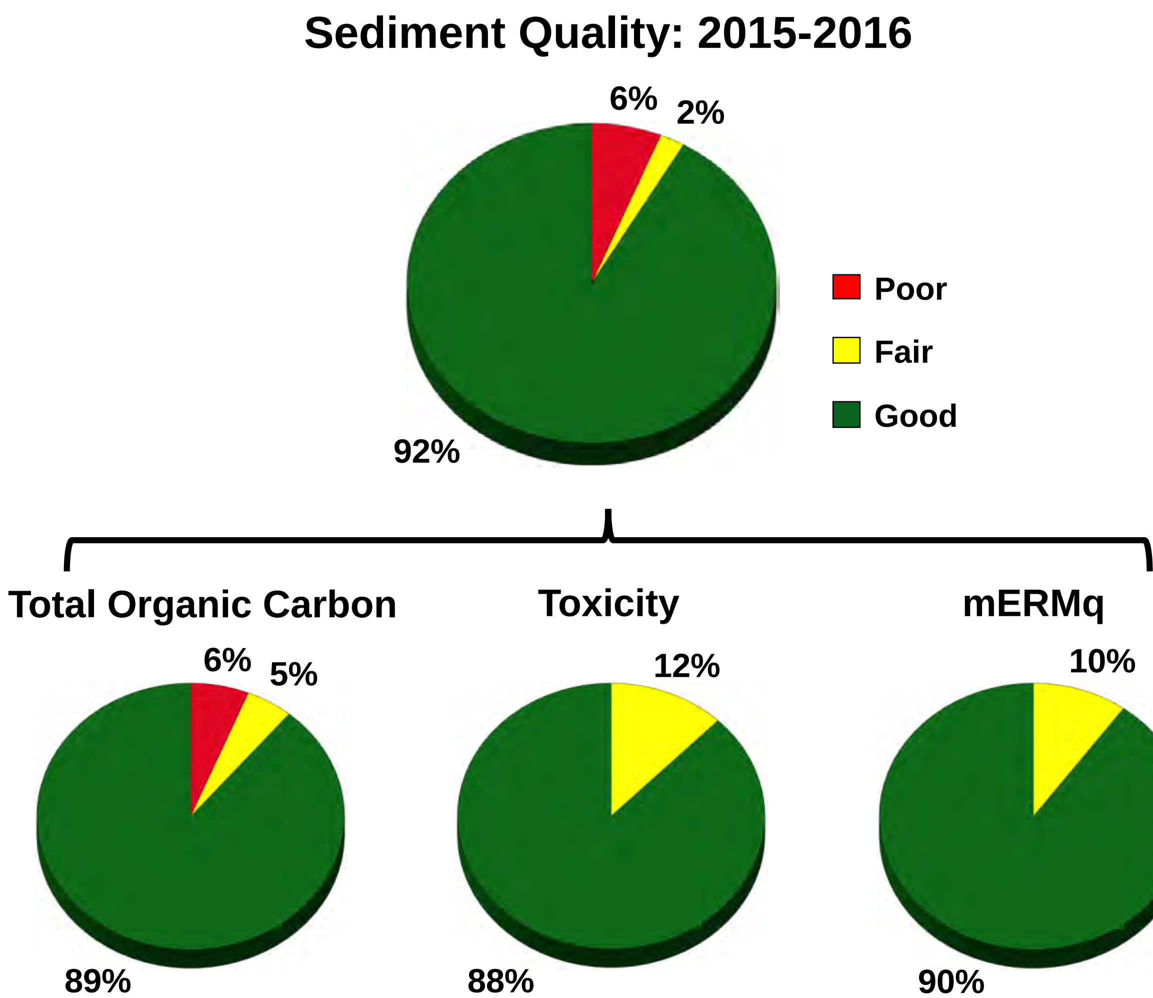


Figure 3.2.1. Percentage of the state's estuarine habitat that scored as good, fair or poor for the Sediment Quality Index and the component parameters that comprise the index. Percentage is based on data obtained from 30 stations for each habitat during 2015 and 2016.

6% of habitat was in poor condition and 5% in fair condition (Figure 3.2.1).

Three stations scored as having poor sediment quality in the 2015-2016 survey: 2 of the 30 open water sites and 1 of the 30 tidal creek sites (Figures 3.2.4a, 3.2.5a, 3.2.6a; Appendix 3). The open water sites with poor sediment quality were located in the Wadmalaw (RO15376) and Combahee (RO15368) Rivers, and the tidal creek site was located in an unnamed creek near Whale Branch (RT16123). All three of the sites with poor sediment quality scored poor for TOC, fair for mERMq, and good for toxicity. Poor sediment quality has been observed previously in the Wadmalaw River and in tidal creeks near Whale Branch, but this was the first time that it has been observed in that section of the Combahee River. In 2015-2016, 4 of the 60 stations scored as having fair SQI scores, all of which were tidal creek stations. When all survey periods are considered collectively, areas with clusters of poor to fair SQI scores were observed in Winyah Bay, Santee River, Cape Romain area, Ashley River, Cooper River, Edisto River, Whale Branch, New River, and Savannah River (Figures 3.2.4b, 3.2.5b, 3.2.6b).

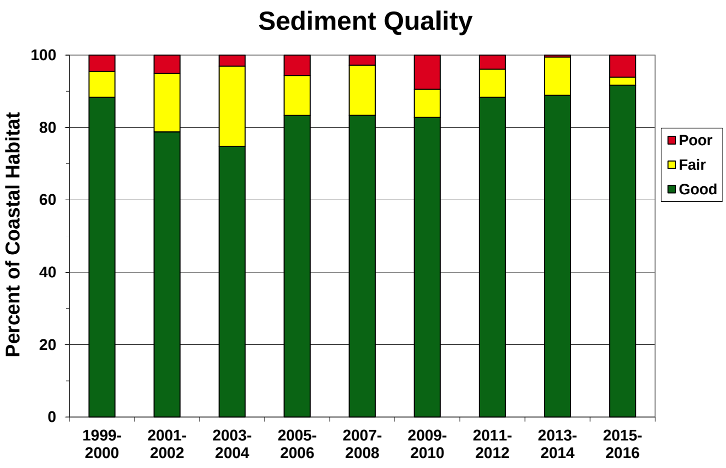


Figure 3.2.2. Percent of coastal waters corresponding to each Sediment Quality Index category by survey period.

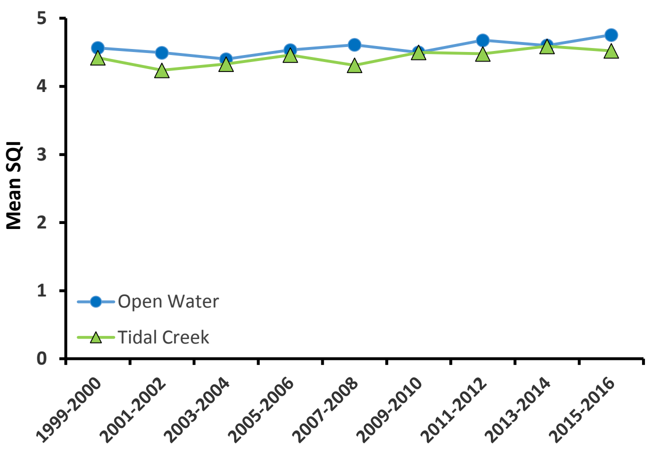


Figure 3.2.3. Sediment Quality Index scores observed by survey period and habitat type.

3.3. Biological Condition

Benthic Communities

Benthic macrofauna serve as ecologically important components of the food web by consuming detritus, plankton, and smaller organisms living in the sediments and in turn serve as prey for fish, shrimp, and crabs. Benthic macrofauna are also relatively sedentary, and many species are sensitive to changing environmental conditions. As a result, these organisms are important biological indicators of water and sediment quality and are useful in monitoring programs to assess overall coastal and estuarine health (Hyland et al., 1999; Van Dolah et al., 1999). The Biological Condition Index (BCI), which is used to score estuarine habitat in terms of benthic community quality, is based upon the Benthic Index of Biotic Integrity (B-IBI; Van Dolah et al., 1999).

During the 2015-2016 survey, using the Biological Condition Index, 73% of the state's estuarine habitat scored as good condition, 23% as fair, and 4% as poor (Figure 3.3.1). In contrast to the Water Quality Index and Sediment Quality Index results, which have shown improvement at the coastal scale in recent years, the percent of coastal habitat scored as being in good Biological Condition has been relatively low for the past two survey periods (2013-2014 and 2015-2016; Figure 3.3.2). The two lowest open water annual mean B-IBI values of SCECAP were observed in 2014 and 2016, and three of the lowest tidal creek annual mean B-IBI values were observed in 2013, 2015, and 2016 (Table 3.3.1). The low B-IBI values in 2013-2016 result from low densities of benthic invertebrates, low species richness (number of species), and/or low percent of stress-sensitive taxa (Table 3.3.1). The low mean tidal creek B-IBI in 2013 was associated with elevated annual means of Total Organic Carbon (TOC) and mERMq; the low tidal creek B-IBI in 2015 and 2016 was associated with elevated TOC; and the low open water B-IBI in 2014 was associated with elevated TOC and Total Ammonia Nitrogen (Table 3.2.1; Table 3.3.1). The two highest open water annual mean TOC values, and the three highest tidal creek annual mean TOC values, occurred in 2013-2016. The only open water station that received a poor B-IBI score in 2016 also received a poor score for the Eutrophic Index, and eutrophic conditions can lead to low DO and other stressors for benthic organisms (Appendix 3). As in most previous surveys, mean B-IBI values were higher in open water habitats than in tidal creeks in 2015-2016 (Figure 3.3.3), and the relatively lower B-IBI values often seen in tidal creek habitats likely reflects the more stressful conditions of shallow tidal creek systems compared to tidal rivers and bays.

The B-IBI provides a convenient, broad index of benthic community condition, but because this index combines four measures into a single value, it does not provide detailed information on community composition. While some of the benthic community measures shown in

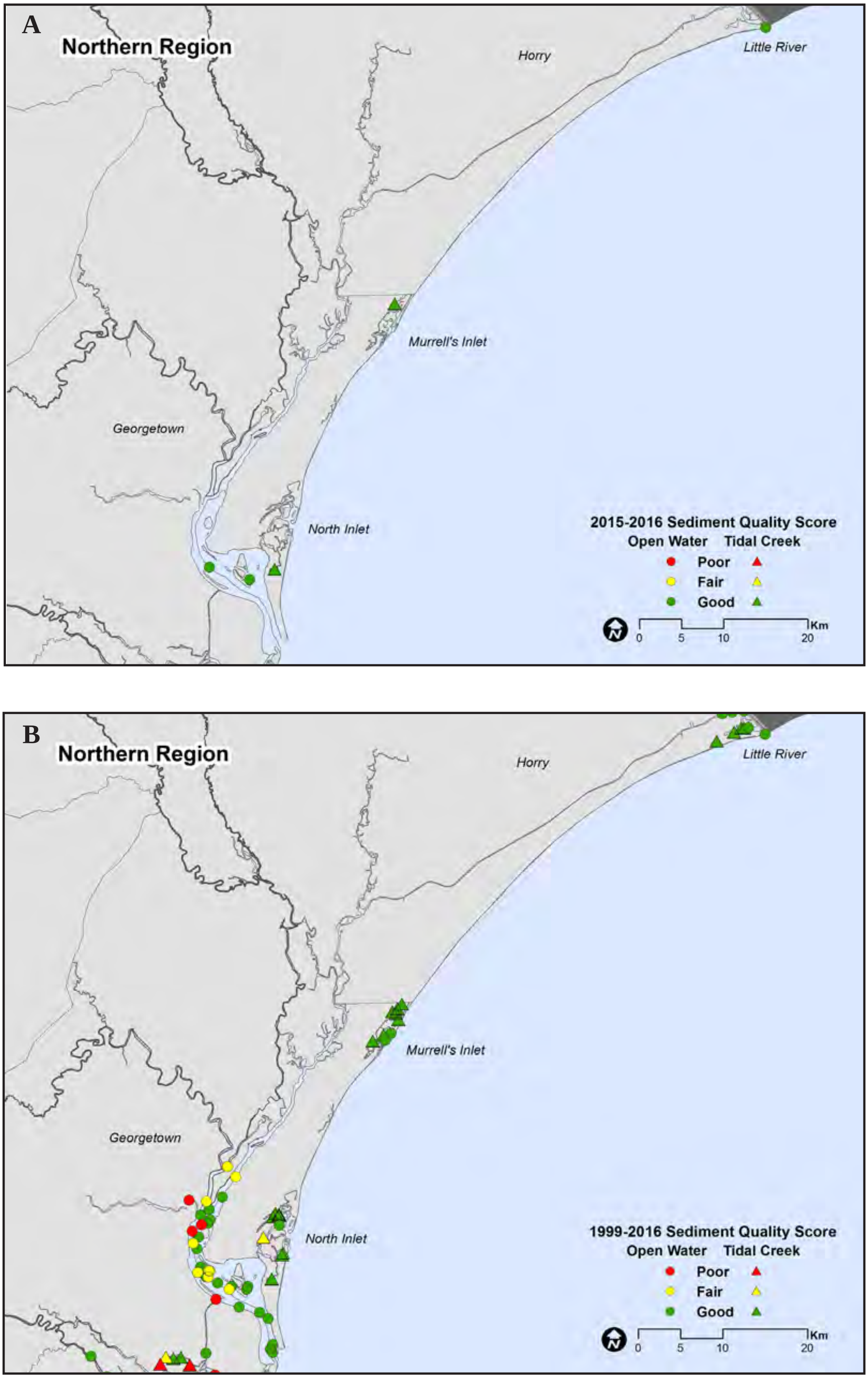
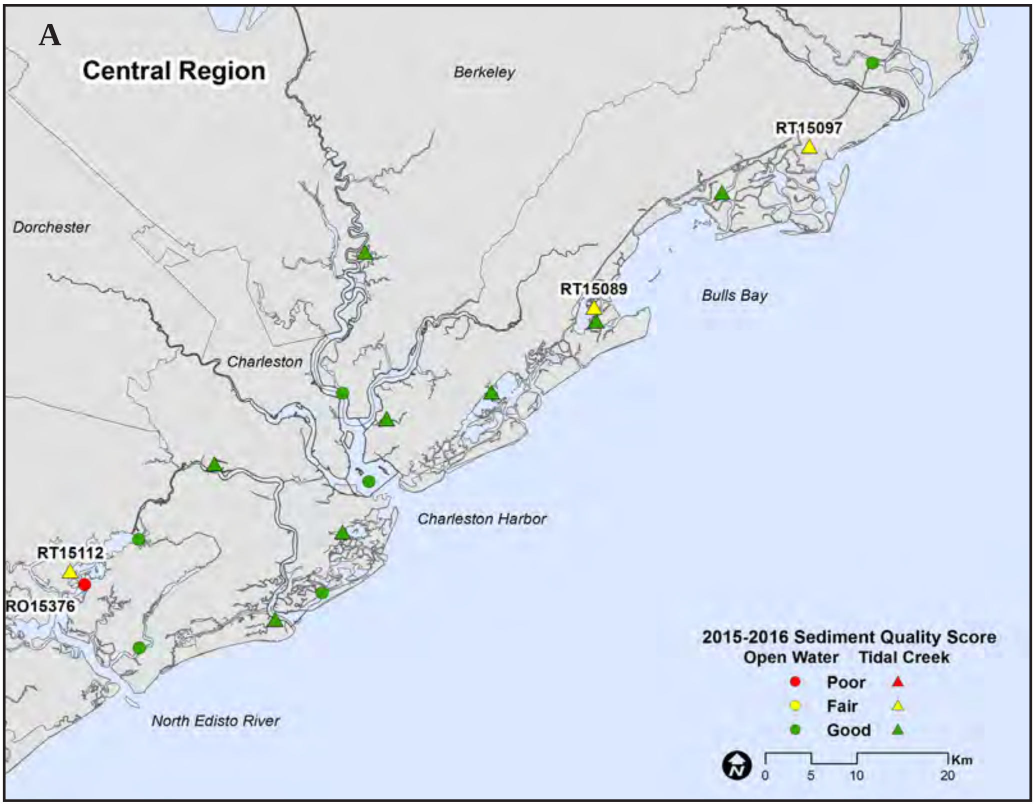


Figure 3.2.4. Distribution of stations with good, fair, or poor scores for the Sediment Quality Index during the 2015-2016 (A) and 1999-2016 (B) periods for the northern region of South Carolina.



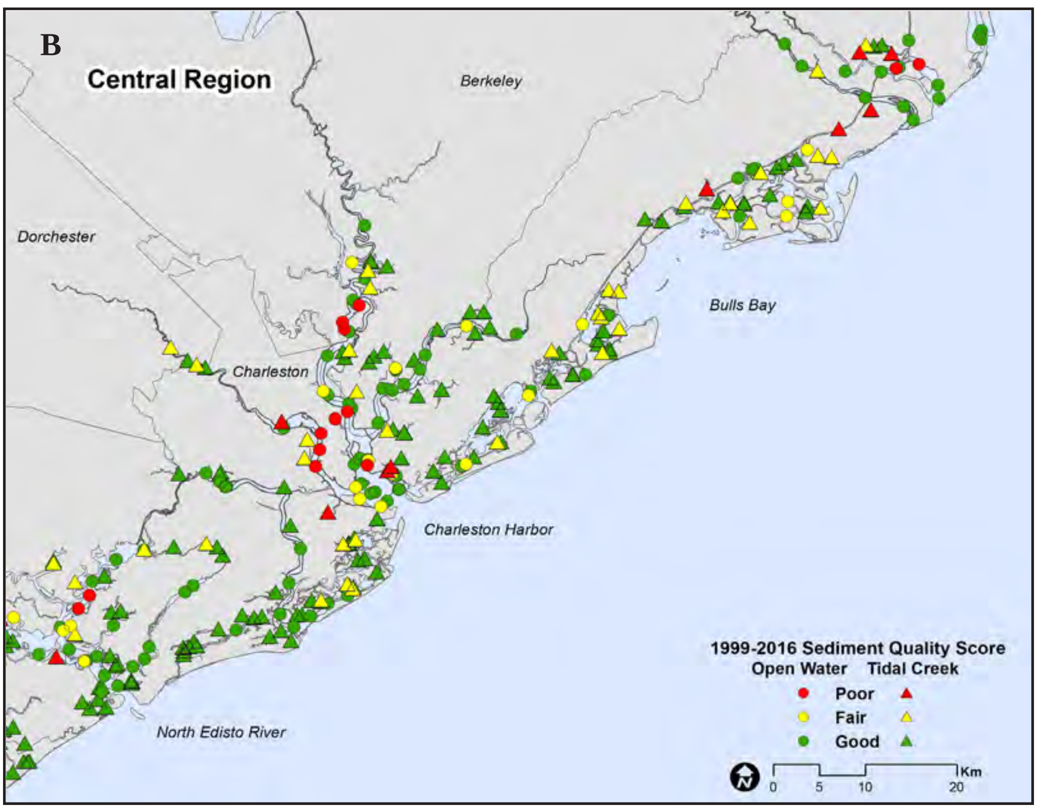


Figure 3.2.5. Distribution of stations with good, fair, or poor scores for the Sediment Quality Index during the 2015-2016 (A) and 1999-2016 (B) periods for the central region of South Carolina.

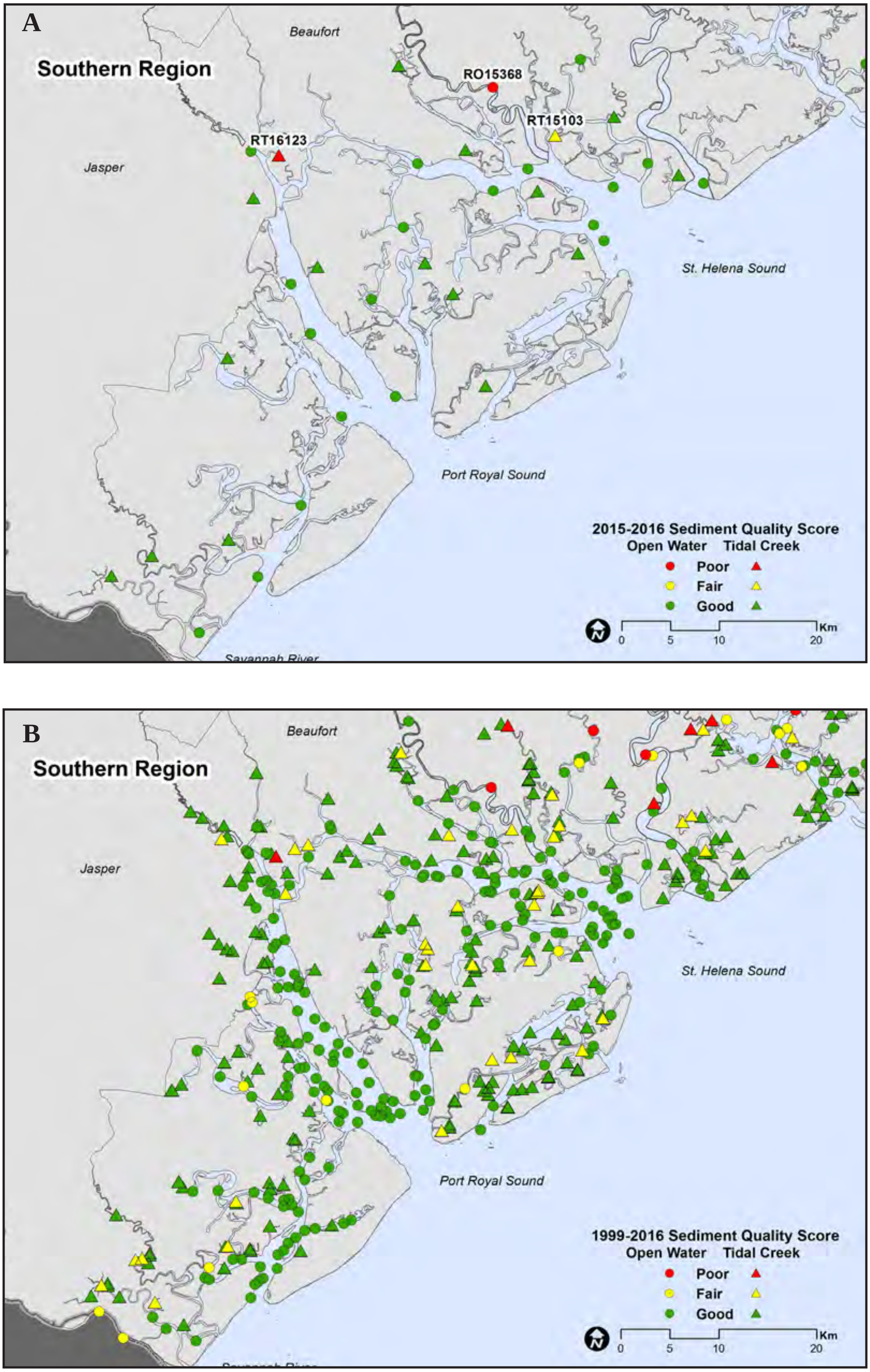


Figure 3.2.6. Distribution of stations with good, fair, or poor scores for the Sediment Quality Index during the 2015-2016 (A) and 1999-2016 (B) periods for the southern region of South Carolina.

Table 3.3.1 do not explicitly identify degraded conditions, they do allow the comparison of community characteristics among habitats and through time. Traditional community descriptors such as total faunal density, number of species (species richness), species evenness (J'), and species diversity (H') can be lower in more stressful environments. This is because fewer and fewer species within a community can tolerate increasingly stressful conditions, such as those caused by decreasing dissolved oxygen or increasing sediment contamination. Using published literature, species that are sensitive to pollution can be identified in order to examine potential patterns in estuarine contamination. As with the more traditional indices above, open water habitats typically supported significantly higher densities and percentages of sensitive fauna than tidal creek habitats (Table 3.3.1). Taxonomic groups, such as amphipods, mollusks and polychaetes, occupy a diverse range of habitats, but relative to each other, vary predictably with environmental conditions. For example, polychaetes tend to dominate the communities of shallow, muddy tidal creek habitats whereas amphipods and mollusks become increasingly more abundant in sandier oceanic environments (Little, 2000). A comparison between tidal creek and open water habitats support these expected patterns, with the densities and proportions of amphipods and mollusks typically being higher in open water habitats and the proportion of polychaetes being higher in tidal creek habitats (Table 3.3.1).

The distribution of stations with good, fair, or poor BCI scores during the 2015-2016 survey period is shown in Figures 3.3.4a, 3.3.5a, 3.3.6a, and Appendix 3. Only 3 of the 60 stations sampled in 2015-2016 scored as poor for the BCI: an open water station located in Winyah Bay (RO16391), a tidal creek draining into Wadmalaw Sound (RT15112), and a tidal creek draining into the Coosaw River, 3 miles north of Sam's Point Landing in Beaufort County (RT15091). Poor to fair BCI values have been associated with these areas in the past, although less commonly in the Coosaw River area. In 2015-2016, 7 of the 30 open water stations and 7 of the 30 tidal creek stations had fair BCI scores. Historically, poor to fair BCI scores have been observed in Winyah Bay, Santee River, Ashley River, Cooper River, North Edisto River and some of the more inland creeks that drain into St. Helena Sound and Port Royal Sound (Figures 3.3.4b, 3.3.5b, 3.3.6b).

Fish and Large Invertebrate Communities

South Carolina's estuaries provide food, habitat, and nursery grounds for diverse communities including fish and large invertebrates such as shrimp and blue crab (Joseph, 1973; Mann, 1982; Nelson et al., 1991). These communities include many important species that contribute significantly to the state's economy and the well-being of its citizens. Estuaries present naturally stressful conditions that limit species' abilities to use this habitat. Add to that human impacts, such as commercial and recreational fishing, coastal urbanization, and habitat destruction, and the estuarine environment can change substantially, leading to losses of important fish and invertebrate species. Densities of fish (finfish, sharks, rays), decapods (crabs, shrimp), and all fauna combined (fish, squid, decapods, and horseshoe crabs) were generally higher in tidal creek habitats compared to open water habitats (Table 3.3.2; Figure 3.3.7). This likely reflects the importance of shallower creek habitats as refuge and nursery habitat for many of these species. Densities of all fauna combined in both tidal creek and open water habitats were relatively high from 1999-2006, underwent a steep decline in 2007, showed a continuation of low densities in 2008-2009, and then ranged from mid-range to low densities in 2010-2016. The lowest overall densities in both open water and tidal creek habitats were observed in 2015, driven by low densities of fishes and white shrimp (*Litopenaeus setiferus*). In general, patterns of changes in density were similar in both estuarine habitat types over time (Table 3.3.2; Figure 3.3.7).

Our tidal creeks serve as an early warning sentinel habitat. While the elevated contaminant concentrations in our state's tidal creeks are not substantial relative to known bioeffects levels, continued degradation of these habitats is likely to occur with increasing coastal development.

Table 3.2.1. Summary of mean sediment quality measures observed in tidal creek and open water habitats during each year for the SCECAP survey. Blue highlight indicates those measures included in the Sediment Quality Index.

Measure	Habitat	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sediment Quality Index	Open	4.52	4.61	4.59	4.40	4.43	4.37	4.53	4.53	4.53	4.69	4.40	4.60	4.71	4.64	4.73	4.47	4.56	4.96
	Creek	4.43	4.41	4.17	4.30	4.26	4.40	4.33	4.59	4.16	4.47	4.78	4.22	4.84	4.11	4.36	4.82	4.38	4.67
Total Organic Carbon (%)	Open	0.86	0.63	0.94	0.84	0.74	0.88	0.70	0.77	0.79	0.70	1.15	0.62	0.89	0.75	0.45	1.20	1.35	0.81
	Creek	1.08	1.33	1.30	1.39	1.30	1.12	1.48	1.03	1.71	1.06	1.08	1.35	0.43	1.67	1.85	0.86	2.24	2.05
mERMq	Open	0.013	0.013	0.013	0.017	0.014	0.015	0.013	0.017	0.013	0.014	0.213	0.018	0.020	0.014	0.019	0.017	0.011	0.008
	Creek	0.015	0.014	0.017	0.015	0.018	0.016	0.018	0.013	0.022	0.015	0.011	0.026	0.016	0.020	0.023	0.013	0.016	0.013
Microtox® Bioassay (% toxic)	Open	37.9	40.0	26.7	43.3	46.7	53.3	40.0	24.0	33.3	20.0	20.0	33.3	6.7	33.3	6.7	33.3	20.0	6.7
	Creek	51.9	50.0	60.0	46.7	56.7	50.0	36.0	28.0	42.9	40.0	20.0	33.3	0.0	40.0	20.0	6.7	6.7	6.7
Silt & Clay (%)	Open	22.3	15.1	23.0	20.5	15.4	24.2	17.7	17.9	22.7	18.7	26.8	15.8	16.4	21.5	12.3	29.1	18.4	10.6
	Creek	32.0	31.8	30.3	30.9	34.3	26.0	37.4	21.0	40.7	23.4	27.6	26.9	15.2	42.0	36.8	21.3	39.4	31.8
Total Ammonia Nitrogen (mg/L)	Open	2.62	2.91	2.51	3.64	3.22	4.13	1.95	2.09	1.69	3.44	3.24	1.96	1.99	2.46	2.03	5.89	1.81	1.03
	Creek	2.79	3.06	3.46	2.75	4.74	2.17	2.48	2.16	2.04	2.23	2.97	3.62	1.04	4.49	2.21	1.45	2.27	2.87

SCECAP provides a fishery-independent assessment of several of South Carolina's commercially and recreationally-important fish and crustacean species. Of these, the most common species collected by SCECAP include the fish spot (*Leiostomus xanthurus*), Atlantic croaker (*Micropogonias undulatus*), weakfish (*Cynoscion regalis*), silver perch (*Bairdiella chrysoura*), and Atlantic spadefish (*Chaetodipterus faber*), and the crustaceans blue crab (*Callinectes sapidus*), white shrimp (*Litopenaeus setiferus*), and brown shrimp (*Farfantepenaeus aztecus*). All of these species, with the exception of weakfish and Atlantic croaker, were generally more abundant in tidal creek habitats (Table 3.3.2). In a recent detailed analysis of spot, Atlantic croaker and weakfish catches, Sanger et al. (2017) found evidence that SCECAP captures of Atlantic croaker from 1999-2016 have remained fairly constant through time, while both weakfish and spot show decreasing trends, due to a decrease in the percent of stations where these species were caught over time as well as a decrease in their abundances at the stations where they were caught.

3.4. Incidence of Litter

As the coastline of South Carolina changes and more people access our shorelines and waterways, the incidence of litter (plastic bags and bottles, abandoned crab traps, etc.) is likely to increase. The primary sources of litter include storm drains, roadways and recreational and commercial activities on or near our waterways. Beyond the visual impact, litter contributes to the mortality of wildlife through entanglement, primarily with fishing line and fishing nets, and through ingestion of plastic bags and other small debris particles. Additionally, invasive species may be spread through the movement of litter from one area to another.

During the 2015-2016 survey period, litter was visible in 16% of our state's estuarine habitat. When each habitat type is considered separately, litter was visible in 30% of the tidal creek and 13% of the open water stations. The percentage of estuarine habitat with visible litter has remained fairly consistent from 2005-2016 (13-19%), except for during the 2007-2008 survey period when visible litter hit its peak at 34%.

Fish and large invertebrates are collected by trawl and measured at each site.

3.5. Overall Habitat Quality

Using the Habitat Quality Index (HQI) for the 2015-2016 assessment period, 88% of South Carolina's coastal estuarine habitat (tidal creek and open water habitats combined) was in good condition (Figure 3.5.1). Only 1% of the coastal estuarine habitat was considered to be in poor condition, and 11% in fair condition. The percent of coastal habitat in good condition has fluctuated over time; the survey period with the lowest percent of habitat with good HQI was in 2003-2004 (77%), and the highest periods were in 2007-2008 and 2011-2012 (92-93%; Figure 3.5.2). When the two habitats were considered separately, a greater percentage of tidal creek habitat during the 2015-2016 survey was in fair to poor condition (13% fair, 7% poor) as compared to open water habitats (10% fair, 0% poor; Appendix 2). This difference between habitat quality in tidal creek and open water habitats observed in 2015-

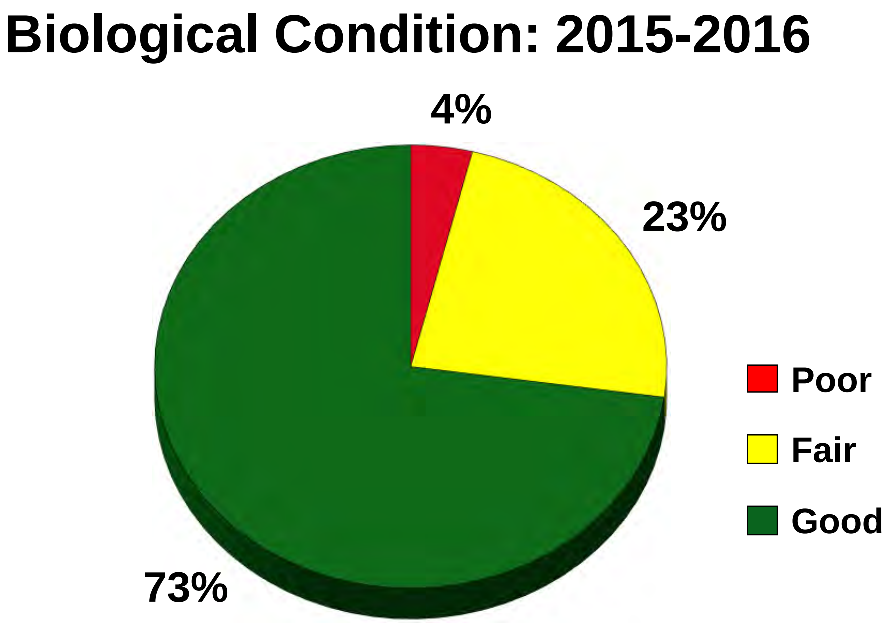


Figure 3.3.1. Percentage of the state's estuarine habitat that scored as good, fair or poor for the Biological Condition Index. Percentage is based on data obtained from 30 stations for each habitat during 2015 and 2016.

2016 is consistent with previous SCECAP surveys (Figure 3.5.3).

During the 2015-2016 survey period, SCECAP stations with fair or poor habitat quality were scattered across the state (Figures 3.5.4a, 3.5.5a, 3.5.6a, Appendix 3). Only 2 of the 60 sites sampled in 2015-2016 had poor HQI scores, both of which were in tidal creek habitats. The poor habitat quality sites were located in Rock Creek (RT15103), a system connected to the Ashepoo and Combahee Rivers, and in the Cape Romain National Wildlife Refuge near the Santee Coastal Reserve (RT15097). Both of these sites scored poor for the WQI and fair for the SQI and BCI, and are located in areas where previous surveys have observed fair to poor habitat quality. Seven of the 60 stations were observed to have fair habitat quality during the 2015-2016 survey, and all of the fair-scoring stations were located in areas noted in previous surveys to have fair to poor habitat quality.

Stations in Winyah Bay, the Santee delta region, the rivers draining into Charleston Harbor, and North Edisto near Dawhoo Creek historically show a persistent pattern of degraded habitat quality (Figures 3.5.4b, 3.5.5b, 3.5.6b). Winyah Bay and Charleston Harbor both have a history of industrial activity and/or high-density urban development that likely contributed to the degraded conditions in these areas. The causes of degraded habitat quality in the areas draining into St. Helena Sound, home to the Ashepoo-Combahee-Edisto (ACE) Basin National Estuarine Research Reserve (NERR), are not entirely clear.

3.6. Program Uses and Activities

SCECAP continues to be an effective collaboration between the SCDNR, SCDHEC, and NOAA to assess the condition of South Carolina's coastal environment. The results of these assessments have been used extensively in research, outreach, and planning by staff from these and other institutions and organizations. SCECAP data have been used to provide Charleston Harbor baseline information to the U.S. Army Corps of Engineers, including data related to sediment composition, distribution of sediment contaminants, benthic community, and near-bottom fish and crustacean community; these data were used in the Charleston Harbor Deepening Feasibility Study. SCDNR staff mined the SCECAP database for updated fishery independent information regarding the status of

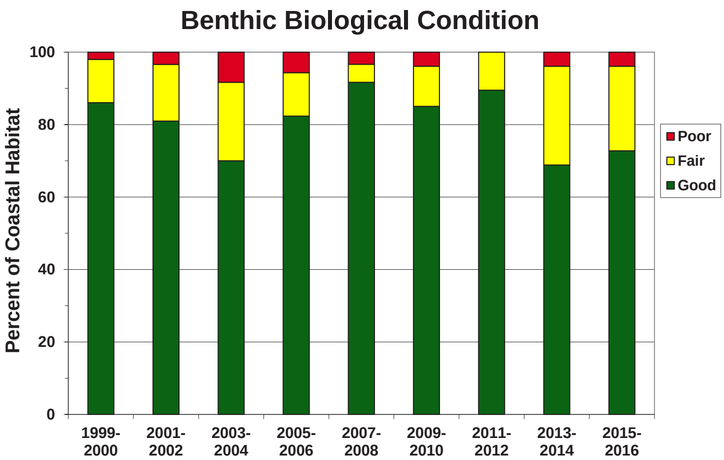


Figure 3.3.2. Percent of coastal waters corresponding to each Biological Condition Index category by survey period.

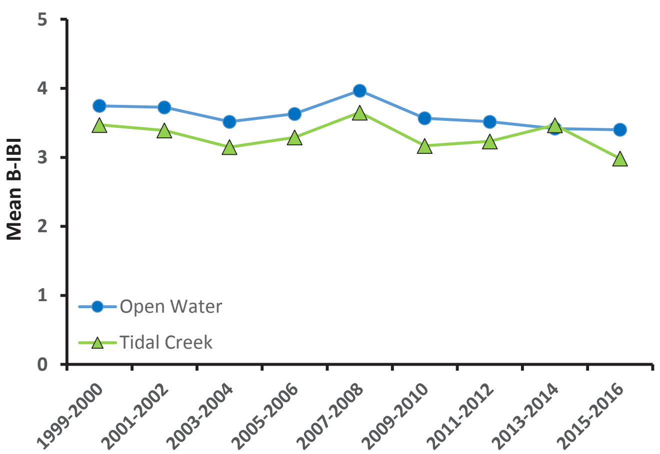


Figure 3.3.3. Benthic Index of Biological Integrity scores observed by survey period and habitat type.

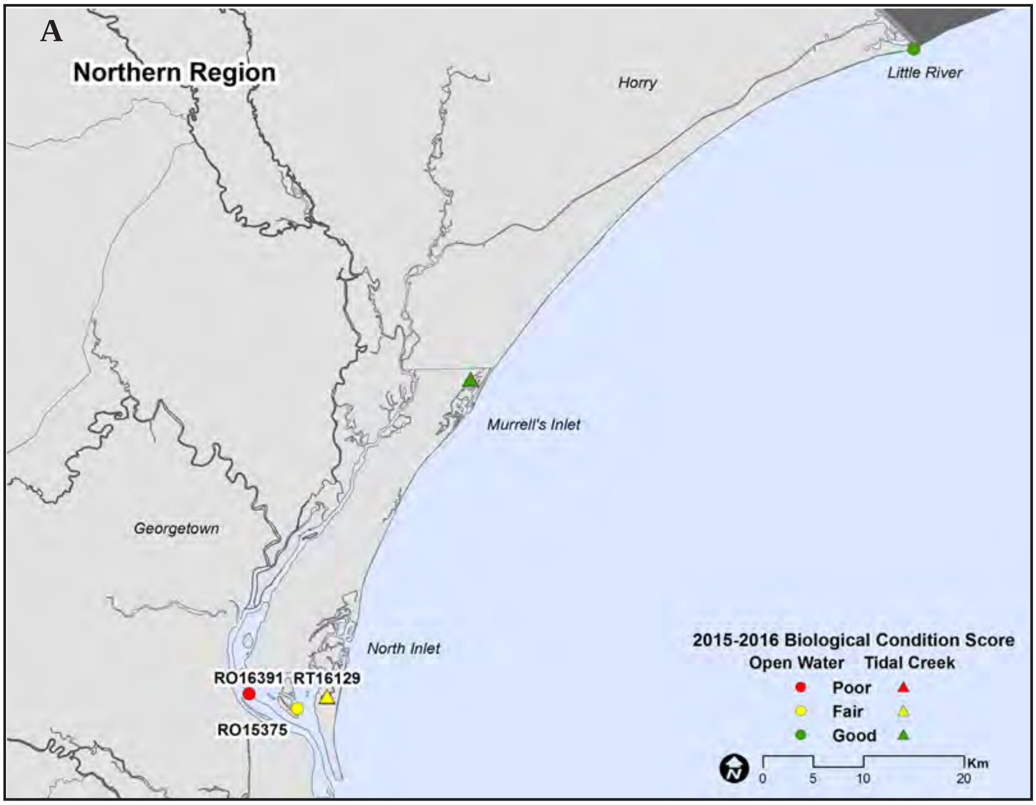
various crustacean species as part of the Marine Resources Division's annual assessment of stocks. SCECAP benthic data have also been used for a significant national effort being led by the USEPA to develop a national benthic index. This database provides one of the few detailed empirical databases with species abundance data tied directly to sediment contaminant data, which is critically needed to evaluate pollution sensitivity of various species. Finally, the SCECAP database provides one of the few sources of data on the distribution and relative abundance of key recreational species (e.g., spot, Atlantic croaker, weakfish) using unbiased sampling at a broad array of sites representing tidal creek and open water estuarine habitats. These data complement information obtained from other SCDNR programs (e.g., inshore recreational finfish program, SEAMAP), by sampling in areas those programs do not target, by monitoring young of the year abundances for multiple recreationally important finfish species (a life stage not targeted by other fisheries monitoring programs), and by collecting a wealth of environmental data that can be used to relate stock condition to the health of estuarine systems. Weakfish, Atlantic croaker, and spot abundance data from SCECAP were reported in the 2016 SCDNR Compliance Reports to the Atlantic States Fisheries Management Commission (ASFMC).

During the 2015-2016 survey period, primary funding for this program was obtained from the USFWS Sport Fish Restoration Program (SC-F-F17AF00936). The program maintains sampling at a minimum of 30 sites each year to provide for a total of 60 sites (30 tidal creek, 30 open water) for each two year assessment period. This is considered to be the minimum effort required to make statistically defensible assessments of condition for the coastal waters of our state. Continuing this program on a long-term basis will provide valuable information on trends in estuarine condition that are likely to be affected by continued coastal development.

Shrimp, crabs, and many fish species are dependent upon estuarine habitat for survival. In turn, fishermen are dependent upon good estuarine habitat quality for their livelihood.

Table 3.3.1. Summary of mean benthic biological measures observed in tidal creek and open water habitats during each year of the SCECAP survey. Blue highlight indicates the measure included in the Biological Condition Index.

Measure	Habitat	Year																	
		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Biological Condition Index	Open	4.62	4.73	4.50	4.63	4.00	4.30	4.68	4.32	2.53	5.00	4.40	4.87	5.00	4.73	4.60	3.87	4.47	4.27
	Creek	4.37	4.77	4.32	4.23	3.97	4.33	4.20	4.52	4.40	4.73	4.87	3.80	4.47	4.33	4.07	4.73	4.07	4.33
B-IBI	Open	3.76	3.73	3.55	3.90	3.48	3.55	3.74	3.52	3.93	4.00	3.50	3.63	3.57	3.47	3.77	3.07	3.57	3.23
(Carolinian Province)	Creek	3.24	3.70	3.38	3.40	3.08	3.22	3.04	3.54	3.37	3.93	3.57	2.77	3.37	3.10	2.97	3.97	2.90	3.07
Overall Density	Open	5354	6293	4095	7198	4236	4127	5282	4513	6873	8626	2698	3246	4616	2377	5893	2938	4319	2388
(individuals/m^2)	Creek	2363	4659	4710	5001	3198	2863	2282	5060	3008	6395	2843	2133	2222	6328	2267	4563	1997	2388
Number of Species	Open	25.9	22.1	17.5	26.7	18.9	18.7	21.1	19.0	22.5	23.8	15.3	18.8	15.9	14.4	20.0	14.0	21.0	13.9
	Creek	14.8	19.8	17.5	20.7	14.4	15.8	12.0	22.2	14.1	23.3	15.6	10.6	15.2	14.7	11.0	22.6	10.8	12.0
Species Evenness (J')	Open	0.76	0.70	0.72	0.73	0.73	0.74	0.74	0.77	0.69	0.68	0.78	0.79	0.74	0.74	0.66	0.80	0.73	0.74
	Creek	0.72	0.69	0.71	0.70	0.72	0.72	0.75	0.67	0.74	0.72	0.72	0.67	0.76	0.62	0.66	0.75	0.72	0.74
Species Diversity (H')	Open	3.30	2.81	2.74	3.14	2.67	2.84	2.94	2.99	2.94	2.99	2.72	3.16	2.72	2.68	2.70	2.67	2.99	2.54
	Creek	2.59	2.85	2.78	2.78	2.33	2.65	2.41	2.75	2.64	3.03	2.72	2.05	2.81	2.22	2.07	3.19	2.30	2.53
Percent Sensitive Taxa	Open	13.4	26.8	19.6	16.5	16.4	24.1	19.5	17.9	19.8	19.6	14.1	14.5	14.8	23.2	13.7	11.7	17.7	18.4
	Creek	10.0	16.5	12.0	8.2	11.5	8.9	13.5	14.6	14.4	14.3	15.4	9.8	18.3	8.5	5.9	22.8	9.1	4.6
Percent Amphipods	Open	10.9	18.6	12.7	13.2	17.5	17.5	16.3	12.7	13.7	9.5	12.3	15.7	8.7	16.4	12.6	10.4	12.3	15.5
	Creek	6.1	11.8	4.5	5.3	7.8	4.5	12.9	10.4	13.7	14.2	8.6	1.6	5.9	6.7	7.0	7.0	8.5	9.1
Percent Molluscs	Open	5.9	7.9	10.0	9.6	7.8	8.5	2.8	10.6	6.4	6.3	7.9	5.2	12.1	9.2	3.9	7.8	8.3	6.7
	Creek	3.5	6.0	5.7	6.2	5.6	4.9	1.8	5.0	4.5	3.5	5.0	2.0	8.1	2.4	3.3	9.6	3.2	5.4
Percent Polychaetes	Open	56.3	54.3	60.3	57.2	52.3	50.3	56.7	50.3	54.2	59.8	50.2	61.4	60.9	50.0	62.0	46.6	64.0	44.0
	Creek	68.8	57.8	69.7	70.9	53.4	70.9	59.4	68.5	59.4	65.0	59.4	74.1	76.3	73.6	62.6	63.6	71.3	63.7
Percent Other Taxa	Open	26.8	19.2	16.9	20.0	22.4	23.8	24.2	26.4	25.7	24.4	29.7	17.7	18.3	24.4	21.5	35.2	15.4	33.8
	Creek	21.6	24.4	20.0	17.6	33.2	19.7	25.8	16.0	22.4	17.3	27.0	22.3	9.6	17.3	27.1	19.8	17.1	21.8



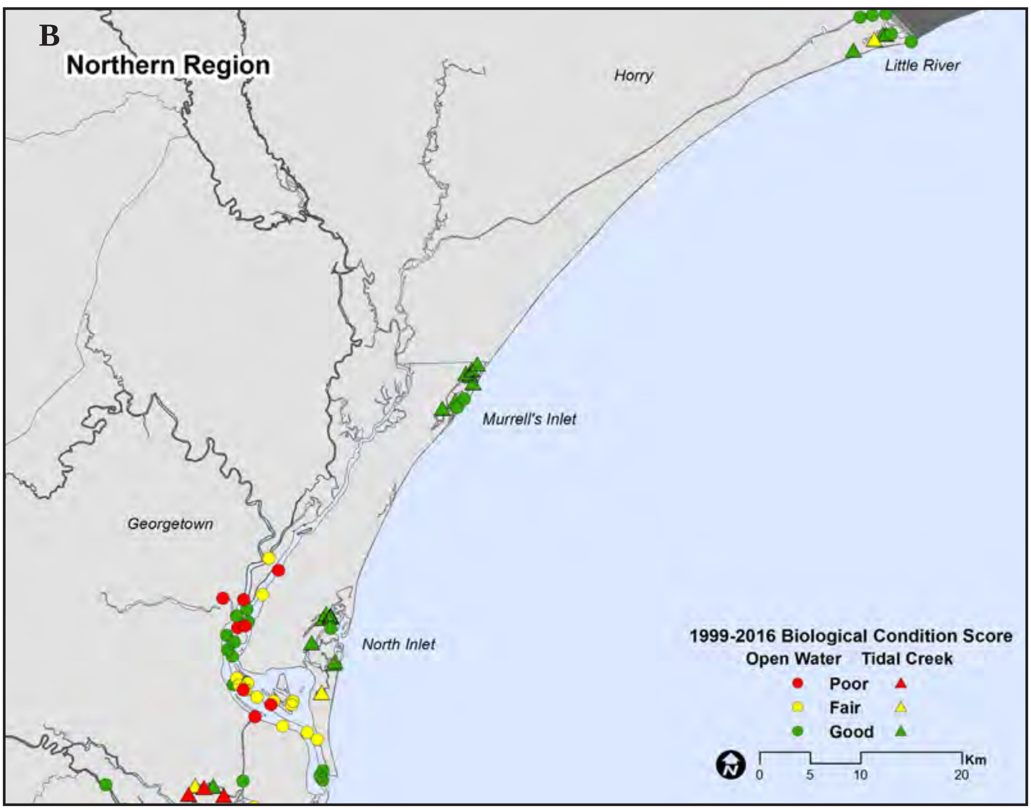
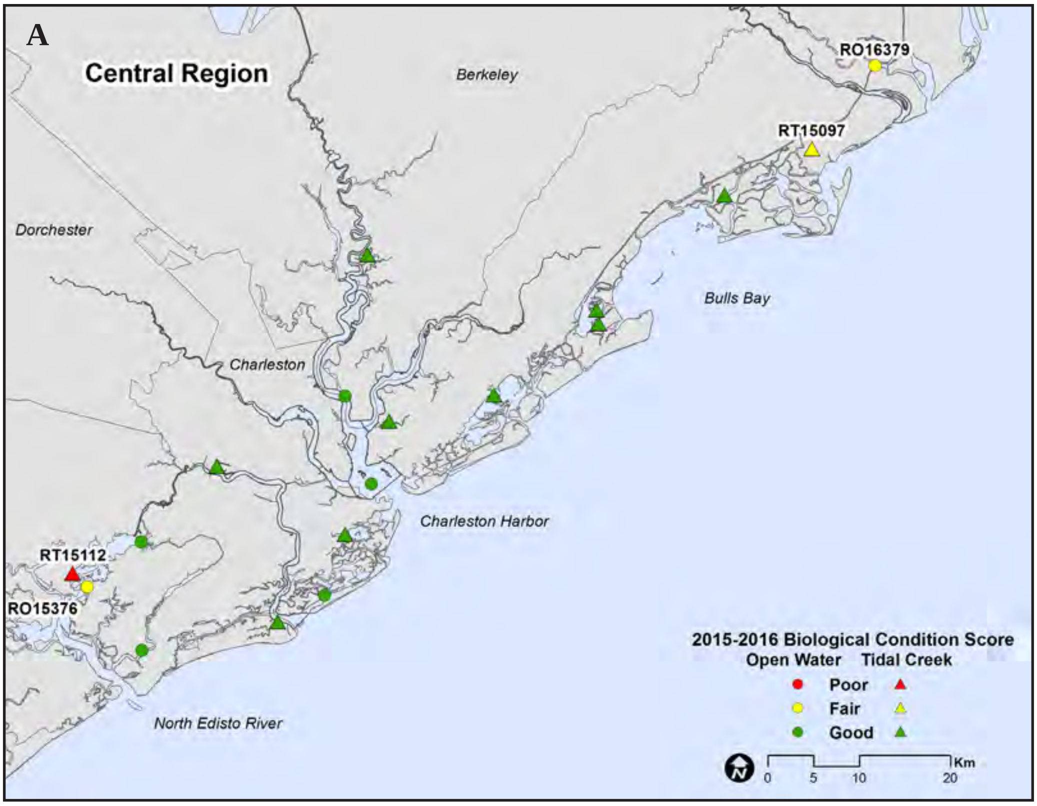


Figure 3.3.4. Distribution of stations with good, fair, or poor scores for the Biological Condition Index during the 2015-2016 (A) and 1999-2016 (B) periods for the northern region of South Carolina.



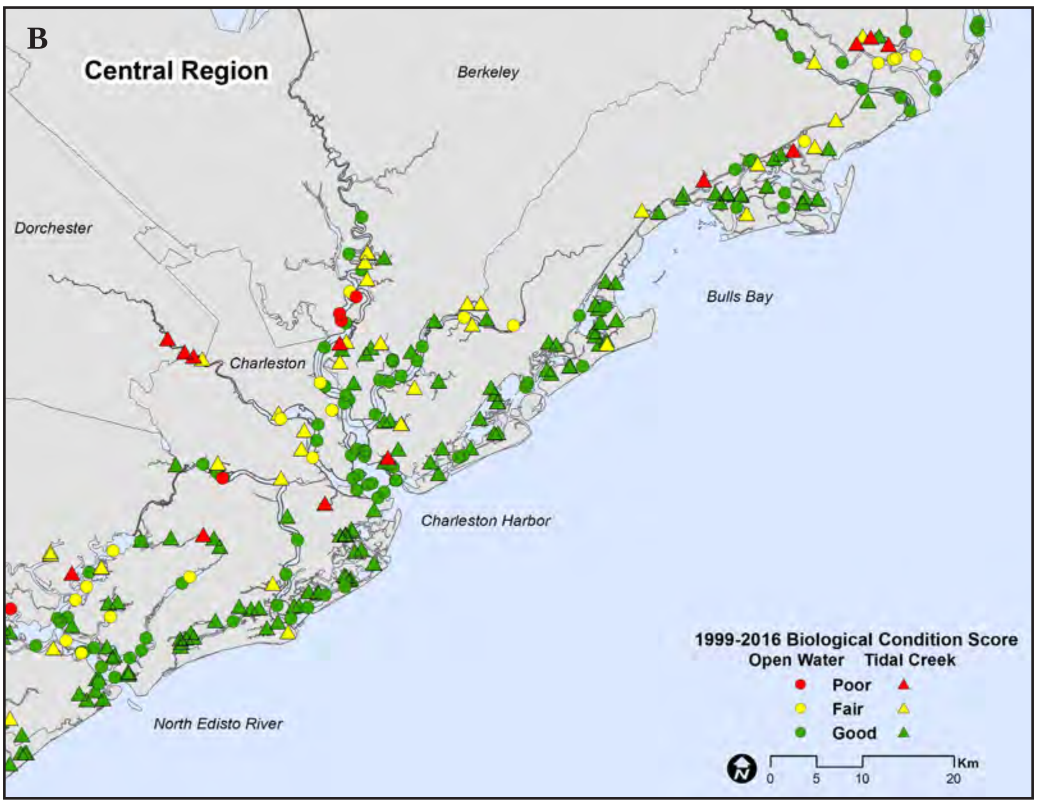
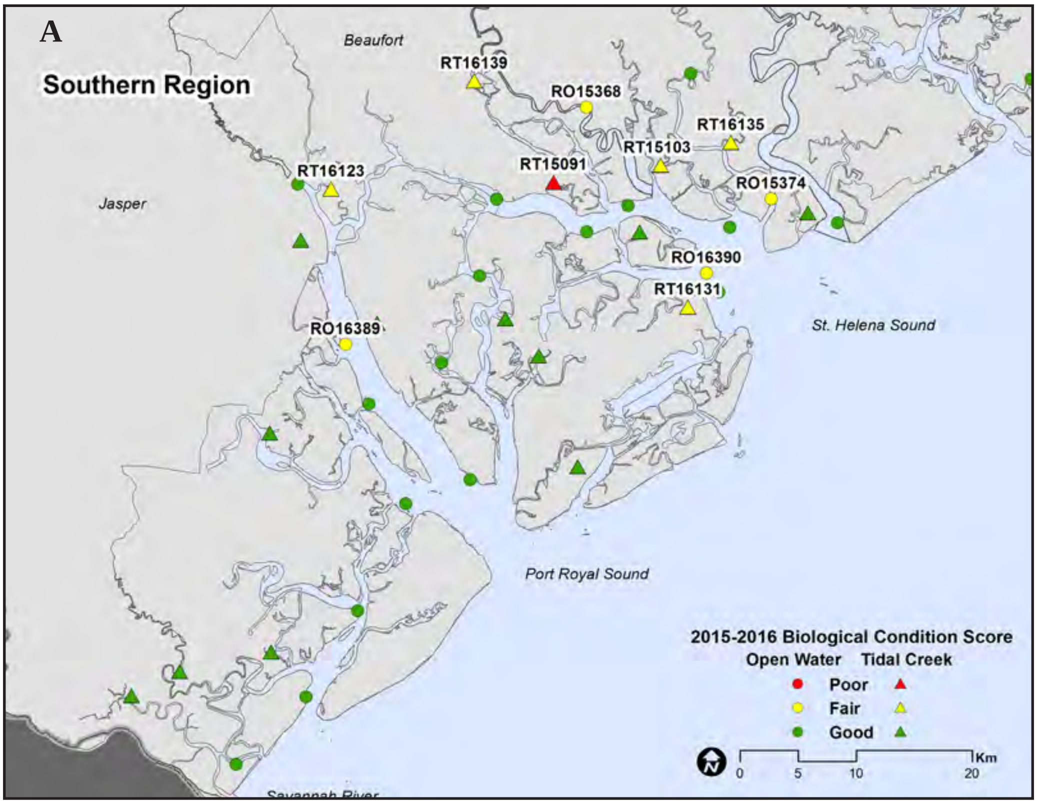


Figure 3.3.5. Distribution of stations with good, fair, or poor scores for the Biological Condition Index during the 2015-2016 (A) and 1999-2016 (B) periods for the central region of South Carolina.



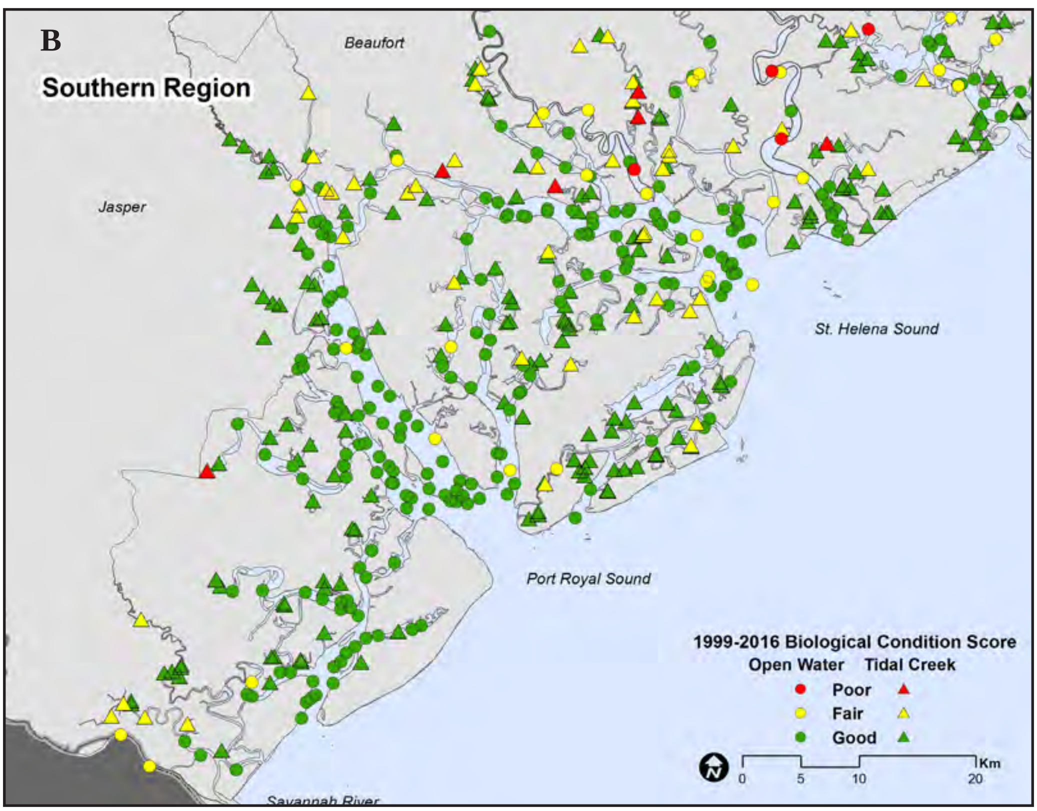


Figure 3.3.6. Distribution of stations with good, fair, or poor scores for the Biological Condition Index during the 2015-2016 (A) and 1999-2016 (B) periods for the southern region of South Carolina.

Table 3.3.2. Summary of fish and large invertebrate biological measures observed in tidal creek and open water habitats during each year of the SCECAP survey. Fish include finfish, sharks, and rays. Large invertebrates include decapods, horseshoe crabs, and squid. All Density (and No. Species) measures represent mean density (and mean number of species per station), with the exception of "Overall Density: Median". Densities are in units of individuals/hectare.

Measure	Habitat	Year																	
		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Overall Density: Mean	Open	329	324	389	557	325	453	381	476	281	116	91	247	325	177	155	191	67	166
	Creek	831	853	698	1137	760	1321	738	1611	296	295	329	876	387	804	656	528	244	524
Overall Density: Median	Open	149	216	181	326	196	197	232	239	123	36	43	112	199	112	58	91	51	51
	Creek	565	406	399	601	467	503	500	384	196	116	123	442	384	536	333	167	217	159
No. Species	Open	7.8	7.5	8.0	9.2	7.2	8.3	8.2	7.9	8.4	5.6	4.7	7.6	8.5	5.8	5.9	4.9	4.4	5.3
	Creek	8.6	9.6	8.2	9.4	8.5	9.5	9.3	8.1	7.1	6.1	6.3	9.3	8.4	9.5	7.7	7.2	5.5	6.5
Fish Density	Open	202	198	203	297	178	218	196	237	154	92	37	99	178	73	86	100	43	74
	Creek	314	373	319	273	299	331	308	171	99	196	98	180	183	282	111	157	94	119
No. Fish Species	Open	5.3	5.0	5.7	6.5	5.4	5.9	5.7	5.9	6.1	4.1	3.5	4.8	6.3	3.8	4.3	3.4	2.9	3.5
	Creek	5.8	6.6	5.7	6.7	6.0	6.4	6.4	5.8	4.9	4.0	4.5	6.1	5.7	6.7	5.3	5.5	3.1	4.2
Decapod Density	Open	89	96	171	248	137	211	166	226	111	16	53	138	138	99	64	89	21	85
	Creek	476	425	346	788	429	945	385	1417	182	74	207	678	188	510	538	354	140	396
No. Decapod Species	Open	1.7	1.8	1.7	2.0	1.5	1.6	1.8	1.4	1.5	0.9	1.1	2.0	1.7	1.7	1.3	1.2	0.9	1.3
	Creek	2.0	2.2	1.8	2.0	2.0	2.4	2.4	1.7	1.8	1.5	1.1	2.4	2.0	2.3	2.0	1.1	1.8	1.8
Spot Density	Open	7	18	67	27	23	50	57	29	12	21	1	11	52	2	7	4	1	7
	Creek	72	131	112	39	71	95	147	24	13	44	29	41	32	58	16	51	13	7
Croaker Density	Open	3	48	37	112	71	25	27	27	51	5	5	11	31	14	12	24	10	15
	Creek	9	8	16	18	12	6	6	1	14	1	11	27	3	10	20	9	8	4
Weakfish Density	Open	12	24	23	42	3	52	11	14	11	11	2	8	9	4	3	20	1	7
	Creek	14	6	4	12	3	3	8	2	8	4	4	2	2	6	5	2	0	3
Blue Crab Density	Open	2	8	1	1	3	3	3	6	0	0	0	1	3	1	1	2	0	1
	Creek	4	22	5	6	11	18	21	9	10	3	0	14	5	123	10	1	2	7
Brown Shrimp Density	Open	8	42	108	69	51	34	46	34	63	9	10	47	23	25	16	74	10	29
	Creek	127	69	97	135	67	128	150	41	27	37	13	105	35	40	23	10	42	3
White Shrimp Density	Open	77	42	56	166	78	173	111	184	43	6	42	88	110	69	46	12	11	54
	Creek	339	323	238	631	348	792	208	1364	143	25	193	544	141	342	502	342	95	382

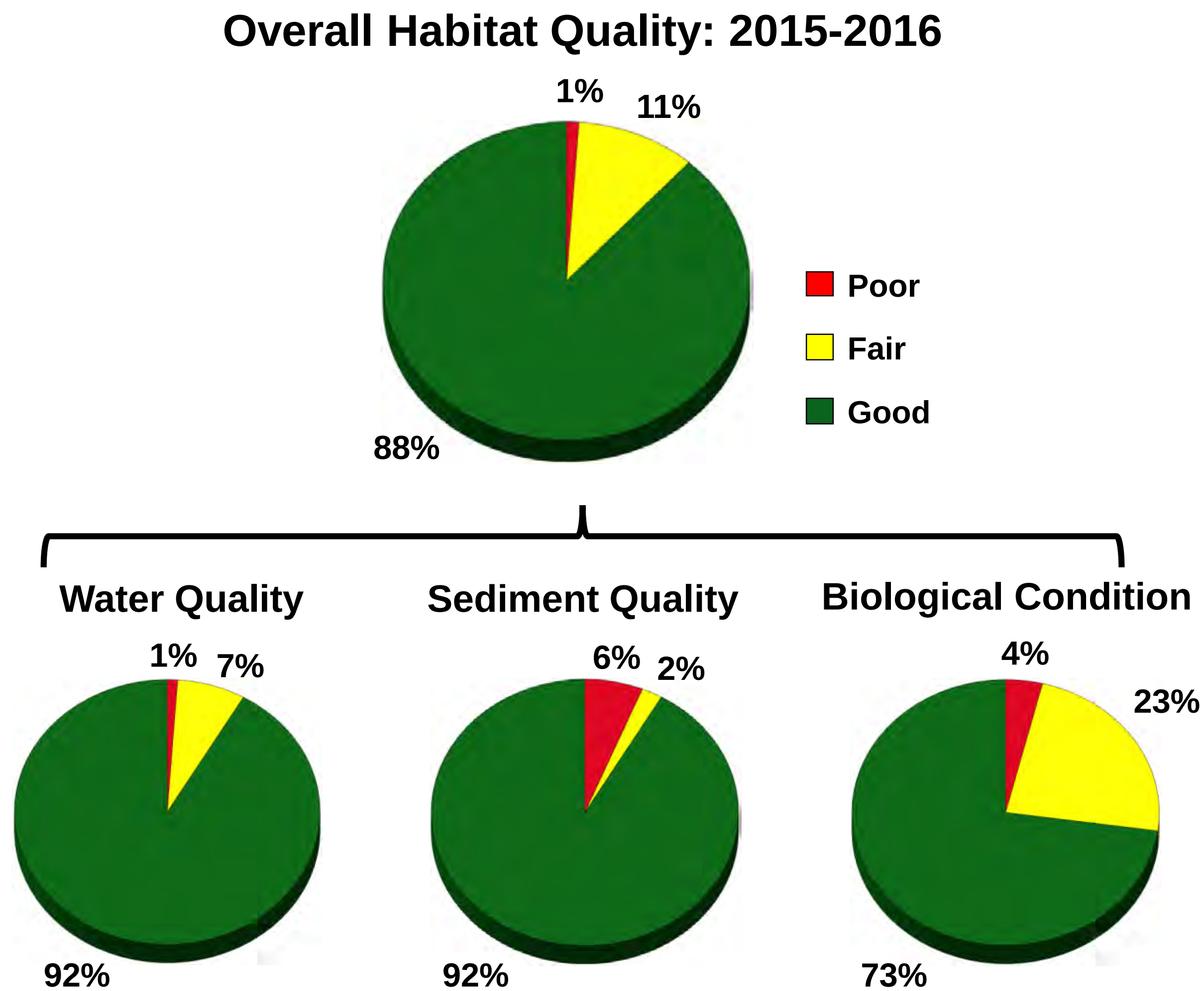


Figure 3.5.1. Percentage of the state's estuarine habitat that scored as good, fair or poor for the Habitat Quality Index and the component indices that comprise the index. Percentage is based on data obtained from 30 stations for each habitat during 2015 and 2016.

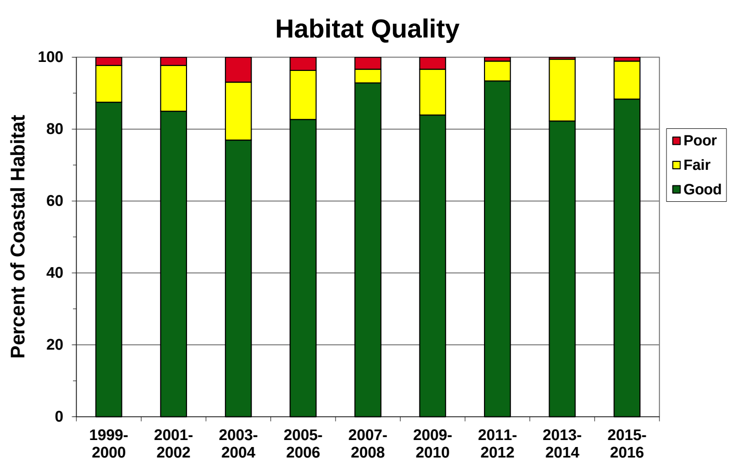


Figure 3.5.2. Percent of coastal waters corresponding to each Habitat Quality Index category by survey period.

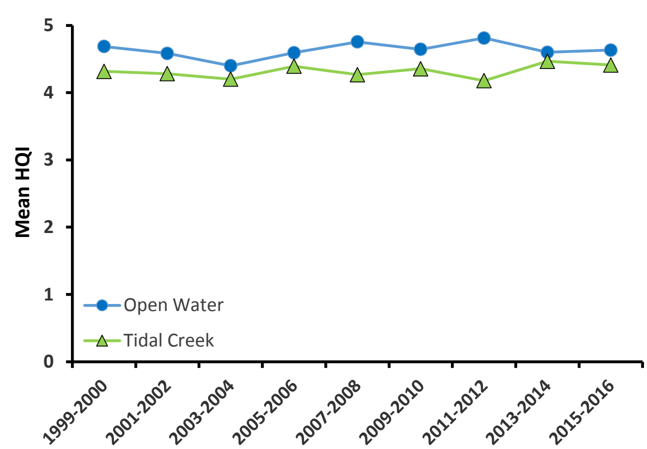
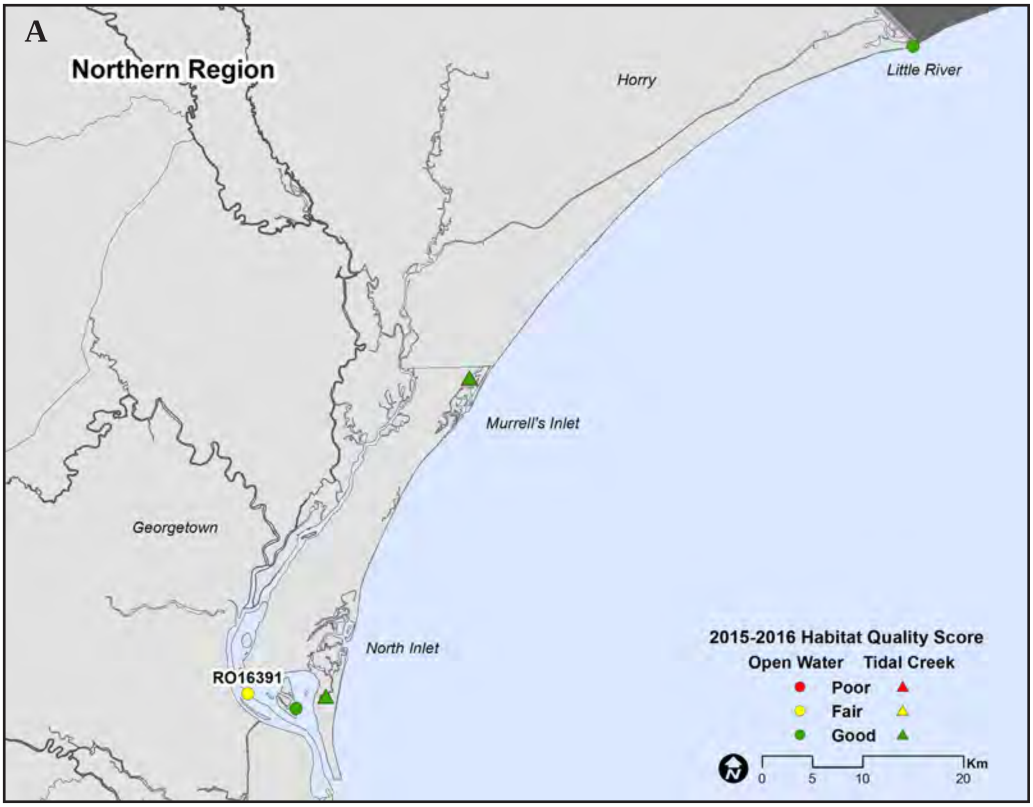


Figure 3.5.3. Habitat Quality Index scores observed by survey period and habitat type.



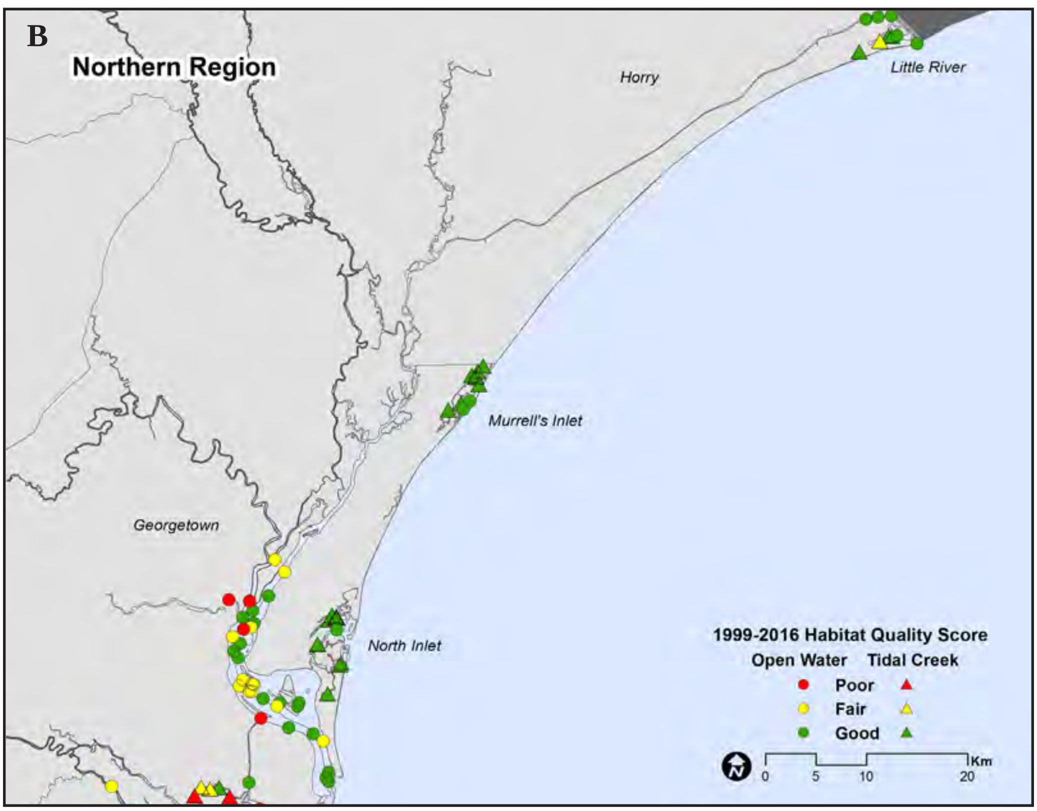


Figure 3.5.4. Distribution of stations with good, fair, or poor scores for the Habitat Quality Index during the 2015-2016 (A) and 1999-2016 (B) periods for the northern region of South Carolina.

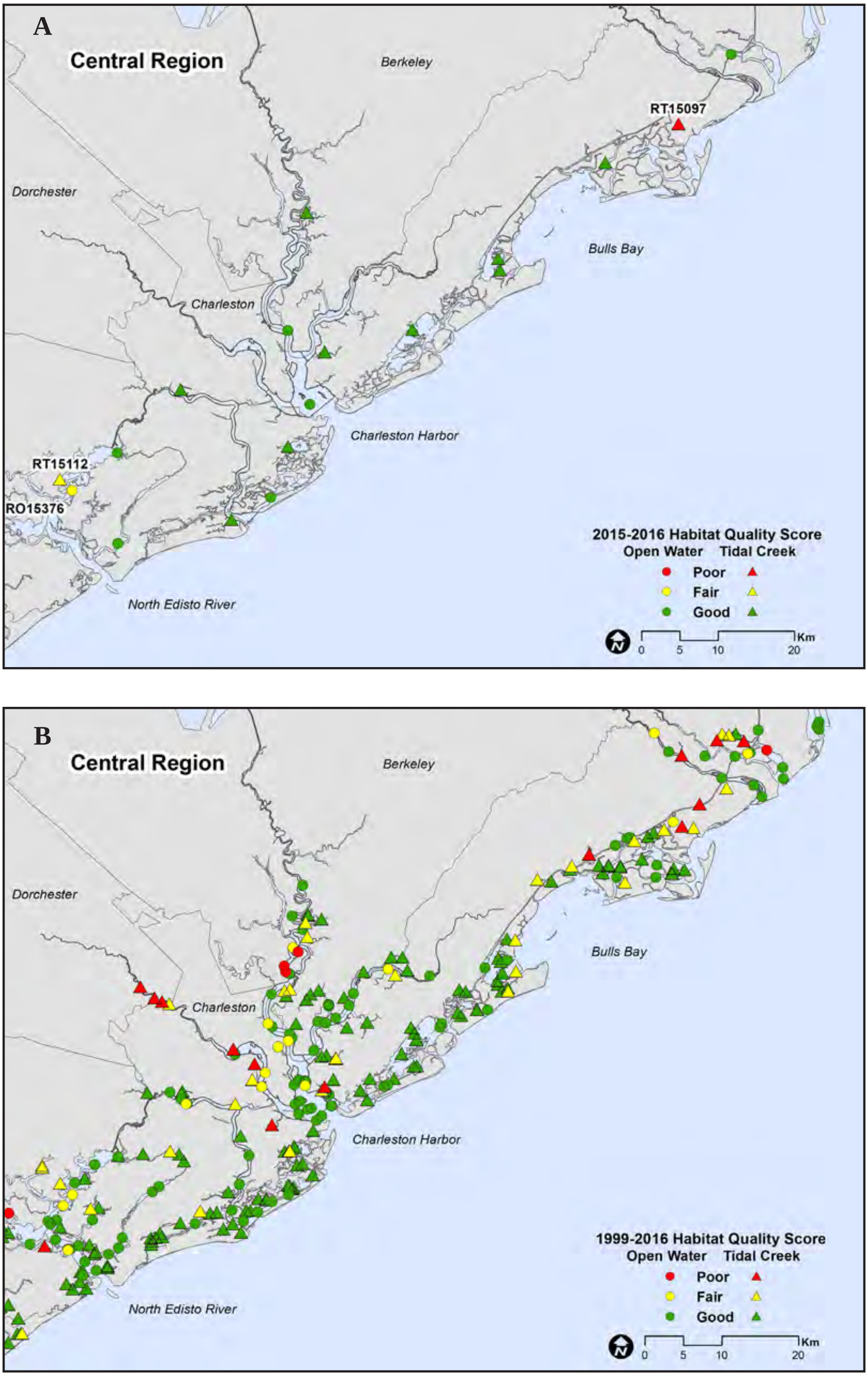


Figure 3.5.5. Distribution of stations with good, fair, or poor scores for the Habitat Quality Index during the 2015-2016 (A) and 1999-2016 (B) periods for the central region of South Carolina.

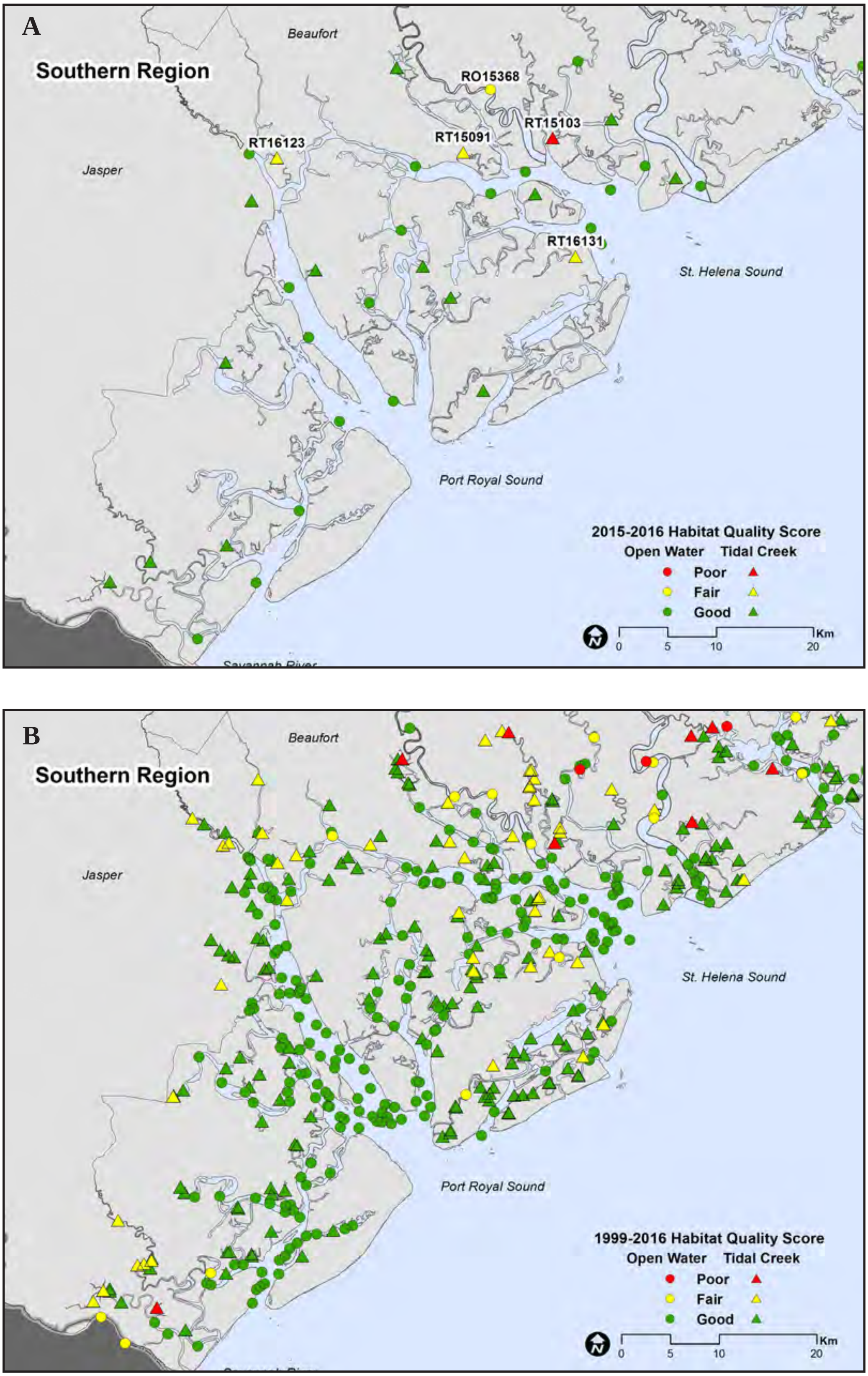


Figure 3.5.6. Distribution of stations with good, fair, or poor scores for the Habitat Quality Index during the 2015-2016 (A) and 1999-2016 (B) periods for the southern region of South Carolina.

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The credit for the immense amount of work involved in planning a project of this size, collecting, processing, analyzing the data, and finally writing this report goes to many people. Some have been involved since its inception in 1999 while others may have only been involved for a summer. Either way, the project cannot be completed without the dedicated efforts of these individuals. We would like to thank Marty Levisen for leading the SCECAP field efforts during the 2015-2016 seasons. Tony Olsen and staff at the USEPA NHEERL, Corvallis, OR assisted in developing the sampling design and CDF routines used during the analysis. The bulk of the field work falls on two groups, the staff of the SCDNR's Environmental Research Section (ERS) and SCDHEC's Aquatic Science Programs. In addition to the authors, SCDNR field teams included Steve Burns, Leona Forbes, Catharine Parker, Norm Shea, Nicole Carey, Aaron Burnette, Alexandra Miller, Emily Hutchison, Malia Canaan, John Venturella, and Robbie O'Quinn, and SCDHEC field staff included David Graves. Once the diverse array of samples arrived back at the lab at the end of a field day, they were distributed to cooperating groups that included the ERS (many named above) which processed benthic community and sediment samples; the NOAA /NOS National Centers for Coastal Ocean Sciences Charleston Laboratory which processed sediment chemistry and toxicology assays (Brian Shaddrix, LouAnn Reed, and Katy Chung); and the SCDNR Algal Ecology Lab (Dianne Greenfield, Cameron Doll, Michelle Reed, Kimberly Sitta) which processed the Chlorophyll-a samples. Staff at the SCDHEC Bureau of Environmental Health Services, Analytical and Radiological Environmental Services Division that processed the nutrient and fecal samples included Roger Brewer (Central Lab), Sharon Gilbert (Region 7 ECQ Trident Lab), Penny Cornett (Region 8 EQC Low Country Lab), and Leigh Plummer (Region 8 EQC Pee Dee Lab). Jessica L. Elmore with SCDNR Graphics generated the layout of this report.

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Appendix 1. Summary of station locations and dates sampled in 2015 through 2016. Open water stations have the prefix "RO" and tidal creek stations have the prefix "RT".

SCECAP 2015
Station Information -- Open Water

Station	Station Type	Latitude Decimal Degrees	Longitude Decimal Degrees	Station Depth (meters)	Date Sampled	County	Development Code*	Approximate Location
RO15362	Open	32.49040	-80.44873	1.8	8/05/2015	Colleton	NDV	St. Helena Sound near confluence of Ashepoo and Coosaw
RO15364	Open	32.65675	-79.95752	6.7	7/21/2015	Charleston	R<1	Folly River west of Folly River Landing
RO15365	Open	33.84938	-78.54462	3.0	8/18/2015	Horry	R>1	Little River Inlet between the start of the jetties
RO15366	Open	32.27655	-80.74643	1.8	7/08/2015	Beaufort	R<1	Port Royal Sound 4.1 miles NE of C.C. Haig, Jr. Landing
RO15367	Open	32.48729	-80.58003	6.1	8/04/2015	Beaufort	R<1	Coosaw River 1.2 miles EES of Sam's Point Landing
RO15368	Open	32.58418	-80.57979	4.9	8/11/2015	Beaufort	NDV	Combahee River 1.7 miles NW of Fields Landing
RO15369	Open	32.35429	-80.77979	3.7	7/07/2015	Beaufort	NDV	Broad River 3.6 miles SE of Edgar Glen Landing
RO15370	Open	32.29512	-80.68743	4.0	7/08/2015	Beaufort	R>1	Port Royal Sound 1.15 miles west of Parris Island
RO15371	Open	32.51300	-80.66245	3.0	8/04/2015	Beaufort	R>1	Coosaw River 1.2 miles NE of Brickyard Creek Landing
RO15372	Open	32.85292	-79.93104	2.4	7/21/2015	Berkeley	I<1	Cooper River 1.6 miles NE of mouth of Shipyard Creek
RO15374	Open	32.51240	-80.41068	3.0	8/05/2015	Colleton	NDV	Ashepoo River 4 miles SE of Bennetts Point Landing
RO15375	Open	33.27006	-79.21889	2.7	7/29/2015	Georgetown	NDV	Winyah Bay 3.8 miles NNW of Georgetown Lighthouse
RO15376	Open	32.66663	-80.23462	0.6	7/22/2015	Charleston	R<1	Wadmalaw River 2 mi NE of confluence of Toogoodoo Creek
RO15377	Open	32.07448	-80.90188	4.0	7/07/2015	Jasper	R<1	New River 1 mi SE of confluence of Walts Cut to Wright River
RO15378	Open	32.50741	-80.54189	4.9	8/05/2015	Beaufort	R>1	Coosaw River 3.7 miles NE of Sams Point Landing

* Development codes: NDV = no development visible, R<1 = residential less than 1 km away, R>1 = residential greater than 1 km away, I<1 = industrial site less than 1 km away, I>1 = industrial site located greater than 1 km away.

SCECAP 2015
Station Information -- Tidal Creeks

Station	Station Type	Latitude Decimal Degrees	Longitude Decimal Degrees	Station Depth (meters)	Date Sampled	County	Development Code*	Approximate Location
RT15089	Creek	32.93521	-79.63570	3.0	7/22/2015	Charleston	NDV	Near Anderson Creek in Cape Romain NWR
RT15091	Creek	32.52607	-80.60993	1.5	8/04/2015	Beaufort	NDV	Coosaw River 2.9 miles north of Sams Point Landing
RT15092	Creek	32.78496	-80.08225	1.2	7/21/2015	Charleston	R>1	Stono River 1.45 miles east of John P Limehouse Landing
RT15093	Creek	32.33196	-80.87051	1.5	7/07/2015	Beaufort	R<1	Chechessee Creek near confluence with Colleton River
RT15095	Creek	32.99225	-79.90335	3.5	7/21/2015	Berkeley	NDV	Cooper River 2.7 miles NE of Bushy Park Saltwater Landing
RT15097	Creek	33.09125	-79.38054	2.7	7/29/2015	Charleston	NDV	Ramhorn Creek 4.5 miles east of McClellanville
RT15099	Creek	32.30506	-80.58906	2.1	7/08/2015	Beaufort	NDV	Tributary to Trenchards Inlet 7.9 miles SE of Port Royal
RT15101	Creek	32.92149	-79.63338	3.7	7/22/2015	Charleston	NDV	Bull Creek 1.85 miles SE of Moores Landing
RT15102	Creek	32.12793	-80.99722	3.7	7/07/2015	Jasper	I>1	Wright River 0.75 miles SW of Glasgow Landing
RT15103	Creek	32.53905	-80.51195	3.0	8/05/2015	Colleton	NDV	Rock Creek between Combahee and Ashepoo Rivers
RT15104	Creek	32.71638	-79.93295	2.4	8/12/2015	Charleston	R<1	Clark Sound 0.3 miles south of the end of Wayfarer Lane
RT15105	Creek	33.56242	-79.02721	0.9	8/19/2015	Georgetown	R<1	Main Creek Murrells Inlet NE of Murrells Inlet Landing
RT15106	Creek	32.39139	-80.62421	1.2	7/08/2015	Beaufort	R<1	Cowen Creek 0.7 mi SW of US Hwy 21 Bridge
RT15110	Creek	32.48708	-80.53132	4.0	8/04/2015	Beaufort	NDV	Bass Creek 1.1 miles NW of confluence with Parrott Creek
RT15112	Creek	32.68041	-80.25144	1.2	7/22/2015	Charleston	R<1	Wadmalaw Sound near Sebago Rd/Legacy Ln intersection

* Development codes: NDV = no development visible, R<1 = residential less than 1 km away, R>1 = residential greater than 1 km away, I<1 = industrial site less than 1 km away, I>1 = industrial site located greater than 1 km away.

SCECAP 2016
Station Information -- Open Water

Station	Station Type	Latitude Decimal Degrees	Longitude Decimal Degrees	Station Depth (meters)	Date Sampled	County	Development Code*	Approximate Location
RO16379	Open	33.17196	-79.30513	1.8	8/16/2016	Georgetown	NDV	North Santee River near mouth of Four Mile Creek canal
RO16380	Open	32.76602	-79.90154	3.0	7/12/2016	Charleston	I<1	Folly Island Channel approx 1 mile ESE of Castle Pinkney
RO16381	Open	32.52496	-80.84492	2.4	7/19/2016	Jasper	R>1	Broad River below the confluence of Pocotaligo and Coosawhatchie River
RO16382	Open	32.19351	-80.79079	3.0	7/20/2016	Beaufort	R<1	May River near confluence with Calibogue Sound
RO16383	Open	32.45356	-80.67830	3.0	8/10/2016	Beaufort	R>1	Beaufort River, 0.5 mi SE of Pleasant Point
RO16384	Open	32.61003	-80.48389	5.2	8/03/2016	Colleton	NDV	Ashepoo River, between Bennett's Point Rd and Hole in the Wall loop
RO16386	Open	32.38619	-80.71347	4.0	8/09/2016	Beaufort	R>1	Unnamed loop off Battery Creek
RO16387	Open	32.49326	-80.35004	7.6	8/03/2016	Colleton	R>1	South Edisto River 0.9 mi SSW of Big Bay Creek
RO16388	Open	32.60394	-80.17147	1.8	7/13/2016	Charleston	R<1	Bohicket Creek
RO16389	Open	32.40058	-80.80132	3.7	8/09/2016	Beaufort	NDV	Broad River off mouth of Euhaw Creek
RO16390	Open	32.45483	-80.47054	2.7	8/02/2016	Beaufort	R>1	Morgan River mouth/St. Helena Sound
RO16391	Open	33.28379	-79.26986	2.1	8/17/2016	Georgetown	I>1	Winyah Bay out from Island separating the Western Channel
RO16392	Open	32.71088	-80.17148	1.5	7/13/2016	Charleston	R<1	New cut between Stono River and Church Creek
RO16393	Open	32.12682	-80.83810	2.4	7/20/2016	Beaufort	R<1	Calibogue Sound near shore of Daufuskie Island
RO16394	Open	32.44012	-80.45921	5.2	8/02/2016	Beaufort	R>1	St. Helena Sound

* Development codes: NDV = no development visible, R<1 = residential less than 1 km away, R>1 = residential greater than 1 km away, I<1 = industrial site less than 1 km away, I>1 = industrial site located greater than 1 km away.

SCECAP 2016
Station Information -- Tidal Creeks

Station	Station Type	Latitude Decimal Degrees	Longitude Decimal Degrees	Station Depth (meters)	Date Sampled	County	Development Code*	Approximate Location
RT16114	Creek	32.16196	-80.86949	3.0	7/20/2016	Beaufort	NDV	Hoophole Creek approx 515 m SW of confluence with Bull Creek
RT16116	Creek	32.63080	-80.01249	2.4	7/13/2016	Charleston	NDV	Bass Creek
RT16121	Creek	32.50137	-80.37717	4.0	8/03/2016	Colleton	NDV	Pine Island Creek near split into 2 creeks
RT16123	Creek	32.52123	-80.81433	2.4	7/19/2016	Beaufort	NDV	Unnamed Creek to South Haulover Creek
RT16125	Creek	32.41689	-80.77216	1.2	7/19/2016	Beaufort	R<1	Habersham Creek
RT16127	Creek	32.85244	-79.75674	1.5	7/12/2016	Charleston	R<1	Copehee Sound
RT16129	Creek	33.28064	-79.18680	1.2	7/27/2016	Georgetown	NDV	Jones Creek on Baruch Property
RT16130	Creek	32.48158	-80.84192	4.0	7/19/2016	Jasper	NDV	East Branch Creek
RT16131	Creek	32.42884	-80.48753	2.4	8/02/2016	Beaufort	R<1	Coffin Creek approx 330 m E of the end of N Front Drive
RT16132	Creek	32.82801	-79.88008	2.1	7/12/2016	Charleston	R<1	Hobcaw Creek
RT16134	Creek	32.14670	-80.95317	3.7	7/20/2016	Jasper	NDV	New River near Coleman Island
RT16135	Creek	32.55629	-80.44754	2.7	8/03/2016	Colleton	R<1	Mosquito Creek opposite mouth of Musselboro Creek
RT16137	Creek	33.04702	-79.48382	1.8	8/16/2016	Charleston	NDV	Little Sett Creek between Sett Creek and Five Fathom Creek
RT16138	Creek	32.42020	-80.65461	2.1	8/10/2016	Beaufort	R<1	Factory Creek near dock at the end of High Point
RT16139	Creek	32.60492	-80.68253	6.1	8/02/2016	Beaufort	NDV	Branford Creek approx 1 mile NNW of confluence with True Blue Creek

* Development codes: NDV = no development visible, R<1 = residential less than 1 km away, R>1 = residential greater than 1 km away, I<1 = industrial site less than 1 km away, I>1 = industrial site located greater than 1 km away.

Appendix 2. Summary of the criteria and amount of open water and tidal creek habitat scoring as good, fair or poor for each SCECAP parameter and index for 2015 through 2016.

Index / Parameter	Criteria			2015-2016 Survey					
				Percent of Open Water Habitat			Percent of Tidal Creek Habitat		
	Poor	Fair	Good	Poor	Fair	Good	Poor	Fair	Good
WATER QUALITY									
Water Quality Index				0	7	93	7	10	83
Dissolved Oxygen (mg/L)	< 3	3 ≤ x < 4	≥ 4	0**	3**	80**	0*	30*	67*
pH (salinity corrected)	≤ 7.22	7.22 < x ≤ 7.35	> 7.35	0*	7*	90*	7	30	63
Fecal Coliform (cfu/100mL)	> 400	43 < x ≤ 400	≤ 43	0	7	93	7	7	87
Eutrophic Index				3	10	87	7	13	80
Total Nitrogen (mg/L)	> 1.05	0.81 < x ≤ 1.05	≤ 0.81	3	0	97	0	10	90
Total Phosphorus (mg/L)	> 0.12	0.10 < x ≤ 0.12	≤ 0.10	3	7	90	13	7	80
Chlorophyll *a* (μg/L)	> 16.4	11.5 < x ≤ 16.4	≤ 11.5	7*	3*	87*	7	17	77
SEDIMENT QUALITY									
Sediment Quality Index				7	0	93	3	13	83
Contaminants (mERMq)	> 0.058	0.020 < x ≤ 0.058	≤ 0.020	0	7	93	0	27	73
Toxicity	N/A	1	0	0	13	87	0	7	93
Sediment TOC (%)	> 5	3 ≤ x ≤ 5	< 3	7	0	93	3	30	67
BIOLOGICAL CONDITION									
Benthic-IBI	< 2	2 ≤ x < 3	≥ 3	3	23	73	7	23	70
HABITAT QUALITY									
Habitat Quality Index				0	10	90	7	13	80

Percentages in fields marked with asterices do not add up to 100 because data were missing, resulting in no score for the represented areas.
* Data from one station was missing. ** Data from five stations were missing.

Appendix 3. Summary of the Water Quality, Sediment Quality, Biological Condition, and Habitat Quality Index scores and their component measure scores by station for 2015 through 2016. Green represents good condition, yellow represent fair condition, and red represents poor condition. The actual Habitat Quality Index score is shown to allow the reader to see where the values fall within the above general coding criteria. See text for further details on the ranges of values representing good, fair, and poor for each measure and index score.

Station	Water Quality								Sediment Quality				Biological Condition	Habitat Quality	County	Location
	Dissolved Oxygen	Fecal Coliform	pH	Total Nitrogen	Total Phosphorus	Chlorophyll a	Eutrophic Index	Water Quality Index	Toxicity	Sediment TOC	Contaminants	Sediment Quality Index	Biological Index (B-IBI)	Habitat Quality Index		
RO15362							5	5				5	5	5.0	Colleton	St. Helena Sound between confluence of Ashepoo and Coosaw rivers
RO15364							5	5				5	5	5.0	Charleston	Folly River west of Folly River Landing
RO15365							5	5				5	5	5.0	Horry	Little River Inlet between the start of the jetties
RO15366							5	5				5	5	5.0	Beaufort	Port Royal Sound 4.1 miles northeast of C.C. Haig, Jr. Landing
RO15367							5	5				5	5	5.0	Beaufort	Coosaw River 1.2 miles southeast of Sam's Point Landing
RO15368							5	5				0	3	2.7	Beaufort	Combahee River 1.7 miles northwest of Fields Landing
RO15369							5	5				5	5	5.0	Beaufort	Broad River 3.6 miles southeast of Edgar Glen Landing
RO15370							5	5				5	5	5.0	Beaufort	Port Royal Sound 1.15 miles west of the southern tip of Paris Island
RO15371							5	5				5	5	5.0	Beaufort	Coosaw River 1.2 miles northeast of Brickyard Creek Landing
RO15372							5	5				5	5	5.0	Berkeley	Cooper River 1.6 miles northeast of mouth of Shipyard Creek
RO15374							5	5				5	3	4.3	Colleton	Ashepoo River 4 miles southeast of Bennett's Point Landing
RO15375							3	5				5	3	4.3	Georgetown	Winyah Bay 3.8 miles northwest of Georgetown Lighthouse
RO15376							5	5				0	3	2.7	Charleston	Wadmalaw River 2 miles northeast of Toogoodoo Creek
RO15377							5	5				5	5	5.0	Jasper	New River 0.8 miles southeast of Walts Cut & Wright River
RO15378							5	5				5	5	5.0	Beaufort	Coosaw River 3.7 miles northeast of Sams Point Landing
RT15089							5	5				3	5	4.3	Charleston	Creek in Cape Romain NWR, 1.34 miles east of Moores Landing
RT15091							5	5				5	0	3.3	Beaufort	Creek to Coosaw River 2.9 miles north of Sams Point Landing
RT15092							5	5				5	5	5.0	Charleston	Creek to Stono River 1.45 miles east of John P Limehouse Landing
RT15093							5	5				5	5	5.0	Beaufort	Chechessee Creek near confluence with Colleton River
RT15095							5	5				5	5	5.0	Berkeley	Creek to Cooper River 2.7 miles northeast of Bushy Park Landing
RT15097							3	0				3	3	2.0	Charleston	Ramhorn Creek 4.5 miles east of McClellanville
RT15099							5	5				5	5	5.0	Beaufort	Tributary to Trenchards Inlet 7.9 miles southeast of Port Royal
RT15101							5	5				5	5	5.0	Charleston	Bull Creek 1.85 miles southeast of Moores Landing
RT15102							5	5				5	5	5.0	Jasper	Wright River 0.75 miles southwest of Glasgow Landing
RT15103							0	0				3	3	2.0	Colleton	Rock Creek 1 mile NNE of confluence of New & Combahee rivers
RT15104							5	5				5	5	5.0	Charleston	Clark Sound 0.3 miles south of the end of Wayfarer Lane
RT15105							5	3				5	5	4.3	Georgetown	Main Creek 0.63 miles northeast of Murrells Inlet Landing
RT15106							5	5				5	5	5.0	Beaufort	Cowen Creek 0.7 miles southwest of US Hwy 21 Bridge
RT15110							5	5				5	5	5.0	Beaufort	Bass Creek 1.1 miles northwest of confluence with Parrott Creek
RT15112							5	5				3	0	2.7	Charleston	Unnamed Creek to Wadmalaw Sound

Station	Water Quality								Sediment Quality				Biological Condition	Habitat Quality	County	Location
	Dissolved Oxygen	Fecal Coliform	pH	Total Nitrogen	Total Phosphorus	Chlorophyll a	Eutrophic Index	Water Quality Index	Toxicity	Sediment TOC	Contaminants	Sediment Quality Index	Biological Index (B-IBI)	Habitat Quality Index		
RO16379							5	5				5	3	4.3	Georgetown	North Santee River near mouth of Four Mile Creek canal
RO16380							5	5				5	5	5.0	Charleston	Folly Island Channel approx 1 mile southeast of Castle Pinkney
RO16381							5	5				5	5	5.0	Jasper	Broad River below the Pocotaligo and Coosawhatchie rivers
RO16382							5	5				5	5	5.0	Beaufort	May River near confluence with Calibogue Sound
RO16383							3	5				5	5	5.0	Beaufort	Beaufort River, 0.5 miles southeast of Pleasant Point
RO16384							3	3				5	5	4.3	Colleton	Ashepoo River between Bennett's Point Rd & Hole in the Wall loop
RO16386							5	5				5	5	5.0	Beaufort	Unnamed loop off Battery Creek
RO16387							5	5				5	5	5.0	Colleton	South Edisto River 0.9 mi southwest of Big Bay Creek
RO16388							5	5				5	5	5.0	Charleston	Bohicket Creek
RO16389							5	5				5	3	4.3	Beaufort	Broad River off mouth of Euhaw Creek
RO16390							5	5				5	3	4.3	Beaufort	Morgan River mouth at St. Helena Sound
RO16391							0	3				5	0	2.7	Georgetown	Winyah Bay out from island separating the western channel
RO16392							5	5				5	5	5.0	Charleston	New cut between Stono River and Church Creek
RO16393							5	5				5	5	5.0	Beaufort	Calibogue Sound near Daufuskie Island off end of Freeport Drive
RO16394							5	5				5	5	5.0	Beaufort	St. Helena Sound
RT16114							5	5				5	5	5.0	Beaufort	Hoophole Creek 515 meters southwest of confluence with Bull Creek
RT16116							5	5				5	5	5.0	Charleston	Bass Creek
RT16121							5	5				5	5	5.0	Colleton	Pine Island Creek near split into 2 creeks
RT16123							3	5				0	3	2.7	Beaufort	Unnamed Creek to South Haulover Creek
RT16125							5	3				5	5	4.3	Beaufort	Habersham Creek
RT16127							3	5				5	5	5.0	Charleston	Copehee Sound
RT16129							5	5				5	3	4.3	Georgetown	Jones Creek on Baruch Property between Sign Creek & Dividing Creek
RT16130							5	5				5	5	5.0	Jasper	East Branch Creek
RT16131							0	3				5	3	3.7	Beaufort	Coffin Creek approx 330 meters east of the end of N Front Drive
RT16132							5	5				5	5	5.0	Charleston	Hobcaw Creek
RT16134							5	5				5	5	5.0	Jasper	New River near Coleman Island
RT16135							3	5				5	3	4.3	Colleton	Mosquito Creek opposite mouth of Musselboro Creek
RT16137							5	5				5	5	5.0	Charleston	Little Sett Creek between Sett Creek and Five Fathom Creek
RT16138							5	5				5	5	5.0	Beaufort	Factory Creek near dock at the end of High Point
RT16139							5	5				5	3	4.3	Beaufort	Branford Creek approx 1 mile northwest of True Blue Creek

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