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Natural Resource Program Center

Inventory of Marine and Estuarine Benthic Macroinvertebrates for Nine Southeast Coast Network Parks

Natural Resource Report NPS/SECN/NRR—2009/121

ON THE COVER

Common benthic macroinvertebrates in the Southeast: (clockwise from top left) *Aglaophamus* spp. , *Hemigraspus sanguineous*, *Renilla reniformes, Littorina irrorata*.

Photographs by: Smithsonian Museum of Natural History, Southeast Regional Taxonomy Center, Jacksonville Shell Club, University of Georgia Marine Extension Service.

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Commonly-Used Abbreviations

B-IBI	Benthic Index of Biotic Integrity
BMI	Benthic Macroinvertebrates
CAHA	Cape Hatteras National Seashore
CALO	Cape Lookout National Seashore
CANA	Canaveral National Seashore
CUIS	Cumberland Island National Seashore
DO	Dissolved Oxygen
EIS	Environmental Impact Statement
EMAP	Environmental Monitoring and Assessment Program
FLDEP	Florida Department of Environmental Protection
FOFR	Fort Frederica National Monument
FOMA	Fort Matanzas National Monument
FOPU	Fort Pulaski National Monument
FOSU	Fort Sumter National Monument
GTM	Guana-Tolomato-Matanzas NERR
HML	Hollings Marine Laboratory
ICW	Intracoastal Waterway
ITIS	Integrated Taxonomic Information System
LSJR	Lower St. Johns River
LTER	Long-Term Ecological Research Station
MAREX	Marine Extension Service (University of GA)
MMS	Minerals Management Service
NBI	National Benthic Inventory
NCA	National Coastal Assessment
NCCOS	NOAA Center for Coastal Ocean Science
NERR	National Estuarine Research Reserve
NIW	North Inlet/Winyah Bay NERR Never used after defined
NOAA	National Oceanic and Atmospheric Administration
NOC	North Carolina NERR Used Twice
NPS	National Park Service
ODMDS	Offshore Dredged Material Disposal Site
OHHI	Oceans and Human Health Initiative
PAH	Polyaromatic Hydrocarbon
SCDNR	South Carolina Department of Natural Resources
SCECAP	South Carolina Estuarine and Coastal Assessment Program
SECN	Southeast Coast Network
SERTC	Southeast Regional Taxonomy Center
SJRWMD	St. Johns River Water Management District
TIMU	Timucuan Ecological & Historic Preserve
TSN	Taxonomic Serial Number
USACE	US Army Corps of Engineers
USEPA	US Environmental Protection Agency
USGS	United States Geological Survey

Executive Summary

Objectives

Nine parks in the Southeast Coast Network were selected for a literature-based, benthic macroinvertebrate (BMI) inventory: Cape Hatteras National Seashore (CAHA), Cape Lookout National Seashore (CALO), Canaveral National Seashore (CANA), Cumberland Island National Seashore (CUIS), Fort Frederica National Monument (FOFR), Fort Matanzas National Monument (FOMA), Fort Pulaski National Monument (FOPU), Fort Sumter National Monument (FOSU) and Timucuan Ecological and Historic Preserve (TIMU).

Project goals were to:

- Provide a baseline inventory of BMI abundance and community composition, based on recent studies in or adjacent to mapped park boundaries.
- Determine the predicted distribution of BMI, according to habitat type and geography
- Document species occurrences with vouchered museum records
- Determine the status of any Species of Concern
- Suggest means of continued and future monitoring efforts of BMI in park habitats

Rationale

There are no comprehensive inventories of BMI in the SECN, yet there are compelling reasons to include BMI among checklists of park biota. BMI represent a foundation of biomass that is often used as food for larger vertebrates and invertebrates. Sessile BMI also provide substrate and habitat stabilization in estuarine environments. Because most BMI are either sessile or of limited motility, they can also serve as indicators of local habitat conditions and the impact of natural and anthropogenic stressors. Also, nuisance and invasive BMI introduced from shipping and recreational boating activities pose a threat to native BMI communities, as well as park infrastructure.

Methods

Existing BMI abundance data for stations in/near park boundaries were obtained from the National Benthic Inventory (NBI), the South Carolina Estuarine and Coastal Assessment Program (SCECAP), and several smaller studies. Species lists were generated from these data and supplemented from literature reports for similar habitat types throughout the South Atlantic Bight (SAB). National, state, and private museum collections were queried for records of BMI in North Carolina, South Carolina, Georgia and Florida.

Detailed geographic information was recorded for each species occurrence and museum voucher. Abundance and Shannon-Wiener Diversity (H') of BMI was summarized for each station, and

expected species lists were made for each park. Species names were verified through the Integrated Taxonomic Information System (ITIS), and assigned Taxonomic Serial Numbers (TSN) for inclusion into NPSpecies datasets. Data from the Estuarine Monitoring and Assessment Program (EMAP) and SCECAP was used to create maps of BMI abundance, diversity, and distribution in each park.

Results

North Carolina Parks

Ninety BMI taxa were documented from five EMAP stations in CAHA, and *H'* ranged from 1.54 (low) to 4.32 (high). Dominant BMI included bivalves (*Mulinia lateralis, Tellina agilis, Astarte nana, Donax variabilis*, and *Parvilucina multilineata, Macoma balthica*), amphipods (*Parahaustorius longimeris*, *Acanthohaustorius millsi*, and *Protohaustorius wigleyi*), oligochaetes, and polychaetes (*Mediomastus* spp., *Streblospio benedicti*). Three EMAP stations in CALO documented 68 BMI taxa, and *H'* was moderate (3.03) to high (4.32). Major taxa included gastropods (*Acteocina canaliculata*), polychaetes (*Mediomastus ambiseta, Hesionura elongata, Streblospio benedicti*), oligochaetes, and nemerteans. A list of 259 BMI taxa in NC estuarine habitats was compiled from the literature, and 164 voucher records were obtained.

South Carolina Parks

Neither EMAP nor SCECAP studies sampled within park boundaries. However, 8 stations from these studies were located around Charleston Harbor, and documented 260 BMI taxa. Diversity for these stations was mostly low to moderate (*H'* from 2.0 to 3.50). Dominant BMI taxa included polychaetes (*Streblospio benedicti*, *Mediomastus ambiseta*, *Mediomastus* spp., *Lumbrineris tenuis*, *Paraprionospio pinnata*), oligochaetes (*Tubificoides wasselli*), and bivalves (*Tellina agilis*). A list of 270 taxa was compiled from the literature, and 360 voucher records were located.

Georgia Parks

Three EMAP stations fell within park boundaries for CUIS. From these, 175 BMI taxa were identified, and diversity was extremely high (*H'* > 4.5). Dominant taxa included barnacles (*Balanus* spp.), anthozoans, polychaetes (*Sabellaria vulgaris*, *Exogone dispar*), bivalves (*Sphenia antilillensis*, *Barbatia* spp., *Nucula proxima*), brittle stars (*Microphiolis gracillima*), and amphipods (*Batea catharinensis*). No EMAP stations were located in FOFR, although three stations were found within a 30-mile radius. From these, 105 BMI taxa were identified, and *H'* ranged from 2.3 to 5.0. BMI taxa were primarily made up of oligochaetes and polychaetes (*Scoloplos rubra*, *Streblospio benedicti*, *Glycinde normanni*, *Paraprionospio pinnata*), and nematodes. Eight stations from EMAP and SCECAP studies were located for FOPU, resulting in more than 150 identified BMI taxa. Overall diversity was low to moderate (*H'* from 2.0 to 3.3, with one station reporting high diversity (*H'* = 3.85). Dominant BMI taxa included polychaetes (*Paraprionosyllis* spp., *Streptosyllis* spp., *Tharyx acutus*, *Paraprionospio pinnata*, *Nereis succinea*, *Streblospio benedicti*, *Heteromastus filiformis*, *Streptosyllis pettiboneae*), oligochaetes (*Tubificoides brownae*), and amphipods (*Batea catharinensis*, *Melita nitida*). More than 460 additional BMI taxa were predicted from previous studies of Georgia salt marshes, tidal creeks and sounds, and 298 museum vouchers were located.

Florida Parks

More than 162 BMI taxa were documented from five EMAP stations in and around Mosquito Lagoon in CANA, and *H'* was high (3.87 to 4.80). Dominant taxa included amphipods (*Lysianopsis alba*, *Grandidierella bonnieroides*, *Ampelisca abdita*, *Erichthonius brasiliensis*, *Corophium baconi*), polychaetes (*Capitella capitata*, *Pectinaria gouldi*), oligochaetes, phoronid worms (*Phoronis architecta*, *Phoronis* spp.), sipunculids (*Phascolion* strombi), and cumaceans (*Oxyurostylis smithi*). In TIMU, six stations from EMAP, 27 from the Lower St. Johns River (LSJR) studies and four from a 2003 commissioned study, documented more than 350 BMI taxa. The majority of stations reported moderate to high *H'*, with a low of 1.31 in the western-most LSJR station, to a high of 4.74 from Clapboard Creek, inside TIMU boundaries. Dominant BMI taxa included polychaetes (*Sabellaria vulgaris*, *Tharyx* spp., *Aphelochaeta marioni*, *Paraonis fulgens*, *Caullerilla* spp., *Streblospio benedicti*, *Mediomastus* spp., *Marenzellaria viridis*, *Podarke* spp., *Paraprionospio pinnata*), gastropods (*Boonea impressa*, *Nassarius obsoletus*), bivalves (*Pleuromeris tridentata*, *Tellina versicolor*, *Gemma gemma*, *Abra aequalis*), amphipods (*Rhepoxynius hudsoni*, *Protohaustorius deichmannae*, *Apocorophium lacustre*), and phoronid worms (*Phoronis* spp.). No EMAP stations fell within park boundaries of FOMA, or within a 50 mi. radius. However, more than 500 BMI taxa were predicted for various oyster reef, salt marsh, river, and tidal creek habitats in FOMA, CANA, and TIMU, based on earlier studies. In addition, more than 200 voucher records for Florida were located.

Invasive Species of Concern

There are no federally- or state-listed, threatened or endangered estuarine/marine BMI in the SAB. However, 46 occurrences invasive marine invertebrates have been documented from state and federal listings..Invasive BMI have already have been documented in some SECN parks, including the acorn barnacle (*Megabalanus coccopoma*), the Green Porcelain Crab (*Petrolisthes armatus*), the Green Mussel (*Perna viridis*), the Charru Mussel (*Mytella charruana*), and the Atlantic Rangia (*Rangia cuneata*).

Discussion

Based on a synthesis of the EMAP and SCECAP studies, the majority of BMI habitats and communities in the SECN geographic area are listed in good condition, with more than 500 documented taxa, and moderate to high diversity. More than 560 BMI taxa are predicted, based on museum collections and smaller studies of estuarine habitats similar to those found in the SECN. Poor BMI habitat conditions have been previously correlated with poor sediment and water quality, associated with urban, shipping, or industrial centers.

Parks in the SECN face several natural and man-made stressors to BMI communities. Tropical weather systems and tidal events can erode beaches, alter local salinity and geography, and deposit debris and contaminants into BMI habitats. Ship and boat traffic can erode shorelines, transport and alter composition of sediments, result in oil and fuel spills, and carry invasive BMI into local waterways. Maintenance of shipping channels, as well as construction of water impoundments, can disrupt BMI habitats. Nutrients, pollutants, and sewage can be introduced via residential and industrial processes and runoff. Benthic habitats can also be altered by off-road vehicle use and feral horses.

In the SAB, BMI communities have demonstrated variable responses to environmental stressors. BMI communities in areas with frequent disturbances from tropical weather systems or dredging, typically undergo only short-term decreases in abundance and changes in species composition. However, long-term loss of BMI abundance and diversity is often associated with contamination from pollutants introduced into waterways and sediments.

Recommendations

In order to establish current baseline data, it is advised that BMI surveys be initiated for at least seven parks in the SECN: CAHA, CANA, CUIS, FOMA, FOFR, FOPU, and TIMU. It is imperative that FOMA and FOFR be sampled, as these parks were missed by EMAP studies. A probabilistic survey of reference and impacted sites is recommended, and surveys should be repeated every five years. Post-event sampling should be considered following hurricanes, oil spills, pollution discharges, and dredging. Park managers should seek out partnerships and/or contracts with state, federal, and private entities experienced in BMI monitoring. In addition, data from ongoing and planned surveys near SECN park boundaries should be consulted for estimates of BMI abundance and community composition. Finally, park personnel should become familiar with identification of invasive BMI, and report occurrences to state and federal monitoring agencies.

Introduction

Inventory of Benthic Macroinvertebrates in the Southeast Coast Network

Many parks in the National Park Service (NPS) Southeast Coast Network (SECN) are characterized by estuarine or marine habitats, yet few studies have been conducted to assess the composition and condition of benthic macroinvertebrate (BMI) assemblages within or adjacent to park boundaries. In 2006, the SECN commissioned a literature-based inventory of BMI for nine representative parks in the network: Cape Hatteras National Seashore (CAHA), Cape Lookout National Seashore (CALO), Canaveral National Seashore (CANA), Cumberland Island National Seashore (CUIS), Fort Frederica National Monument (FOFR), Fort Matanzas National Monument (FOMA), Fort Pulaski National Monument (FOPU), Fort Sumter National Monument (FOSU) and Timucuan Ecological and Historic Preserve (TIMU).

These parks represent a broad distribution of habitat types, from dynamic, barrier-island beaches, to tidal creeks and rivers, to salt-marsh wetlands. Data gleaned from studies within and adjacent to park boundaries represents a valuable resource for park managers and other researchers in the South Atlantic Bight (SAB). When combined with inventories of plants and vertebrates, BMI data augment the picture of expected biota within park lands. In addition, an emerging concern for the SECN is the occurrence of invasive BMI species introduced into waterways by ballast water exchanges in ports, or from commercial and recreational boating activities.

Benthic Macroinvertebrate Inventory Project Goals

For each of the representative parks, the following project goals were identified:

- Provide a baseline inventory of BMI abundance and community composition, based on recent studies in or adjacent to mapped park boundaries,
- Document species occurrences with vouchered museum records,
- Determine the predicted distribution of BMI, according to habitat type and geography,
- Determine the status of any Species of Concern, and
- Suggest means of continued and future monitoring efforts of BMI in park habitats.

Why study Benthic Macroinvertebrates?

Benthic macroinvertebrates (BMI) are usually defined as aquatic (freshwater, estuarine, or marine) invertebrates passing through a 1 mm sieve, but retained on a 0.5 mm sieve. Collectively, BMI represent a foundation of biomass that is often used as food for larger vertebrates and invertebrates. Fishes, birds, mammals, and commercially-important invertebrates (e.g., blue crabs), depend on rich resources of BMI found in salt marshes, tidal creeks, beaches, mudflats, and oyster-reef habitats. Sessile BMI, such as oysters, barnacles, and mussels, also

provide substrate and habitat stabilization, similar to the way in which coral reefs form and anchor tropical communities.

Because most BMI are either sessile or of limited motility, they can also serve as indicators of local habitat conditions. Suspension-feeders (Figure 1), respond to changing water-quality conditions. Deposit-feeders (Figure 1) ingest sediments directly, and can experience prolonged exposure to contaminants, such as polyaromatic hydrocarbons (PAH), pesticides, fertilizers, and toxic metals. Finally, nuisance and invasive BMI are often introduced via ballast water exchanges or from boating activities (Figure 1).

Figure 1. Examples of BMI with environmental importance. A) A suspension-feeder, the Blue Mussel (*Mytilus edulis*; by L. Wooster); B) A deposit-feeder, the Eastern Mud Snail, (left; *Ilyanassa obsoleta*; by J. Wooster); C) An invasive species, the Atlantic Rangia (*Rangia cuneata*, by T. Bliss).

Uses of Benthic Macroinvertebrate Data

BMI abundance, biomass, and community composition data can be utilized to gauge ecosystem conditions. Previous studies have found good correlations between population characteristics of BMI (e.g., abundance, diversity, biomass) and water- or sediment-quality variables, such as pH, grain-size distribution, dissolved oxygen (DO), and contaminant loads (e.g., Ringwood et al. 1996; Posey et al. 1997; Hyland et al. 2000; Mallin et al. 2000). In environments where land use is altered by natural or man-made changes to watersheds, BMI data can be used to assess the impacts of development (e.g., Zimmerman 1997; Eggleston et al. 1999; Holland et al. 2004; Lerberg et al. 2000; Evans et al. 2004; Potter et al. 2005). In zones subject to hurricanes, BMI habitats can be altered by changes in salinity and local geography (Van Dolah et al. 1999; Van Dolah et al. 2002; Mallin et al. 2002; Posey and Alphin 2002).

In order to comply with federal and state regulations, BMI communities are often evaluated prior to dredging and disposal activities (Barry Vittor Associates, Inc. (BVA) 2000a-b; Weinbach and Van Dolah 2001; Jutte et al. 2005; USACE 2005). Prior to construction of homes, manufacturing facilities, and power plants, BMI data are often used to prepare environmental impact statements (EIS) for adjacent coastal wetlands, (BVA 2000b; Van Dolah, Sanger & Filipowicz. 2004).

In addition to measures of community composition, individual BMI taxa have been used as indicators of habitat quality. For example, the capitellid polychaete worm, *Capitella capitata* (Figure 2), is viewed as an opportunistic species, tolerant of natural disturbances (e.g., storm events), as well pollutants in the sediments or water column (Weisberg et al. 1997; Van Dolah et al. 1999). When *C. capitata* and other pollution-tolerant BMI comprise the numerical dominants in a community, the system may be interpreted as undergoing some type of environmental stress

(Van Dolah et al. 1999). Other BMI are used directly in laboratory studies to assess the level of contaminants or stressors. For example, Ringwood & Keppler (1998) developed a sediment toxicity bioassay using seed clams, (*Mercenaria mercenaria*; Figure 2), for use in the Environmental Monitoring and Assessment Program (EMAP) studies of the Carolinian Province (Ringwood et al. 1996).

Figure 2. Examples of BMI used to assess environmental conditions. A) A pollution-tolerant species, the polychaete worm *Capitella capitata* (by H. Hillewart; MarBEF; http://www.marbef.org). B) A pollution-sensitive species, the juvenile bivalve, *Mercenaria mercenaria* (by Jacksonville Shell Club; http://jaxshells.org).

Finally, no description of animal communities in coastal environments would be complete without including BMI abundances and community composition. Although often 'out of sight, out of mind', BMI can make up a large proportion of animal biomass in coastal habitats (e.g., Alphin and Posey 2000; Barry Vittor Associates, Inc. 2000a-b). One comprehensive picture is generated by the calculation of an index of benthic habitat condition. Commonly known as the Benthic Index of Biotic Integrity (B-IBI), this algorithm pulls together measures of habitat quality, such as pH, DO, grain-size distribution, sediment contaminants, as well as measures of BMI abundance and community composition. Several such indices are used and tailored to specific bioregions, so as to generate the most accurate 'snapshot' of local habitat conditions (Lenat 1993; Weisberg et al. 1997; Hyland et al. 1999; Van Dolah et al. 1999) Whereas calculation of such an index is beyond the scope of this work, studies utilizing the EMAP and South Carolina Estuarine and Coastal Assessment Program (SCECAP) data have addressed habitats found throughout the SAB (Van Dolah et al. 1997; Van Dolah et al. 1999; Van Dolah, Sanger & Filipowicz 2004; Hyland et al. 1999).

Previous BMI Studies in the Southeast Coast Network Geographic Region

Environmental Monitoring And Assessment and Lower St. Johns River

The EMAP and LSJR studies incorporated a battery of physical, chemical, water-quality, and biotic surveys of coastal habitats, usually carried out by partner institutions in the home state. These included measurements of BMI abundance, biomass, and community composition, as well as toxicity bioassays (e.g., Ringwood et al. 1996). In addition, several published studies have utilized data from the EMAP surveys (Balthis et al. 2002, Hyland et al. 2003; Hyland et al. 2005; Alber et al. 2005; McFarlin & Alber 2005). In Florida, a comprehensive survey of the LSJR

watershed was conducted from 2000-2002, and included detailed BMI surveys (http://nbi.noaa.gov/mapStJohnsriver.aspx).

State, Academic, and Private Studies

South Carolina. The SCECAP studies have also recorded a variety of BMI parameters, from 1999 to the present. Several smaller BMI studies have been conducted along the SC coast (Van Dolah et al. 1979; Van Dolah et al. 1994; Lerberg 1997; Posey & Alphin 1997; Zimmerman 1997; Sanger 1998; BVA 2000b; Lerberg et al. 2000; Mallin et al. 2000; Gawle 2002; Holland et al. 2004; Van Dolah et al. 2004). In addition, The Baruch Institute for Marine and Coastal Sciences (BMFL) operates a Long-Term Environmental Research site from their field laboratory in Georgetown, SC (http://links.baruch.sc.edu/Data/LongTermData.html). The Port of Charleston was also surveyed for BMI by Power et al. (2006), as part of their risk assessment on invasive species.

North Carolina. Duke University, the University of NC-Wilmington, NC State University, and the Minerals Management Service (MMS) have conducted studies of estuaries and coasts throughout NC (Day et al. 1971; Leber 1982; Chester et al. 1983; Posey & Ambrose 1994; Eggleston et al. 1999; MMS 2000; Mallin et al. 1999; Mallin et al. 2000; Posey & Alphin 1997, 2002; Alphin & Posey 2000; Posey et al. 2002; Darcy & Eggleston 2005). These studies have encompassed baseline ecological assessments (Chester et al. 1983; Mallin et al. 1999; MMS 2000), evaluations of hurricane effects (Mallin et al. 1999; Posey & Alphin 2002), influence of habitat fragmentation (Eggleston et al. 1999; Darcy & Eggleston 2005), and the effects of contaminants on BMI communities (Balthis et al. 2002; Hyland et al. 1999-2005). In addition, the Port of Wilmington was surveyed for BMI by Power et al. (2006).

Georgia. Many BMI surveys have been conducted in Georgia, in conjunction with coastal studies. Prezant et al. (2002) surveyed BMI on St. Catherine's Island. The effects of contaminants on salt marshes (Horne et al. 1999) and soft-bottom habitats near Grays Reef National Marine Sanctuary (GRNMS), have also been studied (Cooksey et al. 2004; Hyland et al. 2006). Barry Vittor Associates, Inc. (2000a) completed a comprehensive survey of BMI in Brunswick Harbor sediments, prior to proposed dredging activities. In a report on for the NPS Water Resources Division (WRD), Alber et al. (2005) summarized BMI data from the EMAP studies, as part of a watershed assessment for CUIS. A similar summary was prepared by McFarlin et al. (2005) for FOPU. Power et al. (2006) also surveyed BMI from the Port of Savannah, as part of a study on invasive invertebrate species in the SAB.

Florida. Several studies have examined BMI communities in Florida habitats. In 2004, BVA and Continental Shelf Associates, Inc. (CSA) investigated potential sand-borrow areas along the Florida coast, for the MMS. As part of the Monitoring and Event Response for Harmful Algal Blooms (MERHAB) program, Cooksey et al. (2001) conducted BMI surveys along the St. Johns River. Other St. Johns River studies with BMI surveys include Evans (2001), Evans et al. (2004), and Landesberg et al. (2004). Florida sites were also used by Van Dolah et al. (1999) to develop their B-IBI. In 2003, a study of BMI invertebrates in TIMU was commissioned by park personnel for a site near Sisters Creek and the Ft. George River (Long 2004). In CANA, Boudreaux and Walters (2006) sampled oyster reef communities in Mosquito Lagoon, and Boudreaux and Stiner (2006) reported on the distribution of the invasive Charru Mussel (*Mytella*

charruana). The Port of Jacksonville was included in BMI surveys conducted by Power et al. (2006).

Methods

Selection of BMI Data

Benthic Macroinvertebrate Data Obtained from the National Benthic Inventory

BMI abundance data relevant to EMAP (Figure 3), as well as from the LSJR, were downloaded from the National Benthic Inventory (NBI) data portal (http://nbi.noaa.gov), a site managed by the National Oceanic and Atmospheric Administration (NOAA) Center for Coastal Ocean Studies (NCCOS). Bounding coordinates obtained from the NPS Southeast Regional Office (SERO) were used to locate stations relevant to each park (Table 1). Since these coordinates sometimes generated rectangles that were much larger than actual park polygons (e.g., CAHA and CALO), stations were plotted using the online mapping utility Generic Mapping Tools (GMT; http://www.aquarius.geomar.de/omc). Stations closest to or within park polygons were then selected after visual inspection (Table 2). No EMAP stations were found within the bounding coordinates of FOMA.

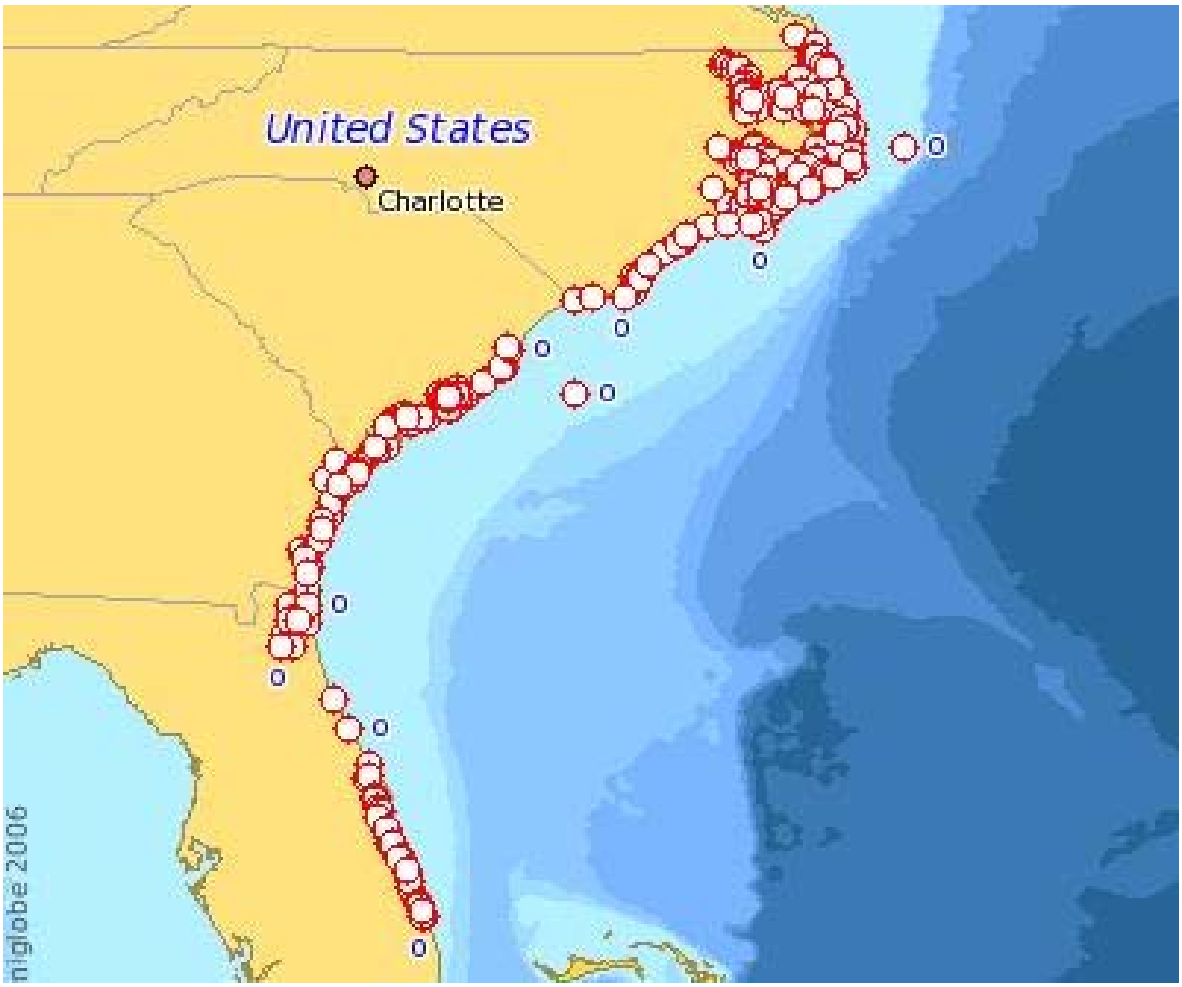

Figure 3. Location of stations with BMI data archived in the National Benthic Inventory (NBI). Map generated using Generic Mapping Tools (http://www.aquarius.geomar.de/omc).

Table 1.
Bounding coordinates for SECN parks included in the BMI Inventory.

Park	Top (N)	Bottom (S)	Left (W)	Right (E)
Cape Hatteras National Seashore	35.915365	35.056064	-76.025148	-75.448946
Cape Lookout National Seashore	35.082166	34.572257	-76.676442	-76.026512
Fort Sumter National Monument (Fort Sumter only)	32.756730	32.750469	-79.886608	-79.872017
Fort Pulaski National Monument	32.086121	31.978771	-81.015048	-80.869115
Fort Frederica National Monument	31.229608	31.155351	-81.401660	-81.378774
Cumberland Island National Seashore	30.990432	30.702543	-81.563650	-81.388157
Timucuan Ecological and Historic Preserve	30.585596	30.365219	-81.692520	-81.398323
Fort Matanzas National Monument	29.718052	29.701468	-81.245789	-81.227280
Canaveral National Seashore	28.957294	28.643335	-80.880881	-80.613573

Data from Literature and State Monitoring Programs

In order to generate the most comprehensive expected species lists, additional data were obtained from published studies and databases of BMI abundance. Although these studies did not necessarily fall within park boundaries, they encompassed habitat types likely to be found in the SECN. Also, within ecoregions, BMI usually have greater fidelity to habitat than to geography (D. Knott & R. Van Dolah, pers. comm.), and species lists generated from this approach are likely to be representative of similar habitats within the SECN.

A survey of the literature going back no more than 25 years was made, with the goal of augmenting expected species lists for each park, rather than preparing a comprehensive history of BMI data. There are certainly studies extending back much further, yet the reasons for this cut-off were three-fold. First, the EMAP data itself is no older than 12 years, and many more recent studies were found in the literature. Secondly, the taxonomy of several key groups, such as polychaete worms, has undergone considerable revision in the last 25 years (M. Levisen, D. Knott, pers. comm.). New families and genera have appeared, whereas others have been eliminated. In order to be consistent with future monitoring efforts, the most recent studies (where possible) were selected to eliminate outdated taxonomy. And finally, the degree of natural coastal habitat change due to tropical storms and hurricanes (e.g., Pendleton et al. 2004), as well as changes in coastal land use and development (e.g., Zimmerman 1997), might weaken comparisons with older BMI studies.

In addition to the 1999-2002 data available from the SCECAP web site (http://www.dnr.sc.gov/marine/scecap/), quality-reviewed data from the 2003 and 2004 surveys were made available by R. Van Dolah and G. Riekerk of the South Carolina Department of Natural Resources (SCDNR). In addition, data from the St. John's Water Management District (SJWMD) were queried for BMI data relevant to TIMU. A special study commissioned by the NPS for TIMU was also incorporated (Long 2004). A request was made to the Region 4 USEPA office for BMI data archived from the National Coastal Assessment (NCA), but as of this writing, remains outstanding.

Table 2.
Environmental Monitoring and Assessment Program (EMAP) stations used in abundance analyses. [* - Depth Not Reported].

Park	State	Location	Year	Station	Lat.	Lon.	Depth (m)
CAHA	NC	Pamlico Sound	1995	CP95_135	35.08	-76.00	1.2
CAHA	NC	Croatan Sound	1994	CP94_60	35.85	-75.66	3.1
CAHA	NC	Pamlico Sound	1995	CP95_112	35.83	-75.67	1.1
CAHA	NC	Pamlico Sound	1995	CP95_133	35.19	-75.77	2.1
CAHA	NC	NC Outer Banks and Associated Tributaries	1996	CP96_212	35.82	-75.68	3.5
CAHA	NC	Pamlico Sound	1997	CP97_332	35.19	-75.76	7.0
CAHA	NC	NC Outer Banks and Associated Tributaries	1996	CP96_231	35.19	-75.77	0.6
CAHA	NC	Pamlico Sound	1997	CP97_331	35.23	-75.84	4.1
CALO	NC	Shackleford Channel	1997	CP97_341	34.7	-76.67	16
CALO	NC	Core Sound	1994	CP94_33	34.77	-76.46	1.8
CALO	NC	NC Outer Banks and Associated Tributaries	1996	CP96_239	34.62	-76.53	3.5
CANA	FL	Mosquito Lagoon	1994	CP94_14	28.85	-80.79	1.7
CANA	FL	Indian River Lagoon	1994	CP94_13	28.72	-80.80	1.5
CANA	FL	Indian River Lagoon	1994	CP94_12	28.71	-80.79	1.5
CANA	FL	Titusville -Indian River	1993	CP93_24	28.69	-80.81	*
CANA	FL	Indian River Lagoon	1995	CP95_175	28.73	-80.79	1.7
CUIS	GA	Cumberland River	1995	CP95_169	30.92	-81.46	4.0
CUIS	GA	Saint Marys River	1994	CP94_19	30.71	-81.47	8.3
CUIS	GA	Saint Andrews Sound	1994	CP94_20	30.98	-81.42	8.2
FOFR	GA	Hampton River	1995	CP95_167	31.25	-81.32	3.7
FOFR	GA	Saint Simons Sound	1994	CP94_21	31.10	-81.45	9.0
FOFR	GA	Jointer Creek	1995	CP95_168	31.07	-81.49	5.8
FOPU	GA	South Channel	1995	CP95_162	32.02	-80.91	3.4
FOPU	GA	Bull River	1995	CP95_163	31.98	-80.92	7
FOPU	SC	Wright River	1994	CP94_27	32.06	-80.91	3.6
FOPU	GA	Tybee Roads	1995	CP95_161	32.08	-80.87	4.9
FOSU	SC	Hamlin Creek	1995	CP95_153	32.78	-79.8	3.3
FOSU	SC	Charleston Harbor	1994	CP94_79	32.76	-79.88	12
FOSU	SC	Parrot Point Creek	1995	CP95_154	32.73	-79.88	1.2
TIMU	FL	Nassau Sound	1994	CP94_18	30.51	-81.44	6.6
TIMU	FL	Trout River	1994	CP94_17	30.39	-81.64	1.0
TIMU	FL	Nassau River	1993	CP93_12	30.57	-81.64	*
TIMU	FL	South Amelia River	1995	CP95_170	30.55	-81.47	5.3
TIMU	FL	Saint Johns River	1995	CP95_171	30.39	-81.55	11
TIMU	FL	Jacksonville	1994	CP94_88	30.38	-81.44	11

Types of Information Collected

Geographic Information

For each BMI record, detailed geographic station information was recorded, including latitude (lat), longitude (lon), depth, habitat type, and salinity (where available).

Abundance and Taxonomic Information from the EMAP, LSJR, SCECAP, and TIMU data sets, scientific names of BMI, identified to the lowest practical identification level (LPIL; usually to species) were recorded. [Note: hereafter the generic term for a scientific name of any rank is 'taxon' and the plural is 'taxa']. Abundance (i.e. the number of individuals per m^2) was obtained, and replicates for each station were averaged to create summary data. Abundance data from the literature were not used; however, species lists were utilized. For each taxon, a Taxonomic Serial Number (TSN) was obtained and verified via the Integrated Taxonomic Information System (ITIS; http://www.itis.gov). Species lists utilized the most current (i.e. valid) name/TSN recorded in ITIS. However, since some BMI taxa are still known by invalid synonyms/TSNs, these were included in tables submitted for inclusion into NPSpecies. In some cases, TSNs could not be found in ITIS, yet there was compelling evidence in the literature that these were valid names. Therefore, these data were assigned a "-99XX" TSN for organizational purposes.

Shannon-Wiener Diversity Index (*H'*)

There are several measurements ecologists use to determine the diversity (i.e. biodiversity) of animal and plant communities. The Shannon-Wiener Diversity Index (*H'*) is a widely recognized method that accounts for the total number of species, as well as the relative abundance (i.e. proportion) of individual species in a given sample [see Llansó 2002 for detailed calculations]. For BMI communities, values between 0 and 2.5 are considered 'low', 2.5-3.8 'moderate', and greater than 3.8 'high' (Dent et al. 1988). Typical values calculated for different marine BMI communities are shown in Table 3.

Table 3.
Examples of Shannon-Wiener Diversity Index Scores (*H'*) calculated from invertebrate studies. [† - Average diversity among all sample stations].

Study	Location	Habitat	Community	H'
van Bochove et al., 2006†	Polillo Islands, Philippines	shallow coral reef	corals	2.80
Boudreaux et al., 2006	Mosquito Lagoon, FL	oyster reef	BMI	2.13
Barrett and Mcbrien, 2006†	Hackensack Meadowlands, NJ	urban tidal marsh	BMI	1.24
Lewis et al., 2002†	Clonakily Bay Estuary, Ireland	cold-ocean mud flat	BMI	0.35

Maps and Species Lists

Maps for each park, were created to geo-reference EMAP and SCECAP stations selected for BMI abundance data. In addition, the three most abundant taxa, total number of taxa, and *H'* per station were mapped. Data tables of BMI abundance, as well as expected species lists were prepared for inclusion into NPSpecies.

Specimen Vouchers

Voucher records of archived specimens were sought for each BMI taxon, within each state. Given the assumption that most BMI have greater preference for a type of habitat, rather than for a specific location, vouchers were included from any study or location within a state boundary or nearshore waters. While not ideal from a geographic perspective, this approach was taken to ensure the most complete record of voucher specimens.

The majority of vouchers were obtained from the NBI specimen database, which catalogs invertebrates from numerous studies, including the EMAP and LSJR studies. The Marine Resources Research Institute of the SCDNR likewise maintains an extensive voucher collection from several BMI surveys, including SCECAP. Several additional vouchers were obtained from the Southeast Regional Taxonomy Center (SERTC) in Charleston, SC. Vouchers were also obtained online from the Florida Museum of Natural History (http://www.flmnh.ufl.edu/databases/mala), The Academy of Natural Sciences Malacog database (Rosenberg 2005; http://data.acnatsci.org/wasp/findsnail.php); the Georgia Museum of Natural History, and the online database of the Smithsonian National Museum of Natural History (http://goode.si.edu/webnew/pages/nmnh/iz).

Geographic information was recorded, as described above (see Types of Information Collected). Additional parameters such as date/time of collection, repository, and the identity of personnel who collected and/or identified the specimen were also included, where available. As described above, TSNs were matched to species, and updated with valid TSNs from ITIS.

Results

Cape Hatteras National Seashore

Environmental Monitoring and Assessment Abundance Data

Eight stations were selected from the EMAP data set (Figure 4). Five of these were from Pamlico Sound (CP95_112, CP95_133, CP97_312, CP97_331, CP97_332), two from areas near Bodie Island (CP96_212, CP96_231) and one from Croatan Sound, near Roanoke Island (CP94_60).

A list of 90 BMI taxa was compiled from all stations (Appendix A) Station CP94_60 was dominated by oligochaete worms and the bivalve mollusks *Mulinia lateralis* and *Tellina agilis* (Figure 4), and *H'* was 2.67. Stations CP96_212, CP96_231, and CP97_312 were characterized primarily by the polychaete worms *Mediomastus* spp. and *Streblospio benedicti*, and bivalves *Astarte nana* and *Macoma balthica*; *H'* was 2.78, 4.32 and 2.54, respectively. The amphipod crustaceans *Parahaustorius longimeris*, *Acanthohaustorius millsi*, and *Protohaustorius wigleyi* were the numeric dominants for CP95_135 and CP97_332, and *H'* for these stations was low (1.54) and moderate (3.13). Stations CP95_112, CP95_133, and CP97_331 were characterized mainly by bivalves *T. agilis*, *Donax variabilis*, and *Parvilucina multilineata*; and *H'* was 2.55, 3.38, and 2.54, respectively.

Taxa Identified or Predicted from Other Data Sources

A number of studies from the literature were consulted to generate a list of species predicted to occur in the same NC habitats found in CAHA (Appendix B). From this list, 29 taxa were predicted from beach habitats, 191 from marsh habitats, 15 from tidal creeks, and 24 from open-water areas such as sounds.

Taxa Identified or Predicted from Voucher Records

Voucher records relevant to NC species are summarized in Appendix C. A list of 164 vouchers was prepared, and is relevant to BMI in both CAHA and CALO.

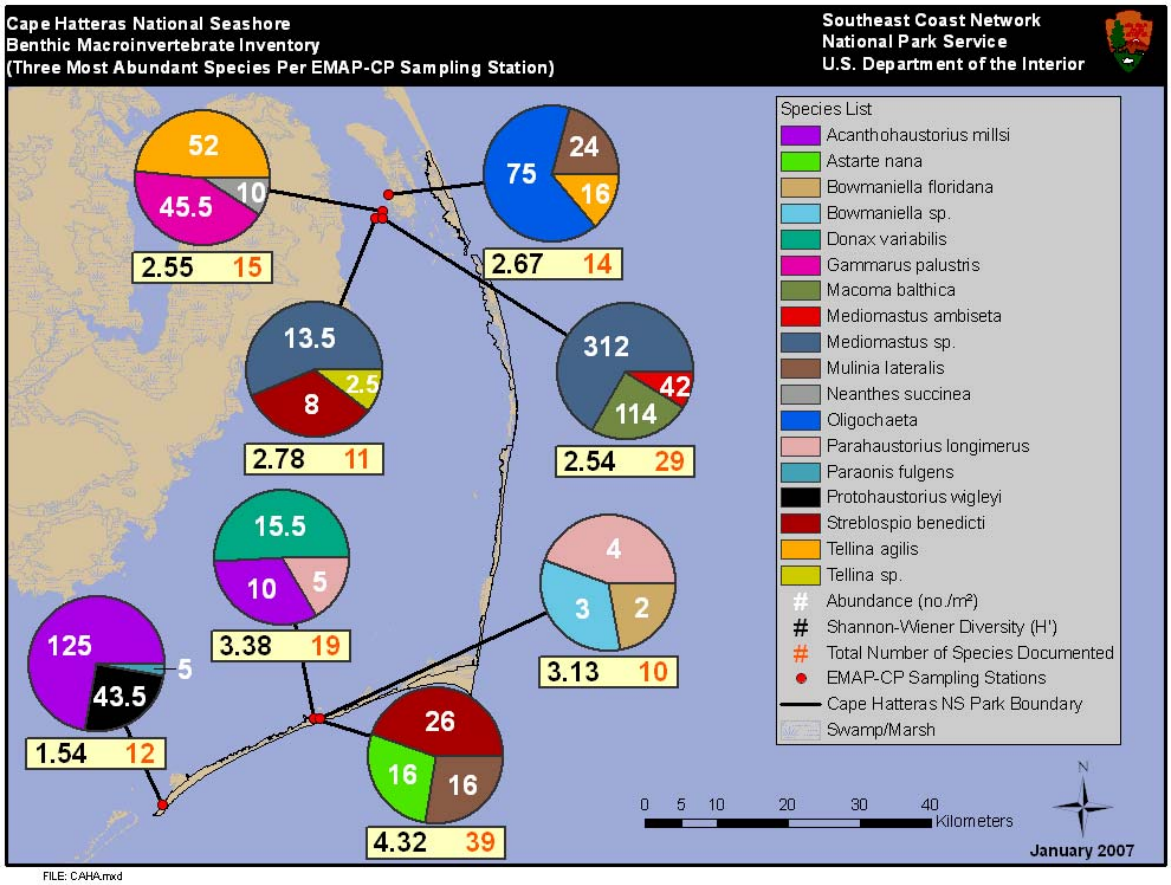

Figure 4. BMI abundance data from EMAP stations near CAHA. Three most abundant taxa and Shannon-Wiener Diversity (*H'*).

Cape Lookout National Seashore

Environmental Monitoring and Assessment Abundance Data

Three stations from the EMAP data fell within park boundaries (Figure 5). Station CP94_33 was taken from Core Sound, and CP97_341 from Shackleford Channel. One beach area sample was taken at station CP96_239.

A list of 68 BMI taxa was compiled (Appendix A). The gastropod (snail) *Acteocina canaliculata*, and the polychaetes *Mediomastus ambiseta* and *Streblospio benedicti* were the dominants in station CP94_33 (Figure 5). The dominant taxon for station CP96_239 was also *A. canaliculata*, with the bivalve *Parvilucina multilineata* and the gastropod *Acteocina canaliculata* rounding out the top three numeric dominants. In station CP97_341, the dominants were oligochaetes from the family Lumbriculidae the polychaete *Hesionura elongata*, and unidentified nemerteans (blood worms). Diversity was high (*H'* = 4.09 CP94_33, H' = 4.13 CP96_239) to moderate (*H'* = 3.03 CP97_239).

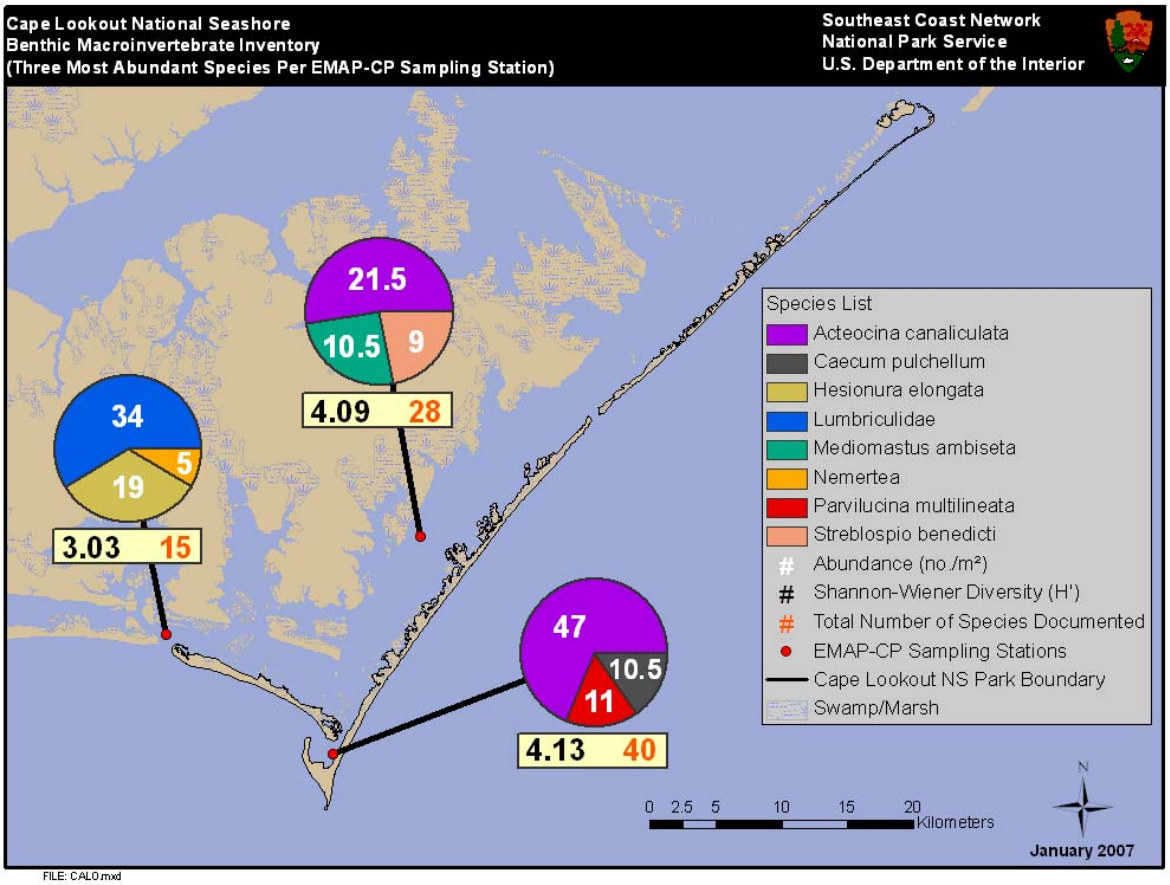

Figure 5. BMI abundance data from EMAP stations near CALO. Three most abundant taxa and Shannon-Wiener Diversity (*H'*).

Taxa Identified or Predicted from Other Data Sources

Since CALO is in close proximity to CAHA, studies of BMI consulted for taxa lists are the same (Appendix A). From this list, 29 taxa were predicted from beach habitats, 191 from marsh habitats, 15 from tidal creeks, and 24 from open-water areas,

Taxa Identified or Predicted from Voucher Records

Voucher specimens recorded for CALO are the same as those for CAHA (Appendix C).

Canaveral National Seashore

Environmental Monitoring and Assessment Abundance Data

Five stations from the EMAP dataset were selected for BMI abundance data (Figure 6). One station, CP94_14, was located just inside Mosquito Lagoon. Stations CP94_12, CP94_13, and CP95_175 were located near the Indian River Lagoon. Station CP93_24 was located farther inland near Titusville, FL.

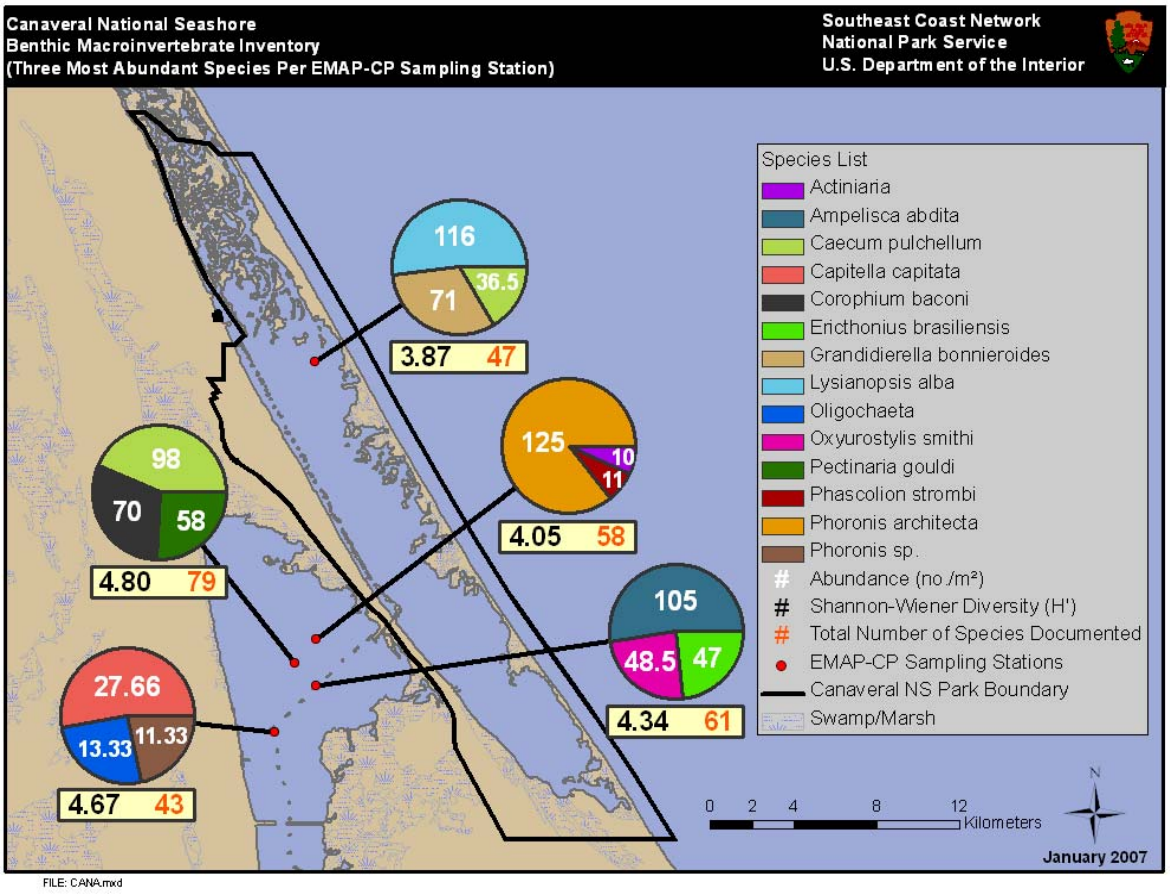

Figure 6. BMI abundance data from EMAP stations near CANA. Three most abundant taxa and Shannon-Wiener Diversity (*H'*).

A list of 142 BMI taxa was compiled (Appendix A). The dominants from station CP94_14 were the amphipods *Lysianopsis alba* and *Grandidierella bonnieroides*, and the gastropod *Caecum pulchellum* (Figure 6). The polychaete *Capitella capitata*, unidentified oligochaetes, and the phoronid worms *Phoronis* spp. were the most abundant taxa in station CP93_24. *Phoronis architecta* was the overwhelming dominant in station CP95_175, at more than 10 times the abundance of either of the next two dominants, the sipunculid (peanut worm) *Phascolion strombi*, and unidentified actinarians (sea anemones, corals; Figure 6). Station CP94_12 was characterized by the amphipods *Ampelisca abdita* and *Erichthonius brasiliensis*, and the cumacean crustacean *Oxyurostylis smithi*. The most abundant taxa in station CP94_13 were

Caecum pulchellum, the amphipod *Corophium baconi*, and the polychaete *Pectinaria gouldi* . Diversity for each station was either moderate (*H'* = 3.87; CP94_14) to high (*H'* = 4.67, 4.80, 4.05, 4.52 for CP94_12, CP94_13, CP94_93, and CP93_24, respectively.

Taxa Identified or Predicted from Other Data Sources

A data request made to the Region 4 USEPA office for BMI data was not fulfilled at the time of writing. However a STOrage and RETrieval (STORET) record of BMI from Brevard and Duval Counties (Appendix B) was obtained from the Florida Department of Environmental Protection web page. Although some BMI in this dataset were merely identified as either 'ADULT' or 'JUVENILE', 34 named taxa were obtained. Three hundred BMI taxa associated with oyster reefs were obtained from surveys in Mosquito Lagoon (Boudreaux and Walters 2006).

Taxa Identified or Predicted from Voucher Records

A list of 200 voucher records was compiled from specimens collected in coastal regions of Florida (Appendix C).

Cumberland Island National Seashore

Environmental Monitoring and Assessment Abundance Data

Three stations falling within or very close to park boundaries were selected from the EMAP dataset (Figure 7). Station CP94_19 was taken near the mouth of the St. Marys River, and CP95_169 was near the channel between the Cumberland River and the north end of Cumberland Island. Station CP94_20 was located in St. Andrews Sound, just north of Little Cumberland Island.

A list of 175 BMI taxa was compiled (Appendix A). The dominants for station CP94_19 were the maxillopod (barnacle) *Balanus* spp., unidentified anthozoans (corals, anemones), and the bivalve *Nucula proxima* (Figure 7). Station CP4_20 was characterized by the polychaete *Sabellaria vulgaris*, the ophiuroid (brittle star) *Micropholis gracillima*, and the amphipod *Batea catharinensis*. The bivalves *Sphenia antilillensis* and *Barbatia* spp., as well as the polychaete *Exogone dispar*, were the dominant taxa for station CP95_169 (Figure 7). Diversity was high at all three stations (*H'* = 4.52, 5.22, and 4.48 for stations CP94_19, CP94_20, and CP95_169, respectively).

Taxa Identified or Predicted from Other Data Sources

Several studies identified BMI taxa from coastal regions of Georgia with habitats similar to CUIS (Appendix B). In salt marsh habitats, 19 taxa were identified, and 309 taxa were predicted from open-water habitats.

Taxa Identified or Predicted from Voucher Records

Voucher profiles were obtained from taxa collected in coastal Georgia habitats (Appendix C). A list of 289 BMI taxa was compiled from these records.

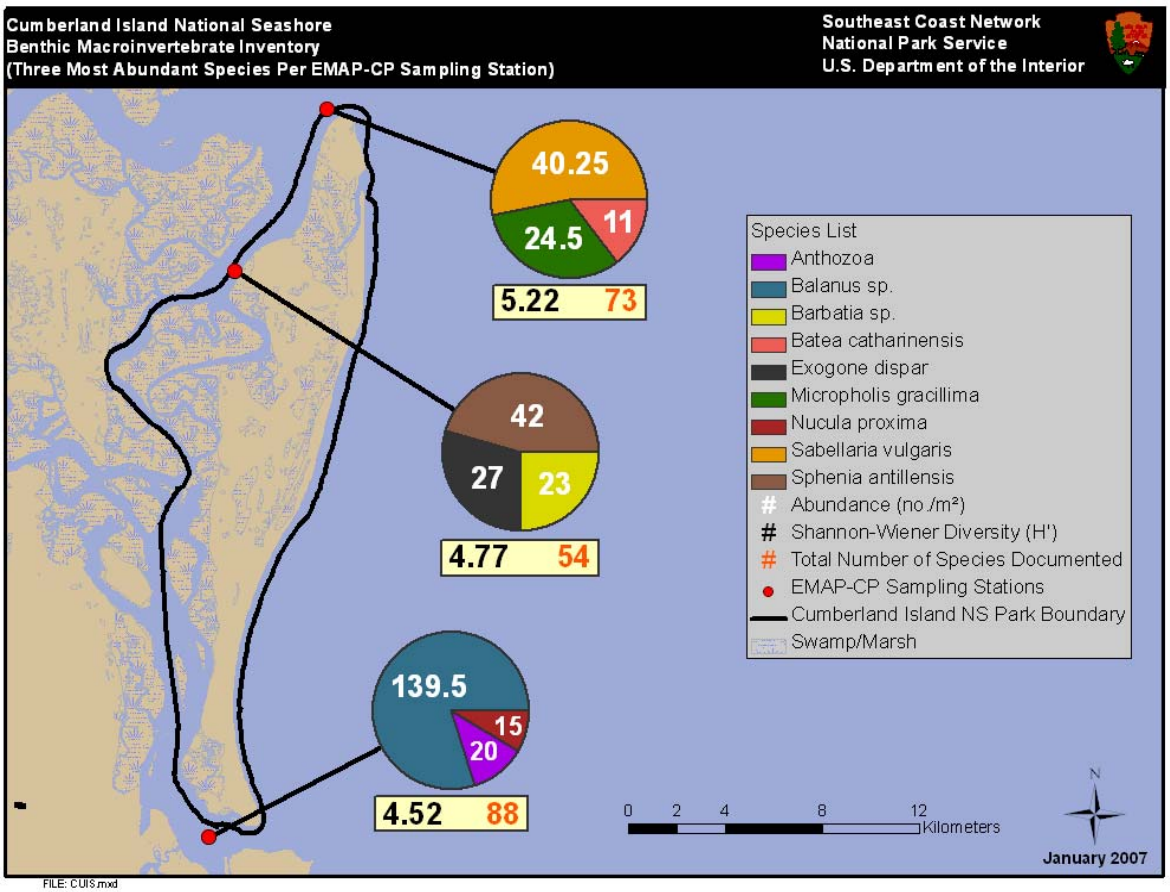

Figure 7. BMI abundance data from EMAP stations near CUIS. Three most abundant taxa and Shannon-Wiener Diversity (H').

Fort Frederica National Monument

Environmental Monitoring and Assessment Abundance Data

Three stations from the EMAP data set were selected for FOFR (Figure 8). For this park, no stations fell within the relatively small boundaries of FOFR or the nearby Bloody Marsh Site. The following stations were selected from coastal habitats falling within 30 miles of park boundaries (see Table 2): St. Simons Sound (CP94_212), Hampton River (CP95_167), and Jointer Creek (CP95_168).

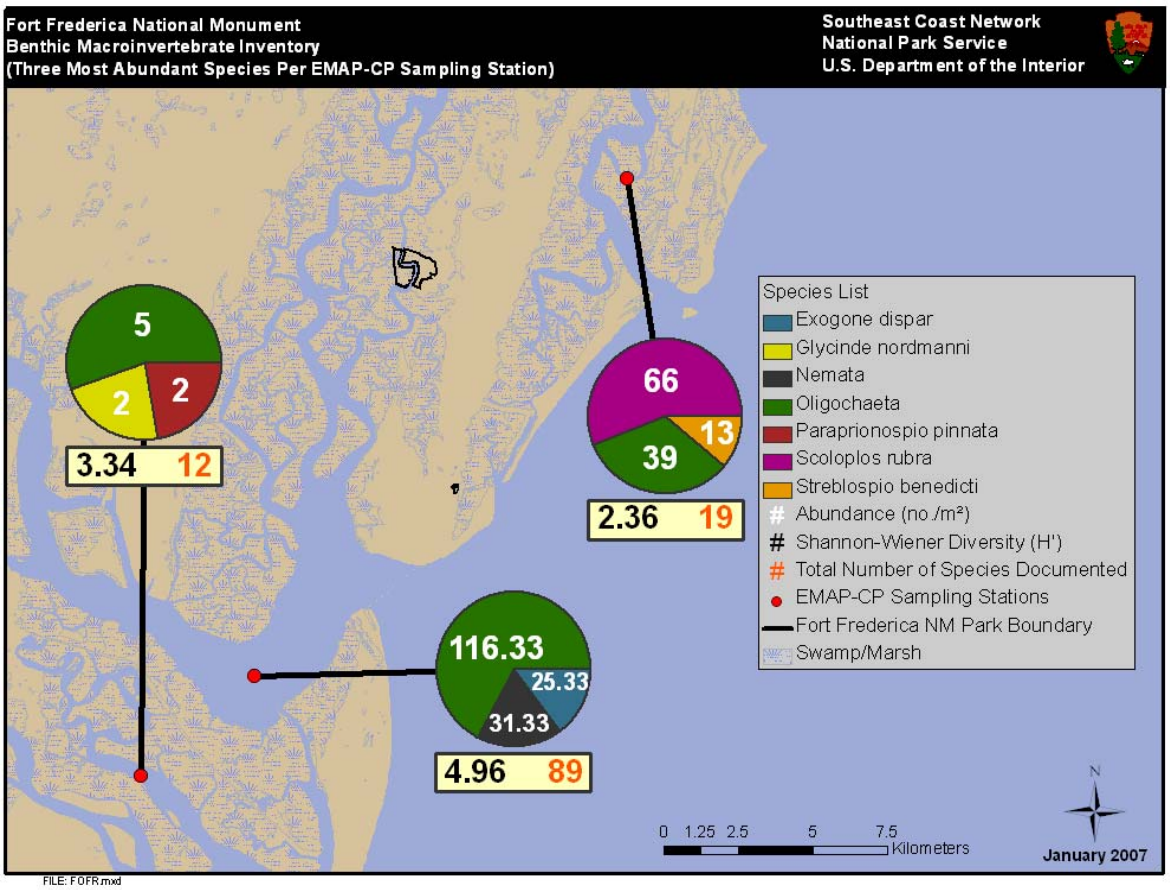

Figure 8. BMI abundance data from EMAP stations near FOFR. Three most abundant taxa and Shannon-Wiener Diversity (*H'*).

A list of 105 taxa was compiled (Appendix A). Station CP94_21 was primarily populated by unidentified oligochaetes and nematans (=nematodes; threadworms), as well as by the polychaete *Exogone dispar* (Figure 8). Two polychaetes, *Scoloplos rubra* and *Streblospio benedicti*, were among the most abundant taxa in station CP95_167, along with unidentified oligochaetes. Extremely low BMI abundances were sampled from the station in Jointer Creek (CP95_168), and oligochaetes, the polychaetes *Glycinde normanni*, and *Paraprionospio pinnata* were the three most abundant taxa. Diversity was very high at the St. Simons Sound station ($H' = 5.0$), whereas Jointer Creek was moderate ($H' = 3.3$), and the Hampton River low ($H' = 2.4$).

Taxa Identified or Predicted from Other Data Sources

Based on published records of BMI from habitats similar to those found in FOFR, 209 taxa were identified (Appendix B). The majority of these were from open-water, (i.e., sounds); however, 14 taxa were collected from Georgia salt marshes, similar to the Bloody Marshes.

Taxa Identified or Predicted from Voucher Records
Voucher records were located for 298 taxa collected from Georgia coastal habitats (Appendix C).

Fort Matanzas National Monument

Environmental Monitoring and Assessment Abundance Data
No EMAP stations fell within park boundaries, or even within a rectangle of park coordinates (see Figure 3). However, abundance data collected from stations within TIMU (see below) are likely to be representative of tidal creek, salt marsh, and river habitats within FOMA.

Taxa Identified or Predicted from Other Data Sources

Data from Florida coastal habitats similar to those in FOMA was used to generate an expected species list (Appendix B) Sixty-five taxa were predicted from surveys conducted by the Florida Department of Environmental Protection, and an additional 163 from studies carried out in TIMU (Appendix B).

Taxa Identified or Predicted from Voucher Records
As with CANA and TIMU, voucher specimens collected from Florida coastal habitats are considered representative of similar habitats within FOMA. A list of 200 voucher records was compiled from specimens collected from coastal regions of Florida (Appendix C).

Fort Pulaski National Monument

Environmental Monitoring and Assessment Abundance Data
Four stations were selected from the EMAP dataset (Figure 9). The only station within park boundaries was taken on McQueens Island, near the south channel of the Savannah River (CP95_162). Station CP94_27 was located near the mouth of the Wright River (Turtle Island, SC), and CP95_161 was just offshore of Tybee Roads.
Station CP95_163 was located just south of FOPU boundaries, on Little Tybee Island.

A list of 74 BMI taxa was compiled (Appendix A). Station CP94_27 was sparsely populated, and the three most abundant taxa were the polychaetes *Heteromastus filiformis*, *Streptosyllis pettiboneae*, and those from the family Paraonidae (Figure 9). Unidentified oligochaetes were the dominant taxa in station CP95_161, with the polychaetes *Paraprionospio longicirrata* and *Streptosyllis* spp. also among the three most abundant taxa. Station CP95_162 exhibited low BMI abundances, with unidentified oligochaetes and nemerteans the dominant taxa. The polychaete *Streblospio benedicti* and unidentified oligochaetes, along with the amphipod *Batea catharinensis*, were the three most abundant taxa on station CP95_165. Diversity was moderate for stations CP94_27 and CP96_163 (H' = 3.34 and 3.85, respectively). Stations CP95_162 and CP95_161 exhibited low diversity (H' = 2.09 and 2.56, respectively).

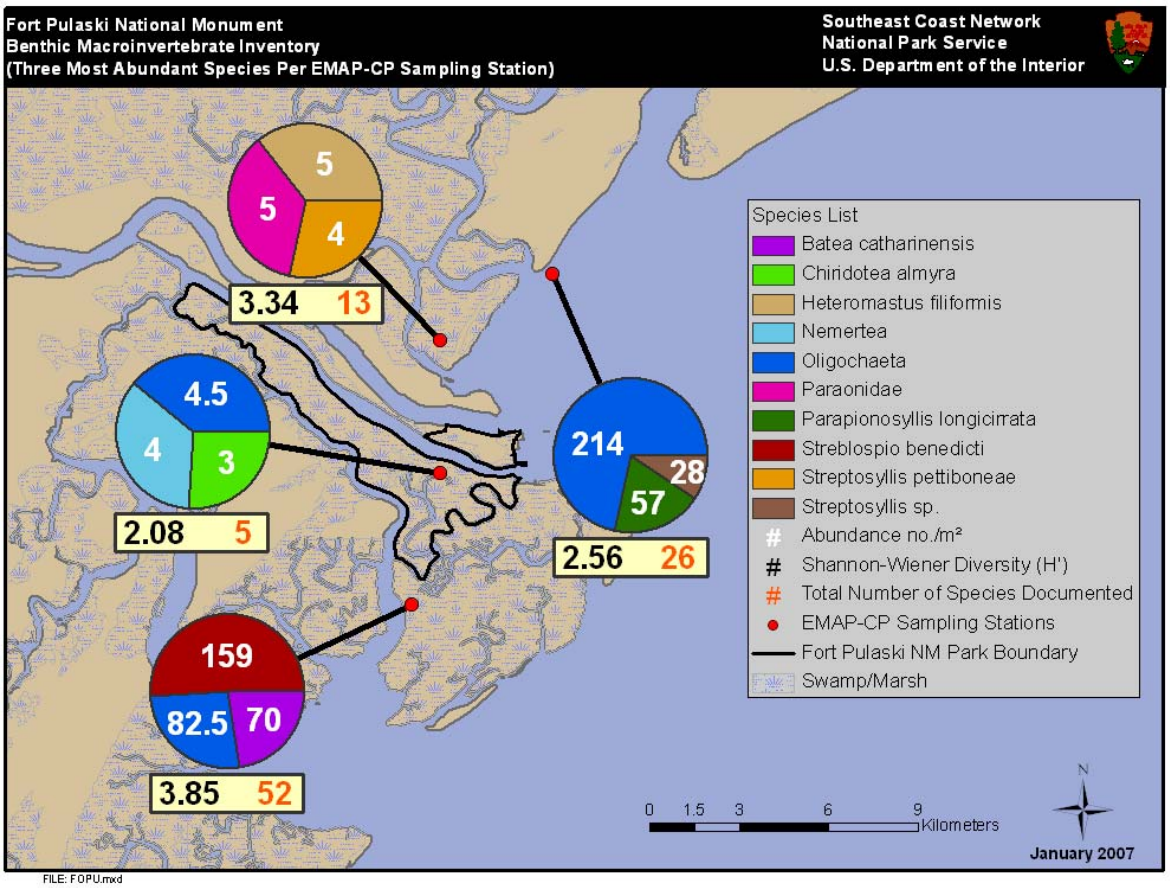

Figure 9. BMI abundance data from EMAP stations near FOPU. Three most abundant taxa and Shannon-Wiener Diversity (*H'*) .

South Carolina Estuarine And Coastal Assessment Program Abundance Data

Four stations that were very close to FOPU boundaries were selected from the SCECAP data sets (Figure 10; Table 4). Two stations along the Wright River, RO026011 and RT042063, represented open water and tidal creek habitat similar to the EMAP station CP94_027. Station RO046061 was taken in the Savannah River, approximately 3.3 miles from the coast.

Table 4.
SCECAP station information for BMI abundance. [O – Open Water; T – Tidal Creek].

Park	State	Location	Year	Station	Latitude	Longitude	Habitat	Depth (m)
FOSUSC		Charleston Harbor near Patriots Point	1999	RO99322	32.79	-79.90	O	2.80
FOSUSC		Charleston Harbor behind Crab Bank	2000	RO00033	32.78	-79.87	O	1.20
FOSUSC		Charleston Harbor 0.5 mi. SE of Mouth of Shem Creek	2003	RO036044	32.78	-79.88	O	1.79
FOSUSC		Crab Bank in Charleston Harbor	2002	RO026026	32.76	-79.87	O	6.10
FOSUSC		Charleston Harbor near Fort Johnson	2001	RO01129	32.75	-79.88	O	7.60
FOSUSC		Unnamed Tributary to Parrot Point Creek 0.8 mi S of Fort Johnson	2004	RT042072	32.74	-79.89	T	1.50
FOSUSC		Wright River N of Mud River	2002	RO026011	32.09	-80.94	O	5.80
FOSUSC		Wright River in Creek at Walls Cut	2000	RT00501	32.08	-80.91	T	3.00
FOPUSC		New River 8.5 mi SW Of Bluffton	2004	RT042063	32.14	-80.96	T	2.80
FOPUSC		Upper Wright River Below Turn Bridge Boat Ramp	2002	RT022152	32.12	-81.00	T	4.60
FOPUSC		Wright River 1.9 mi SE Of Turn Bridge Landing	2003	RT032032	32.11	-80.98	T	4.59
FOPUSC		Savannah River 3.3 mi NW Of Fields Cut (Mud River)	2004	RO046061	32.10	-81.00	O	9.23

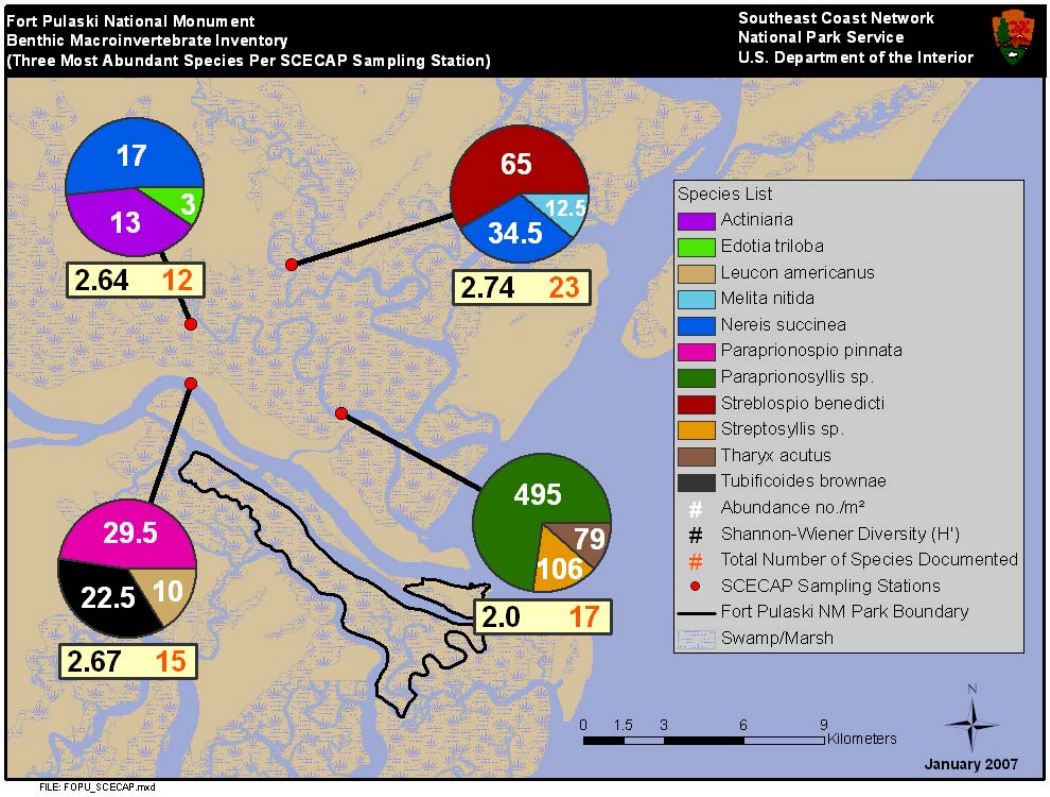

Figure 10. BMI abundance data from SCECAP stations near FOPU. Three most abundant taxa and Shannon-Wiener Diversity (H').

A list of 94 BMI taxa was compiled from the four SCECAP stations (Appendix A). Stations RO026011 had high BMI abundances, with the polychaetes *Paraprionosyllis* spp., *Streptosyllis* spp., and *Tharyx acutus* making up the majority of individuals (Figure 10). Diversity for this station was low (H' = 2.0). Diversity was also low (H' = 2.8) for station RO046061, where the most dominant taxa were the polychaete *Paraprionospio pinnata*, the oligochaete *Tubificoides brownae*, and the cumacean *Leucon americanus*. The tidal creek station in the upper Wright River (RT022152) was characterized by the polychaete *Nereis succinea*, unidentified actinarians, and the isopod *Edotia triloba*. The three most abundant taxa for the tidal creek station RT04063 were the polychaetes *Streblospio benedicti* and *N. succinea*, and the amphipod *Melita nitida*. Diversity for the tidal creek stations was also low (H' = 2.63 and 2.74 for stations RT022152 and RT044063, respectively).

Taxa Identified or Predicted from Other Data Sources

A search of studies of Georgia coastal habitats yielded 209 BMI taxa expected to occur in habitats similar to those found in FOPU (Appendix B). Of these, 195 were from open water (i.e., sounds and tidal creeks), and the remaining from salt marshes.

Taxa Identified or Predicted from Voucher Records

Voucher profiles were obtained from taxa collected in coastal Georgia habitats (Appendix C). A list of 289 BMI taxa was compiled from these records.

Fort Sumter National Monument

Environmental Monitoring and Assessment Abundance Data

Three stations were selected from the EMAP dataset (Figure 11, Table 2). Stations CP95_153 and CP95_154 were taken from Hamlin Creek and Parrot Point Creek, and CP94_79 was taken within Charleston Harbor, near FOSU (Figure 11).

A list of 60 taxa was compiled (Appendix A). The polychaetes *Paraprionospio pinnata* and *Streblospio benedicti* were the overwhelming dominants in stations CP94_79 and CP95_153 (Figure 11), and diversity was low to moderate (H' = 2.96 and 3.91, respectively. The bivalve *Tellina agilis* was also very abundant in CP95_153. Total BMI abundance was relatively low for CP95_154, with the polychaetes *S. benedicti*, *Mediomastus ambiseta*, and *P. pinnata* comprising the three most abundant taxa.

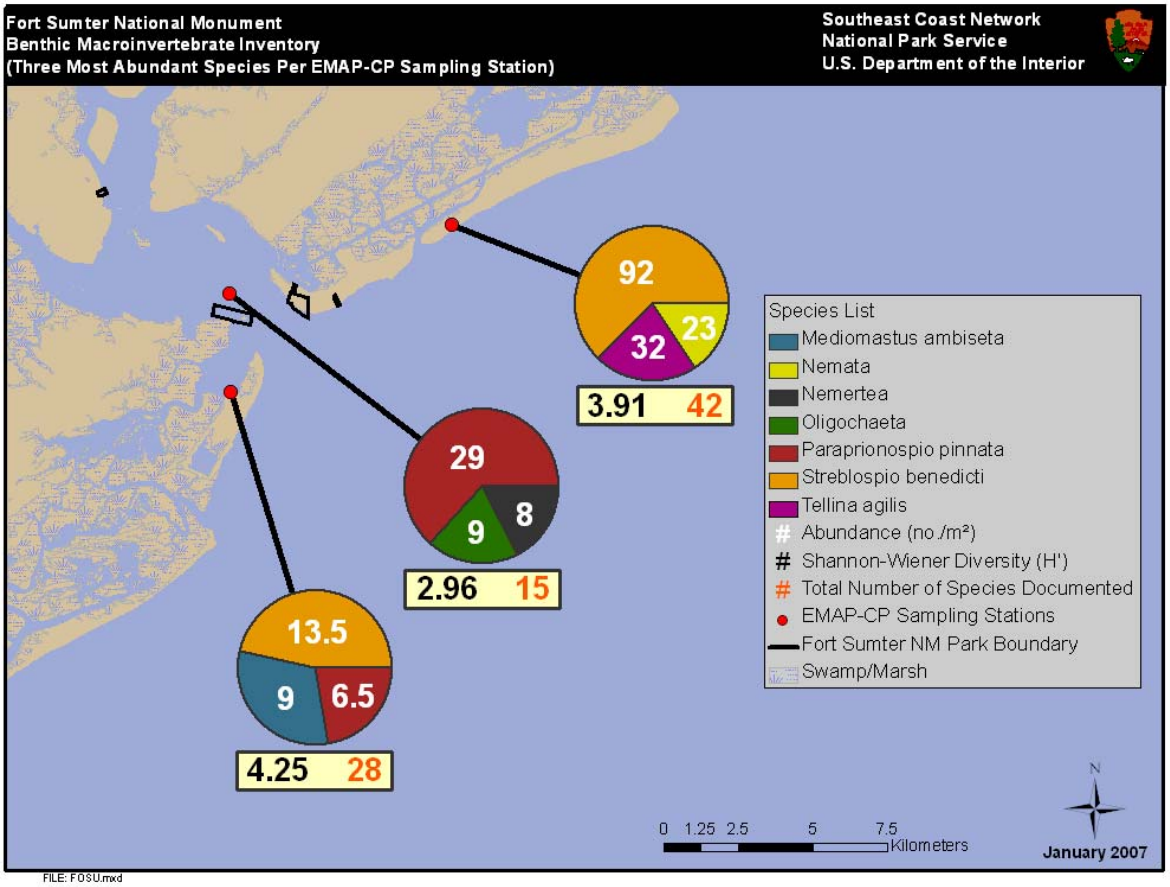

Figure 11. BMI abundance data from EMAP stations near FOSU. Three most abundant taxa and Shannon-Wiener Diversity (*H'*) .

South Carolina Estuarine and Coastal Assessment Program Abundance Data

Five open-water stations were selected from the SCECAP datasets (Figure 12; Table 4). Since the FOSU park boundary extends into Charleston Harbor, stations around Charleston Harbor were selected to better approximate BMI abundances and community composition.

A list of 200 BMI taxa was compiled (Appendix A). Two polychaetes, *Streblospio benedicti* and *Mediomastus* spp., as well as the oligochaete *Tubificoides wasselli*, were among the three most abundant taxa for stations RO00033, RO01129, RO026026, and RO99322 (Figure 12). However, station RO036044, located at the mouth of Shem Creek, appeared unique, in that the three most abundant taxa were bivalves of the superfamily Galeommatoidea, the ophiuroid *Amphiodia pulchella*, and the polychaete *Lumbrineris tenuis*. Diversity was greatest for stations RO026026, RO01129, and RO036044 (H' = 4.23, 4.37, and 4.45, respectively) and lowest for stations RO99322 and RO00033 (H' = 2.03 and 2.31, respectively).

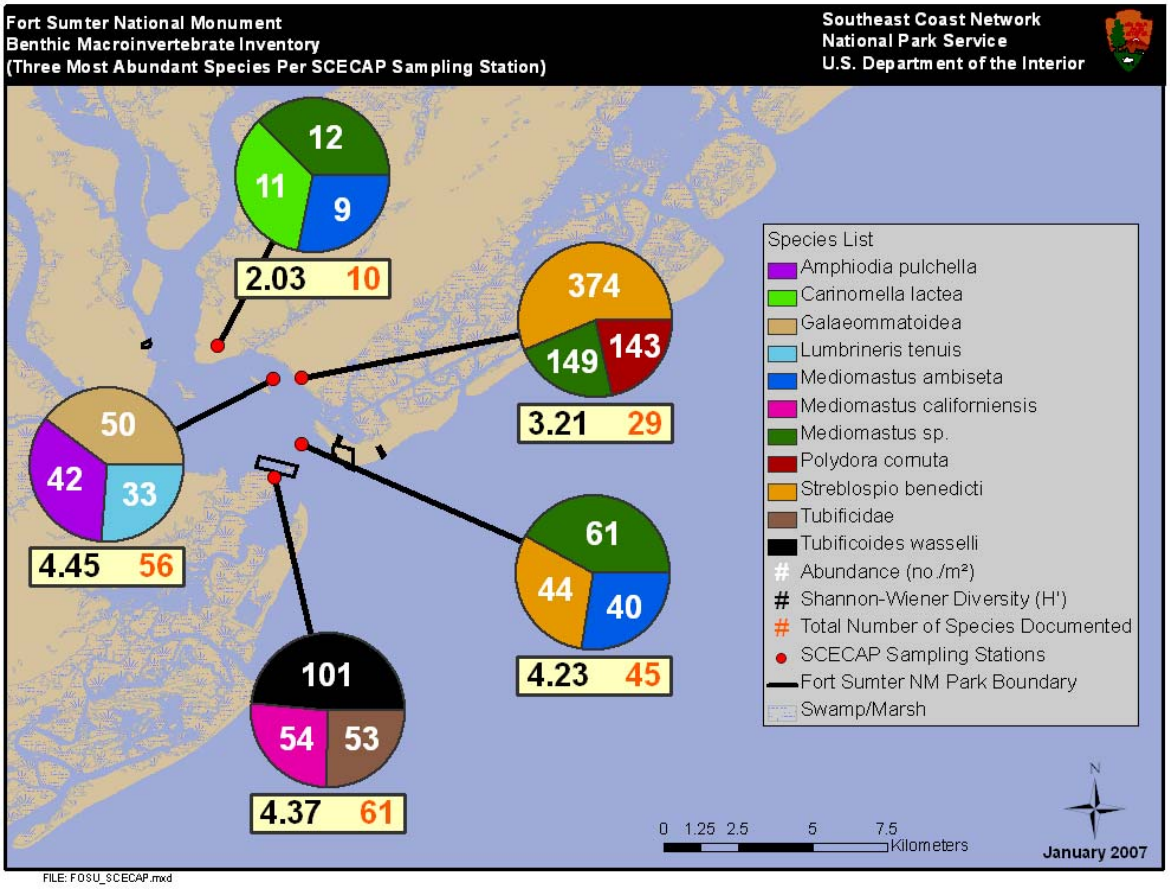

Figure 12. BMI abundance data from SCECAP stations near FOSU. Three most abundant taxa and Shannon-Wiener Diversity (*H'*).

Taxa Identified or Predicted from Other Data Sources

Several studies of BMI from South Carolina coastal habitats were consulted to generate a list of species expected to occur within similar habitats in FOSU (Appendix B). Most of the 270 taxa obtained from these studies were from open-water (i.e. sound and tidal creek) habitats along the northern South Carolina coast (i.e., Winyah Bay) and near Hilton Head Island along the south coast (Appendix B).

Taxa Identified or Predicted from Voucher Records

The voucher record for BMI taxa in South Carolina is very well-represented (Appendix C). A list of 316 taxa was collected and catalogued from habitats along the SC coast.

Timucuan Ecological & Historic Preserve

Environmental Monitoring and Assessment Abundance Data

Six stations were selected from the EMAP dataset for TIMU (Figure 13). Stations CP93_12 and CP94_18 were located in the Nassau River and adjoining Nassau Sound, respectively. Three other stations were taken near the Trout River (CP94_17), South Amelia River (CP95_170), and the St. Johns River (CP_171). The remaining station was taken near the Jacksonville city limits (CP94_88).

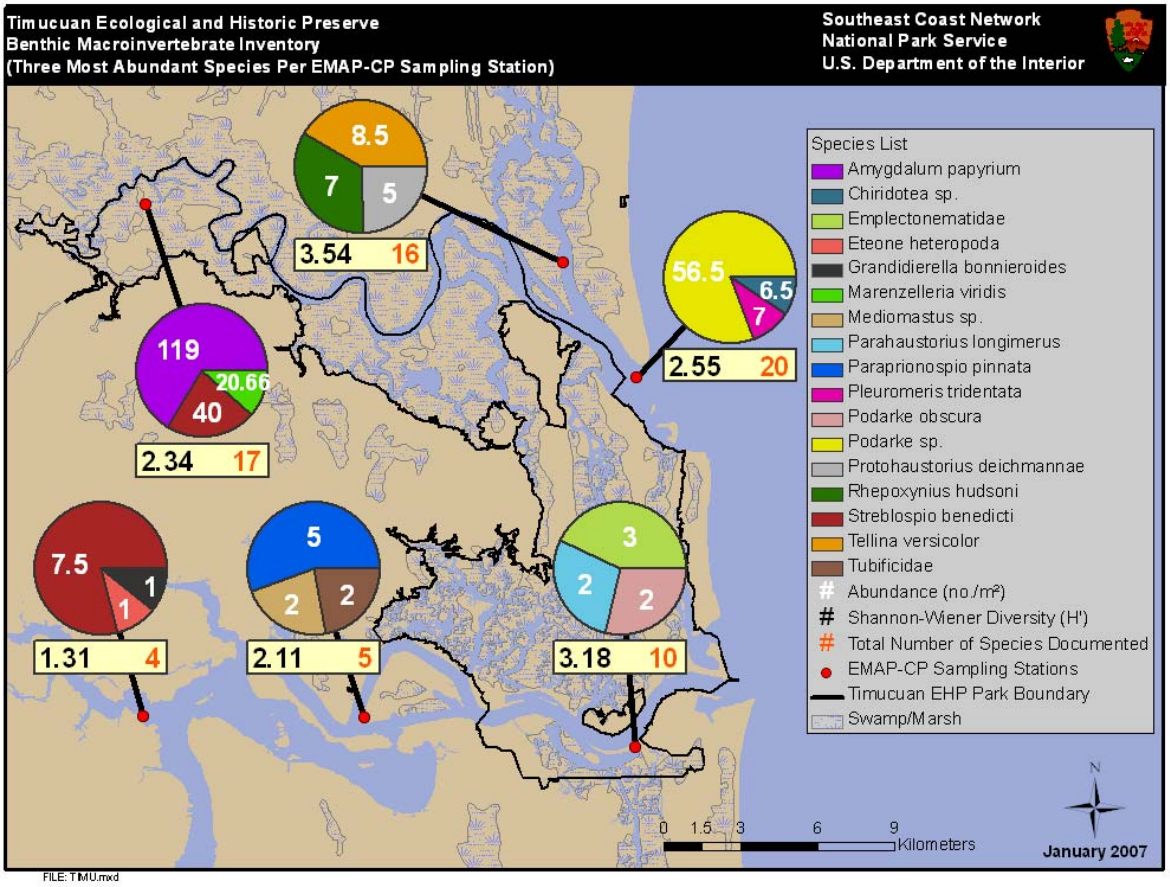

Figure 13. BMI abundance data from EMAP stations near TIMU. Three most abundant taxa and Shannon-Wiener Diversity (*H'*).

A list of 62 BMI taxa was compiled (Appendix A). At the Nassau River station (CP93_12), the bivalve *Amygdalum papyrium* and the polychaetes *Streblospio benedicti* and *Marenzellaria viridis* were the most abundant species (Figure 13). Farther into Nassau Sound (CP94_18), the polychaete *Podarke* spp., was the most dominant species, at nearly 10 times the abundance of the bivalve *Pleuromeris tridentata*, and the isopod (water roach) *Chridotea* spp. Extremely low BMI abundances were recorded in the Trout River station (CP94_17), was well as in the St. Johns River (CP95_171), with the polychaetes *S. benedicti* and *Paraprionospio pinnata* the most abundant taxa, respectively. The bivalve *Tellina versicolor*, and the amphipods *Rhepoxynius*

hudsoni and *Protohaustorius deichmannae* were the three most abundant taxa in the South Amelia River station (CP95_170). Samples from the Jacksonville station (CP94_88) were also sparsely populated by BMI, and the most abundant taxa were nemerteans in the family Emplectonematidae. Overall, diversity was moderate (*H'* = 3.54 Trout River) to low (*H'* = 1.31 South Amelia River).

Lower St. Johns River Studies Abundance Data

Twenty-seven sampling stations within bounding coordinates for TIMU were selected from the LSJR studies (Table 5). This study design employed multiple tidal-creek stations at each set of coordinates, and many were clustered near the Fort Caroline National Memorial and adjoining Theodore Roosevelt area (Figure 14).

A list of 227 BMI taxa was compiled from these stations (Appendix A). By far, the dominant taxa were polychaetes, such as *Streblospio benedicti* and *Mediomastus* spp., as well as amphipods such as *Paracrapella pusilla* and *Apocorophium lacustre* (Table 6). Although abundances of most taxa were low, the large numbers of taxa in most of the stations resulted in mostly moderate to high diversity. In particular, diversity was very high for stations at the located near the Ft. Caroline National Memorial section of the St. Johns River (*H'* from 3.64 to 5.58; Table 5).

BMI Abundance Data from 2003 TIMU Study

In 2003, a study was commissioned by park staff at TIMU (Long 2004) to sample BMI over four time points, at a station where the Fort George River meets Sisters Creek (lat. 30.44525, lon. -81.44583). This site has been a long-term sampling location for BMI since the late 1970's, and data have been archived as part of the STORET database. BMI were sampled from this station in March, May, August, and October of 2003 (Table 6).

A list of 103 taxa was compiled (Appendix A). For March 2003 , the polychaetes *Tharyx* spp., *Aphelochaeta marioni*, and *Paraonis fulgens* (Table 7) were the dominant taxa, and *H'* was 3.85 (Table 7) The polychaete *Caullerilla* spp. was the dominant BMI taxon during the May and October sampling dates (Table 6). The August sampling date was characterized by polychaetes from the family Cirratulidae and *Streblospio benedicti* (Table 7). Other dominant taxa for this study were the gastropod *Terebra* spp., and bivalves from the family Tellinidae (Table 7). Diversities for May, August, and October were *H'* = 3.79, 4.14, and 4.64, respectively (Table 7).

Taxa Identified or Predicted from Other Data Sources

National Aquatic Resource Survey Data (a program of the USEPA) for Duval County were consulted to obtain 33 records of additional BMI taxa predicted to occur along the St. Johns River (Appendix B). Also, studies of southern Georgia marsh and open water habitats yielded another 209 BMI taxa likely to occur in TIMU (Appendix B).

Taxa Identified or Predicted from Voucher Records

A list of 200 vouchers was compiled from coastal regions of Florida (Appendix C).

Table 5.
Lower St. Johns River stations for Timucuan Ecological & Historic Preserve. Station information and Shannon-Wiener indices (*H'*).

Park	State	Location	Year	Station	Latitude	Longitude	Depth	*H'*
TIMU	FL	St. John's River	2000	SJRC1_7	30.43	-81.50	2	3.86
TIMU	FL	St. John's River	2000	SJRC2_7	30.43	-81.50	2	4.39
TIMU	FL	St. John's River	2001	SJRC3_7	30.43	-81.50	1	4.35
TIMU	FL	St. John's River	2001	SJRC4_7	30.43	-81.50	1	4.74
TIMU	FL	St. John's River	2001	SJRC5_7	30.43	-81.50	2	2.86
TIMU	FL	St. John's River	2002	SJRC6_7	30.43	-81.50	2	2.40
TIMU	FL	St. John's River	2002	SJRC7_7	30.40	-81.50	2	3.93
TIMU	FL	St. John's River	2000	SJRC1_4	30.39	-81.65	2	3.14
TIMU	FL	St. John's River	2000	SJRC2_4	30.39	-81.65	3	3.68
TIMU	FL	St. John's River	2001	SJRC3_4	30.39	-81.65	3	4.12
TIMU	FL	St. John's River	2001	SJRC4_4	30.39	-81.65	3	4.35
TIMU	FL	St. John's River	2001	SJRC5_4	30.39	-81.65	3	2.41
TIMU	FL	St. John's River	2002	SJRC6_4	30.39	-81.65	3	3.46
TIMU	FL	St. John's River	2002	SJRC7_4	30.39	-81.65	3	2.62
TIMU	FL	St. John's River	2000	SJRC1_5	30.38	-81.56	8	4.72
TIMU	FL	St. John's River	2000	SJRC2_5	30.38	-81.56	0	4.24
TIMU	FL	St. John's River	2001	SJRC3_5	30.38	-81.56	4	3.40
TIMU	FL	St. John's River	2001	SJRC4_5	30.38	-81.56	0	5.59
TIMU	FL	St. John's River	2001	SJRC5_5	30.38	-81.56	9	3.64
TIMU	FL	St. John's River	2002	SJRC6_5	30.38	-81.56	4	4.16
TIMU	FL	St. John's River	2002	SJRC7_5	30.38	-81.52	6	1.89
TIMU	FL	St. John's River	2000	SJRC1_6	30.37	-81.53	4	3.31
TIMU	FL	St. John's River	2000	SJRC2_6	30.37	-81.53	2	2.52
TIMU	FL	St. John's River	2001	SJRC3_6	30.37	-81.53	3	4.08
TIMU	FL	St. John's River	2001	SJRC4_6	30.37	-81.53	4	3.36
TIMU	FL	St. John's River	2002	SJRC6_6	30.37	-81.53	2	2.52
TIMU	FL	St. John's River	2002	SJRC7_6	30.37	-81.53	4	2.37

Table 6.
BMI abundance data from Lower St. Johns River stations near TIMU. Three most abundant taxa per station.

Station	Group	Taxon	Average Abundance
SJRC1_4	Gastropod	*Boonea impressa*	88
SJRC1_4	Polychaete	*Neanthes succinea*	12
SJRC1_4	Crustacean	*Melita spp.*	6
SJRC1_5	Polychaete	*Sabellaria vulgaris*	69
SJRC1_5	Crustacean	*Paracaprella pusilla*	42
SJRC1_5	Anthozoan	Actiniaria	35
SJRC1_6	Polychaete	*Paraonis fulgens*	10
SJRC1_6	Polychaete	*Mediomastus spp.*	2
SJRC1_6	Nemertean	*Nemertea*	2
SJRC1_7	Bivalve	*Gemma gemma*	97
SJRC1_7	Sponge	Porifera	19
SJRC1_7	Polychaete	*Mediomastus spp.*	11
SJRC2_4	Polychaete	*Heteromastus filiformis*	6
SJRC2_4	Polychaete	*Nereis spp.*	6
SJRC2_4	Polychaete	*Neanthes succinea*	4
SJRC2_5	Polychaete	*Nereis spp.*	7
SJRC2_5	Polychaete	*Nereis micromma*	5
SJRC2_5	Bivalve	*Petricolidae*	5
SJRC2_6	Polychaete	*Paraonis fulgens*	2
SJRC2_6	Crustacean	*Americhelidium americanum*	1
SJRC2_6	Bivalve	Bivalvia	1
SJRC2_7	Polychaete	*Mediomastus spp.*	57
SJRC2_7	Ascidian	Ascidiacea	29
SJRC2_7	Crustacean	*Ampelisca vadorum*	8
SJRC3_4	Polychaete	*Streblospio benedicti*	15
SJRC3_4	Polychaete	*Mediomastus spp.*	13
SJRC3_4	Polychaete	*Neanthes succinea*	8
SJRC3_5	Polychaete	*Streblospio benedicti*	123
SJRC3_5	Polychaete	*Mediomastus spp.*	16
SJRC3_5	Nemertean	*Tubulanus spp.*	11
SJRC3_6	Bivalve	Bivalvia	6
SJRC3_6	Crustacean	*Monocorophium acherusicum*	4
SJRC3_6	Crustacean	*Protohaustorius wigleyi*	4
SJRC3_7	Phoronid	*Phoronis spp.*	78
SJRC3_7	Polychaete	*Mediomastus spp.*	35
SJRC3_7	Polychaete	*Streblospio benedicti*	23
SJRC4_4	Polychaete	*Mediomastus spp.*	21
SJRC4_4	Polychaete	*Neanthes succinea*	15
SJRC4_4	Polychaete	*Nereis spp.*	10
SJRC4_5	Polychaete	*Sabellaria vulgaris*	21
SJRC4_5	Bivalve	*Anadara transversa*	12
SJRC4_5	Ascidian	Ascidiacea	12
SJRC4_6	Bivalve	Tellinidae	4
SJRC4_6	Polychaete	*Spiophanes bombyx*	4
SJRC4_6	Anthozoan	Actiniaria	3
SJRC4_7	Gastropod	*Nassarius obsoletus*	40
SJRC4_7	Polychaete	*Mediomastus spp.*	21
SJRC4_7	Anthozoan	Actiniaria	12
SJRC5_4	Polychaete	*Nereis spp.*	7

Station	Group	Taxon	Average Abundance
SJRC5_4	Polychaete	*Neanthes succinea*	7
SJRC5_4	Nemertean	Nemertea	2
SJRC5_5	Bivalve	*Sphenia antillensis*	2
SJRC5_5	Polychaete	*Streblospio benedicti*	2
SJRC5_5	Polychaete	*Magelona spp.*	2
SJRC5_7	Polychaete	*Mediomastus spp.*	3
SJRC5_7	Gastropod	*Acteocina canaliculata*	2
SJRC5_7	Polychaete	*Scoloplos rubra*	2
SJRC6_4	Polychaete	*Nereis spp.*	6
SJRC6_4	Polychaete	*Neanthes succinea*	5
SJRC6_4	Oligochaete	*Tubificidae*	3
SJRC6_5	Bivalve	*Abra aequalis*	10
SJRC6_5	Polychaete	*Asabellides oculata*	9
SJRC6_5	Polychaete	*Nereis spp.*	9
SJRC6_6	Crustacean	*Oxyurostylis smithi*	2
SJRC6_6	Polychaete	*Paraonis spp.*	2
SJRC6_6	Polychaete	*Laeonereis culveri*	1
SJRC7_4	Bivalve	*Macoma mitchelli*	4
SJRC7_4	Polychaete	*Nereis spp.*	4
SJRC7_4	Polychaete	*Neanthes succinea*	2
SJRC7_5	Crustacean	*Apocorophium lacustre*	100
SJRC7_5	Polychaete	*Nereis spp.*	7
SJRC7_5	Bivalve	*Sphenia antillensis*	6
SJRC7_6	Bivalve	*Macoma spp.*	3
SJRC7_6	Polychaete	*Paraonis fulgens*	3
SJRC7_6	Polychaete	*Cirrophorus spp.*	1
SJRC7_7	Bivalve	Bivalvia	4
SJRC7_7	Crustacean	*Ampelisca cristata*	4
SJRC7_7	Crustacean	*Ampelisca spp.*	3

Table 7.
BMI abundance data from 2003 study commissioned by TIMU park personnel. Three most abundant taxa per sampling date.

Date	Taxon	Abundance	TSN	Group
3/25/2003	*Tharyx spp.*	122	67141	Polychaete
3/25/2003	*Aphelochaeta marioni*	28	573737	Polychaete
3/25/2003	*Paraonis fulgens*	26	66697	Polychaete
5/21/2003	*Caulleriella spp.*	96	67126	Polychaete
5/21/2003	*Terebra spp.*	74.5	75408	Gastropod
5/21/2003	Cirratulidae	71.5	67116	Polychaete
8/27/2003	*Streblospio benedicti*	62.33	66939	Polychaete
8/27/2003	Bivalvia	8.33	79118	Bivalve
8/27/2003	*Ampelisca holmesi*	7.5	93345	Crustacean
10/30/2003	*Caulleriella spp.*	18.66	67126	Polychaete
10/30/2003	Tellinidae	16.66	81032	Bivalve
10/30/2003	*Mediomastus spp.*	10	67438	Polychaete

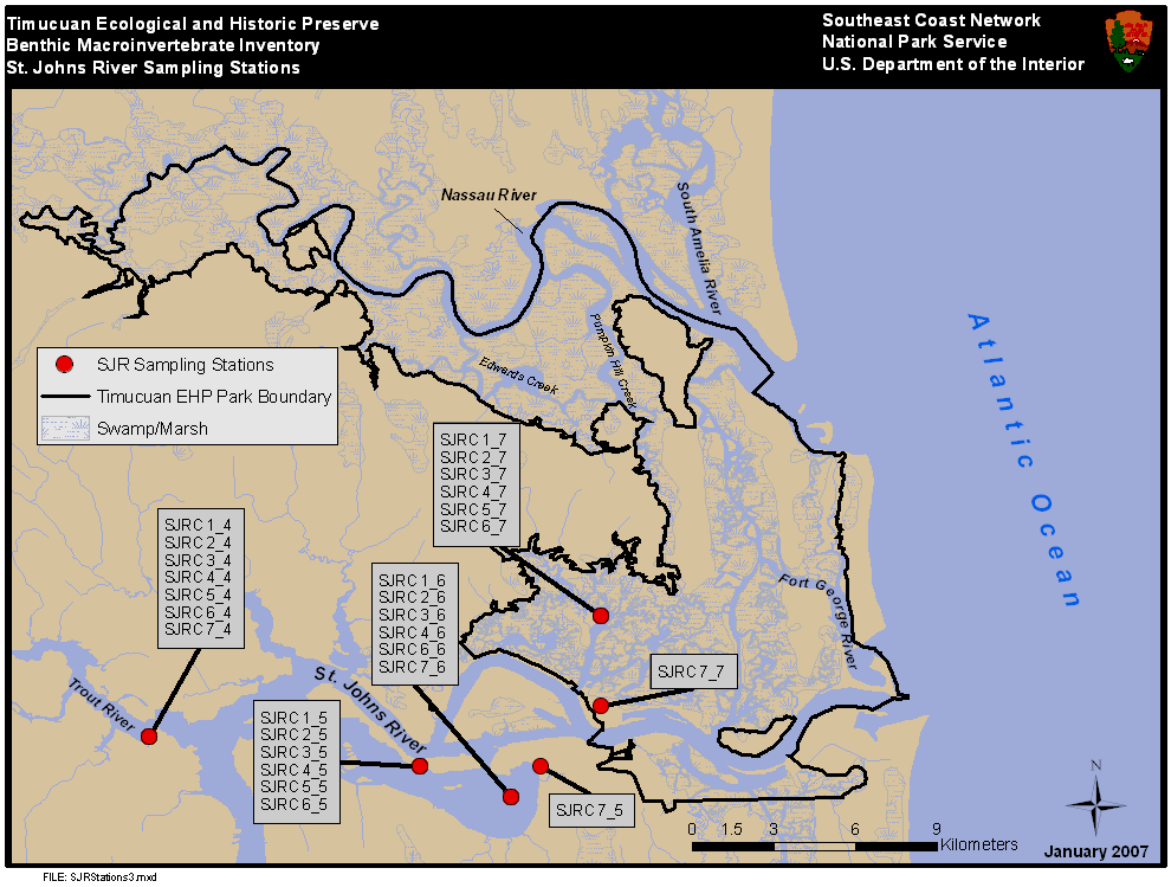

Figure 14. Stations sampled for BMI as part of the Lower St. Johns River studies.

Species of Concern: Invasive Species

A search of the US Fish and Wildlife catalog of Threatened and Endangered Species Status, did not yield any BMI from the SAB. However, 46 occurrences invasive marine invertebrates were documented from state and federal listings for the South Atlantic Bight (Table 8). Most of these (25) were from Florida, followed by South Carolina (16), North Carolina (14), and Georgia (1). Five species were reported as widespread

from all four states: the amphipod *Apocorophium lacustre*, the barnacles *Balanus amphitrite* and *Balanus trigonus*, the Green Porcelain Crab *Petrolisthes armatus*, and the Asian Clam *Corbicula fluminea*. Three species, *Rangia cuneata*, *P. armatus*, and *A. lacustre*, were documented from abundance data obtained for this inventory.

Table 8.
Invasive invertebrates documented from the South Atlantic Bight. Table modified from Power et al. (2006). [TSN = Taxonomic Serial Number; USGS = United States Geological Survey – Nuisance Aquatic Species; MAREX – University of Georgia Marine Extension Service; SCDNR = South Carolina Department of Natural Resources; GADNR = Georgia Department of Natural Resources].

Taxon	Common Name	Classification	TSN	Catalogued by	FL	GA	SC	NC
Apocorophium lacustre	Amphipod	Crustacean	656749	MAREX	X	X	X	X
Balanus amphitrite	Striped Barnacle	Crustacean	89616	USGS - NAS, MAREX	X	X	X	X
Balanus reticulatus	Barnacle	Crustacean	89635	USGS - NAS, MAREX	X			
Balanus trigonus	Barnacle	Crustacean	89628	MAREX	X	X	X	X
Callinectes bocourti	Red Bluecrab	Crustacean	98703	USGS - NAS	X		X	X
Callinectes exasperatus	Rugose Swimming Crab	Crustacean	98704	USGS - NAS		X		
Callinectes larvatus	Masked Swimming crab	Crustacean	98705	USGS - NAS, MAREX			X	X
Charybdis helleri	Indo-Pacific Crab	Crustacean	199969	USGS - NAS	X		X	X
Chelura terebrans	Amphipod	Crustacean	93571	USGS - NAS, MAREX	X			
Hemigraspus sanguineus	Asian Shore Crab	Crustacean	621740	USGS - NAS				X
Ligia exotica	Wharf Roach	Crustacean	93228	USGS - NAS, MAREX	X	X		X
Litopenaeus vannamei	Pacific White Shrimp	Crustacean	551682	USGS - NAS, MAREX			X	
Megabalanus coccopoma	Acorn Barnacle	Crustacean	206260	MAREX, SCDNR, GADNR		X	X	
Palaemon africanus	African Prawn	Crustacean	96326	USGS - NAS, MAREX	X			
Penaeus monodon	Jumbo Tiger Prawn	Crustacean	95638	USGS - NAS, MAREX	X	X	X	
Penaeus stylirostris	Blue Shrimp	Crustacean	95645	USGS - NAS, MAREX			X	
Petrolisthes armatus	Green Porcelain Crab	Crustacean	98062	USGS - NAS, MAREX	X	X	X	X
Sphaeroma terebrans	Isopod	Crustacean	92342	USGS - NAS, MAREX	X			
Sphaeroma walkeri	Isopod	Crustacean	92341	USGS - NAS, MAREX	X			
Synidotea laevidorsalis	Isopod	Crustacean	546963	USGS - NAS, MAREX			X	
Corbicula fluminea	Asian Clam	Mollusc	81387	USGS - NAS	X	X	X	X
Crassostrea ariakensis	Suminoe oyster	Mollusc	693930	USGS - NAS, MAREX				X
Drymonema dalmatinum	Pink Meanie	Mollusc	51692	USGS - NAS	X		X	
Ercolania fuscovittata	Nudibranch	Mollusc	51692	USGS - NAS, MAREX	X			
Lyrodus medilobatus	Indo-Pacific Shipworm	Mollusc	999X	USGS - NAS, MAREX	X			
Myosotella myosotis	Mouse-ear Marsh snail	Mollusc	567926	USGS - NAS, MAREX	X			
Mytella charruana	Charru Mussel	Mollusc	999X	USGS - NAS, MAREX	X			
Perna viridis	Green Mussel	Mollusc	79577	USGS - NAS	X	X		
Pinctada margaritafera	Black-Lipped Pearl Oyster	Mollusc	999X	USGS - NAS, MAREX	X			X
Polycera chilluna	Harlequin	Mollusc	78320	USGS - NAS, MAREX				X
Rangia cuneata	Atlantic Rangia	Mollusc	80962	USGS - NAS, MAREX	X			
Truncatella subcylindrica	Looping Snail	Mollusc	70720	USGS - NAS, MAREX	X			
Hydroides diramphus	Tubeworm	Polychaete	999X	USGS - NAS, MAREX	X			
Hydroides elegans	Tubeworm	Polychaete	68295	USGS - NAS, MAREX	X			

Discussion

Overall condition of Benthic Macroinvertebrates in the Southeast Coast Network geographic region

Based on the EMAP stations used in this inventory, BMI communities in the SECN are diverse, with more than 480 documented taxa. These findings agree with overall assessments indicating that BMI habitats in the SAB are primarily in good condition (Mallin et al. 2000; USEPA 2004; Van Dolah et al. 2004; Guadagnoli et al. 2005). However, given the small number of stations within or adjacent to park boundaries, BMI abundance and community composition data from EMAP are likely to be an underestimate. Also, it cannot be overlooked that even the most recent EMAP data presented are more than a decade old, and thus prediction of current BMI distributions should be made with some caution. The LSJR studies are certainly more recent (2000-2002), though less geographically comprehensive. From these surveys, 220 taxa were documented, and diversity was moderate to high. The SCECAP studies to date have identified 364 BMI taxa relevant to FOSU and FOPU, and the condition of estuaries in the South Carolina has been judged as healthy (Van Dolah et al. 2002, 2004; Van Dolah, Sanger & Filipowicz 2004). In the absence of a dedicated BMI monitoring effort for the SECN, data from these studies the provide the most comprehensive and detailed record of distribution, abundance, and community composition of BMI across the SECN.

Many more BMI taxa are predicted from museum collections and smaller studies of estuarine habitats similar to those in the SECN. Previous investigators have documented more than 560 BMI taxa from salt marshes, tidal creeks, rivers, sounds and beaches throughout the SAB. Whereas abundance and community composition data cannot always be obtained, taxa lists will be useful to compare with future BMI surveys.

The parks in the SECN, although established as protected areas, are not immune to the effects of natural and man-made stressors. Boat wakes from traffic on the Intracoastal Waterway can deposit sediments onto oyster reefs, disturb soft-bottom benthic habitat, and cause erosion of shorelines, and alter the grain-size distribution of sediments (Bishop 2005). In addition, storms and hurricanes, as well as abnormal tidal events can greatly alter local salinity and geography, as well as carry debris into BMI communities (Mallin et al. 1999, 2002; Posey and Alphin 2002). Many of the SECN parks connect to waterways influenced by shipping, recreational boating, residential development, and industrial processes (Holland et al. 2004; Potter et al. 2005). The salt marshes' 'filtering' effect of runoff from developed areas can also transfer nutrients, debris, and pollutants into sediments, and thus adversely affect BMI communities (Horne 1999; Hyland et al. 2003; Holland et al. 2004). In addition, dredging activities connected with pipeline construction (Lewis et al. 2002), shipping channels (USACE 2005), and beach nourishment (Greene 2002; MMS 2004) directly disturb BMI communities. Dredge disposal initially buries submerged benthic habitats, yet may also lead to the creation of islands in which new BMI communities can establish (Bishop 2005). Beach areas are often compacted and disturbed by off-road vehicle (ORV) use (Mallin et al. 2006). For CAHA, CALO, and CUIS, there is also disturbance to marshes and beach habitats from feral horse populations on these islands (Alber et al. 2005). In addition, oil spills deposited onto beaches, salt marshes, and tidal creeks contaminate sediments and kill many pollution-sensitive BMI, such as amphipods (Van Dolah et

al. 1999). Even after oils have visibly cleared from the water column and shorelines, negative effects on BMI abundance and community composition can persist (Jewett et al. 1999).

What is remarkable about BMI communities in the SECN geographic region, however, is their resilience to disturbance and capacity for recovery. In a study of multiple-hurricane impacts on the lower Cape Fear River watershed, Mallin et al. (2002) found that BMI communities at most of the sample sites underwent short-term (i.e. 1-year) decreases in abundance and changes in species composition, yet showed long term resilience to disturbance. Similarly, Posey & Alphin (2002) also found that offshore BMI communities in the Neuse River Estuary exhibited a rapid recovery following hurricanes (i.e., within a year of disturbance), and that seasonality was a greater predictor of community composition and abundance than was disturbance. Similarly, BMI communities impacted by dredging activities and beach nourishment can reestablish within a short interval (Mallin et al. 2002; Posey & Alphin 2002; Bishop 2005).

North Carolina Parks: Cape Hatteras and Cape Lookout National Seashores

The North Carolina Department of Environment and Natural Resources reported a lack of information sufficient to characterize soft-bottom habitats utilized by BMI in North Carolina estuaries (Street et al. 2005). They identified dredging, bottom-trawl fishing, shellfish harvesting, marine and dock construction, and beach nourishment as areas of concern for future monitoring (Street et al. 2005). Low DO and sediment contamination were also reported as significant threats to water quality and BMI recruitment (Street et al. 2005).

In their watershed condition assessment of CAHA and CALO, Mallin et al. (2004 & 2006) summarized known and potential stressors. Although they noted the potential for impairments, they did not consider either park profoundly affected either by nutrients or pollutants. Continued water-quality monitoring within and surrounding CAHA/CALO should provide insight into any to negative effects caused by increased coastal development. In addition, mudflats in CAHA are primary feeding grounds for the endangered Piping Plover (*Charadrius melodus*; US Fish & Wildlife 2006), and BMI surveys should be included in the resource management plan for this species.

As barrier island parks, CAHA and CALO are characterized by a juxtaposition of high-energy beaches and relatively calm tidal-creek, sound, and marsh habitats. The natural remodeling of barrier islands due to overwash from storms and high tides is an important factor (Hoyt & Henry 1967; Leatherman 1983). For example, in 2003, Hurricane Isabel carved a new inlet through Hatteras Island that persisted for several months (Pendelton et al. 2004).

Tidal flooding can also affect BMI in CAHA and CALO. During site visits to CAHA in September of 2006, tidal flooding through the dunes and over the highway occurred on Hatteras Island (S. Hymel pers. obs.). According to CAHA personnel, this flooding was an unusually large event, and was likely due to a dome of seawater pushed shoreward as Hurricane Florence passed by ~200 miles from the coast. Unusually high tides during this time were also observed by park personnel at CALO (M. Rikard, pers. comm.). Shoreward incursion of high-salinity waters, as well as resuspension/deposition of sediments can also disrupt BMI communities (Chester 1983).

Feral horse populations on CAHA, CALO, and CUIS (Figure 15) are a further source of disturbance to salt marshes and ecological processes (Levin et al. 2002). However, the current impact of horses on BMI communities is unknown, and it would be beneficial to initiate a survey of BMI communities in areas prone to grazing and digging.

Figure 15. Feral horses at CUIS and close-up of grazed-down *Spartina* marsh. Photos by E. DiDonato 2005.

South Carolina Parks (FOSU)

Previous SCECAP studies have found that the majority of tidal-creek and open-water habitats in South Carolina are in good condition, although the percentage poor habitat has doubled in recent years (from 4 % to 8 %; Van Dolah et al. 2004). Potential stressors to BMI communities include contaminants such as metals and PAHs, nutrient runoff from fertilized areas, and changes in salinity due to drought or rainfall (Van Dolah et al. 2002). Although SCECAP does not sample on FOSU grounds or nearshore waters, estimates of biotic condition around Charleston Harbor are a good approximation.

Charleston Harbor has also been the subject of many studies on water quality and BMI communities. Many of these took place during the 1999-2002 harbor deepening project (South Carolina Ports Authority 2006). Zimmerman et al. (2003) and Jutte et al. (2005) concluded that BMI communities in the Offshore Dredged Material Disposal Site (ODMDS) underwent significant reductions in abundance, diversity, and numbers of species. Although FOSU is at some distance from the ODMDS, it is reasonable to expect that similar activities could harm BMI communities near the monument.

There is also the potential for oil spills from ship traffic. Charleston Harbor has not experienced a major oil spill in recent years, since oiled wildlife from the 1999 *M/S Star Evviva* spill were found on local beaches (US Fish & Wildlife 2004). In September 2002, 2,500 gallons of heavy oil spilled into the Cooper River (Center for Safety and Emergency Response Training; http://www.csert.com/emergency.asp). Although this was a relatively small spill, oil quickly spread to beach areas around Sullivan's Island, Folly Beach, and Morris Island.

Like other ports along the east coast, invasive BMI species can be introduced to Charleston Harbor from ballast water exchanges, recreational boating, and dislodgment from ship hulls. Recently, the giant Acorn Barnacle (*Megabalanus coccopoma*; Plate 6) was discovered in the Folly River, a site where the Green Mussel (*Perna viridis*) has also been documented (SCDNR 2006). Furthermore, large container ships like those transiting Charleston Harbor are more likely to transport invasive species to ports (Power et al. 2006).

FOSU lies within a moderately-protected harbor, and impacts on BMI from tidal and storm events should be less profound than for barrier-island parks like CAHA, CALO, and CUIS. Charleston Harbor has not experienced a strong hurricane event since 1989, when Hugo made landfall as a category 4 storm (National Hurricane Center 1999). However, wind-driven waves and large tides from storms have the potential to shift or erode sediments around FOSU.

Georgia Parks

In their report on the condition of benthos in Georgia estuarine and coastal habitats, Guadagnoli et al. (2005) rated 81% as 'good', 12% 'fair', and 7% 'poor'. Poor benthic conditions co-occurred most often with poor water quality. Areas of poor habitat were identified along portions of the Savannah, Ogeechee, Wilmington and Medway rivers, as well as in Jointer Creek and Altamaha Sound (Guadagnoli et al. 2005).

Fort Pulaski National Monument

In their report on coastal resources and watershed conditions for FOPU, McFarlin & Alber (2005) documented several existing or potential impairments. Among these were toxic NPDES discharges from industry, low DO, thermal discharges from the Savannah River Nuclear Site, metals contamination, invasive species (see Table 8), fishing activities, and direct habitat destruction from channel dredging and harbor expansion (McFarlin & Alber 2005). There was insufficient nutrient data to determine whether non-point source contamination from sewer/septic systems or agriculture is an existing or potential problem for the FOPU watershed (McFarlin & Alber 2005).

Surrounded by the two channels of the Savannah River, BMI communities in FOPU are particularly vulnerable to the effects of shipping through the Port of Savannah. Potential impairments to BMI communities include suspension of sediments and erosion (McFarlin & Alber 2005), and the introduction of invasive species (Power et al. 2006). In addition, the Savannah Harbor Expansion Project (http://sav-harbor.com/), proposes to deepen a 36-mile stretch of the Savannah River, from FOPU to the Kings Island Turning Basin (McFarlin & Alber 2005). A Tier II EIS is expected in 2008, and will provide additional information on BMI communities.

FOPU is also at risk for oil spills from Savannah Harbor. On July 17, 2006, an estimated 5,000 gallons of heavy oil was spilled into the north channel of the Savannah River (NPS 2006; Figure 16). Although the US Coast Guard logged the spill at 5,000 gallons, it is estimated that as much as 20,000 gallons may have spilled (T. Risius, pers. comm.).

Figure 16. A) An oil spill on July 17, 2006 migrates to marsh habitats along the Savannah River, near FOPU. Photo courtesy of the US Coast Guard. B) six weeks later, oiled stems of *Spartina alterniflora* remain as evidence. Photo by S. Hymel 2006.

During site visits to FOPU in August of 2006, park personnel reported that oiled marsh areas were recovering (T. Risius, pers. comm.). The only remaining evidence of the spill was found on stems of *Spartina alterniflora* (**Error! Reference source not found.**), and the gastropods *Ilyanassa obsoleta* and *Littorina irrorata* were visibly abundant (S. Hymel, pers. obs.). However, the impact to BMI abundance and community composition in FOPU is not presently known, and underscores the importance of establishing baseline data and event-response sampling.

Cumberland Island National Seashore

As an isolated barrier-island park, CUIS is unlikely to experience direct impacts to BMI communities from human activities. Alber et al. (2005) identified only a few potential impairments to water resources which could also affect benthic habitats. The most significant were habitat disruption, invasive species, and low DO. Erosion on the south end of the island (Raccoon Keys), as well as from dredging activities connected with Kings Bay Naval Station and the ICW, is a also potential loss of BMI habitat (Alber et al. 2005). However, the shoaling in of Pelican Banks (J. Fry pers. comm.) may create marsh habitat for settlement by BMI (Alphin & Posey 2000).

Like all barrier island parks, CUIS is vulnerable to overwash, flooding, and suspension of sediments from hurricanes and unusual tidal events. Hurricane Frances (2004) and Tropical Storm Tammy (2005), brought heavy rain to and a subsequent drop in salinity (Huston et al. 2006). As discussed earlier (see *North Carolina Parks*), storm effects can alter BMI abundance community structure in both the short and long term.

Invasive species carried from the St. Marys and Cumberland Rivers, as well as the Intra-coastal Waterway, are certainly a threat to native BMI communities. As discussed earlier, the Green and Charru mussels have been found on docks, deployed substrates and floating buoys. In addition, there have been reports of the Acorn Barnacle (*Megabalanus coccopoma*; Plate 6) within CUIS boundaries (J. Fry pers. comm.).

Fort Frederica National Monument

No EMAP stations were located within the park boundaries, so a direct assessment of BMI communities in FOFR cannot be made at this time. Also, there are no watershed assessments completed for FOFR. Rapidly-increasing housing and retail developments on St. Simons Island may expose BMI communities to stressors such as nutrient runoff, septic seepage, and contaminants. BMI communities on FOFR are not likely to experience problems from shipping or invasive species.

Florida Parks

Collectively, CANA, FOMA, and TIMU encompass several types of BMI habitats along a ~150 mi. stretch of shoreline. TIMU and FOMA are characterized by tidal creeks, rivers and salt marshes, whereas CANA is largely high-energy beach and mangrove-fringed lagoon. According to state monitoring agencies, the greatest threats to water-quality co-occur with large urban estuaries, including the St. Johns River (Florida Department of Environmental Protection 2004). Given the strong association between water-quality and overall benthic condition (Van Dolah et al. 1999), there is concern over the condition of BMI communities.

Canaveral National Seashore

Like the other barrier-island parks, CANA is a collection of contrasting BMI habitats, including salt marshes, intertidal oyster reefs. Seaward are narrow margins of high-energy beaches. Salt marshes and mangrove swamps fringe Mosquito Lagoon. Within the lagoon are several hundred intertidal oyster reefs that provide habitat to a very diverse community of sessile and motile BMI (Boudreaux et al. 2006). However, little is known about the soft-bottom BMI communities in Mosquito Lagoon, as only a single EMAP station fell within lagoonal boundaries.

According the most recent Water Resources Management Plan (Walters et al. 2001), several factors pose a risk to water quality in CANA. These include: mosquito control (chemical and impoundment), the Intra-coastal Waterway, aquaculture, shellfish harvesting, wastewater treatment plants, septic-tank systems, recreational boating, personal watercraft, and exotic species. The extent to which all of these factors affect BMI communities is largely unknown, and baseline BMI surveys within park boundaries are urgently needed.

Mosquito Lagoon is heavily used by recreational boaters on the Intra-coastal Waterway, and negative effects of boat wakes on oyster reefs have been documented (Wall et al. 2005). The same processes of sedimentation and erosion that can produce dead margins in oyster reef communities can also disrupt soft-bottom BMI communities (Bishop 2005). There are additional risks of fuel and oil spills from boats and personal watercraft.

Hurricane effects on BMI communities in CANA can include sediment disruption and erosion, decreases in salinity due to heavy rains, and runoff of nutrients and contaminants from inland areas. There is also a history of temporary inlet formation due to hurricanes (NPS 2007).

Although not directly connected to the Port of Canaveral, CANA is vulnerable to invasions of exotic invertebrates. Recently, the Charru Mussel (*Mytella charruana*; Figure 17), was found in several locations in Mosquito Lagoon (Boudreaux and Walters 2006). In addition, the Green Mussel (*Perna viridis*; Plate 6) has been reported in Mosquito Lagoon (Indian River Lagoon

Update 2005). Both represent highly-invasive species that can threaten native mussels and oyster reefs.

Fort Matanzas National Monument

A watershed assessment for FOMA is targeted for completion by 2010 (K. Keteles, pers. comm.). No EMAP stations fell within or close to park boundaries, and the status of BMI communities is unknown. This lack of baseline watershed and BMI data is a pressing concern. However new studies in the nearby Guana-Tolomato-Matanzas (GTM) National Estuarine Research Reserve (NERR) should provide good estimates of BMI communities in FOMA (see Recommendations).

FOMA is located between two navigation channels: the Intra-coastal Waterway and the Matanzas River. Since 2001, Matanzas Inlet has undergone maintenance dredging to prevent shoaling in of the ICW, and dredge spoil has been added to nearby Summer Haven. An environmental assessment completed prior to dredging determined there would be only minor, short-term impact to BMI habitats (USACE 2001), but final EIS reports have not been completed.

Timucuan Ecological & Historic Preserve

Situated within the St. Johns River estuary, TIMU is heavily influenced by urban areas (City of Jacksonville), manufacturing (pulp and paper mills), petroleum storage, shipping (Port of Jacksonville; JAXPORT), military bases (Naval Station Mayport), power stations (Jacksonville Electric Authority), and recreational activities on the Nassau, Ft. George, and St. Johns rivers (Landsberg et al. 2004). Anderson et al. (2005) completed an assessment of coastal water resources and watershed conditions for TIMU. They reported several existing and potential impairments to water-quality (Table 9) that are known to adversely affect BMI (Van Dolah et al. 1999; Hyland et al. 2003).

A long-term study of BMI communities was completed by Long (2004) for a fixed monitoring site at Sisters Creek and the Ft. George River. He found that BMI community structure had shifted from low-salinity, pollution-sensitive (e.g., tellinid bivalves) to higher-salinity, pollution-tolerant taxa (e.g., *Streblospio benedicti*, *Mediomastus* spp.). Diversity showed a non-significant increase (*H'* from 2.33 to 3.15) over the 20-year study interval. Other parameters, such as BMI abundance and density increased by more than 50 % (Long 2004). These trends may reflect changes in water and sediment contamination in the St. Johns River Estuary reported by Evans (2001); Evans et al. (2004); Landsberg et. al. (2004); Anderson et al. (2005), and Florida Department of Environmental Protection (2005).

Evans et al. (2004) conducted a study of BMI communities in the lower St. Johns River basin from 2001-2003. They reported that BMI communities in the four stations nearest to TIMU boundaries were moderately impaired, compared to strongly-impaired stations to the south (Table 10).

Table 9.
Potential impairments to BMI communities at Timucuan Ecological & Historic Preserve (modified from Anderson et al. (2005). [HP = high concern problem; MP = moderate concern problem; LP = low concern or problem; PP = potential problem; ND = insufficient data to make judgment].

Indicator	LSJR	Nassau River	Tidal Creeks	Atlantic Coast
Nutrient loading	HP	MP	HP	LP
Metals contamination	HP	HP	PP	HP
Toxic compounds	HP	PP	PP	ND
Habitat disruption	HP	MP	HP	PP
Low DO	MP	HP	MP	ND
Sea level rise	PP	PP	PP	PP
Shoreline change	MP	HP	LP	HP

Table 10.
Summary of BMI data and impairment ratings from surface-water sites along the LSJR (Modified from Evans et al. (2004)). [† = stations nearest to TIMU; A = moderate diversity, pollution-tolerant taxa dominant to moderately dominant; B = low diversity, dominated by pollution-tolerant taxa].

Station	Site	Density	Taxa	H'	% Pollution Tolerant Taxa	Class
CLAP01†	Clapboard Creek	896	15	3.02	82	A
DUNR01†	Dunn River	453	10	2.64	67	A
BROW01†	Broward River	303	8	2.58	61	A
TROT02†	Trout River	269	6	2.21	96	A
BOLL02	Bolles School	517	3	1.04	100	B
SNAS02	South NAS	302	4	0.92	96	B
DRLK01	Doctors Lake	11	1	0.00	100	B
PIRC01	Pirate Cove	22	1	0.00	100	B

Invasive species introduced by ships traveling through JAXPORT are an emerging concern for TIMU. Among the four coastal ports studied by Power et al. (2006), JAXPORT had the highest incidence (19.5 %) and volume (92,703 metric tons) of untreated ballast water discharges. In addition, JAXPORT operates a large container terminal at the Blount Island Marina. Berthed vessels carrying invasive BMI in ballast waters, as well as on hulls, pose a threat to the nearby Ft. Caroline Memorial, and waterways connecting to the St. Johns River (Power et al. 2006). Recently, the Green Mussel (*Perna viridis*; Plate 6) was reported from several sites in the St. Johns River (R. Bryant, pers. comm.).

Invasive Species in the SECN Region

Invasive BMI species (Plate 6) enter the waterways connecting to SECN parks by a number of pathways, including ballast water exchanges in ports, aquaculture, and range extension (Power et al. 2006; http://www.shellfish.uga.edu/researchinvasiveconstr.htm). They can also be introduced directly, if attached to hulls ships or smaller watercraft. In their review of invasive BMI reports,

Power et al. (2006) estimated that the majority (40 %) of invasive marine BMI were introduced via ship hulls. Some species, such as the Charru Mussel (*Mytella charruana*; Figure 17), can be traced to a single point of entry, such as a seawater intake pipe of a power company (Boudreaux and Walters 2006).

Figure 17. The invasive Charru Mussel (*Mytella charruana*). A) a cluster retrieved from a deployed substrate. B) Mussels encrusting a floating dock. C) A buoy washed down the St. Marys River is encrusted with *M. charruana* and the Green Mussel (*Perna viridis*). D) A seawater intake pipe from a power plant is encrusted with *M. charruana*. Photos courtesy of MAREX (A. Power) and the Jacksonville shell club (http://jaxshell.org).

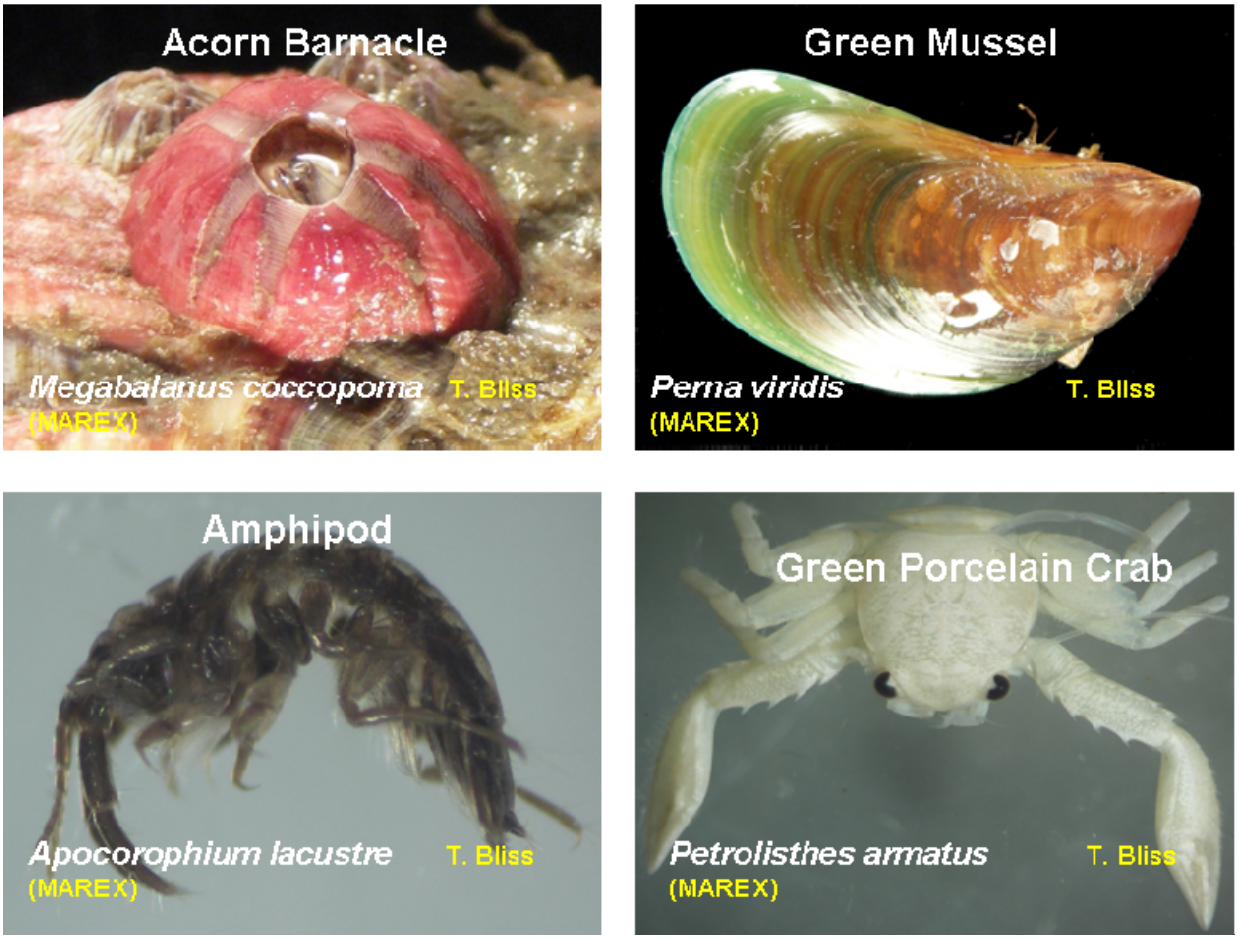

Figure 18. Common invasive BMI in the SAB.

Once established, populations of invasive BMI can rapidly spread throughout coastal habitats. For example, the Green Mussel (*Perna viridis*; Figure 18) was first introduced into the Gulf of Mexico in 1999, and quickly spread along Florida's west coast (Power et al. 2004). A second introduction into waters of northeast Florida occurred in 2002, and by 2003, *P. viridis* was reported from several sites along the Georgia coast (Power et al. 2004). To date, this species has continued to spread throughout the SECN region (M. Gilg 2006, memorandum to R. Bryant and N. Robinson). Karen Chester and students at the Camden County High School in St. Marys, GA, have documented *P. viridis* attached to deployed substrates in the St. Marys River (J. Fry, pers. comm.).

Major waterways connecting to SECN parks are usually monitored for invasive BMI, although adjoining park waterways and habitats may not be included in regular surveys. However, records of invasive BMI and data are available via several online databases (Table 11). Most databases are searchable by state, city, or habitat classification, as well as by taxon. Many of these web sites also provide fact sheets and identification keys for use by the public.

Table 11.
Agencies monitoring for invasive BMI in the SAB.

Agency	Division	Web Address	Description
Smithsonian Environmental Research Center (SERC)	Marine Invasions Research Laboratory	http://www.serc.si.edu/labs/marine_invasions/index.jsp	National research on invasive species; links to several invasive species databases
USGS	Nonindigenous Aquatic Species (NAS)	http://nas.er.usgs.gov/	Information, communications center.
NOAA	Sea Grant	http://www.seagrant.noaa.gov/themesnpa/aquaticinvasivespecies.html	Funding for invasive species research, via state Sea Grant partnerships
SCDNR	SERTC	http://www.dnr.sc.gov/marine/sertc/index.html	Taxonomic verification of collected specimens, specimen museum, training, species and literature databases
UGA	MAREX	http://www.shellfish.uga.edu/researchinvasiveconstr.htm	Surveys, taxonomic verification, fact sheets, outreach and education

Recommendations

BMI Surveys in SECN Parks

In order to establish current baseline data, it is recommended that BMI surveys commence for at least 7 parks in the SECN: CAHA, CANA, CUIS, FOFR, FOMA, FOPU, and TIMU. These parks are influenced by areas undergoing rapid development and/or port traffic, and should be established as sentinels for the network. It is imperative that FOMA and FOFR be sampled, as there were no EMAP stations within park boundaries.

The probabilistic sampling design utilized by the SCECAP studies is a good model for implementing BMI surveys (Van Dolah et al. 2002). This approach, modeled after the EMAP design, randomly selects a fixed number of stations each year, within an established area grid. Selection criteria include minimum water depth (e.g., 1 m), habitat classification (e.g., tidal creeks < 100 m wide), and the relative proportions of each habitat type (e.g., in SC, 17% tidal creeks vs. 83 % open water). Once baseline data are assembled, it is typically recommended that BMI surveys repeat every five years (Van Dolah, Sanger, & Filipowicz 2004; Jutte et al. 2005). Immediate post-event sampling is warranted when parks experience oil spills, acute pollutant discharges, major storm events, or dredging activities. Sampling should take place in mid-summer (June-Aug), because during this time, water quality variables are likely to be limiting, and important BMI and fishes utilize estuaries as nurseries (SCECAP 2007).

Both reference and potential impact sites should be included in the design, so as to detect changes in BMI communities (Van Dolah et al. 1999). Because of its location away from major shipping lanes and large population centers, FOFR could serve as an ideal reference site. Another possibility is to locate BMI sampling sites near stations already established for water-quality monitoring. Ideally, BMI surveys should be paired with surveys of sediment characteristics and toxicology (Van Dolah, Sanger, & Filipowicz 2004).

Recommended Partners for BMI Surveys

The training, knowledge, and equipment required to conduct BMI surveys is extensive, and it is recommended that the SECN contract with agencies and companies versed in BMI surveys (Table 12). Park managers should also seek out partnerships with their states' departments of natural resources/environmental protection, local universities, and federal agencies (e.g., USGS, NOAA) to include SECN parks in established sampling programs.

Table 12.
Recommended agencies and companies to survey BMI in the SECN.

Name	Division	State or Region	Contact Information
Barry Vittor Associates, Inc.	Corporate Headquarters	Nation-wide; extensive experience in the SAB	Barry A. Vittor, President (bvittor@bvaenviro.com) 8060 Cottage Hill Rd., Mobile, AL 36695 (251) 633-6100 http://www.bvaenviro.com/
Water & Air Research, Inc.	Biological Services	SAB	David L. Evans, Principal Scientist (devans@waterandair.com) 6821 SW Archer Road, Gainesville, FL 32608 (352) 372-1500x140 http://www.waterandair.com/index.htm
NOAA	NCCOS-Coastal Ecology Program	SAB	Jeff Hyland (Jeff.Hyland@noaa.gov) CCEHBR 219 Fort Johnson Road, Charleston, S.C. 29412-9110 (843) 762-8652 http://www.chbr.noaa.gov/
SCDNR	SERTC	SAB	David Knott (sertc.@dnr.sc.gov) Marine Resources Research Institute PO Box 12559, Charleston, SC 29422-2559 USA (843) 953-9098 http://www.dnr.sc.gov/marine/sertc/contact.htm
USEPA; Region 4 Office	National Coastal Assessment	CP	John Macauley (macauley.john@epa.gov) USEPA Environmental Effects Research Laboratory Gulf Ecology Division/ORD Sabine Island Drive, Gulf Breeze, FL 32561-5299 (850) 934-9353 http://www.epa.gov/ged/
UNCW	Benthic Ecology Laboratory	NC	Martin Posey (poseym@uncwil.edu) Center for Marine Science 601 S. College Road, Wilmington NC 28403, (910) 962-3470 http://www.uncw.edu/cmsr/benthic/
SCDNR	MRD-MRRI	SC	Robert F. Van Dolah, Director (vandolahr@dnr.sc.gov) Marine Resources Research Institute P.O. Box 12559, Charleston, South Carolina 29422-2559 (843) 953-9819 http://www.dnr.sc.gov/marine/mrri/mrri.htm
University of GA	MAREX	GA	Alan Power (alanpowr@uga.edu) University of Georgia, Marine Extension Service, Shellfish Research Laboratory 20 Ocean Science Circle, Savannah, GA 31411-1011 (912) 598-2348 http://www.shellfish.uga.edu/
University of Central FL	Department of Biology	FL	Linda J. Walters (ljwalter@pegasus.cc.ucf.edu) University of Central Florida 4000 Central Florida Blvd., Orlando, FL 32816-2368 (407) 823-2148 http://pegasus.cc.ucf.edu/~ljwalter/
University of FL	Department of Fisheries and Aquatic Sciences	FL GTM NERR (Advisor to PhD student N. Dix)	Edward J. Phlips (phlips@ufl.edu) 7922 NW 71st St., Gainesville, FL 32653 (352) 392-9617 ext. 248 http://fishweb.ifas.ufl.edu/Phlips/Phlips.htm

Current BMI Studies in the SECN Geographic Area

In the absence of regular BMI surveys commissioned by the SECN, it is recommended that data from the following studies be obtained, in order to estimate BMI abundances in similar habitats. In addition, it is recommended that park personnel become familiar with invasive BMI, and report observations to state and federal agencies

Integrative Assessments of Ecological Resources and Ecosystem Stressors at National Estuarine Research Reserves Sites (NERRS). Jeff Hyland, PI. NOAA/NOS/NCCOS

This project is a multi-institutional partnership among four NCCOS centers: Hollings Marine Laboratory (HML) and the Center for Coastal Environmental Health and Biomolecular Research (CCEHBR) in Charleston, SC; the Center for Coastal Monitoring and Assessment (CCMA) in Silver Spring, MD; and the Center for Coastal Fisheries and Habitat Research (CCFHR) in Beaufort, NC.

Four NERRS in the SECN region are included in this study: North Carolina, North Inlet/Winyah Bay (South Carolina), Ace Basin (South Carolina), and Sapelo Island (Georgia). The primary objectives of this study are two-fold: a tidal-creek assessment to determine the impacts of land use and attendant environmental stressors; and by means of a probabilistic monitoring program, provide a baseline ecological assessment of sub-tidal estuarine waters of NERRS sites.

A component of this study will include surveys of BMI from soft-bottom habitats. The tidal creek objective will focus on Sapelo Island, and the Masonboro Island site of North Carolina. The sub-tidal objective will focus on the four monitoring sites in North Carolina: Masonboro Island, Currituck Sound, Zeke Island, and Rachel Carson. These sites contain habitats that mirror many of those found throughout the SECN. Although no sampling is planned within SECN parks, data from this project will update and augment the earlier EMAP data. The final report is expected in March 2008, and BMI data will be archived in the NBI database.

SCECAP

The SCECAP studies utilized in this inventory continue under the umbrella of the NCA. This monitoring program measures water- and sediment-quality variables, and surveys BMI in tidal creek and open water habitats. Recently, the SCECAP data portal has been updated to include data from the 2003-2004 sampling seasons (http://www.dnr.sc.gov/marine/scecap/index.htm). In addition to providing information relevant to FOSU, SCECAP stations near the Savannah River will be useful for FOPU. Data from SCECAP are also included in the Oceans and Human Health Initiative (OHHI) programs conducted at through the NOAA Center of Excellence for Oceans and Human Health at HML (see below).

Ph. D Thesis Research, Ms. Nicole Dix (University of Florida; Edward J. Phlips, supervisor)

This project will be located in the GTM NERR, as a continuation of earlier studies of hurricane impacts on salinity and nutrient input to the reserve (Dix 2006). In addition to characterizing the flow of nutrients into waters of the St. Augustine and Fort Matanzas regions, a major focus will be to measure BMI abundance and community characteristics (N. Dix, pers. comm.) This project will be coordinated through the GTM reserve, and will be particularly significant for estimating BMI abundance in FOMA (see Table 19 for GTM contact information).

Oceans Human Health Initiative

In 2003, the Oceans and Human Health Act was passed, and mandated that NOAA establish Centers of Excellence in Oceans and Human Health among its NCCOS divisions. For the east coast, the Hollings Marine Laboratory (HML) was chosen to implement OHHI project goals (http://www.eol.ucar.edu/projects/ohhi/). Under the umbrella of HML, state, academic and federal partners in the Charleston, SC area have combined efforts to monitor and assess the condition of estuaries and oceans. Among the projects providing BMI data to the OHHI are SCECAP and the Tidal Creeks Program of HML. Historic and current data have been centralized, and will be made available through the OHHI data portal.

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Appendix A. BMI Abundance Data

Table A-1.
Benthic macroinvertebrate abundance (#/m^2) data for Carolinian Province stations at Cape Hatteras National Seashore collected under the Environmental Monitoring and Assessment Program.

Taxon	CP94_60	CP95_112	CP95_133	CP95_135	CP96_212	CP96_231	CP97_312	CP97_332
Acanthohaustorius millsi	0	0	10	125	0	0	0	0
Acteocina bidentata	0	0	0	0	0	0	1	0
Acteocina canaliculata	2.5	0	0	0	0	5	0	0
Ampelisca verrilli	0	0	0	0	0	0	1.5	0
Anadara transversa	0	0	1	0	0	0	0	0
Ancinus depressus	0	0	1	0	0	0	0	0
Ancistrosyllis jonesi	0	0	0	0	0	0	1	0
Apoprionospio pygmaea	0	0	0	0	0	7.5	0	0
Armandia agilis	0	0	0	0	0	4	0	0
Astarte nana	0	0	0	0	0	16	0	0
Balanoglossus spp.	0	0	0	0	0	2	0	0
Bivalvia	0	0	0	0	2	0	0	0
Bowmaniella floridana	0	0	0	0	0	0	0	2
Bowmaniella spp.	0	0	1	0	0	0	0	3
Brachyura	0	0	0	0	0	0	0	1
Branchiostoma caribaeum	0	0	1	0	0	0	0	0
Chiridotea almyra	0	0	0	0	0	0	0	1
Chiridotea spp.	0	0	0	0	0	0	0	2
Cyclaspis varians	1	0	0	0	0	0	0	0
Dispio uncinata	0	0	0	1	0	0	0	0
Donax variabilis	0	0	15.5	1.5	0	0	0	0
Echinoidea	0	0	0	1	0	0	0	0
Edotia triloba	0	1	0	0	0	1	2	0
Ensis directus	0	0	0	0	0	0	1	0
Eteone heteropoda	1	4.5	0	0	0	0	0	0
Gammarus palustris	0	45.5	0	0	0	0	0	0
Gastropoda	0	5	0	0	0	0	0	0
Glycera spp.	0	0	0	0	0	0	14	1
Glycinde solitaria	5.5	0	0	0	0	1	5	0
Goniadidae	0	0	0	0	0	1	0	0
Haminoea succinea	0	0	0	0	0	1	0	0
Harpacticoida	0	0	0	0	0	0	1	0
Heteromastus filiformis	1	1	0	0	2	0	0	0
Jaspidella jaspidea	0	0	1	0	0	0	0	0
Leitoscoloplos fragilis	0	0	0	0	0	1	0	0
Leitoscoloplos spp.	0	0	0	1	0	5.5	1	0
Lineidae	0	0	0	0	2	2	0	0
Listriella barnardi	0	0	0	0	0	0	1	0
Macoma balthica	0	0	0	0	0	0	114	0
Macoma mitchelli	5	0	0	0	0	0	0	0
Macoma tenta	0	0	0	0	0	3	4	0
Magelona spp.	0	0	3	0	0	0	0	0
Marenzelleria viridis	0	0	0	0	0	0	6	0
Mediomastus ambiseta	7.5	0	0	0	0	0	42	0
Mediomastus californiensis	0	0	0	0	0	0	2	1
Mediomastus spp.	0	0	0	0	13.5	2.5	312	0

Taxon	CP94_60	CP95_112	CP95_133	CP95_135	CP96_212	CP96_231	CP97_312	CP97_332
Monoculodes edwardsi	0	0	0	0	0	0	1	0
Mulinia lateralis	24	2.5	0	0	0	16	0	0
Mytilidae	0	3.5	0	0	1	0	0	0
Neanthes succinea	3	10	0	0	0	0	0	0
Nemertea	1	0	0	1	2	0	5.5	2
Nephtys picta	0	0	1	0	0	1.5	0	0
Nereididae	0	0	0	0	1	0	0	0
Nereiphylla fragilis	0	0	1	0	0	0	0	0
Oenonidae	0	0	1	0	0	0	0	0
Oligochaeta	75	0	0	0	0	0	0	0
Parahaustorius longimerus	0	0	5	5	0	0	0	4
Paraonidae	0	0	0	0	0	1	0	0
Paraonis fulgens	0	0	1	5	0	1	0	0
Paraprionospio pinnata	0	0	0	0	0	1	0	0
Parvilucina multilineata	0	0	0	0	0	0	4.5	0
Peloscolex heterochaetus	0	0	0	0	0	0	19	0
Phoronis spp.	0	0	0	0	0	1	18	0
Phyllodoce arenae	0	0	0	0	0	1	0	0
Phyllodoce mucosa	0	0	0	0	0	4	0	0
Phyllodocidae	0	0	0	0	1	0	0	0
Podocopa	0	4	0	0	0	0	0	0
Polinices duplicatus	0	0	0	0	0	0	1	0
Polydora cornuta	0	0	0	0	0	2	0	0
Polydora spp.	0	1	0	0	0	0	0	0
Protohaustorius wigleyi	0	0	1	43.5	0	0	0	0
Pseudoleptocuma minus	0	0	0	1	0	0	0	0
Rangia cuneata	0	0	0	0	1	0	0	0
Rictaxis punctostriatus	9	0	0	0	0	1	0	0
Schistomeringos rudolphi	0	1	0	0	0	0	0	0
Scolelepis texana	0	0	0	0	0	1	0	0
Scoloplos robustus	0	0	0	0	0	1	0	0
Scoloplos rubra	0	0	0	0	0	1	2	0
Spio pettiboneae	0	0	1	3	0	1	0	0
Spiochaetopterus costarum oculatus	0	0	0	0	0	1	1	0
Spionidae	0	0	0	0	0	1.5	0	0
Spiophanes bombyx	0	0	0	0	0	1	5	0
Spisula solidissima	0	0	0	0	0	1	0	0
Streblospio benedicti	14.5	1	0	0	8	26	21.5	0
Syllidae	0	0	1	0	0	2	0	0
Tagelus divisus	0	0	1	0	0	0	0	0
Tanaidacea	0	2	1	0	0	0	0	0
Tellina agilis	16	52	4	1	0	0	5	0
Tellina iris	0	0	0	0	0	8	0	0
Tellina spp.	0	0	0	0	2.5	0	5	0
Tellinidae	0	0	0	0	0	4	0	0
Tharyx acutus	0	0	0	0	0	1	0	0
Tubificidae	0	4	0	0	0	0	0	0
Tubulanus spp.	0	0	0	0	0	1	0	0
Turbellaria	0	0	0	0	0	0	1	1
Total	**166**	**138**	**51.5**	**189**	**36**	**132.5**	**598**	**18**

Table A-2.
Benthic macroinvertebrate abundance (#/m^2) data for Carolinian Province stations at Cape Lookout National Seashore collected under the Environmental Monitoring and Assessment Program.

Taxon	CP94_33	CP96_239	CP97_341
Acteocina canaliculata	21.5	47	0
Actiniaria	0	2	0
Aglaophamus verrilli	1	0	0
Ampelisca verrilli	6	0	0
Apoprionospio pygmaea	1.5	3	0
Bivalvia	0	5	0
Brachiopoda	0	1	0
Caecum pulchellum	0	10.5	0
Calanoida	0	0	3
Caulleriella spp.	1.5	1	0
Ceratonereis irritabilis	0	1	0
Cerithium spp.	0	7	0
Chaetognatha	2	0	3.5
Chione cancellata	0	1	0
Chiridotea coeca	0	0	1
Chiridotea spp.	0	0	1
Clymenella torquata	3	0	0
Dosinia discus	0	1	0
Ericthonius brasiliensis	0	1	0
Eulimastoma engonium	2	0	0
Exogone dispar	1	0	0
Galathowenia oculata	0	1	0
Gemma gemma	3.5	0	0
Glycera dibranchiata	1	0	0
Glycera spp.	0	0	4
Glycinde solitaria	1	0	0
Goniada littorea	2	1.5	0
Goniada maculata	0	1	0
Gyptis spp.	0	0	3
Haminoea solitaria	1	0	0
Haminoea succinea	0	6	0
Harpacticoida	0	0	4
Hesionura elongata	0	0	19
Leitoscoloplos spp.	0	1	0
Leptosynapta tenuis	6	1	0
Lineidae	0	1.5	0
Listriella barnardi	1	2	0
Listriella clymenellae	4.5	0	0
Lumbriculidae	0	0	34
Mediomastus ambiseta	10.5	0	0
Mediomastus spp.	0	3	0
Melinna maculata	0	1	0
Nemertea	2	1.5	5
Nephtys picta	2	2	0
Notomastus spp.	0	1	0
Oligochaeta	0	5	0
Owenia fusiformis	0	1	0
Pagurus spp.	0	0	3

Taxon	CP94_33	CP96_239	CP97_341
Paramphinome spp.	0	0	2
Paraprionospio pinnata	0	2	0
Parvilucina multilineata	1.5	11	0
Phascolion strombi	0	1.5	0
Prionospio heterobranchia	0	2	0
Rhepoxynius hudsoni	2	0	0
Saccocirrus spp.	0	0	4
Saccoglossus kowalevskii	1	0	0
Scolelepis texana	1	0	0
Sipuncula	1	0	0
Spiochaetopterus costarum oculatus	0	1	0
Streblospio benedicti	9	1	0
Tectonatica pusilla	0	1	0
Tellina agilis	4	5	0
Tellina spp.	0	2	0
Tellinidae	0	8	0
Tharyx acutus	0	1.5	0
Tubificidae	0	0	3
Turbellaria	0	0	2
Turbonilla interrupta	1	1	0
Veneridae	0	1	0
Total	**94.5**	**148**	**91.5**

Table A-3.
Benthic macroinvertebrate abundance (#/m^2) data for Carolinian Province stations at Canaveral National Seashore collected under the Environmental Monitoring and Assessment Program.

Taxon	CP93_24	CP94_12	CP94_13	CP94_14	CP95_175
Aberrantidae	0	0	1	0	0
Acteocina canaliculata	1	4.5	2	1	4
Actiniaria	0	0	0	0	10
Alpheus normanni	0	0	0	1	0
Americhelidium americanum	0	0	0	0	1
Ampelisca abdita	0	105	2	0	1.5
Ampelisca vadorum	0	24	1	0	0
Amphioplus thrombodes	0	0	0	1	1
Amphipholis squamata	0	1	4	1	2
Amphiporidae	0	0	0	1	0
Amphiuridae	0	0	0	0	1
Amygdalum papyrium	2	17	8.5	1	0
Anthozoa	2	1	1	0	0
Arenicola cristata	2	0	0	0	0
Aricidea fragilis	2	0	0	0	2.5
Aricidea philbinae	3	0	0	0	0
Astyris lunata	1.5	2	2	0	1
Asychis spp.	0	0	0	6	0
Augeneriella spp.	0	0	0	9	0
Axiothella mucosa	4	0	0	1	0
Bowerbankia gracilis	0	0	0	1	0
Brachidontes exustus	10	1	9.5	0	0
Branchiomma spp.	0	0	7	12	0
Caecum pulchellum	0	36.5	98	36.5	1
Caecum regulare	6	0	0	0	0
Callipallene brevirostris	0	0	2	0	0
Capitella capitata	27.66	2	4	0	0
Capitellides jonesi	0	0	3	0	0
Carinomidae	0	0	0	3	0
Cerapus benthophilus	0	2	0	0	0
Cerapus spp.	0	0	0	0	1
Cerithium muscarum	0	0	0	1	1
Cerithium spp.	1	0	0	0	0
Chaetognatha	0	1	1	0	0
Chione cancellata	2	1	1.5	0	4.5
Chone spp.	0	0	2	0	5
Conopeum tenuissimum	0	0	1	0	0
Corophium acherusicum	0	5	0	0	0
Corophium baconi	0	6	70	4.5	0
Crepidula convexa	0	1	0	0	0
Crepidula spp.	0	0	1	0	0
Cyclaspis varians	0	10	1	0	0
Cymadusa compta	0	0	0	16	0
Dasybranchus spp.	0	0	0	0	1
Demonax microphthalmus	0	0	4	1	0
Demonax spp.	0	0	2	0	0
Diopatra cuprea	1	3	8	1	9.5
Dynamenella spp.	0	1	1	8	0

Taxon	CP93_24	CP94_12	CP94_13	CP94_14	CP95_175
Edotia triloba	0	2	0	0	0
Emplectonematidae	0	6	5.5	0	0
Epitonium spp.	0	1	0	0	0
Erichsonella attenuata	5	0	0	0	0
Ericthonius brasiliensis	0	47	18.5	0	8
Erycina spp.	0	2	3	1	2
Eulimastoma spp.	0	1	2	0	0
Eunicidae	1	0	0	0	0
Exogone dispar	0	0	0	1	0
Fabricola trilobata	0	0	0	13.5	1
Gitanopsis tortugae	0	0	4	3	0
Glycera americana	0	0	1	0	4
Glycinde solitaria	0	1.5	1.5	0	2.5
Grandidierella bonnieroides	0	4.5	3	71	10
Haminoea succinea	0	0	1	0	2.5
Hesionidae	0	0	1	0	0
Idoteidae	1	0	0	0	0
Kinbergonuphis simoni	2	4.5	1	0	5.5
Laevicardium mortoni	0	1.5	1	0	0
Leptochelia spp.	0	1	0	0	0
Leptosynapta crassipatina	0	0	0	3	0
Leptosynapta tenuis	0	1	0	0	0
Limnodriloides barnardi	0	1	0	0	0
Limnodriloides rubicundus	0	3	8	0	0
Lineidae	0	0	0	0	1
Listriella barnardi	0	2	2.5	0	2
Lysianopsis alba	0	1	5	116	1
Maldanidae	5	0	0	0	0
Malmgreniella spp.	0	0	0	0	1
Marphysa sanguinea	0	0	0	1	0
Mediomastus ambiseta	0	2	9.5	1.5	2.5
Mediomastus spp.	5	6	8	0	3
Melinna maculata	0	0	0	1	3
Molgula occidentalis	0	0	1	2	0
Mooreonuphis spp.	0	0	0	0	4
Mulinia lateralis	0	7	1.5	0	0
Mysidopsis bigelowi	0	2	0	0	0
Mysidopsis spp.	0	0	0	0	1
Nassarius vibex	2	4	2	0	1
Nemata	0	1	1	1	0
Nemertea	4	0	0	0	0
Nereididae	0	0	1	0	1
Nereiphylla spp.	0	1.5	1	0	0
Notomastus hemipodus	0	0	1	0	0
Nucula annulata	1	0	0	0	0
Nucula proxima	0	0	1	0	2.5
Nudibranchia	1	0	0	0	0
Odontosyllis enopla	0	0	2	0	0
Odontosyllis spp.	0	0	2	0	0
Odostomia spp.	0	3	1	0	0
Oligochaeta	13.33	0	0	0	0
Onuphidae	0	0	2	0	0
Ophiactis spp.	0	0	0	30	0
Ophiophragmus filograneus	1	4	2.5	0	1

Taxon	CP93_24	CP94_12	CP94_13	CP94_14	CP95_175
Ophiurida	1	0	0	0	0
Oxyurostylis smithi	0	48.5	9	0	6.5
Pagurus maclaughlinae	0	0	1	0	0
Parahesione luteola	0	1	7	3	0
Paraprionospio pinnata	0	0	1	0	6
Pectinaria gouldi	1	13	58	0	6
Phascolion strombi	0	4.5	12	0	11
Phoronis architecta	0	14	19.5	1	125
Phoronis spp.	11.33	0	0	0	0
Pista palmata	0	1	1.5	0	6
Platynereis dumerilii	0	0	0	0	1
Podarke obscura	1	1	2.5	1.5	1
Podarke spp.	0	0	0	0	1
Podarkeopsis levifuscina	0	0	0	2	2
Polydora cornuta	2	0	33	9	0
Polydora socialis	1	0	0	0	1
Porifera	0	1	1	4	1
Prionospio heterobranchia	3	5	2	0	2.5
Prionospio perkinsi	4.5	0	2	0	0
Prionospio spp.	0	1	0	0	0
Prunum apicinum	0	0	0	1	1
Pyramidella crenulata	1.5	0	0	0	0
Pyramidellidae	0	0	8.5	0	0
Rictaxis punctostriatus	0	3	1	0	0
Schistomeringos rudolphi	0	0	0	6	0
Scolelepis texana	6	0	10.5	1	5
Scoloplos rubra	1	2	2.5	0	1.5
Sipuncula	2.33	0	0	0	0
Spiochaetopterus costarum oculatus	1.66	1.5	8	1	1.5
Streblosoma hartmanae	0	0	0	4	0
Streblospio benedicti	0	0	1	4	0
Syllidae	0	0	5	0	0
Syllis spp.	0	1	1	6	5
Tellina spp.	1	0	0	0	0
Tellina versicolor	0	1	2.5	0	1
Tharyx dorsobranchialis	0	0	0	6	1
Tubificidae	0	1	2.5	3	1
Tubulanidae	0	1	4.5	0	0
Turbellaria	3	0	0	0	0
Turridae	1	0	0	0	0
Veneridae	1	0	0	0	0
Total	**149.81**	**435**	**528.5**	**403.5**	**293.5**

Table A-4.
Benthic macroinvertebrate abundance (#/m^2) data for Carolinian Province stations at Cumberland Island National Seashore collected under the Environmental Monitoring and Assessment Program.

Taxon	CP94_19	CP94_20	CP95_169
Abra aequalis	0	4	1
Alpheus spp.	1	0	0
Amastigos spp.	0	4	0
Ampelisca spp.	0	3	2
Ampelisca vadorum	3	0	0
Ampharetidae	0	1	0
Amphipholis squamata	1	0	0
Anadara transversa	1	0	8
Ancistrosyllis carolinensis	0	1	0
Anthozoa	20	2	0
Aphelochaeta marioni	0	1	0
Apseudes spp.	1	0	0
Arabella iricolor	0	1	2
Aricidea fragilis	0	1	1.5
Armandia maculata	1	0	0
Astyris lunata	0	0	5
Autolytus spp.	1	0	0
Balanus spp.	139.5	0	0
Balanus venustus	2	0	0
Barbatia spp.	0	0	23
Batea catharinensis	7	11	7
Biffarius biformis	0	1	0
Bivalvia	0	2	2
Boccardiella hamata	1	0	0
Boguea enigmatica	1	0	0
Brania wellfleetensis	7	0	0
Bugula neritina	1	1	0
Callianassidae	0	1.5	3
Caprellidae	0	0	6
Carinomidae	1	0	2.5
Caulleriella spp.	12	0	0
Cerapus tubularis	0	0	1
Cheilostomata	1	0	0
Chiridotea spp.	0	0	5
Cirratulidae	2	0	0
Clymenella torquata	0	3.66	0
Conopeum tenuissimum	1	0	0
Corbula contracta	0	1	0
Corbula swiftiana	2	0	0
Corophiidae	2	0	0
Corophium spp.	0	1	0
Costoanachis avara	0	0	6
Crassinella lunulata	1.5	0	0
Crassostrea virginica	0	1	0
Crepidula spp.	1	0	0
Ctenostomata	1	0	0
Diopatra cuprea	1	0	2
Doridella obscura	0	1	0

Taxon	CP94_19	CP94_20	CP95_169
Ectoprocta	0	0	1
Edotia triloba	0	1	0
Elasmopus laevis	3	0	0
Emplectonematidae	1	0	0
Entoprocta	1	0	0
Eobrolgus spinosus	2	0	0
Euceramus praelongus	1	0	0
Eumida sanguinea	4	0	0
Exogone dispar	9	0	27
Glycera americana	0	0	2
Glycera spp.	0	1.5	0
Glycinde solitaria	0	0	1
Glycinde spp.	0	2	0
Haplosyllis spp.	1	0	0
Hemipholis elongata	2	3.5	0
Hydrozoa	1	0	0
Kupellonura spp.	1	0	0
Leitoscoloplos fragilis	0	2	0
Lepidonotus sublevis	0	1.5	0
Leptochela serratorbita	1	1	0
Leptosynapta tenuis	0	1	0
Leucon americanus	0	1	0
Lineidae	1	0	0
Linopherus paucibracnchiata	1	0	0
Lioberus castaneus	1	0	0
Listriella barnardi	0	1	0
Listriella clymenellae	0	7	0
Loimia medusa	1	0	0
Loimia viridis	0	2	0
Lumbrineris tenuis	0	4	7
Magelona phyllisae	0	2	0
Maldanidae	0	2.75	0
Malmgreniella spp.	0	3.25	0
Mediomastus ambiseta	1	0	2
Mediomastus californiensis	0	0	12
Mediomastus spp.	0	1.33	21
Membranipora aborescens	1	0	0
Membranipora tuberculata	1	0	0
Micropholis gracillima	0	24.5	0
Modiolus modiolus squamosus	3	0	0
Nassarius acutus	0	2.25	0
Nassarius trivittatus	0	1	0
Natica pusilla	0	1	0
Neanthes spp.	4	0	0
Neanthes succinea	2	10.25	3
Nemata	1	0	8
Nemertea	0	6	1.5
Nereiphylla spp.	0	0	1
Nereis micromma	11.5	1.5	0
Noetia ponderosa	1	0	0
Nucula proxima	15	6	0
Odontosyllis spp.	0	0	8
Odostomia laevigata	0	1	0
Oligochaeta	0	1	17

Taxon	CP94_19	CP94_20	CP95_169
Ophiophragmus filograneus	1	0	0
Ophiurida	0	0	20
Ostrea equestris	2	0	0
Oxyurostylis smithi	0	1.5	0
Paguridae	0	0	1
Pagurus annulipes	1	0	0
Pagurus pollicaris	1	0	0
Pagurus spp.	0	1	0
Panopeus herbstii	2	0	0
Parapionosyllis longicirrata	0	0	3
Paraprionospio pinnata	0	1.33	1
Parvanachis obesa	0	1.5	0
Pectinaria gouldi	0	1	0
Petricolaria pholadiformis	0	1	0
Phoronis architecta	0	4.33	0
Phyllodoce arenae	0	2.5	0
Phyllodocidae	1	0	0
Pinnixa sayana	0	3.66	0
Pinnixa spp.	0	0	2
Pinnotheridae	1	0	0
Podarke spp.	1.5	0	0
Podarkeopsis levifuscina	0	1	2
Podocopa	0	1	1
Polychaeta	0	3	0
Polycirrus spp.	14	0	0
Polydora barbilla	2	0	0
Polydora cornuta	1	0	0
Polydora socialis	1	0	0
Polydora spp.	4	1	1
Polygordius spp.	1	0	0
Porifera	1	0	0
Potamilla spp.	2	0	0
Prionospio cristata	8	0	0
Prionospio perkinsi	1	2	0
Proceraea cornuta	0	0	1
Pycnogonidae	0	0	2
Pyramidellidae	0	0	1
Sabellaria floridensis	1	0	0
Sabellaria spp.	1.5	0	0
Sabellaria vulgaris	4	40.25	1
Saccoglossus kowalevskii	0	1	0
Schistomeringos rudolphi	0	0	1
Schizoporella unicornis	1	0	0
Sclerodactyla briareus	0	0	1
Seila adamsi	1	0	0
Sigambra tentaculata	0	1.5	3
Sphenia antillensis	4	0	42
Spiochaetopterus costarum oculatus	0	1	1
Spionidae	0	1	1
Spiophanes bombyx	2.5	1	0
Spiophanes missionensis	0	1.5	0
Sthenelais boa	1	0	0
Sthenelais limicola	0	1	0
Streblospio benedicti	0	0	4

Taxon	CP94_19	CP94_20	CP95_169
Streptosyllis pettiboneae	3	0	0
Streptosyllis spp.	3	0	0
Syllidae	7	0	0
Syllides floridanus	1	0	0
Syllis gracilis	1	0	0
Tectidrilus spp.	1	0	0
Tellina spp.	0	0	6
Tellina texana	0	3.5	0
Tellina versicolor	1	0	0
Terebra concava	0	1	0
Thalassinidea	0	0	1
Tharyx dorsobranchialis	0	10	0
Tharyx spp.	0	0	3
Tubificidae	2	0	0
Tubulanidae	4.5	0	0
Turbellaria	0	3.33	0
Turridae	0	0	1
Unciola spp.	2	0	0
Veneroida	0	2.75	0
Xanthidae	0	0	1
Total	**371.5**	**229.14**	**289.5**

Table A-5.
Benthic macroinvertebrate abundance (#/m^2) data for Carolinian Province stations at Fort Frederica National Monument.

Taxon	CP94_21	CP95_167	CP95_168
Abra aequalis	2	0	0
Acteocina canaliculata	0	0	1
Actiniaria	0	0	1
Alpheus heterochaelis	1	0	0
Amastigos spp.	1	0	0
Ampelisca spp.	17.33	0	0
Ampelisca vadorum	6.66	0	0
Ampharete americana	1	0	0
Amphiuridae	1	0	0
Anadara spp.	2	0	0
Anthozoa	6.66	0	0
Aphelochaeta marioni	1.5	0	0
Aphelochaeta spp.	0	1	0
Arabella iricolor	2	0	0
Arabella mutans	2	0	0
Aricidea fragilis	1	0	0
Bivalvia	6.5	0	0
Bowmaniella spp.	1	0	0
Brachidontes exustus	1.5	0	0
Brania spp.	1	0	0
Bugula spp.	1	0	0
Capitellidae	2	0	0
Cerapus tubularis	1	0	0
Cirrophorus branchiatus	1	0	0
Clymenella torquata	1.5	0	0
Corbula contracta	1	1	1
Corophium spp.	1	0	0
Cyathura burbancki	1	0	0
Drilonereis longa	0	1	0
Edotia triloba	3	0	0
Enoplobranchus sanguineus	3	0	0
Eteone heteropoda	2	0	0
Eteone lactea	0	1	0
Eumida sanguinea	1	0	0
Eupolymnia spp.	1	0	0
Exogone dispar	25.33	0	0
Glycera americana	3	0	0
Glycera spp.	1	0	0
Glycinde nordmanni	0	0	2
Glycinde solitaria	0	1	0
Hemipholis elongata	5.5	0	0
Heteromastus filiformis	0	2	0
Hexapanopeus angustifrons	1.5	0	0
Hiatella arctica	3	0	0
Hydroides dianthus	1	0	0
Leitoscoloplos spp.	1	0	0
Lepidasthenia commensalis	2.66	0	0
Lepidonotus sublevis	1.5	0	0

Taxon	CP94_21	CP95_167	CP95_168
Leptosynapta tenuis	1	0	0
Leucon americanus	3	0	0
Linopherus ambigua	4	0	0
Listriella barnardi	2	0	0
Listriella clymenellae	1	0	0
Loimia viridis	1	0	0
Lumbrineris tenuis	17.5	0	0
Macoma balthica	0	1	0
Maldanidae	2	0	0
Marphysa sanguinea	1	0	0
Mediomastus ambiseta	0	1	0
Mediomastus spp.	21.33	2	0
Micropholis gracillima	6	0	0
Monoculodes spp.	0	0	1
Neanthes succinea	1	0	0
Nemata	31.33	3	0
Nemertea	6.33	0	0
Nereis riisei	1	0	0
Nucula proxima	2.33	0	0
Odontosyllis spp.	5.33	0	0
Oligochaeta	116.33	39	6
Orbiniidae	1	0	0
Ostreidae	2	0	0
Paracaprella tenuis	1	0	0
Parapionosyllis longicirrata	6	0	0
Paraprionospio pinnata	0	1	4
Petricolaria pholadiformis	1	0	0
Phyllodoce arenae	1	0	0
Phyllodocidae	1	0	0
Pinnixa sayana	1	0	0
Podarkeopsis levifuscina	3	2.5	0
Podocopa	5.33	0	0
Polychaeta	1	0	0
Polycirrus carolinensis	7	0	0
Polycirrus spp.	1	0	0
Polydora socialis	1.5	0	0
Potamilla spp.	1	0	0
Prionospio perkinsi	1	0	0
Pyrgocythara plicosa	2	0	0
Sabellaria vulgaris	19.33	0	0
Saccoglossus kowalevskii	1	0	0
Scoloplos rubra	0	66	2
Sigambra tentaculata	5	1	0
Sphaerosyllis spp.	0	1	0
Spionidae	1	0	0
Streblosoma hartmanae	3	0	0
Streblospio benedicti	7.66	13	0
Syllidae	3	0	0
Syllides spp.	0	1	0
Syllis cornuta	3	0	0
Syllis ferrugina	9	0	0
Tellina spp.	0	0	1
Tellina texana	1	0	0
Thalassinidea	0	1	0

Taxon	CP94_21	CP95_167	CP95_168
Tharyx killariensis	12	0	0
Tharyx spp.	1	0	1
Thelepus setosus	6	0	0
Unciola serrata	3	0	0
Total	**455.44**	**139.5**	**20**

Table A-6.
Benthic macroinvertebrate abundance (#/m^2) data for Carolinian Province stations at Fort Pulaski National Monument.

Taxon	CP94_27	CP95_161	CP95_162	CP95_163
Actiniaria	0	0	0	17
Alpheus normanni	0	0	0	1
Americhelidium americanum	1	0	0	0
Ampelisca vadorum	0	0	0	1
Aphelochaeta spp.	0	0	0	3
Arabella iricolor	0	0	0	1
Aricidea wassi	3.5	1	0	0
Batea catharinensis	0	0	0	70
Bivalvia	0	0	0	1
Callianassidae	0	0	0	1
Caridea	0	0	0	1
Carinomidae	0	0	0	6
Caulleriella spp.	0	10	0	7.5
Chiridotea almyra	0	0	3	0
Cirratulidae	0	0	0	6
Cirrophorus branchiatus	1	0	0	0
Cirrophorus spp.	0	2	0	0
Corbula barrattiana	0	0	0	2
Corbula contracta	0	0	0	2
Cyathura burbancki	0	0	0	16
Ectoprocta	0	0	0	2
Exogone dispar	0	0	0	1.5
Glycera americana	1	1	0	1
Glycinde solitaria	0	0	0	3
Gorgonacea	0	0	0	1
Hemipholis elongata	0	0	0	2
Heteromastus filiformis	5	7	0	1
Hexapanopeus angustifrons	0	0	0	1
Hiatella arctica	1	0	0	0
Leitoscoloplos foliosus	1	0	0	0
Lumbrineris tenuis	0	1	0	10.5
Maera caroliniana	0	0	0	1
Mediomastus ambiseta	0	0	0	5
Mediomastus californiensis	0	0	0	2
Mediomastus spp.	0	2	0	11
Microphthalmus fragilis	0	4	0	0
Monoculodes spp.	0	0	1	0
Mooreonuphis pallidula	0	1	0	0
Neanthes succinea	0	11	0	0
Nemata	0	11.5	0	24
Nemertea	1	6	4	2
Nephtys bucera	0	2	0	0
Nephtys picta	0	2	0	0
Odontosyllis spp.	0	3	0	0
Oligochaeta	3	214	4.5	82.5
Ophiurida	0	0	0	3
Paraonidae	5	0	0	0
Parapionosyllis longicirrata	0	57	0	6

Taxon	CP94_27	CP95_161	CP95_162	CP95_163
Paraprionospio pinnata	0	6	0	0
Pinnixa spp.	0	0	0	1
Podarkeopsis levifuscina	0	1	0	4
Podocopa	0	0	0	1
Polydora spp.	0	1	0	10
Prionospio perkinsi	0	0	0	6
Prionospio spp.	0	0	0	3.5
Proceraea cornuta	0	0	0	1
Sabellaria vulgaris	0	0	0	1
Sclerodactyla briareus	0	0	0	3
Scoloplos rubra	0	7	0	1
Sphaerosyllis spp.	0	0	0	5
Sphenia antillensis	0	0	0	3
Spionidae	0	1	0	0
Spiophanes bombyx	1	0	0	0
Streblospio benedicti	0	3	0	159
Streptosyllis pettiboneae	4	0	0	0
Streptosyllis spp.	0	28	0	0
Syllides spp.	0	4	0	0
Synalpheus spp.	0	0	1	0
Tagelus divisus	0	0	0	1
Tellina agilis	0	0	0	7
Tellina spp.	0	0	0	9.5
Tharyx dorsobranchialis	0	0	0	9
Tharyx killariensis	1	0	0	0
Tharyx spp.	0	1	0	1
Xanthidae	0	0	0	1
Total	**28.5**	**387.5**	**13.5**	**522**

Table A-7.
Benthic macroinvertebrate abundance (#/m^2) data for Carolinian Province stations at Cumberland Island National Seashore collected under the South Carolina Estuarine Monitoring and Assessment Program.

Taxon	RO026011	RO046061	RT022152	RT042063
Actiniaria	0	0	13	0
Aegathoa medialis	0	0	0	0.5
Ampelisca abdita	0	0	0	0.5
Bivalvia	0	1.5	0	1.5
Brania spp.	8	0	0	0
Campylaspis affinis	0	0	1	0
Carinomella lactea	0	1	0	0
Caulleriella spp.	7	0	0	0
Cirratulidae	20	0	0	0.5
Cleantis planicauda	0	0	1	0.5
Corophium simile	0	0	0	1.5
Corophium spp.	0	0	1	0
Decapoda	0	0	0	0.5
Edotia triloba	0	0	3	6
Enchytraeidae	15	0	0	0
Eteone heteropoda	1	0	0	0
Eteone lactea	0	0	0	0.5
Glycinde solitaria	0	1.5	0	0
Heteromastus filiformis	0	0	1	4
Isopoda	0	0	0	1
Lasaeidae	0	0	1	0
Leitoscoloplos fragilis	1	0	0	0
Lepidactylus dytiscus	4	0	0	0
Leucon americanus	0	10	0	0
Mediomastus spp.	0	5	0	0
Melita nitida	0	0	2	12.5
Monoculodes edwardsi	0	0.5	0	0
Mulinia lateralis	0	1.5	0	0
Nematoda	0	0	0	0.5
Nemertea	27	1.5	2	0
Neomysis americana	0	0	0	1
Neopanope sayi	0	0	0	2.5
Nereis succinea	0	0	17	34.5
Ogyrides alphaerostris	0	2.5	0	0
Panopeus herbstii	0	0	0	0.5
Paracaprella tenuis	0	0	1	0
Paraonis fulgens	1	0	0	0
Parapionosyllis spp.	495	0	0	0
Paraprionospio pinnata	0	29.5	0	0
Polydora cornuta	1	0	0	2.5
Polydora socialis	0	0	0	6
Scolelepis texana	1	0	0	0
Sigambra tentaculata	0	0.5	0	0
Streblospio benedicti	23	3	2	65
Streptosyllis spp.	106	0	0	0
Tellina agilis	1	0	0	0
Tellinidae	0	0.5	0	0
Tharyx acutus	79	0	0	0.5

Taxon	RO026011	RO046061	RT022152	RT042063
Tubificoides brownae	0	22.5	0	0
Tubificoides heterochaetus	0	0	0	4
Tubificoides wasselli	7	0.5	0	0
Websterinereis tridentata	0	0	0	2.5
Total	**797**	**81.5**	**45**	**149**

Table A-8.
Environmental Monitoring and Assessment Program (EMAP) data for FOSU. Benthic macroinvertebrate abundance (#/m^2).

Taxon	CP94_79	CP95_153	CP95_154
Abra aequalis	0	6	0
Acteocina canaliculata	0	4	3
Ampelisca spp.	0	1.5	1
Ampelisca verrilli	0	2.5	0
Ancistrosyllis commensalis	0	0	2
Aoridae	0	1	0
Aphelochaeta spp.	0	0	3
Balanus spp.	1	0	0
Bivalvia	0	3	1
Brania wellfleetensis	0	4.5	0
Carinomidae	0	1.5	3
Cirrophorus spp.	0	1	0
Corbula contracta	0	1	0
Corbula spp.	0	1	0
Cumacea	0	0	1
Cyathura burbancki	0	1	0
Cyrtopleura costata	0	0	4
Eteone lactea	0	0	1
Eteone spp.	0	0	1
Gammarus palustris	0	1	0
Gastropoda	1	0	1
Glycinde solitaria	1	6	1
Goniada littorea	0	1	0
Goniadidae	0	2	0
Heteromastus filiformis	0	0	1
Leitoscoloplos spp.	0	5	3.5
Leucon americanus	3	0	4
Listriella barnardi	0	4	0
Loimia medusa	0	1	0
Lumbrineris tenuis	0	0	4
Magelona phyllisae	1	0	0
Maldanidae	0	0	1
Mediomastus ambiseta	0	13	9
Mediomastus spp.	5	3	1
Micropholis gracillima	0	1.5	1
Microphthalmus spp.	0	1	0
Monoculodes spp.	0	1	0
Nassarius acutus	1	1	0
Nemata	0	23	0
Nemertea	8	5.5	0
Neomysis americana	1	0	0
Nucula proxima	0	12	0
Ogyrides alphaerostris	3.5	0	3
Oligochaeta	9	22.5	2
Ophiurida	0	2.5	0
Owenia fusiformis	0	1	0
Paraprionospio pinnata	29	0	6.5
Parvilucina multilineata	0	2	0

Taxon	CP94_79	CP95_153	CP95_154
Pinnixa spp.	2	7	0
Podocopa	0	1	0
Polydora cornuta	0	2	1
Polydora spp.	0	6	0
Prionospio perkinsi	3.5	0	0
Scoloplos rubra	0	1	1
Sigambra tentaculata	2	0	0
Sipuncula	0	1	0
Streblospio benedicti	0	92	13.5
Tellina agilis	0	32	0
Thalassinidea	0	0	1
Tharyx spp.	0	6	1
Turbonilla spp.	0	1	0
Total	**71**	**286**	**75.5**

Table A-9.
South Carolina Estuarine Monitoring and Assessment Program (SCECAP) data for FOSU. Benthic macroinvertebrate abundance (#/m^2).

Taxon	RO00033	RO01129	RO026026	RO036044	RO99322
Abra aequalis	0	6	0	0.5	0
Acteocina canaliculata	0	0	0	1.5	0
Actiniaria	2	18	0	0	0
Aglaophamus verrilli	0	0	2	0	0
Aligena elevata	0	0	0	1	0
Ampelisca abdita	0	0	5	6	6
Ampelisca macrocephala	0	0	1	0	0
Ampelisca vadorum	0	2	0	0	0
Ampelisca verrilli	12	0	0	0	0
Amphiodia pulchella	0	0	0	42	0
Anadara transversa	0	7	0	0	0
Ancistrosyllis spp.	0	4	0	0	0
Aphelochaeta spp.	0	0	0	6	0
Araneae	0	0	0	0.5	0
Astyris lunata	0	2	0	0	0
Batea catharinensis	0	0	0	1.5	0
Bhawania heteroseta	0	2	1	0	0
Biffarius biformis	0	0	6	0	0
Bivalvia	1	3	0	0	0
Brania spp.	0	1	0	0	0
Caecum spp.	0	0	1	0	0
Caprella spp.	0	0	0	1	0
Carazziella hobsonae	0	0	0	1	0
Carinomella lactea	11	0	5	6	11
Caulleriella spp.	0	0	1	0	0
Cerapus tubularis	0	0	2	0	0
Cirratulidae	0	1	0	17.5	0
Cirrophorus spp.	55	0	0	0	0
Corbula contracta	0	1	0	0	0
Corophium acherusicum	0	0	0	1	0
Corophium simile	0	1	0	0	0
Costoanachis avara	0	0	0	0.5	0
Crassinella lunulata	0	0	1	0	0
Crepidula fornicata	0	0	0	0.5	0
Crepidula plana	0	4	0	0	0
Cryptostrea permollis	0	2	0	0	0
Cyathura burbancki	11	0	0	0	0
Diopatra cuprea	0	1	0	0	0
Drilonereis longa	0	1	0	0	0
Dulichiella appendiculata	0	0	0	1.5	0
Ericthonius brasiliensis	0	0	0	6	0
Eteone heteropoda	0	0	1	0	0
Eulalia sanguinea	0	4	0	0	0
Eupleura caudata	0	0	0	0.5	0
Eurythoe spp.	0	0	1	0	0
Exogone spp.	8	0	1	0.5	0
Galaeommatoidea	0	0	0	50	0
Gammarus palustris	0	2	0	0	0

Taxon	RO00033	RO01129	RO026026	RO036044	RO99322
Glycera americana	10	5	0	4	2
Glycera dibranchiata	0	1	0	0	0
Glycinde solitaria	0	1	9	1	0
Harmothoe spp.	0	0	0	0.5	0
Hauchiella spp.	0	0	0	2.5	0
Hemipholis elongata	0	0	1	0	0
Holothuroidea	0	1	0	0	0
Hydroides dianthus	0	1	0	0	0
Hydroides microtis	0	1	0	0	0
Lasaeidae	0	0	2	0	0
Leitoscoloplos fragilis	0	0	2	2	0
Lepidonotus sublevis	0	8	0	0	0
Leptochela serratorbita	0	0	2	0	0
Limnoria tripunctata	0	1	0	0	0
Lirophora latilirata	0	0	0	5	0
Listriella clymenellae	0	0	24	1	0
Lumbrineris tenuis	13	0	0	33	0
Lysianopsis alba	0	4	0	0	0
Lysidice ninetta	0	1	0	0.5	0
Magelona spp.	0	0	1	0	0
Maldanidae	0	0	9	0	0
Martesia striata	0	3	0	0	0
Mediomastus ambiseta	14	0	40	0	9
Mediomastus californiensis	55	54	0	0	0
Mediomastus spp.	149	0	61	0.5	12
Minuspio cirrifera	0	8	0	10	0
Mulinia lateralis	0	1	0	0	0
Nassarius acutus	0	0	2	0	0
Nematoda	0	0	0	1	0
Nemertea	1	6	3	0	2
Neopanope sayi	0	0	1	0	0
Nephtys picta	0	0	1	0	0
Nereis succinea	0	7	0	0.5	0
Notomastus latericeus	0	0	0	1.5	0
Notomastus lobatus	0	0	0	1	0
Nucula spp.	2	0	18	0	0
Ophiuroidea	0	3	2	0	0
Orbiniidae	0	0	0	0.5	0
Ostracoda	0	0	0	1	0
Pagurus longicarpus	0	0	1	0	0
Palaemonetes vulgaris	0	1	0	0	0
Panopeus herbstii	0	3	0	0	0
Parapionosyllis spp.	1	2	0	0	0
Paraprionospio pinnata	0	0	0	4	78
Phoronida	0	1	0	5	0
Phyllodoce arenae	0	0	4	1	0
Phyllodocidae	0	1	0	0	0
Pinnixa spp.	21	0	40	0	0
Pinnotheridae	0	0	0	0.5	0
Piromis roberti	0	1	0	0.5	0
Platyhelminthes	0	1	1	0	0
Podarke obscura	0	2	0	0	0
Podarkeopsis levifuscina	1	6	1	1	0
Polydora cornuta	143	0	0	5.5	0

Taxon	RO00033	RO01129	RO026026	RO036044	RO99322
Polydora socialis	0	5	0	3	0
Polyodontes lupina	0	0	1	0	0
Potamilla reniformis	0	0	0	1	0
Prionospio spp.	2	0	0	0	0
Processa spp.	0	0	0	0.5	0
Renilla reniformis	0	0	3	0	0
Rhepoxynius hudsoni	0	0	1	0	0
Sabella microphthalma	0	6	0	0	0
Sabellaria vulgaris	0	6	0	0	0
Scolelepis spp.	0	1	0	0	0
Scoloplos rubra	6	0	0	1	1
Sphenia antillensis	0	1	0	0	0
Spiochaetopterus oculatus	50	0	0	11	2
Spionidae	0	1	0	0	0
Spiophanes bombyx	0	0	7	0.5	0
Streblospio benedicti	374	37	44	15.5	0
Streptosyllis spp.	0	1	0	0	0
Syllidae	0	1	0	0	0
Syllis spp.	0	19	0	0	0
Tellina agilis	14	0	16	0	0
Tellinidae	5	0	1	9	0
Terebra dislocata	0	3	0	0	0
Tharyx acutus	8	6	0	20	0
Tharyx spp.	24	6	0	17	0
Tubificidae	21	59	0	5	0
Tubificoides brownae	2	0	0	0	4
Tubificoides wasselli	0	101	38	0	0
Turbonilla spp.	1	0	16	0	0
Unciola serrata	0	1	3	0	0
Websterinereis spp.	0	0	12	0.5	0
Total	**1017**	**440**	**395**	**312**	**127**

Table A-10.
Environmental Monitoring and Assessment Program (EMAP) data for stations located at TIMU. Benthic macroinvertebrate abundance (#/m^2).

Taxon	CP93_12	CP94_17	CP94_18	CP94_88	CP95_170	CP95_171
Abra aequalis	0	0	0	0	1	0
Actiniaria	0	0	0	0	1	0
Amygdalum papyrium	119	0	0	0	0	0
Anthozoa	0	0	1	0	0	0
Aphelochaeta spp.	0	0	0	0	1	0
Armandia agilis	0	0	0	0	1	0
Balanus improvisus	2	0	0	0	0	0
Caecum strigosum	0	0	5	0	0	0
Carinomidae	0	0	0	0	2	0
Chiridotea almyra	12	0	0	0	0	0
Chiridotea spp.	0	0	6.5	1	0	0
Cirrophorus spp.	0	0	0	0	1.5	0
Corophium spp.	1	0	0	0	0	0
Crassinella dupliniana	0	0	1	0	0	0
Crassinella lunulata	0	0	0	1	0	0
Cyathura polita	9	0	0	0	0	0
Cyclaspis varians	3.66	0	0	0	0	0
Discoporella umbellata	0	0	1	0	0	0
Echinoidea	0	0	2.5	0	0	0
Edotia triloba	1	0	0	0	0	0
Emplectonematidae	0	0	2	3	0	0
Eteone heteropoda	0	1	0	0	0	0
Goniada littorea	0	0	0	0	1	0
Grandidierella bonnieroides	0	1	0	0	0	0
Hemipodus borealis	0	0	2.5	0	0	0
Heterodrilus spp.	0	0	1	0	0	0
Heteromastus filiformis	2	0	0	0	0	0
Laeonereis culveri	1	0	0	0	0	0
Lepidactylus dytiscus	2	0	0	0	0	0
Linopherus paucibracnchiata	0	0	2.5	0	0	0
Listriella barnardi	0	0	0	0	2	0
Maera spp.	0	0	1	0	0	0
Marenzelleria viridis	20.66	0	0	0	0	0
Mediomastus spp.	0	0	0	0	0	2
Membranipora aborescens	0	0	1	0	0	0
Microphthalmus spp.	0	0	0	1	0	0
Microporella spp.	0	0	1	0	0	0
Monoculodes spp.	1	0	0	0	0	0
Mulinia lateralis	0	0	0	0	2	0
Mysida	0	0	1	0	0	0
Mytilidae	3	0	0	0	0	0
Nemata	0	1	1	1	0	0
Nemertea	4.33	0	0	0	0	0
Nephtys picta	0	0	0	0	3	0
Oligochaeta	1	0	0	0	0	0
Onuphidae	0	0	1	0	0	0
Parahaustorius longimerus	0	0	0	2	0	0
Paraprionospio pinnata	0	0	0	0	1	5

Taxon	CP93_12	CP94_17	CP94_18	CP94_88	CP95_170	CP95_171
Pleuromeris tridentata	0	0	7	0	0	0
Podarke obscura	0	0	0	2	0	0
Podarke spp.	0	0	56.5	1	0	0
Prionospio perkinsi	0	0	0	0	0	1
Protohaustorius deichmannae	0	0	0	0	5	0
Rangia cuneata	1	0	0	0	0	0
Rhepoxynius hudsoni	0	0	0	0	7	0
Sabellaria spp.	0	0	1	0	0	0
Spiophanes bombyx	0	0	0	0	1	0
Spisula solidissima	0	0	1	0	0	0
Streblospio benedicti	40	7.5	0	0	2	0
Tellina versicolor	0	0	0	1	8.5	0
Travisia spp.	0	0	0	1	0	0
Tubificidae	0	0	0	0	0	2
Tubulanidae	0	0	0	0	0	2
Total	**223.65**	**10.5**	**96.5**	**14**	**40**	**12**

Table A-11.
Species identified at stations located at TIMU as part of park-commissioned study (Long 2004) for TIMU. Benthic macroinvertebrate abundance (#/m^2).

Taxon	19020038_1	19020038_2	19020038_3	19020038_4
Acanthohaustorius spp.	5	2	0	0
Acteocina canaliculata	0	0	0	1
Acteocina spp.	0	0	0	3
Aglaophamus spp.	2	0	0	0
Americamysis bigelowi	3	0	0	0
Americamysis spp.	4	3	2	0
Americhelidium americanum	0	2	1	4
Ameroculodes edwardsi	1.5	3.5	0	0
Ameroculodes spp.	1	1.33	0	0
Ampelisca abdita	0	0	3	0
Ampelisca holmesi	0	0	7.5	2
Ampelisca spp.	0	0	6	1.5
Aphelochaeta marioni	28	0	0	0
Aphelochaeta spp.	0	0	2.5	2.66
Aricidea spp.	0	0	1	0
Aricidea wassi	16	3	0	6
Armandia agilis	0	0	0	3
Armandia spp.	1	8.5	0	1
Balanus spp.	0	0	5	0
Bivalvia	1	1	8.33	2.5
Bowmaniella floridana	0	1	0	2
Bowmaniella spp.	0	0	1	0
Brania spp.	0	0	0	1
Capitella capitata	0	0	3	1
Caulleriella spp.	1	96	0	18.66
Cerapus spp.	0	0	1	2
Cerberilla spp.	1	4	0	0
Chione spp.	0	1	1	0
Cirratulidae	1	71.5	0	0
Cirratulus grandis	1	0	0	0
Cirrophorus spp.	0	1	0	0
Cyclaspis varians	1	0	1	0
Cyrenoida floridana	0	0	1	0
Demonax microphthalmus	1	2	0	0
Edotia triloba	0	0	2	0
Eteone heteropoda	0	0	1	0
Eudevenopus honduranus	2	0	0	2.5
Gastropoda	0	0	1	0
Gemma gemma	0	0	2.5	2.33
Glycera americana	0	0	1	0
Glycera spp.	1	0	0	0
Glycinde solitaria	0	0	1	0
Glycinde spp.	0	0	0	1
Goniadidae	0	0	1	0
Haustoriidae	1	2	0	0
Kinbergonuphis spp.	0	0	7.5	0
Leitoscoloplos fragilis	8.5	3	0	6.5
Leitoscoloplos spp.	0	0	0	4

Taxon	19020038_1	19020038_2	19020038_3	19020038_4
Leptochelia dubia	0	2	0	0
Lumbrineris tenuis	6	1	2	0
Mactra fragilis	0	0	0	3
Mediomastus ambiseta	2	0	0	2
Mediomastus californiensis	1	0	0	0
Mediomastus spp.	1	0	2.66	10
Melita nitida	0	0	3	0
Mercenaria campechiensis	1	0	0	2
Metharpinia floridana	0	3	0	0
Microspio pigmentata	0	46	0	0
Monocorophium spp.	0	5.5	4.33	0
Monticellina dorsobranchialis	0	46	0	0
Nemertea	2.5	0	6.66	1.66
Nephtys picta	0	1	0	0
Nephtys spp.	0	4	0	0
Nereiphylla castanea	0	1	0	0
Nereis succinea	0	0	2	0
Onuphidae	0	0	7	0
Orbinia americana	0	1	0	0
Orbiniidae	0	0	1	1
Oweniidae	0	0	1	0
Oxyurostylis smithi	8	2.5	0	0
Oxyurostylis spp.	4	1	0	1
Pagurus spp.	0	0	1	0
Parahaustorius spp.	0	13	0	0
Paraonis fulgens	26	4	0	7
Paraprionospio pinnata	7	3	2	0
Parvilucina multilineata	0	0	1	0
Phoxocephalidae	0	0	0	2
Phyllodoce arenae	0	1	0	0
Phyllodocidae	0	0	1	0
Polydora socialis	0	0	2.5	1
Portunidae	0	0	1	0
Prionospio spp.	0	0	0	1
Protohaustorius spp.	23	0	0	2
Pseudohaustorius caroliniensis	21	14	0	0
Pyramidellidae	0	0	0	1
Scoloplos rubra	0	0	3	0
Semelidae	1	0	0	0
Sigambra tentaculata	0	2	1	0
Solen viridis	2	0	0	0
Sphenia antillensis	0	0	1	0
Spilocuma watlingi	6.5	3	0	0
Spiophanes bombyx	2	3	1	0
Streblospio benedicti	2	1	62.33	2
Syllidae	1	0	0	1
Taphromysis bowmani	2	3.5	0	0
Tellina spp.	12	0	0	0
Tellina versicolor	5	0	0	0
Tellinidae	4	16	2	16.66
Terebra spp.	0	74.5	0	2
Terebridae	0	0	1	0
Tharyx spp.	122	0	0	0
Tubificidae	0	1	0	2

Taxon	19020038_1	19020038_2	19020038_3	19020038_4
Tubulanus pellucidus	0	3	0	0
Total	**343**	**461.83**	**170.81**	**125.97**

Table A-12.
Lower St. Johns River Studies (LSJR) data for TIMU. Stations SJRC1_4 to SJRC2_7. Benthic macroinvertebrate abundance (#/m^2).

Taxon	SJRC1_4	SJRC1_5	SJRC1_6	SJRC1_7	SJRC2_4	SJRC2_5	SJRC2_6	SJRC2_7
Abra aequalis	0	3	0	0	0	0	0	0
Acteocina canaliculata	1	0	0	0	0	0	0	1
Actiniaria	0	35	1	4.66	0	0	0	2
Aglaophamus verrilli	0	1	0	1	0	0	0	1.5
Alpheus armillatus	0	0	0	0	0	0	0	0
Americhelidium americanum	0	0	1.5	0	0	0	1	1
Ampelisca abdita	0	0	0	0	0	0	0	0
Ampelisca cristata	0	0	0	0	0	0	0	0
Ampelisca spp.	0	2	0	8	0	0	0	6.66
Ampelisca vadorum	0	2	0	0	0	0	0	7.5
Ampharetidae	0	0	0	0	0	0	0	0
Amphilochidae	1	2	0	0	0	0	0	0
Amphipoda	0	0	0	0	1	1	0	0
Ampithoidae	0	0	0	0	0	0	0	0
Amygdalum papyrium	1	0	0	0	0	0	0	0
Anachis lafresnayi	0	1	0	0	0	0	0	0
Anadara transversa	0	2	0	0	0	1	0	0
Aoridae	0	0	0	1	1	0	0	0
Apocorophium lacustre	0	0	0	0	0	0	0	0
Apoprionospio dayi	0	0	0	0	0	0	0	0
Arcidae	0	0	0	0	0	0	0	0
Armandia agilis	0	0	0	0	0	0	0	0
Armandia maculata	0	1	0	1	0	0	0	1
Asabellides oculata	0	0	0	0	0	0	0	0
Ascidiacea	1.5	2.66	0	1	0	0	0	29.33
Autolytus spp.	0	0	0	0	0	0	0	0
Automate spp.	0	0	0	0	0	1	0	0
Batea catharinensis	0	23	1	1	0	1	0	1
Bateidae	0	2	0	0	0	0	0	0
Bivalvia	0	1	0	1	0	2	1	4.66
Boonea impressa	88	0	0	0	0	0	0	0
Boonea seminuda	0	0	0	0	0	0	0	0
Bowmaniella floridana	0	0	0	0	0	0	0	2
Calotrophon ostrearum	0	0	0	0	0	1	0	0
Capitella capitata	0	0	0	0	0	0	0	1
Capitella spp.	0	0	0	0	0	0	0	0
Capitellidae	0	0	0	1	1	0	0	0
Caprella scaura	0	0	0	0	0	0	0	0
Caprellidae	0	10	0	0	0	0	0	0
Carazziella hobsonae	0	0	0	0	0	0	0	0
Cerapus benthophilus	0	1	0	0	0	0	0	2
Cerapus spp.	0	1	0	0	0	0	0	2
Ceratonereis irritabilis	0	2	0	0	0	0	0	0
Chione cancellata	0	0	0	0	0	0	0	0
Chione intapurpurea	0	1	0	0	0	0	0	0
Chironomus spp.	0	0	0	0	0	0	0	0
Cirratulidae	0	1	0	0	0	0	0	0
Cirrophorus spp.	0	0	0	2	0	0	0	1

Taxon	SJRC1_4	SJRC1_5	SJRC1_6	SJRC1_7	SJRC2_4	SJRC2_5	SJRC2_6	SJRC2_7
Columbellidae	0	1	0	0	0	0	0	0
Corbula spp.	1	0	0	0	0	0	0	0
Corbulidae	3	0	0	0	0	0	0	0
Corophiidae	0	0	0	0	0	4	0	0
Corophium lacustre	1.5	0	0	0	0	0	0	0
Corophium spp.	0	0	0	8	0	0	0	0
Crassinella lunulata	0	0	0	0	0	0	0	0
Crassostrea virginica	3	0	0	0	0	0	0	0
Crepidula spp.	0	0	0	0	0	0	0	0
Cryptochironomus spp.	0	0	0	0	0	0	0	0
Cyathura polita	1	0	0	0	0	0	0	0
Cyclaspis varians	1	0	0	0	0	0	0	1
Cyclostremiscus pentagonus	0	0	0	0	0	0	0	0
Decapoda	0	0	0	0	0	0	0	0
Demonax microphthalmus	0	0	0	0	0	0	0	1
Demonax spp.	1	3	0	0	0	0	0	0
Diopatra cuprea	0	6.33	0	0	0	1.5	0	0
Diplodonta semiaspera	0	0	0	0	0	0	0	0
Diplodonta spp.	0	1	0	0	0	0	0	0
Doridella obscura	0	0	0	0	0	0	0	0
Doridella spp.	0	0	0	0	0	0	0	0
Dorvilleidae	0	0	0	0	0	0	0	0
Edotia triloba	0	1	0	0	0	0	0	0
Eobrolgus spinosus	0	1	0	1	0	0	0	0
Epitonium multistriatum	0	1	0	0	0	0	0	0
Epitonium spp.	0	1	0	0	0	0	0	0
Euceramus praelongus	0	2	0	0	0	0	0	0
Eulimastoma weberi	0	0	0	0	0	0	0	0
Eumida sanguinea	0	0	0	0	0	0	0	0
Eunicidae	0	0	0	0	0	0	0	0
Eurypanopeus depressus	0	0	0	0	0	4	0	0
Eusarsiella zostericola	0	6.66	0	1	0	0	0	0
Exogone spp.	0	0	0	3	0	0	0	0
Fimbriosthenelais minor	0	0	0	0	0	0	0	0
Gastropoda	0	1	0	0	0	0	0	0
Gemma gemma	0	0	0	97.33	0	0	0	1
Geukensia demissa	0	0	0	0	0	0	0	0
Glycera americana	0	0	0	0	0	1	0	0
Glyceridae	0	0	0	0	0	0	0	1
Glycinde solitaria	0	0	0	0	0	0	0	1
Goniada littorea	0	0	0	0	0	0	0	0
Grandidierella bonnieroides	4.66	0	0	1	0	0	0	0
Gyptis spp.	1.5	0	0	0	0	0	0	0
Haustoriidae	0	0	0	0	0	0	0	0
Hemipholis elongata	0	0	0	0	0	0	0	2
Hesionidae	0	0	0	0	0	0	0	1
Heteromastus filiformis	1.66	0	0	0	6	0	0	0
Hydroides dianthus	0	6	0	0	0	0	0	0
Hydrozoa	0	0	0	0	0	0	0	0
Ischadium recurvum	2	0	0	0	0	0	0	0
Ischyroceridae	0	0	0	0	0	0	0	0
Laeonereis culveri	0	0	0	0	0	0	0	0
Latreutes parvulus	0	2	0	1	0	0	0	0
Leitoscoloplos spp.	1	0	1	0	0	0	0	0

Taxon	SJRC1_4	SJRC1_5	SJRC1_6	SJRC1_7	SJRC2_4	SJRC2_5	SJRC2_6	SJRC2_7
Lepidonotus sublevis	0	1	0	0	0	0	0	0
Lepidonotus variabilis	0	1	0	0	0	0	0	0
Leptochelia rapax	0	0	0	0	0	0	0	0
Leptosynapta tenuis	0	0	0	3	0	0	0	0
Leucon americanus	1	0	0	0	0	0	0	0
Lineidae	0	0	0	0	0	0	0	0
Lucina spp.	0	0	0	0	0	1	0	1
Lumbrineris verrilli	0	0	0	0	0	0	0	1
Macoma mitchelli	0	0	0	1	0	0	0	0
Macoma spp.	0	0	0	0	0	0	0	0
Macoma tenta	0	0	0	0	0	0	0	0
Mactridae	1	0	0	2	1	0	0	1.5
Magelona spp.	0	2	0	0	0	0	0	0
Maldanidae	0	0	0	2	0	0	0	0
Mancocuma stellifera	0	0	0	0	0	0	0	0
Marphysa spp.	0	0	0	0	0	0	0	0
Mediomastus ambiseta	0	0	0	1.5	0	0	0	0
Mediomastus californiensis	0	1	0	0	0	0	0	3
Mediomastus spp.	2	6.33	2	11	3.33	0	0	56.66
Melinna maculata	0	0	0	0	0	0	0	0
Melita longisetosa	0	1	0	1	0	0	0	0
Melita spp.	6	1.66	0	2	0	0	0	0
Melitidae	1	1	0	1	2	1	0	0
Mitrella lunata	0	0	0	2	0	0	0	0
Monocorophium acherusicum	0	0	0	0	0	0	0	0
Monoculodes spp.	0	0	0	0	0	0	0	0
Mulinia lateralis	0	0	0	0	0	0	0	0
Mytilidae	0	0	0	0	0	0	0	0
Nassariidae	0	0	0	0	0	0	0	0
Nassarius obsoletus	0	0	0	0	0	0	0	0
Nassarius trivittatus	0	1	0	0	0	0	0	0
Nassarius vibex	0	1	0	0	0	0	0	2.33
Neanthes succinea	12	1	0	4	3.5	0	0	2
Nematonereis hebes	0	0	0	0	0	0	0	1
Nemertea	0	0	2	2	1	1	1	6.5
Nephtys bucera	0	0	0	0	0	0	0	0
Nephtys picta	0	0	1	0	0	0	0	0
Nephtys spp.	0	0	0	0	0	0	0	0
Nereididae	0	0	0	0	0	1	0	0
Nereiphylla fragilis	2	0	0	0	0	0	0	0
Nereis falsa	0	0	0	0	0	0	0	1
Nereis lamellosa	0	4.5	0	1	0	0	0	0
Nereis micromma	0	2	0	0	0	5	0	1
Nereis riisei	0	1	0	1	0	0	0	0
Nereis spp.	2	1	0	0	5.66	7	0	1
Notomastus hemipodus	0	1	0	0	0	0	0	0
Nucula proxima	0	1.66	1	1	0	0	0	0
Nuculidae	0	0	0	0	0	0	0	0
Odontosyllis enopla	0	0	0	0	0	0	0	0
Odostomia spp.	1	0	0	0	0	0	0	0
Ogyrides alphaerostris	0	0	0	0	0	0	0	0
Onuphidae	0	0	0	0	0	0	0	0
Ophiuroidea	0	4	0	0	0	0	0	0
Ostreidae	0	0	0	0	0	0	0	0

Taxon	SJRC1_4	SJRC1_5	SJRC1_6	SJRC1_7	SJRC2_4	SJRC2_5	SJRC2_6	SJRC2_7
Owenia fusiformis	0	0	0	1	0	0	0	2
Oxyurostylis smithi	0	0	0	0	0	0	0	0
Oxyurostylis spp.	0	0	0	0	0	0	0	0
Pagurus longicarpus	0	0	0	0	0	0	0	0
Pagurus spp.	0	0	0	0	0	0	0	0
Panopeus herbstii	0	1	0	0	2	1	0	0
Paracaprella pusilla	0	41.66	1	1	0	1	0	1
Paraonis fulgens	0	0	9.66	0	0	0	2	0
Paraonis spp.	0	0	0	0	0	0	0	0
Paraprionospio pinnata	0	1	0	0	0	0	0	0
Parvilucina multilineata	0	0	0	6	0	0	0	3
Pectinaria gouldi	0	0	0	0	0	1	0	0
Peloscolex heterochaetus	0	0	0	0	0	0	0	0
Petricolidae	0	0	0	0	0	4.5	0	0
Petrolisthes politus	0	0	0	0	0	0	0	0
Phoronis spp.	0	0	0	1	0	0	0	0
Phyllodoce arenae	0	1	0	1	0	0	0	0
Phyllodocidae	0	0	0	0	0	0	0	0
Pinnixa spp.	0	0	0	0	0	0	0	1
Pinnotheridae	0	0	1	0	0	0	0	0
Piromis roberti	1	0	0	1	0	1	0	0
Pista palmata	0	0	0	0	0	0	0	1
Pista quadrilobata	0	4.33	0	0	0	0	0	0
Podarke obscura	0	1	0	2	0	0	0	1
Podarkeopsis levifuscina	3	2	0	1	1.5	0	0	0
Podocopida	0	0	0	0	0	0	0	0
Polydora cornuta	0	3.33	0	1	0	0	0	0
Polydora socialis	3	6	0	10	0	0	0	3.66
Polynoidae	0	0	0	0	0	0	0	0
Porcellanidae	0	0	0	1	0	0	0	0
Porifera	0	0	0	18.66	0	0	0	0
Prionospio spp.	0	2	0	2	0	0	0	0
Protohaustorius wigleyi	0	0	0	0	0	0	0	0
Rangia cuneata	2	0	1	0	0	0	0	0
Rhepoxynius epistomus	0	0	0	0	0	0	0	0
Rhithropanopeus harrisii	0	0	0	0	0	0	0	0
Sabellaria vulgaris	1	69.33	0	0	0	2	0	1
Sabellidae	0	1	0	0	0	0	0	1
Scolelepis texana	0	0	0	0	0	0	1	0
Scoloplos robustus	0	0	0	0	0	0	0	0
Scoloplos rubra	0	1	0	0	0	0	1	6
Serpulidae	0	1.5	0	0	0	0	0	0
Sigambra tentaculata	0	1.66	0	1	0	0	0	0
Sphenia antillensis	0	3	0	0	1.66	0	0	0
Sphenia so.	0	0	0	0	0	0	0	1
Spiochaetopterus oculatus	0	1	0	1	0	0	0	1.5
Spionidae	0	0	1	0	0	0	0	4
Spiophanes bombyx	0	0	0	0	0	0	0	0
Spiophanes missionensis	0	0	0	0	0	0	0	0
Streblosoma hartmanae	0	1	0	0	0	0	0	0
Streblospio benedicti	3	2	1	5.5	2	0	0	2.66
Streptosyllis pettiboneae	0	0	0	1	0	0	0	2
Syllidae	0	0	0	0	0	0	0	1.5
Syllis spp.	1	0	0	0	0	0	0	0

Taxon	SJRC1_4	SJRC1_5	SJRC1_6	SJRC1_7	SJRC2_4	SJRC2_5	SJRC2_6	SJRC2_7
Synidotea spp.	0	1	0	0	0	0	0	0
Tagelus plebeius	0	0	0	0	0	0	0	1
Tellina spp.	0	2	0	0	0	1	0	0
Tellinidae	0	2	1	1	0	0	0	0
Tharyx acutus	0	1	0	0	0	0	0	0
Tubificidae	0	0	0	0	1	0	0	3
Tubulanus spp.	0	11.33	0	6	0	0	0	3
Turbonilla interrupta	0	0	0	0	0	0	0	0
Turbonilla spp.	0	0	0	0	0	0	0	2
Turridae	0	0	0	0	0	1	0	0
Unciola serrata	0	0	0	0	0	0	0	0
Ungulinidae	0	1	0	0	0	0	0	0
Upogebia affinis	0	0	0	0	0	0	0	0
Veneridae	0	0	0	1	0	0	0	0
Vitrinella floridana	1	0	0	0	0	1	0	0
Vitrinellidae	2	0	0	0	1	0	0	0
Xanthidae	2	1	0	0	0	0	0	1
Total	**161.82**	**323.94**	**26.16**	**232.65**	**34.65**	**47**	**7**	**192.96**

Table A-13.
BMI abundance data for stations within Lower St. Johns River Studies (LSJR) data for TIMU. Stations SJRC3_4 to SJRC 4_7. Benthic macroinvertebrate abundance (#/m^2).

Taxon	SJRC3_4	SJRC3_5	SJRC3_6	SJRC3_7	SJRC4_4	SJRC4_5	SJRC4_6	SJRC4_7
Abra aequalis	0	2	0	2	0	2	0	2
Acteocina canaliculata	2	2	0	1	4	0	0	1.33
Actiniaria	0	1	0	2.33	0	8	3	12.33
Aglaophamus verrilli	0	0	0	0	0	0	0	0
Alpheus armillatus	0	0	0	0	1	1	0	0
Americhelidium americanum	0	0	1	0	0	0	1	0
Ampelisca abdita	0	0	0	0	0	2	0	0
Ampelisca cristata	0	0	0	0	0	0	0	5.5
Ampelisca spp.	0	3	0	15	1	1	0	10
Ampelisca vadorum	0	0	0	8.66	0	0	0	0
Ampharetidae	0	1.5	0	0	0	0	0	0
Amphilochidae	2	0	0	0	0	0	0	0
Amphipoda	0	1.5	0	0	0	0	0	0
Ampithoidae	0	0	0	0	2	0	0	0
Amygdalum papyrium	0	0	0	0	0	1	0	1
Anachis lafresnayi	0	0	0	0	0	0	0	0
Anadara transversa	0	0	0	0	0	12.33	0	2
Aoridae	0	0	0	0	0	0	0	0
Apocorophium lacustre	3	0	0	0	0	0	0	0
Apoprionospio dayi	0	0	0	0	0	0	1	0
Arcidae	0	1	0	0	0	0	0	0
Armandia agilis	0	0	0	0	0	0	1	0
Armandia maculata	0	2	0	0	0	3	0	1
Asabellides oculata	0	2	1	1.33	0	0	0	0
Ascidiacea	0	3	1	6	7	12.33	0	1
Autolytus spp.	0	1	0	0	0	0	0	0
Automate spp.	0	0	0	0	0	0	0	0
Batea catharinensis	0	0	0	0	0	8.33	0	0
Bateidae	0	0	0	0	0	0	0	0
Bivalvia	0	3	6	1	1	1	1	1
Boonea impressa	0	0	0	0	1	0	0	0
Boonea seminuda	0	0	0	0	0	2	0	1
Bowmaniella floridana	0	0	0	0	0	0	0	0
Calotrophon ostrearum	0	1	0	0	0	0	0	1
Capitella capitata	0	0	0	0	1	0	0	0
Capitella spp.	0	0	0	1	0	0	0	0
Capitellidae	0	0	0	0	1	0	0	0
Caprella scaura	0	1	0	0	0	0	0	0
Caprellidae	0	2	0	0	0	0	0	0
Carazziella hobsonae	0	0	0	0	0	0	0	1
Cerapus benthophilus	0	0	0	0	0	0	0	0
Cerapus spp.	0	0	0	0	0	0	0	0
Ceratonereis irritabilis	0	0	0	0	0	0	0	0
Chione cancellata	0	0	0	0	0	0	0	0
Chione intapurpurea	0	0	0	0	0	1	0	0
Chironomus spp.	0	1	0	0	0	0	0	0
Cirratulidae	0	0	0	1	0	0	0	5
Cirrophorus spp.	0	0	1.5	0	0	0	0	0

Taxon	SJRC3_4	SJRC3_5	SJRC3_6	SJRC3_7	SJRC4_4	SJRC4_5	SJRC4_6	SJRC4_7
Columbellidae	0	0	0	0	0	0	0	0
Corbula spp.	0	0	0	0	0	0	0	0
Corbulidae	0	0	0	0	0	0	0	0
Corophiidae	6	5.33	0	0	0	1	0	0
Corophium lacustre	0	0	0	0	0	0	0	0
Corophium spp.	0	0	0	0	0	0	0	0
Crassinella lunulata	0	0	0	0	0	1	0	0
Crassostrea virginica	0	0	0	0	0	0	0	0
Crepidula spp.	0	0	0	0	0	1	0	0
Cryptochironomus spp.	0	0	0	0	1	0	0	0
Cyathura polita	0	0	0	2	0	0	0	0
Cyclaspis varians	0	0	0	0	0	0	0	0
Cyclostremiscus pentagonus	0	0	0	0	0	1	0	0
Decapoda	0	0	0	0	0	0	0	0
Demonax microphthalmus	0	0	0	0	0	2.33	0	0
Demonax spp.	0	0	0	0	0	0	0	0
Diopatra cuprea	0	0	0	1	0	3.66	0	1
Diplodonta semiaspera	0	0	0	3	0	1	0	0
Diplodonta spp.	0	0	0	0	0	0	0	0
Doridella obscura	1	0	0	0	0	0	0	0
Doridella spp.	0	1	0	0	0	0	0	0
Dorvilleidae	0	0	0	0	0	1	0	0
Edotia triloba	0	0	0	0	0	0	0	0
Eobrolgus spinosus	0	9	0	0	0	0	0	0
Epitonium multistriatum	0	0	0	0	0	0	0	1.5
Epitonium spp.	0	0	0	0	0	0	0	0
Euceramus praelongus	0	0	0	0	0	0	0	0
Eulimastoma weberi	0	0	0	0	0	2	0	1
Eumida sanguinea	0	0	0	0	0	1	0	0
Eunicidae	0	0	0	0	0	1	0	0
Eurypanopeus depressus	1	0	0	0	0	0	0	0
Eusarsiella zostericola	0	0	0	0	0	0	0	3.5
Exogone spp.	0	0	0	0	0	1.5	0	0
Fimbriosthenelais minor	0	0	0	0	0	0	0	1
Gastropoda	0	0	0	0	0	0	0	0
Gemma gemma	0	0	0	1	0	0	0	1
Geukensia demissa	0	0	0	0	0	0	0	0
Glycera americana	0	1	0	0	0	0	0	0
Glyceridae	0	0	0	0	0	0	0	0
Glycinde solitaria	0	0	0	0	1	1	0	0
Goniada littorea	0	0	0	1	0	0	0	0
Grandidierella bonnieroides	0	0	0	0	2.66	0	0	0
Gyptis spp.	0	0	0	0	0	0	0	0
Haustoriidae	0	0	0	0	0	0	0	0
Hemipholis elongata	0	0	0	0	0	1	0	0
Hesionidae	0	0	0	0	1	0	0	0
Heteromastus filiformis	1.66	0	0	0	1	0	0	0
Hydroides dianthus	0	2	0	0	2	7.66	0	1
Hydrozoa	0	0	0	0	1	1	0	0
Ischadium recurvum	0	0	0	0	0	0	0	0
Ischyroceridae	0	0	0	0	0	1	0	0
Laeonereis culveri	0	0	0	0	0	0	0	0
Latreutes parvulus	0	0	0	0	0	0	0	0
Leitoscoloplos spp.	2	0	0	1	0	0	1	1

Taxon	SJRC3_4	SJRC3_5	SJRC3_6	SJRC3_7	SJRC4_4	SJRC4_5	SJRC4_6	SJRC4_7
Lepidonotus sublevis	0	0	0	0	0	1	0	0
Lepidonotus variabilis	0	0	0	0	0	0	0	0
Leptochelia rapax	0	0	0	0	0	0	0	0
Leptosynapta tenuis	0	0	0	2	0	0	2.5	3.33
Leucon americanus	0	0	0	0	0	0	0	0
Lineidae	0	0	1	0	0	0	0	0
Lucina spp.	0	1	0	5.5	0	0	0	0
Lumbrineris verrilli	0	0	0	0	0	0	0	0
Macoma mitchelli	0	0	0	1	0	1	0	2
Macoma spp.	0	0	0	0	0	0	0	0
Macoma tenta	0	0	0	0	0	0	0	1
Mactridae	0	1	0	2.5	0	0	0	0
Magelona spp.	0	0	0	1	0	4	0	1
Maldanidae	0	0	0	1	0	0	0	1
Mancocuma stellifera	0	0	1	0	0	0	0	0
Marphysa spp.	1	0	0	0	0	0	0	0
Mediomastus ambiseta	0	0	0	2	0	0	0	0
Mediomastus californiensis	0	0	0	1	0	2.5	0	0
Mediomastus spp.	13.33	15.66	0	34.66	21.33	8.5	0	20.66
Melinna maculata	0	1	0	1	0	0	0	2
Melita longisetosa	0	0	0	0	6	1	0	0
Melita spp.	4.5	0	0	0	1	0	0	0
Melitidae	2.5	0	0	0	0	2	0	0
Mitrella lunata	0	0	0	0	1	1	0	1
Monocorophium acherusicum	0	0	4	2	0	1	0	0
Monoculodes spp.	0	1	0	2	0	0	0	0
Mulinia lateralis	3	1	1	0	0	0	0	1
Mytilidae	0	0	0	0	1	0	0	0
Nassariidae	0	1	0	0	0	0	0	0
Nassarius obsoletus	0	0	2	3.66	0	0	0	39.66
Nassarius trivittatus	0	0	0	0	0	0	0	0
Nassarius vibex	0	2	0	1	0	0	0	1
Neanthes succinea	7.5	1	0	0	14.66	2	0	0
Nematonereis hebes	0	0	0	0	0	0	0	0
Nemertea	1	2	0	3	1	2	1	3
Nephtys bucera	0	0	1	0	0	0	0	0
Nephtys picta	0	0	0	0	0	0	2	0
Nephtys spp.	0	1	2	0	0	0	0	0
Nereididae	0	0	0	0	0	0	0	0
Nereiphylla fragilis	0	0	0	0	0	0	0	0
Nereis falsa	0	0	0	0	0	1	0	0
Nereis lamellosa	0	0	0	0	0	0	0	0
Nereis micromma	0	1.5	0	0	0	3	0	0
Nereis riisei	0	0	0	0	0	0	0	0
Nereis spp.	2.5	1	0	0	9.66	3.5	0	1
Notomastus hemipodus	0	0	0	0	0	0	0	0
Nucula proxima	0	0	0	0	0	1	0	1.33
Nuculidae	0	0	0	1	0	0	0	0
Odontosyllis enopla	0	0	0	0	0	1	0	0
Odostomia spp.	0	0	0	2	0	1.5	0	0
Ogyrides alphaerostris	0	0	0	0	0	0	0	0
Onuphidae	0	0	0	0	0	1	0	0
Ophiuroidea	0	0	0	0	0	2.5	0	0
Ostreidae	0	0	0	0	5	2	0	0

Taxon	SJRC3_4	SJRC3_5	SJRC3_6	SJRC3_7	SJRC4_4	SJRC4_5	SJRC4_6	SJRC4_7
Owenia fusiformis	0	1	0	1.5	0	1	0	0
Oxyurostylis smithi	0	0	2	5.33	0	0	0	0
Oxyurostylis spp.	0	1	1	0	0	0	0	0
Pagurus longicarpus	0	0	0	0	0	0	0	0
Pagurus spp.	0	0	0	0	0	1	0	0
Panopeus herbstii	0	1	0	0	2	4	0	0
Paracaprella pusilla	0	0	0	0	2	6	0	3
Paraonis fulgens	0	0	2.66	0	0	0	0	0
Paraonis spp.	1	0	0	0	0	0	0	0
Paraprionospio pinnata	0	0	0	0	1	0	0	0
Parvilucina multilineata	0	0	0	8	0	1	0	6.33
Pectinaria gouldi	0	2	0	1	0	0	0	0
Peloscolex heterochaetus	4	0	0	0	1	0	0	0
Petricolidae	0	0	0	0	0	0	0	0
Petrolisthes politus	1	0	0	0	0	0	0	0
Phoronis spp.	0	5	0	78.33	0	0	0	1
Phyllodoce arenae	0	0	0	0	0	0	0	1
Phyllodocidae	0	1	0	0	0	1	0	2
Pinnixa spp.	0	0	0	0	0	0	0	0
Pinnotheridae	0	0	0	0	0	0	0	0
Piromis roberti	0	0	0	0	0	0	0	0
Pista palmata	0	0	0	0	0	0	0	0
Pista quadrilobata	0	0	0	0	0	2	0	0
Podarke obscura	0	0	0	0	1	0	0	0
Podarkeopsis levifuscina	0	0	0	3	1.33	0	0	1
Podocopida	0	0	0	0	0	0	0	1
Polydora cornuta	1	0	0	0	1	2	0	0
Polydora socialis	0	1	0	3	1	2.5	0	4.33
Polynoidae	0	0	0	0	0	1	0	1
Porcellanidae	0	0	0	0	0	0	0	0
Porifera	0	0	0	0	0	0	0	0
Prionospio spp.	0	0	0	1	0	0	0	2
Protohaustorius wigleyi	0	0	4	0	0	0	0	0
Rangia cuneata	0	0	0	0	0	0	0	0
Rhepoxynius epistomus	0	0	1	0	0	0	0	0
Rhithropanopeus harrisii	0	0	0	0	0	0	0	0
Sabellaria vulgaris	0	1.5	0	0	0	21.33	0	0
Sabellidae	0	0	0	0	0	1	0	0
Scolelepis texana	0	0	0	0	0	0	0	0
Scoloplos robustus	0	0	0	0	0	0	0	0
Scoloplos rubra	1	1	0	6	1	2	0	4.33
Serpulidae	0	0	0	0	1	8	0	0
Sigambra tentaculata	1	0	0	1	0	2	0	0
Sphenia antillensis	1	1	0	0	7	5.33	0	0
Sphenia so.	0	1	0	0	0	0	0	0
Spiochaetopterus oculatus	0	0	0	1	0	0	1	1
Spionidae	1	0	1	1	0	1	0	1
Spiophanes bombyx	0	2	1	1	0	0	3.5	2
Spiophanes missionensis	0	0	0	1	0	2	0	0
Streblosoma hartmanae	0	0	0	0	0	0	0	0
Streblospio benedicti	15	123	0	23	0	0	0	2.33
Streptosyllis pettiboneae	0	1	0	1	0	0	0	0
Syllidae	0	1	0	0	0	2	0	0
Syllis spp.	0	0	0	0	0	2.5	0	0

Taxon	SJRC3_4	SJRC3_5	SJRC3_6	SJRC3_7	SJRC4_4	SJRC4_5	SJRC4_6	SJRC4_7
Synidotea spp.	0	0	0	0	0	0	0	0
Tagelus plebeius	0	0	0	0	0	0	0	1
Tellina spp.	0	0	0	0	0	0	0	1
Tellinidae	0	2	4	1	0	1	3.66	6.33
Tharyx acutus	0	0	0	6	0	0	0	0
Tubificidae	6.5	1	0	4.33	0	2	0	3.33
Tubulanus spp.	1	11.33	1	9	0	1	0	2
Turbonilla interrupta	0	0	0	2.5	0	0	0	0
Turbonilla spp.	0	0	0	2	0	0	0	0
Turridae	0	0	0	0	0	0	0	0
Unciola serrata	0	0	0	0	0	1	0	0
Ungulinidae	0	0	0	0	0	0	0	0
Upogebia affinis	0	0	0	0	0	0	0	0
Veneridae	0	0	0	0	0	0	0	0
Vitrinella floridana	0	0	0	0	3	0	0	0
Vitrinellidae	0	0	0	0	0	0	0	0
Xanthidae	0	0	0	0	0	5	0	0
Total	**87.49**	**234.32**	**40.16**	**275.63**	**111.64**	**205.3**	**21.66**	**182.12**

Table A-14.
BMI abundance data for stations within Lower St. Johns River Studies (LSJR) data for TIMU. Stations SJRC5_4 to SJRC 6_7. Benthic macroinvertebrate abundance (#/m^2).

Taxon	SJRC5_4	SJRC5_5	SJRC5_7	SJRC6_4	SJRC6_5	SJRC6_6	SJRC6_7
Abra aequalis	0	0	0	0	10	0	0
Acteocina canaliculata	0	0	2	0	0	0	1
Actiniaria	0	0	0	0	0	0	0
Aglaophamus verrilli	0	0	0	0	0	0	0
Alpheus armillatus	0	0	0	0	0	0	0
Americhelidium americanum	0	0	0	0	0	0	0
Ampelisca abdita	0	0	0	0	0	0	0
Ampelisca cristata	0	0	0	0	0	0	0
Ampelisca spp.	0	0	0	0	0	0	0
Ampelisca vadorum	0	0	0	0	0	0	0
Ampharetidae	0	0	0	0	1	0	0
Amphilochidae	0	0	0	0	0	0	0
Amphipoda	0	0	0	1	1	0	0
Ampithoidae	0	0	0	0	0	0	0
Amygdalum papyrium	0	0	0	0	2	0	0
Anachis lafresnayi	0	0	0	0	0	0	0
Anadara transversa	0	0	0	0	0	0	0
Aoridae	0	0	0	0	0	0	0
Apocorophium lacustre	0	0	0	0	0	0	0
Apoprionospio dayi	0	0	0	0	0	0	0
Arcidae	0	0	0	0	1	0	0
Armandia agilis	0	0	0	0	0	0	0
Armandia maculata	0	0	0	0	0	0	0
Asabellides oculata	0	0	0	0	9	0	0
Ascidiacea	0	0	0	0	0	0	0
Autolytus spp.	0	0	0	0	0	0	0
Automate spp.	0	0	0	0	1	0	0
Batea catharinensis	0	0	0	0	0	0	0
Bateidae	0	0	0	0	0	0	0
Bivalvia	0	1	0	1	7	0	0
Boonea impressa	0	0	0	0	0	0	0
Boonea seminuda	0	0	0	0	0	0	0
Bowmaniella floridana	0	0	0	0	0	0	0
Calotrophon ostrearum	0	0	0	0	0	0	0
Capitella capitata	0	0	0	0	0	0	1.5
Capitella spp.	0	0	0	0	0	0	0
Capitellidae	0	0	0	0	0	0	0
Caprella scaura	0	0	0	0	0	0	0
Caprellidae	0	0	0	0	0	0	0
Carazziella hobsonae	0	0	0	0	0	0	0
Cerapus benthophilus	0	0	0	0	0	0	0
Cerapus spp.	0	0	0	0	0	0	0
Ceratonereis irritabilis	0	0	0	0	0	0	0
Chione cancellata	0	0	0	0	0	0	0
Chione intapurpurea	0	0	0	0	0	0	0
Chironomus spp.	0	0	0	0	0	0	0
Cirratulidae	0	0	0	0	0	0	0
Cirrophorus spp.	0	0	0	0	0	0	25
Columbellidae	0	0	0	0	0	0	0

Taxon	SJRC5_4	SJRC5_5	SJRC5_7	SJRC6_4	SJRC6_5	SJRC6_6	SJRC6_7
Corbula spp.	0	0	0	0	0	0	0
Corbulidae	0	0	0	0	0	0	0
Corophiidae	0	0	0	2.5	7	0	1
Corophium lacustre	0	0	0	0	0	0	0
Corophium spp.	0	0	0	0	0	0	0
Crassinella lunulata	0	0	0	0	0	0	0
Crassostrea virginica	0	0	0	0	0	0	0
Crepidula spp.	0	0	0	0	0	0	0
Cryptochironomus spp.	0	0	0	0	0	0	0
Cyathura polita	0	0	0	0	0	0	0
Cyclaspis varians	0	0	1	0	0	0	1
Cyclostremiscus pentagonus	0	0	0	0	0	0	0
Decapoda	1	0	0	0	0	0	0
Demonax microphthalmus	0	0	0	0	0	0	0
Demonax spp.	0	0	0	0	0	0	0
Diopatra cuprea	0	0	0	0	0	0	0
Diplodonta semiaspera	0	0	0	0	0	0	0
Diplodonta spp.	0	0	0	0	0	0	0
Doridella obscura	0	0	0	0	0	0	0
Doridella spp.	0	0	0	0	0	0	0
Dorvilleidae	0	0	0	0	0	0	0
Edotia triloba	0	0	0	0	0	0	0
Eobrolgus spinosus	0	0	0	0	0	0	0
Epitonium multistriatum	0	0	0	0	0	0	0
Epitonium spp.	0	0	0	0	0	0	0
Euceramus praelongus	0	0	0	0	0	0	0
Eulimastoma weberi	0	0	0	0	0	0	0
Eumida sanguinea	0	0	0	0	0	0	0
Eunicidae	0	0	0	0	0	0	0
Eurypanopeus depressus	0	0	0	0	0	0	0
Eusarsiella zostericola	0	0	0	0	0	0	0
Exogone spp.	0	0	0	0	1	0	0
Fimbriosthenelais minor	0	0	0	0	0	0	0
Gastropoda	0	0	0	0	0	0	0
Gemma gemma	0	0	0	0	0	0	0
Geukensia demissa	1	0	0	1	0	0	0
Glycera americana	0	0	0	0	0	0	0
Glyceridae	0	0	0	0	1	0	0
Glycinde solitaria	0	0	0	0	0	0	0
Goniada littorea	0	0	0	0	0	0	0
Grandidierella bonnieroides	0	0	0	0	0	0	0
Gyptis spp.	0	0	0	0	0	0	0
Haustoriidae	0	0	0	0	0	0	1
Hemipholis elongata	0	0	0	0	0	0	0
Hesionidae	0	0	0	0	0	0	0
Heteromastus filiformis	1	0	0	0	0	0	0
Hydroides dianthus	0	0	0	0	0	0	0
Hydrozoa	0	0	0	0	0	0	0
Ischadium recurvum	0	0	0	0	0	0	0
Ischyroceridae	0	0	0	0	0	0	0
Laeonereis culveri	0	0	0	0	0	1	0
Latreutes parvulus	0	0	0	0	0	0	0
Leitoscoloplos spp.	0	0	0	0	0	0	0
Lepidonotus sublevis	0	0	0	0	0	0	0

Taxon	SJRC5_4	SJRC5_5	SJRC5_7	SJRC6_4	SJRC6_5	SJRC6_6	SJRC6_7
Lepidonotus variabilis	0	0	0	0	0	0	0
Leptochelia rapax	0	0	0	1	0	0	1
Leptosynapta tenuis	0	0	0	0	0	0	0
Leucon americanus	0	1	0	0	0	0	0
Lineidae	0	0	0	0	0	0	0
Lucina spp.	0	0	0	0	0	0	0
Lumbrineris verrilli	0	0	0	0	0	0	0
Macoma mitchelli	0	0	0	0	0	0	0
Macoma spp.	0	0	0	0	0	0	0
Macoma tenta	0	0	0	0	0	0	0
Mactridae	0	0	0	0	4	0	0
Magelona spp.	0	1.5	0	0	0	0	0
Maldanidae	0	0	0	0	0	0	0
Mancocuma stellifera	0	0	0	0	0	0	0
Marphysa spp.	0	0	0	0	0	0	0
Mediomastus ambiseta	0	0	0	0	0	0	0
Mediomastus californiensis	0	0	0	0	0	0	0
Mediomastus spp.	0	1.33	3	0	4	0	1.33
Melinna maculata	0	0	0	0	0	0	0
Melita longisetosa	0	1	0	0	0	0	0
Melita spp.	0	0	0	0	0	0	0
Melitidae	0	0	0	0	0	0	0
Mitrella lunata	0	0	0	0	0	0	0
Monocorophium acherusicum	0	0	0	0	0	0	0
Monoculodes spp.	0	0	0	0	0	0	0
Mulinia lateralis	0	0	0	0	0	0	0
Mytilidae	0	0	0	0	2	0	0
Nassariidae	0	0	0	0	0	0	0
Nassarius obsoletus	0	0	0	0	0	0	0
Nassarius trivittatus	0	0	0	0	0	0	0
Nassarius vibex	0	0	0	0	0	0	0
Neanthes succinea	7	0	0	5	3.66	0	0
Nematonereis hebes	0	0	0	0	0	0	0
Nemertea	1.5	0	1	1.33	2	1	0
Nephtys bucera	0	0	0	0	0	0	0
Nephtys picta	0	0	0	0	0	0	0
Nephtys spp.	0	0	0	0	0	0	0
Nereididae	0	0	0	0	0	0	0
Nereiphylla fragilis	0	0	0	0	0	0	0
Nereis falsa	0	0	0	0	0	0	0
Nereis lamellosa	0	0	0	0	0	0	0
Nereis micromma	0	1	0	0	1	0	0
Nereis riisei	0	0	0	0	0	0	0
Nereis spp.	7.33	1	0	6	8.5	0	0
Notomastus hemipodus	0	0	0	0	0	0	0
Nucula proxima	0	0	0	0	0	0	0
Nuculidae	0	0	0	0	0	0	0
Odontosyllis enopla	0	0	0	0	0	0	0
Odostomia spp.	0	0	0	0	0	0	0
Ogyrides alphaerostris	0	1	0	0	0	0	0
Onuphidae	0	0	0	0	0	0	0
Ophiuroidea	0	0	0	0	0	0	0
Ostreidae	0	0	0	0	0	0	0
Owenia fusiformis	0	0	0	0	0	0	0

Taxon	SJRC5_4	SJRC5_5	SJRC5_7	SJRC6_4	SJRC6_5	SJRC6_6	SJRC6_7
Oxyurostylis smithi	0	0	0	0	0	2	0
Oxyurostylis spp.	0	0	0	0	0	0	1
Pagurus longicarpus	0	0	0	0	0	0	0
Pagurus spp.	0	0	0	0	0	0	0
Panopeus herbstii	0	0	0	1.5	0	0	0
Paracaprella pusilla	0	0	0	0	0	0	0
Paraonis fulgens	0	0	0	0	0	1	1
Paraonis spp.	0	0	0	0	0	1.5	0
Paraprionospio pinnata	0	1	0	0	0	0	0
Parvilucina multilineata	0	0	0	0	0	0	0
Pectinaria gouldi	0	0	0	0	0	0	0
Peloscolex heterochaetus	1.33	0	0	1	0	0	0
Petricolidae	0	0	0	0	0	0	0
Petrolisthes politus	0	0	0	0	0	0	0
Phoronis spp.	0	0	0	0	0	0	0
Phyllodoce arenae	0	0	0	0	0	0	0
Phyllodocidae	0	0	0	0	2	0	0
Pinnixa spp.	0	0	0	0	0	0	0
Pinnotheridae	0	0	0	0	0	0	0
Piromis roberti	0	0	0	0	0	0	0
Pista palmata	0	0	0	0	0	0	0
Pista quadrilobata	0	0	0	0	0	0	0
Podarke obscura	0	0	0	0	0	0	0
Podarkeopsis levifuscina	0	0	0	0	0	0	0
Podocopida	0	0	0	0	0	0	0
Polydora cornuta	0	0	0	0	0	0	0
Polydora socialis	0	0	0	1	0	0	0
Polynoidae	0	0	0	0	0	0	0
Porcellanidae	0	0	0	0	0	0	0
Porifera	0	0	0	0	0	0	0
Prionospio spp.	0	0	1	0	0	0	0
Protohaustorius wigleyi	0	0	0	0	0	0	0
Rangia cuneata	1	0	0	0	0	0	0
Rhepoxynius epistomus	0	0	0	0	0	0	0
Rhithropanopeus harrisii	0	0	0	0	1	0	0
Sabellaria vulgaris	0	0	0	0	2	0	0
Sabellidae	0	0	0	0	0	0	0
Scolelepis texana	0	0	0	0	0	0	0
Scoloplos robustus	0	0	0	0	0	0	0
Scoloplos rubra	0	1	2	0	0	0	1
Serpulidae	0	0	0	0	0	0	0
Sigambra tentaculata	0	0	1	0	0	0	0
Sphenia antillensis	0	2	0	0	3	0	0
Sphenia so.	0	0	0	0	0	0	0
Spiochaetopterus oculatus	0	0	0	0	0	0	0
Spionidae	0	0	0	0	0	0	0
Spiophanes bombyx	0	0	0	0	0	0	1
Spiophanes missionensis	0	0	0	0	0	0	0
Streblosoma hartmanae	0	0	0	0	0	0	0
Streblospio benedicti	0	2	0	2	2.5	0	1
Streptosyllis pettiboneae	0	0	0	0	0	0	0
Syllidae	0	0	0	0	0	0	0
Syllis spp.	0	0	0	0	0	0	0
Synidotea spp.	0	0	0	0	0	0	0

Taxon	SJRC5_4	SJRC5_5	SJRC5_7	SJRC6_4	SJRC6_5	SJRC6_6	SJRC6_7
Tagelus plebeius	0	0	0	0	0	0	0
Tellina spp.	0	0	0	0	0	0	0
Tellinidae	0	0	0	0	0	0	0
Tharyx acutus	0	0	0	0	0	0	0
Tubificidae	0	0	1	3	0	0	0
Tubulanus spp.	0	1	0	0	1	1	0
Turbonilla interrupta	0	0	0	0	0	0	0
Turbonilla spp.	0	0	0	0	0	0	0
Turridae	0	0	0	0	0	0	0
Unciola serrata	0	0	0	0	0	0	0
Ungulinidae	0	0	0	0	0	0	0
Upogebia affinis	0	0	0	0	1	0	0
Veneridae	0	0	0	0	0	0	0
Vitrinella floridana	0	0	0	0	0	0	0
Vitrinellidae	0	0	0	0	0	0	0
Xanthidae	0	0	0	1	0	0	0
Total	**21.16**	**15.83**	**12**	**28.33**	**78.66**	**7.5**	**37.83**

Table A-15.
BMI abundance data for stations within Lower St. Johns River Studies (LSJR) data for TIMU. Stations SJRC7_4 to SJRC7_7. Benthic macroinvertebrate abundance (#/m^2).

Taxon	SJRC7_4	SJRC7_5	SJRC7_6	SJRC7_7
Abra aequalis	0	0	0	0
Acteocina canaliculata	0	0	0	1
Actiniaria	0	0	0	1
Aglaophamus verrilli	0	0	0	0
Alpheus armillatus	0	0	0	0
Americhelidium americanum	0	0	0	1
Ampelisca abdita	0	0	0	0
Ampelisca cristata	0	0	0	3.5
Ampelisca spp.	0	0	0	3
Ampelisca vadorum	0	0	0	0
Ampharetidae	0	0	0	0
Amphilochidae	0	0	0	0
Amphipoda	0	0	0	0
Ampithoidae	0	0	0	0
Amygdalum papyrium	0	1.66	0	0
Anachis lafresnayi	0	0	0	0
Anadara transversa	0	0	0	0
Aoridae	0	0	0	0
Apocorophium lacustre	0	100	0	0
Apoprionospio dayi	0	0	0	0
Arcidae	0	0	0	0
Armandia agilis	0	0	0	0
Armandia maculata	0	0	0	0
Asabellides oculata	0	0	0	0
Ascidiacea	0	0	0	0
Autolytus spp.	0	0	0	0
Automate spp.	0	0	0	1
Batea catharinensis	0	0	0	0
Bateidae	0	0	0	0
Bivalvia	0	0	0	4
Boonea impressa	0	0	0	0
Boonea seminuda	0	0	0	0
Bowmaniella floridana	0	0	0	0
Calotrophon ostrearum	0	0	0	0
Capitella capitata	0	0	0	0
Capitella spp.	0	0	0	0
Capitellidae	0	0	0	0
Caprella scaura	0	0	0	0
Caprellidae	0	0	0	0
Carazziella hobsonae	0	0	0	0
Cerapus benthophilus	0	0	0	0
Cerapus spp.	0	0	0	0
Ceratonereis irritabilis	0	0	0	0
Chione cancellata	0	0	0	1
Chione intapurpurea	0	0	0	0
Chironomus spp.	0	0	0	0
Cirratulidae	0	0	0	0
Cirrophorus spp.	0	0	1	0

Taxon	SJRC7_4	SJRC7_5	SJRC7_6	SJRC7_7
Columbellidae	0	0	0	0
Corbula spp.	0	0	0	0
Corbulidae	0	0	0	0
Corophiidae	0	5	0	0
Corophium lacustre	0	0	0	0
Corophium spp.	0	0	0	0
Crassinella lunulata	0	0	0	0
Crassostrea virginica	0	0	0	0
Crepidula spp.	0	0	0	0
Cryptochironomus spp.	0	0	0	0
Cyathura polita	0	0	0	1
Cyclaspis varians	0	0	0	0
Cyclostremiscus pentagonus	0	0	0	0
Decapoda	1	0	0	0
Demonax microphthalmus	0	0	0	0
Demonax spp.	0	0	0	0
Diopatra cuprea	0	0	0	0
Diplodonta semiaspera	0	0	0	0
Diplodonta spp.	0	0	0	0
Doridella obscura	0	0	0	0
Doridella spp.	0	0	0	0
Dorvilleidae	0	0	0	0
Edotia triloba	0	1	0	0
Eobrolgus spinosus	0	0	0	0
Epitonium multistriatum	0	0	0	0
Epitonium spp.	0	0	0	0
Euceramus praelongus	0	0	0	0
Eulimastoma weberi	0	0	0	0
Eumida sanguinea	0	0	0	0
Eunicidae	0	1	0	0
Eurypanopeus depressus	0	0	0	0
Eusarsiella zostericola	0	0	0	0
Exogone spp.	0	0	0	0
Fimbriosthenelais minor	0	0	0	0
Gastropoda	0	0	0	0
Gemma gemma	0	0	0	0
Geukensia demissa	0	0	0	0
Glycera americana	0	0	0	0
Glyceridae	0	0	0	0
Glycinde solitaria	0	0	0	0
Goniada littorea	0	0	0	0
Grandidierella bonnieroides	1	0	0	0
Gyptis spp.	0	0	0	0
Haustoriidae	0	0	0	0
Hemipholis elongata	0	0	0	0
Hesionidae	0	0	0	0
Heteromastus filiformis	1	0	0	0
Hydroides dianthus	0	0	0	0
Hydrozoa	0	0	0	0
Ischadium recurvum	0	0	0	0
Ischyroceridae	0	0	0	0
Laeonereis culveri	0	0	0	0
Latreutes parvulus	0	0	0	0
Leitoscoloplos spp.	0	0	1	0

Taxon	SJRC7_4	SJRC7_5	SJRC7_6	SJRC7_7
Lepidonotus sublevis	0	0	0	0
Lepidonotus variabilis	0	0	0	0
Leptochelia rapax	0	0	0	0
Leptosynapta tenuis	0	0	0	1
Leucon americanus	0	0	0	0
Lineidae	0	0	0	0
Lucina spp.	0	0	0	0
Lumbrineris verrilli	0	0	0	0
Macoma mitchelli	3.5	0	0	0
Macoma spp.	0	0	3	0
Macoma tenta	0	0	0	0
Mactridae	0	0	0	0
Magelona spp.	0	0	0	0
Maldanidae	0	0	0	0
Mancocuma stellifera	0	0	0	0
Marphysa spp.	0	2	0	0
Mediomastus ambiseta	0	0	0	0
Mediomastus californiensis	0	0	0	0
Mediomastus spp.	0	0	0	1
Melinna maculata	0	0	0	0
Melita longisetosa	0	2	0	0
Melita spp.	0	0	0	0
Melitidae	0	0	0	0
Mitrella lunata	0	0	0	0
Monocorophium acherusicum	0	0	0	0
Monoculodes spp.	0	0	0	0
Mulinia lateralis	0	0	0	3
Mytilidae	0	0	0	0
Nassariidae	0	0	0	0
Nassarius obsoletus	0	0	0	1
Nassarius trivittatus	0	0	0	0
Nassarius vibex	0	0	0	0
Neanthes succinea	2	0	0	0
Nematonereis hebes	0	0	0	0
Nemertea	0	0	0	0
Nephtys bucera	0	0	0	0
Nephtys picta	0	0	0	0
Nephtys spp.	0	0	0	0
Nereididae	0	0	0	0
Nereiphylla fragilis	0	0	0	0
Nereis falsa	0	0	0	0
Nereis lamellosa	0	0	0	0
Nereis micromma	0	0	0	0
Nereis riisei	0	0	0	0
Nereis spp.	3.5	7.33	0	0
Notomastus hemipodus	0	0	0	0
Nucula proxima	0	0	0	0
Nuculidae	0	0	0	0
Odontosyllis enopla	0	0	0	0
Odostomia spp.	0	0	0	0
Ogyrides alphaerostris	0	0	0	0
Onuphidae	0	0	0	0
Ophiuroidea	0	0	0	0
Ostreidae	0	0	0	0

Taxon	SJRC7_4	SJRC7_5	SJRC7_6	SJRC7_7
Owenia fusiformis	0	0	0	1
Oxyurostylis smithi	0	0	0	0
Oxyurostylis spp.	0	0	0	0
Pagurus longicarpus	0	0	0	1
Pagurus spp.	0	0	0	0
Panopeus herbstii	2	2	0	0
Paracaprella pusilla	0	0	0	0
Paraonis fulgens	0	0	3	0
Paraonis spp.	0	0	0	0
Paraprionospio pinnata	0	0	0	0
Parvilucina multilineata	0	0	0	0
Pectinaria gouldi	0	0	0	0
Peloscolex heterochaetus	0	0	0	0
Petricolidae	0	0	0	0
Petrolisthes politus	0	0	0	0
Phoronis spp.	0	0	0	0
Phyllodoce arenae	0	0	0	0
Phyllodocidae	0	0	0	0
Pinnixa spp.	0	0	0	0
Pinnotheridae	0	0	0	0
Piromis roberti	0	0	0	0
Pista palmata	0	0	0	0
Pista quadrilobata	0	0	0	0
Podarke obscura	0	0	0	0
Podarkeopsis levifuscina	0	0	0	0
Podocopida	0	0	0	0
Polydora cornuta	0	0	0	0
Polydora socialis	0	3	0	1
Polynoidae	0	0	0	0
Porcellanidae	0	0	0	0
Porifera	0	0	0	0
Prionospio spp.	0	0	0	0
Protohaustorius wigleyi	0	0	0	0
Rangia cuneata	0	0	1	0
Rhepoxynius epistomus	0	0	0	0
Rhithropanopeus harrisii	0	1	0	0
Sabellaria vulgaris	0	2	0	0
Sabellidae	0	0	0	0
Scolelepis texana	0	0	0	0
Scoloplos robustus	0	0	1	0
Scoloplos rubra	0	0	0	0
Serpulidae	0	1	0	0
Sigambra tentaculata	0	0	0	0
Sphenia antillensis	0	6	0	0
Sphenia so.	0	0	0	0
Spiochaetopterus oculatus	0	0	0	0
Spionidae	0	0	0	0
Spiophanes bombyx	0	0	0	0
Spiophanes missionensis	0	0	0	0
Streblosoma hartmanae	0	0	0	0
Streblospio benedicti	0	0	0	1.66
Streptosyllis pettiboneae	0	0	0	0
Syllidae	0	0	0	0
Syllis spp.	0	1	0	0

Taxon	SJRC7_4	SJRC7_5	SJRC7_6	SJRC7_7
Synidotea spp.	0	0	0	0
Tagelus plebeius	0	0	0	0
Tellina spp.	0	0	0	0
Tellinidae	0	0	0	0
Tharyx acutus	0	0	0	0
Tubificidae	0	0	0	1
Tubulanus spp.	0	0	0	0
Turbonilla interrupta	0	0	0	0
Turbonilla spp.	0	0	0	0
Turridae	0	0	0	0
Unciola serrata	0	0	0	0
Ungulinidae	0	0	0	0
Upogebia affinis	0	0	0	0
Veneridae	0	0	0	0
Vitrinella floridana	0	0	0	0
Vitrinellidae	0	0	0	0
Xanthidae	0	4.5	0	0
Total	**14**	**140.49**	**10**	**28.16**

Appendix B. BMI Taxa Predicted from Literature

Table B-1.
Expected BMI species for CAHA and CALO and habitats in which they might be found.

Group	Taxon	Beach	Marsh	Sound	Tidal Creek
Anoplan	*Cerebratulus lacteus*			X	
Anthozoan	*Nematostella spp.*				X
Bivalve	*Abra aequalis*		X	X	
	Aligena elevata			X	
	Anadara ovalis		X		
	Anadara transversa		X		
	Argopecten irradians		X		
	Brachidontes exustus		X		
	Chione cancellata		X		
	Chione grus		X		
	Chione spp.	X			
	Cooperella atlantica	X			
	Corbula nasuta		X		
	Crassostrea virginica		X		
	Cumingia tellinoides		X		
	Delectopecten vitreus		X		
	Diplodonta spp.	X			
	Divaricella quadrisulcata			X	
	Donax variabilis	X	X		
	Dosinia discus		X	X	
	Dosinia elegans		X		
	Gemma gemma		X		X
	Lyonsia hyalina		X		
	Macoma baltica			X	
	Macoma tenta		X	X	
	Mactra fragilis		X		
	Mercenaria mercenaria		X	X	
	Modiolus americanus		X		
	Mulinia lateralis		X	X	
	Musculus lateralis		X		
	Nucula proxima		X		
	Papyridea soleniformis		X		
	Parvilucina multilineata	X			
	Petricolaria pholadiformis		X		
	Solemya velum		X	X	
	Solen viridis			X	X
	Tagelus divisus		X	X	
	Tagelus plebeius		X	X	X
	Tellina aequistriata				X
	Tellina alternata		X		
	Tellina spp.	X			
	Tellina versicolor		X	X	
	Varicorbula operculata	X			
	Ventricolaria rugatina		X		
Enteropneust	*Saccoglossus spp.*				X
Gastropod	*Acteocina canaliculata*				X
	Acteon punctostriatus		X		
	Anachis avara		X		

Group	Taxon	Beach	Marsh	Sound	Tidal Creek
Gastropod	*Anachis translirata*		X		
	Bittium varium		X		
	Bursatella leachi		X		
	Busycon spp.		X		
	Caecum pulchellum		X		
	Cerithium floridanum		X		
	Cerithium spp.		X		
	Chaetopleura apiculata		X		
	Crepidula fornicata		X		
	Crepidula maculosa		X		
	Crepidula spp.		X		
	Elysia catulus		X		
	Eupleura caudata		X		
	Gastropoda		X		
	Hydrobia minuta		X		
	Ilyanassa obsoleta			X	X
	Littorina spp.		X		
	Mangelia plicosa		X		
	Mitrella lunata		X		
	Nassarius vibex		X	X	
	Odostomia bisuturalis		X		
	Odostomia impressa		X		
	Polinices duplicatus		X		
	Polycera hummi		X		
	Pyramidella crenulata		X		
	Retusa candei		X		
	Retusa obtusa	X			
	Rissoina decussata		X		
	Terebra dislocata		X		
	Turbonilla interrupta		X		
Holothuroid	*Sclerodactyla briareus*		X		
Insect	*Chironomidae*			X	X
	Palpomyia spp.		X		
	Polypedilum spp.			X	
	Procladius spp.			X	
Crustacean	*Acanthohaustorius spp.*	X			
	Alpheus heterochaelis		X		
	Alpheus normanni		X		
	Ampelisca abdita		X		
	Ampelisca vadorum		X		
	Ampelisca verrilli			X	
	Amphipoda			X	
	Amphiporeia virginiana	X			
	Ampithoe longimana		X		
	Ampithoe valida		X		
	Arenaeus cribrarius	X			
	Batea catharinensis		X		
	Callinectes sapidus	X	X		
	Callinectes similis		X		
	Caprella equilibra		X		
	Caprella penantis		X		
	Ceradocus spp.	X			
	Chiridotea caeca	X			
	Corophium acherusicum		X		

Group	Taxon	Beach	Marsh	Sound	Tidal Creek
Crustacean	*Corophium acutum*		X		
	Corophium spp.		X		
	Crassinella lunulata	X	X		
	Cyathura burbancki		X		
	Cyathura polita		X	X	
	Cyathura spp.		X	X	
	Cyclopoida		X		
	Cymadusa compta		X		
	Edotia spp.			X	
	Edotia triloba		X		
	Elasmopus levis		X		
	Emerita talpoida	X			
	Ericthonius brasiliensis		X		
	Farfantepenaeus aztecus		X		
	Farfantepenaeus duorarum		X		
	Gammarus mucronatus		X		
	Gammarus palustris		X	X	
	Gammarus tigrinus			X	
	Hargeria rapax		X		
	Harpacticoida		X		
	Harpinia propinqua		X		
	Haustoriidae			X	
	Haustorius spp.	X			
	Hexapanopeus angustifrons		X		
	Hippolyte pleuracanthus		X		
	Hippolyte zostericola		X		
	Idotea spp.				X
	Jaera marina		X		
	Lembos unicornis		X		
	Lembos websteri		X		
	Leptochelia dubia		X		
	Lysianopsis alba		X		
	Melita appendiculata		X		
	Melita dentata		X		
	Melita nitida		X		
	Microprotopus raneyi		X		
	Monoculodes spp.			X	
	Neopanope sayi		X		
	Ocypode quadrata	X			
	Ovalipes ocellatus	X			
	Palaemonetes intermedius		X		
	Palaemonetes pugio		X		
	Palaemonetes vulgaris		X		
	Panopeus herbstii		X		
	Panopeus occidentalis		X		
	Paracaprella tenuis		X		
	Paraphoxus spinosus		X		
	Periclimenes longicaudatus		X		
	Sphaeroma quadridentatum		X		
	Stenothoe minuta		X		
	Talorchestia megalophthalma	X			
	Tozeuma carolinense		X		
	Uca pugnax		X		
	Upogebia affinis			X	

Group	Taxon	Beach	Marsh	Sound	Tidal Creek
Maxillopod	*Argulus spp.*		X		
	Balanus eburneus		X		
	Balanus spp.		X		
	Calanoida		X		
Nemertean	*Amphiporus ochraceus*		X		
	Tetrastemma elegans		X		
Oligochaete	*Oligochaeta*		X	X	X
Ophiuroid	*Ophioderma brevispinum*		X		
Ostracod	*Ostracoda*		X		
Phoronid	*Phoronida*				X
	Phoronis psammophila		X		
Polychaete	*Acaridei*		X		
	Amphitrite ornata			X	
	Anaitides spp.	X			
	Aphelochaeta marioni		X		
	Arabella iricolor		X	X	
	Arabella mutans		X		
	Aricidea fragilis		X		
	Aricidea spp.				X
	Armandia maculata		X		X
	Axiothella mucosa		X		
	Bhawania goodei		X		
	Brania clavata		X		
	Capitella spp.		X		X
	Ceratonereis irritabilis		X		
	Chaetozone spp.	X			
	Cirrophorus branchiatus	X			
	Clymenella torquata		X	X	
	Dexiospira spirillum		X		
	Diopatra cuprea		X		
	Dorvillea sociabilis		X		
	Drilonereis magna		X	X	
	Eulalia sanguinea		X		
	Exogone dispar		X		
	Fabricia spp.		X		
	Glycera americana	X	X		
	Glycera dibranchiata			X	
	Glyceridae	X			
	Goniada littorea		X		
	Goniada maculata	X			
	Haploscoloplos fragilis			X	
	Haploscoloplos robustus		X		
	Hemipodus roseus				X
	Heteromastus spp.		X		
	Hydroides dianthus		X		
	Laeonereis culveri		X		X
	Leitoscoloplos robustus				X
	Lumbrineridae	X			
	Lumbrineris coccinea		X		
	Lumbrineris spp.				X
	Lumbrineris tenuis		X		
	Magelona spp.	X			
	Malacoceros vanderhorsti		X		
	Marenzelleria viridis			X	

Group	Taxon	Beach	Marsh	Sound	Tidal Creek
Polychaete	*Marphysa mortenseni*		X		
	Marphysa sanguinea		X		
	Mediomastus californiensis		X		
	Mediomastus spp.			X	X
	Megalomma bioculatum		X		
	Melinna maculata		X		
	Nephtys picta	X	X	X	
	Nephtys spp.	X			
	Nereis falsa		X	X	X
	Nereis succinea		X		X
	Notomastus hemipodus		X	X	
	Notomastus spp.				X
	Onuphis microcephala			X	
	Onuphis spp.	X			
	Ophelia denticulata	X			
	Orbinia ornata			X	
	Parapionosyllis longicirrata		X		
	Pectinaria gouldi		X		
	Petaloproctus socialis		X		
	Phyllodoce arenae		X		
	Phyllodoce fragilis		X		
	Piromis eruca		X		
	Pista palmata		X		
	Platynereis dumerilii		X		
	Podarke obscura		X		
	Poecilochaetus johnsoni		X		
	Polycirrus eximius		X		
	Polydora socialis				X
	Polynoidae	X			
	Prionospio heterobranchia				X
	Prionospio spp.		X		
	Sabella microphthalma		X		
	Sabellaria vulgaris		X		
	Schistomeringos rudolphi		X		
	Scoloplos rubra			X	
	Sphaerosyllis labrinthophila		X		
	Spio setosa		X		
	Spiophanes bombyx		X		X
	Spirorbis borealis		X		
	Streblospio benedicti		X		X
	Syllidae	X			X
	Syllis cornuta		X		
	Tharyx annulosus				X
Pycnogonid	*Anoplodactylus lentus*		X		
	Callipallene brevirostris		X		
	Tanystylum orbiculare		X		
Sipunculid	*Aspidosiphon parvulus*		X		
Turbellarian	*Stylochus spp.*		X		
	Turbellaria				X

Table B-2.
Expected BMI species for FOFR and CUIS and habitats in which they might be found.

Group	Taxon	Marsh	Sound
Anoplan	*Lineidae*		X
Anthozoan	*Actiniaria*		X
Ascidian	*Ascidiacea*		X
	Molgula spp.		X
Bivalve	*Abra aequalis*		X
	Anomia simplex		X
	Bivalvia		X
	Cardiidae		X
	Corbula contracta		X
	Diplodonta semiaspera		X
	Ervilia concentrica		X
	Lucina spp.		X
	Lucinidae		X
	Mactra fragilis		X
	Montacuta percompressa		X
	Nucula proxima		X
	Nucula spp.		X
	Parvilucina multilineata		X
	Pleuromeris tridentata		X
	Pythinella cuneata		X
	Solenidae		X
	Strigilla mirabilis		X
	Tellina alternata		X
	Tellina iris		X
	Tellina spp.		X
	Tellina sybaritica		X
	Tellinidae		X
Cephalochordate	*Branchiostoma spp.*		X
Cnidarian	*Cnidaria*		X
Echinoid	*Echinoidea*		X
Echiura	*Echiura*		X
Enteropneust	*Balanoglossus spp.*		X
Gastropod	*Acteocina bidentata*		X
	Acteocina canaliculata		X
	Caecidae		X
	Caecum johnsoni		X
	Caecum pulchellum		X
	Caecum spp.		X
	Calyptraea centralis		X
	Calyptraeidae		X
	Epitonium rupicola		X
	Gastropoda	X	X
	Kurtziella rubella		X
	Melanella intermedia		X
	Nassarius acutus		X
	Olivella mutica		X
	Sinum perspectivum		X
	Strombiformis bilineatus		X
	Tectonatica pusilla		X
	Terebra dislocata		X
Gastropod	*Turbonilla conradi*		X

Group	Taxon	Marsh	Sound
	Turbonilla spp.		X
Holothuroid	*Holothuroidea*		X
	Leptosynapta tenuis		X
Insect	*Collembola*	X	
	Diptera	X	
	Dolichopodidae	X	
	Tabanidae	X	
Crustacean	*Acanthohaustorius intermedius*		X
	Acanthohaustorius millsi		X
	Amakusanthura magnifica		X
	Americamysis bigelowi		X
	Americhelidium americanum		X
	Ancinus depressus		X
	Apseudes spp.		X
	Batea catharinensis		X
	Bathyporeia spp.		X
	Bowmaniella brasiliensis		X
	Brasilomysis castroi		X
	Callianassidae		X
	Callinectes similis		X
	Chiridotea tuftsi		X
	Crassinella lunulata		X
	Crassinella spp.		X
	Cyathura burbancki		X
	Cyathura polita	X	
	Cyclaspis pustulata		X
	Dissodactylus mellitae		X
	Emerita talpoida		X
	Eudevenopus honduranus		X
	Gammaridae	X	
	Harpacticoida	X	
	Hepatus epheliticus		X
	Hippomedon serratus		X
	Leptochelia spp.	X	
	Listriella barnardi		X
	Listriella spp.		X
	Metatiron triocellatus		X
	Metatiron tropakis		X
	Metharpinia floridana		X
	Mysidae		X
	Ogyrides hayi		X
	Oxyurostylis smithi		X
	Pagurus annulipes		X
	Pagurus spp.		X
	Periclimenes iridescens		X
	Photis spp.		X
	Phoxocephalidae		X
	Pinnixa floridana		X
	Pinnixa sayana		X
	Pinnixa spp.		X
	Pinnotheridae		X
	Processa hemphilli		X
	Protohaustorius wigleyi		X
	Sesarma spp.	X	

Group	Taxon	Marsh	Sound
	Tanaissus psammophilus		X
	Uca spp.	X	
Crustacean	*Xanthidae*		X
Nematoda	*Nematoda*	X	
Nemertean	*Nemertea*	X	
	Rhynchocoela		X
	Tubulanus spp.		X
Oligochaete	*Oligochaeta*		X
Ophiuroid	*Amphiuridae*		X
	Hemipholis elongata		X
	Ophiophragmus septus		X
Ophiuroid	*Ophiuroidea*		X
Ostracod	*Amboleberis americana*		X
	Asteropterygion oculitristis		X
	Pseudophilomedes ambon		X
	Trachyleberididae		X
Polychaete	*Aricidea catherinae*		X
	Aglaophamus spp.		X
	Aglaophamus verrilli		X
	Ancistrosyllis hartmanae		X
	Ancistrosyllis jonesi		X
	Apoprionospio dayi		X
	Aricidea cerrutii		X
	Aricidea spp.		X
	Aricidea wassi		X
	Armandia agilis		X
	Armandia maculata		X
	Armandia spp.		X
	Bhawania heteroseta		X
	Boguea enigmatica		X
	Brania wellfleetensis		X
	Capitella spp.	X	
	Capitellidae	X	X
	Caulleriella spp.		X
	Chaetopteridae		X
	Cirratulidae		X
	Dentatisyllis carolinae		X
	Dispio uncinata		X
	Drilonereis longa		X
	Eulepethidae		X
	Eunicidae		X
	Exogone dispar		X
	Exogone lourei		X
	Fimbriosthenelais spp.		X
	Glycera americana		X
	Glycera dibranchiata		X
	Glycera spp.		X
	Glyceridae		X
	Goniada littorea		X
	Goniadidae		X
	Goniadides carolinae		X
	Hemipodus roseus		X
	Hesionidae		X
	Hesionura elongata		X

Group	Taxon	Marsh	Sound
	Heteropodarke lyonsi		X
	Leitoscoloplos fragilis		X
	Leitoscoloplos spp.		X
Polychaete	*Lumbrineris latreilli*		X
	Magelona papillicornis		X
	Magelona spp.		X
	Maldanidae		X
	Manayunkia aestuarina	X	
	Mediomastus ambiseta		X
	Mediomastus spp.		X
	Nephtys bucera		X
	Nephtys picta		X
	Nereis lamellosa		X
	Nereis micromma		X
	Nereis spp.		X
	Onuphidae		X
	Onuphis eremita		X
	Orbiniidae	X	X
	Owenia fusiformis		X
	Paramphinome spp.		X
	Paraonidae		X
	Parapionosyllis longicirrata		X
	Paraprionospio pinnata		X
	Pectinaria gouldi		X
	Phyllodocidae		X
	Podarke obscura		X
	Polycirrus eximius		X
	Polydora cornuta		X
	Polydora socialis		X
	Polygordius spp.		X
	Sabellaria vulgaris		X
	Schistomeringos pectinata		X
	Scolelepis texana		X
	Scoloplos spp.		X
	Sigalionidae		X
	Sigambra tentaculata		X
	Sphaerosyllis aciculata		X
	Spiochaetopterus oculatus		X
	Spionidae		X
	Spiophanes bombyx		X
	Sthenelais limicola		X
	Streblospio benedicti	X	X
	Streptosyllis arenae		X
	Syllidae	X	X
	Syllis cornuta		X
	Syllis spp.		X
	Synelmis spp.		X
	Travisia parva		X
Sipunculid	*Phascolion strombi*		X
Turbellarian	*Turbellaria*		X

Table B-3.
Expected BMI species for FOMA, TIMU, and CANA and habitats in which they might be found.

Group	Taxon	Marsh	Oyster Reef	Sound
Actinarian	*Haliplanella lineata*		X	
Anoplan	*Lineidae*			X
Anthozoan	*Actiniaria*			X
	Aiptasia pallida		X	
Ascidian	*Ascidiacea*			X
	Molgula spp.			X
Bivalve	*Abra aequalis*			X
	Anomia simplex		X	X
	Atrina rigida		X	
	Bivalvia			X
	Brachidontes exustus		X	
	Cardiidae			X
	Corbula contracta			X
	Crassostrea virginica		X	
	Diplodonta semiaspera			X
	Ervilia concentrica			X
	Geukensia demissa		X	
	Lithophaga bisulcata		X	
	Lucina spp.			X
	Lucinidae			X
	Mactra fragilis			X
	Montacuta percompressa			X
	Mytella charruana		X	
	Nucula proxima			X
	Nucula spp.			X
	Parvilucina multilineata			X
	Pleuromeris tridentata			X
	Pythinella cuneata			X
	Solenidae			X
	Strigilla mirabilis			X
	Tagelus divisus		X	
	Tellina alternata			X
	Tellina iris			X
	Tellina spp.			X
	Tellina sybaritica			X
	Tellinidae			X
Cephalochordate	*Branchiostoma spp.*			X
Cnidarian	*Cnidaria*			X
Echinoid	*Echinoidea*			X
Echiura	*Echiura*			X
Ectoproct	*Bugula neritina*		X	
	Hippoporina verrilli		X	
	Zoobotryon verticillatum		X	
Enteropneust	*Balanoglossus spp.*			X
Gastropod	*Acteocina bidentata*			X
	Acteocina canaliculata			X
	Caecidae			X
	Caecum johnsoni			X
	Caecum pulchellum			X
	Caecum spp.			X

Group	Taxon	Marsh	Oyster Reef	Sound
	Calyptraea centralis			X
Gastropod	*Calyptraeidae*			X
	Crepidula astrasolea		X	
	Crepidula fornicata		X	
	Diodora cayenensis		X	
	Epitonium rupicola			X
	Gastropoda	X		X
	Kurtziella rubella			X
	Melanella intermedia			X
	Nassarius acutus			X
	Olivella mutica			X
	Sinum perspectivum			X
	Strombiformis bilineatus			X
	Tectonatica pusilla			X
	Terebra dislocata			X
	Turbonilla conradi			X
	Turbonilla spp.			X
Holothuroid	*Holothuroidea*			X
	Leptosynapta tenuis			X
Insect	*Collembola*	X		
	Diptera	X		
	Dolichopodidae	X		
	Tabanidae	X		
Crustacean	*Acanthohaustorius intermedius*			X
	Acanthohaustorius millsi			X
	Amakusanthura magnifica			X
	Americamysis bigelowi			X
	Americhelidium americanum			X
	Ancinus depressus			X
	Apseudes spp.			X
	Batea catharinensis			X
	Bathyporeia spp.			X
	Bowmaniella brasiliensis			X
	Brasilomysis castroi			X
	Callianassidae			X
	Callinectes similis			X
	Chiridotea tuftsi			X
	Crassinella lunulata			X
	Crassinella spp.			X
	Cyathura burbancki			X
	Cyathura polita	X		
	Cyclaspis pustulata			X
	Dissodactylus mellitae			X
	Emerita talpoida			X
	Eudevenopus honduranus			X
	Gammaridae	X		
	Harpacticoida	X		
	Hepatus epheliticus			X
	Hippomedon serratus			X
	Leptochelia spp.	X		
	Listriella barnardi			X
	Listriella spp.			X
	Metatiron triocellatus			X
	Metatiron tropakis			X

Group	Taxon	Marsh	Oyster Reef	Sound
	Metharpinia floridana			X
	Mysidae			X
Crustacean	*Ogyrides hayi*			X
	Oxyurostylis smithi			X
	Pagurus annulipes			X
	Pagurus spp.			X
	Periclimenes iridescens			X
	Photis spp.			X
	Phoxocephalidae			X
	Pinnixa floridana			X
	Pinnixa sayana			X
	Pinnixa spp.			X
	Pinnotheridae			X
	Processa hemphilli			X
	Protohaustorius wigleyi			X
	Sesarma spp.	X		
	Tanaissus psammophilus			X
	Uca spp.	X		
	Xanthidae			X
Maxillopod	*Balanus amphitrite*		X	
	Balanus eburneus		X	
Nematoda	*Nematoda*	X		
Nemertean	*Nemertea*	X		
	Rhynchocoela			X
	Tubulanus spp.			X
Oligochaete	*Oligochaeta*			X
Ophiuroid	*Amphiuridae*			X
	Hemipholis elongata			X
	Ophiophragmus septus			X
	Ophiuroidea			X
Ostracod	*Amboleberis americana*			X
	Asteropterygion oculitristis			X
	Pseudophilomedes ambon			X
	Trachyleberididae			X
Polychaete	*Aricidea catherinae*			X
	Aglaophamus spp.			X
	Aglaophamus verrilli			X
	Ancistrosyllis hartmanae			X
	Ancistrosyllis jonesi			X
	Apoprionospio dayi			X
	Aricidea cerrutii			X
	Aricidea spp.			X
	Aricidea wassi			X
	Armandia agilis			X
	Armandia maculata			X
	Armandia spp.			X
	Bhawania heteroseta			X
	Boguea enigmatica			X
	Brania wellfleetensis			X
	Capitella spp.	X		
	Capitellidae	X		X
	Caulleriella spp.			X
	Chaetopteridae			X
	Cirratulidae			X

Group	Taxon	Marsh	Oyster Reef	Sound
	Dentatisyllis carolinae			X
	Dispio uncinata			X
	Drilonereis longa			X
Polychaete	*Eulepethidae*			X
	Eunicidae			X
	Exogone dispar			X
	Exogone lourei			X
	Fimbriosthenelais spp.			X
	Glycera americana			X
	Glycera dibranchiata			X
	Glycera spp.			X
	Glyceridae			X
	Goniada littorea			X
	Goniadidae			X
	Goniadides carolinae			X
	Hemipodus roseus			X
	Hesionidae			X
	Hesionura elongata			X
	Heteropodarke lyonsi			X
	Hydroides spp.		X	
	Leitoscoloplos fragilis			X
	Leitoscoloplos spp.			X
	Lumbrineris latreilli			X
	Magelona papillicornis			X
	Magelona spp.			X
	Maldanidae			X
	Manayunkia aestuarina	X		
	Mediomastus ambiseta			X
	Mediomastus spp.			X
	Nephtys bucera			X
	Nephtys picta			X
	Nereis lamellosa			X
	Nereis micromma			X
	Nereis spp.			X
	Onuphidae			X
	Onuphis eremita			X
	Orbiniidae	X		X
	Owenia fusiformis			X
	Paramphinome spp.			X
	Paraonidae			X
	Parapionosyllis longicirrata			X
	Paraprionospio pinnata			X
	Pectinaria gouldi			X
	Phyllodocidae			X
	Podarke obscura			X
	Polycirrus eximius			X
	Polydora cornuta			X
	Polydora socialis			X
	Polygordius spp.			X
	Sabella spp.		X	
	Sabellaria vulgaris			X
	Schistomeringos pectinata			X
	Scolelepis texana			X
	Scoloplos spp.			X

Group	Taxon	Marsh	Oyster Reef	Sound
	Sigalionidae			X
	Sigambra tentaculata			X
	Sphaerosyllis aciculata			X
	Spiochaetopterus oculatus			X
Polychaete	*Spionidae*			X
	Spiophanes bombyx			X
	Sthenelais limicola			X
	Streblospio benedicti	X		X
	Streptosyllis arenae			X
	Syllidae	X		X
	Syllis cornuta			X
	Syllis spp.			X
	Synelmis spp.			X
	Travisia parva			X
Sipunculid	*Phascolion strombi*			X
Tunicate	*Perophera viridis*		X	
	Styela plicata		X	
Turbellarian	*Turbellaria*			X

Table B-4.
Expected BMI species for FOPU and FOSU and habitats in which they might be found.

Group	Taxon	Marsh	Offshore	Sound	Tidal Creek
Anoplan	*Lineidae*			X	
Anthozoan	*Actiniaria*			X	
Bivalve	*Arcidae*			X	
	Barbatia candida			X	
	Bivalvia			X	
	Corbula contracta		X	X	
	Corbula spp.			X	
	Corbulidae		X	X	
	Crassostrea virginica			X	
	Crenella spp.			X	
	Cuspidariidae			X	
	Ensis directus			X	
	Gemma gemma		X		X
	Lyonsia hyalina			X	
	Macoma tenta		X		
	Mulinia lateralis		X	X	X
	Musculus lateralis			X	
	Nucula crenulata			X	
	Nucula spp.			X	
	Nuculidae			X	
	Petricolaria pholadiformis			X	
	Pholadidae			X	
	Pleuromeris tridentata			X	
	Polymesoda caroliniana		X		
	Semele proficua			X	
	Solen viridis			X	
	Solenidae			X	
	Sphenia so.			X	
	Spisula solidissima			X	
	Tellina agilis			X	
	Tellina spp.			X	
	Tellinidae		X	X	
Cephalochordate	*Branchiostoma spp.*			X	
Gastropod	*Anachis floridana*			X	
	Caecum johnsoni			X	
	Calyptraeidae			X	
	Columbellidae			X	
	Crepidula fornicata			X	
	Crepidula plana			X	
	Crepidula spp.			X	
	Gastropoda		X	X	
	Ilyanassa obsoleta				X
	Kurtziella rubella			X	
	Mitrella lunata			X	
	Nassarius acutus			X	
	Nudibranchia			X	
	Olivella mutica			X	
	Seila adamsi			X	
	Strombiformis bilineatus			X	
	Tectonatica pusilla			X	

Group	Taxon	Marsh	Offshore	Sound	Tidal Creek
	Turbonilla spp.			X	
Hemichordate	*Hemichordata*		X		
Hirudinean	*Hirudinea*			X	
Holothuroid	*Leptosynapta tenuis*			X	
	Thyone pseudofusus			X	
Crustacean	*Acanthohaustorius intermedius*		X	X	X
	Acanthohaustorius millsi			X	
	Aeginellidae			X	
	Alpheus normanni			X	
	Ampelisca spp.			X	
	Ampelisca vadorum			X	
	Ampeliscidae			X	
	Ancinus depressus			X	
	Batea catharinensis			X	X
	Bowmaniella portoricensis			X	
	Callianassidae			X	
	Callinectes similis			X	
	Cassidinidea lunifrons		X		X
	Cerapus spp.			X	
	Cerapus tubularis			X	
	Chiridotea tuftsi			X	
	Corophiidae			X	
	Corophium lacustre		X		X
	Corophium spp.			X	
	Crassinella lunulata			X	
	Cyathura burbancki		X	X	X
	Decapoda			X	
	Dulichiella appendiculata			X	
	Edotia triloba			X	
	Elasmopus levis			X	
	Eobrolgus spinosus			X	
	Ericthonius brasiliensis			X	
	Gammarus mucronatus		X		
	Goneplacidae			X	
	Hargeria rapax				X
	Hyalella spp.			X	
	Latreutes parvulus			X	
	Leptochelia spp.		X		
	Leucosiidae			X	
	Listriella barnardi			X	
	Lysianassidae			X	
	Lysianopsis alba			X	
	Maera caroliniana			X	
	Maera spp.			X	
	Melita nitida		X	X	X
	Melita spp.			X	
	Melitidae			X	
	Metharpinia floridana			X	
	Mysidae			X	
	Mysidopsis bigelowi		X		
	Mysidopsis furca		X		
	Ogyrides hayi			X	
	Ogyrididae			X	
	Orchestia uhleri	X			

Group	Taxon	Marsh	Offshore	Sound	Tidal Creek
	Oxyurostylis smithi			X	
	Pagurus longicarpus			X	
Crustacean	*Pagurus spp.*			X	
	Palaemonetes vulgaris			X	
	Palaemonidae			X	
	Panopeus herbstii			X	X
	Paracaprella tenuis			X	
	Penaeidae			X	
	Phoxocephalidae			X	
	Pinnixa chaetopterana			X	
	Pinnixa sayana			X	
	Pinnixa spp.			X	
	Pinnotheridae			X	
	Porcellanidae			X	
	Protohaustorius wigleyi			X	
	Rhepoxynius hudsoni			X	
	Stenothoe minuta			X	
	Stenothoe spp.			X	
	Stenothoidae			X	
	Tanaissus psammophilus			X	
	Uca minax				X
	Uca pugnax				X
	Unciola serrata			X	
	Upogebia affinis			X	
	Xanthidae			X	
Nemertean	*Nemertea*		X		X
	Rhynchocoela			X	
	Tubulanus spp.			X	
Oligochaete	*Enchytraeidae*			X	
	Monopylephorus irroratus		X		X
	Monopylephorus rubroniveus		X		X
	Monopylephorus spp.	X			
	Paranais litoralis				X
	Tubificidae		X	X	X
	Tubificoides brownae		X		X
	Tubificoides heterochaetus	X	X		
	Tubificoides spp.				X
	Tubificoides wasselli		X		
Ophiuroid	*Amphioplus abdita*			X	
	Amphiuridae			X	
	Ophiuroidea			X	
Ostracod	*Eusarsiella spp.*			X	
	Ostracoda		X		
	Podocopida			X	
Polychaete	*Aglaophamus verrilli*			X	
	Amphinomidae			X	
	Amphitrite ornata		X		
	Anaitides madeirensis			X	
	Ancistrosyllis hartmanae			X	
	Ancistrosyllis jonesi			X	
	Arabella iricolor			X	
	Arabella mutans			X	
	Arabella nultidentata			X	
	Arabella spp.			X	

Group	Taxon	Marsh	Offshore	Sound	Tidal Creek
	Aricidea wassi			X	
	Armandia agilis			X	
	Asabellides oculata			X	
Polychaete	*Autolytus spp.*			X	
	Axiothella mucosa			X	
	Axiothella spp.			X	
	Bhawania heteroseta			X	
	Boccardiella spp.		X		
	Brania swedmarki			X	
	Brania wellfleetensis			X	
	Capitella capitata		X		X
	Capitellidae			X	X
	Carazziella hobsonae			X	
	Caulleriella spp.			X	
	Chaetozone spp.			X	
	Cirratulidae			X	
	Cirrophorus furcatus			X	
	Cirrophorus lyra			X	
	Cirrophorus spp.			X	
	Clymenella torquata			X	
	Commensodorum spp.			X	
	Demonax microphthalmus			X	
	Dentatisyllis carolinae			X	
	Diopatra cuprea			X	
	Dispio uncinata			X	
	Drilonereis longa			X	
	Enoplobranchus sanguineus			X	
	Eteone heteropoda		X	X	X
	Eumida sanguinea			X	
	Exogone rolani			X	
	Exogone spp.			X	
	Fabricia spp.		X		X
	Fimbriosthenelais spp.			X	
	Glycera americana		X	X	
	Glycera spp.			X	
	Glyceridae			X	
	Glycinde solitaria			X	
	Goniadides carolinae			X	
	Hesionidae		X	X	
	Heteromastus filiformis		X	X	X
	Hydroides dianthus			X	
	Hydroides protulicola			X	
	Hydroides spp.			X	
	Laeonereis culveri		X		X
	Leitoscoloplos fragilis		X		X
	Leitoscoloplos spp.			X	X
	Lepidonotus sublevis			X	
	Lumbrineridae		X		
	Lumbrineris ernesti			X	
	Lumbrineris spp.			X	
	Maldanidae			X	
	Malmgreniella spp.			X	
	Marphysa sanguinea			X	
	Mediomastus californiensis		X	X	

Group	Taxon	Marsh	Offshore	Sound	Tidal Creek
	Mediomastus spp.			X	
	Melinna maculata			X	
	Microphthalmus spp.			X	
	Monticellina dorsobranchialis		X	X	
Polychaete	*Neanthes succinea*		X		X
	Nematonereis hebes			X	
	Nephtys picta			X	
	Nereis acuminata			X	
	Nereis micromma			X	
	Nereis spp.			X	
	Nereis succinea			X	
	Oenonidae			X	
	Owenia fusiformis			X	
	Paramphinome spp.			X	
	Paraonis fulgens			X	
	Parapionosyllis longicirrata			X	
	Parapionosyllis spp.			X	
	Paraprionospio pinnata		X	X	
	Phyllodoce arenae			X	
	Phyllodoce spp.			X	
	Phyllodocidae			X	
	Podarke obscura			X	
	Podarkeopsis levifuscina			X	
	Polychaeta				X
	Polycirrus eximius			X	
	Polycirrus spp.			X	
	Polydora cornuta		X	X	X
	Polydora socialis		X	X	
	Polydora spp.				X
	Polygordius spp.			X	
	Polynoidae			X	
	Potamilla spp.		X		
	Prionospio perkinsi			X	
	Prionospio spp.		X	X	
	Sabellaria vulgaris			X	
	Sabellidae		X	X	
	Schistomeringos pectinata			X	
	Schistomeringos rudolphi			X	
	Scoloplos rubra			X	
	Serpulidae			X	
	Sigambra bassi			X	
	Sphaerosyllis longicauda		X		X
	Sphaerosyllis taylori			X	
	Spionidae			X	
	Spiophanes bombyx			X	
	Streblospio benedicti	X	X	X	X
	Streptosyllis arenae			X	
	Syllidae			X	
	Syllides floridanus			X	
	Syllis gracilis			X	
	Syllis spp.			X	
	Synelmis spp.			X	
	Tharyx acutus		X	X	X
	Travisia parva			X	

Group	Taxon	Marsh	Offshore	Sound	Tidal Creek
	Websterinereis spp.		X		
Polyplacophora	*Polyplacophora*			X	
Sipunculid	*Sipuncula*		X		
Turbellarian	*Turbellaria*		X	X	

Appendix C. BMI Museum Records

Table C-1.
Voucher specimens of marine benthic macroinvertebrate species located in holdings within NC repositories. Species listed are those known or expected to be located within SECN parks. [NBI – National Benthic Inventory; NMNH – National Museum of Natural History; SERTC – Southeast Regional Taxonomy Center].

Group	Taxon	NBI	NMNH	SERTC
Anoplan	*Lineidae*	X		
Bivalve	*Anadara ovalis*		X	
	Anadara transversa		X	
	Argopecten irradians		X	
	Astarte nana	X		
	Delectopecten vitreus		X	
	Donax variabilis	X		
	Gemma gemma	X		
	Macoma balthica	X		
	Macoma tenta	X		
	Mercenaria mercenaria		X	
	Mulinia lateralis	X		
	Musculus lateralis		X	
	Papyridea soleniformis		X	
	Parvilucina multilineata	X		
	Petricolaria pholadiformis		X	
	Rangia cuneata	X		
	Spisula solidissima	X		
	Tagelus divisus		X	
	Tellina agilis	X		
	Tellina alternata		X	
	Tellina iris	X		
Enteropneust	*Balanoglossus spp.*		X	
	Saccoglossus kowalevskii		X	
Gastropod	*Astyris lunata*			X
	Busycon spp.		X	
	Cerithium spp.		X	
	Crepidula spp.		X	
	Haminoea succinea	X		
	Mitrella lunata	X		
	Nassarius vibex	X		
	Odostomia spp.		X	
	Polinices duplicatus		X	
	Polycera hummi		X	
	Rictaxis punctostriatus	X		
	Turbonilla interrupta	X		
Holothuroid	*Sclerodactyla briareus*		X	
Crustacean	*Acanthohaustorius millsi*		X	
	Alpheus heterochaelis		X	
	Amakusanthura magnifica		X	
	Ancinus depressus		X	
	Arenaeus cribrarius		X	
	Callinectes sapidus			X
	Callinectes similis			X
	Chiridotea coeca		X	
	Cyathura polita		X	
	Emerita talpoida		X	

Group	Taxon	NBI	NMNH	SERTC
Crustacean	*Farfantepenaeus aztecus*			X
	Farfantepenaeus duorarum			X
	Gammarus mucronatus		X	
	Haustorius spp.		X	
	Hippolyte pleuracanthus		X	
	Hippolyte zostericola		X	
	Idotea spp.		X	
	Lembos unicornis		X	
	Leptochelia dubia		X	
	Leucon americanus		X	
	Mysidopsis bigelowi		X	
	Ogyrides alphaerostris		X	
	Ovalipes ocellatus			X
	Pagurus spp.		X	
	Palaemonetes pugio		X	
	Palaemonetes vulgaris		X	
	Panopeus herbstii		X	
	Paracaprella tenuis		X	
	Parahaustorius longimerus		X	
	Periclimenes longicaudatus			X
	Pinnixa spp.		X	
	Protohaustorius wigleyi		X	
	Sphaeroma quadridentatum		X	
	Tozeuma carolinense		X	
	Upogebia affinis		X	
Maxillopod	*Argulus spp.*		X	
	Balanus eburneus		X	
	Balanus spp.		X	
Nemertean	*Tubulanus spp.*	X		
Oligochaete	*Tubificoides spp.*		X	
Ophiuroid	*Ophioderma brevispinum*		X	
Phoronid	*Phoronis spp.*		X	
Polychaete	*Aglaophamus verrilli*	X		
	Amphicteis gunneri	X		
	Amphitrite ornata		X	
	Ancistrosyllis carolinensis		X	
	Ancistrosyllis hartmanae	X		
	Ancistrosyllis spp.	X		
	Apoprionospio pygmaea	X		
	Arabella iricolor		X	
	Aricidea fragilis		X	
	Armandia agilis	X		
	Bhawania goodei		X	
	Brania wellfleetensis	X		
	Capitella spp.		X	
	Carazziella hobsonae	X		
	Ceratonereis irritabilis	X		
	Chaetopterus variopedatus	X		
	Chaetozone spp.		X	
	Clymenella torquata	X		
	Diopatra cuprea		X	
	Dorvillea sociabilis		X	
	Drilonereis magna		X	
	Eulalia sanguinea		X	

Group	Taxon	NBI	NMNH	SERTC
	Exogone dispar		X	
Polychaete	*Glycera dibranchiata*	X		
	Glycera spp.	X		
	Glycinde solitaria	X		
	Goniada maculata		X	
	Gyptis spp.		X	
	Hesionura elongata		X	
	Heteromastus filiformis	X		
	Loimia medusa	X		
	Lumbrineris coccinea		X	
	Magelona spp.	X		
	Malacoceros vanderhorsti		X	
	Marenzelleria viridis	X		
	Marphysa sanguinea		X	
	Mediomastus ambiseta	X		
	Mesochaetopterus taylori		X	
	Neanthes succinea	X	X	
	Nephtys picta	X		
	Nereiphylla fragilis		X	
	Nereis falsa		X	
	Notomastus hemipodus		X	
	Onuphis microcephala		X	
	Ophelia denticulata		X	
	Orbinia ornata		X	
	Paramphinome spp.	X		
	Paraonis fulgens	X		
	Paraprionospio pinnata	X		
	Pectinaria gouldi	X		
	Petaloproctus socialis		X	
	Phyllodoce arenae	X		
	Phyllodoce fragilis		X	
	Phyllodoce mucosa	X		
	Platynereis dumerilii		X	
	Podarke obscura		X	
	Podarkeopsis levifuscina		X	
	Polycirrus eximius		X	
	Polydora cornuta	X		
	Polydora ligni		X	
	Polydora socialis		X	
	Prionospio heterobranchia	X	X	
	Schistomeringos rudolphi	X		
	Scolelepis texana	X		
	Scoloplos robustus		X	
	Scoloplos rubra	X		
	Sigambra bassi	X		
	Sigambra tentaculata	X		
	Sphaerosyllis labrinthophila		X	
	Spio pettiboneae	X		
	Spio setosa		X	
	Spiochaetopterus oculatus	X		
	Spiophanes bombyx	X		
	Streblospio benedicti	X		
	Syllidae	X		
	Syllis cornuta		X	

Group	Taxon	NBI	NMNH	SERTC
	Tharyx acutus	X		
Pycnogonid	*Anoplodactylus lentus*		X	
Sipunculid	*Aspidosiphon parvulus*		X	
	Phascolion strombi	X		
Turbellarian	*Stylochus spp.*		X	

Table C-2.
Voucher specimens of marine benthic macroinvertebrate species located in holdings within SC repositories. Species listed are those known or expected to be located within SECN parks. [FMNH – Florida Museum of Natural History; MRRI – Marine Resources Research Institute; NMNH – National Museum of Natural History; SERTC – Southeast Regional Taxonomy Center].

Group	Taxon	FMNH	MRRI	NMNH	SERTC
Anoplan	*Carinomella lactea*		X		
Anthozoan	*Actiniaria*		X		
Arachnid	*Araneae*		X		
Bivalve	*Abra aequalis*		X		
	Aligena elevata		X		
	Anadara notabilis		X		
	Anadara transversa		X		
	Arcidae		X		
	Barbatia candida				X
	Brachidontes exustus		X		
	Corbula contracta		X		
	Corbula spp.		X		
	Crassostrea virginica		X		
	Crenella spp.			X	
	Diplothyra smithii		X		
	Ensis directus		X		
	Gemma gemma		X		
	Geukensia demissa	X			
	Hiatella arctica		X		
	Lirophora latilirata				X
	Macoma tenta		X		
	Martesia striata		X		
	Mercenaria mercenaria		X		
	Mulinia lateralis		X		
	Musculus lateralis				X
	Nucula proxima		X		
	Nucula spp.		X		
	Parvilucina multilineata		X		
	Petricolaria pholadiformis		X		
	Solen viridis		X		
	Sphenia antillensis		X		
	Tagelus divisus		X		
	Tellina agilis		X		
	Tellina texana		X		
Gastropod	*Acteocina canaliculata*		X		
	Anachis avara		X		
	Astyris lunata		X		
	Caecum spp.		X		
	Chaetopleura apiculata		X		
	Costoanachis avara				X
	Crepidula fornicata		X		
	Crepidula plana		X		
	Doriopsilla pharpa		X		
	Epitonium spp.		X		
	Eupleura caudata		X		
	Gastropoda		X		

Group	Taxon	FMNH	MRRI	NMNH	SERTC
	Ilyanassa obsoleta		X		
Gastropod	*Nassarius acutus*		X		
	Nassarius trivittatus		X		
	Nassarius vibex		X		
	Polinices duplicatus		X		
	Tectonatica pusilla				X
	Terebra dislocata		X		
	Turbonilla spp.		X		
	Turridae		X		
Holothuroid	*Holothuroidea*		X		
	Leptosynapta tenuis		X		
Crustacean	*Acanthohaustorius intermedius*		X		
	Acanthohaustorius millsi		X		
	Aegathoa medialis		X		
	Aegathoa oculata		X		
	Alpheus formosus		X		
	Alpheus heterochaelis		X		
	Amakusanthura magnifica		X		
	Americamysis bigelowi		X		
	Americamysis spp.		X		
	Americhelidium americanum		X		
	Ampelisca abdita		X		
	Ampelisca spp.		X		
	Ampelisca vadorum		X		
	Ampelisca verrilli		X		
	Anchialina typica				X
	Ancinus depressus				X
	Batea catharinensis		X		
	Biffarius biformis		X		
	Bowmaniella floridana		X		
	Brasilomysis castroi		X		
	Callinectes similis				X
	Campylaspis affinis		X		
	Campylaspis spp.		X		
	Caprella penantis		X		
	Cassidinidea lunifrons		X		
	Cerapus tubularis		X		
	Chiridotea caeca				X
	Cleantis planicauda		X		
	Corophium acherusicum		X		
	Corophium spp.		X		
	Crassinella lunulata		X		
	Cumacea				X
	Cyathura burbancki		X		
	Cyclaspis varians		X		
	Dulichiella appendiculata		X		
	Edotia triloba		X		
	Elasmopus levis		X		
	Eobrolgus spinosus		X		
	Ericthonius brasiliensis		X		
	Euceramus praelongus		X		
	Eudevenopus honduranus		X		
	Gammarus mucronatus				X
	Gammarus palustris		X		

Group	Taxon	FMNH	MRRI	NMNH	SERTC
	Hargeria rapax				X
	Heterocrypta granulata		X		
Crustacean	*Heteromysis spp.*		X		
	Hyalella spp.			X	
	Latreutes parvulus		X		
	Lembos smithi		X		
	Lembos spp.		X		
	Lembos websteri		X		
	Lepidactylus dytiscus		X		
	Leptochela serratorbita		X		
	Leptochela spp.		X		
	Leptognathia caeca		X		
	Leucon americanus		X		
	Leucon spp.		X		
	Leucothoe spinicarpa		X		
	Libinia spp.		X		
	Limnoria tripunctata		X		
	Listriella barnardi		X		
	Listriella clymenellae		X		
	Listriella spp.		X		
	Lysianopsis alba		X		
	Maera caroliniana		X		
	Melita dentata		X		
	Melita nitida		X		
	Melita spp.		X		
	Metapenaeopsis goodei		X		
	Metharpinia floridana		X		
	Monoculodes edwardsi		X		
	Mysidopsis furca				X
	Mysidopsis spp.		X		
	Neomysis americana		X		
	Neopanope sayi		X		
	Ogyrides alphaerostris		X		
	Ogyrides hayi		X		
	Oxyurostylis smithi		X		
	Pagurus longicarpus		X		
	Pagurus spp.		X		
	Palaemonetes vulgaris		X		
	Panopeus herbstii		X		
	Paracaprella tenuis		X		
	Parahaustorius longimerus		X		
	Periclimenes iridescens		X		
	Petrolisthes armatus		X		
	Pinnixa chaetopterana		X		
	Pinnixa spp.		X		
	Pinnotheres spp.		X		
	Portunus gibbesii		X		
	Portunus spp.		X		
	Portunus spinimanus			X	
	Processa spp.			X	
	Protohaustorius deichmannae		X		
	Protohaustorius wigleyi				X
	Pseudohaustorius caroliniensis		X		
	Rhepoxynius epistomus		X		

Group	Taxon	FMNH	MRRI	NMNH	SERTC
	Rhepoxynius hudsoni		X		
	Rimapenaeus constrictus			X	
	Stenothoe minuta		X		
Crustacean	*Synchelidium americanum*		X		
	Tanaissus psammophilus				X
	Uca minax				X
	Uca pugnax				X
	Unciola serrata		X		
	Upogebia affinis		X		
Maxillopod	*Balanus spp.*			X	
Nematoda	*Nematoda*		X		
Nemertean	*Nemertea*		X		
Oligochaete	*Enchytraeidae*		X		
	Monopylephorus rubroniveus		X		
	Tubificidae		X		
	Tubificoides brownae		X		
	Tubificoides heterochaetus		X		
	Tubificoides spp.		X		
	Tubificoides wasselli		X		
Ophiuroid	*Amphiodia pulchella*		X		
	Hemipholis elongata		X		
Phoronid	*Phoronida*		X		
Platyhelmith	*Platyhelminthes*		X		
Polychaete	*Aglaophamus verrilli*		X		
	Amphicteis gunneri		X		
	Ancistrosyllis commensalis		X		
	Ancistrosyllis spp.		X		
	Aphelochaeta spp.		X		
	Aphrogenia spp.		X		
	Arabella mutans		X		
	Aricidea fragilis		X		
	Aricidea spp.		X		
	Aricidea suecica		X		
	Aricidea wassi		X		
	Armandia maculata		X		
	Autolytus spp.		X		
	Bhawania heteroseta		X		
	Brania spp.		X		
	Brania wellfleetensis		X		
	Capitella capitata		X		
	Carazziella hobsonae		X		
	Caulleriella spp.		X		
	Chaetozone spp.		X		
	Cirrophorus spp.		X		
	Commensodorum spp.			X	
	Diopatra cuprea		X		
	Dorvilleidae		X		
	Drilonereis longa		X		
	Drilonereis spp.		X		
	Enoplobranchus sanguineus		X		
	Eteone heteropoda		X		
	Eteone lactea		X		
	Eteone spp.		X		
	Eulalia sanguinea		X		

Group	Taxon	FMNH	MRRI	NMNH	SERTC
	Eupolymnia nebulosa		X		
	Eupolymnia spp.		X		
	Eurythoe spp.		X		
	Exogone spp.		X		
Polychaete	*Fabricia spp.*		X		
	Glycera americana		X		
	Glycera dibranchiata		X		
	Glycera spp.		X		
	Glyceridae		X		
	Glycinde spp.		X		
	Goniada littorea		X		
	Goniadidae		X		
	Gyptis vittata		X		
	Haplosyllis spongicola		X		
	Harmothoe spp.		X		
	Hauchiella spp.		X		
	Hesionidae		X		
	Heteromastus filiformis		X		
	Hydroides dianthus		X		
	Hydroides spp.		X		
	Laeonereis culveri		X		
	Leitoscoloplos foliosus		X		
	Leitoscoloplos fragilis		X		
	Leitoscoloplos robustus		X		
	Leitoscoloplos spp.		X		
	Lepidonotus sublevis		X		
	Loimia medusa		X		
	Lumbrineris spp.		X		
	Lumbrineris tenuis		X		
	Lysidice ninetta		X		
	Magelona phyllisae		X		
	Magelona spp.		X		
	Marphysa sanguinea		X		
	Mediomastus ambiseta		X		
	Mediomastus californiensis		X		
	Mediomastus spp.		X		
	Microphthalmus spp.		X		
	Mystides borealis		X		
	Neanthes succinea			X	
	Nematonereis hebes		X		
	Nephtys bucera		X		
	Nephtys picta		X		
	Nereis spp.		X		
	Nereis succinea		X		
	Notomastus latericeus		X		
	Notomastus lineatus		X		
	Odontosyllis enopla		X		
	Orbiniidae		X		
	Owenia fusiformis		X		
	Paramphinome spp.			X	
	Paranaitis speciosa		X		
	Paraonis fulgens		X		
	Parapionosyllis longicirrata		X		
	Paraprionospio pinnata		X		

Group	Taxon	FMNH	MRRI	NMNH	SERTC
	Pectinaria gouldi		X		
	Phyllodoce arenae		X		
	Pionosyllis spp.		X		
	Piromis roberti		X		
	Pista spp.		X		
Polychaete	*Podarke obscura*		X		
	Podarkeopsis levifuscina		X		
	Poecilochaetus johnsoni		X		
	Polycirrus spp.		X		
	Polydora colonia		X		
	Polydora cornuta		X		
	Polydora socialis		X		
	Polydora spp.		X		
	Potamilla reniformis		X		
	Prionospio cristata		X		
	Prionospio perkinsi		X		
	Proceraea spp.		X		
	Sabella microphthalma		X		
	Sabellaria spp.		X		
	Sabellaria vulgaris		X		
	Schistomeringos rudolphi			X	
	Scolelepis texana		X		
	Scoloplos rubra		X		
	Sigambra tentaculata		X		
	Sphaerosyllis aciculata		X		
	Sphaerosyllis longicauda		X		
	Sphaerosyllis spp.		X		
	Spiochaetopterus oculatus		X		
	Spiophanes bombyx		X		
	Spiophanes spp.		X		
	Sthenelais boa		X		
	Streblospio benedicti		X		
	Streptosyllis pettiboneae		X		
	Streptosyllis spp.		X		
	Syllidae		X		
	Syllides floridanus		X		
	Syllides fulva		X		
	Syllides spp.		X		
	Syllis gracilis		X		
	Syllis spp.		X		
	Tharyx acutus		X		
	Travisia parva		X		
	Websterinereis spp.		X		
	Websterinereis tridentata		X		
Pycnogonid	*Achelia sawayai*		X		
	Callipallene brevirostris		X		
	Nymphopsis duodorsospinosa		X		
	Phoxichilidium femoratum		X		
Sipunculid	*Sipuncula*		X		

Table C-3.
Voucher specimens of marine benthic macroinvertebrate species located in holdings within GA repositories. Species listed are those known or expected to be located within SECN parks. [GMNH – Georgia Museum of Natural Nistory; NBI – National Benthic Inventory; NMNH – National Museum of Natural History; SERTC – Southeast Regional Taxonomy Center].

Group	Taxon	GMNH	NBI	NMNH	SERTC
Anthozoan	*Gorgonacea*	X			
	Renilla reniformis	X			
Ascidian	*Molgula spp.*			X	
Asteroidean	*Astropecten articulatus*		X		
Bivalve	*Abra aequalis*		X		
	Anadara transversa				X
	Anodontia alba		X		
	Asthenothaerus hemphilli		X		
	Brachidontes exustus		X		
	Chama congregata		X		
	Chione cancellata		X		
	Chione grus		X		
	Chione intapurpurea		X		
	Cooperella atlantica		X		
	Corbula contracta		X		
	Corbula spp.				X
	Crassinella dupliniana		X		
	Crassostrea virginica		X		
	Crenella divaricata		X		
	Cumingia tellinoides				X
	Cymatoica orientalis		X		
	Diplodonta semiaspera	X			
	Divaricella quadrisulcata		X		
	Ensis minor		X		
	Ervilia concentrica		X		
	Gouldia cerina	X			
	Hiatella arctica		X		
	Laevicardium laevigatum	X			
	Lyonsia hyalina				X
	Macoma balthica				X
	Macoma spp.				X
	Mactra fragilis	X			
	Modiolus americanus				X
	Musculus lateralis			X	
	Mya arenaria				X
	Noetia ponderosa				X
	Nucula proxima		X		
	Ostrea equestris		X		
	Parvilucina multilineata	X			
	Petricolaria pholadiformis				X
	Pleuromeris tridentata	X			
	Pteromeris perplana				X
	Semele bellastriata				X
	Solemya velum				X
	Sphenia antillensis			X	
	Tagelus divisus				X

Group	Taxon	GMNH	NBI	NMNH	SERTC
	Tellina agilis		X		
Bivalve	*Tellina texana*				X
	Tellina versicolor		X		
Cephalochordate	*Branchiostoma spp.*		X		
Echinoid	*Encope aberrans*		X		
Ectoproct	*Bugula spp.*			X	
	Cupuladria spp.		X		
Enteropneust	*Balanoglossus spp.*			X	
Gastropod	*Acteocina bidentata*		X		
	Acteocina candei		X		
	Acteocina lepta		X		
Gastropod	*Acteocina recta*		X		
	Anachis lafresnayi		X		
	Arene tricarinata		X		
	Astyris lunata				X
	Atys sandersoni		X		
	Buccinidae	X			
	Caecum carolinianum		X		
	Caecum cooperi		X		
	Caecum floridanum		X		
	Caecum johnsoni		X		
	Caecum pulchellum		X		
	Calliostoma pulchrum		X		
	Calyptraea centralis		X		
	Cancellaria reticulata	X			
	Conus jaspideus		X		
	Costoanachis avara				X
	Crepidula plana		X		
	Cyclostrematidae		X		
	Diodora cayenensis		X		
	Diplodonta punctata		X		
	Doridella obscura		X		
	Epitonium multistriatum		X		
	Epitonium rupicola				X
	Erato maugeriae		X		
	Mitra nodulosa	X			
	Mitrella lunata	X			
	Nassarius acutus		X		
	Nassarius trivittatus				X
	Odostomia spp.	X			
	Oliva sayana				X
	Olivella mutica				X
	Seila adamsi	X			
	Simnia uniplicata	X			
	Sinum perspectivum	X			X
	Terebra concava		X		
	Terebra dislocata				X
	Terebra spp.				X
	Trochidae	X			
Holothuroid	*Sclerodactyla briareus*			X	
	Thyonella pervicax				X
Crustacean	*Acanthohaustorius intermedius*		X		
	Acanthohaustorius millsi		X		
	Acanthohaustorius shoemakeri		X		

Group	Taxon	GMNH	NBI	NMNH	SERTC
	Acuminodeutopus naglei		X		
	Albunea paretii		X		
Crustacean	*Alpheus heterochaelis*			X	
	Alpheus normanni			X	
	Amakusanthura magnifica		X		
	Americhelidium americanum		X		
	Ampelisca abdita		X		
	Ampelisca agassizi		X		
	Ampelisca bicarinata		X		
	Ampelisca schellenbergi		X		
	Ampelisca vadorum		X		
	Amphilochus casahoya		X		
	Ampithoe rubricata		X		
	Ancinus depressus		X		
	Apocorophium simile		X		
	Apseudes spp.		X		
	Apseudidae		X		
	Argissa hamatipes		X		
	Austinixa cristata				X
	Automate spp.			X	
	Batea catharinensis		X		
	Bathyporeia parkeri		X		
	Bathyporeia quoddyensis		X		
	Biffarius biformis			X	
	Bowmaniella brasiliensis			X	
	Bowmaniella portoricensis		X		
	Brasilomysis castroi			X	
	Callinectes similis				X
	Campylaspis spp.		X		
	Caprella equilibra		X		
	Carpias bermudensis		X		
	Cerapus tubularis		X		
	Chiridotea almyra			X	
	Chiridotea caeca		X		
	Colomastix halichondriae		X		
	Corophium spp.			X	
	Crassinella lunulata		X		
	Cumella garrityi		X		
	Cyathura burbancki		X		
	Cyathura polita			X	
	Cyclaspis pustulata		X		
	Cyclaspis unicornis		X		
	Cyclaspis varians		X		
	Cymadusa compta		X		
	Dissodactylus mellitae		X		
	Dulichiella appendiculata		X		
	Edotia triloba		X		
	Elasmopus laevis				X
	Elasmopus levis		X		
	Eobrolgus spinosus		X		
	Erichsonella filiformis		X		
	Euceramus praelongus		X		
	Eudevenopus honduranus		X		
	Gammaropsis spp.				X

Group	Taxon	GMNH	NBI	NMNH	SERTC
	Garosyrrhoe bigarra				X
	Haustorius spp.			X	
	Hexapanopeus angustifrons			X	
Crustacean	*Hypoconcha arcuata*			X	
	Iphimedia zora				X
	Kalliapseudes spp.				X
	Kupellonura spp.		X		
	Leptochela papulata			X	
	Leptochela serratorbita	X			
	Leptochelia dubia				X
	Leucon americanus		X		
	Liljeborgia spp.				X
	Listriella barnardi		X		
	Macrocoeloma camptocerum				X
	Maera caroliniana		X		
	Metharpinia floridana			X	
	Metoporhaphis calcarata				X
	Microprotopus raneyi			X	
	Mysidopsis furca				X
	Ogyrides alphaerostris			X	
	Ogyrides hayi			X	
	Ovalipes stephensoni				X
	Oxyurostylis smithi		X		
	Pagurus pollicaris				X
	Pagurus spp.				X
	Paracerceis caudata				X
	Pilumnus sayi				X
	Pinnixa spp.			X	
	Podochela spp.			X	
	Portunus spp.				X
	Processa spp.			X	
	Promysis atlantica			X	
	Protohaustorius wigleyi				X
	Ptilanthura tenuis			X	
	Sicyonia laevigata			X	
	Sicyonia parri			X	
	Synalpheus spp.			X	
	Unciola serrata		X		
Maxillopod	*Balanus spp.*			X	
Oligochaete	*Tubificidae*		X		
Ophiuroid	*Hemipholis elongata*			X	
	Ophiolepis elegans			X	
	Ophiothrix spp.				X
Ostracod	*Amboleberis americana*			X	
Polychaete	*Aglaophamus verrilli*		X		
	Ancistrosyllis hartmanae		X		
	Ancistrosyllis jonesi		X		
	Aonides mayaguezensis		X		
	Apoprionospio dayi		X		
	Apoprionospio pygmaea		X		
	Arabella iricolor		X		
	Arabella nultidentata		X		
	Aricidea suecica		X		
	Aricidea taylori		X		

Group	Taxon	GMNH	NBI	NMNH	SERTC
	Aricidea wassi		X		
	Armandia agilis		X		
	Armandia maculata		X		
	Asabellides oculata		X		
Polychaete	*Autolytus spp.*		X		
	Axiothella mucosa		X		
	Bhawania goodei		X		
	Bhawania heteroseta		X		
	Boguea enigmatica		X		
	Branchiosyllis exilis		X		
	Branchiosyllis oculata		X		
	Brania gallagheri		X		
	Brania wellfleetensis		X		
	Caulleriella spp.		X		
	Ceratocephale oculata		X		
	Ceratonereis spp.			X	
	Chloeia viridis		X		
	Chone spp.		X		
	Cirratulus spp.		X		
	Cirrophorus branchiatus		X		
	Cirrophorus lyra		X		
	Cirrophorus spp.		X		
	Clymenella torquata		X		
	Dasybranchus lunulatus		X		
	Dentatisyllis carolinae		X		
	Diopatra cuprea		X		
	Dispio uncinata		X		
	Dodecaceria coralii			X	
	Drilonereis longa		X		
	Eumida sanguinea		X		
	Eunice spp.		X		
	Exogone dispar			X	
	Exogone spp.			X	
	Glycera americana		X		
	Glycera dibranchiata			X	
	Glycinde solitaria		X		
	Goniada maculata			X	
	Haplosyllis spongicola			X	
	Hydroides dianthus		X		
	Laeonereis culveri			X	
	Leitoscoloplos spp.		X		
	Loimia medusa		X		
	Lumbrineris spp.			X	
	Malmgreniella spp.		X		
	Marphysa sanguinea		X		
	Mediomastus ambiseta		X		
	Mediomastus californiensis		X		
	Mooreonuphis pallidula		X		
	Neanthes succinea		X		
	Nephtys bucera			X	
	Nephtys picta		X		
	Nereiphylla fragilis			X	
	Nereis micromma		X		
	Parapionosyllis longicirrata		X		

Group	Taxon	GMNH	NBI	NMNH	SERTC
	Paraprionospio pinnata		X		
	Pectinaria gouldi		X		
	Phyllodoce arenae		X		
	Pionosyllis spp.				
	Podarke obscura		X	X	
Polychaete	*Podarkeopsis levifuscina*		X		
	Polydora cornuta		X		
	Polydora socialis		X		
	Polygordius spp.		X		
	Prionospio cristata		X		
	Prionospio perkinsi			X	
	Sabellaria vulgaris		X		
	Schistomeringos rudolphi		X		
	Scolelepis squamata			X	
	Scoloplos rubra		X		
	Scoloplos spp.			X	
	Sigambra tentaculata			X	
	Sphaerosyllis taylori		X		
	Spionidae		X		
	Spiophanes bombyx		X		
	Spiophanes missionensis		X		
	Streblospio benedicti		X		
	Syllides floridanus		X		
	Syllis cornuta		X		
	Syllis gracilis		X		
	Tharyx acutus		X		
Scaphopod	*Cadulus quadridentatus*		X		
Sipunculid	*Aspidosiphon albus*		X		
	Aspidosiphon muelleri		X		

Table C-4.
Voucher specimens of marine benthic macroinvertebrate species located in holdings within FL repositories. Species listed are those known or expected to be located within SECN parks. [FMNH – Florida Museum of Natural History; GMNH – Georgia Museum of Natural History; NBI – National Benthic Inventory; NMNH – National Museum of Natural History].

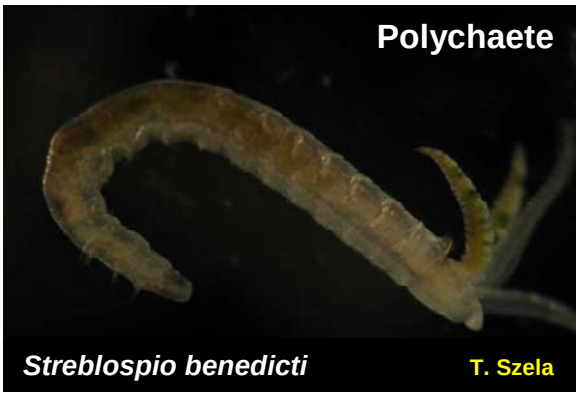
Group	Taxon	FMNH	GMNH	NBI	NMNH
Anthozoan	*Actiniaria*			X	
Ascidian	*Ascidiacea*			X	
	Molgula occidentalis				X
Bivalve	*Abra aequalis*			X	
	Amygdalum papyrium			X	
	Arcidae			X	
	Chione cancellata	X			
	Chione intapurpurea			X	
	Corbula barrattiana	X			
	Crassostrea virginica			X	
	Diplodonta semiaspera			X	
	Gemma gemma			X	
	Geukensia demissa	X			
	Ischadium recurvum			X	
	Laevicardium mortoni				X
	Macoma mitchelli			X	
	Macoma tenta			X	
	Mulinia lateralis				X
	Mytilopsis leucophaeata			X	
	Nucula proxima			X	
	Parvilucina multilineata			X	
	Pleuromeris tridentata			X	
	Rangia cuneata			X	
	Sphenia antillensis			X	
	Tagelus plebeius	X			
	Tellina spp.			X	
	Tellina versicolor	X			
	Veneridae			X	
Ectoproct	*Microporella spp.*				X
Gastropod	*Acteocina canaliculata*			X	
	Anachis lafresnayi			X	
	Assiminea succinea			X	
	Astyris lunata	X			
	Boonea impressa			X	
	Caecum pulchellum	X			
	Caecum regulare	X			
	Caecum strigosum	X			
	Calotrophon ostrearum			X	
	Cerithium muscarum			X	
	Crepidula convexa	X			
	Crepidula maculosa	X			
	Cyclostremiscus pentagonus			X	
	Epitonium multistriatum			X	
	Eulimastoma weberi	X			
	Haminoea succinea				X
	Mitrella lunata			X	

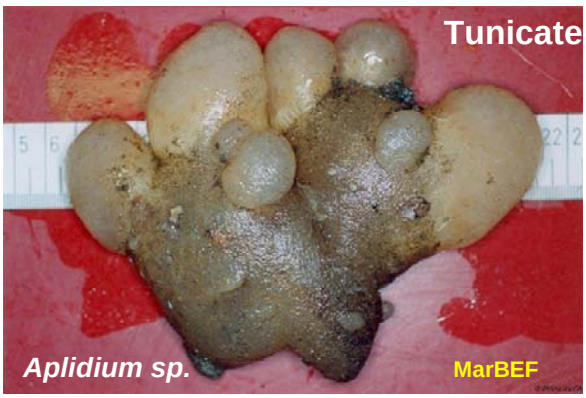
Group	Taxon	FMNH	GMNH	NBI	NMNH
	Nassarius obsoletus	X			
	Nassarius trivittatus			X	
	Odostomia bisuturalis	X			
	Prunum apicinum	X			
	Pyramidella crenulata			X	
	Rictaxis punctostriatus		X		
	Texadina sphinctostoma	X			
	Turbonilla interrupta			X	
	Vitrinella floridana			X	
Holothuroid	*Leptosynapta tenuis*			X	
Crustacean	*Alpheus armillatus*				X
	Americhelidium americanum			X	
	Ampelisca spp.			X	
	Ampelisca vadorum			X	
	Ampithoidae			X	
	Automate spp.			X	
	Batea catharinensis			X	
	Cerapus benthophilus			X	
	Corophium lacustre			X	
	Crassinella lunulata			X	
	Cyathura polita			X	
	Cyclaspis varians			X	
	Cymadusa compta				X
	Edotia triloba			X	
	Eobrolgus spinosus			X	
	Erichsonella attenuata				X
	Euceramus praelongus			X	
	Gitanopsis tortugae				X
	Grandidierella bonnieroides			X	
	Latreutes parvulus			X	
	Lepidactylus dytiscus				X
	Leptochelia rapax				X
	Leucon americanus			X	
	Listriella barnardi				X
	Lysianopsis alba			X	
	Maera spp.			X	
	Melita longisetosa			X	
	Monoculodes spp.				X
	Ogyrides alphaerostris			X	
	Oxyurostylis smithi				X
	Pagurus maclaughlinae				X
	Panopeus herbstii			X	
	Paracaprella pusilla			X	
	Rhithropanopeus harrisii				X
	Synidotea spp.			X	
	Unciola serrata			X	
	Upogebia affinis			X	
Nemertean	*Tubulanus spp.*			X	
Oligochaete	*Heterodrilus spp.*				X
	Limnodriloides rubicundus				X
	Tubificidae			X	
Ophiuroid	*Amphioplus thrombodes*				X
	Ophiactis spp.				X
	Ophiophragmus filograneus				X

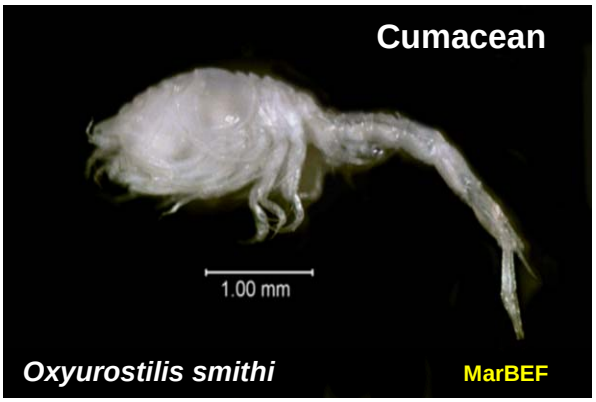
Group	Taxon	FMNH	GMNH	NBI	NMNH
Ostracod	*Eusarsiella zostericola*			X	
	Podocopida			X	
Phoronid	*Phoronis architecta*				X
Polychaete	*Aglaophamus verrilli*			X	
	Ampharetidae			X	
	Apoprionospio dayi			X	
	Arenicola cristata				X
	Aricidea fragilis				X
	Aricidea philbinae			X	
	Armandia agilis			X	
	Asychis spp.				X
	Autolytus spp.				X
	Axiothella mucosa				X
	Capitella capitata			X	
	Ceratonereis irritabilis			X	
Polychaete	*Chone spp.*			X	
	Cirratulidae			X	
	Cirrophorus spp.			X	
	Dasybranchus spp.				X
	Demonax microphthalmus				X
	Diopatra cuprea			X	
	Eteone heteropoda			X	
	Eteone spp.			X	
	Exogone dispar				X
	Exogone spp.			X	
	Fabricola trilobata				X
	Glycera americana				X
	Glycinde solitaria			X	
	Goniada littorea				X
	Gyptis spp.			X	
	Heteromastus filiformis			X	
	Hydroides dianthus			X	
	Kinbergonuphis simoni			X	
	Laeonereis culveri				X
	Lepidonotus sublevis			X	
	Lepidonotus variabilis			X	
	Magelona spp.			X	
	Maldanidae			X	
	Malmgreniella spp.			X	
	Marenzelleria viridis			X	
	Marphysa sanguinea				X
	Mediomastus ambiseta			X	
	Mediomastus californiensis			X	
	Melinna maculata				X
	Microphthalmus spp.			X	
	Mooreonuphis spp.			X	
	Neanthes succinea			X	
	Nephtys picta			X	
	Nereiphylla fragilis			X	
	Nereis lamellosa			X	
	Nereis micromma			X	
	Nereis riisei			X	
	Notomastus hemipodus			X	
	Odontosyllis enopla				X

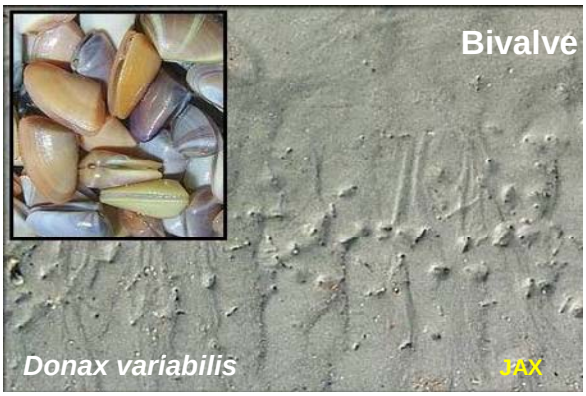
Group	Taxon	FMNH	GMNH	NBI	NMNH
	Odontosyllis spp.			X	
	Owenia fusiformis			X	
	Parahesione luteola			X	
	Paraonis fulgens			X	
	Paraprionospio pinnata			X	
	Pectinaria gouldi				X
	Phyllodoce arenae			X	
	Piromis roberti			X	
	Pista palmata				X
	Pista quadrilobata			X	
	Platynereis dumerilii				X
	Podarke obscura			X	
	Podarkeopsis levifuscina			X	
	Polydora cornuta			X	
	Polydora socialis			X	
	Prionospio heterobranchia				X
	Prionospio perkinsi				X
	Prionospio spp.			X	
	Sabellaria vulgaris			X	
	Schistomeringos rudolphi			X	
Polychaete	*Scolelepis texana*				X
	Scoloplos rubra			X	
	Sigambra tentaculata			X	
	Spiochaetopterus oculatus			X	
	Spiophanes bombyx			X	
	Spiophanes missionensis			X	
	Streblosoma hartmanae			X	
	Streblospio benedicti			X	
	Streptosyllis pettiboneae			X	
	Syllidae			X	
	Syllis spp.			X	
	Tharyx acutus			X	
	Tharyx dorsobranchialis				X
Pycnogonid	*Callipallene brevirostris*				X
Sipunculid	*Phascolion strombi*				X

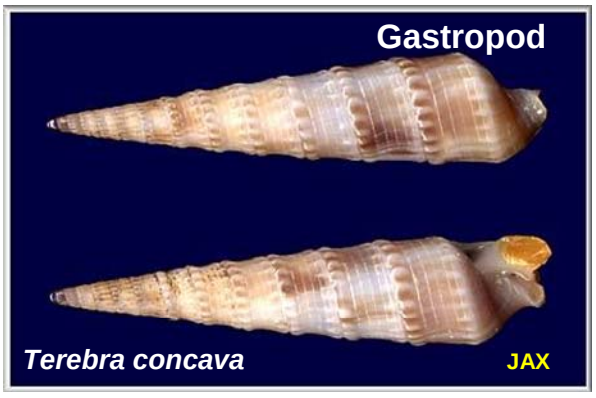
Appendix D. Common Benthic Macroinvertebrate Species

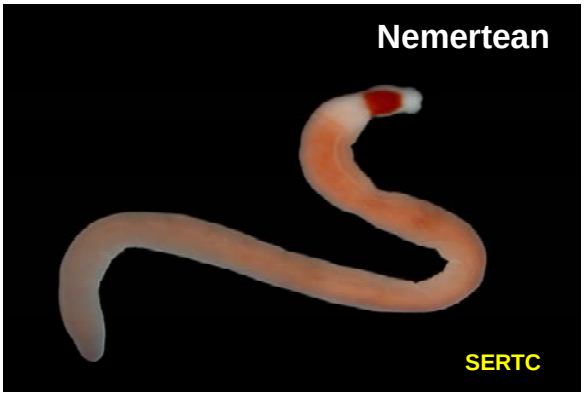


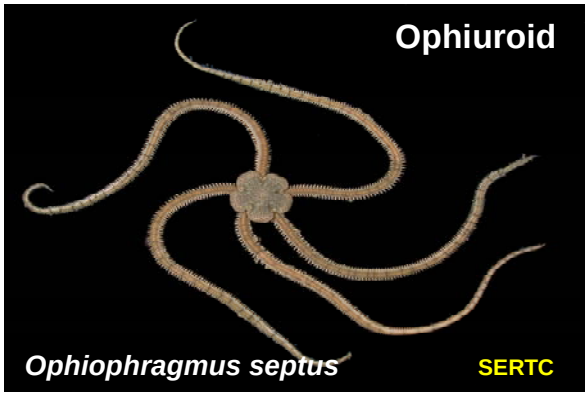


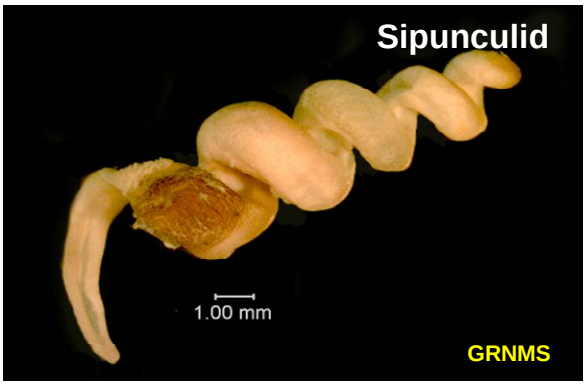


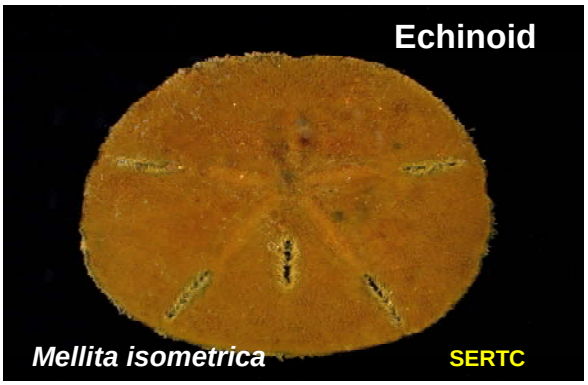


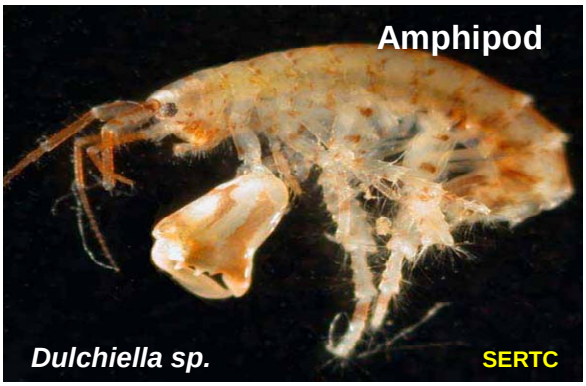






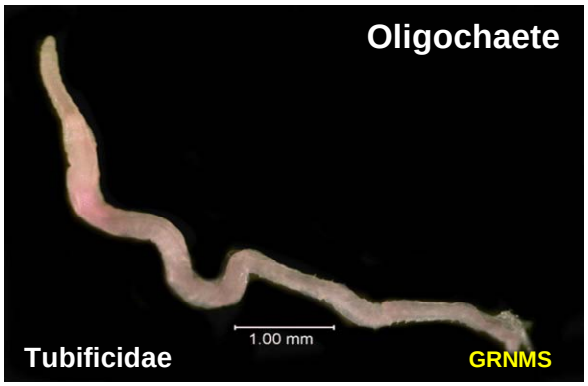

Sipunculid
1.00 mm
GRNMS


Echinoid
Mellita isometrica
SERTC

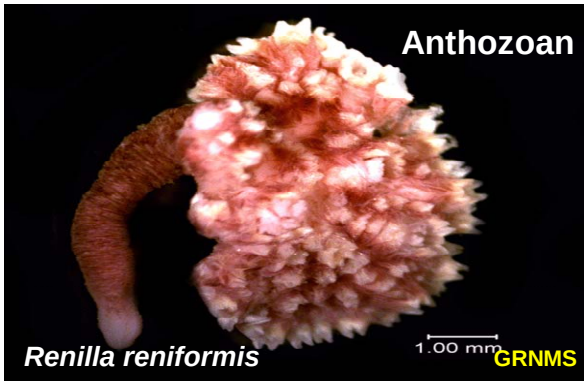

Amphipod
Dulchiella sp.
SERTC


Isopod
Idotea sp.
SERTC


Gastropod
Ilyanassa obsoleta
JAX


Oligochaete
1.00 mm
Tubificidae
GRNMS

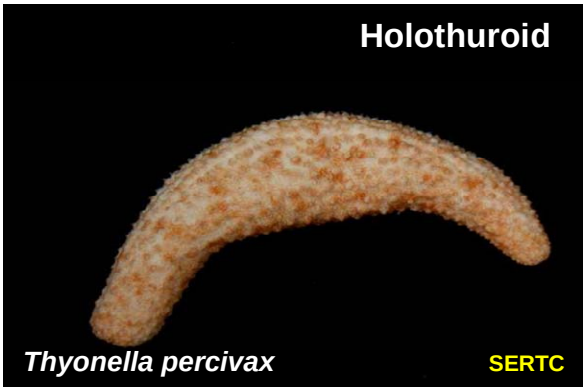

Polychaete
Nereis succinea
MarBEF

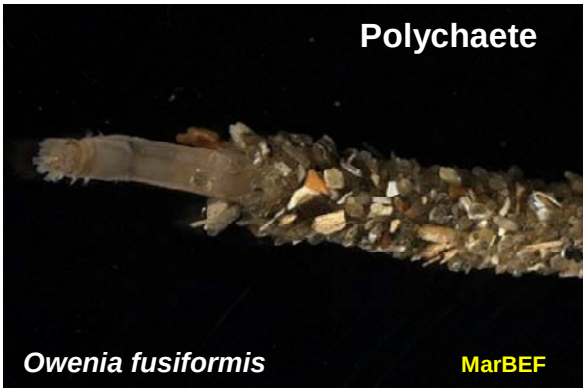

Anthozoan
Renilla reniformis
1.00 mm
GRNMS

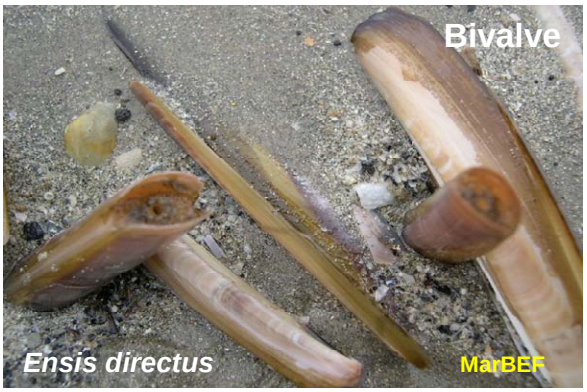

Bryozoan
Alcyonidium sp.
MarBEF


Chiton
Chaetopleura apiculata
JAX


Pycnogonid
Nymphon gracili
MarBEF


Holothuroid
Thyonella percivax
SERTC


Polychaete
Owenia fusiformis
MarBEF


Bivalve
Ensis directus
MarBEF


Gastropod
Littorina irrorata
JAX


Amphipod
Orchestia sp.
MarBEF

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.

NPS 910/100147, July 2009

National Park Service
U.S. Department of the Interior

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