U. S. Army Corps of Engineers
New York District

Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York: Reformulation Study

Beach and Intertidal Invertebrate Survey

January 2005 (Final)

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE), New York District is conducting a comprehensive feasibility-level Reformulation study to identify, evaluate, and recommend long-term measures for hurricane storm damage reduction for the south shore of Long Island, New York from Fire Island Inlet to Montauk Point (FIMP). The Reformulation Study is a multi-year and multi-task effort, involving project planning and engineering, economic analyses and environmental studies. Numerous study tasks are involved in the planning of storm damage reduction projects for the approximately 83-mile study area length. The study area also includes 26 miles of the Fire Island National Seashore (FINS) which is under the jurisdiction of the National Park Service (NPS).

The project area is located entirely in Suffolk County, Long Island, New York, along the Atlantic and bay shores of the towns of Babylon, Islip, Brookhaven, Southampton and East Hampton. The study area includes estuarial bays, which area (in order from west to east): Great South Bay, Moriches Bay and Shinnecock Bay (Figure 1). Great South Bay extends a coastal distance of 33.8 miles with connections to the ocean through Hempstead Bay to the west, Fire Island Inlet and Moriches Bay (at Narrow Bay) to the east (USFWS 1983). Moriches Bay extends 14.4 miles along the coast with oceanic connections at Great South Bay (Narrow Bay) to the west, Moriches Inlet and Shinnecock Bay to the east via Quantuck Canal, Quantuck Bay and Quogue Canal (USFWS 1983). Shinnecock Bay extends 11.2 miles coastally with connections to the ocean through Moriches Bay to the west via Quogue Canal and Shinnecock Inlet and to the east through Great Peconic Bay via the Shinnecock Canal (USFWS 1983).

This report presents the study design, methodologies and results from a seasonal survey of the beach and intertidal invertebrates in the FIMP study. The project was designed as an ecological inventory of beach and intertidal invertebrates at twelve bay and ocean transects located throughout the FIMP study area. These data will be used as baseline information on the beach and intertidal invertebrate community structure of the FIMP barrier islands against which future data can be compared.

The study area for this project includes the north side bay environment and south side ocean environment of the barrier islands. The south side of the barrier island is part of the Atlantic Ocean coastline. All three bays are identified as Federal and State Significant Fish and Wildlife Habitats and listed as “Significant Habitat and Habitat Complexes of the New York Bight Watershed.” Existing information on the upland, nearshore and intertidal invertebrate community structure of the south shore estuary of the FIMP study area is limited. As part of this major reformulation study, a multitude of studies is being conducted in order to bridge this data gap.

Sampling was conducted at twelve sites located along north-south transects of Fire Island and West Hampton Island using benthic cores, wrackline observations and pitfall traps. Sampling was conducted during the Spring (May) and Fall (October) of 2003. Major portions of the program targeted collections of benthic invertebrates at wrack, low, mid- and high tide locations, and collections of beach insects at supratidal, upland grass and wrack locations.

Invertebrate species collected incidental to these target organisms in both sampling areas were collected for information purposes.

The following are major elements of the study design and results:

General Study Results

- In all sample collections (cores, wrack sight, pitfalls), bay samples contained more individuals and taxa than ocean samples.

- Spring samples contained more organisms than fall samples in all collections except wrackline sight where fall abundances were greater than spring.

- Sediment grain size along both the bay and ocean consisted of sand primarily, with some gravel and fine sediment in low percentages.

Benthic Core Results

- A total of 17,672 organisms were collected in the benthic core samples; 13,218 organisms were collected from the bayside, while 4,454 were collected from the oceanside samples.

- A total of 68 taxa were represented in the benthic core samples. The dominant taxa were: Oligochaeta, Nematoda, Nematomorpha, *Corophium* sp., *Gemma gemma.* Although not considered a benthic organism, Collembola was observed to be dominant in the benthic core samples.

Pitfall Trap Results

- A total of 1,989 organisms were collected in the pitfall traps; 1,462 were collected from the bayside, while 527 were collected in oceanside samples.

- The number of taxa represented in pitfall trap samples was 83. The dominant taxa collected in pitfall trap samples were the insects *Lasius neoniger,* Ephydridae and Muscidae. Although not insects, the following amphipod species were abundant in the pitfall trap samples: *Talorchestia longicornis, Orchestia grillus, Talorchestia megalopthalma.*

Wrackline Sight Results

- A total of 1,339 organisms were collected in the wrackline sight samples; 1,268 were collected from the bayside, while 71 were collected in oceanside samples.

- A total of 29 taxa were represented in the samples. The dominant taxa collected in wrackline sight samples were the insects *Annulida maritima* and Acarina. Other dominant taxa include non-insect groups of Bivalvia, Annelida and Amphipoda.

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I. ACRONYMS

DEIS	**Draft Environmental Impact Statement**
EPA	**Environmental Protection Agency**
ESZ	**Eastern Shore Zone**
FIMP	**Fire Island to Montauk Point**
FINS	**Fire Island National Seashore**
GPS	**Global Positioning System**
GSB	**Great South Bay**
HEP	**Habitat Evaluation Procedure**
LPIL	**Lowest Practical Identification Level**
MOR	**Moriches Bay**
MSRC	**Marine Sciences Research Center**
NOAA	**National Oceanic and Atmospheric Association**
NPS	**National Park Service**
NYSDEC	**New York State Department of Environmental Conservation**
NYSDOS	**New York State Department of State**
NYSGEP	**New York Sea Grant Extension Program**
SAV	**Submerged Aquatic Vegetation**
SH	**Shinnecock Bay**
SSER	**South Shore Estuary Reserve**
STP	**Sewage Treatment Plant**
USACE	**United States Army Corps of Engineers**

II. INTRODUCTION

Naturally occurring storms create the potential for breaching and/or flooding of Long Island's barrier islands, which can significantly impact mainland communities bordering Great South Bay (GSB), Moriches Bay (MOR) and Shinnecock Bay (SH). Coastal communities of the study area are subject to economic losses during severe storms. Principal damages to these coastal areas are the result of flooding and erosion associated with extreme tides and wave action. These storms, as well as alternatives that provide for storm damage protection, also have the potential to affect nearshore benthic assemblages, e.g. those resulting from fill and other project related operations. A study to evaluate possible alternatives for storm damage reduction entitled, "The Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York: Reformulation Study" is being conducted by the U.S. Army Corps of Engineers (USACE).

The barrier island is a dynamic transition zone between land and sea, subject to sudden disturbances. The barrier islands function as protective buffers to a highly productive estuarine ecosystem. Prior to the 1900's, high energy beach environments were thought to be devoid of life (Kluft-Steinback 1999). More recent studies have indicated the existence of macrofauna adapted to this high energy beach environment (Kluft-Steinback 1999). However, there is still a need for more information on beach and intertidal invertebrate communities, especially since they are an important component of the ecosystem serving as forage for shore birds.

While avifauna were not directly studied as part of this investigation, this report focuses on their potential prey items. Some shorebirds that utilize the barrier island ecosystem include the breeding and migrating birds listed in Table 1. Table 1 lists the bird species along with information on their seasonality and type of use in the study area. Of the species listed in Table 1, the piping plover (*Charadrius melodus*) is currently listed as federally threatened in this region. In addition, the eastern population of red knot (*Caladris canutus*) is currently listed as threatened in New Jersey and endangered in Delaware. Other shorebird species that forage on invertebrates along the beaches of the study area include: dunlin (*Calidris alpina),* sanderling *(Calidris alba),* red knot (*Calidris canutus*), semipalmated sandpiper (*Calidris pusilla*), piping plover (*Charadrius melodus*), semipalmated plover (*Charadrius semipalmatus*), black-bellied plover (*Pluvialis squataroia*), lesser yellowlegs (*Tringa flavipes*), greater yellowlegs (*Tringa melanoleuca*), willet (*Catoptrophorus semipalmatus*), American oystercatcher (*Haematopus palliates*).

Numerous investigations have been performed to provide information that will assist the USACE in evaluating project alternatives of the reformulation study. This component of the program seeks to develop a baseline characterization of the intertidal benthic fauna and beach insect communities that occur in the Fire Island Inlet to Montauk Point (FIMP) study area. This report presents the study design, methodologies and results from a spring and fall survey of the beach and intertidal invertebrate assemblages located along both the oceanside and bayside of the FIMP study area (Figure 1). The primary objective of the field study was to characterize the temporal and spatial community structure of intertidal benthic invertebrates (organisms living on or in the sediment) and beach invertebrates along a high-to-low gradient from the upland beach grass zone through the intertidal zone. This information will be used as a basis for the impact assessment in the Draft Environmental Impact Statement (DEIS). Alternatives presented in the reformulation program will be assessed with respect to spatial and temporal trends in community structure along both oceanside and bayside transects. This information will also be used in impact analysis tools such as the Habitat Evaluation Procedure (HEP) and Conceptual Model currently under development for the study area.

III. METHODOLOGY

Sampling was conducted in May and October 2003. Samples were collected at a total of twelve sites along the barrier islands bordering the Atlantic Ocean and Great South Bay (GSB), Moriches Bay (MOR) and Shinnecock Bay (SH) (Figure 2). The program included collections of beach invertebrates along a high-to-low gradient from an upland grassy zone in the dune to the low tide of the intertidal zone. The focus of this program was invertebrate forage species residing in nearshore habitats (e.g. beach and intertidal invertebrates) that may be impacted by beach nourishment and other project alternatives.

A. Stations

Stations sampled on Fire Island were chosen to coincide with stations sampled by Kluft-Steinback in 1995-96. For this effort, twelve stations were sampled during both the spring and the fall. Station logistics of the current study, such as location, date, time of sampling, tide, moon phase, latitude, longitude and sample type are provided in Table 2. Latitude and longitude were recorded at each site using a hand-held Garmin 185 Global Positioning System unit (GPS). Photographs of representative stations of the study area are shown in Figure 3.

The following locations were sampled during the spring: Democrat Point, Kismet West, Sailor's Haven, Talisman, Long Cove, Old Inlet, Smith Point, Pattersquash, Great Gun, Pike's Beach, Tiana, Ponquogue East. The same twelve stations were sampled during the fall with the exception of Long Cove. Due to the difficulty in accessing the oceanside beach stations at Long Cove during the spring, this station was replaced with Watch Hill for fall sampling. All stations were sampled along the bayside and oceanside of the barrier island. Therefore, samples collected on the oceanside of the barrier island were identified by the bay which is located in the geographic area of the station. Bayside transects were located at the following stations in each bay: GSB: Democrat Point, Kismet West, Sailor's Haven, Talisman, Long Cove/Watch Hill, Old Inlet, Smith Point; MOR: Great Gun, Pattersquash, Pike's Beach; and SH: Tiana, Ponquogue East. All ocean sites were sampled along the Atlantic and not in the bay. For example, Kismet West was sampled along the bay and along the ocean. However, in tables and plots it may be classified as GSB since it was located either in GSB or on the oceanside opposite GSB. The collection of target organisms from the various habitats were: intertidal infauna (cores), wrackline infauna and surface organisms (cores, wrack sight, pitfall traps), supratidal organisms in the bare sand of the back-beach and beach grass zones (pitfall traps).

B. Sampling Periodicity- Spring and Fall 2003

Sampling was conducted once during the spring (May/June) and once during the fall (October) in 2003. The sampling periods were selected to coincide with the spring and fall migrations of Atlantic coast shorebirds in the New York region (Cornell University 1988 & 1998). Table 1 lists species of shorebirds found in the sampling area and seasonality of occurrence. Information on tidal phase, lunar cycle and time of sampling event was recorded on all station logs. The Sampling Protocol (see Section C below) discusses the types of samples collected, specific sampling methodologies and sample locations at each site.

C. Sampling Protocol

The sampling effort was designed to provide semi-quantitative data on the invertebrate communities of the beach and intertidal zones of the study area. While the design of the study is not sufficiently robust to perform statistical analyses (i.e. one sample per location per season), it does provide an overview of the temporal and seasonal distribution of the invertebrate communities.

Sampling was conducted along a transect gradient that extended from the upland beach grass zone (dune) to the intertidal zone on both the bay and ocean sides of the barrier island. The exact sample collection location along the beach depended on the type of sample, e.g. benthic core, pitfall trap, wrack sight. The following sections will discuss the types of samples collected and their locations.

Sediment Grain Size

At each transect, sediment grain size samples were collected at each of the four tidal zones where benthic infauna samples were collected ; low, mid, high tide and wrackline (Figure 4). During the spring round of sampling, sediment samples for grain size were collected by scooping sediment out of the impression in the sand left by the benthic corer. During the fall, sediment was collected with a 3 cm diameter x 65 cm long aluminum corer hammered into the sediment to a depth of 20 cm (Figure 5). A minimum of 225 grams of sediment was necessary to perform grain size analysis. Grain size samples were transferred to plastic bags (double-bagged) and sent to the laboratory for analysis. In the laboratory, the grain size samples were analyzed using ASTM D 422, "Standard Test Method for Particle-Size Analysis of Soils," (ASTM International 2002).

Core samples were collected for both benthic invertebrates and sediment grain size. Cores used for benthic invertebrates were collected by hand with a 7.6 cm diameter x 65 cm long aluminum corer hammered into the sediment to a depth of 20 cm (Figure 5). Each core sample was sieved through a 0.5 mm mesh screen to retain macrofauna.

Contents were then transferred to a jar, preserved in 95% ethanol and sent to the laboratory for analysis.

In the laboratory, all core samples were rinsed gently with tap water through a 0.5 mm mesh sieve to remove preservatives and sediment. Benthic samples were stained with Rose Bengal, and stored in 70% isopropanol solution until processing. Benthos samples were processed under a stereoscope separating sediment from biota. Organisms were carefully removed from the remainder of the sample with forceps and placed in labeled plastic vials containing 70% isopropanol. After sorting, macroinvertebrates were identified to the lowest practical identification level (LPIL). The nemerteans, anthozoans, and hydrozoans were left as high taxonomic groupings due to the difficulty associated with their identification or the small size and scarcity of specimens. The number of individuals for each taxon, excluding fragments, was recorded. In this report, the term abundance refers to the total number of organisms in a sample. In some instances non-benthic organisms were collected in the samples that were not targeted for collection. These organisms are considered incidental, e.g. beach insects in benthic cores. With the exception of Collembola in the benthic core samples, incidental organisms were noted as present but not included in quantitative data analyses. Some organisms could not be identified as either benthic invertebrates or incidental and, therefore, considered unidentified and noted as 'UNID'. Unidentified organisms were not considered in calculations of number of taxa. All laboratory benchsheet data were transferred to Microsoft Excel (.xls) format spreadsheets for subsequent analyses. Invertebrate densities were calculated by dividing the total number of animals by the area sampled. The area sampled was calculated using the formula πr^2, where r= the radius of the aluminum corer.

Wrack Sight Samples

A visual search for wrack fauna was conducted on site in the field. Once on site, a 0.075 m^2 quadrat (~0.28 x 0.28 m) was randomly tossed in the wrackline (Figure 6). All wrack within the quadrat was then processed for organisms using two methods. During the spring, the samples were collected using the bucket-flotation method (Lavoie 1985). The bucket-flotation methodology consisted of collecting all wrack debris from inside the quadrat and transferring it to a white bucket filled with seawater. In the bucket, the wrack debris was submerged for five minutes. All organisms that floated to the surface were picked out of the bucket using either forceps or a pipet. All organisms were placed in vials, preserved in 95% ethanol and taken to the lab for analysis. In the lab, specimens in the vials were poured into a Petri dish and sorted under a dissecting microscope. All organisms were enumerated and identified to the LPIL.

During the fall an alternate method was developed in the field to collect wrackline organisms. The method utilized in the fall was as follows: wrackline debris was collected from within the quadrat, wrack debris was transferred to a 3.8 liter bag (double bagged), wrack debris contents were taken to the lab for analysis. In the lab, the contents of each bag were shaken out into a 250 micron sieve. All debris and sand within the sieve was sorted using forceps with the aid of a NOVA 2000 high intensity illuminator and magnifying glass. All wrack organisms collected on the sieve were sorted and identified using a Nikon SMZ1000 dissecting scope. A bin was kept under the sieve at all times to collect any organisms that might have passed through the sieve. Contents of the bin were then viewed under the Nikon dissecting scope and all wrack organisms were enumerated and identified to LPIL. The bin typically collected very fine sand and springtail insects (Collembola). Collembola identified in the bin were included in calculations of insects inhabiting wrackline debris. Some organisms could not be identified as either a beach insect or incidental organism and were, therefore, considered unidentified and noted as 'UNID'. Unidentified organisms were not considered in calculations of number of taxa.

To ensure that all organisms were collected, all samples were sorted using the water submersion method in addition to the sieve sorting. The wrack debris remaining after the first round of sorting was put into a five gallon bucket filled with water, agitated underwater and allowed to sit for 5-10 minutes with periodic agitation under the water. All insects floating on top of the water after this time were collected and identified. If the presence of small annelid worms was noted, the entire sample was examined by eye in addition to the above methods. This method provided more sorting accuracy in removing annelid worms that adhered to eelgrass due to their mucous coating. However, this was not typical since most of the annelids were in the sand. Data was recorded on laboratory benchsheets. Lab data was entered into the computer using the MS Excel spreadsheet program.

Pitfall Traps

Pitfall traps were set to collect mobile insects living on the beach in the wrackline, supratidal, and grass zones (Figures 4 and 7). The wrackline region was the same area defined in the benthic core methods section. Supratidal samples were collected upland of the high tide line, e.g base of dune. At some locations, vehicle tracks were evident at the wrackline and/or supratidal locations (Figure 8). In those instances, the pitfall trap was set further upland, duneward of the vehicle tracks. Samples set in the beach grass zone were located in the upland grassy portion of the barrier island in the dune. Pitfall trap samples were left overnight and collected the following day. In a few instances, upon arrival the next day, pitfall trap samples were either missing or contents had washed away. Those samples are denoted on the sample sheets as n/a, not available.

Pitfall traps consisted of plastic cups (0.23 liters) buried level with the sand surface. Each pitfall trap was partially filled with soapy water in order to trap organisms. The pitfall traps were left overnight in order to collect nocturnal organisms. Upon retrieval, approximately 20 ml of full-strength formalin was added to each sample for preservation. Samples were then picked up for laboratory analysis. In the laboratory, pitfall trap contents were emptied into a sorting tray, contents were sorted and observed under a stereoscopic sorting microscope and separated from detritus. After sorting, all organisms were identified to the LPIL. In some instances organisms were collected in the samples that were considered incidental, e.g. benthic invertebrates in pitfall traps. These incidental organisms were noted as present and not included in quantitative data analyses.

Some organisms could not be identified as either beach invertebrates or incidental and, therefore, considered unidentified and noted as 'UNID'. Unidentified organisms were not considered in calculations of number of taxa.

IV. RESULTS AND DISCUSSION OF THE CURRENT STUDY

Descriptions of each station are provided in Table 3. Table 3 includes information on the station location, depth of water offshore, amount of wrack, type of vegetation on the beach/dune, beach width, and beach profile. In addition, notes are provided on other important characteristics for each site. Table 3 includes profiles for all 13 stations.

Table 4 summarizes the number of organisms collected at each location for each sampling methodology. Also listed in Table 4 is a comparison of the total number of organisms collected in the bay versus ocean, as well as the number of samples collected for each sampling technique. The total number of organisms collected when all sampling techniques are combined was 21,058. A total of 16,004 individuals was collected in bay samples, while a total of 5,054 was collected along the oceanside. A total of 12,565 organisms was collected in the spring, while a total of 8,493 was collected in the fall. The greatest abundance of invertebrates (17,672) was recovered from the core samples, followed by 1,989 organisms in pitfall trap collections and 1,397 wrack sight organisms. Individual results from each of these surveys will be described in the following sections.

Table 5 lists the scientific and common name of the classes and orders of the taxonomic groups phylogenetically. Organisms will be referred to by their scientific name as some taxonomic groups are broad and may have overlapping common names. Technical appendix tables list all of the taxa collected in the beach and intertidal invertebrate survey using all gear types.

A. Benthic Invertebrate Survey

i. Sediment Grain Size

Sediment grain size analyses were performed for samples collected at all benthic stations and classified as percent sand, gravel and fines. Sediment types are defined by the diameter of the grain particle based on the Unified Soil Classification System as follows: fines= up to 0.075mm, sand= 0.075 to 4.75mm, gravel= 4.75 to 75mm. Sand can be further broken down into the following size categories: find sand= 0.075 to 0.425mm, medium sand= 0.425 to 2.0mm, coarse sand= 2.0 to 4.75mm. Grain size was predominantly sand at all stations throughout the study for both seasons. This was to be expected as sand, derived from the continental shelf by onshore wave action, is the predominant component of barrier island beaches. Outliers including a small percentage of gravel and a lesser percentage of fines were observed at some stations. Appendix Tables 1 and 2 provide a summary of the percent composition of sediment grain size at each station for each season. Since sand was the predominant type of sediment, the percent sand composition was plotted for each station in Figure 9.

The results of sediment grain size analyses for this study are consistent with other studies. Grain size analyses from other FIMP studies show that the average composite grain sizes were generally coarsest in the intertidal zone and finest in the subtidal zone with an average median grain size of 0.2 to 0.4mm (Anders and Leatherman, 1981; Gravens *et al.* 1999). The sand grain particles within the beach zones studies are composed primarily of quartz, granite and biotite (Anders and Leatherman, 1981).

As would be expected based on the habitats studies, sand was the dominant grain size in all samples for all seasons, generally making up greater than 95% of the sediment grain size distribution for samples collected in both seasons. At stations where gravel was present, the percentage of gravel was higher during the spring than the fall at all locations. Spatially, the grain size at all stations was predominantly sand, generally always greater than 90% of the total composition (typically 99-100%). During the spring, stations with lower percentages of sand (~80%) were located at Old Inlet (GSB, low tide, ocean), Pattersquash (GSB, low tide, ocean), Ponquogue East (SH, low tide, bay), Tiana (SH, mid-tide, bay) and Tiana (SH, wrack, bay). The stations with percentages of sand approximating 80% during the fall were located at Tiana (SH, low tide, ocean), Watch Hill (GSB, low tide, ocean), Talisman (GSB, low tide, bay) and Great Gun (MOR, low tide, bay).

Sediment composition along tide zones was similar, consisting primarily of sand with a low percentage of gravel (less than 5%) at the low tide location. Fine sediment was present at all tide locations, however comprising only ~1% of the total composition. Waves are the primary cause of sediment transport in the littoral (intertidal) zone (www2.nature.nps.gov/geology/parks/fiis). In shallower waters, wave energy is dissipated through bottom friction, thereby losing energy, e.g. along the bayside. Waves approaching the shoreline from deeper waters retain more energy (e.g. along the oceanside). As expected, the oceanside sediment samples were well sorted and the bayside less sorted due to more intense wave action along the oceanside.

ii. Animal Abundance and Species Composition

The total number of organisms collected in the bayside and oceanside samples were 13,218 and 4,454, respectively. Total richness ranged from a total of 43 different taxa collected in the spring bayside samples, to 13 taxa in the spring Oceanside (Appendix Table 3). Hence, overall, greater numbers of individual and taxa were collected from the bayside compared to the oceanside samples. This trend is likely due to the generally more stable physical conditions present on the bayside, along with a greater source of nutrients.

a. Seasonal Trends: Spring vs. Fall

A greater number of benthic invertebrates was collected during the spring compared to the fall. In the spring, 10,290 organisms (representing 43 taxa) were collected while only 7,382 organisms (representing 42 taxa) were collected in the fall (Appendix Table 3). The significance of this difference cannot be determined based on the size of the data set, however, typically warmer, nutrient rich waters present in the spring result in greater benthic densities. Overall, the benthic communities on both the ocean and bay sides include a wide variety of forms based on feeding types and salinity preference. Eight taxa of benthic invertebrates dominated the bay and ocean collections contributing at least 1% to the total composition during either spring or fall. Oligochaeta were dominant in both bay and ocean samples during both seasons. Other dominant taxa collected along the bayside were nematode and nematomorph worms, the gem clam *Gemma gemma,* and *Corophium* sp., a tube dwelling amphipod. The insect order Collembola (springtails) was also abundant in the bayside samples, however, Collembola were noted as incidental since they are not benthic organisms. In addition to oligochaetes, the oceanside samples were numerically dominated by nematodes, *Mytilus edulis* (blue mussel) and Turbellaria flatworms.

Taxa contributing at least one percent to the total percent composition are plotted in pie charts in Figure 10. The upper two pie charts show the percent composition of benthic invertebrates for bayside spring and fall collections. During the spring and fall Oligochaeta dominated the samples contributing 92% and 42% to the total composition, respectively. The lower two pie charts show the percent composition of benthic invertebrates in oceanside spring and fall collections. During the spring, Oligochaeta was the dominant taxon contributing 55% to the total composition, while Nematoda was most abundant in the fall contributing 70% to the total composition.

Total abundance and taxonomic richness were higher during the spring on the bayside and higher during the fall on the oceanside. Despite these observed differences, taxonomic richness did not vary greatly between seasons on either the bay or oceanside. Benthic invertebrate collections along the bay were approximately three times greater in the spring than the fall, while oceanside abundances were five times higher during the fall than the spring. Along the bay, 43 taxa were represented in spring samples compared to 36 taxa in the fall, while along the ocean 11 taxa were represented in the spring versus 13 taxa in the fall (Appendix Table 3).

b. Spatial Trends

Appendix Table 4 is a list of the total number of benthic invertebrates collected at each station and tidal location for both bay and oceanside samples. An analysis of benthic invertebrate abundance at these locations is provided in the following sections.

i. West-to-East (by station and bay region)

The total number of benthic organisms collected at each station is shown in Figure 11. Stations in Figure 11 are plotted from west-to-east and designated by bay region nearest the sample. As noted earlier, the bay designation refers to the adjacent bay for both the ocean and bay stations. The total number of organisms at each station appears to fluctuate randomly from station to station along a west-to-east gradient. While no trend is apparent, the wide fluctuations in the number of organisms, is largely due to the distribution of Oligochaeta and Nematoda (Technical Appendix Tables). An analysis of the total number of organisms along the bayside versus oceanside stations is provided in the next section.

Mean abundances of organisms were calculated for each season and bay/ocean station and designated by bay region in Appendix Table 5. During the spring, mean abundances along the bayside decreased greatly from west-to-east, while during the fall they remained fairly constant. Along the oceanside, mean abundances for each bay were fairly constant for both spring and fall. A calculation of bay and ocean mean abundances for each bay indicates that the highest and lowest abundances of benthic invertebrates were collected in the GSB region: 951 organisms along the bayside transect and 247 organisms along the oceanside transect. Highest mean abundances were observed in GSB during the spring, while the lowest mean abundances were observed during the spring along the oceanside. Both GSB and MOR had higher mean abundances along the bay, while SH had a higher mean abundance along the ocean transect.

ii. Bayside vs. Oceanside

A comparison was made of the abundance of the intertidal benthic invertebrates (i.e. organisms collected in the core samples) inhabiting the bayside transect with those located along the oceanside transect. In general, there were three times as many organisms in the bay samples than ocean samples (13,218 vs. 4,454, Appendix Table 3). Figure 11 shows the distribution of intertidal benthic invertebrates at each station for both the bay and ocean samples. The stations with the highest abundances along the bay were both located in GSB: Talisman (4,130 organisms) and Kismet West (3,530 organisms). The lowest abundances in the bay were at Democrat Point (GSB) (13 organisms) and Tiana (SH) (61 organisms). Along the ocean transect, the highest abundances were located at Talisman in the GSB region (833 organisms) and Pattersquash (GSB) (709 organisms). The lowest abundance on the oceanside was also in the GSB region at Sailor's Haven (40 organisms).

In general, the greatest difference in the number of benthic invertebrates collected from the bay and ocean samples was observed among stations located in the GSB region. At all stations in GSB, with the exception of Democrat Point and Watch Hill, bay abundances were higher than ocean abundances. In MOR, the number of benthic invertebrates collected from the bay and ocean sites were similar in abundance, ranging from 40 to 386 organisms. Along the bayside, higher abundances were observed in the

GSB region with the highest abundances located at Kismet West and Talisman. Benthic abundances in SH and MOR were similarly low along the bayside. Abundances of benthic organisms along the oceanside were variable between stations. The highest abundances along the oceanside transect were observed at Talisman (GSB), Pattersquash (MOR) and Ponquogue East (SH). The lowest oceanside abundances were observed at Sailor's Haven and Democrat Point in GSB.

c. Tidal Transects (Low, Mid, High, Wrack)

i. Seasonal Species Composition Along Tide Lines

Benthic invertebrates were analyzed along different tidal zones (low, mid, high, wrack) for similarities/differences in species composition and abundance (Appendix Tables 6 and 7). Figures 12a and 12b are pie charts showing the taxonomic composition of organisms collected along the bayside and oceanside transects. Only those taxa contributing more than 1% to the total composition of the sample are represented in Figures 12a and 12b. Figure 12a shows the dominant taxa in the bay and ocean samples during the spring. Oligochaetes and nematodes were dominant in both the bay and ocean samples. During the spring in the bay, Oligochaeta was the dominant taxon at all tide zones (mid, high, wrack) except low where *Corophium* sp. was dominant. Oligochaetes and nematodes were dominant during the spring in the ocean samples at all tidal zones. *M. edulis* and Turbellaria were also abundant at the low tide zone. The low tide sample had the greatest number of taxa along both the bay and the ocean.

Figure 12b shows the dominant taxa in the bay and ocean fall samples. During the fall, oligochaetes were still a dominant taxon along the bayside, however nematodes and nematomorphs had greater representation than during the spring. Additionally, nematomorphs contributed most to percent composition during the fall along the bay at low tide. The fall oceanside samples were primarily nematodes and oligochaetes, as in the spring, however nematodes were more abundant than during the spring. Oligochaetes and nematodes are typical components of all marine benthic communities more typically associated with fine-grained sediments. The presence of oligochaetes and nematodes in high numbers during this study is more likely attributed to physical disturbance of the sediment by wave action rather than a community distribution based on ecological preferences.

Analyses of the total number of benthic invertebrates and total number of taxa collected at each tidal location during the spring and fall is shown in Figure 13. The top panel in Figure 13 represents the total number of organisms collected at each tide location (wrack, high, mid, low). In general, relative abundance corresponded with the distribution of Oligochaeta and Nematoda for the different zones (Technical Appendix Tables). Benthic abundance was greatest along the bay during the spring at the high and wrack tide zones (4,498 and 3,525 organisms, respectively). Lowest benthic abundances were observed during the spring along the ocean at the high and wrack zones (58 and 47 organisms respectively). Spring abundances along the oceanside were consistently lowest at each tide location. Fall benthic abundances along both the bay and ocean appeared similar at each tide location ranging from 642 to 1,187 organisms.

Taxonomic richness was consistently greater in the bay samples than the ocean samples (Figure 13 bottom panel), largely due to the presence of a much greater variety of Polychaeta and Crustacea (Appendix Table 3) in the bayside samples. This difference is likely due to the more stable and nutrient rich nature of the habitats on the bayside compared to the oceanside. Taxonomic richness was highest on the bayside, during the spring in the low tide zone (30 taxa). Spring and fall oceanside samples were consistently low at all tide zones, likely due to the unstable high energy nature of this habitat to which few benthic organisms are adapted. In general, bayside taxonomic richness across all tide zones ranged from 9 to 30 taxa, while oceanside richness ranged from 4 to 10 taxa.

During the spring, when overall collections were higher, the trend is for more organisms to be found in the high and wrack zones. During the fall, all zones had approximately equal numbers of organisms. The same pattern is evident in a comparison of bay versus ocean benthos. Along the bayside, there were more organisms collected in the high and wrack zones, while along the ocean the number of organisms was relatively similar for all tidal zones.

d. Species Composition vs. Sediment Grain Size

Sediment grain size was analyzed along with taxonomic abundance at all tidal locations. As stated previously, sediment grain size was fairly consistently sand throughout all locations with minimal amounts of gravel and fine sediment, hence, it is likely that the distribution of organisms is more related to habitat stability, availability of a food source and the regularity of inundation, than it is to sediment grain size. The highest amounts of gravel were located at the low tide locations, which is also the zone of most frequent inundation. An analysis of organisms located at low tide (i.e. stations with slightly more gravel) versus other tidal locations was presented in the previous section on benthos.

The results of that analysis indicated the following differences between low, mid, high and wrack tide locations:

- Oligochaeta was most abundant at tidal locations with primarily sand (mid, high, wrack) while nematodes were dominant at the low tide locations which tended to have more gravel present;
- Nematomorpha was present only at low tide where more gravel and moisture were present;
- taxonomic richness (total number of taxonomic groups) was approximately twice as great at low tide than at the mid, high and wrack locations;
- and the highest percentage of fines was present at Talisman, the station with the highest number of organisms. This was observed along the bayside where wave

action was less intense and could be the result of higher nutrient content associated with the fine-grained sediments.

While it appears that the distribution of organisms may in some cases be influenced by sediment grain size, it is more likely due to hydrological stability. In zones where hydrology is present more frequently throughout the tidal cycle, higher densities and greater taxonomic richness would be observed. Sediment grain size is not dictating the distribution of the organisms, rather both the distributions of sediment grain size and organisms is likely due to wave action and not ecological requirements.

B. Beach Invertebrates

i. Beach Invertebrate Abundance and Species Composition

The total number of beach invertebrates collected in the bayside and oceanside pitfall samples were 1,462 and 527, respectively (Appendix Table 8). Seventy two different taxa were collected from the bayside pitfall samples, and 38 taxa were collected from the Oceanside samples (Appendix Table 8). Hence, as with the intertidal core samples, greater numbers of individual and taxa were collected from the bayside compared to the oceanside pitfall samples.

a. Seasonal (Spring vs. Fall)

A greater number of beach invertebrates was collected in the spring samples compared to the fall (Appendix Table 8). During the spring, 1,128 organisms (representing 58 taxa) were collected along the bayside and 476 organisms (30 taxa) along the oceanside. In the fall, only 334 organisms (representing 34 taxa) were collected along the bayside and 51 organisms (15 taxa) along the oceanside.

Five beach invertebrate taxa dominated both the bay and ocean collections contributing at least 5% to the total composition during either spring or fall. The five dominant taxa collected along the bayside were three types of insects: Ephydridae (shore flies), *Lasius neoniger* (turfgrass ant), Muscidae (muscid flies) and two species of beach flea amphipods, *Orchestia grillus* and *Talorchestia longicornis.* Of the five dominant taxa collected along the oceanside two were the insects Ephydridae and *Clivinia* sp. (ground beetle), while three were non-insect taxa, two species of beach flea amphipods, *Talorchestia longicornis and Talorchestia megalopthalma* and incidental collections of the bivalve *Mytilus edulis (*blue mussel). *T. longicornis* is typically found on fine sandy beaches, in protected locations, at and above mean high water and can withstand lower salinities. *T. megalopthalma* prefers higher salinities and coarser sand (Bousefield, 1973). This may explain the higher incidence of *T. longicornis* in the bayside samples.

Taxa contributing at least one percent to the total composition of the sample are plotted in pie charts in Figure 14. The upper two pie charts show the percent composition of beach invertebrates for bayside spring and fall collections. During the spring, *T. longicornis* (65%) dominated the samples, and was replaced in the fall with *O. grillus*

(52%). Each of these species contributed to greater than half of the total composition. The lower two pie charts show the percent composition of beach invertebrates in oceanside spring and fall collections. During the spring, *T. longicornis* (58%) was dominant, while during the fall both *T. megalopthalma* (36%) and *T. longicornis* (24%) dominated contributing to more than half of the total composition.

Note, throughout the study, total abundance and taxa richness were generally low during both seasons. Total abundance and taxonomic richness were both higher during the spring than the fall at both bay and ocean locations. Beach invertebrate collections along the bayside were approximately three times greater in the spring than the fall, while oceanside abundances were nine times higher during the spring than the fall. Taxonomic richness was also higher in the spring than the fall. Along the bay, 58 taxa were represented in spring samples compared to 30 taxa in the fall, while along the ocean 34 taxa were represented in the spring versus 15 taxa in the fall.

b. Spatial

The total number of beach invertebrates collected at each station and beach zone location (wrack, supra, grass) is listed in Appendix Table 9. Total abundance on an individual transect basis ranged from 0 to 386, but was typically less than 75. Richness on an individual transect basis ranged from 0 to 21, but was typically below 10. Appendix Table 9 lists total pitfall organisms by spring/fall and bay/ocean.

i. West-to-East (by station and bay)

The total abundance of beach invertebrates collected at each station is shown in Figure 15. Stations in Figure 15 are plotted from west-to-east and designated by bay region nearest the station. Note that oceanside collections were all located opposite the bays on the south side of the barrier island. The top panel in Figure 15 shows the bayside collections by station for spring and fall. The highest bayside abundance was located in the GSB at Smith Point during the spring (398 organisms), twice as many organisms as was observed at other sites. The great majority of organisms collected from the Smith Point was the amphipod *T. longicornis* (Technical Appendix Tables). The lowest abundances were observed during the fall in GSB at Old Inlet (4 organisms), Kismet West (10 organisms) and in SH at Ponquogue East (9 organisms). The bottom panel in Figure 15 shows the oceanside collections by station for spring and fall. The highest oceanside abundance was located during the spring in GSB at Old Inlet (162 organisms). With the exception of the Wrack Site sample, the overwhelming dominant for the spring, Oceanside beach insect community was also *T. longicornis* (Technical Appendix Tables). In general, fall abundances were low (5 or fewer organisms) at all stations except in SH at Tiana (20 organisms). Abundance at Kismet West in GSB during the spring was only 5 organisms.

Appendix Table 10 shows the mean abundances of organisms collected in the pitfall traps for each region and season. Mean beach invertebrate abundances were calculated for both bay and ocean samples. The highest mean abundance was observed along the bay in MOR with 161 organisms, followed by 118 organisms in GSB. *T. longicornis* was the dominant component for most of the stations in these two bays (Technical Appendix Tables). The highest mean seasonal abundance was also observed in MOR during the spring with 142 organisms. The lowest mean abundances were observed in GSB along the ocean (36 organisms) and SH along the bay (39 organisms). The lowest mean seasonal abundances were observed during the fall in the ocean at GSB (2) and MOR (5). Numbers of organisms were relatively low across all sites. In general, the highest mean beach invertebrate abundances occurred in the spring at both the ocean and bay sites. The lowest mean abundances were recorded in the fall across all regions.

ii. Bayside vs. Oceanside

A comparison of bayside versus oceanside beach invertebrate abundances was conducted (Appendix Table 9). In general, there were approximately three times as many organisms in the bayside samples compared to oceanside samples when both seasons were combined, 1,462 versus 527, respectively. When spring and fall samples were compared, it appears that more organisms were collected in the bay samples than the ocean with the exception of Talisman (spring), Old Inlet (spring), Tiana (spring and fall), Ponquogue East (spring) (Appendix Table 9). Figure 15 shows the distribution of beach invertebrates at each station for both the bay and ocean samples.

The bottom panel in Figure 15 shows the difference in each station between the bay and ocean samples. While most pitfall samples had generally low numbers of individuals (less than 10), the station with the highest abundance along the bay was Smith Point (GSB, 421 organisms); *T. longicornis* represented 94% of the total number collected in the Smith Point Bay samples (Technical Appendix Tables). Sailor's Haven (GSB), Pattersquash (GSB) and Pike's Beach (MOR) also had high abundances with approximately 150-200 organisms. The high abundances at those stations can be attributed to the spring collections that contributed most to the total. The lowest bay abundances were located in GSB at Watch Hill (17 organisms, note this station was only sampled during the fall) and Old Inlet (27 organisms). Kismet West (GSB), Tiana (SH) and Ponquogue East (SH) also had low abundances of approximately 30-40 organisms.

As with the bayside pitfall samples, abundance was typically low in Oceanside samples. Along the ocean transect, the highest abundance of beach invertebrates was located at Old Inlet in the GSB region (166 organisms), dominated largely by *T. longicornis* collected in wrack, supra and grass samples. Talisman (GSB) and Great Gun (MOR) had the next highest abundances approximating 70 organisms per station, based largely on the spring wrack samples, where *T. longicornis* dominated at Great Gun, and *Mytilus edulis* dominated at Talisman (Technical Appendix Tables). The ocean samples with the fewest organisms were all located in the GSB region: Watch Hill (2 organisms, sampled fall only), Democrat Point (8 organisms), Kismet West (8 organisms).

Overall, the abundance of beach invertebrates on the bayside was approximately three times higher than the oceanside. A few station exceptions were noted above where the number of organisms collected on the oceanside were greater than those collected from the bayside. However, at those sites, numbers of organisms were generally lower than average. A similar trend was observed in spring and fall collections where the number of beach invertebrates collected separately during the spring and fall was higher in the bay than in the ocean. Mean beach invertebrate abundances were highest in the MOR region for both bay and ocean collections, averaging 161 and 53 organisms, respectively (Appendix Table 10). The lowest mean abundances were observed in SH for the bay collections (39 organisms) and the GSB region for the ocean collections (36 organisms). Note that the distribution of beach insects is typically patchy at best, and it is not uncommon to see these low densities owing to the nature and physical limitations of the habitat.

c. Tidal Transects (Wrack, Supra, Grass)

i. Seasonal: Species Composition Along Beach Zones

Beach invertebrates were collected from the wrack, supra and grass zones at each station (see methods section for definitions). Similarities and/or differences in species composition and abundance were assessed for all three zones. Appendix Table 9 shows the comparison of beach invertebrate collections in each zone for spring/fall and bay/ocean. The highest number of beach invertebrates was collected during the spring in the wrack zone along the bay (761 organisms). The number of beach invertebrates in the wrack was generally two to three times higher than either the supra or grass zones for each bay/ocean location.

An analysis of the dominant taxa along the three beach zones (wrack, supra, grass) indicated that although abundances varied, taxonomic richness was similar within bayside and oceanside collections. Along the bayside, taxonomic richness ranged from 40 taxa in the grass zone to 48 taxa in the wrack zone. Taxonomic richness was lower along the oceanside ranging from 18 taxa in the wrack to 24 taxa in the grass zone. A comparison of the dominant taxa (those contributing more than 3% to the total composition) for each beach zone is shown in Figures 16a and 16b.

Bayside collections were dominated by the beach flea amphipod *T. longicornis* in all three zones, while both *T. longicornis* and *T. megalopthalma* dominated the oceanside. The number of *T. longicornis* was highest in the bayside wrack (539 organisms) contributing to approximately half of the overall collections (Figure 16a). This distribution is consistent with the habitat requirements of this amphipod that includes protected areas and lower salinities (Bousefield 1973). At the wrack and supra beach zones, *T. longicornis* contributed to over half of the total number. In the grass zone, *T. longicornis* comprised 28% of the total. The next most abundant bayside species at all three tidal zones was the beach flea amphipod, *O. grillus*, contributing 11-15% of the total. *Orchestia grillus* is present on all types of shores (rock, sand, gravel, marsh), and is considered a primary beach colonizer that may become established prior to more specialized members of the family Talitridae, like *Talorchestia* (Bousefield 1973). Other abundant taxa in the wrack zone were the insects: *L. neoniger* (5%), dipteran gnats (5%), shore flies of the family Ephydridae (4%). In the supra zone taxa, in addition to the amphipods *T. longicornis* and *O. grillus,* the following insects contributed more than 3% to the total composition were mites of the order Acari (4%) and *L. neoniger* (4%). Additional taxa comprising 3% or more of the total composition in the grass zone were the following insects: Acari (7%), *L. neoniger* (5%), the rove beetle family Staphylinidae (4%), the long-legged fly family Dolichopodidae (3%).

Oceanside collections were dominated by *T. longicornis* in the wrack and supra zones, and *T. megalopthalma* in the grass zone. The number of *T. longicornis* was highest in the oceanside supra (101 organisms) contributing approximately two-thirds of the overall total (Figure 16b). *T. longicornis* contributed nearly half of the total (42%) number of organisms collected in the wrack zone. *T. longicornis* was not present in the grass zone, however *T. megalophthalma* comprised 56% of the total. The next most abundant oceanside invertebrate species at the wrack location was the blue mussel, *M. edulis* (24%), followed by the ground beetle *Clivinia* spp. (13%), amphipod *T. megalophthalma* (6%) and Nematomorpha (3%). The high percentage of *M. edulis* observed was due primarily to a large number collected during the spring at the Talisman station. Taxa contributing to more than 3% of the total in the supra zone were the amphipod *T. longicornis* (69%) and the following insects: *Clivinia* spp. (5%), Ephydridae (5%), and the clown beetle *Hypocaccus fraternus* (4%). Additional taxa comprising 3% or more of the total in the grass zone were the following insects: *L. neoniger* (8%), *H. fraternus* (7%), Ephydridae (3%), the antlike flower beetle *Amblyderus pallens* (3%).

The total number of beach invertebrates collected in the pitfall traps by location and beach zone is summarized (Appendix Table 9). A pattern of decreasing abundances occurs from the wrack zone to the upland grass zone of the beach front along both the bay and ocean. Along the oceanside invertebrate abundances were similar, however, the pattern of decreasing abundance from wrack to grass zone is still evident. Along the bayside, there is a large difference in the number of organisms collected in the wrack zone versus both the supra and grass tidal locations.

C. Wrackline Sight Collections

Wrack debris consisted primarily of macroalgae and seagrasses. A total of 1,339 organisms, representing 29 taxa, were collected from the wrackline debris using the "sight quadrat" methodology (see methods section II) (Appendix Table 11).

i. Seasonal (Spring versus Fall)

Cumulatively, eight taxa of beach invertebrates dominated both the bay and ocean wrack collections contributing at least 5% to the total composition during either spring or fall. The dominant taxa collected along the bayside included two insect taxa; the order of Acari mites and ticks and the seashore springtail *Anurida maritima*, as well as annelid worms, bivalves and the eastern mud snail *Ilyanassa obsoletus*. Typically, the terrestrial insects were more common in the samples collected from the drier supra and grass locations, and aquatic benthic invertebrates became more abundant approaching the intertidal zone in the wrack. The dominant taxa along the oceanside were the insect species *A. maritima,* as well as bivalves, amphipod beach fleas and the common sea star *Asterias forbesii.*

Taxa contributing at least one percent to the total percent composition are plotted in pie charts in Figure 17. The upper two pie charts show the percent composition of wrackline invertebrates for bayside spring and fall collections. During the spring the springtail *A. maritima* (67%) dominated the samples, while during the fall Annelida (48%) was most dominant. Each of these taxa contributed approximately half or more to the total composition. The lower two pie charts show the percent composition of wrackline invertebrates in oceanside spring and fall collections. During the spring, Amphipoda (47%) was dominant, while during the fall the only organism present was the echinoderm *A. forbesii* (100%).

Total abundance and taxonomic richness in the wrack were higher along the bay in fall and along the ocean in spring (Appendix Table 11). Beach invertebrate collections along the bay were similar during both the spring and fall. Ocean abundances were similarly low during both the spring and fall. Taxonomic richness along the bay was similar during the spring and fall; 15 versus 19 taxa respectively. Taxonomic richness along the ocean was similary low during the spring and fall; 5 versus 1 taxon, respectively.

ii. West-to-East by Station

Appendix Table 12 lists the total number of beach invertebrates at each wrack sight quadrat station for spring and fall, bay and ocean collections. Figure 18 shows the wrack sight abundances on a vertical plot of stations from west-to-east. The stations with the highest invertebrate abundances along the bay were Ponquogue East in SH (450) with nemertean worms dominant, and Pattersquash in GSB (344). In general, oceanside wrack invertebrate abundances were low. The stations with the highest abundances along the oceanside were Kismet West in GSB (27) and Ponquogue East in SH (22). One bayside station had no organisms (Old Inlet in GSB), while there were several oceanside stations with no organisms, such as Talisman, Watch Hill and Pattersquash in GSB, Pike's Beach in MOR and Tiana in SH. No trend is observed from west to east. Abundance is generally low (less than 100 organisms) with the exception of a few bayside stations.

a. Bayside vs. Oceanside

Collections of wrack organisms from the bayside were compared with those from the oceanside (Figure 19). Two taxa were dominant in both bay and ocean samples, the insect *A. maritima* and Bivalvia. Along the bay the springtail *A. maritima* contributed 47% to the total composition, and 11% along the ocean. Bivalvia contributed 9% to the total composition along the bay and 24% along the ocean. Also dominant along the bay were Annelida and Acarina (mites and ticks) contributing 25% and 7% to the total composition, respectively. Along the ocean, Amphipoda was also abundant contributing 38% to the total composition, bayside wrack abundances were greater than oceanside abundances at all stations except Old Inlet. However, the number of organisms at Old Inlet was low overall, with only 4 organisms collected. Mean abundances were calculated for each bay region for summer/fall and bay/ocean collections (Appendix Table 13). A general pattern emerges with mean wrack abundances on the bayside greater than oceanside wrack abundances for both spring and fall seasons. Another pattern observed in the mean abundances is that for both bay and ocean samples, SH had the highest abundances with GSB following and MOR the lowest abundances.

V. COMPARISON OF THE CURRENT STUDY TO PREVIOUS STUDIES

A. USACE Benthic Invertebrate Survey: Eastern Shore Zone, FIMP Reformulation Study (July 2003)

The objective of this study was to characterize invertebrate community structure of the beach, intertidal and subtidal zones of the easternmost section of the Reformulation project area from Montauk Point to Shinnecock Inlet. The study focused on areas that had not been studied as extensively, and with geomorphic conditions different from the sandy beaches of the barrier island. Benthic invertebrate sampling was conducted along the east end of Long Island, New York from Shinnecock Inlet to Montauk Point. Nearshore and subtidal transects were sampled during May and November/December 2000 in the wrack, mid tide and surf zones.

The dominant taxa groups collected in the Eastern Shore Zone (ESZ) study were Mollusca (75%), Annelida (11%), and Arthropoda (9%). Molluscs were assumed to have washed off the surrounding jetties (USACE 2001). The blue mussel, *Mytilus edulis,* the bristleworm, *Scolelepis squamata,* and Nematoda were the most abundant organisms at each station. The mid tide and surf zones generally had higher organism abundances than the wrack zone. Organism abundance and number of taxa were greater during the spring than fall/winter collections.

A comparison of the ESZ study with the present USACE study indicated seasonal similarities in abundances and taxa. However, differences between the studies were observed along beach transects. In both studies, the dominant taxa were similar (Annelida, Arthropoda, Nematoda) however, the species representation was different. For example, the dominant annelid in the present study was represented by Oligochaeta, whereas in the ESZ study it was the polychaete *S. squamata.* Both studies had significantly higher organism abundances and number of species during the spring. In the present study, a higher number of benthic invertebrates were found in the high and wrack locations than in the low and mid tide zones. The ESZ study showed higher organism abundances in the mid and surf zones than the wrack.

Results of the ESZ study were comparable to the Kluft-Steinback 1999 and USACE 1999 studies conducted in Long Island, New York (see below). However, there were noticeable differences in organism abundances between the ESZ study and the USACE 2001 New Jersey study (see below). Additionally, there were large numbers of nemerteans collected in both West Hampton Island and New Jersey, but none reported from Fire Island and the east of Long Island from Shinnecock Inlet to Montauk Point. The reason for this difference in nemertean abundances is unclear.

B. USACE Comparative Study of Beach Invertebrates on the West Hampton Barrier Island, FIMP Reformulation Study (April 1999)

The objective of this study was to compare the benthic invertebrate community of a relatively stable beach to an area of beach recently created following a breach. Samples were collected during one event in the spring of 1998. Samples were collected in the wrack, mid tide and surf zones of the ocean and bay beaches of the West Hampton Barrier Island located in Long Island, New York. Benthic cores were collected in four areas: placement location, groin field, updrift control area and bayside of the breach area.

Results of the study indicated that a significantly higher number of organisms were collected along the bayside than the oceanside. Mollusca dominated the samples followed by Nematoda and Oligochaeta. The highest percentage of organisms was located in the surf zone, while the mid tide region contained the lowest percentage of organisms.

Benthic invertebrate species composition between the USACE West Hampton study and the present study was similar however, dominant taxa were different. Similar to the present study, nematodes and oligochaetes were dominant. Molluscs (*M. edulis*) were present in the current study, but not dominant. The presence of *M. edulis* in high numbers in the West Hampton study can be attributed to the sampling in groin fields which support more mussels. Although the West Hampton study found that the three study zones (wrack, mid, surf) supported similar organism abundances, the surf zone had slightly higher densities. These results were similar to the ESZ study where the highest numbers of organisms were collected in the surf zone. In the current USACE study the highest number of organisms was located in the high and wrack zones.

C. USACE Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury Park to Manasquan Section, Beach Erosion Control Project (Final Report 2001)

Intertidal and nearshore benthos were sampled by the USACE as part of the New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury Park to Manasquan Section, Beach Erosion Control Project. The aim of this study was to detect changes in short-term and long-term impacts to the benthic infaunal abundance, biomass, and assemblage structure along an intertidal to subtidal depth gradient. The monitoring plan for this study consisted of two phases. The first phase consisted of spring and fall sampling from June 1994 through May 2000. After nourishment operations began, the second phase began once in 1997 and again in 1999-2000. The second phase commenced with monthly sampling taking place between May and September in 1997, 1999 and 2000 at both reference and nourishment locations. The purpose of the second phase of the program was to provide a more detailed temporal analysis and to estimate recovery rates.

Major conclusions derived from the New Jersey USACE study are described in the following paragraphs. The findings from this New Jersey benthic study are compared with findings from the benthic component of the current invertebrate study. Note, the New Jersey USACE study sampled both nearshore and subtidal areas, as well as near groins. The present study sampled nearshore (intertidal) depths only and stations were not located near groins. Comparisons between the two studies will be based on comparisons of data from nearshore locations.

Seasonal distributions of faunal abundance and taxonomic richness were measured. During 1997, abundance of infauna at the nourished beach was lower than in the reference area. The estimated recovery time, i.e. time necessary to achieve pre-nourishment conditions, was 49 days for faunal abundance and 23 days for taxa richness. An analysis of 1999-2000 data indicated no obvious change in species composition or abundance of the dominant taxa relating to nourishment activities. There were relatively high faunal abundances in spring/summer, with numbers declining in winter (lowest in January). The estimated time of benthos recovery was 189 days. Taxa richness followed abundance trends in 1999-2000. Based on the 1999-2000 USACE study, the estimated recovery time of taxa richness was 178 days.

Distribution of intertidal fauna was patchy with unpredictable "hot spots" (USACE 2001). Intertidal faunal abundances were dominated by Rhynchocoela, the spionid polychaete *Scolelepis squamata* and Oligochaeta. Rhynchocoels made up 51% of the overall composition. Peaks in abundance coincided with high rhynchocoel densities. Spatially, taxa richness decreased along a gradient from south to north. There were no differences in species composition between intertidal depths or areas within the same depths. There was a change in species composition noted with nourishment. This change in species composition was likely due to lower total abundances and taxa richness during September and May.

Intertidal benthic taxa found in the USACE New Jersey study were similar to the present study however, in some cases, the species composition was different. Although not observed in the present study, Rhynchocoela, represented by nemerteans, was the most abundant taxonomic group in the New Jersey study comprising half of the overall composition. Results of the New Jersey study indicated that spatially there was no difference in species composition between intertidal depths. The present USACE study found higher abundances of benthic invertebrates in the wrack and high tide zones.

Grain size analysis was performed as part of the USACE New Jersey benthic study. The study found that finer sediment was associated with increased depth. Seasonally, coarser sediments were more pronounced in the spring than fall. This seasonal sedimentation pattern follows sediment erosion and deposition patterns. During the winter and spring sediments tend to be coarser due to storms, which remove finer grained sediments (Nordstrom 1975). Due to milder weather during the summer, finer sediment is deposited (Nordstrom 1975). However, a mild winter may result in no significant changes to sediment grain size composition.

Sediment composition was similar between the USACE New Jersey study and the present study. Sediment along the New Jersey and New York beaches was primarily fine sand, with some gravel and medium sand. The New Jersey study found seasonal differences in sediment composition that were not observed in the present study. For example, coarser sediments were observed during the spring than the fall in the New Jersey study however, no change was observed between spring and fall in the present study. The present study noted more gravel at the low tide locations however this was not assessed in the New Jersey study.

D. Kluft-Steinback, National Park Service (NPS), The Ocean Beach Invertebrates of Fire Island National Seashore, New York: Spatial and Temporal Trends and the Effects of Vehicular Disturbance (June 1999)

Kluft-Steinback performed a beach invertebrate study for the National Park Service (NPS) in 1995-1996, hereafter referred too as Kluft-Steinback (1999). The main purpose of the study was to describe spatial and temporal trends in abundance and species richness of ocean beach invertebrate fauna associated with the south shore (oceanside) of FINS and to identify environmental factors affecting their distribution (Kluft-Steinback 1999). Sampling was conducted seasonally from September 1995 to July 1996. A total of six sites were sampled at Kismet, Sailor's Haven, Talisman, Long Cove, Old Inlet, and Smith Point. Samples were collected using benthic cores, wrack sight and pitfall trap methodologies.

The sampling methodology of the present study was designed to follow the same protocol as the Kluft-Steinback (1999) study. The major sampling difference between the two studies was in the location of the stations. The Kluft-Steinback (1999) study sampled along the oceanside of the FINS only, whereas the present USACE study sampled both the bayside and oceanside of both the Fire Island and West Hampton barrier islands. The present USACE study also added new locations including additional sites along the bay and oceanside of Great South Bay (2 sites), Moriches Bay (2 sites) and Shinnecock Bay (2 sites). Additionally, Kluft-Steinback (1999) combined the wrack core and wrack sight samples when conducting analyses. The present USACE study analyzed the wrack sight samples separately while combining the wrack core samples with the other core collections.

Results of the study found the most abundant species in all collections (cores, pits, sight) to be the tenebrionid beetle (*Phaleria teastacea),* the talitrid amphipod (*Talorchestia longicornis),* the ant (*Lasius nenoiger),* the anthicid beetle (*Mecynotarsus candidus),* homopterans and the planthopper (*Delphacodes* sp). The most common taxonomic groups were: Coleoptera, Diptera, Amphipoda, Hymenoptera. The dominant taxa by sampling method (core/sight/pitfall) were analyzed. The benthic core, wrack sight and pitfall trap collections were dominated by Coleoptera. Second in abundance for the benthic cores and wrack sight samples were the haustoriid amphipods, *Amphiporeia virginiana* and *T. longicornis.* In the transect cores (not including the wrack core) Annelida were commonly found. Diptera was common in the pitfall traps. Percent composition of taxa for each sampling method was as follows: pitfall traps caught 70% of the total number of taxa, wrack core/wrack sight collected 50%, transect cores represented only 7% of the total taxa.

Species composition was similar between the Kluft-Steinback (1999) study and the present USACE study. The major taxonomic groups in both studies were Coleoptera, Diptera and Amphipoda. In many instances, similar species constituted the most abundant animals in both studies, e.g. *T. longicornis, L. neoniger.* Annelids were also common in both studies. Taxonomic groups represented by sampling methodology were also similar with Annelida (Oligochaeta) common in the core samples and Diptera common in the pitfall traps. A difference between the two studies was observed in the number of taxonomic groups identified by sampling method. The Kluft-Steinback (1999) study observed the most taxonomic groups collected in the pitfall traps and wrack samples. The present USACE study observed similar species composition between the pitfall trap and benthic core collections however, the wrack sight samples represented approximately half the taxonomic groups as those found in the other collection methodologies (note that the present USACE study did not combine wrack sight and wrack core collections). The present study observed higher organism abundances in the wrack samples and not the beach grass samples as was observed in the Kluft-Steinback (1999) study.

Seasonally, the highest number of organisms was collected during the summer followed by spring, fall and winter in the Kluft-Steinback (1999) study. Arachnida and Collembola were abundant during the winter, while Annelida and Homoptera abundances increased in the spring and summer. Beach grass pitfall traps caught the most individuals of all seasons except during the spring when wrack pitfalls were highest. The present USACE study did not sample during either the summer or the winter, therefore comparisons can be made based on spring and fall collections only. Similar to the Kluft-Steinback (1999) study, the present study found higher collections in samples during the spring than in the fall.

Lasius neoniger was the most abundant organism observed at Kismet, Talisman and Smith Point on a station by station basis. At Sailor's Haven and Long Cove the following amphipods were most abundant: *T. longicornis* at Sailor's Haven and Long Cove and *O. grillus* at Long Cove. Coleoptera was common at Old Inlet and Sailor's Haven but not as abundant as the amphipods. Homoptera were common at Old Inlet and Smith Point but not as abundant as the amphipods. Species richness, measured by the total number of species, was analyzed for each station. The total number of species was highest at Smith Point (93), followed by Kismet (92), Old Inlet (83), Long Cove (82), Talisman (72) and Sailor's Haven (66).

Spatially by sampling methodology, Sailor's Haven pitfall traps caught the most, followed by Kismet, Old Inlet, Smith Point, Long Cove and Talisman. Talisman had the lowest abundances in all types of samples except transect cores. A few taxa were found only in certain locations. The following species were found only at the lower intertidal location: *S. squamata, E. talpoida, A. virginiana, H. canadensis.* Dominant organisms in the wrack were interstitial annelids, enchytraeids, talitrid amphipods (*O. grillus* in summer), wrack fly (*Thoracochaeta brachystoma*) and some carabids. The talitrids (*T. megalophthalma*, and *T. longicornis*), tenebronid (*P. testacea*), anthomyiid *F. tergina* and dance fly C*hersdromia inusitata* were most numerous in the wrack, but not exclusively found in wrack samples. Wrack species were generally less diverse than beach grass species due to extremely high numbers of a few dominants. This was especially evident in the spring when many species congregate in wrack to breed (e.g. the tenebrionid beetle *P. testacea*, talitrid amphipod *T. longicornis* and anthomyiid fly *F. tergina*) (Stenton-Dozey and Griffiths, 1983). Pitfall trap collections in the supratidal region were lower than the wrack and grass locations. Individuals collected in the supratidal were also found in the wrack and grass sites. Insect pupae and *L. neoniger* were found in the dunes only. In the pitfall traps, the flies *Fucellia tergina,* and *Tethina parvula* occurred at each season and at each site at least once.

Spatial comparisons were made for the pitfall trap organisms at the beach oceanside locations in both the Kluft-Steinback (1999) and present USACE studies. The Kluft-Steinback (1999) study found the abundance of pitfall insects at each station from highest to lowest was Sailor's Haven followed by Kismet, Old Inlet, Smith Point, Long Cove and Talisman. The present study observed the highest abundance at Old Inlet, followed by Talisman. The next highest abundances were located further east outside of the Kluft-Steinback (1999) study area. Kluft-Steinback (1999) also noted that wrack species were generally less diverse than beach grass species due to extremely high numbers of a few dominants. This was not the case in the present study where the taxonomic representation was similar (~50 taxonomic groups) in all three beach zones (wrack, supra, grass).

Samples were analyzed at each station by season and collection method. Kluft-Steinback (1999) observed that sample site was generally the most significant factor affecting faunal distribution (except in the wrack during the spring). Therefore, variation in faunal distributions can be attributed to differences in sample sites. During the fall, in the pitfall trap samples, the most individuals were collected at Talisman, Long Cove and Old Inlet. Organisms were particularly abundant in the supratidal during the fall. During the winter, spring and summer, four of six sites had higher numbers in grass than wrack and supra. Stations that were the exception and had higher wrack abundances were Kismet and Sailor's Haven (fall and spring), and Long Cove (summer). Other exceptions were Smith Point (fall) and Kismet (summer), where higher abundances were observed in the supratidal zone. Due to the low numbers of organisms collected during the fall at the oceanside sites of Fire Island in the present study, it was difficult to make comparisons between the studies.

The spatial distribution of beach dweller species is associated with their food source (Kluft-Steinback 1999). The primary food sources of the areas sampled include suspended detritus in the intertidal, beach grass and wrack debris (Kluft-Steinback 1999).

The most common species in the benthic cores were intertidal detritivores (i.e. *A. virginiana, H. canadensis*, *S. squamata, E. talpoida*). The beach grass species were most diverse and included herbivores such as Homoptera, the elaterid click beetle *Negastrius delumbis*, and the grass fly chloropidae, *Incertella* sp.. These beach grass fauna depend directly on beach grass for food. Indirectly feeding on beach grass were the anthomyiid *Delia capita* and *L. neoniger*. Anthicid flower beetles (*Meycenotarsus candidus* and *Amblyderus pallens*) are strongly affiliated with sand dunes (Werner & Chandler 1995).

VI. DISCUSSION OF OTHER REPORTS

The Atlantic coastline of the northeast United States represents an important component of the marine ecosystem by providing food and habitat for many species. A wide variety of invertebrates can inhabit the energetic beaches of the northeast (Brown and McLachlan 1990). These invertebrates comprise an important component of the food web as prey. For example, ocean beach invertebrates are the main source of food for shore birds (Hoopes *et al*. 1989). Some of these shore birds are federally designated as "threatened", e.g. the piping plover (*Charadrius melodus*), resulting in increased protective measures.

Few quantitative studies exist of beach and intertidal invertebrate assemblages along the Atlantic Coast. The only study that exists for nourishment impacts on beach infauna north of the Carolinas was conducted by the USACE as part of the, "Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury Park to Manasquan Section, Beach Erosion Control Project (2001)". Therefore, it is difficult to determine potential impacts from beach nourishment and other FIMP project activities on the nearshore environment. Most beach invertebrate studies focus on intertidal, wrack and dune environments. Although some studies focus on areas from the intertidal zone to the foot of dune, only one, Kluft-Steinback (1999), has been conducted along the northeast Atlantic coast. Understanding this nearshore environment is important in assessing various coastal issues, including potential alternatives associated with the FIMP project that will affect these areas.

While beach nourishment impacts on infauna are expected to include reduced abundance and altered community structure, the study conducted by the USACE along the New Jersey coast showed no deleterious effects to intertidal assemblages as a result of nourishment operations (USACE 2001). The USACE New Jersey study showed no statistically significant differences between reference and nourished beaches during a 1997 nourishment operation with estimated recovery times of two months There were no dramatic impacts from nourishment to either biomass or species composition (USACE 2001). During a 1999 nourishment operation, there were clear, short-term declines in faunal abundance, biomass and taxa richness in the placement area however there was no evidence of long-term impacts with a recovery time estimate of 6.5 months (USACE 2001). The estimated recovery time for benthos from the two nourishment operations ranged from 2 to 6.5 months, which is consistent with other reports when there is a good match between fill materials and natural beach sediments (USACE 2001).

Another factor in determining recovery rates is the time of the year the operations take place. Recovery time was longer at sites where filling did not conclude before the seasonal decline of infaunal organisms. In the northeast region, infaunal populations decline rapidly from November through January (USACE 2001). The 1997 USACE fill operation was completed by early October, prior to this seasonal decline allowing time for placement area infauna to fully colonize before the onset of the seasonal decline. Therefore, a greater number of infauna was presumably available to colonize the disturbed sediments and recovery time was only 2 months. The 1999 USACE fill operation was completed in mid-December, during the time of decreasing infaunal populations. Therefore, there was not enough time for complete colonization and an insufficient number of animals available to recolonize the disturbed sediments with a recovery time of 6.5 months. The most severe impacts from nourishment were observed from November 1999 to January 2000 (USACE 2001). These findings suggest that in order to decrease benthic recovery time, nourishment fill operations should conclude before seasonal declines in infaunal populations.

The findings from the USACE New Jersey study are similar to those observed in other studies. Hackney *et al*. (1996), Nelson (1985 and 1993) and Jutte *et a*l. (1999) observed short-term nourishment impacts to beach infauna with recovery times ranging from 2 to 7 months. Their findings indicated that the primary factor affecting recovery time of nourished beaches was the match between fill materials and original substrate. For example, the longest recovery times occurred when the silt/clay content of the fill was greater than that of the natural beach (USACE 2001). The most severe impacts associated with beach nourishment are to small relatively immobile species, those unable to burrow through the overburden of new sand (Maurere *et al*. 1978). The placement of coarse sands on a sandy beach can alter beach morphology and intertidal community structure by replacing species associated with fine sands with larger, more robust fauna (McLachlan 1996).

High energy beaches can be characterized by two types of organisms; small interstitial forms (rhynchocoels, oligochaetes, hesionid and polychaetes) and large mobile forms (*Emerita talpoida*, *Donax variabilis, Scolelepis squamata* (McLachlan and Jaramillo, 1995). Fine to medium sized sediment is associated with with haustoriid amphipods (Dexter 1969). Medium sand is dominated by *Emerita* sp. and *Donax* sp. (Leber 1982). Infauna are distributed among three to four zones intertidally however, it's difficult to assign species to a zone due to their motility (USACE 2001). The supralittoral zone of the United States Atlantic Coast is typically dominated by air breathing crustaceans such as talitrid amphipods (beach hoppers), ocypodid (ghost) crabs, oligochaetes and nematodes (McLachlan and Jaramillo, 1995 and the present study). The littoral zone is dominated by isopods, haustoriid amphipods, polychaetes (e.g. *Scolelepis squamata*), oligochaetes and nematodes, while the sublittoral zone is dominated by haustoriid amphipods, *Emerita* sp., *Donax* sp., nematodes and Nematomorpha (USACE 2001 and present study). Note that larger forms such as *Emerita* sp., are found in the nearshore subtidal zone.

The main source of food for each of these zones (supralittoral, littoral, sublittoral) is suspended detritus in the intertidal, beach grass (*A. breviligulata*) or wrack debris (mostly *Z. marina* and *S. alterniflora*) (Kluft-Steinback, 1999 and present study). The spatial distributions of the beach dweller species found in the Kluft-Steinback (1999) study were associated with food sources. The high abundances of organisms in the wrack almost always coincided with large depositional or rejuvenating events, e.g. storms (Kluft-Steinback, 1999). After these "events" the wrack was concentrated and re-wet by tides, which had a significant impact on invertebrate distributions (Kluft-Steinback, 1999). Depositional events at Fire Island altered the successional stage of the wrack, and/or deposited new wrack, which in turn attracted early colonizers (Kluft-Steinback, 1999). These depositional/rejuvenation events increased spatial and temporal heterogeneity on the beaches. Based on feeding guilds, generalists (e.g. omnivores, detritivores, saprophages) probably have the best chance for survival since wrack resources are sporadic (Kluft-Steinback, 1999).

Faunal distribution is also controlled by physical factors, typically wave energy and tidal range (McLachlan 1996). Wave height (energy) and beach slope (swash zone) are the two factors associated the most with different beach assemblages (McLachlan 1990). Wave action, causing bedload transport, may dislodge interstitial taxa from sediment (USACE 2001). Kluft-Steinback (1999) observed that sample site was the most significant factor affecting faunal distribution (except in the wrack during the spring). Therefore, variation in faunal distributions was attributed to differences in sample sites. Site-specific factors, such as proximity of nutritional resources, quality of nutritional resources, and to a lesser degree, resource composition affected faunal distributions in the beach zone.

VII. CONCLUSIONS

The following conclusions can be derived from the current study:

Animal-Sediment Interactions

- Owing to the relatively uniform nature of the substrate throughout the study area (ie., all samples consisted of at least 95% sand), it is not possible to identify any distributional differences based solely on sediment grain-size.
- Deposit-feeding polychaetes that depend on organic material adsorbed to fine grained sediments as a food source, were commonly present but did not typically reach high abundances.
- The distribution of organisms may appear to be influenced by sediment grain size, however it is more likely due to hydrological stability. In zones where hydrology is present more frequently throughout the tidal cycle, higher densities and greater taxonomic richness would be observed. Sediment grain size is not dictating the distribution of the organisms, rather both the distributions of sediment grain size and organisms is likely due to wave action and not ecological requirements.

Spatial Observations (Bayside, Oceanside)

- Sediment samples along the oceanside were better sorted compared to bayside samples due to more intense wave action along the oceanside.
- There were three times as many invertebrates collected along the bayside than the oceanside likely due to the greater habitat stability and better food sources on the bayside.
- Taxonomic richness was consistently greater for invertebrates collected from the bay then the ocean with a greater variety of deposit feeding polychaetes present in the bayside samples.
- While oligochaetes and nematodes were important and sometimes dominant components at most locations, the communities differed between the bayside and oceanside samples. The bayside taxonomic groups represented those typically found in more protected areas, while the oceanside taxa were those tolerant of higher energy environments.
- Approximately three times as many beach invertebrates were collected along the bay than the ocean. Taxonomic richness was generally low, but similar within bay and ocean collections. Bayside and oceanside beach invertebrate abundance was generally low and varied from station to station.

Temporal Observations (Seasonality)

- A greater number of invertebrates were collected during the spring than the fall.
- Total abundance and taxonomic richness of invertebrates was higher during the spring on the bayside and during the fall on the oceanside.
- Oligochaetes were dominant in benthic cores from both bay and ocean samples during both spring and fall, however more abundant during the spring.
- Taxonomic richness in the wrack zone was similar during the spring and fall for both bay and ocean collections.
- Bayside and oceanside collections differed with more wrackline sight collections were dominated by the seashore springtail, *Anurida maritima,* in the spring and Annelida in the fall, comprising approximately half of the total abundance.
- Oceanside wrackline sight collections were dominated Amphipoda in the spring, while the common sea star, *Asterias forbesi,* was the only organism found in one sample during the fall

Based on the present USACE study and previous studies, the following factors are important in determining beach and benthic invertebrate distributions in the beach and intertidal zones of the barrier island:

- The wrack zone supports a diverse and abundant group of organisms available as prey for shore birds.
- Depositional/rejuvenation events act to increase the health and possibly the amount of wrack benefiting the organisms utilizing this zone.

- Wind direction and speed can alter beach communities by pushing species into zones where they are not typically found (Kluft-Steinback, 1999).
- Wave energy and tidal range are physical factors controlling benthic distributions (USACE 2001).

In summary, the 12-transect study area is a representative cross section of the FIMP project area that includes beach and intertidal habitats that support of variety of invertebrate fauna that serve as an important food source to a variety of birds. In general, bayside stations support a greater density and richness of invertebrate forms, especially in the intertidal zone, owing to the more stable nature of this area compared to the oceanside. Oceanside and beachside beach invertebrates are both generally low in density and richness.

If the organismal distributions observed in this two season sampling effort is representative of the system, density and richness is generally greater in the spring compared to the fall. This is found to be true of both the bayside and oceanside sampling areas.

Similarly, lower intertidal zone stations demonstrate the greatest numbers and variety of invertebrate forms. This is likely due to the greater stability of this zone compared to other tidal zones studied. These findings provide valuable consideration in the assessment of potential alternatives to be considered in the FIMP storm damage reduction studies.

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FIGURES

US Army Corps of Engineers
New York District

Fire Island Inlet to Montauk Point, New York Reformulation Study

New York State Department of Environmental Conservation

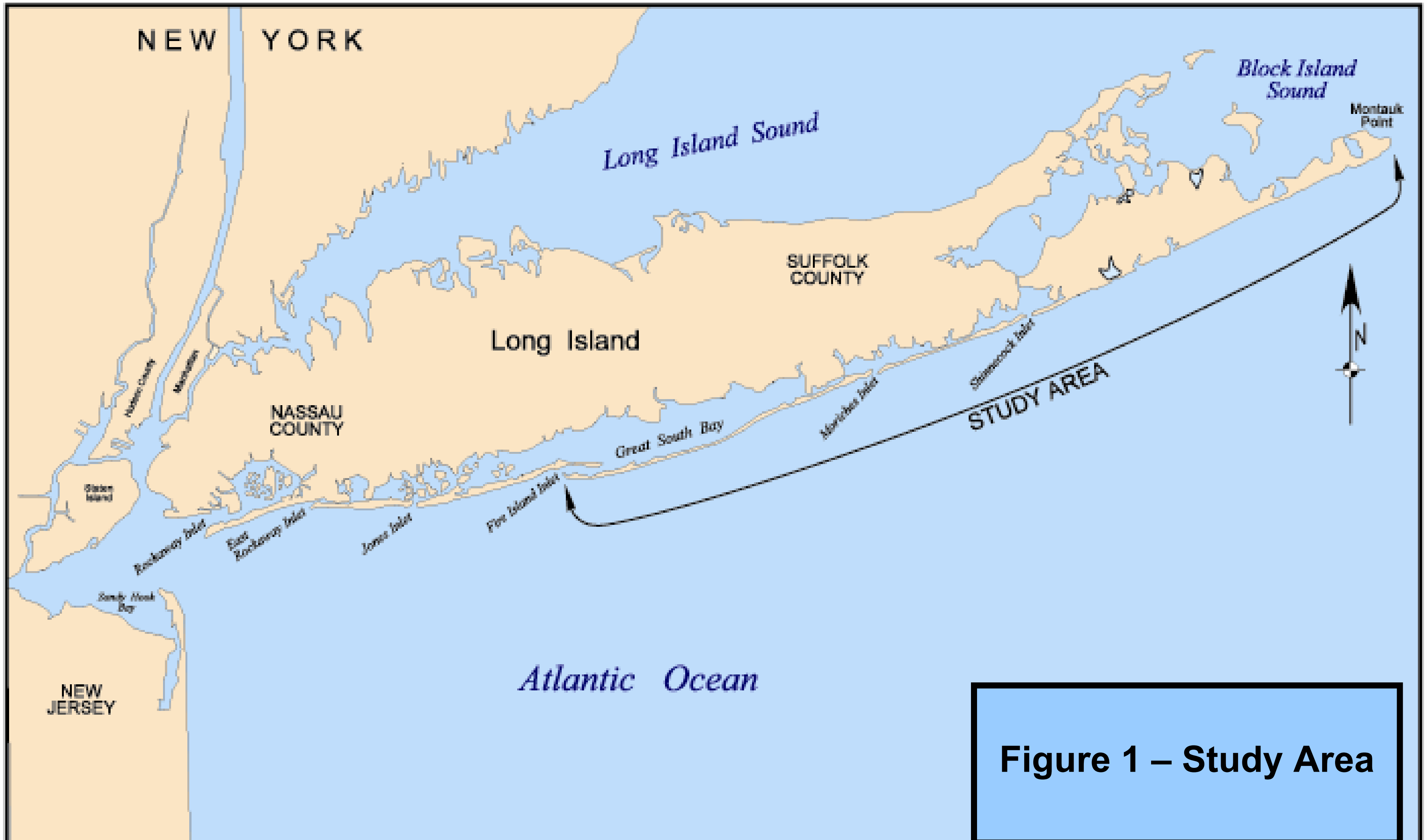


Figure 1 – Study Area

FIGURE 2
Station Locations

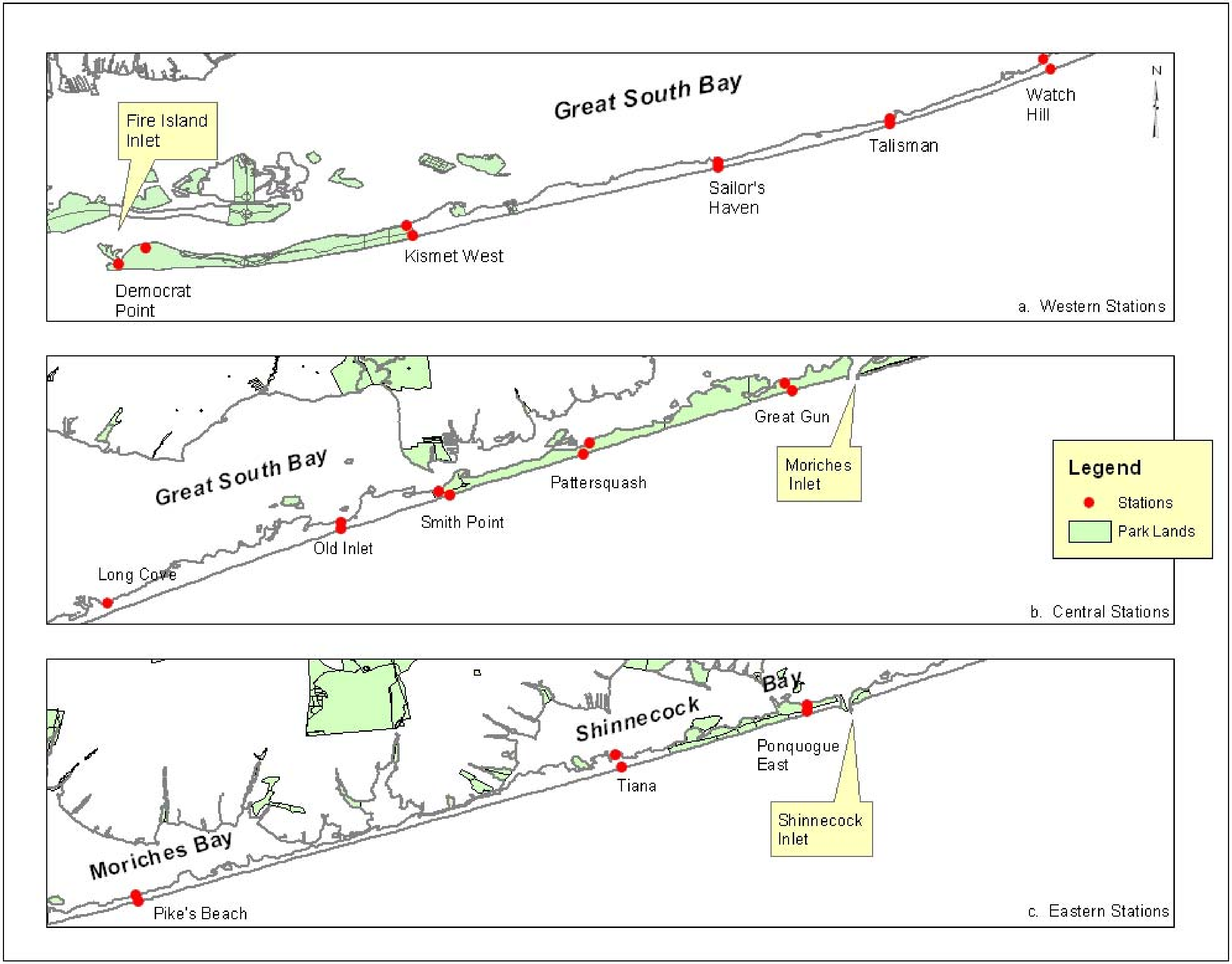


FIGURE 3

Representative Sites of the Study Area

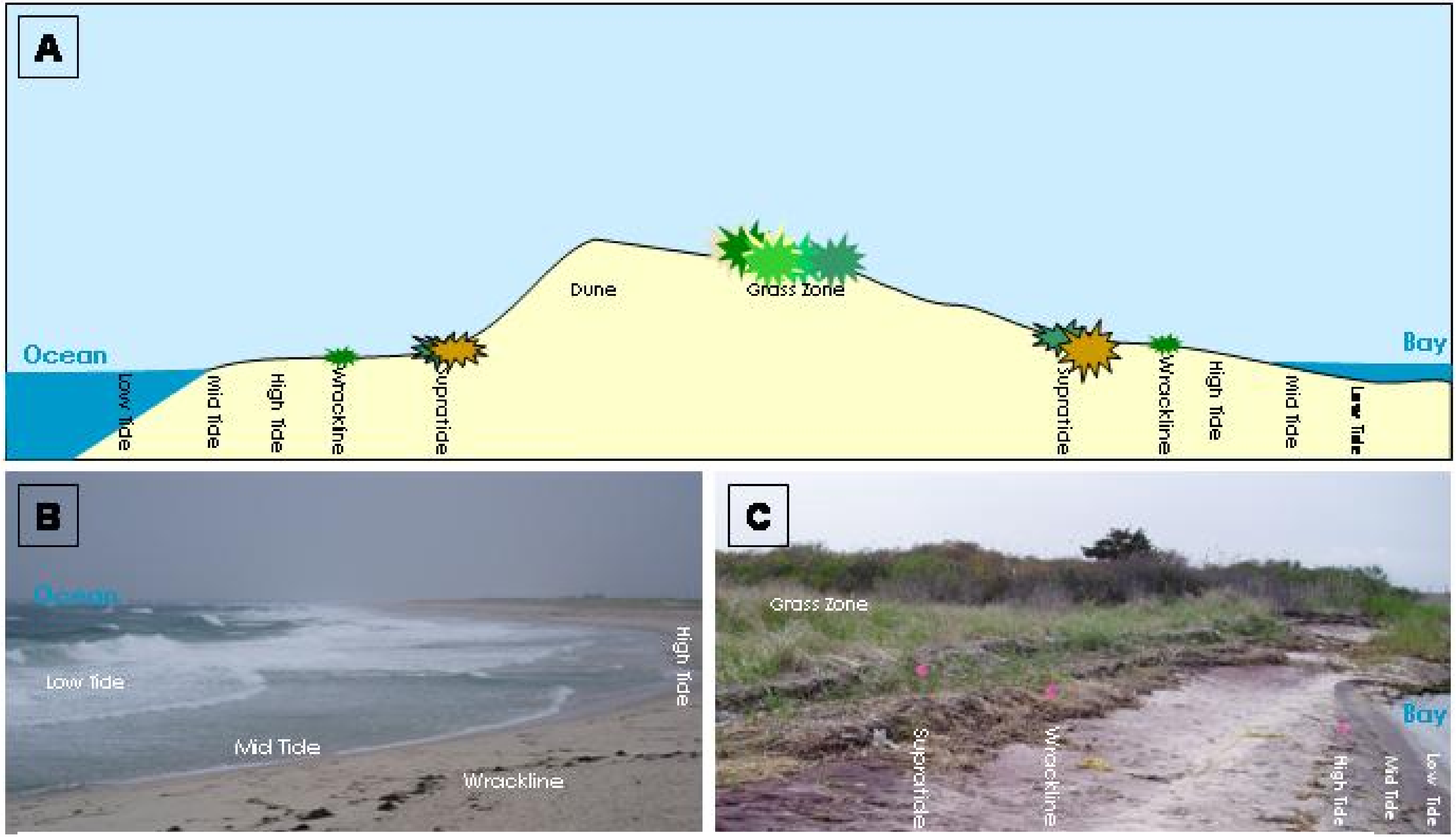
Watch Hill Bayside

Ponquogue East
Oceanside Berm

Sailor's Haven
Oceanside

FIGURE 4

Cross Section Through a Barrier Island Showing Locations Where Samples Were Collected



At the sample site A) A conceptual cross section through a barrier island showing physiographic zones as defined in Section C of this report. B) An oceanside site example and C) A flagged bayside site example.

FIGURE 5

Benthic Core Sampling

Corer used for collecting sediment for grain size analysis.

Corer used for collecting sediment for benthic infauna.

Contents of corer poured into sieve.

FIGURE 6

Wrackline Sight Sampling

Wrackline debris at Ponquogue East Bayside.

Wrack quadrat; Sampling at Great Gun Oceanside.

FIGURE 7

Pitfall Trap Sampling

Pitfall trap samples at Smith Point Bayside.
Traps located at wrack, supra and grass zones.

Pitfall traps marked by pink flags.

Pitfall trap set flush with
surface of beach.

Beach insect contents of pitfall trap sample.

FIGURE 8

Pitfall Trap Sampling: Oceanside Vehicle Tracks Along Beach

Oceanside site showing vehicle track marks.

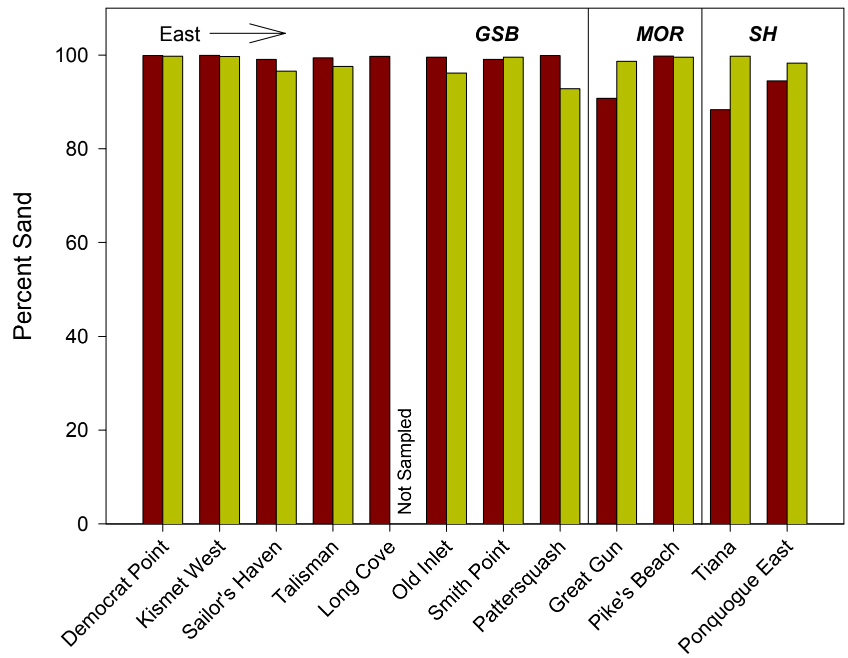
Ponquogue East Oceanside

Ponquogue East Bayside

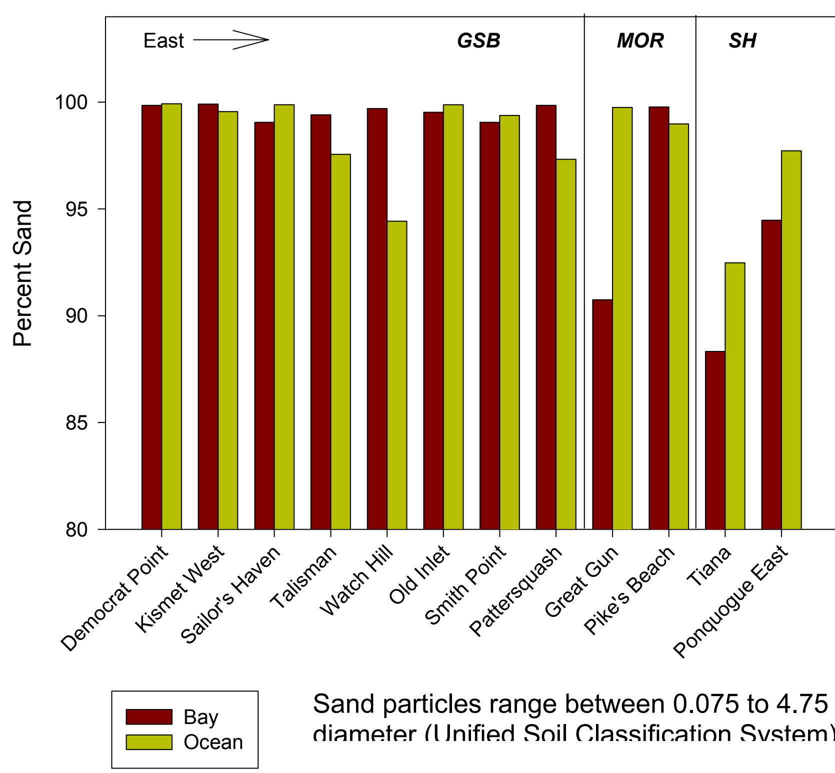
FIGURE 9

Percent Composition of Sand at Each Station
Bay and Ocean Samples

Spring: Mean Sand Values at Each Station



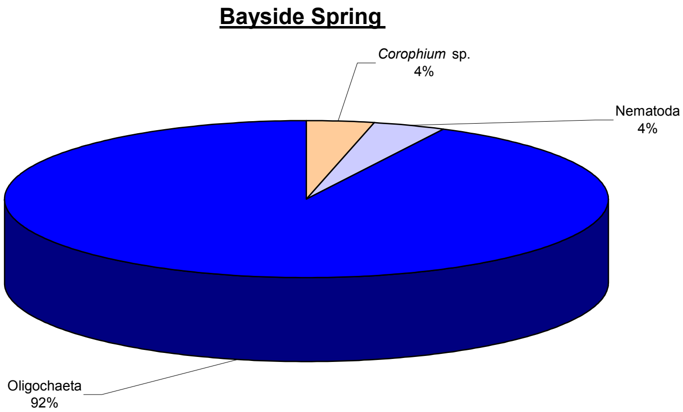
Fall: Mean Sand Values at Each Station

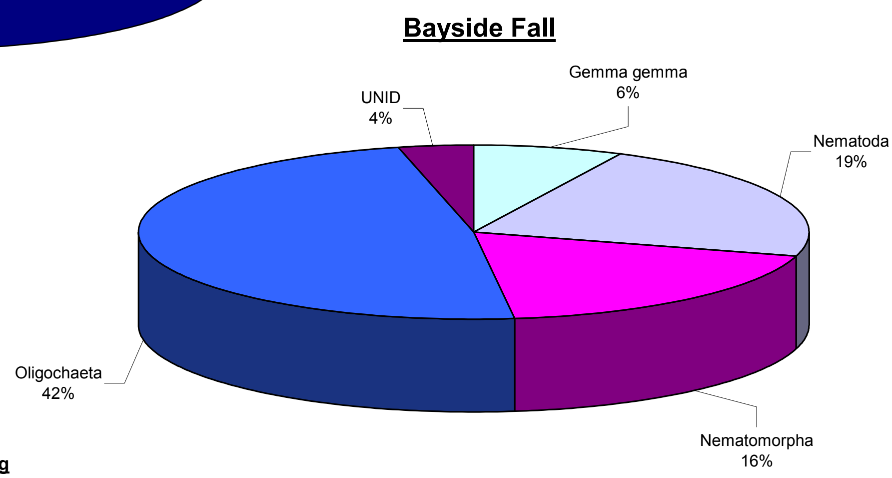


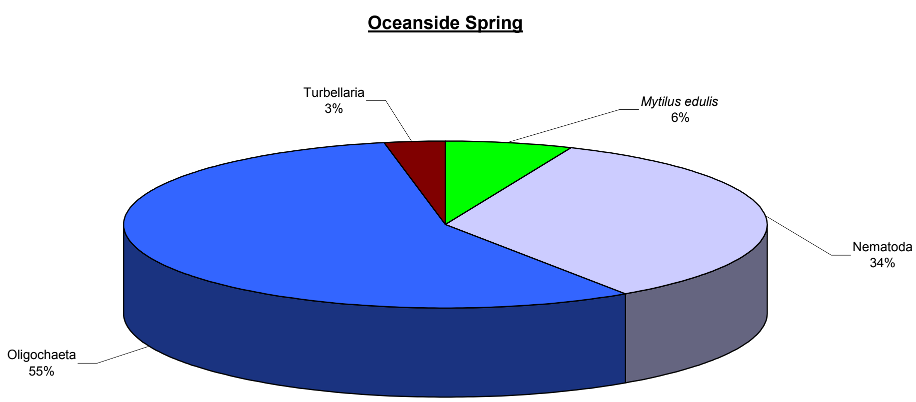
Sand particles range between 0.075 to 4.75 mm in diameter (Unified Soil Classification System)

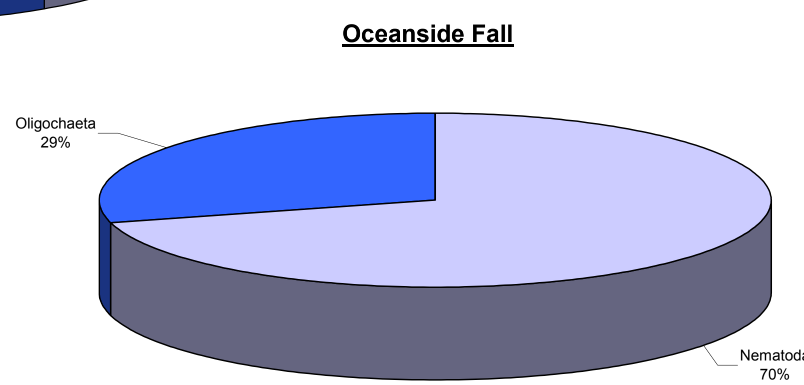
FIGURE 10

Percent Composition of Dominant Benthic Organisms
Bay/Ocean, Spring/Fall





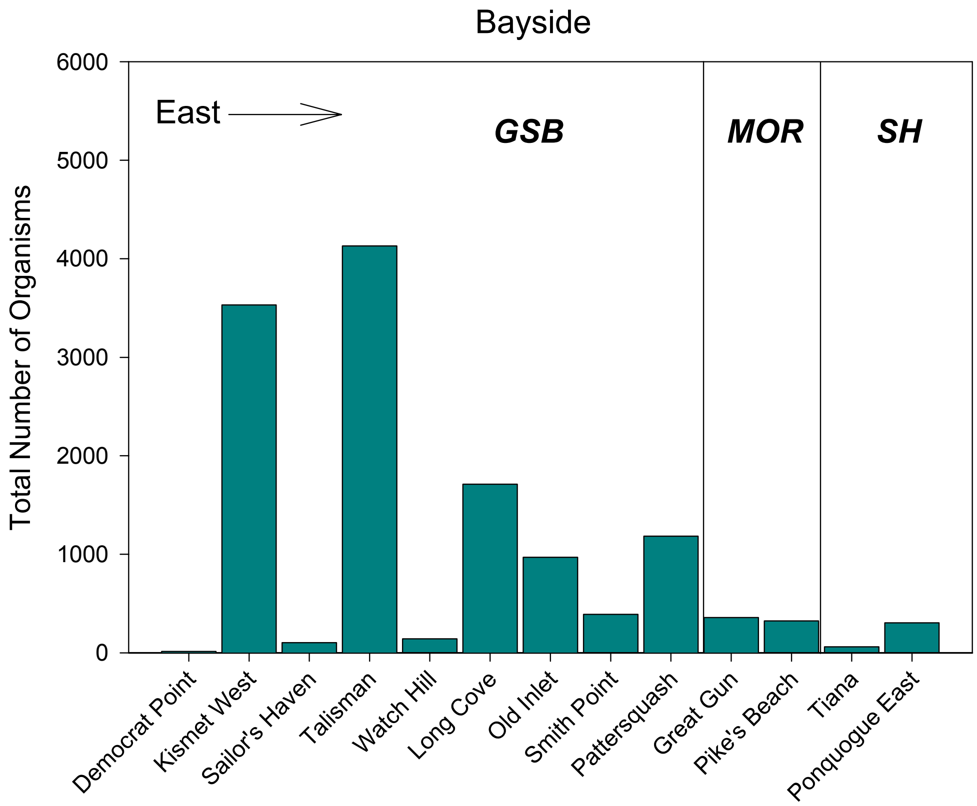


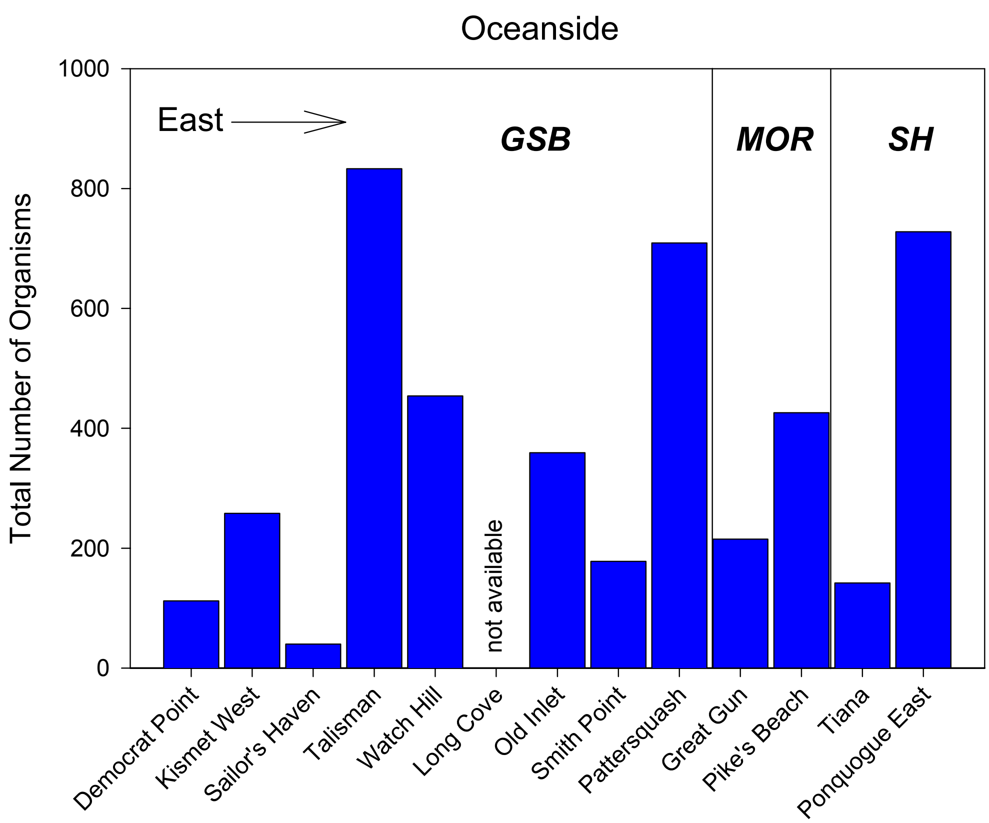


UNID= unidentified organisms as a result of damage.

FIGURE 11

Total Number of Benthic Invertebrates Collected by Station





* Long Cove not sampled due to site inaccessibility.

FIGURE 12a

Percent Composition of the Dominant Benthic Taxa by Tide Location: Spring

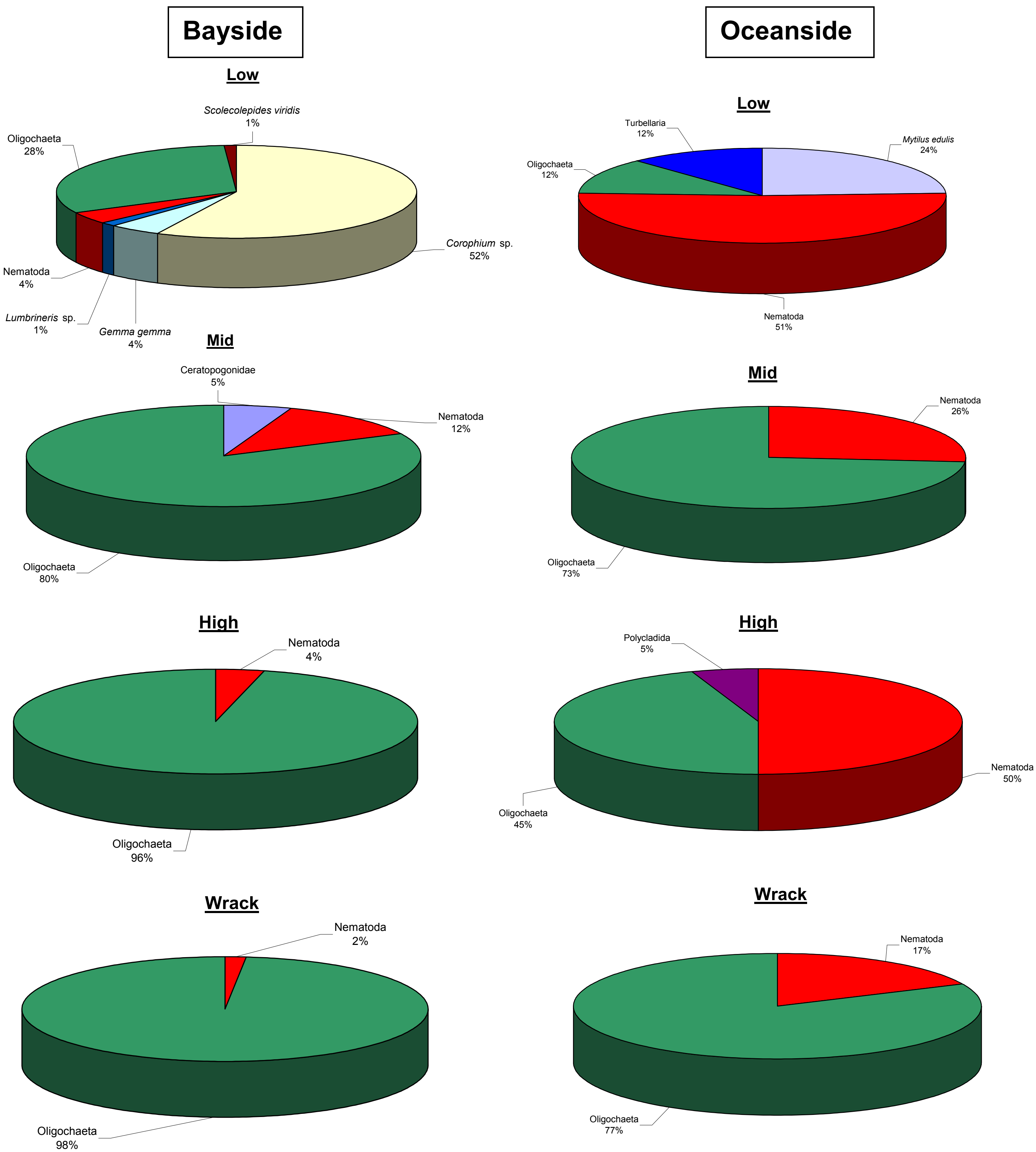


FIGURE 12b

Percent Composition of the Dominant Benthic Taxa by Tide Location: Fall

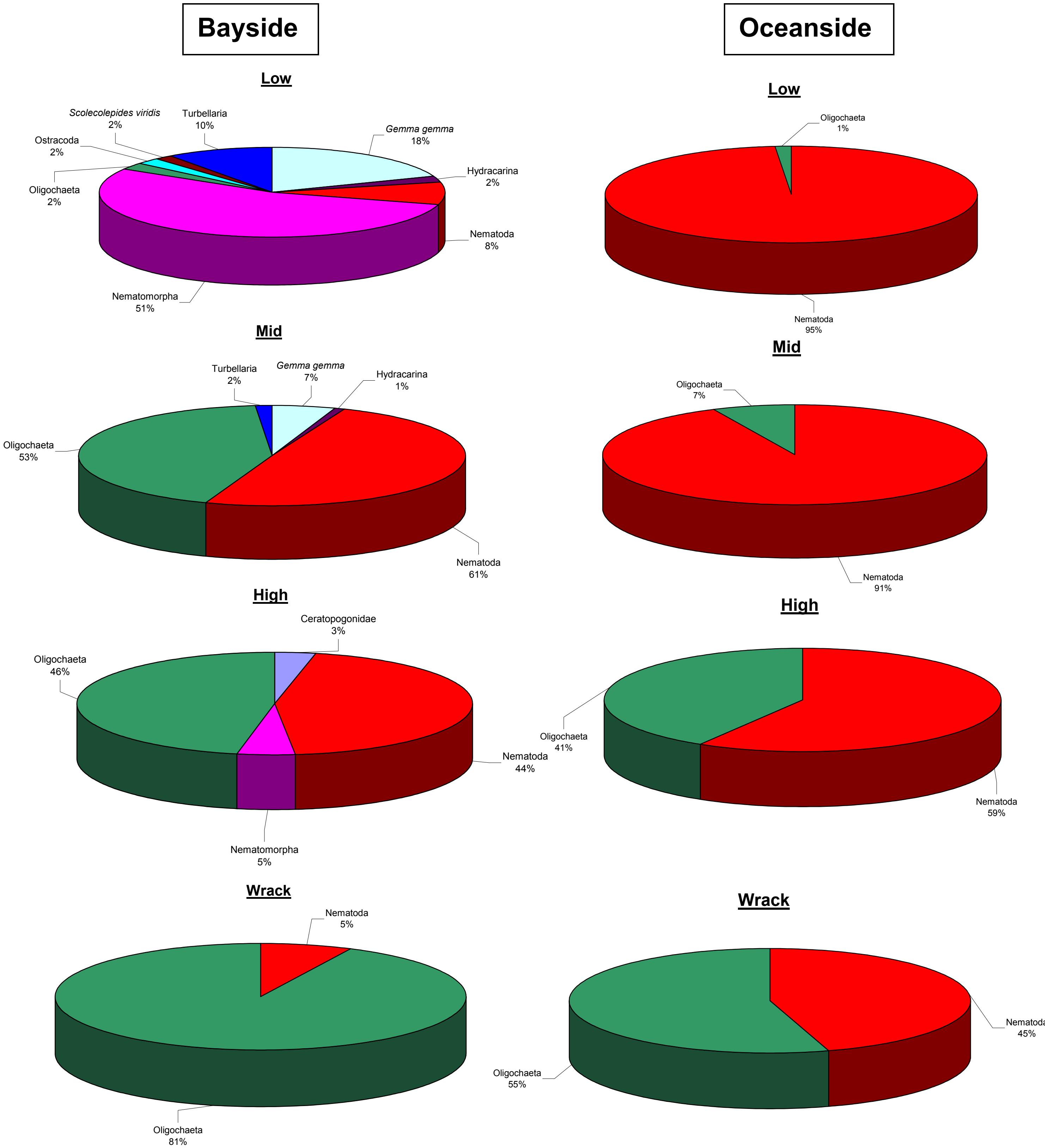
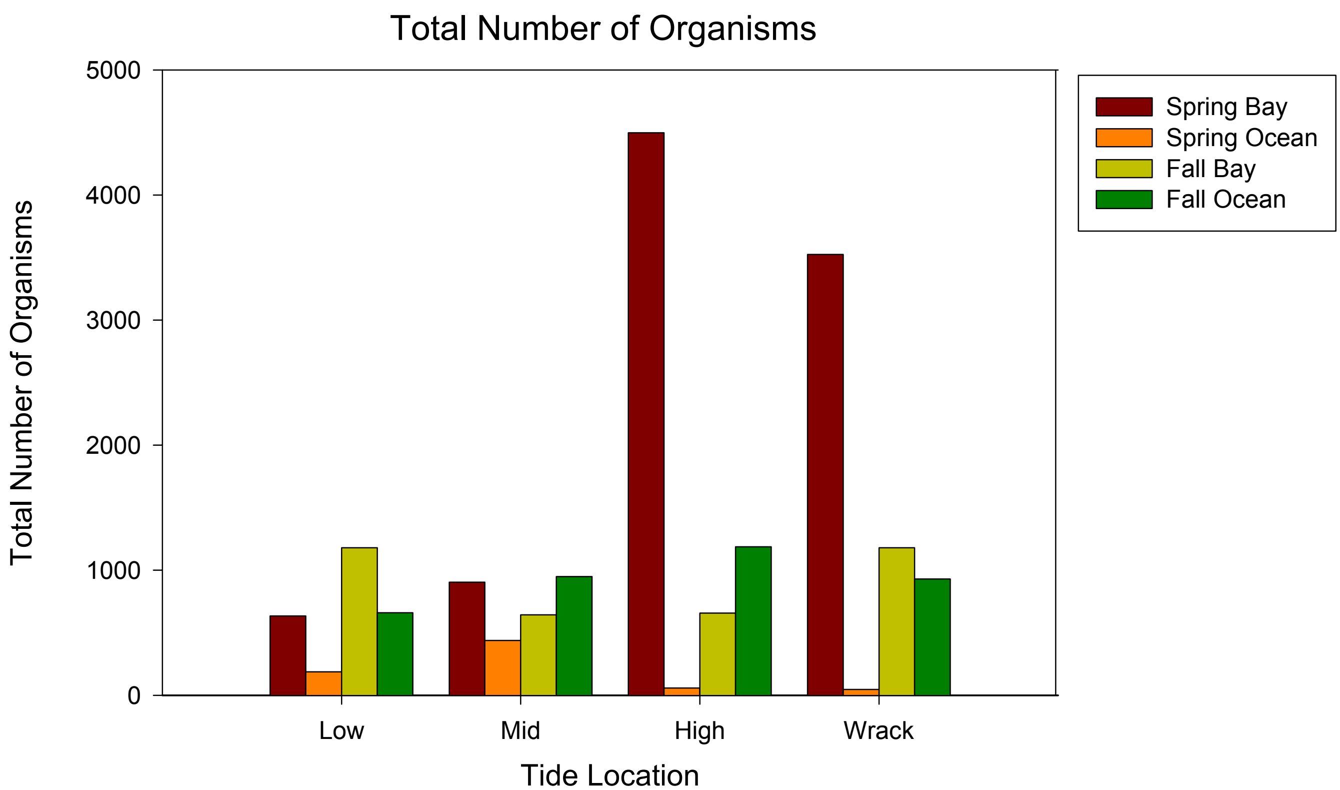


FIGURE 13

Total Number of Benthic Invertebrates and Number of Taxa Along Tide Zones for Spring and Fall Collections



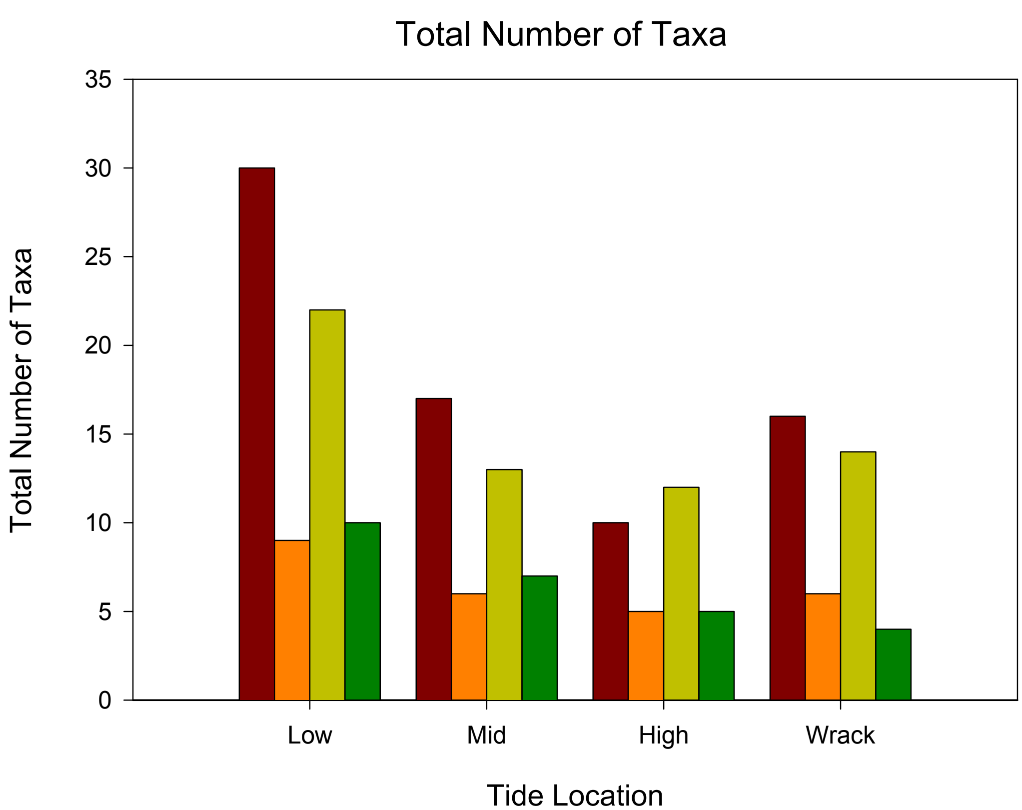
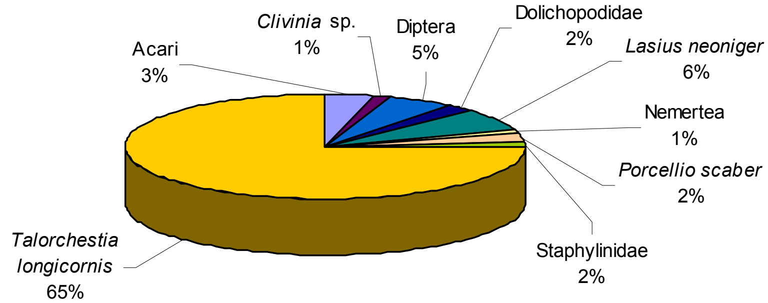


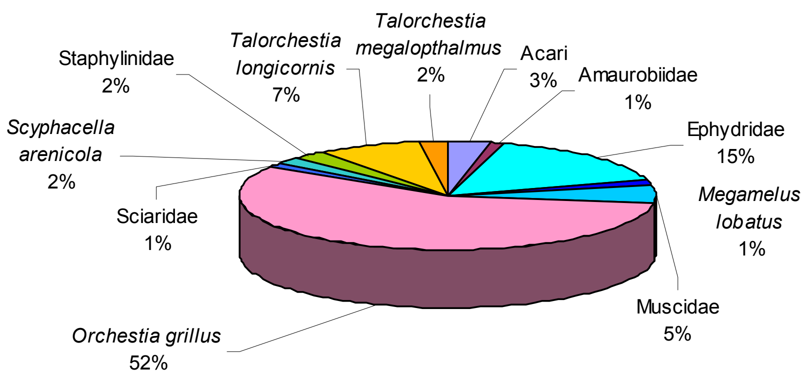
FIGURE 14

Percent Composition of the Dominant Invertebrate Taxa by Season and Location

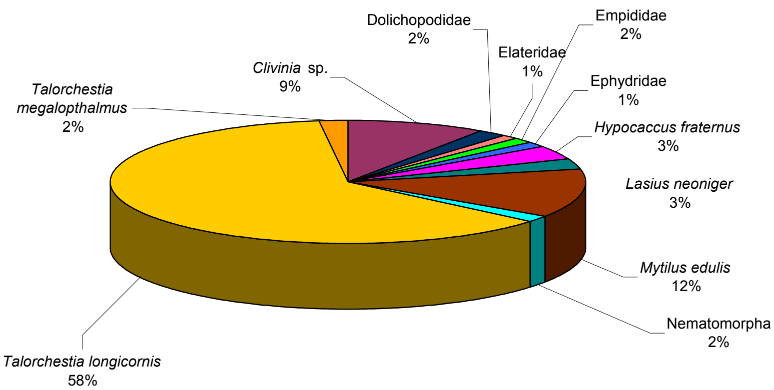
Bayside Spring



Bayside Fall



Oceanside Spring



Oceanside Fall

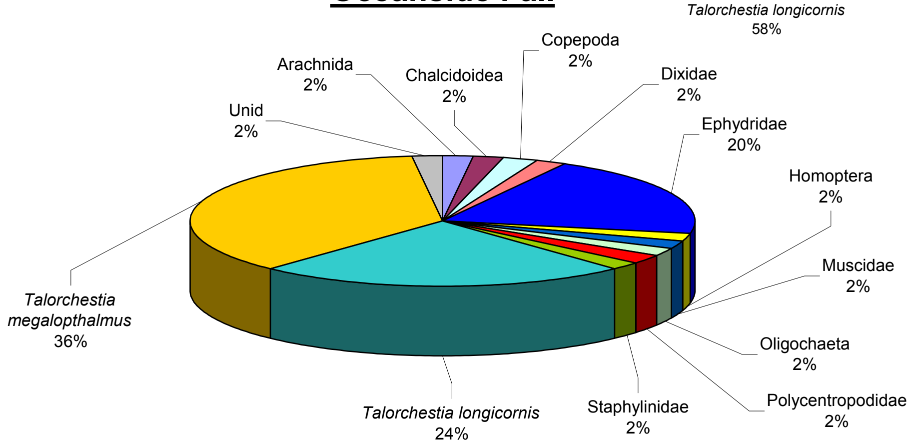
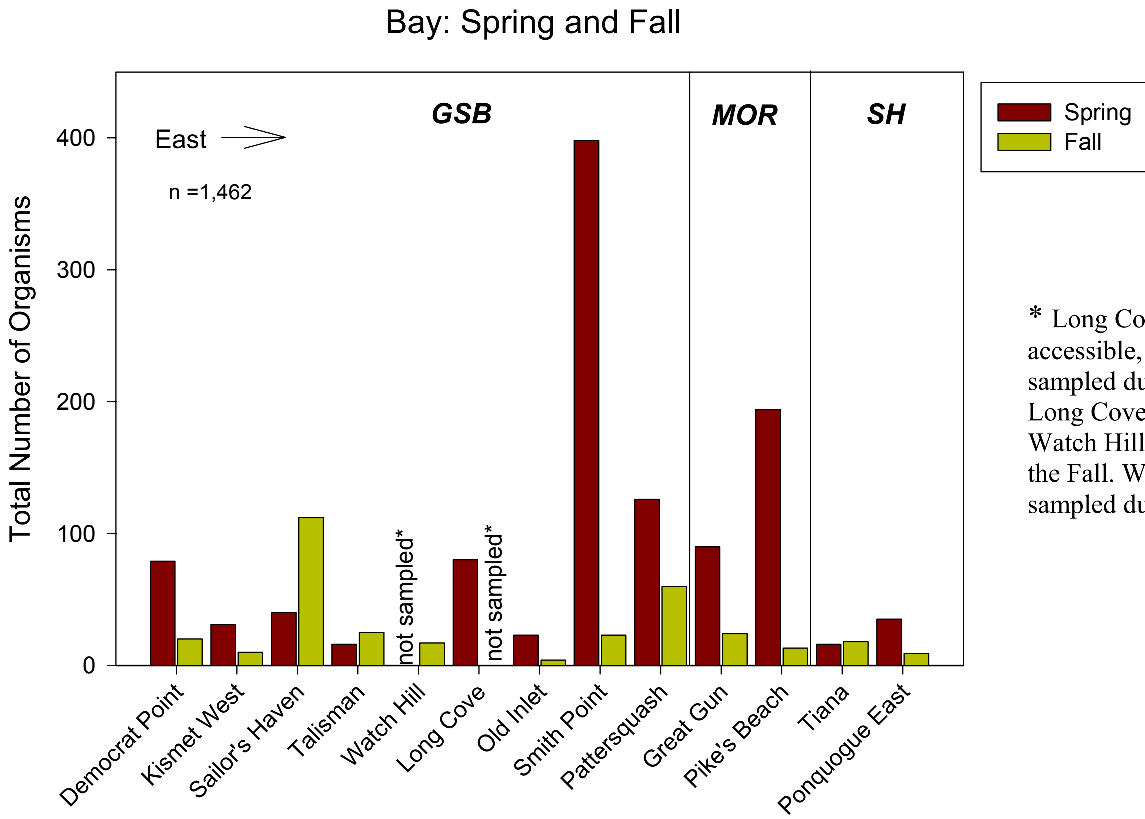


FIGURE 15

Total Number of Pitfall Trap Invertebrates Collected by Station: Bay and Ocean



* Long Cove oceanside not accessible, therefore not sampled during the spring. Long Cove replaced by Watch Hill station during the Fall. Watch Hill not sampled during the Spring.

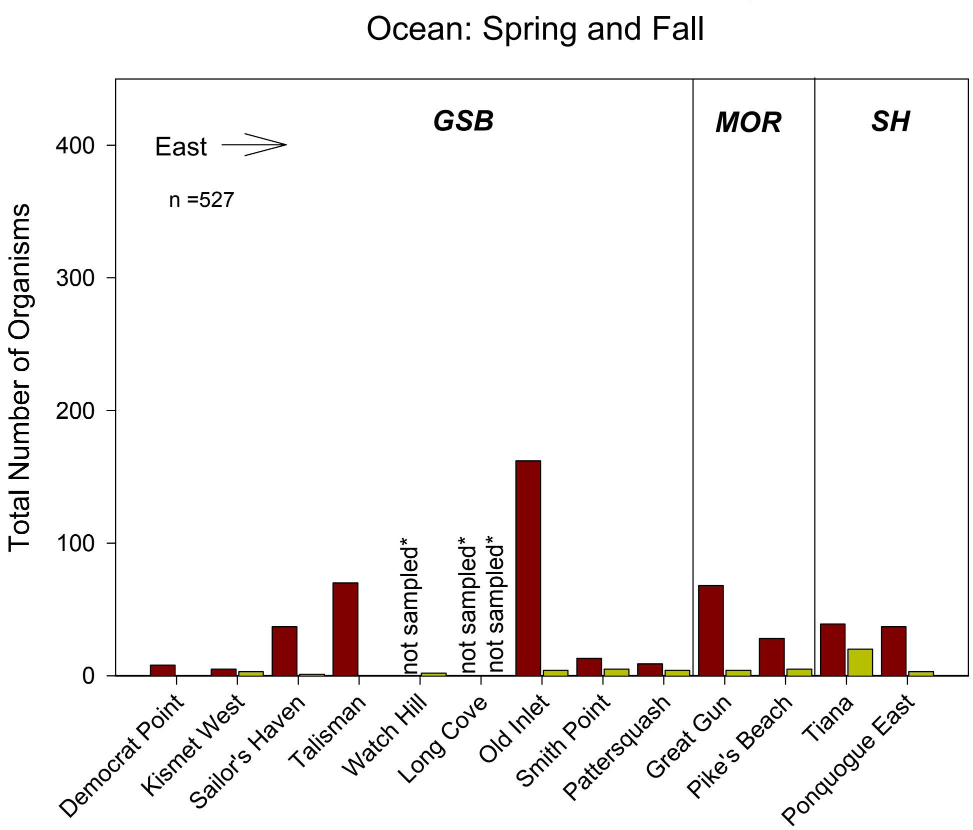
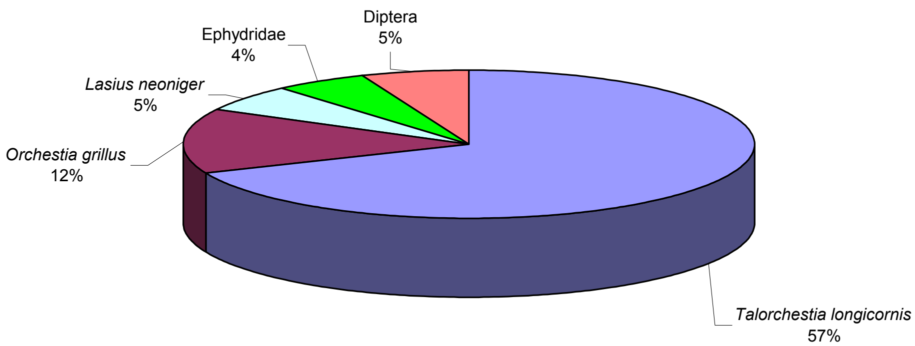


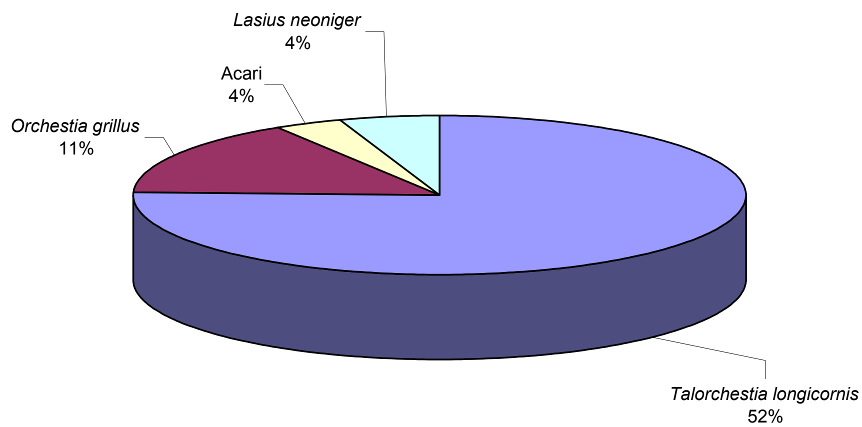
FIGURE 16a

Percent Composition of the Dominant Invertebrate Taxa by Beach Zone
Bayside Samples

Bayside Wrack



Bayside Supra



Bayside Grass

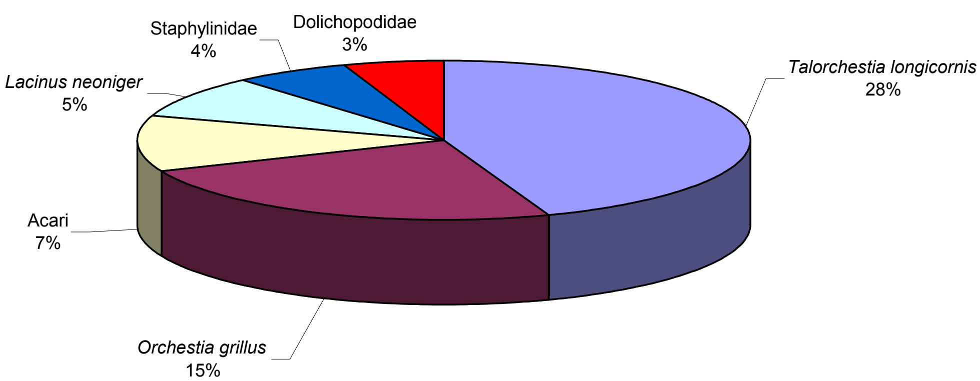
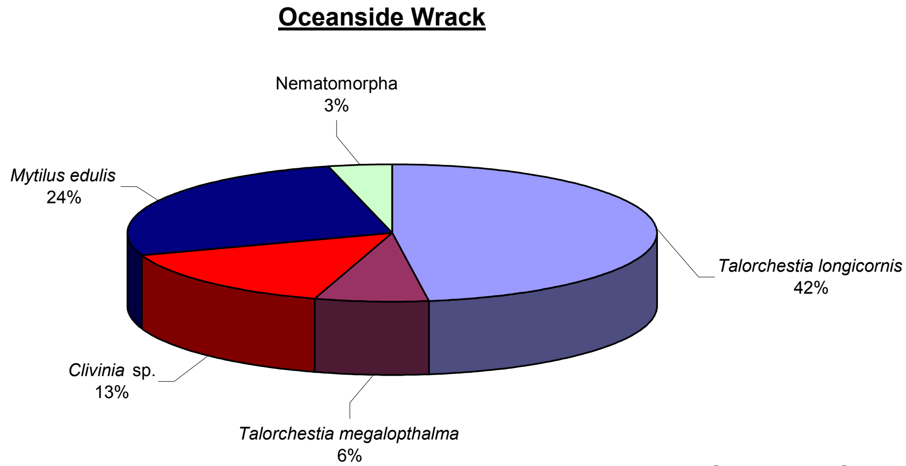
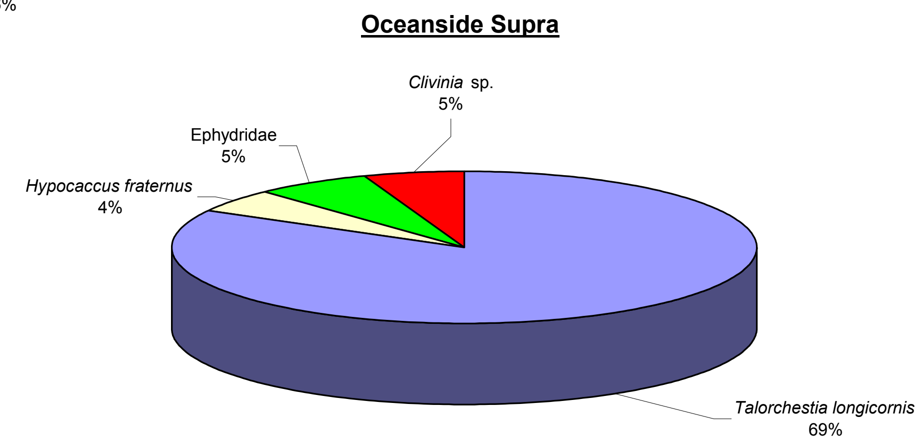


FIGURE 16b

Percent Composition of the Dominant Invertebrate Taxa by Beach Zone Oceanside Samples





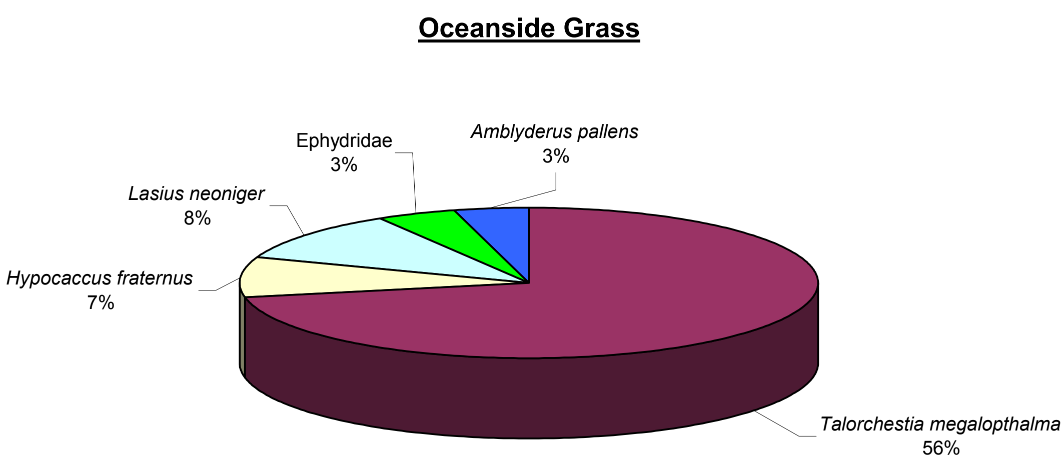
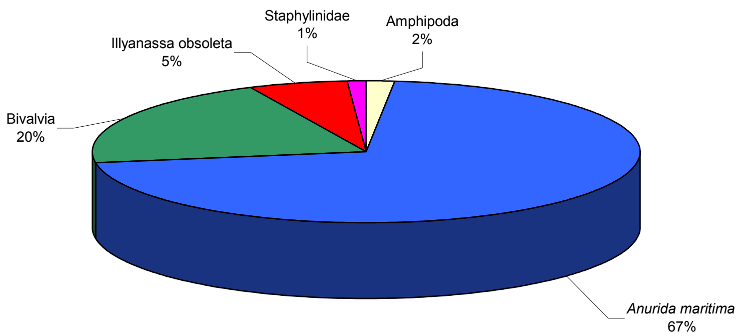


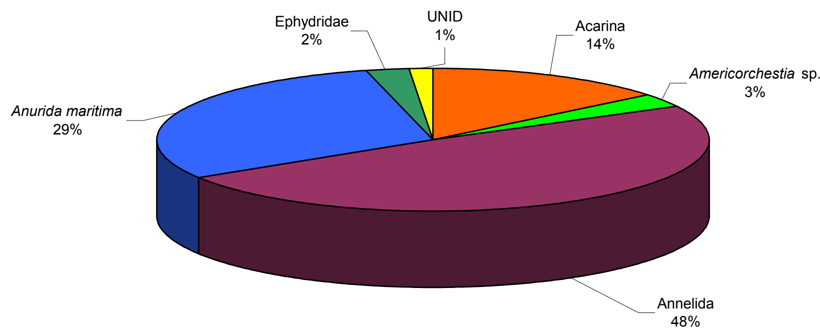
FIGURE 17

Percent Composition of Wrack Sight Organisms: Bay and Ocean, Spring and Fall

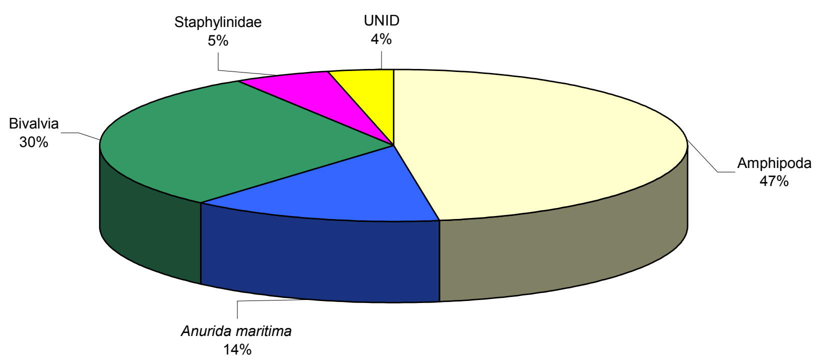
Bayside Spring



Bayside Fall



Oceanside Spring



Oceanside Fall

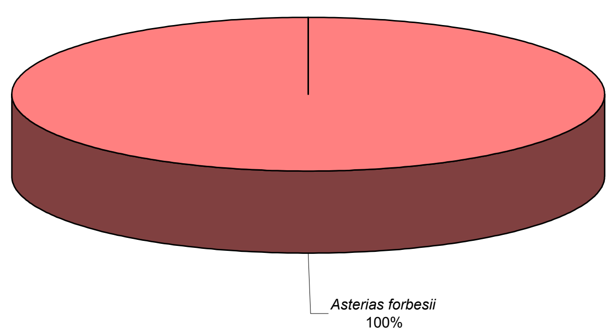
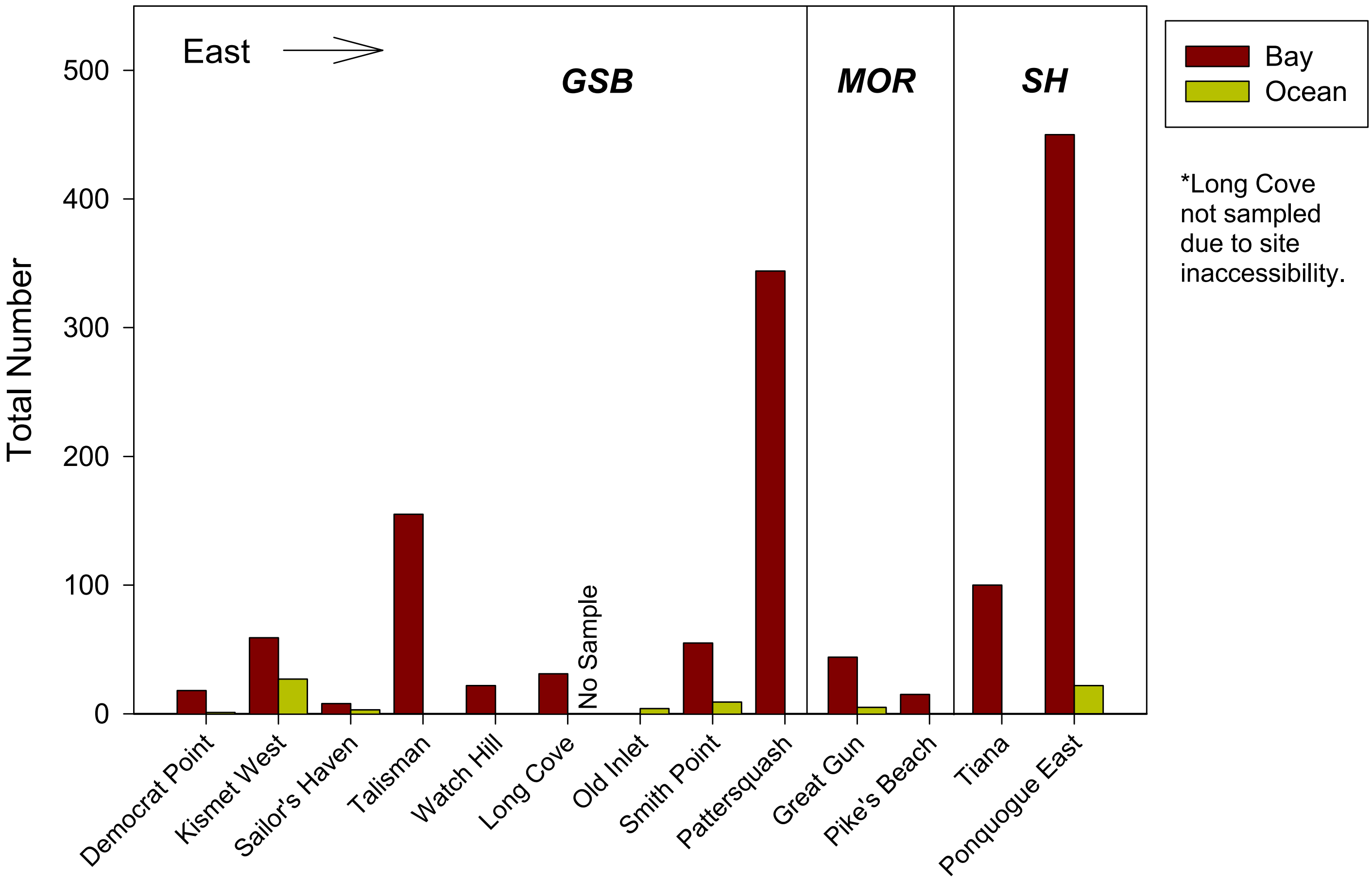


FIGURE 18

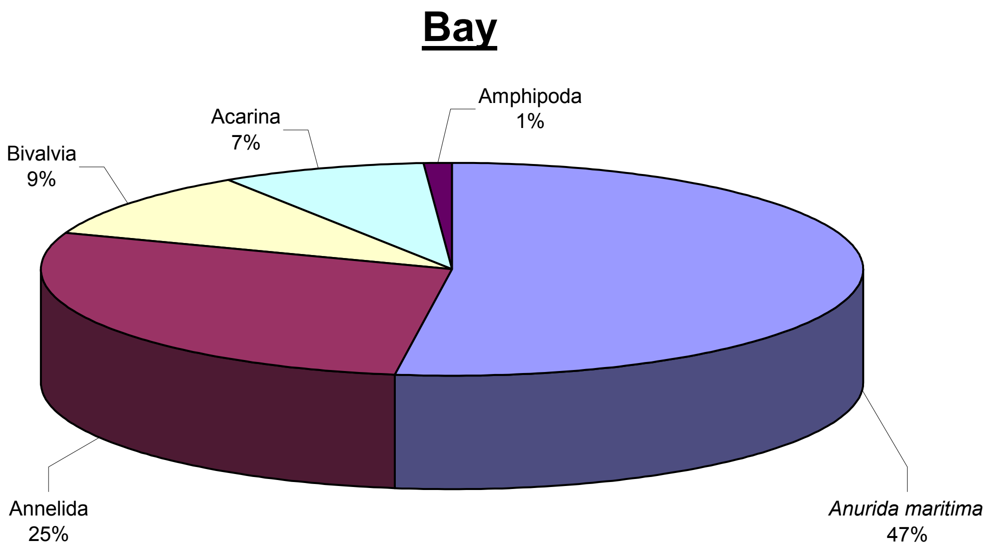
Total Number of Wrack Sight Organisms by Station
Bay and Ocean

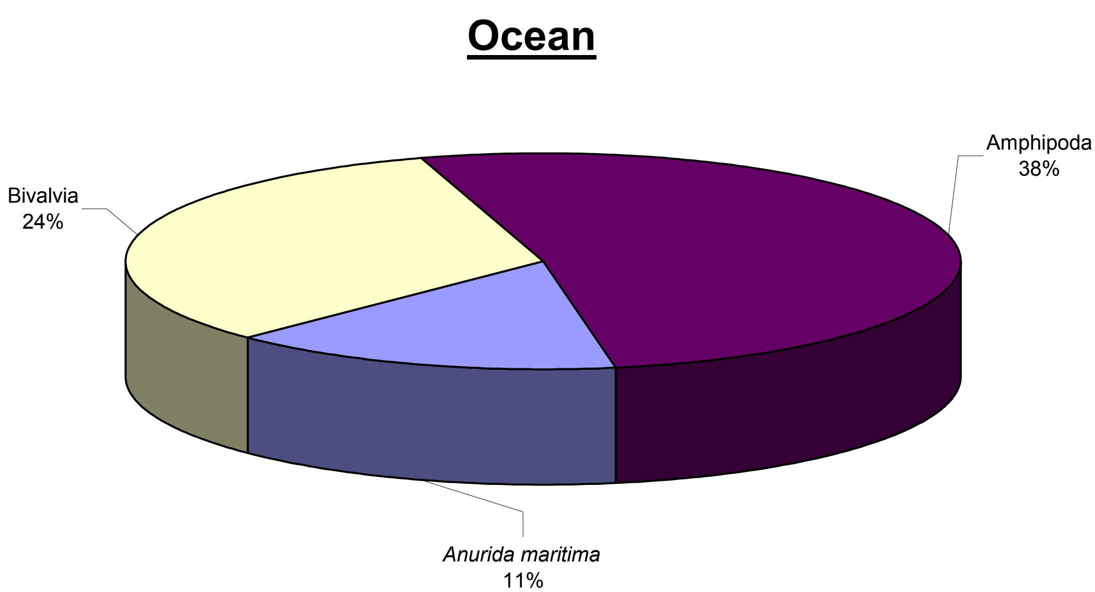


*Long Cove not sampled due to site inaccessibility.

FIGURE 19

Percent Composition of Wrack Sight Organisms: Bay and Ocean





TABLES

TABLE 1

Seasonality of Shorebirds Found in Study Area

Species Scientific Name	Species Common Name	Seasonality	Type
Calidris alba	Sanderling	Early May; end of July to end of September.	Migrant
Calidris alpina	Dunlin	Early April to mid-May Mid-September to early November	Migrant
Calidris canutus	Red Knot	Mid-July to mid-August.	Migrant
Calidris pusilla	Semipalmated Sandpiper	Early April to end of November.	Migrant, Rare
Catoptrophorus semipalmatus	Willet	Mid- to late July to early September	Migrant, Breeding
Charadrius melodus	Piping Plover	Eggs: mid-May to end of July. Fledged: early June to mid-August. Breeding: mid-April to end of August. Usually gone from area by September.	Migrant, Breeding
Charadrius seimpalmatus	Semipalmated Plover	Mid-May to end of November.	Migrant
Haematopus palliatus	American Oystercatcher	Early March to December	Migrant, Breeding
Pluvialis squatarola	Black Bellied Plover	Mid-May to December.	Migrant, Summer Non-Breeder
Tringa flavipes	Lesser Yellowlegs	Early April to end of October on coast.	Migrant
Tringa melanoleuca	Greater Yellowlegs	Mid-March to mid-November.	Migrant

Sources: Cornell University. 1998. Bull's Birds of New York State. E. Levine, ed. Cornell University Press.
Cornell University. 1988. The Atlas of Breeding Birds in New York State. R.F. Andrle and J.R. Carroll, eds. Cornell University Press.

TABLE 2

Station Logistics for Beach and Intertidal Invertebrate Survey

Spring 2003

Bay	Station	Location	Date	Time	Tide	Moon	Latitude	Longitude	Sample Type
GSB	Democrat Point	Bay	5/29/03	11:11	Ebb	New in 2 days	40'37.676	73'17.873	Core-Pit-Wrack Sight
	Democrat Point	Ocean	5/29/03	12:08	Ebb	New in 2 days	40'37.343	73'18.414	Core-Pit-Wrack Sight
GSB	Kismet West	Bay	5/29/03	9:46	Ebb	New in 2 days	40'38.144	73'12.529	Core-Pit-Wrack Sight
	Kismet West	Ocean	5/29/03	9:00	Ebb	New in 2 days	40'37.975	73'12.416	Core-Pit-Wrack Sight
GSB	Sailor's Haven	Bay	5/29/03	14:39	Ebb	New in 2 days	40'39.431	73'06.166	Core-Pit-Wrack Sight
	Sailor's Haven	Ocean	5/29/03	15:04	Flood	New in 2 days	40'39.326	73'06.168	Core-Pit-Wrack Sight
GSB	Talisman	Bay	5/29/03	13:28	Ebb	New in 2 days	40'40.310	73'02.646	Core-Pit-Wrack Sight
	Talisman	Ocean	5/29/03	13:52	Low	New in 2 days	40'40.201	73'02.642	Core-Pit-Wrack Sight
GSB	Long Cove	Bay	5/29/03	12:30	Ebb	New in 2 days	40'42.033	72'57.956	Core-Pit-Wrack Sight
	Long Cove	Ocean	5/29/03	x	x	x	x	x	No Sample
GSB	Old Inlet	Bay	5/29/03	11:15	High	New in 2 days	40'43.409	72'53.976	Core-Pit-Wrack Sight
	Old Inlet	Ocean	5/29/03	10:30	Ebb	New in 2 days	40'43.295	72'53.962	Core-Pit-Wrack Sight
GSB	Smith Point	Bay	5/27/03	16:04	Low	New in 4 days	40'43.934	72'52.299	Core-Pit-Wrack Sight
	Smith Point	Ocean	5/27/03	15:27	Flood	New in 4 days	40'43.856	72'52.123	Core-Pit-Wrack Sight
GSB	Pattersquash	Bay	6/2/03	9:55	Low	1st Quarter in 5 days	40'44.743	72'49.751	Core-Pit-Wrack Sight
	Pattersquash	Ocean	6/2/03	10:00	High	1st Quarter in 5 days	40'44.870	72'49.851	Core-Pit-Wrack Sight
MOR	Great Gun	Bay	6/2/03	8:40	Low	1st Quarter in 5 days	40'45.766	72'46.419	Core-Pit-Wrack Sight
	Great Gun	Ocean	6/2/03	9:00	High	1st Quarter in 5 days	40'45.534	72'46.289	Core-Pit-Wrack Sight
MOR	Pike's Beach	Bay	5/27/03	13:02	Ebb	New in 4 days	40'46.848	72'41.998	Core-Pit-Wrack Sight
	Pike's Beach	Ocean	5/27/03	13:38	Flood	New in 4 days	40'46.739	72'41.947	Core-Pit-Wrack Sight
SH	Tiana	Bay	5/27/03	11:35	Low	New in 4 days	40'49.496	72'32.904	Core-Pit-Wrack Sight
	Tiana	Ocean	5/27/03	12:05	Low	New in 4 days	40'49.282	72'32.788	Core-Pit-Wrack Sight
SH	Ponquogue East	Bay	5/27/03	9:30	Ebb	New in 4 days	40'50.452	72'29.282	Core-Pit-Wrack Sight
	Ponquogue East	Ocean	5/27/03	10:30	Low	New in 4 days	40'50.330	72'39.178	Core-Pit-Wrack Sight

Fall 2003

Bay	Station	Location	Date	Time	Tide	Moon	Latitude	Longitude	Sample Type
GSB	Democrat Point	Bay	10/22/03	12:30	Low	New in 3 days	40'37.676	73'17.873	Core-Pit-Wrack Sight
	Democrat Point	Ocean	10/22/03	11:30	Low	New in 3 days	40'37.343	73'18.414	Core-Pit-Wrack Sight
GSB	Kismet West	Bay	10/22/03	10:30	Ebb	New in 3 days	40'38.144	73'12.529	Core-Pit-Wrack Sight
	Kismet West	Ocean	10/22/03	9:45	Low	New in 3 days	40'37.975	73'12.416	Core-Pit-Wrack Sight
GSB	Sailor's Haven	Bay	10/22/03	11:30	Ebb	New in 3 days	40'39.431	73'06.166	Core-Pit-Wrack Sight
	Sailor's Haven	Ocean	10/22/03	11:00	Low	New in 3 days	40'39.326	73'06.168	Core-Pit-Wrack Sight
GSB	Talisman	Bay	10/22/03	12:40	Ebb	New in 3 days	40'40.310	73'02.646	Core-Pit-Wrack Sight
	Talisman	Ocean	10/22/03	12:10	Low	New in 3 days	40'40.201	73'02.642	Core-Pit-Wrack Sight
GSB	Watch Hill	Bay	10/22/03	13:15	Ebb	New in 3 days	40'41.582	72'59.527	Core-Pit-Wrack Sight
	Watch Hill	Ocean	10/22/03	13:35	Flood	New in 3 days	40'41.320	72'59.360	Core-Pit-Wrack Sight
GSB	Old Inlet	Bay	10/27/03	11:30	High	1st Quarter in 4 days	40'43.409	72'53.976	Core-Pit-Wrack Sight
	Old Inlet	Ocean	10/27/03	10:45	Ebb	1st Quarter in 4 days	40'43.295	72'53.962	Core-Pit-Wrack Sight
GSB	Smith Point	Bay	10/31/03	9:15	Low	1st Quarter	40'43.934	72'52.299	Core-Pit-Wrack Sight
	Smith Point	Ocean	10/31/03	10:00	Flood	1st Quarter	40'43.856	72'52.123	Core-Pit-Wrack Sight
GSB	Pattersquash	Bay	10/31/03	10:00	Low	1st Quarter	40'44.743	72'49.751	Core-Pit-Wrack Sight
	Pattersquash	Ocean	10/31/03	10:40	High	1st Quarter	40'44.870	72'49.851	Core-Pit-Wrack Sight
MOR	Great Gun	Bay	10/30/03	14:30	High	1st Quarter in 1 day	40'45.766	72'46.419	Core-Pit-Wrack Sight
	Great Gun	Ocean	10/30/03	14:00	Low	1st Quarter in 1 day	40'45.534	72'46.289	Core-Pit-Wrack Sight
MOR	Pike's Beach	Bay	10/30/03	14:45	High	1st Quarter in 1 day	40'46.848	72'41.998	Core-Pit-Wrack Sight
	Pike's Beach	Ocean	10/30/03	15:00	Ebb	1st Quarter in 1 day	40'46.739	72'41.947	Core-Pit-Wrack Sight
SH	Tiana	Bay	10/30/03	14:00	Ebb	1st Quarter in 1 day	40'49.496	72'32.904	Core-Pit-Wrack Sight
	Tiana	Ocean	10/30/03	14:20	Ebb	1st Quarter in 1 day	40'49.282	72'32.788	Core-Pit-Wrack Sight
SH	Ponquogue East	Bay	10/30/03	13:52	Ebb	1st Quarter in 1 day	40'50.452	72'29.282	Core-Pit-Wrack Sight
	Ponquogue East	Ocean	10/30/03	13:20	Ebb	1st Quarter in 1 day	40'50.330	72'39.178	Core-Pit-Wrack Sight

Table 3

Station Descriptions for Beach and Intertidal Invertebrate Survey

Station	Location	Depth Offshore	Wrack	Vegetation	Beach Width	Beach Profile	Notes
Democrat Point	Bay	moderate	abundant	Beach grass	very narrow	No berm, narrow/long beach	Jetty to west
Democrat Point	Ocean	deep	very small	Beach grass*	very broad	No berm	Tire tracks
Kismet West	Bay	moderate	moderate	Beach grass	very narrow	Small berm	Short beach
Kismet West	Ocean	deep	very small	Beach grass	very broad	No berm, shallow slope	Tire tracks, very small primary dune
Sailor's Haven	Bay	shallow	moderate	Woody shrub**, Phragmites	very narrow	Very narrow, short beach	Bulkhead to the west
Sailor's Haven	Ocean	deep	abundant	Beach grass, maritime shrubs	very broad	Berm, broad shallow slope	Few tire tracks, high primary dune (~18ft)
Talisman	Bay	shallow	abundant	Woody shrub, Phragmites**	very narrow		Dock to west, shallow sand spit
Talisman	Ocean	deep	small	Beach grass, Phragmites*	very broad	No berm, shallow slope	Tire tracks, small primary dune (~8ft)
Long Cove	Bay		moderate	Spartina	narrow	No berm, shallow slope	
Watch Hill	Bay	shallow	abundant	Phragmites**	very narrow	Small berm	
Watch Hill	Ocean	deep		Beach grass, Phragmites*	very broad	No berm, shallow slope	Tire tracks, steep primary dune (~15ft)
Old Inlet	Bay	very shallow	small	Phragmites** covering beach	narrow		Very shallow sand spit offshore
Old Inlet	Ocean	deep	small	Beach grass	very broad	No berm, shallow slope	Tire tracks, low primary dune (~6ft)
Smith Point	Bay	very shallow	abundant	Phrag**, Spartina, Beach Grass	very narrow	No berm, shallow slope	Heavily vegetated low dune
Smith Point	Ocean	deep		Beach grass	moderate	No berm, shallow slope	Moderately steep dune (~6 ft)
Pattersquash	Bay		abundant	Phrag**, Spartina, Beach Grass	very narrow	Small berm	
Pattersquash	Ocean			Beach grass	very broad	Berm, broad shallow slope	Very low, broad primary dune
Great Gun	Bay	shallow	small	Spartina, Phragmites	very narrow	No berm, shallow slope	Protected by marina to west
Great Gun	Ocean	deep	very small	Beach grass*, Phragmites*	broad	No berm, shallow slope	Tire tracks, low primary dune (~4ft)
Pike's Beach	Bay	very shallow	very small	Spartina, Beach grass, Beach Pea	moderate	No berm, shallow slope	Shallow sand spit to west, heavily developed
Pike's Beach	Ocean	deep	small	Beach grass	broad	Berm, moderate slope	Houses- heavily developed
Tiana	Bay	shallow	abundant	Spartina**, Phragmites, Beach grass	narrow	No berm, shallow slope	Protected cove, hard gravelly sediment
Tiana	Ocean	deep	small	Beach grass, maritime shrubs	moderate	Steep berm, shallow slope	
Ponquogue East	Bay	shallow	abundant	Spartina, Beach grass	narrow	No berm, shallow slope	Tidal pond west, marina east, low dune
Ponquogue East	Ocean		small	Beach grass	moderate	Steep berm	Jetty to east

* sparsely vegetated   ** densely vegetated

Beach Width:

very narrow	0-10 ft
narrow	11-25 ft
moderate	26-50 ft
broad	50-100 ft
very broad	100+

Depth Offshore:

very shallow	< 1 ft
shallow	1-2 ft
moderate	2-3 ft
deep	> 3

TABLE 4

Total Number of Organisms Collected at Each Station from All Gear Types

Overall Animal Abundances

	Low		Mid		High		Wrack		Supra		Grass	
	Bay	**Ocean**	**Bay**	**Ocean**	**Bay**	**Ocean**	**Bay**	**Ocean**	**Bay**	**Ocean**	**Bay**	**Ocean**
Benthic Core Spring Totals												
Benthic Core Fall Totals												
Pitfall Trap Spring Totals												
Pitfall Trap Fall Totals												
Spring Wrack Sight Totals												
Fall Wrack Sight Totals												
Along-Transect Totals	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***

Percent Composition of Bay versus Ocean Samples

	Total Number Bay	Total Number Ocean	Overall Number Bay+Ocean
Benthic Core Spring Totals	46	46	**92**
Benthic Core Fall Totals	48	48	**96**
Total Benthic Cores	***94***	***94***	***188***
Pitfall Trap Spring Totals	36	30	**66**
Pitfall Trap Fall Totals	36	35	**71**
Total Pitfall Traps	***72***	***65***	***137***
Spring Wrack Sight Totals	12	11	**23**
Fall Wrack Sight Totals	12	12	**24**
Total Wrack Samples	***24***	***23***	***47***
Total Number Samples	***190***	***182***	***372***

TABLE 5

List of Taxa Collected in Beach and Intertidal Invertebrate Survey: All Gear Types

	Class	Order	Scientific Name	Common Name
Phylum Annelida				**Segmented Worms**
	Oligochaeta		Oligochaeta	Earthworms
	Polychaeta	**Aciculata**	Dorvilleidae	
			Eteone sp.	Paddle Worm
			Lumbrineris sp.	Opal Worms
			Nereis sp.	Clam Worm
			Nereis arenaceodonta	White Clam Worm
			Aberrantidae[1]	
		Canalipalpata	*Polydora ligni*	Mud or Blister Worm
			Prionospio sp.	
			Scolecolepides viridis	
			Scolelepis squamata	Bristleworm
			Serpulidae	Tube Worm
			Spio filicornis	Bristleworm
			Spio sp.	Bristleworm
			Spiochaetopterus oculatus	Glassy Tubeworm
			Spionidae	
			Spiophanes bombyx	Bristleworm
			Syllidae	
		Capitellida	*Capitella* sp.	Capitellid Threadworm
			Capitellidae	Capitellid Threadworm
			Clymenella torquata	Bamboo Worm
			Tharyx sp.	Fringed Worm
		Orbiniida	*Scoloplos acutus*	Bristleworm
			Scoloplos fragilis	Bristleworm
			Scoloplos robustus	Bristleworm
			Scoloplos sp.	Bristleworm
Phylum Arthropoda				**Insects, Crustaceans, Spiders and Relatives**
	Arachnida			Mites, Ticks, and Spiders
		Acari	Acari Order	Mites, ticks
			Dermacentor variabilis	American Dog Tick
			Hydracarina	Water Mite
		Araneae	Amaurobiidae	Hackled Mesh Weavers
			Clubionidae	Sac Spiders
			Dictynidae	Meshweb Weavers
			Erigonidae	Dwarf Spiders
			Habronattus borealis	Jumping Spider
			Linyphiidae	Sheet Web Spiders
			Lycosidae	Wolf Spiders
			Mimetidae	Pirate Spiders
			Tetragnathidae	Long-Jawed Orb Weaver Spiders
			Thomisidae	Crab Spiders
	Insecta	**Coleoptera**	*Amblyderus palleus*	Antlike flower beetle
			Anthicidae	Antlike flower beetle
			Bledius sp.	Rove Beetle
			Cicindela cuprascens	Tiger Beetle
			Clivinia sp.	Ground Beetle
			Coleoptera	Beetles
			Elateridae	Click Beetles
			Haliplidae	Crawling Water Beetles
			Hydrophilidae	Water Scavenger Beetles
			Hypocaccus fraternus	Clown Beetle
			Lathrididae	Minute Brown Scavenger Beetle
			Mecynotarsus candidus	Antlike flower beetle
			Negastrius choris	Click Beetles
			Podabrus rugosulus	Soldier Beetle
			Scarabaeidae	Scarab Beetles
			Scolytidae	Bark Beetles
			Staphylinidae	Rove Beetle
			Tenebrionidae	Darkling Beetles
		Collembola	*Anurida maritima*	Seashore springtail
			Collembola	Springtails
		Diptera	Cecidomyiidae	Gall Midges
			Ceratopogonidae	Biting Midges
			Chaoborus sp.	Phantom Midge
			Chironomidae	True Midges
			Culicidae	Mosquitoes
			Diptera	Flies, Mosquitoes, Gnats
			Dixidae	Dixid Midge
			Dolichopodidae	Longlegged Fly
			Empididae	Dance Flies
			Ephydridae	Shore Fly
			Muscidae	House and Stable Flies
			Phoridae	Humpbacked Flies
			Pipunculidae	Bigheaded Flies
			Sciaridae	Dark-winged Fungus Gnats
			Stratiomyidae	Soldier Flies
			Tipula sp.	Crane Fly
		Hemiptera	*Blissus* sp.	Chinch Bug

	Class	Order	Scientific Name	Common Name
Phylum Annelida				**Segmented Worms**
		Homoptera	Aphididae	Aphids
			Cicadellidae	Leafhoppers
			Homoptera	True Bugs
			Megamelus lobatus	Delphacid Plant Hopper
		Hymenoptera	Braconidae	Braconid Wasp
			Chalcidoidea	Chalcidid Wasp
			Crematogaster lineolata	Lined Acrobatic Ant
			Formicidae	Ant
			Hymenoptera	Bees, Wasps, Ants and Sawflies
			Lasius neoniger	Cornfield Ant
			Mymaridae	Fairyflies
			Myrmicinae	Ant
			Perilampidae	Chalcidid Wasp
			Platygastridae	Platygastrid Wasps
			Ponerinae	Ant
			Siricidae	Horntail Wasp
		Leptidoptera	Gelechiidae	Twirler Moth
			Lepidoptera	Butterflies and Moths
			Noctuidae	Owlet Moths and Underwings
		Neuroptera	Sisyridae	Spongillaflies
		Odonata	Odonata	Dragonflies and Damselflies
		Trichoptera	Polycentropodidae	Caddisflies
	Pseudoscorpiones		Pseudoscorpiones	False Scorpions
Subphylum Crustacea				**Crustaceans**
	Copepoda[2]			Copepods
	Diplopoda	**Chordeumatida**	Striaridae	Millipede
		Spirostreptida	Cambalida	Millipede
	Malacostraca	**Amphipoda**	*Ampelisca macrocephala*	
			Ampelisca sp.	
			Ampeliscidae	
			Amphipoda	Beach Flea
			Corophium sp.	Tube Dwelling Amphipod
			Gammaridae	Scuds or Sideswimmer
			Gammarus mucronatus	Scuds or Sideswimmer
			Gammarus sp.	Scuds or Sideswimmer
			Haustoriidae	Digging Amphipods
			Microdeutopus sp.	Gammarid Amphipod
			Neohaustorius sp.	
			Orchestia grillus	Common Marsh Hopper
			Parahaustorius attenuatus	
			Talitridae	
			Talorchestia longicornus	Sand Flea
		Decapoda	*Emerita talpoida*	Atlantic Sand Crab or Mole Crab
			Megalops/Mysid	
		Isopoda	*Edotea triloba*	
			Isopoda	Pill Bugs and Sow Bugs
			Porcellio scaber	Sowbug
			Scyphacella arenicola	
			Armadillium vulgare	Pill bug
	Ostracoda		Ostracoda	Seed or Mussel Shrimp
Phylum Cnidaria	**Hydrozoa**	**Hydroida**	*Hydra carnea*	**Jellyfish, Hydroids, Anemones**
Phylum Echinodermata				**Sea urchins, Sand dollars, Sea cucumbers**
	Stelleroidea	**Forcipulatida**	*Asterias forbesii*	Common Sea Star
Phylum Ectoprocta				**Bryozoans**
	Gymnolaemata	**Cheilostomata**	*Electra crustulenta*	Lacy Bryozoan
Phylum Eubranchiopoda			Eubranchiopoda	Fairy Shrimp
Phylum Mollusca				**Cephalopods, Snails, Scallops, Clams, Chitons**
	Bivalvia		Bivalvia	Bivalves and Clams
		Mytiloida	*Mytilus edulis*	Blue Mussel
		Veneroida	*Astarte castanea*	Smooth Astarte
			Donax sp.	Wedge Clam
			Gemma gemma	Amethyst Gem Clam
			Tellina agilis	Northern Dwarf Tellin
			Tellina sp.	Tellin Clam
	Gastropoda		Gastropod	Snails or Slugs
		Neogastropoda	*Ilyanassa obsoletus*	Eastern Mud Snail
		Neotaenioglossa	*Hydrobia minuta*	Swamp or Minute Hydrobia
Phylum Nematoda			Nematoda	**Roundworms**
Phylum Sipunculoidea	**Sipunculida**	**Sipunculiformes**	Sipunculidae	**Peanut Worms**
Phylum Nematomorpha			Nematomorpha	Horsehair Worms
Phylum Nemertea			Nemertea	**Ribbon Worms**
Phylum Platyhelminthes				**Flatworms, Flukes, Tapeworms**
	Turbellaria			Flatworms
		Polycladida	Polycladida	Polyclads

Note: Common names not available for all groups.

[1] Aberrantidae formerly called Spirorbidae.

[2] Subclass

Sources: http://www.entsoc.org, http://www.itis.usda.gov, Arnett (2000), Kluft-Steinback (1999), National Audubon Society (1994), Gosner (1975

APPENDIX TABLES

APPENDIX TABLE 1

Sediment Percent Composition at Each Station Sampled During the Spring 2003

SAMPLE	SPECIMEN	% GRAVEL	% SAND	% FINES
Democrat	Low Bay	0	99.7	0.3
Democrat	Mid Bay	0	99.7	0.3
Democrat	High Bay	0	100	0
Democrat	Wrack Bay	0	100	0
Democrat	Low Ocean	0	99.6	0.4
Democrat	Mid Ocean	0	99.7	0.3
Democrat	High Ocean	0	99.9	0.1
Democrat	Wrack Ocean	0	99.8	0.2
Great Gun	Low Bay	23.5	76	0.5
Great Gun	Mid Bay	7	92.7	0.3
Great Gun	High Bay	3.2	96.5	0.3
Great Gun	Wrack Bay	2.2	97.8	0
Great Gun	Low Ocean	5.1	94.6	0.2
Great Gun	Mid Ocean	0	100	0
Great Gun	High Ocean	0	100	0
Great Gun	Wrack Ocean	0	100	0
Kismet	Low Bay	0	99.6	0.4
Kismet	Mid Bay	0	100	0
Kismet	High Bay	0	100	0
Kismet	Wrack Bay	0	100	0
Kismet	Low Ocean	0	98.8	1.2
Kismet	Mid Ocean	0	100	0
Kismet	High Ocean	0	99.9	0.1
Kismet	Wrack Ocean	0	100	0
Long Cove	Low Bay	0	100	0
Long Cove	Mid Bay	0	99.6	0.4
Long Cove	High Bay	0	99.2	0.8
Long Cove	Wrack Bay	0	100	0
Long Cove	Low Ocean	no sample	no sample	no sample
Long Cove	Mid Ocean	no sample	no sample	no sample
Long Cove	High Ocean	no sample	no sample	no sample
Long Cove	Wrack Ocean	no sample	no sample	no sample
Old Inlet	Low Bay	0.3	99	0.8
Old Inlet	Mid Bay	0.6	99.2	0.2
Old Inlet	High Bay	0	100	0
Old Inlet	Wrack Bay	0	99.9	0.1
Old Inlet	Low Ocean	13.6	85.8	0.6
Old Inlet	Mid Ocean	0	99.5	0.5
Old Inlet	High Ocean	0	99.6	0.4
Old Inlet	Wrack Ocean	0.3	99.7	0
Pattersquash	Low Bay	0	99.8	0.2
Pattersquash	Mid Bay	0	99.7	0.3
Pattersquash	High Bay	0	99.9	0.1
Pattersquash	Wrack Bay	0	100	0
Pattersquash	Low Ocean	27.6	71.9	0.5
Pattersquash	Mid Ocean	0	99.8	0.2
Pattersquash	High Ocean	0	99.6	0.4
Pattersquash	Wrack Ocean	0	100	0
Pike's Beach	Low Bay	0	99.8	0.2
Pike's Beach	Mid Bay	0	99.5	0.5
Pike's Beach	High Bay	0	99.8	0.2
Pike's Beach	Wrack Bay	0	100	0
Pike's Beach	Low Ocean	0	99.1	0.9
Pike's Beach	Mid Ocean	0	100	0
Pike's Beach	High Ocean	0	100	0
Pike's Beach	Wrack Ocean	0	99.1	0.9
Ponquogue	Low Bay	15.7	83.5	0.8
Ponquogue	Mid Bay	0	100	0
Ponquogue	High Bay	5.5	94.4	0.1
Ponquogue	Wrack Bay	0	100	0
Ponquogue	Low Ocean	1.5	97.6	0.9
Ponquogue	Mid Ocean	0	100	0
Ponquogue	High Ocean	4.4	95.5	0.1
Ponquogue	Wrack Ocean	0	100	0
Sailor's Haven	Low Bay	0.9	98.4	0.7
Sailor's Haven	Mid Bay	0	99.6	0.4
Sailor's Haven	High Bay	0	98.5	1.5
Sailor's Haven	Wrack Bay	0	99.7	0.3
Sailor's Haven	Low Ocean	8	91.3	0.8
Sailor's Haven	Mid Ocean	0	99.6	0.4
Sailor's Haven	High Ocean	0	99.8	0.2
Sailor's Haven	Wrack Ocean	4.5	95.5	0
Smith Point	Low Bay	3.5	96.2	0.3
Smith Point	Mid Bay	0	100	0
Smith Point	High Bay	0	100	0
Smith Point	Wrack Bay	0	100	0
Smith Point	Low Ocean	0	99.2	0.8
Smith Point	Mid Ocean	0	99.8	0.2
Smith Point	High Ocean	0.8	99.1	0
Smith Point	Wrack Ocean	0	100	0
Talisman	Low Bay	1.2	98.2	0.7
Talisman	Mid Bay	0	99.6	0.4
Talisman	High Bay	0	100	0
Talisman	Wrack Bay	0	99.8	0.2
Talisman	Low Ocean	7	91.8	1.2
Talisman	Mid Ocean	0	99.3	0.7
Talisman	High Ocean	0	99.4	0.6
Talisman	Wrack Ocean	0	99.6	0.4
Tiana	Low Bay	2.3	96.2	1.5
Tiana	Mid Bay	13.8	85.9	0.3
Tiana	High Bay	0	100	0
Tiana	Wrack Bay	27.3	71.2	1.5
Tiana	Low Ocean	0	99.1	0.9
Tiana	Mid Ocean	0	100	0
Tiana	High Ocean	0	99.9	0.1
Tiana	Wrack Ocean	0	100	0

APPENDIX TABLE 2

Sediment Percent Composition at Each Station Sampled During the Fall 2003

SAMPLE	SPECIMEN	% GRAVEL	% SAND	% FINES
Democrat	Low Bay	0	99.9	0.1
Democrat	Mid Bay	0	99.7	0.3
Democrat	High Bay	0	100	0
Democrat	Wrack Bay	0	100	0
Democrat	Low Ocean	0	99.8	0.2
Democrat	Mid Ocean	0	100	0
Democrat	High Ocean	0	99.9	0.1
Democrat	Wrack Ocean	0	100	0
Great Gun	Low Bay	19.3	80.4	0.3
Great Gun	Mid Bay	3.9	96.1	0
Great Gun	High Bay	0.8	99.2	0
Great Gun	Wrack Bay	0	99.9	0.1
Great Gun	Low Ocean	0.6	99.3	0.1
Great Gun	Mid Ocean	0	100	0
Great Gun	High Ocean	0	99.8	0.2
Great Gun	Wrack Ocean	0	99.9	0.1
Kismet	Low Bay	0	99.9	0.1
Kismet	Mid Bay	0	100	0
Kismet	High Bay	0	99.7	0.3
Kismet	Wrack Bay	0	100	0
Kismet	Low Ocean	0	99.8	0.2
Kismet	Mid Ocean	0	100	0
Kismet	High Ocean	0	100	0
Kismet	Wrack Ocean	1.3	98.4	0.3
Old Inlet	Low Bay	0	99.9	0.1
Old Inlet	Mid Bay	0	99.9	0.1
Old Inlet	High Bay	0	99.9	0.1
Old Inlet	Wrack Bay	0	99.9	0.1
Old Inlet	Low Ocean	0	99.7	0.3
Old Inlet	Mid Ocean	0	100	0
Old Inlet	High Ocean	0	99.8	0.2
Old Inlet	Wrack Ocean	0	100	0
Pattersquash	Low Bay	0	99.2	0.8
Pattersquash	Mid Bay	0	99.7	0.3
Pattersquash	High Bay	0	99.6	0.4
Pattersquash	Wrack Bay	0	100	0
Pattersquash	Low Ocean	0.9	99	0.1
Pattersquash	Mid Ocean	0	90.4	9.6
Pattersquash	High Ocean	0	100	0
Pattersquash	Wrack Ocean	0	99.9	0.1
Pike's Beach	Low Bay	0	99.6	0.4
Pike's Beach	Mid Bay	0	99.5	0.5
Pike's Beach	High Bay	0	99.2	0.8
Pike's Beach	Wrack Bay	0	100	0
Pike's Beach	Low Ocean	3.8	96.1	0.1
Pike's Beach	Mid Ocean	0	99.8	0.2
Pike's Beach	High Ocean	0	100	0
Pike's Beach	Wrack Ocean	0	100	0
Ponquogue	Low Bay	0	99.9	0.1
Ponquogue	Mid Bay	0	100	0
Ponquogue	High Bay	0	100	0
Ponquogue	Wrack Bay	0	100	0
Ponquogue	Low Ocean	8.4	91.5	0
Ponquogue	Mid Ocean	0	99.4	0.6
Ponquogue	High Ocean	0	100	0
Ponquogue	Wrack Ocean	0	100	0
Sailor's Haven	Low Bay	0	99.9	0.1
Sailor's Haven	Mid Bay	0	99.8	0.2
Sailor's Haven	High Bay	0	99.9	0.1
Sailor's Haven	Wrack Bay	0	99.5	0.5
Sailor's Haven	Low Ocean	0	99.9	0.1
Sailor's Haven	Mid Ocean	0	99.7	0.3
Sailor's Haven	High Ocean	0	100	0
Sailor's Haven	Wrack Ocean	0	99.9	0.1
Smith Point	Low Bay	0	99.6	0.4
Smith Point	Mid Bay	0	99.9	0.1
Smith Point	High Bay	0	100	0
Smith Point	Wrack Bay	0	99.9	0.1
Smith Point	Low Ocean	2.2	97.7	0.1
Smith Point	Mid Ocean	0	100	0
Smith Point	High Ocean	0	99.9	0.1
Smith Point	Wrack Ocean	0	99.9	0.1
Talisman	Low Bay	0	83.2	16.8
Talisman	Mid Bay	0	99.9	0.1
Talisman	High Bay	0	99.9	0.1
Talisman	Wrack Bay	0	100	0
Talisman	Low Ocean	9.3	90.6	0.2
Talisman	Mid Ocean	0	99.8	0.2
Talisman	High Ocean	0	99.9	0.1
Talisman	Wrack Ocean	0	99.9	0.1
Tiana	Low Bay	0	99.6	0.4
Tiana	Mid Bay	0	86.9	13.1
Tiana	High Bay	0	99.5	0.5
Tiana	Wrack Bay	0	99.9	0.1
Tiana	Low Ocean	29.7	70.3	0
Tiana	Mid Ocean	0	99.6	0.4
Tiana	High Ocean	0	100	0
Tiana	Wrack Ocean	0	100	0
Watch Hill	Low Bay	1	98.4	0.6
Watch Hill	Mid Bay	1.8	98.1	0.1
Watch Hill	High Bay	0	99.7	0.3
Watch Hill	Wrack Bay	0	95.8	4.2
Watch Hill	Low Ocean	20.6	79.2	0.2
Watch Hill	Mid Ocean	0	99.8	0.2
Watch Hill	High Ocean	0	99.5	0.5
Watch Hill	Wrack Ocean	0.8	99.2	0

APPENDIX TABLE 3

Total Number of Organisms Collected in Benthic Core Samples and Listed by Taxa

Bayside

Taxon	Spring Total No.	Fall Total No.	Percent of Total
Phylum Annelida			
Oligochaeta	8,660	1,663	78.10
Polychaeta			
Aciculata			
Dorvilleidae	2	0	0.02
Eteone sp.	0	1	0.01
Lumbrineris sp.	8	1	0.07
Nereis arenaceodonta	6	8	0.11
Nereis sp.	2	0	0.02
Spirorbidae	0	10	0.08
Canalipalpata			
Polydora ligni	3	3	0.05
Prionospio sp.	0	2	0.02
Scolecolepides viridis	7	0	0.05
Scolelepis squamata	5	1	0.05
Spio filicornis	5	0	0.04
Spio sp.	0	4	0.03
Spionidae	1	0	0.01
Spiophanes bombyx	5	0	0.04
Syllidae	3	8	0.08
Capitellida			
Capitella sp.	0	4	0.03
Capitellidae	1	4	0.04
Clymenella torquata	1	0	0.01
Tharyx sp.	0	2	0.02
Orbiniida			
Scoloplos acutus	4	0	0.03
Scoloplos fragilis	0	23	0.17
Scoloplos robustus	1	0	0.01
Scoloplos sp.	3	0	0.02
Phylum Arthropoda			
Arachnida	1	0	0.01
Acari	0	1	0.01
Hydracarina	1	13	0.11
Insecta			
Coleoptera	2	2	0.03
Hydrophilidae	0	2	0.02
Hypocaccus fraternus	1	0	0.01
Staphylinidae	0	1	0.01
Diptera	1	0	0.01
Ceratopogonidae	51	28	0.60
Chironomidae	2	0	0.02
Tipula sp.	1	11	0.09
Homoptera	0	1	0.01
Megamelus lobatus	0	1	0.01
Hymenoptera			
Subphylum Crustacea			
Malacostraca			
Amphipoda	1	0	0.01
Ampelisca macrocephala	2	0	0.02
Ampelisca sp.	1	0	0.01
Corophium sp.	337	0	2.55
Gammaridae	3	0	0.02
Gammarus mucronatus	1	0	0.01
Gammarus sp.	5	0	0.04
Microdeutopus sp.	1	0	0.01
Neohaustorius sp.	4	0	0.03
Orchestia grillus	2	1	0.02
Parahaustorius attenuatus	0	1	0.01
Decapoda			
Isopoda			
Edotea triloba	1	1	0.02
Scyphacella arenicola	0	8	0.06
Ostracoda	0	25	0.19
Phylum Mollusca	1	0	0.01
Bivalvia			
Mytiloida			
Mytilus edulis	8	1	0.07
Veneroida			
Astarte castanea	5	0	0.04
Gemma gemma	39	250	2.19
Gastropoda			
Neogastropoda			
Ilyanassa obsoletus	3	5	0.06
Neotaenioglossa			
Hydrobia minuta	0	26	0.20
Phylum Nematoda	369	768	8.60
Phylum Nematomorpha	0	641	4.85
Phylum Platyhelminthes			
Turbellaria	0	15	0.11
***UNID**	1	121	0.92
Overall Bay Total	***9,561***	***3,657***	
Total Number of Taxa	***43***	***36***	***61***

*UNID=organism not identified due to damage, life stage.

Oceanside

Taxon	Spring Total No.	Fall Total No.	Percent of Total
Phylum Annelida			
Oligochaeta	404	1,073	33.16
Polychaeta	1	0	0.02
Aciculata			
Nereis arenaceodonta	0	2	0.04
Canalipalpata			
Scolelepis squamata	0	4	0.09
Capitellida			
Capitella sp.	0	1	0.02
Orbiniida			
Scoloplos sp.	1	0	0.02
Phylum Arthropoda			
Insecta			
Diptera	0	1	0.02
Subphylum Crustacea			
Malacostraca			
Amphipoda	1	0	0.02
Haustoriidae	1	0	0.02
Neohaustorius sp.	1	0	0.02
Decapoda			
Emerita talpoida	0	3	0.07
Phylum Eubranchiopoda			
Phylum Mollusca	0	1	0.02
Bivalvia			
Mytiloida			
Mytilus edulis	45	0	1.01
Veneroida			
Astarte castanea	1	0	0.02
Donax sp.	0	3	0.07
Tellina agilis	0	1	0.02
Tellina sp.	0	1	0.02
Phylum Nematoda	247	2,622	64.41
Phylum Platyhelminthes			
Turbellaria	22	6	0.63
Polycladida	5	0	0.11
***UNID**	0	7	0.16
Overall Ocean Total	***729***	***3,725***	
Total Number of Taxa	***11***	***13***	***21***

Summaries	Number of Individuals	Number of Taxa	Number of Samples
Bay Total Number	**13,218**	**61**	**94**
Ocean Total Number	**4,454**	**21**	**94**
Spring Total Number	**10,290**	**47**	**92**
Fall Total Number	**7,382**	**42**	**96**
Overal Total Number	**17,672**	**68**	**188**

APPENDIX TABLE 4

Total Number of Invertebrates Collected in the Benthic Cores at Each Station and Tidal Location Bayside and Oceanside

Spring

		Low		Mid		High		Wrack		Total	Total	Overall
		Bay	Ocean	Bay	Ocean	Bay	Ocean	Bay	Ocean	Bay	Ocean	Totals
GSB	Democrat Point	+	1	2	+	+	+	10	1	12	2	14
GSB	Kismet West	69	+	527	0	53	0	1,544	1	2,193	1	2,194
GSB	Sailor's Haven	2	1	4	1	3	9	0	2	9	13	22
GSB	Talisman	24	52	8	9	3,862	12	0	24	3,894	97	3,991
GSB	Long Cove	3	n/a	78	n/a	186	n/a	1,444	n/a	1,711	n/a	1,711
GSB	Old Inlet	411	14	116	232	69	5	170	5	766	256	1,022
GSB	Smith Point	11	78	41	12	30	1	16	1	98	92	190
GSB	Pattersquash	3	2	0	23	214	+	180	0	397	25	422
MOR	Great Gun	12	5	34	98	65	11	46	+	157	114	271
MOR	Pike's Beach	48	17	63	1	12	20	91	2	214	40	254
SH	Tiana	1	12	5	13	1	0	17	4	24	29	53
SH	Ponquogue East	50	4	26	49	3	+	7	7	86	60	146
	Tide Totals	*634*	*186*	*904*	*438*	*4,498*	*58*	*3,525*	*47*	*9,561*	*729*	*10,290*

Fall

		Low		Mid		High		Wrack		Total	Total	Overall
		Bay	Ocean	Bay	Ocean	Bay	Ocean	Bay	Ocean	Bay	Ocean	Totals
GSB	Democrat Point	0	0	0	0	0	52	1	58	1	110	111
GSB	Kismet West	732	244	210	8	156	3	239	2	1,337	257	1,594
GSB	Sailor's Haven	6	2	59	9	15	6	13	10	93	27	120
GSB	Talisman	0	13	33	114	64	606	139	3	236	736	972
GSB	Watch Hill	8	181	46	269	78	3	9	1	141	454	595
GSB	Old Inlet	145	48	12	52	23	2	24	1	204	103	307
GSB	Smith Point	161	8	72	2	56	7	3	69	292	86	378
GSB	Pattersquash	21	119	1	162	76	91	689	312	787	684	1,471
MOR	Great Gun	11	1	40	100	148	0	2	+	201	101	302
MOR	Pike's Beach	32	21	17	92	23	272	37	1	109	386	495
SH	Tiana	22	15	11	95	3	1	1	2	37	113	150
SH	Ponquogue East	42	8	141	46	14	144	22	470	219	668	887
	Tide Totals	*1,180*	*660*	*642*	*949*	*656*	*1,187*	*1,179*	*929*	*3,657*	*3,725*	*7,382*

n/a: no sample collected due to site inaccessibility, or damaged/missing sample.
+: denotes presence of incidental organisms, not quantified.

APPENDIX TABLE 5

Mean Number of Invertebrates Collected in Benthic Core Bay and Ocean Samples
Spring and Fall

Mean Abundances:

Region:	Spring Bay	Spring Ocean	Fall Bay	Fall Ocean	Total Bay	Total Ocean	Total Ocean + Bay
Great South Bay (GSB)	757	44	515	410	951	247	925
Moriches Bay (MOR)	187	78	155	244	342	322	399
Shinnecock Bay (SH)	56	45	128	391	259	435	519

APPENDIX TABLE 6

Total Number of Benthic Invertebrates Along Tide Locations by Phyla: Spring and Fall

Taxon	Wrack Total Number			High Total Number			Mid Total Number			Low Total Number			Taxon
	Spring	Fall	*Spring+Fall*	Spring	Fall	*Spring+Fall*	Spring	Fall	*Spring+Fall*	Spring	Fall	*Spring+Fall*	Totals
Phylum Annelida													
Oligochaeta	3,481	1,573	5,054	4,339	792	5,131	1,041	334	1,375	203	37	240	11,800
Polychaeta													
Aciculata													
Dorvilleidae										2		2	2
Eteone sp.											1	1	1
Lumbrineris sp.										8	1	9	9
Nereis arenaceodonta	1		1					1	1	6	9	15	17
Nereis sp.										1		1	1
Spirorbidae		2	2		2	2					6	6	10
Canalipalpata													
Polydora ligni										3	3	6	6
Prionospio sp.											2	2	2
Scolecolepides viridis										7		7	7
Scolelepis squamata										5	5	10	10
Spio filicornis										5		5	5
Spio sp.											4	4	4
Spionidae										1		1	1
Spiophanes bombyx	5		5										5
Syllidae										3	8	11	11
Capitellida													
Capitella sp.								1	1		4	4	5
Capitellidae					1	1	1	3	4				5
Clymenella torquata										1		1	1
Tharyx sp.											2	2	2
Orbiniida													
Scoloplos acutus										4		4	4
Scoloplos fragilis											19	19	19
Scoloplos robustus										1		1	1
Scoloplos sp.							2	4	6	2		2	8
Phylum Arthropoda													
Arachnida				1		1							1
Acari		1	1										1
Hydracarina	1	7	8					6	6				14
Insecta													
Coleoptera	2		2		2	2							4
Hydrophilidae		2	2										2
Hypocaccus fraternus				1		1							1
Staphylinidae		1	1										1
Diptera	1		1		1	1							2
Ceratopogonidae		4	4		22	22	48	2	50	3		3	79
Chironomidae pupae				1		1	1		1				2
Tipula sp.		5	5		3	3	1	3	4				12
Homoptera								1	1				1
Megamelus lobatus					1	1							1
Subphylum Crustacea													
Malacostraca													
Amphipoda							1		1	1		1	2
Ampelisca macrocephala										2		2	2
Ampelisca sp.							1		1				1
Corophium sp.	2		2	1		1	4		4	330		330	337
Gammaridae	1		1							2		2	3
Gammarus mucronatus										1		1	1
Gammarus sp.										5		5	5
Haustoriidae	1		1										1
Microdeutopus sp.										1		1	1
Neohaustorius sp.							4		4	1		1	5
Orchestia grillus	2	1	3										3

APPENDIX TABLE 6

Total Number of Benthic Invertebrates Along Tide Locations by Phyla: Spring and Fall

	Wrack Total Number			High Total Number			Mid Total Number			Low Total Number			Taxon
Taxon	**Spring**	**Fall**	***Spring+Fall***	**Spring**	**Fall**	***Spring+Fall***	**Spring**	**Fall**	***Spring+Fall***	**Spring**	**Fall**	***Spring+Fall***	**Totals**
Phylum Annelida													
Oligochaeta	3,481	1,573	***5,054***	4,339	792	***5,131***	1,041	334	***1,375***	203	37	***240***	**11,800**
Parahaustorius attenuatus								1	***1***				**1**
Decapoda													
Emerita talpoida								2	***2***		1	***1***	**3**
Isopoda													
Edotea triloba										1	1	***2***	**2**
Scyphacella arenicola		8	***8***										**8**
Armadillium vulgare													
Ostracoda											25	***25***	**25**
Phylum Mollusca		1	***1***							1		***1***	**2**
Bivalvia													
Mytiloida													
Mytilus edulis	4		***4***		1	***1***	1		***1***	48		***48***	**54**
Veneroida													
Astarte castanea	1		***1***				4		***4***	1		***1***	**6**
Donax sp.											3	***3***	**3**
Gemma gemma				3		***3***	8	33	***41***	28	217	***245***	**289**
Tellina agilis											1	***1***	**1**
Tellina sp.					1	***1***							**1**
Gastropoda													
Neogastropoda													
Ilyanassa obsoletus										3	5	***8***	**8**
Neotaenioglossa													
Hydrobia minuta											26	***26***	**26**
Phylum Nematoda	69	502	***571***	206	1,011	***1,217***	223	1,181	***1,404***	118	726	***844***	**4,036**
Phylum Nematomorpha											611	***611***	**611**
Phylum Platyhelminthes													
Turbellaria								13	***13***	22	8	***30***	**43**
Polycladida	1		***1***	3		***3***	1		***1***				**5**
***UNID**		1	***1***	1	6	***7***	1	6	***7***		115	***115***	**130**
Tide Location Totals	**3,572**	**2,108**	**5,680**	**4,556**	**1,843**	**6,399**	**1,342**	**1,591**	**2,933**	**820**	**1,840**	**2,660**	**17,672**

*UNID=organism not identified due to damage, life stage.

APPENDIX TABLE 7

Total Number and Density (No./m^2) of Organisms Collected in Benthic Cores by Tidal Zone

Spring and Fall, Bay and Ocean

Season	Location	Zone	Total Number	Density (No./m^2)
Spring	Bay	Low	634	14,133
		Mid	904	20,156
		High	4,498	100,000
		Wrack	3,525	78,356
Spring	Ocean	Low	186	4,156
		Mid	438	9,756
		High	58	1,289
		Wrack	47	1,044
Fall	Bay	Low	1,180	26,220
		Mid	642	14,266
		High	656	14,578
		Wrack	1,179	26,199
Fall	Ocean	Low	660	14,689
		Mid	949	21,089
		High	1,187	26,400
		Wrack	929	20,644
		Overall Total	***17,672***	***392,711***

APPENDIX TABLE 8

Total Number of Organisms Collected in Pitfall Traps and Listed by Phyla

Bayside

Taxon	Spring Total No.	Fall Total No.	Percent of Total
Phylum Arthropoda			
Arachnida	2	1	0.21
Acari	39	10	3.35
Dermacentor variabilis	4	0	0.27
Hydracarina	0	1	0.07
Araneae			
Amaurobiidae	0	4	0.27
Clubionidae	9	0	0.62
Dictynidae	1	0	0.07
Erigonidae	5	0	0.34
Habronattus borealis	1	0	0.07
Lycosidae	3	0	0.21
Mimetidae	0	3	0.21
Tetragnathidae	0	1	0.07
Thomisidae	1	0	0.07
Insecta			
Coleoptera	4	0	0.27
Amblyderus palleus	1	1	0.14
Anthicidae	0	1	0.07
Cicindela cuprascens	1	0	0.07
Clivinia sp.	14	1	1.03
Elateridae	8	0	0.55
Haliplidae	3	0	0.21
Hypocaccus fraternus	10	0	0.68
Mecynotarsus candidus	4	1	0.34
Podabrus rugosulus	1	0	0.07
Scarabaeidae	0	1	0.07
Scolytidae	3	0	0.21
Staphylinidae	17	8	1.71
Tenebrionidae	9	0	0.62
Collembola	+	+	+
Diptera	55	0	3.76
Cecidomyiidae	3	1	0.27
Chaoborus sp.	5	0	0.34
Chironomidae	3	1	0.27
Dolichopodidae	21	2	1.57
Empididae	10	0	0.68
Ephydridae	8	49	3.90
Muscidae	0	17	1.16
Phoridae	1	0	0.07
Sciaridae	1	4	0.34
Stratiomyidae	1	0	0.07
Hemiptera			
Blissus sp.	1	0	0.07
Homoptera			
Aphididae	1	1	0.14
Cicadellidae	3	0	0.21
Megamelus lobatus	1	4	0.34
Hymenoptera	2	0	0.14
Braconidae	1	1	0.14
Crematogaster lineolata	1		0.07
Formicidae	2	1	0.21
Lasius neoniger	66	2	4.65
Mymaridae	0	1	0.07
Myrmicinae	0	1	0.07
Perilampidae	0	1	0.07
Platygastridae	0	1	0.07
Ponerinae	2	0	0.14
Siricidae	1	0	0.07
Leptidoptera			
Gelechiidae	2	0	0.14
Neuroptera			
Sisyridae	1	0	0.07
Odonata			
Odonata nymphs	2	0	0.14
Pseudoscorpiones	2	1	0.21
Subphylum Crustacea			
Copepoda	2	0	0.14
Diplopoda			
Chordeumatida			
Striaridae	2	0	0.14
Spirostreptida			
Cambalida	0	1	0.07
Malacostraca			
Amphipoda			
Ampeliscidae	1	0	0.07
Orchestia grillus	0	174	11.89
Talorchestia longicornus	737	25	52.08
Talorchestia megalophthalmus	0	7	0.48
Isopoda			
Porcellio scaber	27	0	1.85
Scyphacella arenicola	0	6	0.41
Phylum Cnidaria			
Hydrozoa			
Hydroida			
Hydra carnea	6	0	0.41
Phylum Eubranchiopoda			
Phylum Mollusca	2	0	0.14
Bivalvia			
Mytiloida			
Mytilus edulis	1	0	0.07
Phylum Nematoda	1	0	0.07
Phylum Nemertea	12	0	0.82
Phylum Platyhelminthes			
Turbellaria	1	0	0.07
Polycladida			
Overall Total Number	***1,128***	***334***	
Total Number of Species	***58***	***34***	***72***

+ indicates organism present, but not quantified.
*UNID=organism not identified due to damage, life stage.

Oceanside

Taxon	Spring Total No.	Fall Total No.	Percent of Total
Phylum Annelida			
Oligochaeta	0	1	0.19
Phylum Arthropoda			
Arachnida	1	1	0.38
Araneae			
Clubionidae	2	0	0.38
Lycosidae	1	0	0.19
Mimetidae			
Tetragnathidae	1	0	0.19
Insecta			
Coleoptera			
Amblyderus palleus	5	1	0.41
Anthicidae	3	0	0.58
Bledius sp.	1	0	0.19
Clivinia sp.	42	0	8.06
Elateridae	5	0	0.96
Hypocaccus fraternus	15	0	2.88
Lathrididae	1	0	0.19
Negastrius choris	3	0	0.58
Staphylinidae	2	1	0.58
Tenebrionidae	8	0	1.54
Collembola	+	+	+
Diptera	3	0	0.58
Cecidomyiidae	2	0	0.38
Dixidae	0	1	0.19
Dolichopodidae	8	0	1.54
Empididae	7	0	1.34
Ephydridae	6	10	3.07
Muscidae	0	1	0.19
Sciaridae	1	0	0.19
Hemiptera			
Blissus sp.			
Homoptera	0	1	0.19
Aphididae	2	0	0.38
Cicadellidae	1	0	0.19
Megamelus lobatus	3	0	0.58
Hymenoptera			
Chalcidoidea	0	1	0.19
Lasius neoniger	13	0	2.50
Leptidoptera			
Noctuidae	1	0	0.19
Trichoptera			
Polycentropodidae	0	1	0.19
Subphylum Crustacea			
Copepoda	0	1	0.19
Malacostraca			
Amphipoda			
Talorchestia longicornus	274	12	54.89
Talorchestia megalophthalmus	0	18	3.45
Phylum Mollusca			
Bivalvia			
Mytiloida			
Mytilus edulis	56	0	10.75
Phylum Nematoda	1	0	0.19
Phylum Nematomorpha	8	0	1.54
***UNID**	0	1	0.19
Overall Total Number	***476***	***51***	
Total Number of Species	***30***	***15***	***38***

	Total No. Organisms	Total No. Taxa	Total No. Samples
Bayside Total	**1,462**	**72**	**72**
Oceanside Total	**527**	**38**	**65**
Spring Total	**1,604**	**65**	**66**
Fall Total	**385**	**40**	**71**
Overall Total	**1,989**	**83**	**137**

APPENDIX TABLE 9

Total Number of Organisms Collected Along Tidal Zones at Each Station from Pitfall Traps

Spring and Fall, Bay and Ocean

Spring

	Wrack		Supra		Grass		*Total*	*Total*	*Overall*
	Bay	Ocean	Bay	Ocean	Bay	Ocean	*Bay*	*Ocean*	*Totals*
Democrat Point	58	2	17	3	4	3	***79***	***8***	***87***
Kismet West	25	0	2	2	4	3	***31***	***5***	***36***
Sailor's Haven	n/a	30	2	7	38	0	***40***	***37***	***77***
Talisman	13	65	+	3	3	2	***16***	***70***	***86***
Long Cove	3	n/a	64	n/a	13	n/a	***80***	***n/a***	***80***
Old Inlet	8	41	9	68	6	53	***23***	***162***	***185***
Smith Point	386	n/a	8	12	4	1	***398***	***13***	***411***
Pattersquash	115	2	5	2	6	5	***126***	***9***	***135***
Great Gun	63	46	9	16	18	6	***90***	***68***	***158***
Pike's Beach	66	7	123	9	5	12	***194***	***28***	***222***
Tiana	6	n/a	2	26	8	13	***16***	***39***	***55***
Ponquogue East	18	22	11	10	6	5	***35***	***37***	***72***
Tide Totals	***761***	***215***	***252***	***158***	***115***	***103***	***1,128***	***476***	***1,604***

Fall

	Wrack		Supra		Grass		*Total*	*Total*	*Overall*
	Bay	Ocean	Bay	Ocean	Bay	Ocean	*Bay*	*Ocean*	*Totals*
Democrat Point	17	n/a	1	0	2	0	***20***	***0***	***20***
Kismet West	4	0	4	2	2	1	***10***	***3***	***13***
Sailor's Haven	104	0	4	0	3	1	***111***	***1***	***112***
Talisman	4	0	9	0	12	0	***25***	***0***	***25***
Watch Hill	5	0	11	0	1	2	***17***	***2***	***19***
Old Inlet	1	0	1	2	2	2	***4***	***4***	***8***
Smith Point	13	4	8	1	2	0	***23***	***5***	***28***
Pattersquash	14	0	10	2	36	2	***60***	***4***	***64***
Great Gun	13	0	7	2	4	2	***24***	***4***	***28***
Pike's Beach	2	1	7	0	4	4	***13***	***5***	***18***
Tiana	9	16	8	3	1	1	***18***	***20***	***38***
Ponquogue East	5	2	4	0	0	1	***9***	***3***	***12***
Tide Totals	***191***	***23***	***74***	***12***	***69***	***16***	***334***	***51***	***385***

Summaries by Bay/Ocean

Bay	**Wrack**	**952**
	Supra	**326**
	Grass	**184**
	Bay Total	***1,462***

Ocean	**Wrack**	**238**
	Supra	**170**
	Grass	**119**
	Ocean Total	***527***

Summaries by Beach Zone

Wrack Total	**1,190**
Supra Total	**496**
Grass Total	**303**
Overall Total	***1,989***

n/a: no sample collected due to site inaccessibility, or damaged/missing sample.

APPENDIX TABLE 10

Mean Number of Organisms Collected in Pitfall Trap Samples

Listed by Bay/Ocean and Spring/Fall

Mean Abundances:

	Spring Bay	Spring Ocean	Fall Bay	Fall Ocean	Total Bay	Total Ocean
Great South Bay (GSB)	88	34	30	2	118	36
Moriches Bay (MOR)	142	48	19	5	161	53
Shinnecock Bay (SH)	26	38	14	12	39	50

APPENDIX TABLE 11

Total Number of Wrack Sight Organisms Collected by Taxa
Spring and Fall, Bay and Ocean

Bayside

Taxon	Spring Total	Fall Totals	Percent of Total
Phylum Annelida	0	329	25
Polychaeta			
Canalipalpata			
Spiochaetopterus oculatus	1	0	<1
Phylum Arthropoda	6	0	<1
Arachnida			
Acari			
Acarina	0	95	7
Araneae	0	2	<1
Linyphiidae	1	0	<1
Lycosidae	0	1	<1
Insecta			
Coleoptera	6	1	1
Hydrophilidae	0	2	<1
Staphylinidae	7	1	1
Collembola	0	1	<1
Anurida maritima	411	200	47
Anurida sp.	0	+	+
Diptera	1	0	<1
Culicidae	0	4	<1
Ephydridae	0	17	<1
Phoridae	1	0	<1
Hymenoptera			
Formicidae	5	0	<1
Leptidoptera	0	1	<1
Pseudoscorpiones	0	1	<1
Subphylum Crustacea			
Malacostraca			
Amphipoda	10	3	1
Gammaridae	1	0	<1
Talitridae	3	22	<1
Isopoda			
Armadillidiidae	0	1	<1
Armadillium vulgare	0	1	<1
Phylum Mollusca			
Bivalvia	120	0	9
Gastropoda			
Neogastropoda			
Ilyanassa obsoletus			
Phylum Sipunculoidea	1	0	<1
***UNID**	2	10	<1
Overall Total Number	***576***	***692***	
Total Number of Taxa	***15***	***19***	***28***

Oceanside

Taxon	Spring Total	Fall Totals	Percent of Total
Phylum Arthropoda			
Insecta			
Coleoptera			
Staphylinidae	3	0	4
Collembola			
Anurida maritima	8	0	11
Subphylum Crustacea			
Malacostraca			
Amphipoda	27	0	38
Phylum Echinodermata			
Stelleroidea			
Forcipulatida			
Asterias forbesii	0	14	20
Phylum Mollusca			
Bivalvia	17	0	24
***UNID**	2	0	3
Overall Total Number	***57***	***14***	
Total Number of Taxa	***5***	***1***	***6***

Summary:

	Number of Individuals	Number of Taxa	Number of Samples
Bay Total Number	**1,268**	**28**	**24**
Ocean Total Number	**71**	**6**	**23**
Spring Total Number	**633**	**15**	**24**
Fall Total Number	**706**	**20**	**23**
Overall Total Number	**1,339**	**29**	**47**

*UNID=organism not identified due to damage, life stage.
+ Denotes present, but not quantified.

APPENDIX TABLE 12

Total Number of Organisms Collected in Wrack Sight Samples at Each Station
Spring and Fall, Bay and Ocean

		Spring		Fall		Spring + Fall		
		Wrack		Wrack				
		Bay	Ocean	Bay	Ocean	*Total Bay*	*Total Ocean*	*Overall Total*
GSB	**Democrat Point**	4	1	14	0	***18***	***1***	***19***
	Kismet West	58	27	1	0	***59***	***27***	***86***
	Sailor's Haven	4	3	4	0	***8***	***3***	***11***
	Talisman	n/a	0	155	0	***155***	***0***	***155***
	Watch Hill	n/a	n/a	22	0	***22***	**0**	***22***
	Long Cove	31	n/a	n/a	n/a	***31***	***n/a***	***31***
	Old Inlet	0	4	0	0	***0***	***4***	***4***
	Smith Point	25	9	0	0	***25***	***9***	***34***
	Pattersquash	203	0	141	0	***344***	***0***	***344***
MOR	**Great Gun**	41	5	0	0	***41***	***5***	***46***
	Pike's Beach	8	0	7	0	***15***	***0***	***15***
SH	**Tiana**	100	0	0	0	***100***	***0***	***100***
	Ponquogue East	102	8	348	14	***450***	***22***	***472***
	Tide Totals	***576***	***57***	***692***	***14***	***1,268***	***71***	***1,339***

n/a: no sample collected due to site inaccessibility, or damaged/missing sample.

APPENDIX TABLE 13

Mean Number of Organisms Collected in Wrack Sight Samples in Each Bay Region
Spring and Fall, Bay and Ocean

Mean Abundances:

	Spring Bay	Spring Ocean	Fall Bay	Fall Ocean	Total Bay	Total Ocean	Total Bay + Ocean
Great South Bay (GSB)	54	6	42	0	73	6	88
Moriches Bay (MOR)	26	3	4	0	30	3	32
Shinnecock Bay (SH)	101	4	174	7	275	11	286

TECHNICAL APPENDIX TABLES

Beach Insect Sample Sheet

EEA, Inc.

Station Name	Location	Date	Time	Tide	Moon

Project No.	Gear

Latitude	Longitude	Sample Type

Collectors:

	Total #		
Species			

	Total #		
Species			

Comments:

DEMOCRAT POINT BAYSIDE

Spring	Benthic Core				Pitfall Trap			Wrackline Sight	Total
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	Number
Phylum Annelida									*0*
Oligochaeta			+	5					*5*
Polychaeta									*0*
Aciculata									*0*
Nereis arenaceodonta				1					*1*
Phylum Arthropoda									*0*
Arachnida									*0*
Araneae									*0*
Erigonidae							1		*1*
Insecta									*0*
Coleoptera									*0*
Amblyderus palleus						1			*1*
Hypocaccus fraternus						1			*1*
Staphylinidae					3			2	*5*
Collembola					+	+			*0*
Diptera				1	46	5			*52*
Dolichopodidae						6	2		*8*
Empididae					3				*3*
Hymenoptera					1				*0*
Lasius neoniger						1			*1*
Leptidoptera									*0*
Gelechiidae							1		*1*
Odonata						2			*2*
Subphylum Crustacea									*0*
Copepoda	+				+				*0*
Malacostraca									*0*
Amphipoda									*0*
Neohaustorius sp.		2							*2*
Talorchestia longicornus					4				*4*
Phylum Mollusca									*0*
Bivalvia								2	*2*
Mytiloida									*0*
Mytilus edulis				2					*2*
Phylum Nematoda				2					*2*
Phylum Platyhelminthes									*0*
Turbellaria									*0*
Polycladida									*0*
Thomisidae						1			*1*
Total Number	***0***	***2***	***0***	***11***	***57***	***17***	***4***	***4***	***94***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	Total
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	Number
Phylum Arthropoda									*0*
Araneae									*0*
Tetragnathidae							1		*1*
Insecta									*0*
Coleoptera									*0*
Amblyderus palleus							1		*1*
Diptera									*0*
Culicidae								1	*1*
Ephydridae								6	*6*
Muscidae					11				*11*
Hymenoptera									*0*
Lasius neoniger						1			*1*
Malacostraca									*0*
Amphipoda									*0*
Orchestia grillus					6				*6*
***UNID**								7	*7*
Total Number	***0***	***0***	***0***	***0***	***17***	***1***	***2***	***14***	***34***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

DEMOCRAT POINT OCEANSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	*Total*
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	*Number*
Phylum Annelida									*0*
Oligochaeta			+						*0*
Insecta									*0*
Coleoptera									*0*
Elateridae					2		1		*3*
Staphylinidae								1	*1*
Diptera									*0*
Dolichopodidae						1			*1*
Homoptera									*0*
Magemelus lobatus						1			*1*
Subphylum Crustacea									*0*
Copepoda		+	+	+					*0*
Malacostraca									*0*
Amphipoda									*0*
Neohaustorius sp.	1								*1*
Talorchestia longicornus						1	2		*3*
Phylum Mollusca									*0*
Bivalvia									*0*
Mytiloida									*0*
Mytilus edulis				1					*1*
Total Number	***1***	***0***	***0***	***1***	***2***	***3***	***3***	***1***	***11***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	*Total*
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	*Number*
Phylum Annelida									*0*
Oligochaeta			49	49					*98*
Collembola				+					*0*
Diptera			1						*1*
Subphylum Crustacea									*0*
Copepoda			+						*0*
Phylum Mollusca									*0*
Bivalvia									*0*
Veneroida									*0*
Tellina sp.			1						*1*
Phylum Nematoda			1	9					*10*
Total Number	***0***	***0***	***52***	***58***	***0***	***0***	***0***	***0***	***110***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

GREAT GUN BAYSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	4	27	62	42					***135***
Polychaeta									***0***
Canalipalpata									***0***
Scolecolepides viridis	1								***1***
Spiochaetopterus oculatus								1	***1***
Phylum Arthropoda									***0***
Arachnida									***0***
Araneae									***0***
Clubionidae							2		***2***
Habronattus borealis					1				***1***
Lycosidae							2		***2***
Insecta									***0***
Coleoptera								2	***2***
Elateridae						1	2		***3***
Haliplidae					1		2		***3***
Hypocaccus fraternus					1				***1***
Mecynotarsus candidus							2		***2***
Podabrus rugosulus					1				***1***
Staphylinidae					1		1		***2***
Tenebrionidae						1	1		***2***
Collembola				+	+	+	+		***0***
Anurida maritima								31	***31***
Diptera									***0***
Empididae						1			***1***
Hymenoptera									***0***
Crematogaster lineolata							1		***1***
Formicidae								4	***4***
Lasius neoniger					3	1	4		***8***
Subphylum Crustacea									***0***
Copepoda				+					***0***
Malacostraca									***0***
Amphipoda									***0***
Amphipoda								1	***1***
Corophium sp.	1								***1***
Gammarus mucronatus	1								***1***
Gammarus sp.	5								***5***
Talorchestia longicornus						5			***5***
Talorchestia megalophthalma					55				***55***
Isopoda									***0***
Porcellio scaber							1		***1***
Phylum Mollusca									***0***
Bivalvia								2	***2***
Veneroida									***0***
Gemma gemma	2								***2***
Phylum Nematoda		5	3	4					***12***
Total Number	***14***	***32***	***65***	***46***	***63***	***9***	***18***	***41***	***288***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	10		18	2					***30***
Phylum Arthropoda									***0***
Arachnida									***0***
Acari									***0***
Hydracarina						1			***1***
Araneae									***0***
Amaurobiidae					1	2			***3***
Insecta									***0***
Coleoptera			2						***2***
Anthicidae						1			***1***
Mecynotarsus candidus						1			***1***
Staphylinidae					1				***1***
Collembola					+				***0***
Diptera									***0***
Chironomidae					1				***1***
Ephydridae					3	1	1		***5***
Homoptera									***0***
Magemelus lobatus							1		***1***
Hymenoptera									***0***
Mymaridae						1			***1***
Subphylum Crustacea									***0***
Diplopoda									***0***
Spirostreptida									***0***
Cambalida					1				***1***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus							1		***1***
Talorchestia megalophthalma					7				***7***
Phylum Nematoda	1	40	128						***169***
Total Number	***11***	***40***	***148***	***2***	***14***	***7***	***3***	***0***	***225***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

GREAT GUN OCEANSIDE

SPRING

	Benthic Core				Pitfall Trap			Wrackline Sight	*Total Number*
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	
Phylum Annelida									***0***
Oligochaeta		80	9						***89***
Phylum Arthropoda									***0***
Insecta									***0***
Coleoptera									***0***
Hypocaccus fraternus						3	2		***5***
Lathridiidae							1		***1***
Negastrius choris						1			***1***
Homoptera									***0***
Magemelus lobatus						1			***1***
Subphylum Crustacea									***0***
Copepoda	+	+	+	+					***0***
Malacostraca									***0***
Amphipoda	1							1	***2***
Talorchestia longicornus					46	11	3		***60***
Decapoda									***0***
Megalops/Mysid	+								***0***
Phylum Mollusca									***0***
Bivalvia								3	***3***
Phylum Nematoda	4	18	2						***24***
***UNID**								1	***1***
Total Number	***5***	***98***	***11***	***0***	***46***	***16***	***6***	***5***	***187***

FALL

	Benthic Core				Pitfall Trap			Wrackline Sight	*Total Number*
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	
Phylum Arthropoda									***0***
Insecta									***0***
Diptera									***0***
Ephydridae						1			***1***
Subphylum Crustacea									***0***
Copepoda				+					***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus						1	2		***3***
Phylum Nematoda		100							***100***
Phylum Platyhelminthes									***0***
Turbellaria	1								***1***
Total Number	***1***	***100***	***0***	***0***	***0***	***2***	***2***	***0***	***105***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

KISMET BAYSIDE

SPRING

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	59	501	48	1544					***2152***
Polychaeta									***0***
Phylum Arthropoda									***0***
Insecta									***0***
Coleoptera									***0***
Staphylinidae								2	***2***
Collembola						+	+		***0***
Anurida maritima								47	***47***
Diptera								1	***1***
Cecidomyiidae							1		***1***
Empididae						1			***1***
Ephydridae						2	1		***3***
Homoptera									***0***
Aphididae					1				***1***
Subphylum Crustacea									***0***
Malacostraca									***0***
Amphipoda								1	***1***
Talorchestia longicornus						23	2		***25***
Phylum Mollusca									***0***
Bivalvia								7	***7***
Mytiloida									***0***
Mytilus edulis		1							***1***
Phylum Nematoda	10	25	5						***40***
Phylum Platyhelminthes									***0***
Turbellaria									***0***
Polycladida									***0***
Total Number	***69***	***527***	***53***	***1544***	***1***	***26***	***4***	***58***	***2282***

FALL

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	6	195	149	216					***566***
Phylum Arthropoda									***0***
Arachnida									***0***
Acari									***0***
Hydracarina		2		2					***4***
Insecta									***0***
Collembola	+	+	+	+					***0***
Diptera									***0***
Ephydridae					2	3			***5***
Muscidae					2		1		***3***
Tipula sp.				2					***2***
Hymenoptera									***0***
Lasius neoniger							1		***1***
Subphylum Crustacea									***0***
Malacostraca									***0***
Amphipoda								1	***1***
Isopoda									***0***
Scyphacella arenicola						1			***1***
Phylum Mollusca									***0***
Bivalvia									***0***
Mytiloida									***0***
Mytilus edulis			1						***1***
Phylum Nematoda	2	4	6	19					***31***
Phylum Nematomorpha	611								***611***
Phylum Platyhelminthes									***0***
Turbellaria		9							***9***
***UNID**	113								***113***
Total Number	***732***	***210***	***156***	***239***	***4***	***4***	***2***	***1***	***1348***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

KISMET OCEANSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta				1					***1***
Phylum Arthropoda									***0***
Insecta									***0***
Coleoptera									***0***
Tenebrionidae						1			***1***
Collembola									***0***
Anurida maritima								1	***1***
Diptera									***0***
Ephydridae							2		***2***
Homoptera									***0***
Aphididae						1			***1***
Hymenoptera									***0***
Lasius neoniger							1		***1***
Subphylum Crustacea									***0***
Copepoda	+								***0***
Malacostraca									***0***
Amphipoda								26	***26***
Total Number	***0***	***0***	***0***	***1***	***0***	***2***	***3***	***27***	***33***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		2	2	2					***6***
Phylum Arthropoda									***0***
Insecta									***0***
Diptera									***0***
Muscidae						1			***1***
Trichoptera									***0***
Polycentropodidae						1			***1***
Subphylum Crustacea									***0***
Copepoda				+					***0***
Phylum Nematoda	244	6	1						***251***
Total Number	***244***	***8***	***3***	***2***	***0***	***2***	***0***	***0***	***259***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

LONG COVE BAYSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	1	10	122	1392					***1525***
Polychaeta									***0***
Orbiniida									***0***
Scoloplos robustus	1								***1***
Phylum Arthropoda									***0***
Arachnida									***0***
Acari					1		1		***2***
Dermacentor variabilis						3	1		***4***
Araneae									***0***
Clubionidae						1			***1***
Insecta									***0***
Coleoptera						1			***1***
Hypocaccus fraternus						4			***4***
Staphylinidae						3		1	***4***
Collembola					+	+			***0***
Anurida maritima								30	***30***
Diptera									***0***
Chironomidae							1		***1***
Dolichopodidae					1		1		***2***
Ephydridae						1			***1***
Hemiptera									***0***
Blissus sp.						1			***1***
Hymenoptera						1			***1***
Braconidae							1		***1***
Neuroptera									***0***
Sisyridae							1		***1***
Subphylum Crustacea									***0***
Copepoda	+		+	+					***0***
Malacostraca									***0***
Amphipoda									***0***
Ampeliscidae					1				***1***
Talorchestia longicornus						37	6		***43***
Isopoda									***0***
Porcellio scaber						6	1		***7***
Phylum Cnidaria									***0***
Hydrozoa									***0***
Hydroida									***0***
Hydra carnea						6			***6***
Phylum Mollusca									***0***
Bivalvia									***0***
Mytiloida									***0***
Mytilus edulis				1					***1***
Veneroida									***0***
Gemma gemma	1								***1***
Phylum Nematoda		68	64	51					***183***
Total Number	***3***	***78***	***186***	***1444***	***3***	***64***	***13***	***31***	***1822***

***No Long Cove Oceanside Sample-site inaccessible. Sampled during Spring only.**

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

OLD INLET BAYSIDE

SPRING

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	60	59	57	170					***346***
Polychaeta									***0***
Aciculata									***0***
Dorvilleidae	1								***1***
Canalipalpata									***0***
Scolecolepides viridis	1								***1***
Syllidae	2								***2***
Capitellida									***0***
Capitellidae		1							***1***
Orbiniida									***0***
Scoloplos sp.	1								***1***
Phylum Arthropoda									***0***
Arachnida									***0***
Acari						6			***6***
Araneae									***0***
Clubionidae					1				***1***
Dictynidae						1			***1***
Insecta									***0***
Coleoptera					3				***3***
Clivinia sp.						2			***2***
Hypocaccus fraternus							1		***1***
Staphylinidae					1				***1***
Diptera									***0***
Cecidomyiidae							1		***1***
Ceratopogonidae	2	48							***50***
Chironomidae		1	1						***2***
Ephydridae							1		***1***
Hymenoptera									***0***
Formicidae					1				***1***
Subphylum Crustacea									***0***
Copepoda	+	+	+	+					***0***
Malacostraca									***0***
Amphipoda									***0***
Corophium sp.	329	4	1						***334***
Microdeutopus sp.	1								***1***
Talorchestia longicornus					2		3		***5***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Gemma gemma	7								***7***
Phylum Nematoda	7	3	10						***20***
Total Number	***411***	***116***	***69***	***170***	***8***	***9***	***6***	***0***	***789***

FALL

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		3		9					***12***
Polychaeta									***0***
Aciculata									***0***
Eteone sp.	1								***1***
Nereis arenaceodonta	4								***4***
Canalipalpata									***0***
Syllidae	5								***5***
Capitellida		3							***3***
Capitella sp.	4								***4***
Phylum Arthropoda									***0***
Arachnida									***0***
Acari				1					***1***
Hydracarina		4							***4***
Insecta									***0***
Coleoptera									***0***
Hydrophilidae				1					***1***
Collembola				+					***0***
Diptera									***0***
Ceratopogonidae			20	4					***24***
Ephydridae						1			***1***
Sciaridae					1				***1***
Homoptera		1							***1***
Aphididae							1		***1***
Magemelus lobatus			1						***1***
Hymenoptera									***0***
Formicidae							1		***1***
Subphylum Crustacea									***0***
Copepoda	+								***0***
Isopoda									***0***
Edotea triloba	1								***1***
Ostracoda	25								***25***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Gemma gemma	33								***33***
Gastropoda									***0***
Neotaenioglossa									***0***
Hydrobia minuta	26								***26***
Phylum Nematoda	39			8					***47***
Phylum Platyhelminthes									***0***
Turbellaria	6								***6***
***UNID**	1		2	1					***4***
Total Number	***145***	***11***	***23***	***24***	***1***	***1***	***2***	***0***	***207***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

OLD INLET OCEANSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	5	154	5	4					***168***
Phylum Arthropoda									***0***
Arachnida									***0***
Araneae									***0***
Clubionidae							1		***1***
Lycosidae						1			***1***
Insecta									***0***
Coleoptera									***0***
Anthicidae							3		***3***
Clivinia sp.					9	1	1		***11***
Elateridae						1	1		***2***
Hypocaccus fraternus						2	2		***4***
Staphylinidae								1	***1***
Collembola					+	+	+		***0***
Anurida maritima								3	***3***
Diptera									***0***
Dolichopodidae							2		***2***
Sciaridae							1		***1***
Hymenoptera									***0***
Lasius neoniger						2	8		***10***
Subphylum Crustacea									***0***
Copepoda	+		+						***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus					32	61	34		***127***
Phylum Nematoda	9	78		1					***88***
Total Number	***14***	***232***	***5***	***5***	***41***	***68***	***53***	***4***	***422***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	1	40							***41***
Phylum Arthropoda									***0***
Insecta									***0***
Diptera									***0***
Ephydridae						2			***2***
Subphylum Crustacea									***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus							2		***2***
Phylum Mollusca				1					***1***
Phylum Nematoda	47	8	2						***57***
***UNID**		4							***4***
Total Number	***48***	***52***	***2***	***1***	***0***	***2***	***2***	***0***	***107***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

OLD INLET BAYSIDE

SPRING

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	60	59	57	170					***346***
Polychaeta									***0***
Aciculata									***0***
Dorvilleidae	1								***1***
Canalipalpata									***0***
Scolecolepides viridis	1								***1***
Syllidae	2								***2***
Capitellida									***0***
Capitellidae		1							***1***
Orbiniida									***0***
Scoloplos sp.	1								***1***
Phylum Arthropoda									***0***
Arachnida									***0***
Acari						6			***6***
Araneae									***0***
Clubionidae					1				***1***
Dictynidae						1			***1***
Insecta									***0***
Coleoptera					3				***3***
Clivinia sp.						2			***2***
Hypocaccus fraternus							1		***1***
Staphylinidae					1				***1***
Diptera									***0***
Cecidomyiidae							1		***1***
Ceratopogonidae	2	48							***50***
Chironomidae		1	1						***2***
Ephydridae							1		***1***
Hymenoptera									***0***
Formicidae					1				***1***
Subphylum Crustacea									***0***
Copepoda	+	+	+	+					***0***
Malacostraca									***0***
Amphipoda									***0***
Corophium sp.	329	4	1						***334***
Microdeutopus sp.	1								***1***
Talorchestia longicornus					2		3		***5***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Gemma gemma	7								***7***
Phylum Nematoda	7	3	10						***20***
Total Number	***411***	***116***	***69***	***170***	***8***	***9***	***6***	***0***	***789***

FALL

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		3		9					***12***
Polychaeta									***0***
Aciculata									***0***
Eteone sp.	1								***1***
Nereis arenaceodonta	4								***4***
Canalipalpata									***0***
Syllidae	5								***5***
Capitellida		3							***3***
Capitella sp.	4								***4***
Phylum Arthropoda									***0***
Arachnida									***0***
Acari				1					***1***
Hydracarina		4							***4***
Insecta									***0***
Coleoptera									***0***
Hydrophilidae				1					***1***
Collembola				+					***0***
Diptera									***0***
Ceratopogonidae			20	4					***24***
Ephydridae						1			***1***
Sciaridae					1				***1***
Homoptera		1							***1***
Aphididae							1		***1***
Magemelus lobatus			1						***1***
Hymenoptera									***0***
Formicidae							1		***1***
Subphylum Crustacea									***0***
Copepoda	+								***0***
Isopoda									***0***
Edotea triloba	1								***1***
Ostracoda	25								***25***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Gemma gemma	33								***33***
Gastropoda									***0***
Neotaenioglossa									***0***
Hydrobia minuta	26								***26***
Phylum Nematoda	39			8					***47***
Phylum Platyhelminthes									***0***
Turbellaria	6								***6***
***UNID**	1		2	1					***4***
Total Number	***145***	***11***	***23***	***24***	***1***	***1***	***2***	***0***	***207***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

OLD INLET OCEANSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	5	154	5	4					***168***
Phylum Arthropoda									***0***
Arachnida									***0***
Araneae									***0***
Clubionidae							1		***1***
Lycosidae						1			***1***
Insecta									***0***
Coleoptera									***0***
Anthicidae							3		***3***
Clivinia sp.					9	1	1		***11***
Elateridae						1	1		***2***
Hypocaccus fraternus						2	2		***4***
Staphylinidae								1	***1***
Collembola					+	+	+		***0***
Anurida maritima								3	***3***
Diptera									***0***
Dolichopodidae							2		***2***
Sciaridae							1		***1***
Hymenoptera									***0***
Lasius neoniger						2	8		***10***
Subphylum Crustacea									***0***
Copepoda	+		+						***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus					32	61	34		***127***
Phylum Nematoda	9	78		1					***88***
Total Number	***14***	***232***	***5***	***5***	***41***	***68***	***53***	***4***	***422***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	1	40							***41***
Phylum Arthropoda									***0***
Insecta									***0***
Diptera									***0***
Ephydridae						2			***2***
Subphylum Crustacea									***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus							2		***2***
Phylum Mollusca				1					***1***
Phylum Nematoda	47	8	2						***57***
***UNID**		4							***4***
Total Number	***48***	***52***	***2***	***1***	***0***	***2***	***2***	***0***	***107***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

PATTERSQUASH BAYSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta			213	174					***387***
Phylum Arthropoda									***0***
Arachnida					2				***2***
Acari					10				***10***
Araneae									***0***
Clubionidae						3			***3***
Insecta									***0***
Coleoptera				2				4	***6***
Cicindela cuprascens					1				***1***
Clivinia sp.					2				***2***
Elateridae					5				***5***
Hypocaccus fraternus					2				***2***
Scolytidae					3				***3***
Staphylinidae					3				***3***
Collembola					+	+	+		***0***
Anurida maritima								198	***198***
Diptera									***0***
Cecidomyiidae							1		***1***
Dolichopodidae					5	1	1		***7***
Phoridae						1			***1***
Homoptera									***0***
Cicadellidae							3		***3***
Hymenoptera									***0***
Formicidae					1				***1***
Lasius neoniger					34		1		***35***
Ponerinae					2				***2***
Pseudoscorpiones					1				***1***
Subphylum Crustacea									***0***
Copepoda	+			+					***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus					41				***41***
Isopoda									***0***
Porcellio scaber					3				***3***
Phylum Mollusca									***0***
Bivalvia									***0***
Gastropoda									***0***
Neogastropoda									***0***
Ilyanassa obsoletus	3								***3***
Phylum Nematoda			1	4					***5***
***UNID**								1	***1***
Total Number	***3***	***0***	***214***	***180***	***115***	***5***	***6***	***203***	***726***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida								1	***1***
Oligochaeta	9		56	688					***753***
Polychaeta									***0***
Canalipalpata									***0***
Polydora ligni	2								***2***
Spio sp.	1								***1***
Syllidae	3								***3***
Capitellida									***0***
Capitellidae			1						***1***
Phylum Arthropoda									***0***
Arachnida						1			***1***
Acari							9	20	***29***
Insecta									***0***
Coleoptera									***0***
Staphylinidae				1			5		***6***
Collembola					+	+			***0***
Diptera									***0***
Ephydridae					1			5	***6***
Muscidae							3		***3***
Tipula sp.			3						***3***
Homoptera									***0***
Magemelus lobatus							1		***1***
Pseudoscorpiones						1			***1***
Subphylum Crustacea									***0***
Malacostraca									***0***
Amphipoda								1	***1***
Talitridae								21	***21***
Orchestia grillus					6	8	16		***30***
Talorchestia longicornus					7		2		***9***
Isopoda								1	***1***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Gemma gemma	1								***1***
Phylum Nematoda	5	1	12						***18***
***UNID**			4						***4***
Total Number	***21***	***1***	***76***	***689***	***14***	***10***	***36***	***49***	***896***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

PATTERSQUASH OCEANSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	***Total Number***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	
Phylum Annelida									***0***
Oligochaeta	2	14							***16***
Phylum Arthropoda									***0***
Insecta									***0***
Coleoptera									***0***
Hypocaccus fraternus						2	1		***3***
Negastrius choris							2		***2***
Collembola						+	+		***0***
Diptera									***0***
Cecidomyiidae					1				***1***
Dolichopodidae					1				***1***
Aphididae							1		***1***
Cicadellidae							1		***1***
Subphylum Crustacea									***0***
Copepoda	+		+						***0***
Phylum Nematoda		9							***9***
Total Number	***2***	***23***	***0***	***0***	***2***	***2***	***5***	***0***	***34***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	***Total Number***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	
Phylum Annelida									***0***
Oligochaeta			83						***83***
Polychaeta									***0***
Aciculata									***0***
Nereis arenaceodonta	1								***1***
Capitellida									***0***
Capitella sp.		1							***1***
Phylum Arthropoda									***0***
Arachnida									***0***
Insecta									***0***
Diptera									***0***
Ephydridae						2	1		***3***
Subphylum Crustacea									***0***
Copepoda			+						***0***
Phylum Nematoda	118	161	8	312					***599***
***UNID**							1		***1***
Total Number	***119***	***162***	***91***	***312***	***0***	***2***	***2***	***0***	***688***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

PIKES BAYSIDE

SPRING

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		61	9	91					***161***
Polychaeta									***0***
Aciculata									***0***
Lumbrineris sp.	8								***8***
Nereis arenaceodonta	2								***2***
Canalipalpata									***0***
Polydora ligni	3								***3***
Scolecolepides viridis	3								***3***
Scolelepis squamata	5								***5***
Spio filicornis	5								***5***
Syllidae	1								***1***
Capitellida									***0***
Clymenella torquata	1								***1***
Orbiniida									***0***
Scoloplos acutus	4								***4***
Phylum Arthropoda									***0***
Arachnida									***0***
Araneae									***0***
Linyphiidae								1	***1***
Insecta									***0***
Coleoptera									***0***
Hypocaccus fraternus			1						***1***
Mecynotarsus candidus						2			***2***
Tenebrionidae						4			***4***
Collembola									***0***
Anurida maritima								5	***5***
Diptera									***0***
Empididae					2				***2***
Ephydridae					3				***3***
Phoridae								1	***1***
Hymenoptera									***0***
Lasius neoniger					8	6			***14***
Subphylum Crustacea									***0***
Copepoda			+						***0***
Malacostraca									***0***
Amphipoda		1							***1***
Ampelisca sp.	2								***2***
Talorchestia longicornus					53	111	5		***169***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Gemma gemma	14	1							***15***
Phylum Sipunculoidea									***0***
Sipunculidae								1	***1***
Phylum Nematoda			1						***1***
***UNID**			1						***1***
Total Number	***48***	***63***	***12***	***91***	***66***	***123***	***5***	***8***	***416***

FALL

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									
Oligochaeta	2	5	1	8					***16***
Phylum Arthropoda									
Arachnida									
Araneae									
Mimetidae						1			***1***
Insecta									
Coleoptera									
Scarabaeidae							1		***1***
Collembola						+			
Diptera									
Ceratopogonidae		2	2						***4***
Culicidae								2	***2***
Ephydridae							1	5	***6***
Tipula sp.		2							***2***
Subphylum Crustacea									
Malacostraca									
Amphipoda									
Talorchestia longicornus					2	6	2		***10***
Phylum Mollusca									
Bivalvia									
Veneroida									
Gemma gemma	25	5							***30***
Gastropoda									
Neogastropoda									
Ilyanassa obsoletus	1								***1***
Phylum Nematoda	4	3	20	29					***56***
Total Number	***32***	***17***	***23***	***37***	***2***	***7***	***4***	***7***	***129***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

PIKES OCEANSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Arthropoda									***0***
Insecta									***0***
Coleoptera									***0***
Amblyderus palleus						1			***1***
Tenebrionidae							2		***2***
Diptera									***0***
Empididae					4	3			***7***
Subphylum Crustacea									***0***
Copepoda		+							***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus					3	5	10		***18***
Phylum Nematoda	5		17	1					***23***
Phylum Platyhelminthes									***0***
Turbellaria	12	1							***13***
Polycladida			3	1					***4***
Total Number	***17***	***1***	***20***	***2***	***7***	***9***	***12***	***0***	***68***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	7		272		1				***280***
Polychaeta									***0***
Canalipalpata									***0***
Scolelepis squamata	2								***2***
Phylum Arthropoda									***0***
Subphylum Crustacea									***0***
Copepoda			+		+				***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus							4		***4***
Phylum Nematoda	12	92		1					***105***
Total Number	***21***	***92***	***272***	***1***	***1***	***0***	***4***	***0***	***391***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

PONQUOGUE EAST BAYSIDE

SPRING

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	32	18	3	6					***59***
Polychaeta									***0***
Aciculata									***0***
Nereis arenaceodonta	4								***4***
Canalipalpata									***0***
Scolecolepides viridis	2								***2***
Spionidae	1								***1***
Orbiniida									***0***
Scoloplos sp.	1	1							***2***
Phylum Arthropoda									***0***
Arachnida									***0***
Araneae									***0***
Clubionidae							1		***1***
Erigonidae						3			***3***
Insecta									***0***
Coleoptera									***0***
Hypocaccus fraternus							1		***1***
Collembola						+	+		***0***
Diptera							1		***1***
Ceratopogonidae	1								***1***
Empididae						1	2		***3***
Hymenoptera									***0***
Lasius neoniger						1			***1***
Gelechiidae					1				***1***
Subphylum Crustacea									***0***
Copepoda	+	+	+	+					***0***
Malacostraca									***0***
Amphipoda									***0***
Gammaridae	2			1					***3***
Talorchestia longicornus						6	1		***7***
Isopoda									***0***
Edotea triloba	1								***1***
Phylum Mollusca	1				2				***3***
Bivalvia									***0***
Mytiloida									***0***
Mytilus edulis	4				1				***5***
Phylum Nematoda	1	7			1				***9***
Phylum Nemertea					12				***12***
Phylum Platyhelminthes									***0***
Turbellaria					1				***1***
Total Number	***50***	***26***	***3***	***7***	***18***	***11***	***6***	***0***	***121***

FALL

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	1	2	2	21					***26***
Polychaeta									***0***
Aciculata									***0***
Nereis arenaceodonta	1								***1***
Orbiniida									***0***
Scoloplos fragilis	19								***19***
Phylum Arthropoda									***0***
Insecta									***0***
Coleoptera									***0***
Staphylinidae					2				***2***
Collembola		+			+	+			***0***
Diptera									***0***
Dolichopodidae					2				***2***
Subphylum Crustacea									***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus					1	4			***5***
Phylum Nematoda	21	139	12	1					***173***
Total Number	***42***	***141***	***14***	***22***	***5***	***4***	***0***	***0***	***228***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

PONQUOGUE EAST OCEANSIDE

SPRING

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		48		7					***55***
Polychaeta									***0***
Orbiniida									***0***
Scoloplos sp.		1							***1***
Phylum Arthropoda									***0***
Insecta									***0***
Coleoptera									***0***
Amblyderus palleus							1		***1***
Bledius sp.							1		***1***
Hypocaccus fraternus							1		***1***
Tenebrionidae					5				***5***
Collembola									***0***
Anurida maritima								4	***4***
Diptera					2				***2***
Dolichopodidae					2				***2***
Ephydridae						1			***1***
Homoptera									***0***
Magemelus lobatus					1				***1***
Subphylum Crustacea									***0***
Copepoda	+	+	+	+					***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus					12	9	2		***23***
Phylum Mollusca									***0***
Bivalvia								1	***1***
Mytiloida								2	***2***
Mytilus edulis	1								***1***
Phylum Nematoda	1								***1***
Phylum Platyhelminthes									***0***
Turbellaria	2								***2***
***UNID**								1	***1***
Total Number	***4***	***49***	***0***	***7***	***22***	***10***	***5***	***8***	***105***

FALL

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	1	2	84	403					***490***
Polychaeta									***0***
Aciculata									***0***
Nereis arenaceodonta	1								***1***
Phylum Arthropoda									***0***
Insecta									***0***
Collembola					+				***0***
Subphylum Crustacea									***0***
Copepoda					1				***1***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus					1		1		***2***
Decapoda									***0***
Emerita talpoida		1							***1***
Phylum Echinodermata									***0***
Stelleroidea									***0***
Forcipulatida									***0***
Asterias forbesii								14	***14***
Phylum Nematoda	5	38	60	67					***170***
Phylum Platyhelminthes									***0***
Turbellaria	1	4							***5***
***UNID**		1							***1***
Total Number	***8***	***46***	***144***	***470***	***2***	***0***	***1***	***14***	***685***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

SAILOR'S HAVEN BAYSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		3							***3***
Phylum Arthropoda									***0***
Arachnida									***0***
Acari							1		***1***
Insecta									***0***
Coleoptera									***0***
Staphylinidae							1		***1***
Collembola							+		***0***
Diptera							1		***1***
Chaoborus sp.						1	4		***5***
Chironomidae							1		***1***
Hymenoptera									***0***
Lasius neoniger							1		***1***
Siricidae							1		***1***
Subphylum Crustacea									***0***
Copepoda		+							***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus							26		***26***
Isopoda									***0***
Porcellio scaber						1	2		***3***
Phylum Mollusca									***0***
Bivalvia								1	***1***
Veneroida									***0***
Astarte castanea		1							***1***
Gemma gemma	2		3						***5***
Total Number	***2***	***4***	***3***	***0***	***0***	***2***	***38***	***1***	***50***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		57	10	11					***78***
Polychaeta									***0***
Aciculata									***0***
Spirorbidae[1]	6		2	2					***10***
Phylum Arthropoda									***0***
Arachnida									***0***
Insecta									***0***
Coleoptera								1	***1***
Collembola							1		***1***
Diptera									***0***
Culicidae								1	***1***
Ephydridae					29		1	1	***31***
Sciaridae							1		***1***
Hymenoptera									***0***
Braconidae					1				***1***
Subphylum Crustacea									***0***
Malacostraca									***0***
Amphipoda								1	***1***
Orchestia grillus					74				***74***
Isopoda									***0***
Scyphacella arenicola						4	1		***5***
Phylum Ectoprocta									***0***
Gymnolaemata									***0***
Cheilostomata									***0***
Electra crustulenta					+				***0***
Phylum Nematoda		2	3						***5***
Total Number	***6***	***59***	***15***	***13***	***104***	***4***	***4***	***4***	***209***

\+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

SAILOR'S HAVEN OCEANSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	Total
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	Number
Phylum Annelida									*0*
Oligochaeta			8	1					*9*
Phylum Arthropoda									*0*
Arachnida									*0*
Araneae									*0*
Clubionidae						1			*1*
Insecta									*0*
Coleoptera									*0*
Clivinia sp.					23				*23*
Diptera					1				*1*
Hymenoptera									*0*
Lasius neoniger						1			*1*
Leptidoptera									*0*
Noctuidae						1			*1*
Subphylum Crustacea									*0*
Copepoda	+								*0*
Malacostraca									*0*
Amphipoda									*0*
Haustoriidae				1					*1*
Talorchestia longicornus					6	4			*10*
Phylum Mollusca									*0*
Bivalvia								3	*3*
Phylum Nematoda	1		1						*2*
Total Number	***1***	***0***	***9***	***2***	***30***	***7***	***0***	***3***	***52***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	Total
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	Number
Phylum Annelida									*0*
Polychaeta									*0*
Canalipalpata									*0*
Scolelepis squamata	1								*1*
Phylum Arthropoda									*0*
Insecta									*0*
Coleoptera									*0*
Amblyderus palleus							1		*1*
Subphylum Crustacea									*0*
Copepoda	7								*7*
Malacostraca									*0*
Decapoda									*0*
Emerita talpoida	1								*1*
Phylum Nematoda		9	6	10					*25*
Total Number	***9***	***9***	***6***	***10***	***0***	***0***	***1***	***0***	***35***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

SMITH POINT BAYSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	11	40	26	14					***91***
Phylum Arthropoda								6	***6***
Arachnida			1						***1***
Acari					16	1	1		***18***
Araneae									***0***
Erigonidae					1				***1***
Insecta									***0***
Coleoptera									***0***
Staphylinidae					3	1		1	***5***
Tenebrionidae					2	1			***3***
Collembola					+	+	+		***0***
Hymenoptera									***0***
Formicidae		+		+					***0***
Lasius neoniger						2	1		***3***
Pseudoscorpiones					1				***1***
Subphylum Crustacea									***0***
Copepoda		+	+	+					***0***
Diplopoda									***0***
Chordeumatida									***0***
Striaridae					1		1		***2***
Malacostraca									***0***
Amphipoda								8	***8***
Ampelisca sp.		1							***1***
Corophium sp.				2					***2***
Gammaridae								1	***1***
Talorchestia longicornus					350	3			***353***
Isopoda									***0***
Porcellio scaber					12		1		***13***
Phylum Mollusca									***0***
Bivalvia								8	***8***
Phylum Nematoda			3						***3***
***UNID**								1	***1***
Total Number	***11***	***41***	***30***	***16***	***386***	***8***	***4***	***25***	***521***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		6	2						***8***
Polychaeta									***0***
Aciculata									***0***
Lumbrineris sp.	1								***1***
Nereis arenaceodonta	1								***1***
Canalipalpata									***0***
Polydora ligni	1								***1***
Prionospio sp.	2								***2***
Spio sp.	3								***3***
Capitellida									***0***
Tharyx sp.	2								***2***
Phylum Arthropoda									***0***
Arachnida									***0***
Araneae									***0***
Mimetidae					1	1			***2***
Insecta									***0***
Diptera									***0***
Ephydridae					3				***3***
Sciaridae					1		1		***2***
Homoptera									***0***
Magemelus lobatus					1				***1***
Subphylum Crustacea									***0***
Malacostraca									***0***
Amphipoda									***0***
Orchestia grillus				1	8	7			***16***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Gemma gemma	145								***145***
Gastropoda									***0***
Neogastropoda									***0***
Ilyanassa obsoletus	4								***4***
Phylum Nematoda	2	66	54	2					***124***
Total Number	***161***	***72***	***56***	***3***	***14***	***8***	***1***	***0***	***315***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

SMITH POINT OCEANSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	8	11	1		1				***21***
Phylum Arthropoda									***0***
Insecta									***0***
Coleoptera									***0***
Staphylinidae								1	***1***
Collembola						+			***0***
Diptera									***0***
Cecidomyiidae						1			***1***
Ephydridae						3			***3***
Hymenoptera									***0***
Lasius neoniger							1		***1***
Subphylum Crustacea									***0***
Copepoda		+	+		+				***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus						8			***8***
Phylum Mollusca									***0***
Bivalvia								8	***8***
Phylum Nematoda	63	1							***64***
Phylum Platyhelminthes									***0***
Turbellaria	7								***7***
Total Number	***78***	***12***	***1***	***0***	***1***	***12***	***1***	***9***	***114***

Fall	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		2		51					***53***
Phylum Arthropoda									***0***
Insecta									***0***
Coleoptera									***0***
Staphylinidae						1			***1***
Diptera									***0***
Ephydridae					3				***3***
Subphylum Crustacea									***0***
Copepoda	+								***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus						1			***1***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Tellina agilis	1								***1***
Phylum Nematoda	6		7	18					***31***
***UNID**	1								***1***
Total Number	***8***	***2***	***7***	***69***	***3***	***2***	***0***	***0***	***91***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

TALISMAN BAYSIDE

SPRING

	Benthic Core				Pitfall Trap			Wrackline Sight	Total
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	Number
Phylum Annelida									***0***
Oligochaeta	14	1	3772						***3787***
Polychaeta									***0***
Aciculata									***0***
Dorvilleidae	1								***1***
Phylum Arthropoda									***0***
Arachnida									***0***
Araneae									***0***
Lycosidae					1				***1***
Insecta									***0***
Coleoptera									***0***
Clivinia sp.					10				***10***
Collembola						+			***0***
Diptera									***0***
Dolichopodidae					1				***1***
Sciaridae							1		***1***
Hymenoptera									***0***
Lasius neoniger					1		2		***3***
Subphylum Crustacea									***0***
Copepoda	+								***0***
Malacostraca									***0***
Amphipoda									***0***
Neohaustorius sp.		2							***2***
Phylum Eubranchiopoda	2								***2***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Gemma gemma	4	5							***9***
Phylum Nematoda	5		90						***95***
Total Number	***26***	***8***	***3862***	***0***	***13***	***0***	***3***	***0***	***3912***

*No Wrackline Sight Sample.

FALL

	Benthic Core				Pitfall Trap			Wrackline Sight	Total
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	Number
Phylum Annelida								44	***44***
Oligochaeta			26	102					***128***
Phylum Arthropoda									***0***
Arachnida								2	***2***
Acari									***0***
Hydracarina				5					***5***
Araneae									***0***
Amaurobiidae						1			***1***
Lycosidae								1	***1***
Insecta									***0***
Coleoptera									***0***
Clivinia sp.						1			***1***
Hydrophilidae				1				2	***3***
Staphylinidae								1	***1***
Anurida maritima								100	***100***
Collembola				+		+			***0***
Diptera									***0***
Ephydridae					1	1			***2***
Tipula sp.				2					***2***
Leptidoptera								1	***1***
Trichoptera									***0***
Polycentropodidae								1	***1***
Subphylum Crustacea									***0***
Malacostraca									***0***
Amphipoda									***0***
Orchestia grillus					3	6	12		***21***
Parahaustorius attenuatus		1							***1***
Talitridae								1	***1***
Isopoda									***0***
Scyphacella arenicola				8					***8***
Armadillium vulgare								1	***1***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Gemma gemma		20							***20***
Phylum Nematoda		12	8	21					***41***
Phylum Nematomorpha			30						***30***
***UNID**								1	***1***
Total Number	***0***	***33***	***64***	***139***	***4***	***9***	***12***	***155***	***416***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

TALISMAN OCEANSIDE

SPRING

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta	7	4	3	19					***33***
Phylum Arthropoda									***0***
Insecta									***0***
Coleoptera									***0***
Amblyderus palleus						1	1		***2***
Diptera									***0***
Dolichopodidae						1	1		***2***
Subphylum Crustacea									***0***
Copepoda	+		+						***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus						1			***1***
Phylum Mollusca									***0***
Bivalvia									***0***
Mytiloida									***0***
Mytilus edulis	43				56				***99***
Phylum Nematoda	1	5	9	5	1				***21***
Phylum Nematomorpha					8				***8***
Phylum Platyhelminthes									***0***
Turbellaria	1								***1***
Total Number	***52***	***9***	***12***	***24***	***65***	***3***	***2***	***0***	***167***

FALL

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		1	1						***2***
Polychaeta									***0***
Canalipalpata									***0***
Scolelepis squamata	1								***1***
Phylum Arthropoda									***0***
Subphylum Crustacea									***0***
Copepoda		+	+	+					***0***
Phylum Nematoda	12	112	605	3					***732***
***UNID**		1							***1***
Total Number	***13***	***114***	***606***	***3***	***0***	***0***	***0***	***0***	***736***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

TIANA BAYSIDE

SPRING

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		1	1	7					***9***
Polychaeta									***0***
Aciculata									***0***
Nereis sp.	1			1					***2***
Canalipalpata									***0***
Spiophanes bombyx				5					***5***
Phylum Arthropoda									***0***
Arachnida									***0***
Acari					1		1		***2***
Hydracarina				1					***1***
Araneae									***0***
Clubionidae							1		***1***
Insecta									***0***
Collembola					+				***0***
Anurida maritima								100	***100***
Diptera					2				***2***
Chironomidae					1				***1***
Dolichopodidae					1		2		***3***
Stratiomyidae						1			***1***
Tipula sp.		1							***1***
Homoptera									***0***
Magemelus lobatus							1		***1***
Subphylum Crustacea									***0***
Copepoda						+			***0***
Malacostraca									***0***
Amphipoda									***0***
Orchestia grillus				2					***2***
Talorchestia longicornus					1		3		***4***
Decapoda									***0***
Megalops/Mysid			+						***0***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Astarte castanea		3		1					***4***
Total Number	***1***	***5***	***1***	***17***	***6***	***1***	***8***	***100***	***139***

FALL

	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		1	3						***4***
Polychaeta									***0***
Aciculata									***0***
Nereis arenaceodonta	1	1							***2***
Canalipalpata									***0***
Scolelepis squamata	1								***1***
Orbiniida									***0***
Scoloplos fragilis		4							***4***
Phylum Arthropoda									***0***
Insecta									***0***
Collembola					+				***0***
Diptera									***0***
Cecidomyiidae							1		***1***
Ephydridae						1			***1***
Hymenoptera									***0***
Perilampidae						1			***1***
Platygastridae						1			***1***
Subphylum Crustacea									***0***
Malacostraca									***0***
Amphipoda									***0***
Orchestia grillus					9	5			***14***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Gemma gemma	5	5							***10***
Phylum Nematoda	15			1					***16***
Total Number	***22***	***11***	***3***	***1***	***9***	***8***	***1***	***0***	***55***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

TIANA OCEANSIDE

SPRING	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		9		3					***12***
Phylum Arthropoda									***0***
Arachnida						1			***1***
Araneae									***0***
Tetragnathidae							1		***1***
Insecta									***0***
Coleoptera									***0***
Amblyderus palleus							1		***1***
Clivinia sp.						7	1		***8***
Hypocaccus fraternus							2		***2***
Staphylinidae						1	1		***2***
Subphylum Crustacea									***0***
Copepoda	+			+					***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia longicornus						17	7		***24***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Astarte castanea	1								***1***
Phylum Nematoda	11	4		1					***16***
Total Number	***12***	***13***	***0***	***4***	***0***	***26***	***13***	***0***	***68***

FALL	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida									***0***
Oligochaeta		18		2					***20***
Phylum Arthropoda									***0***
Arachnida									***0***
Insecta									***0***
Collembola					+				***0***
Diptera									***0***
Dixidae					1				***1***
Hymenoptera									***0***
Chalcidoidea							1		***1***
Subphylum Crustacea									***0***
Malacostraca									***0***
Amphipoda									***0***
Talorchestia megalophthalma					15	3			***18***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Donax sp.	3								***3***
Phylum Nematoda	12	77	1						***90***
Total Number	***15***	***95***	***1***	***2***	***16***	***3***	***1***	***0***	***133***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

WATCH HILL BAYSIDE

FALL ONLY (No Spring Sample)	Benthic Core				Pitfall Trap			Wrackline Sight	***Total***
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	***Number***
Phylum Annelida								20	***20***
Oligochaeta			34	8					***42***
Phylum Arthropoda									***0***
Arachnida									***0***
Acari						1			***1***
Insecta									***0***
Collembola						+			***0***
Diptera									***0***
Tipula sp.				1					***1***
Homoptera									***0***
Magemelus lobatus					1				***1***
Hymenoptera									***0***
Myrmicinae							1		***1***
Subphylum Crustacea									***0***
Malacostraca									***0***
Amphipoda									***0***
Orchestia grillus					4	10			***14***
Phylum Mollusca									***0***
Bivalvia									***0***
Veneroida									***0***
Gemma gemma	8	3							***11***
Phylum Nematoda		43	44						***87***
***UNID**								2	***2***
Total Number	***8***	***46***	***78***	***9***	***5***	***11***	***1***	***22***	***180***

+ denotes incidental collection and not quantified.
*UNID=organism not identified due to damage, life stage.

WATCH HILL OCEANSIDE

FALL ONLY (No Spring Sample)	Benthic Core				Pitfall Trap			Wrackline Sight	Total Number
	Low	Mid	High	Wrack	Wrack	Supra	Grass	Wrack	
Phylum Annelida									***0***
Oligochaeta				1					***1***
Phylum Arthropoda									***0***
Arachnida							1		***1***
Insecta									***0***
Homoptera							1		***1***
Decapoda									***0***
Emerita talpoida		1							***1***
Phylum Nematoda	181	268	3						***452***
Total Number	***181***	***269***	***3***	***1***	***0***	***0***	***2***	***0***	***456***