New York State

Department of Environmental Conservation

Norton Basin/Little Bay
Baseline Data Collection - 2002

Fisheries, Benthic Communities, and Sediment Profile Image Analysis

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EXECUTIVE SUMMARY

The New York State Department of Environmental Conservation (NYSDEC), in partnership with the Port Authority of New York/New Jersey (PANY/NJ), is evaluating the ecological condition of borrow pits in Norton Basin and Little Bay, Far Rockaway, NY. Borrow pits, and the dead-end basins in which they commonly occur are often severely degraded because of restricted tidal circulation, which results in seasonal stratification of the water column and poor water quality. In some cases, hypoxic or anoxic water masses may be present year-round within borrow pits.

The Norton Basin and Little Bay study areas are located on the north shore of the Rockaway Peninsula, in Queens, NY. These embayments are located southeast and south of the Edgemere Landfill, respectively. There are several 45 to 65 ft deep borrow pits in the Norton Basin/Little Bay complex. Baseline studies in Norton Basin and Little Bay were conducted along with studies at two reference areas in Jamaica Bay (Grass Hassock Channel and the Raunt).

Benthic macroinvertebrate surveys of the study and reference areas were conducted during June and October 2002. Fifteen sampling stations were located in Norton Basin and nine sampling stations were located in Little Bay. Three sampling stations were located in both the Grass Hassock Channel and the Raunt reference areas. Benthic macroinvertebrate density, biomass, and taxonomic composition were measured and compared among depth strata and study/reference areas.

Fish and macrocrustacean assemblages were surveyed during May, June, and August 2002. Experimental gill nets were deployed overnight in borrow pits and reference areas. Trawl surveys were conducted in Norton Basin, the Raunt, and Grass Hassock Channel. Trawling was not conducted in Little Bay because of the presence of numerous submerged wrecks and other large debris, as documented in bathymetric surveys conducted by the U.S. Army Corps of Engineers, New York District (USACE-NYD) in 2000.

Fine-scale characterization of benthic habitats within the study and reference areas was performed during May 2002 using sediment profile imagery (SPI). Duplicate photographs were taken at the sediment-water interface at each of 100 stations with a Hulcher sediment profile camera. A range of sediment and biotic parameters were measured/estimated and recorded for each station. The SPI images and accompanying data are included on a CD-ROM (**Appendix III-A**).

Benthic macroinvertebrates were virtually absent from the fine, organic, highly aqueous sediments in the Little Bay borrow pit. Arthropods dominated the benthic macroinvertebrate communities of Grass Hassock Channel and the Norton Basin borrow pits during June and October. Annelids were the dominant major taxa in the shallow areas of Norton Basin. Arthropods and annelids were co-dominant major taxa in the Raunt during June; however, arthropods were numerically dominant at this site during October. Molluscs and other invertebrates represented a minor component of the macroinvertebrate community among all sites during both seasons.

Macroinvertebrate densities were significantly lower in the intermediate depths of Little Bay, relative to Grass Hassock Channel or the Raunt. Total abundance of benthic macroinvertebrates was lower in the borrow pits and the intermediate depths of Norton Basin relative to Grass Hassock Channel or the Raunt in both June and October.

May gill net collections in Norton Basin were dominated by striped searobin (*Prionotus evolans*). Most individuals were collected within the deeper strata of the Norton Basin borrow pits. Species composition and richness within Norton Basin was comparable to that of Grass Hassock Channel; however, collections from the Raunt were dominated by decapod crustaceans. Catch per unit effort (CPUE) in surface and bottom strata within Grass Hassock Channel was twice that of equivalent depth strata within Norton Basin during May. CPUE in mid-depth strata within Grass Hassock

Channel was four times greater than that of Norton Basin. CPUE within the Raunt was comparable to that of shallow areas within Norton Basin. Surface CPUE in Little Bay was comparable to that of Norton Basin, and approximately one half of CPUE measured within Grass Hassock Channel. Relatively few fish were collected from mid-water strata in Little Bay during May, and none were collected in the deeper strata of the Little Bay borrow pit.

June gill net collections in Norton Basin were dominated by striped searobin. Most individuals were collected within the deeper strata of the borrow pits. Species composition and richness within Norton Basin was similar to that of Grass Hassock Channel; however, collections from the Raunt were dominated by decapod crustaceans. CPUE from deeper strata within Norton Basin was comparable to equivalent depths within Grass Hassock Channel. CPUE at mid-depth strata within Norton Basin was twice that of equivalent depth strata within Grass Hassock Channel. Surface CPUE within Grass Hassock Channel was more than twice that observed within surface waters of Norton Basin. No fish were collected from surface and mid-water strata in Little Bay, and none were collected at the bottom of the Little Bay borrow pit. CPUE in the Raunt was nearly twice that of shallow water habitats in Norton Basin.

August gill net collections in Norton Basin were dominated by striped searobin, bluefish (*Pomatomus saltatrix*), and Atlantic menhaden (*Brevoortia tyrannus*). Collections from Grass Hassock Channel were dominated by blue crab (*Callinectes sapidus*), weakfish (*Cynoscion regalis*) and Atlantic menhaden. Gill net collections from the Raunt were dominated by blue crab, Atlantic horseshoe crab (*Limulus polyphemus*), and weakfish. Very few fish were collected from surface and mid-water strata within Norton Basin. CPUE was markedly greater at reference areas relative to the Norton Basin and Little Bay pits. CPUE at the bottom of the Norton Basin borrow pits was one-half that of equivalent depth strata in Grass Hassock Channel. CPUE at the shallow water sampling station in Norton Basin was one-fourth that of the Raunt. No fish were collected at the bottom of the Little Bay borrow pit. Very few fish were collected from surface water and intermediate depth strata within Little Bay.

Trawl surveys of Grass Hassock Channel yielded no fish during May and June, and only a few individuals during August. Norton Basin trawl samples were dominated by macrocrustaceans (blue crab and Atlantic horseshoe crab) during May, June, and August. Trawl samples from the Raunt were dominated by Atlantic horseshoe crab in May and lady crab in June. Blue crab and lady crab were the two most abundant species collected in trawl samples from the Raunt during August.

SPI images from Norton Basin exhibited a range of sediment characteristics, depending on depth. Borrow pit sediments were organic fines, while intermediate-depth and entrance channel sediments ranged from silt to fine sand. Entrance channel sediments were primarily sand and shell hash. SPI samples from Little Bay over-penetrated the soft aqueous sediments present therein and did not yield satisfactory images of the sediment-water interface. Gas voids and bacteria mats were characteristic features of SPI images from Little Bay. Grass Hassock Channel sediments ranged from silt to fine sand, and *Ampelisca* mats were present in 90% of SPI images from this area. The dominant sediment type in the Raunt was silt, with fine sand present at stations located near the confluence of the Raunt and Runway Channel. Approximately 75% of the SPI images from the Raunt included *Ampelisca* colonies.

In general, Norton Basin appears to support a more abundant and diverse biota and exhibits greater substrate/habitat heterogeneity in comparison to Little Bay. The borrow pits located in Norton Basin exhibit substrate/habitat characteristics which resemble those of Little Bay; however, sampling locations of intermediate and shallow depths in Norton Basin appear to support habitats and communities which resemble those of intermediate-depth and shallow reference areas in Jamaica Bay.

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ACRONYMS USED IN THIS REPORT

ANOVA – Analysis of Variance

CD-ROM – compact disk-read only memory

CPUE – catch per unit effort

HTML – hypertext markup language

LPIL – lowest practical identification level

mcy – million cubic yards

MLW – mean low water

NPS-GNRA – National Park Service Gateway National Recreation Area

NYC – New York City

NYSDEC – New York State Department of Environmental Conservation

PANY/NJ – Port Authority of New York/New Jersey

RPD – redox potential discontinuity

SNK – Student-Newman-Keuls

SPI – sediment profile imagery

TL – total length

TOC – total organic carbon

USACE-NYD – U.S. Army Corps of Engineers, New York District

1.0 INTRODUCTION

A common environmental problem in urbanized coastal areas is the prevalence of poor water quality and habitat degradation within dead-end canals and basins. Dead-end basins, and particularly dredged areas within these basins, are often severely degraded because of restricted tidal circulation, which results in seasonal stratification of the water column and poor water quality. Chronic water pollution in dead-end basins often stems from decades of unregulated human and industrial waste discharge, both from vessels and from shore facilities. In some cases, hypoxic or anoxic water masses may be present year-round within the deeper waters of dead-end basins. Invertebrate communities of dead-end basins are typically species-poor and dominated by a few opportunistic taxa (e.g., tubificid worms). High concentrations of heavy metals and other industrial contaminants often occur in the sediments of dead -end basins (Hawkins et al. 1992, Maxted et al. 1997).

Norton Basin and Little Bay are two dead-end basins located on the north shore of the eastern Rockaway Peninsula of Jamaica Bay, in the Borough of Queens, New York City (NYC). The basins are drained by a common channel leading into the southeastern edge of Jamaica Bay. Borrow pits were excavated in each of the two basins basin in 1938 during the development of Edgemere Landfill, which constitutes the northwest boundary of Little Bay. Historically, this area was characterized by extensive subtidal estuarine shallows and intertidal salt marsh habitat.

Preliminary biological and hydrographic sampling, conducted by the U.S. Army Corps of Engineers, New York District (USACE-NYD) in 1998-1999, indicated degraded conditions within the study area, particularly in Little Bay. Side slopes of the borrow pits in both basins are nearly vertical, and this basin geometry has apparently resulted in very low rates of tidal circulation within deeper waters. Preliminary benthic grab and sediment profile imagery (SPI) samples from both pits indicated an impoverished benthic community (USACE-NYD, unpublished data). Sediments were highly aqueous/organic and black in color. Additional indicators of poor sediment quality were a high gas void content in SPI samples, a strong odor of hydrogen sulfide, and the presence of chemolithotrophic bacterial mats.

In September 2000, USACE-NYD conducted a pilot site characterization study in Norton Basin, Little Bay, and two reference areas located in Jamaica Bay (Grass Hassock Channel and the Raunt). This study included sediment analyses [grain size, total organic carbon (TOC), % solids], water quality profiles, and a preliminary survey of living resources (fish, macrocrustaceans) using gill nets and trawls (Barry A. Vittor & Associates 2001). A bathymetric survey of the study area and a sea-bed classification of the study and reference areas were also performed during 2000 (C&R Environmental 2001). These surveys were intended to provide preliminary information on the biological and physico-chemical attributes of Norton Basin/Little Bay with comparison to shallow and deep reference locations within Jamaica Bay, and to guide the data collection efforts during Phase I (Baseline Environmental Studies) of the Norton Basin/Little Bay project.

The Phase I Baseline Environmental Study of the Norton Basin/Little Bay project was initiated in 2001 and continued through 2002. Data were gathered to further characterize conditions within the study and reference areas identified in the pilot study. The comprehensive baseline study includes water quality monitoring, hydrodynamic studies, sediment characterization, bioassay/bioaccumulation studies, characterization of benthic macroinvertebrate communities, SPI surveys, and fish surveys. The results of Year 1 of the baseline study (2001) are summarized in Vittor & Associates (2003). We report here on the results of benthic macroinvertebrate community analyses, fish surveys, and a SPI survey conducted by The New York State Department of Environmental Conservation (NYSDEC) during Year 2 of the baseline study (2002).

2.0 STUDY AREA

2.1 Norton Basin

Norton Basin is located east of the Edgemere Landfill. With its three 45 to 50 ft. deep (MLW) borrow pits, the basin has a planar surface area of approximately 55.5 acres, a bottom surface area of approximately 56.9 acres, and a total volume of approximately 2.3 million cubic yards (mcy). The borrow pits have soft, mud substrates, while shallower areas of the basin include sandy substrates. Side-scan sonar surveys conducted in 2000 have revealed at least two 30 - 40 ft. wrecks and extensive debris (i.e., tires, pilings, other structures) on the floor of the basin. There are several small submerged structures along the eastern shore of the basin, which are thought to be smaller boats or automobiles (CR Environmental, Inc. 2001).

2.2 Little Bay

Little Bay is located southeast of the Edgemere Landfill. With its three 60 to 65 ft. deep (MLW) borrow pits, the basin has a planar surface of approximately 24.5 acres, a bottom surface area of approximately 25.2 acres, and a total volume of approximately 1.2 mcy. The borrow pits have soft, mud substrates, while shallower areas of the inlet tend to have sandy substrates. Side-scan sonar surveys detected several 30 - 40 ft. wrecks and extensive debris (i.e., tires, pilings, other structures) on the floor of the basin (CR Environmental, Inc. 2001).

2.3 Reference Areas

Two reference areas (Grass Hassock Channel and the Raunt) located within the National Park Service's Gateway National Recreation Area (NPS-GNRA) were selected for comparison to Norton Basin/Little Bay. These reference areas were intended to provide information on biotic and physico-chemical conditions from both shallow and deep estuarine habitats within Jamaica Bay.

2.3.1 Grass Hassock Channel

Grass Hassock Channel is a wide, 30 – 50 ft. deep tidal channel, which originates at the confluence of Winhole Channel and Beach Channel, northeast of the Cross Bay Boulevard Bridge, and terminates at the Jo-Co Marsh Pit, east of Runway 4L at JFK Airport. The Channel is bounded by Jo-Co Marsh and Silver Hole Marsh to the west and by Conchs Hole Point, the Edgemere Landfill, Norton Basin, and Motts Point to the east. The substrate of Grass Hassock Channel is very patchy, and includes sand/silt, shell/gravel, extensive *Ampelisca* mats, and dense sponge colonies (CR Environmental, Inc. 2001).

2.3.2 The Raunt

The Raunt is a shallow (7 – 25 ft. deep) tidal gut, which originates at the confluence of Runway Channel and Beach Channel, northeast of Rockaway Inlet. The Raunt passes in a northeasterly direction through Little Egg Marsh, Big Egg Marsh, and Yellow Bar Hassock and terminates at Goose Pond Marsh, in the community of Broad Channel, Queens, NY. Bottom sediments in the Raunt are predominantly sands and silts, with seasonally dense mats of sea lettuce (*Ulva lactuca*) and extensive beds of tube-dwelling amphipods (*Ampelisca* spp.) in the upper reaches. The *Ampelisca* mats gradually diminish and the substrate becomes an unoccupied hard sand bottom in the lower reaches of the Raunt (CR Environmental, Inc. 2001).

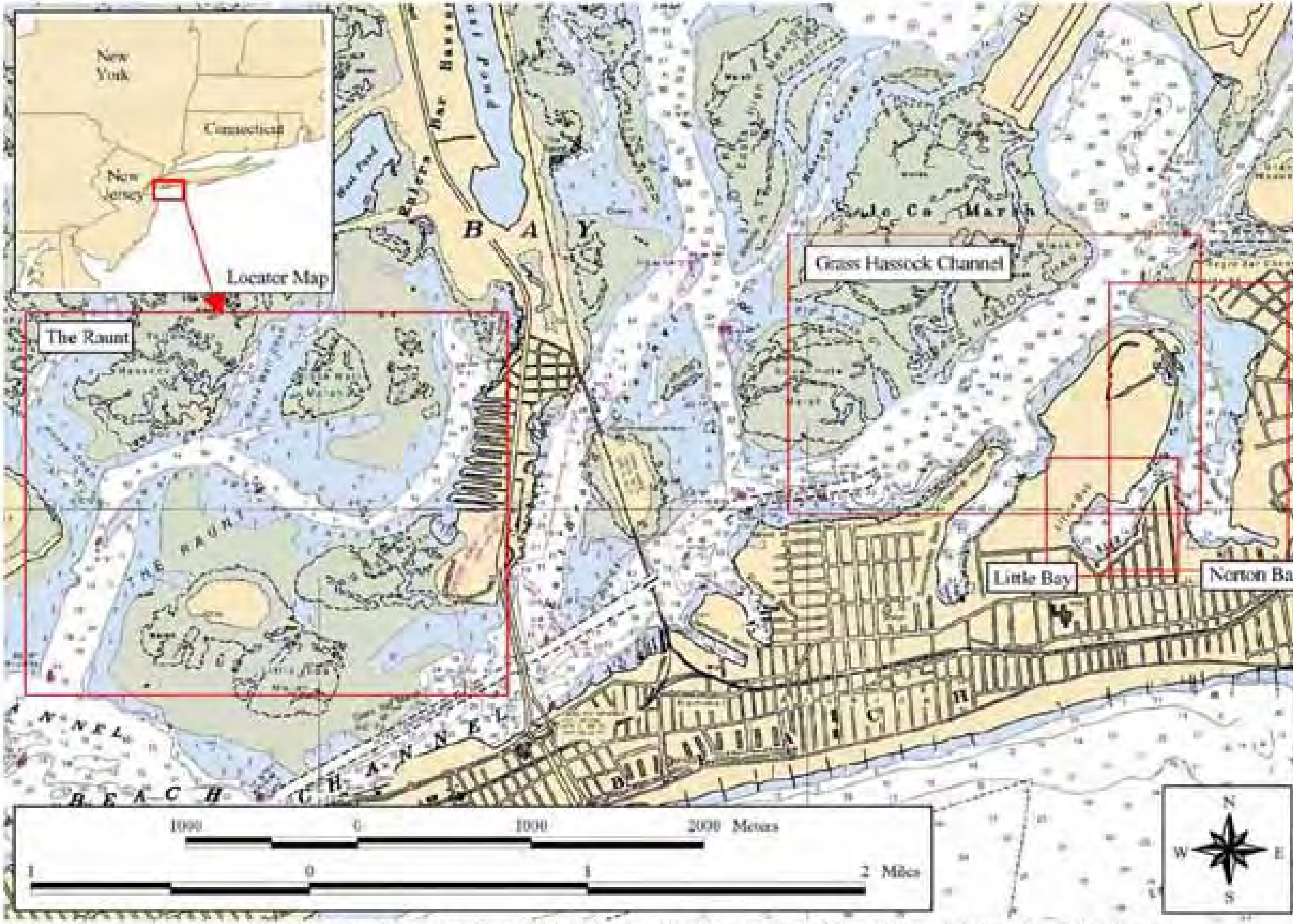


Figure 2.1 Locations of study areas (Norton Basin and Little Bay) and reference areas (Grass Hassock Channel and the Raunt).

3.0 METHODS

3.1 Benthic Macroinvertebrates

A total of 180 samples (three replicate samples from each of 30 sampling stations, X2 collection dates) were collected within the study and reference areas (**Fig. 3.1.1, Table 3.1.1**) using a 0.04m2 Ted Young modified Van Veen grab during June and October 2002. Three sampling sites were located in the Grass Hassock Channel reference area (GH1, GH2, and GH3); three were located in the Raunt reference area (R1, R2, and R3); nine were located in the Little Bay study area (LB1 through LB9); eleven were located in the Norton Basin study area (NB1 through NB11); and four were located in the entrance to Norton Basin (NB12 through NB15). Samples were sieved through a 0.5-mm mesh screen and preserved with a 10% buffered formalin/Rose Bengal solution in the field. Benthic samples were shipped to Barry A. Vittor & Associates, Inc.'s taxonomic laboratory in Mobile, Alabama for analysis.

In the laboratory, macroinvertebrates were identified to the lowest practical identification level (LPIL), which in most cases was to species unless the specimen was unidentifiable (a juvenile, damaged, or unknown). The number of individuals of each taxon, excluding fragments, was recorded. A voucher collection was prepared, composed of representative individuals of each species not previously encountered in samples from this region.

Macroinvertebrate density and biomass were calculated per unit area for each station. Species diversity and community "evenness" were also determined and compared among sampling stations. The data were graphically and statistically analyzed to identify differences in macroinvertebrate density among the study and reference areas. Data were log (y+1) transformed to meet normality assumptions. Transformed abundance data were analyzed using a one-way Analysis of Variance (ANOVA) and post-hoc comparisons were conducted using the Student-Newman-Keuls (SNK) test. Statistical analyses were conducted using the SuperANOVA General Linear Modeling Program for the Macintosh PC (Version 1.11).

3.2 Gill Net Sampling

Experimental gill nets were deployed over a range of tidal conditions to characterize fish use of the proposed study and reference areas. Each gill net measured 125' x 8' in size and contained five panels of 1 in., 1.5 in., 2 in., 3 in., and 4 in. (stretched) monofilament mesh. On May 6-9, June 24-26 and August 12-14, 2002, gill nets were deployed at a total of three deep-water stations (one in the Little Bay borrow pit, one in the larger Norton Basin borrow pit, and one in the Grass Hassock Channel reference area) and four shallow-water stations (one in Little Bay, two in Norton Basin and one in the Raunt reference area) (**Figure 3.2.1, Figure 3.2.2, and Figure 3.2.3**). Six nets were deployed at each of the deep-water stations (two at the surface, two at mid-water, approximately 20-25 feet below the surface, and two along the bottom). Two nets were deployed at the shallow-water stations (bottom only). All fishes and macrocrustaceans collected in gill nets were processed in the field. Captured organisms were identified to species, enumerated, weighed, measured [total length (TL) or carapace width], and released alive, if possible. Catch per unit effort (CPUE) was calculated by dividing fish and macrocrustacean biomass by the number of hours that gill nets were deployed.

3.3 Bottom Trawling

A 16' otter trawl (1 3/8 in. mesh walls, 1 in. mesh cod end) was deployed in the Norton Basin study area and Grass Hassock Channel and the Raunt reference areas. Standard trawling procedures of approximately 4 knots in speed and 10 minute durations were used where possible. Trawl runs within Norton Basin were too short to complete the 10 minute standard duration. While trawl runs within the reference areas were consistent with regards to depth, trawl runs within Norton Basin often covered a mosaic of water depths (i.e., shallow areas and borrow pits). On May 6-9, 2002,

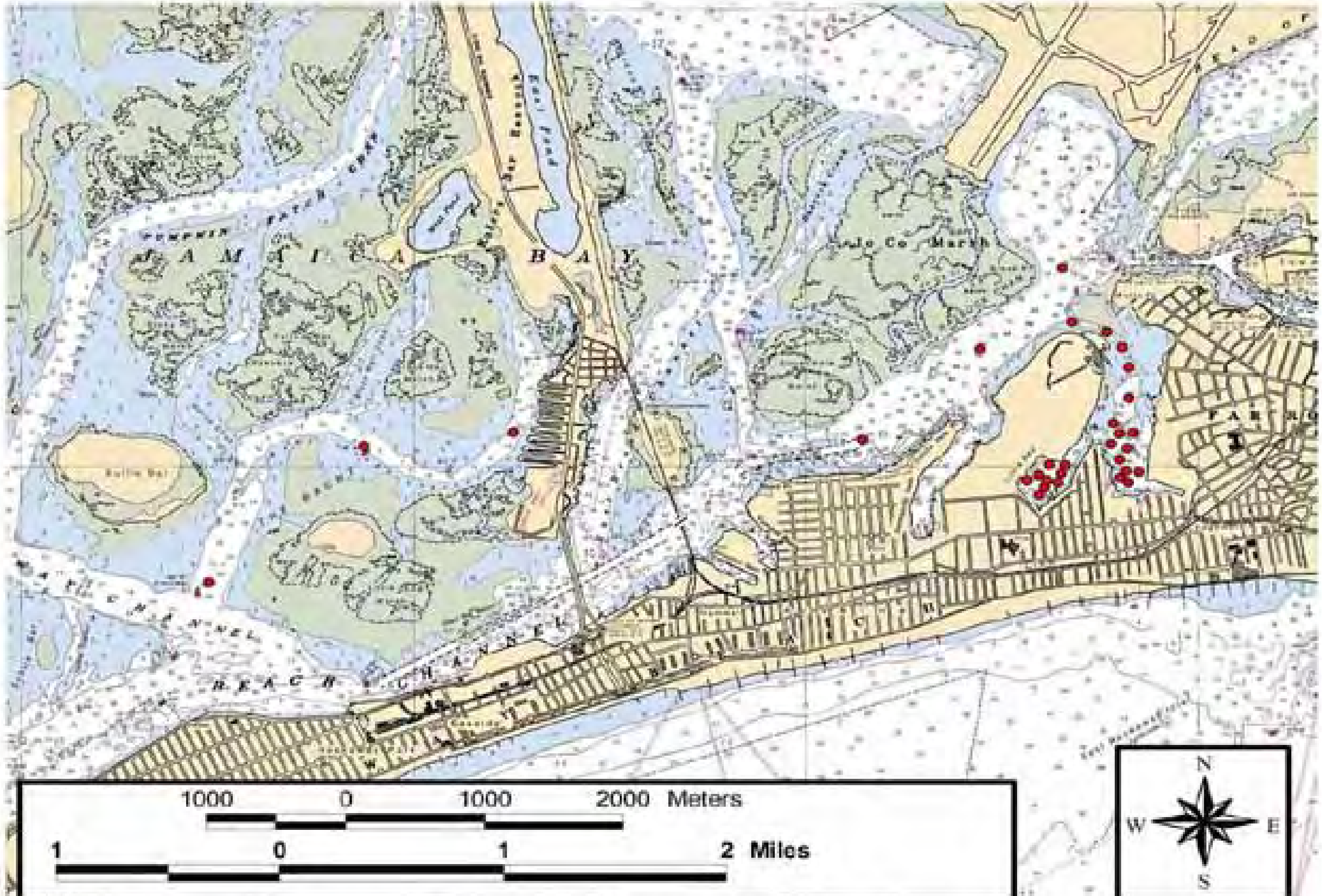


Figure 3.1.1 Locations of benthic grab sampling stations within Norton Basin study and reference areas, June and October 2002.

Table 3.1.1 Benthic sampling station locations (latitude and longitude) and depth, Norton Basin study and reference areas, June and October 2002.

Site	Latitude	Longitude	Depth (ft.)
LB-1	40° 35.8926 '	73° 46.8135 '	32
LB-2	40° 35.9400 '	73° 46.8740 '	40
LB-3	40° 35.9320 '	73° 46.7860 '	50
LB-4	40° 35.9816 '	73° 46.8133 '	44
LB-5	40° 35.9560 '	73° 46.8155 '	64
LB-6	40° 35.9391 '	73° 46.7453 '	50
LB-7	40° 36.0019 '	73° 46.7572 '	30
LB-8	40° 35.9617 '	73° 46.6744 '	50
LB-9	40° 36.0333 '	73° 46.6470 '	31
NB-1	40° 35.9182 '	73° 46.3504 '	26
NB-2	40° 35.9630 '	73° 46.4163 '	29
NB-3	40° 35.9853 '	73° 46.3327 '	30
NB-4	40° 36.0086 '	73° 46.3939 '	45
NB-5	40° 36.0484 '	73° 46.4341 '	29
NB-6	40° 36.0879 '	73° 46.3894 '	32
NB-7	40° 36.1460 '	73° 46.4565 '	29
NB-8	40° 36.1677 '	73° 46.4035 '	45
NB-9	40° 36.2315 '	73° 46.3423 '	20
NB-10	40° 36.2723 '	73° 46.4115 '	23
NB-11	40° 36.4266 '	73° 46.3524 '	43
NB-12	40° 36.4778 '	73° 46.3577 '	18
NB-13	40° 36.5357 '	73° 46.3947 '	15
NB-14	40° 36.5851 '	73° 46.4528 '	13
NB-15	40° 36.6096 '	73° 46.5612 '	10
GH-1	40° 36.2638 '	73° 47.6327 '	23
GH-2	40° 36.7156 '	73° 46.8842 '	49
GH-3	40° 36.2022 '	73° 46.6634 '	26
R-1	40° 35.6329 '	73° 51.0451 '	12
R-2	40° 36.0881 '	73° 50.2277 '	9
R-3	40° 36.2022 '	73° 49.4790 '	10

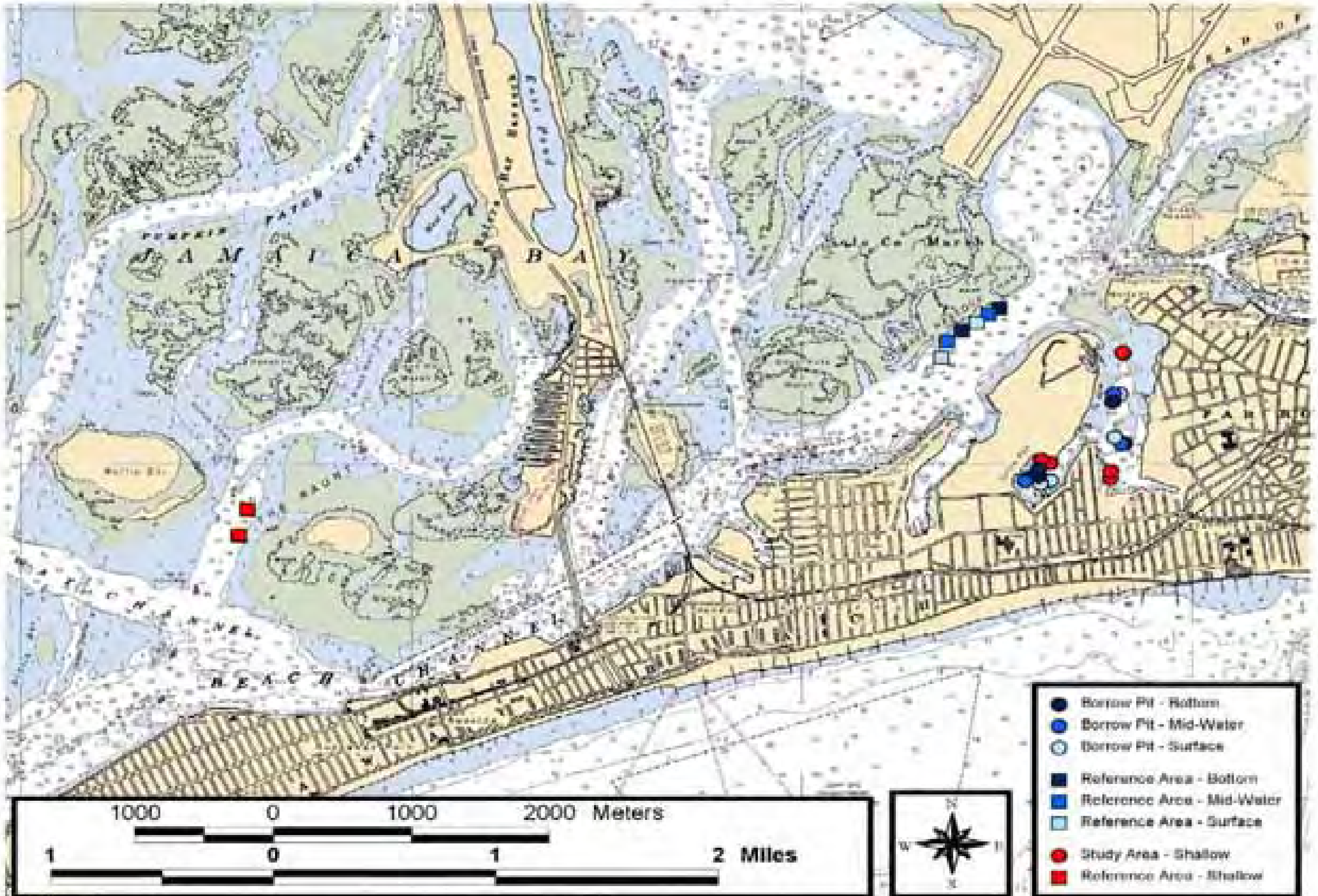


Figure 3.2.1 Locations of gill net sampling stations within Norton Basin study and reference areas, May 2002.

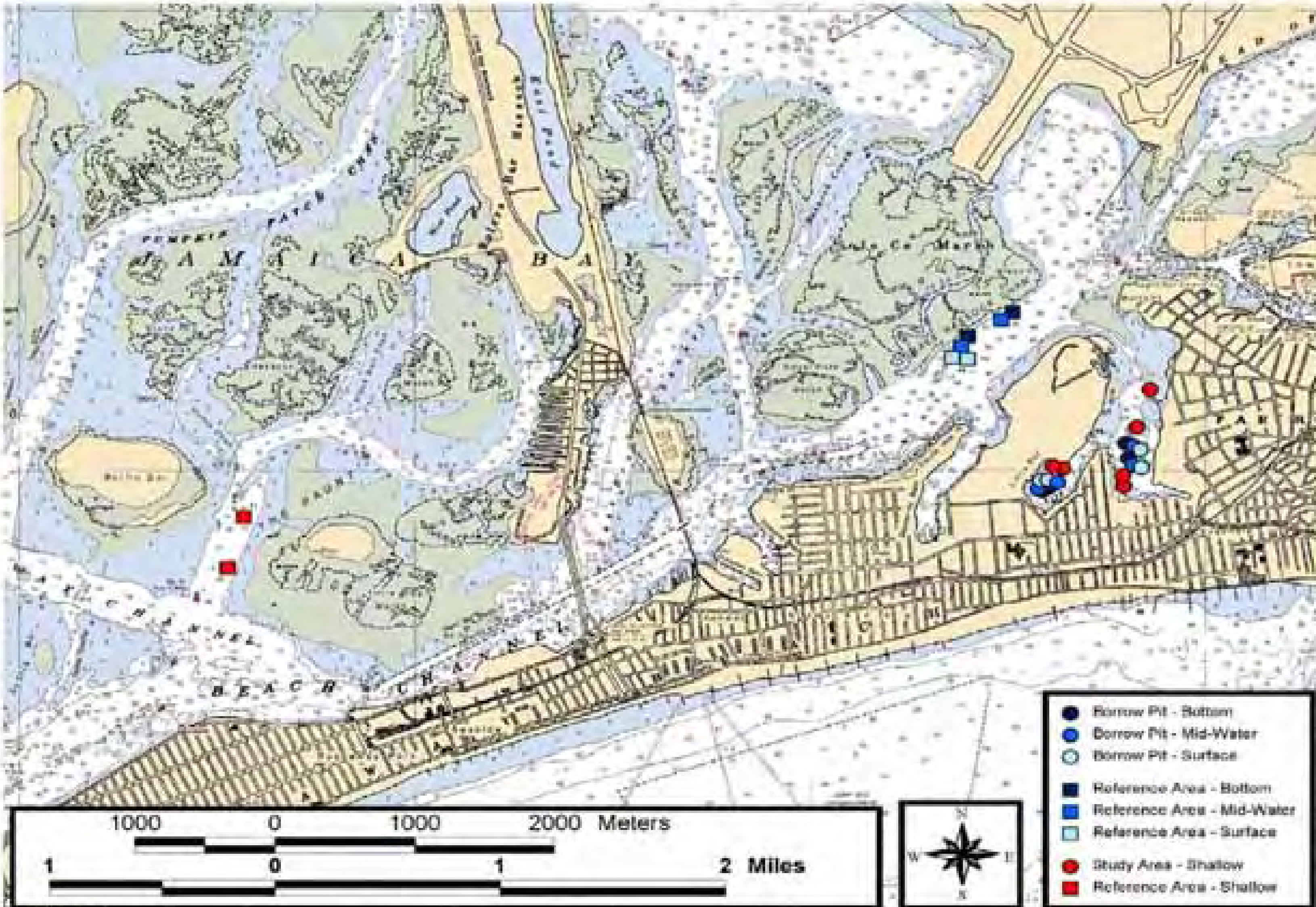


Figure 3.2.2 Locations of gill net sampling stations within Norton Basin study and reference areas, June 2002.

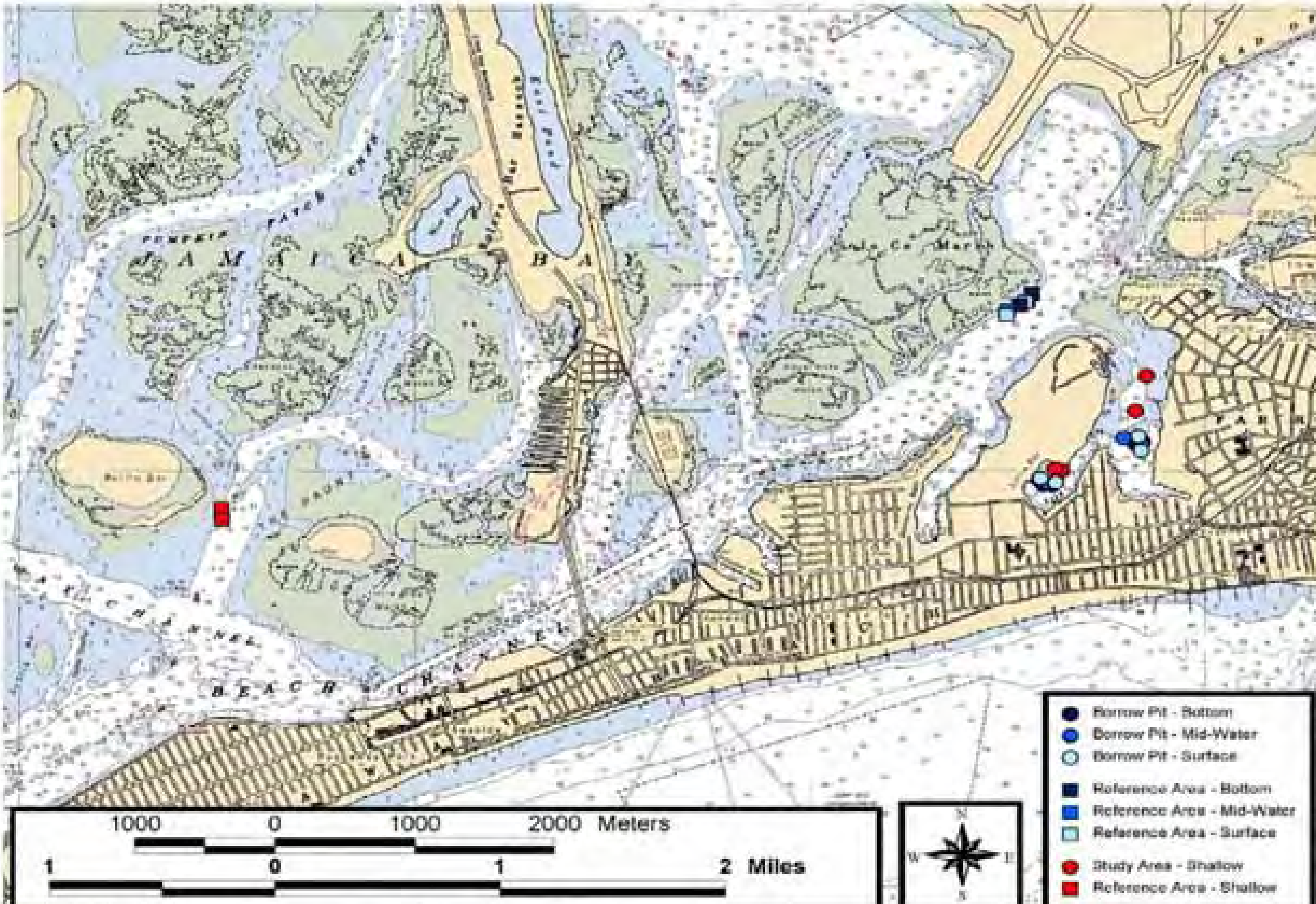


Figure 3.2.3 Locations of gill net sampling stations within Norton Basin study and reference areas, August 2002.

three trawls were pulled for a duration of 5 minutes in Norton Basin and three trawls were pulled for a duration of 10 minutes in each reference area (**Figure 3.3.1**). On June 24-26, 2002, five trawls were pulled for a duration of 6-9 minutes in Norton Basin, five trawls were pulled for a duration of 10 minutes in the Grass Hassock Channel reference area and four trawls were pulled for a duration of 2-10 minutes in the Raunt reference area (**Figure 3.3.2**). On August 12-14, 2002, five trawls were pulled for a duration of 8-9 minutes in Norton Basin and five trawls were pulled for a duration of 10 minutes in each reference area (**Figure 3.3.3**). All fish and macrocrustaceans captured in trawls were processed in the field. Captured organisms were identified to species, enumerated, weighed, measured (TL or carapace width), and released alive, if possible. CPUE was calculated by dividing fish and macrocrustacean biomass by trawl duration (in minutes).

3.4 Sediment Profile Imaging

3.4.1 Field Collection

In May 2002, a total of 199 SPI images were obtained from 100 stations, in the Norton Basin/Little Bay study area and throughout the reference areas (**Figure 3.4.1**). SPI images were taken with a Hulcher Model Minnie sediment profile camera equipped with a UW-Nikkor 35 mm lens (F/3.5, water-corrected) and loaded with Fujichrome 100P slide film. The profile camera was set to take two photographs at each station at 6 and 12 seconds after bottom contact. The weight of the camera frame was adjusted using detachable iron weights to account for differences in sediment type at various locations throughout the study and reference areas.

3.4.2 Image Analysis

The sediment profile photographs were analyzed visually by projecting the images and recording all features seen into a preformatted, standardized spreadsheet file. The images were then digitized using a Nikon Coolscan 2000 scanner and analyzed using Adobe PhotoShop and NTIS Image programs. Steps in the computer analysis of each image were standardized and followed the basic procedures in Viles and Diaz (1991). Data from each image were sequentially saved to a spreadsheet file for later analysis. Details of these analytical methods can be found in Diaz and Schaffner (1988) and Rhoads and Germano (1986), and in the standardized image analysis procedures of Viles and Diaz (1991).

3.4.3 SPI Parameters

3.4.3.1 Prism Penetration

This parameter provides a geotechnical estimate of sediment compaction with the profile camera prism acting as a dead weight penetrometer. Camera penetration is positively correlated with soft sediments, high water content for fine sediments, and poorer sorting coefficients for sandy sediments. Penetration is measured as the distance (in cm) that the sediment moved up the 23-cm height of the camera faceplate.

3.4.3.2 Surface Relief

Small scale surface relief or boundary roughness measured across the 15 cm width of the prism is the difference between the maximum and minimum distance sediment extends up the prism face plate. It is possible, by careful examination of the images, to determine the dominant processes responsible for surface relief, which assists in assessing benthic habitat characteristics.

3.4.3.3 Apparent Color Redox Potential Discontinuity (RPD) Layer

This parameter has been determined to be an important indicator of benthic habitat quality (Rhoads and Germano 1986, Diaz and Schaffner 1988) and provides an estimate of the depth to which

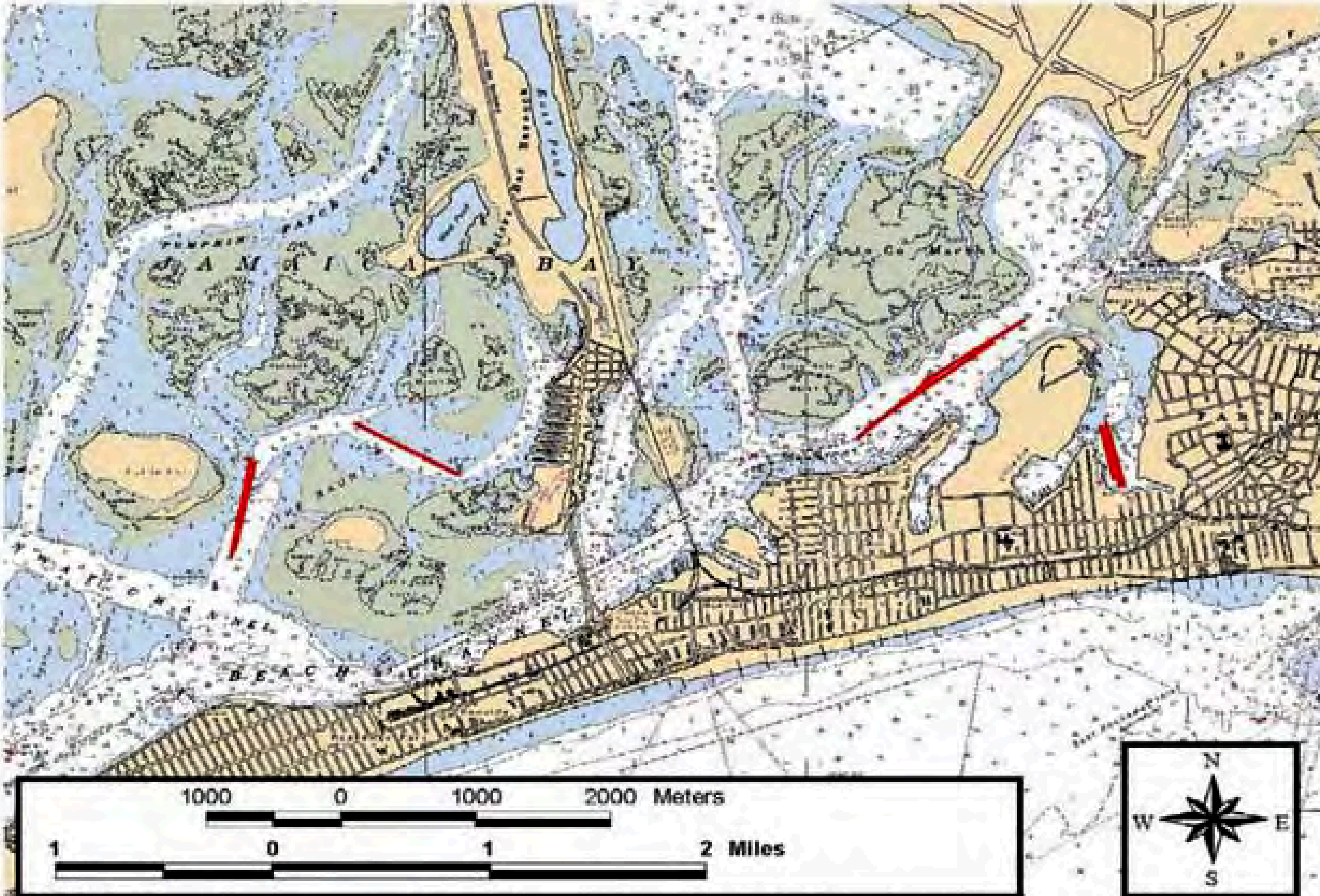


Figure 3.3.1 Locations of bottom trawl sampling lines within Norton Basin study and reference areas, May 2002.

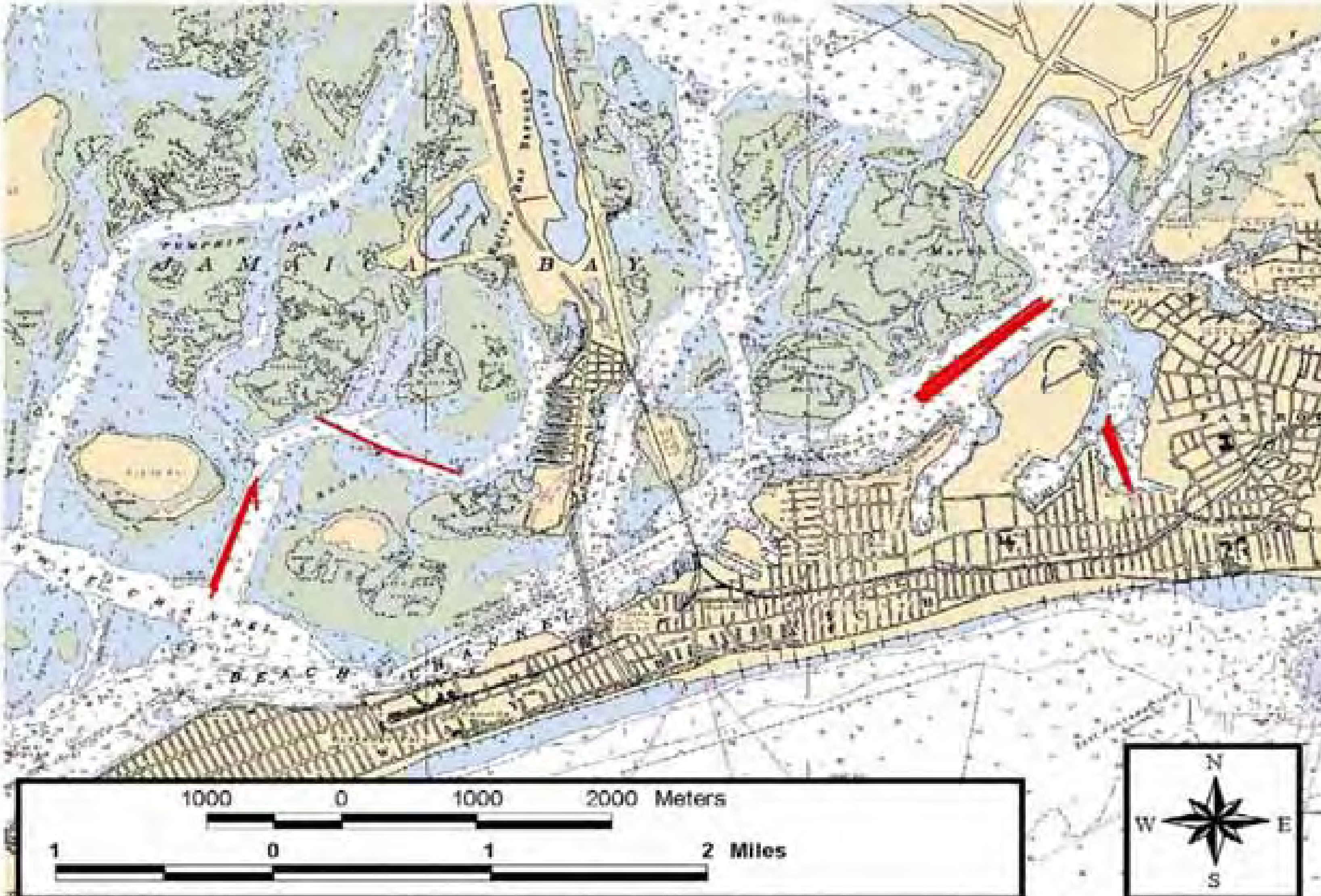


Figure 3.3.2 Locations of bottom trawl sampling lines within Norton Basin study and reference areas, June 2002.

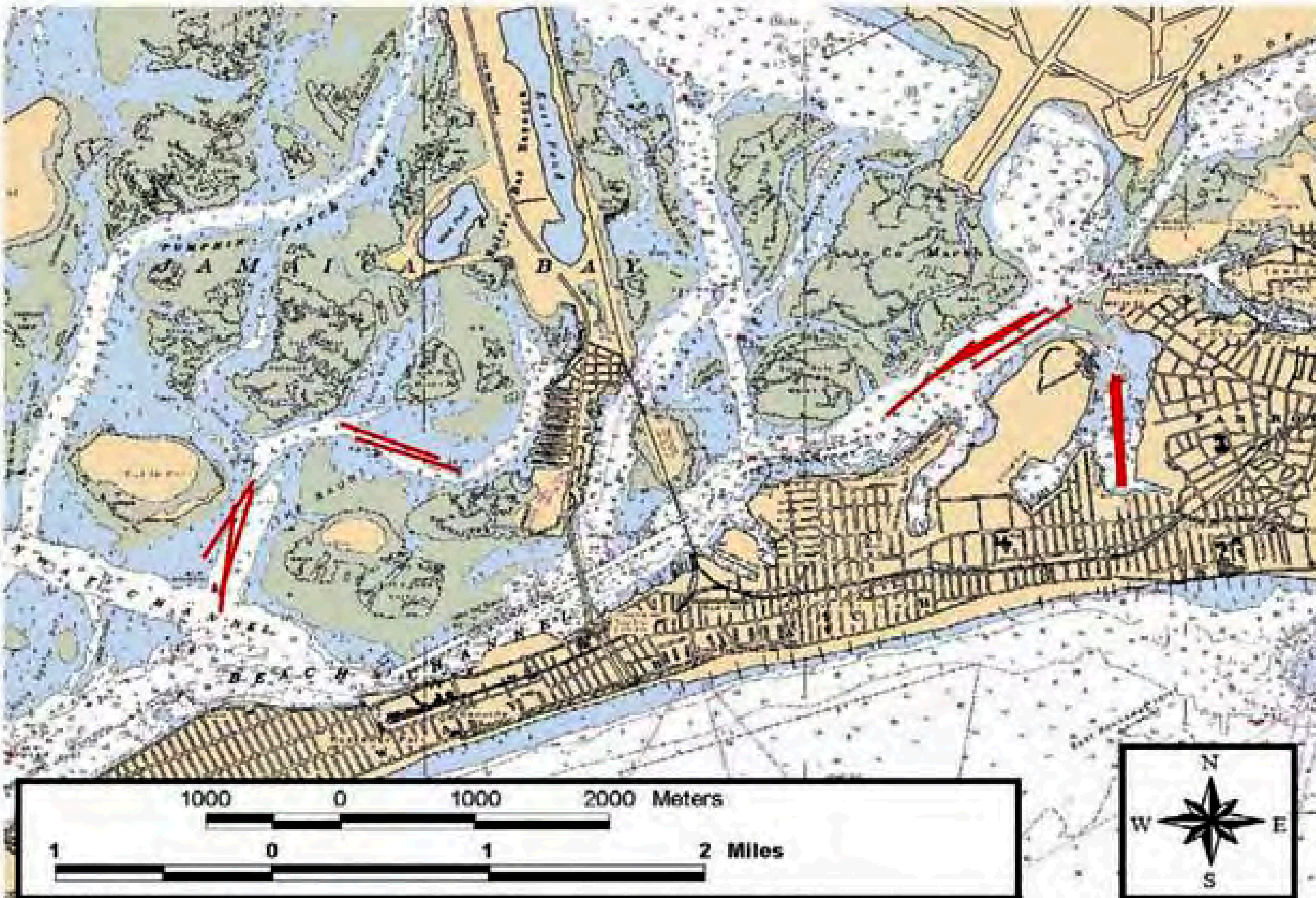


Figure 3.3.3 Locations of bottom trawl sampling lines within Norton Basin study and reference areas, August 2002.

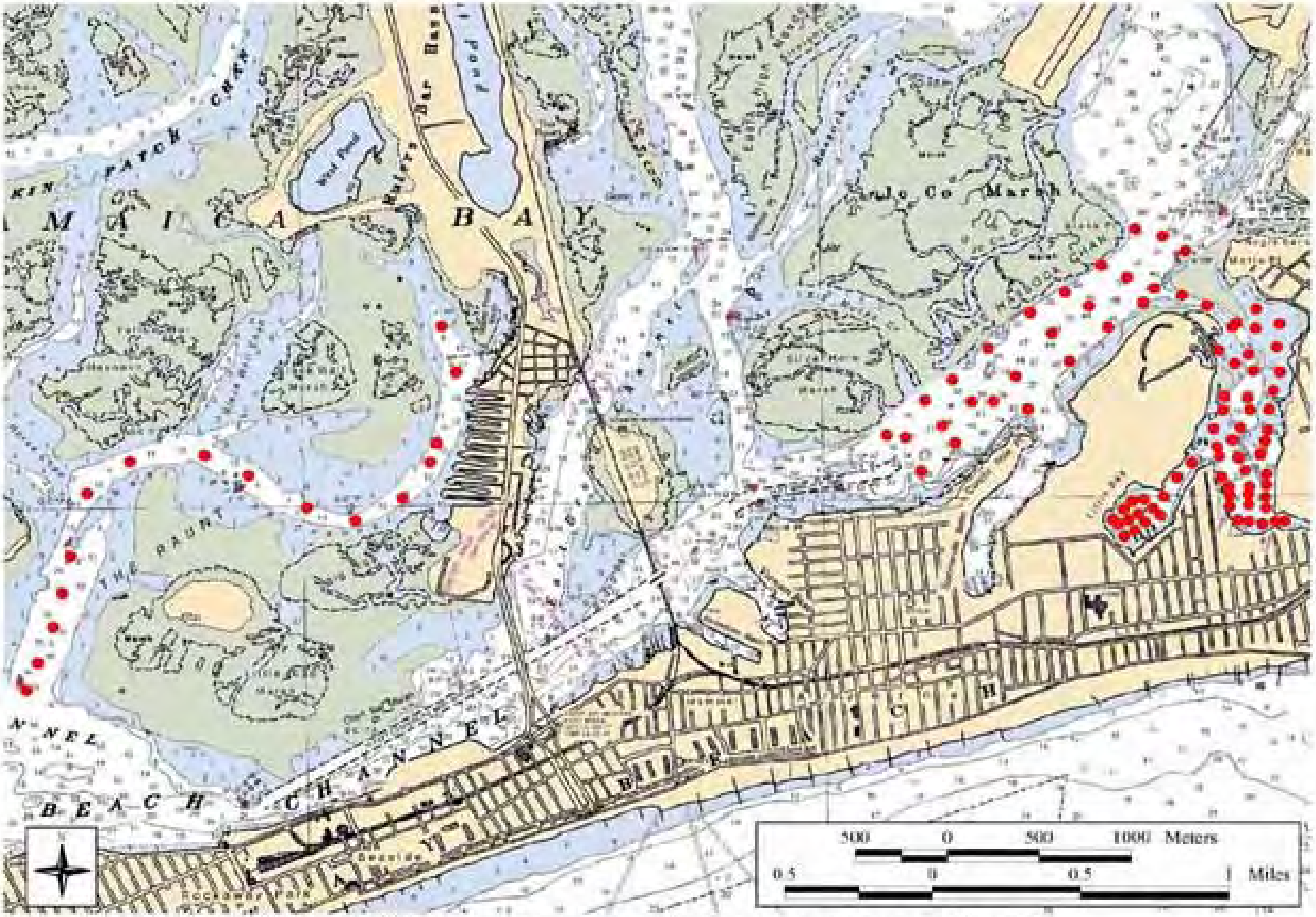


Figure 3.4.1 Sediment profile imagery (SPI) sample locations in Norton Basin study and reference areas, May 2002.

sediments appear to be oxidized. The term “apparent” is used in describing this parameter because no actual measurement is made of the redox potential. An assumption is made that, given the complexities of iron and sulfate reduction-oxidation chemistry, reddish-brown sediment color tones, (or in black and white images whiter or lighter areas of the image) are indications that the sediments are oxidized, or at least are not intensely reducing (Rhoads and Germano 1986, Diaz and Schaffner 1988). The depth of the apparent color RPD is defined as the area of all the pixels in the image discerned as being oxidized divided by the width of the digitized image. The area of the image with oxidized sediment is obtained by digitally manipulating the image to enhance characteristics associated with oxidized sediment (greenish-brown color tones). The enhanced area is then determined from a density slice of the image.

3.4.3.4 Sediment Grain Size

Grain size is an important parameter for determining the nature of the physical forces acting on a habitat and is a major factor in determining benthic community structure (Rhoads 1974). The sediment type descriptors used for image analysis follow the Wentworth classification as described in Folk (1980), and represent the major modal class for each image. Grain size is determined by comparison of collected images with a set of standard images for which mean grain size has been determined in the laboratory.

3.4.3.5 Surface Features

These parameters include a wide variety of features, each of which provides information on the type of habitat and its quality for supporting benthic species. The presence of certain surface features is indicative of the overall nature of a habitat. For example, bedforms are always associated with physically dominated habitats, whereas the presence of worm tubes or feeding pits is indicative of a more biologically accommodating habitat (Rhoads and Germano 1986, Diaz and Schaffner 1988). Surface features are visually evaluated from each image and compiled by type and frequency of occurrence.

3.4.3.6 Subsurface Features

These parameters include a wide variety of features and are used to characterize the physical and biological processes influencing the bottom. For example, the presence of methane gas voids has been found to be an indication of anaerobic metabolism associated with high rates of bacterial activity (Rhoads and Germano 1986). Muddy habitats with large amounts of methane gas are generally associated with areas of oxygen stress or high organic loading. Habitats with burrows, infaunal feeding voids, and/or actual infauna visible are generally considered "healthy" (Rhoads and Germano 1986, Diaz and Schaffner 1988, Valente et al. 1992). Surface features are visually evaluated from each slide and compiled by type and frequency of occurrence.

4.0 RESULTS

4.1 Benthic Macroinvertebrates

4.1.1 June, 2002 Community Composition

A total of 80,934 individuals, representing 127 taxa, were identified from the 90 grab samples collected at 30 stations within the Norton Basin/Little Bay study areas and reference areas in June of 2002. Arthropods were the most abundant taxa, representing 49.4% of the total assemblage. Annelids (marine worms) represented 48.3% of the total organisms. A list of all taxa is provided in **Appendix I-A**.

Polychaetes dominated the annelid community. The ubiquitous estuarine spionid polychaete *Streblospio benedicti* was well represented among samples, as was *Polydora cornuta*, *Mediomastis* spp., *Sabellaria vulgaris*, and *Capitella capitata*. Tubificid oligochaetes represented nearly two percent of the annelid community.

The arthropod community was dominated by amphipods, primarily *Ampelisca vadorum*, which accounted for nearly one-third of the total benthic macroinvertebrate community in June. Other amphipods present included *Monocorophium turberculatum*, *Microdeutopus gryllotalpa*, and *Unciola serrata*. Mud crabs (*Xanthidae*) and the ostracod *Parasterope pollex* were collected but represented only a minor component of the arthropod community.

Molluscs were a minor component of the benthic community (< 2%). The mollusc community included various bivalves and gastropods, most notably the mud snail *Ilyanassa obsoleta*. Proboscis worms, flatworms, peanut worms, tunicates, bryozoans, and brachiopods were present in some samples but accounted for < 0.5% of the total benthic community. The total number of macroinvertebrate taxa ranged from 0 (LB3, LB4, LB5, LB7, and LB8) to 56 (NB13) (**Figure 4.1.1.1; Figure 4.1.1.2; Appendix I-B**). The total number of individuals per station (composite of 3 grabs) ranged from 0 (LB3, LB4, LB5, LB7, and LB8) to 10,937 (NB14) (**Table 4.1.1.1**).

In the deep areas of Norton Basin (over 40 ft. deep), arthropods represented 70.8% of the total assemblage, annelids represented 27.6%, mollusks represented 1.6%, and flatworms and brachiopods represented < 1% (**Figure 4.1.1.3**). The dominant species was *A. vadorum*, representing 45.1% of the total assemblage. In the intermediate depth areas of Norton Basin (20-ft. to 35-ft. deep), annelids represented 54.6% of the total assemblage, arthropods represented 44.4%, mollusks represented 1.0%, and proboscis worms and bryozoans represented < 1% (**Figure 4.1.1.3**). The dominant species again was *A. vadorum*, representing 32.5% of the total assemblage.

At the Norton Basin Entrance Channel, annelids represented 76.2% of the total assemblage, arthropods represented 20.3%, and molluscs represented 3.3%. Proboscis worms and tunicates represented < 1%of the total assemblage (**Figure 4.1.1.4**). The dominant species again was *S. benedicti*, representing 18.7% of the total assemblage.

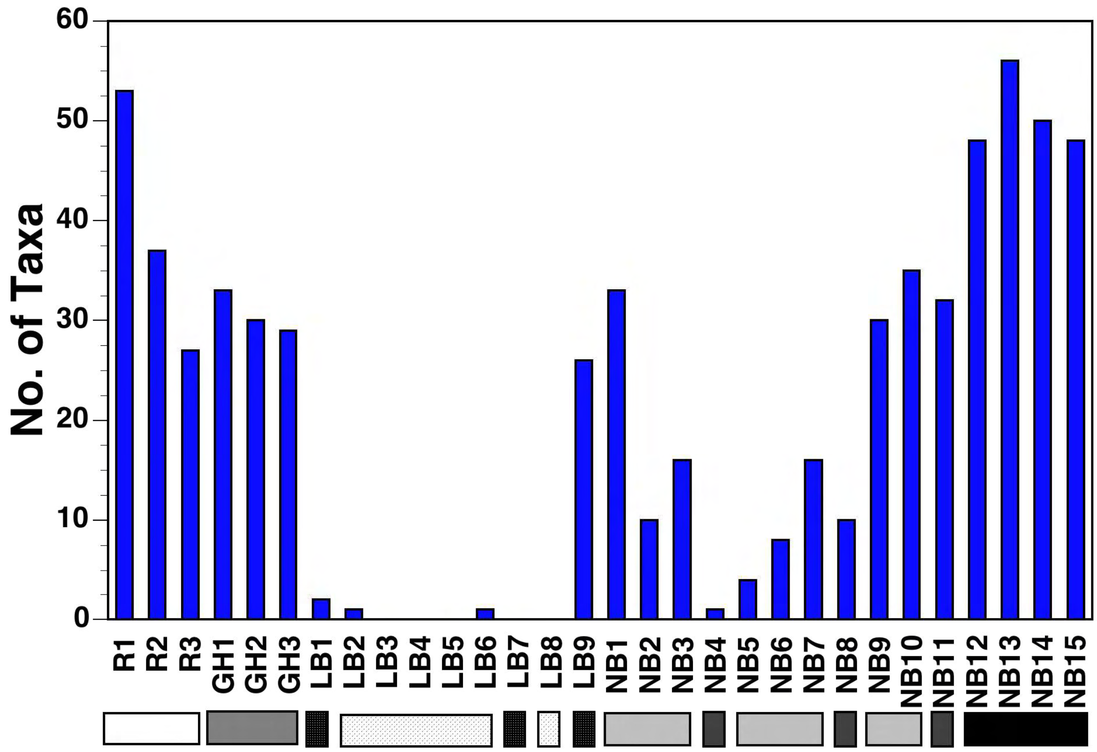
A total of two individuals were collected from the deep areas of Little Bay (over 40-ft. deep). One individual was an amphipod (*Gammarus mucronatus*), while the other was an annelid (*Enchytraeidae* spp.). In the intermediate depths of Little Bay (approx. 30-ft. deep), annelids represented 92.4% of the total assemblage, arthropods represented 4.1%, molluscs represented 3.3%, and bryozoans represented < 1% (**Figure 4.1.1.3**). The dominant species was *S. benedicti*, representing 57.9% of the total assemblage.

At the Grass Hassock Channel reference area, arthropods represented 87.4% of the total assemblage, while annelids represented 11.8%. Molluscs, proboscis worms, and peanut worms represented < 1% of the total assemblage (**Figure 4.1.1.4**). The dominant species was *A. vadorum*, representing 67.1% of the total assemblage.

At the Raunt reference area, arthropods represented 53.5% of the total assemblage, annelids represented 41.4%, molluscs represented 3.3%, and proboscis worms represented 1.8% of the total assemblage (**Figure 4.1.1.4**). The dominant species was *A. vadorum*, representing 29.2% of the total assemblage.

4.1.2 October, 2002 Community Composition

A total of 40,095 individuals, representing 109 taxa, were identified from the 90 grab samples collected at 30 stations within the Norton Basin/Little Bay study areas and reference areas in October of 2002. Annelids (marine worms) were the most abundant taxa, representing 69.7% of the



The Raunt..........R1 - R3
Grass Hassock Channel..........GH1 - GH3
Intermediate depth stations (approx. 30 ft.) in Little Bay.......... LB1, LB7, LB9
Deep stations (over 40 ft.) in Little Bay..........LB2 - LB6, LB8
Intermediate depth stations (20 ft. to 35 ft.) in Norton Basin.......... NB1 - NB3, NB5 - NB7, NB9, NB10
Deep stations (over 40 ft.) in Norton Basin..........NB4, NB8, NB11
Norton Basin entrance channel..........NB12 - NB15

Figure 4.1.1.1 Total number of benthic macroinvertebrate taxa, June 2002.

Figure 4.1.1.2 Total number of benthic macroinvertebrate taxa, June 2002.

Table 4.1.1.1 Community Parameters, Norton Basin study and reference area benthic stations, June 2002.

Station	Date (m/d/y)	Total No. Taxa	Total No. Individuals	Mean Density (No. m^{-2})	Density (Std Err)	H' Shannon (log e)	J' Pielou Evenness
R1	6/1/02	53	5023	41858.3	11206.6	2.20	0.56
R2	6/1/02	37	2659	22158.3	12038.3	1.72	0.48
R3	6/1/02	27	2499	20825.0	17206.7	1.62	0.49
GH1	6/1/02	33	8842	73683.3	36224.9	1.01	0.29
GH2	6/1/02	30	8386	69883.3	12596.6	1.25	0.37
GH3	6/1/02	29	2901	24175.0	8941.2	1.86	0.55
LB1	6/1/02	2	7	58.3	22.0	0.68	0.99
LB2	6/1/02	1	1	8.3	8.3	0.00	0.00
LB3	6/1/02	0	0	0.0	0.0	0.00	0.00
LB4	6/1/02	0	0	0.0	0.0	0.00	0.00
LB5	6/1/02	0	0	0.0	0.0	0.00	0.00
LB6	6/1/02	1	1	8.3	8.3	0.00	0.00
LB7	6/1/02	0	0	0.0	0.0	0.00	0.00
LB8	6/1/02	0	0	0.0	0.0	0.00	0.00
LB9	6/1/02	26	573	4775.0	3632.3	1.65	0.51
NB1	6/1/02	33	3945	32875.0	17147.3	2.01	0.58
NB2	6/1/02	10	923	7691.7	2273.5	0.34	0.15
NB3	6/1/02	16	1782	14850.0	4824.0	1.04	0.37
NB4	6/1/02	1	1	8.3	8.3	0.00	0.00
NB5	6/1/02	4	531	4425.0	398.7	0.45	0.32
NB6	6/1/02	8	1148	9566.7	1558.5	1.27	0.61
NB7	6/1/02	16	1751	14591.7	5306.2	1.34	0.48
NB8	6/1/02	10	380	3166.7	1665.2	1.31	0.57
NB9	6/1/02	30	2928	24400.0	10726.8	1.78	0.52
NB10	6/1/02	35	9264	77200.0	47495.9	1.57	0.44
NB11	6/1/02	32	2400	20000.0	11441.0	1.70	0.49
NB12	6/1/02	48	7496	62466.7	23463.3	1.97	0.51
NB13	6/1/02	56	3433	28608.3	9512.9	2.72	0.68
NB14	6/1/02	50	10937	91141.7	31473.5	2.62	0.67
NB15	6/1/02	48	3123	26025.0	12122.1	2.56	0.66

total assemblage. Arthropods represented 27.9% of the total organisms. A list of all taxa is provided in **Appendix I-C**. Polychaetes dominated the worm community. The ubiquitous estuarine spionid polychaete *S. benedicti* was well represented among samples, as was *Mediomastis* spp., *S. vulgaris*, and *C. capitata*. Tubificid oligochaetes represented 4.4% of the annelid community.

The arthropod community was dominated by amphipods, primarily *A. vadorum*, which accounted for nearly a quarter of the total benthic macroinvertebrate community during October. Other amphipods present included *Lysianopsis alba*, *Melita nitida*, and *M. tuberculatum*. Mud crabs (*Xanthidae*) were collected but represented only a minor component of the arthropod community.

Molluscs were a minor component of the benthic community (< 4%). The mollusc community included various bivalves and gastropods, most notably the mud snail *I. Obsoleta*. Proboscis worms, flatworms, hydrozoans, tunicates, horseshoe worms, and sponges were present in some samples, but only accounted for < 0.5% of the total benthic community. The total number of macroinvertebrate taxa ranged from 0 (LB6, LB7, LB8, NB3) to 52 (NB14) (**Table 4.1.2.1; Figure 4.1.2.1; Figure 4.1.2.2; Appendix I-D**).

In the deep areas of Norton Basin (over 40 ft deep), annelids represented 91.1% of the total assemblage, mollusks represented 7.9%, and arthropods represented 1.0% (**Figure 4.1.2.3**). The dominant species was *S. benedicti*, representing 47.8% of the total assemblage. In the intermediate depth areas of Norton Basin (20 ft. to 35 ft. deep), annelids represented 93.7% of the total assemblage, molluscs represented 5.0%, arthropods represented 1.3%, and flatworms represented < 1.0% (**Figure 4.1.2.3**). The dominant species again was *S. benedicti*, representing 62.8% of the total assemblage.

At the Norton Basin entrance channel, annelids represented 90.2% of the total assemblage, arthropods represented 6.0%, and molluscs represented 3.7%. Hydrozoans, flatworms, sponges, and tunicates represented < 1% (**Figure 4.1.2.4**). The dominant species was *S. benedicti*, representing 37.8% of the total assemblage.

A total of six individuals were collected from the deep areas of Little Bay (over 40 ft. deep). Three were molluscs (gastropods), two were annelids (polychaetes), and one was an arthropod (*Ampelisca* spp.) (**Figure 4.1.2.3**). In the intermediate depth areas of Little Bay (approximately 30 ft. deep), annelids represented 87.0% of the total assemblage, molluscs represented 8.7%, and arthropods represented 4.3% (**Figure 4.1.2.3**). The dominant species was *C. capitata*, representing 78.3% of the total assemblage.

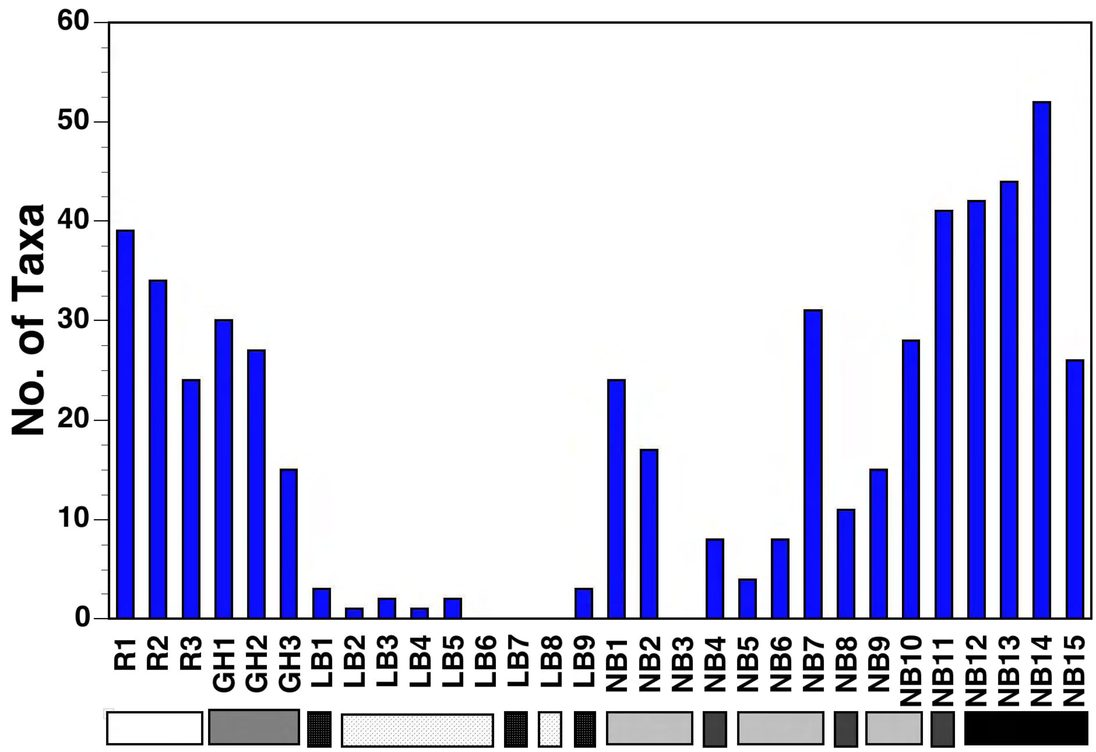
At the Grass Hassock Channel reference area, arthropods represented 62.3 % of the total assemblage, annelids represented 36.1 % and molluscs represented 1.5%. Proboscis worms and flatworms represented < 1 % of the total assemblage (**Figure 4.1.2.4**). The dominant species was *A. vadorum*, representing 37.8 % of the total assemblage.

At the Raunt reference area, annelids represented 90.5 % of the total, arthropods represented 5.7%, and molluscs represented 3.7 %. Proboscis worms and horseshoe worms represented < 1% of the total assemblage (**Figure 4.1.2.4**). The dominant species was *S. benedicti*, representing 67.3% of the total assemblage.

4.1.3 Abundance and Distribution

4.1.3.1 Total Macroinvertebrates

In June 2002, mean density of macroinvertebrates ranged from 0.0 ind. m^{-2} (LB3 - LB5, LB7 LB8) to 91,141.7 ind. m^{-2} (NB14). In October of 2002, mean density of macroinvertebrates ranged from 0.0 ind. m^{-2} (LB6 - LB8, NB3) to 46,241.7 ind. m^{-2} (GH2). Total macroinvertebrate density at the



The Raunt....................................R1 - R3

Grass Hassock Channel....................................GH1 - GH3

Intermediate depth stations (approx. 30 ft.) in Little Bay................ LB1, LB7, LB9

Deep stations (over 40 ft.) in Little Bay....................................LB2 - LB6, LB8

Intermediate depth stations (20 ft. to 35 ft.) in Norton Basin.......... NB1 - NB3, NB5 - NB7, NB9, NB10

Deep stations (over 40 ft.) in Norton Basin....................................NB4, NB8, NB11

Norton Basin entrance channel....................................NB12 - NB15

Figure 4.1.2.1 Total number of benthic macroinvertebrate taxa, October 2002.

Figure 4.1.2.2 Total number of benthic macroinvertebrate taxa, October 2002.

Table 4.1.2.1 Community Parameters, Norton Basin study and reference area benthic stations, October 2002.

Station	Date (m/d/y)	Total No. Taxa	Total No. Individuals	Mean Density (No. m^{-2})	Density (Std Err)	H' Shannon (log e)	J' Pielou Evenness
R1	10/10/02	39	2601	21675.0	1925.9	1.20	0.33
R2	10/10/02	34	3877	32308.3	12080.2	1.27	0.36
R3	10/10/02	24	2223	18525.0	2224.9	1.20	0.38
GH1	10/10/02	30	4692	39100.0	6445.4	1.46	0.43
GH2	10/10/02	27	5549	46241.7	6432.3	1.26	0.38
GH3	10/10/02	15	3460	28833.3	1257.4	0.67	0.25
LB1	10/10/02	3	3	25.0	0.0	1.10	1.00
LB2	10/10/02	1	1	8.3	8.3	0.00	0.00
LB3	10/10/02	2	2	16.7	16.7	0.69	1.00
LB4	10/10/02	1	1	8.3	8.3	0.00	0.00
LB5	10/10/02	2	2	16.7	8.3	0.69	1.00
LB6	10/10/02	0	0	0.0	0.0	0.00	0.00
LB7	10/10/02	0	0	0.0	0.0	0.00	0.00
LB8	10/10/02	0	0	0.0	0.0	0.00	0.00
LB9	10/10/02	3	20	166.7	96.1	0.39	0.36
NB1	10/10/02	24	1091	9091.7	2904.4	1.46	0.46
NB2	10/10/02	17	402	3350.0	3250.0	1.35	0.48
NB3	10/10/02	0	0	0	0.0	0.00	0.00
NB4	10/10/02	8	21	175.0	104.1	1.76	0.84
NB5	10/10/02	4	20	166.7	58.3	1.24	0.89
NB6	10/10/02	8	16	133.3	84.6	1.84	0.88
NB7	10/10/02	31	2843	23691.7	11286.4	1.14	0.33
NB8	10/10/02	11	159	1325.0	215.5	1.53	0.64
NB9	10/10/02	15	188	1566.7	423.9	1.69	0.62
NB10	10/10/02	28	633	5275.0	1081.2	1.73	0.52
NB11	10/10/02	41	1556	12966.7	1419.4	1.97	0.53
NB12	10/10/02	42	1673	13941.7	1879.2	1.93	0.52
NB13	10/10/02	44	2037	16975.0	1650.3	1.77	0.47
NB14	10/10/02	52	4795	39958.3	16035.9	2.76	0.70
NB15	10/10/02	26	2230	18583.3	8526.9	1.26	0.39

deep-water stations within Little Bay was significantly less than all other stations sampled in June. Total macroinvertebrate density at all the intermediate depth stations within Little Bay was significantly less than all other stations sampled in June with the exception of the Little Bay deep stations. Total macroinvertebrate density at the deep water stations within Norton Basin was significantly less than all other stations sampled in June with the exception of those located in Little Bay (ANOVA, p=0.0001) (**Figure 4.1.3.1.1, Figure 4.1.3.1.2**). There were no significant differences in total macroinvertebrate densities among the remaining stations during June (**Appendix I-E**). Although not significantly different from each other, total macroinvertebrate densities at the Little Bay deep water and intermediate depth stations were significantly less than all other stations sampled in October. Similarly, total macroinvertebrate densities at the Norton Basin deep water and intermediate depth stations were significantly less than all other stations sampled in October with the exception of the Little Bay stations (ANOVA, p=0.0001) (**Figure 4.1.3.1.1, Figure 4.1.3.1.3**). There were no significant differences in total macroinvertebrate densities among all remaining stations during October (**Appendix I-F**).

4.1.3.2 Annelids

In June of 2002, mean density of annelids ranged from 0.0 ind. m^{-2} (LB2 - LB5, LB7, LB8) to 22,538.9 ind. m^{-2} (NB14). In October of 2002, mean density of annelids ranged from 0.0 ind. m^{-2} (LB1, LB2, LB5 - NB8, NB3) to 10,963.9 ind. m^{-2} (NB14). Annelid density at the deep-water stations within Little Bay was significantly less than all other stations sampled in June; annelid density at the intermediate depth stations within Little Bay was significantly less than all other stations sampled in June with the exception of the Little Bay deep stations. Annelid density at the deep-water stations within Norton Basin was significantly less than all other stations sampled in June with the exception of those located in Little Bay. Annelid density at stations located in the Norton Basin entrance channel was significantly greater than all other stations sampled in June (ANOVA, p=0.0001) (**Figure 4.1.3.2.1**). There were no significant differences in annelid densities among all remaining stations during June (**Appendix I-E**). Although not significantly different from each other, annelid densities at the Little Bay deep-water and intermediate depth stations were significantly less than all other stations sampled in October. Similarly, annelid densities at the Norton Basin deep-water and intermediate depth stations were significantly less than all other stations sampled in October with the exception of the Little Bay stations (ANOVA, p=0.0001) (**Figure 4.1.3.2.1**). There were no significant differences in annelid densities among all remaining stations during October (**Appendix I-F**).

4.1.3.3 Arthropods

In June of 2002, mean density of arthropods ranged from 0.0 ind. m^{-2} (LB3 - LB8, NB4, NB6) to 22,133.3 ind. m^{-2} (GH1). In October of 2002, mean density of arthropods ranged from 0.0 ind. m^{-2} (LB3 - LB9, NB1 - NB3, NB5) to 8,988.9 ind. m^{-2} (GH2). Although not significantly different from each other, arthropod densities at the Little Bay deep water and intermediate-depth stations were significantly less than all other stations sampled in June. Arthropod density at the deep-water stations within Norton Basin was significantly less than stations in the Norton Basin entrance channel and both of the reference areas (Grass Hassock Channel and the Raunt). Arthropod density at the intermediate depth stations within Norton Basin was significantly less than stations located in the Norton Basin entrance channel and in the Grass Hassock Channel reference area. Arthropod density at stations located in the Grass Hassock Channel reference area was significantly greater than all other stations sampled in June (ANOVA, p=0.0001) (**Figure 4.1.3.3.1**). There were no significant differences in arthropod densities among all remaining stations during June (**Appendix I-E**). Although not significantly different from each other, arthropod densities at the Norton Basin and Little Bay deep-water and intermediate-depth stations were significantly less than all other stations sampled in October. Arthropod density at stations located in the Norton Basin entrance channel was significantly less than both reference areas (Grass Hassock Channel and the Raunt). Arthropod

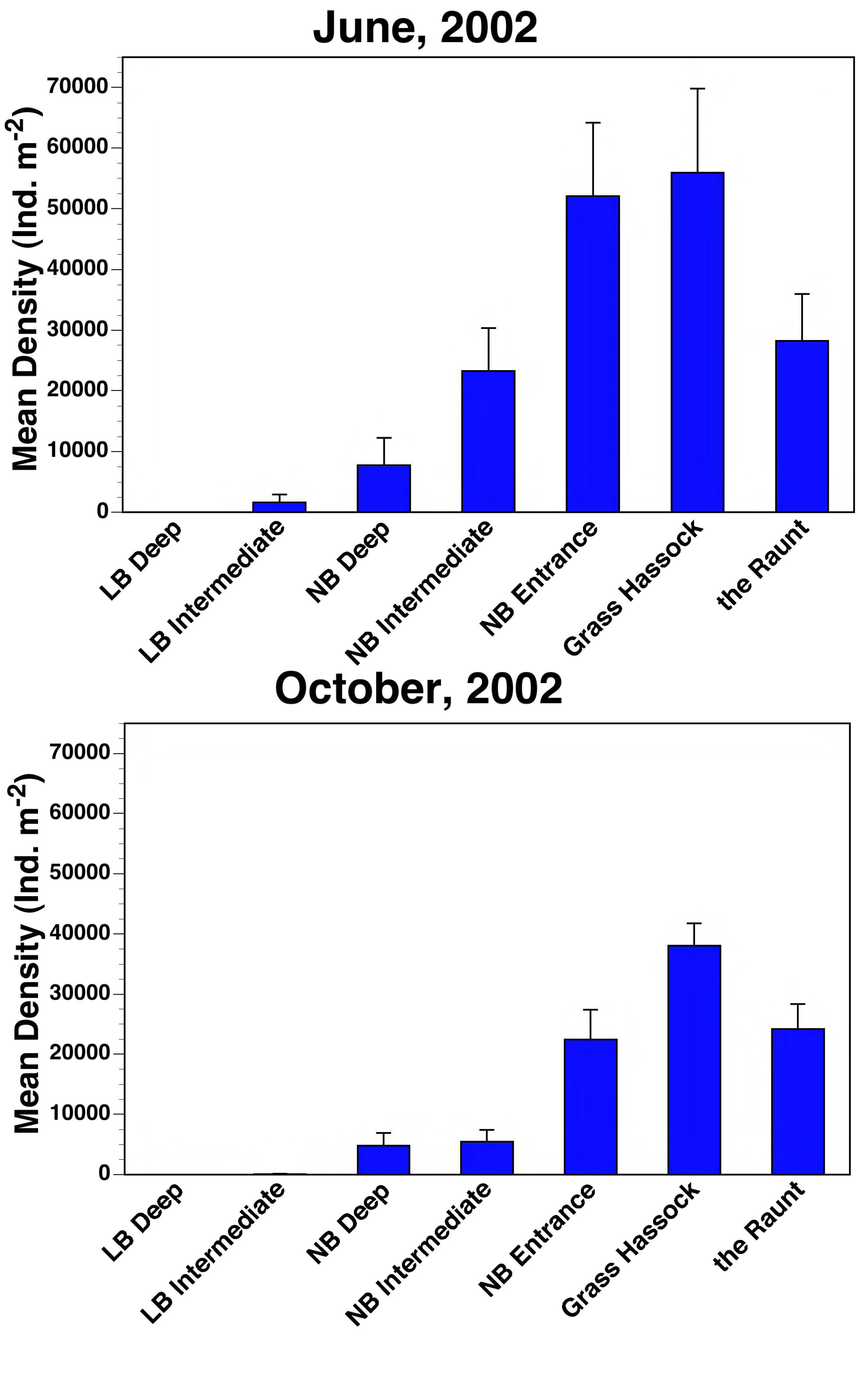


Figure 4.1.3.1.1 Total macroinvertebrate density (ind. m^{-2}), Norton Basin study and reference areas, June and October 2002.

Figure 4.1.3.1.2 Total macroinvertebrate density (ind. m^{-2}), Norton Basin study and reference areas, June 2002.

Figure 4.1.3.1.3 Total macroinvertebrate density (ind. m^{-2}), Norton Basin study and reference areas, October 2002.

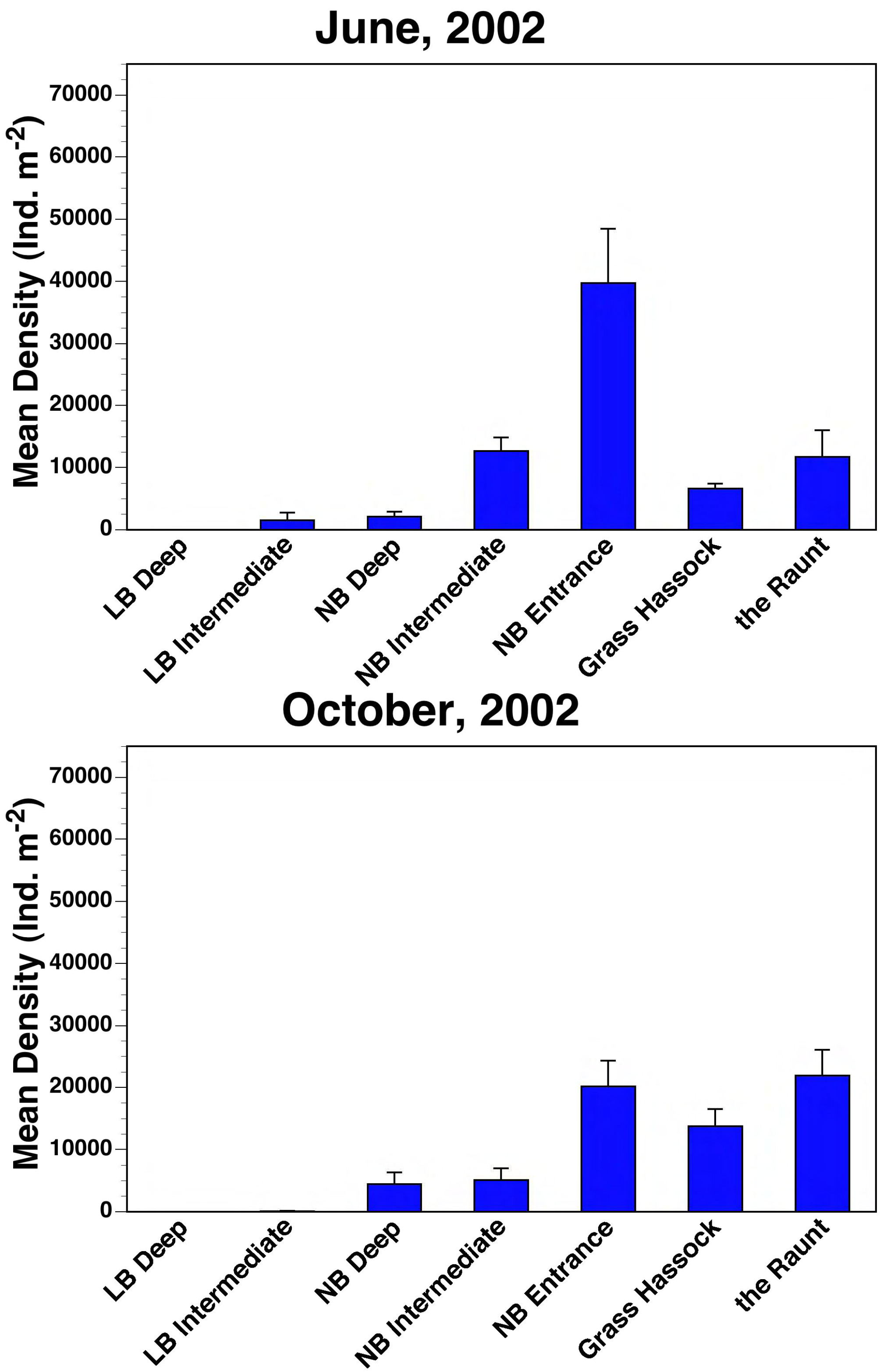


Figure 4.1.3.2.1 Annelid density (ind. m^{-2}), Norton Basin study and reference areas, June and October 2002.

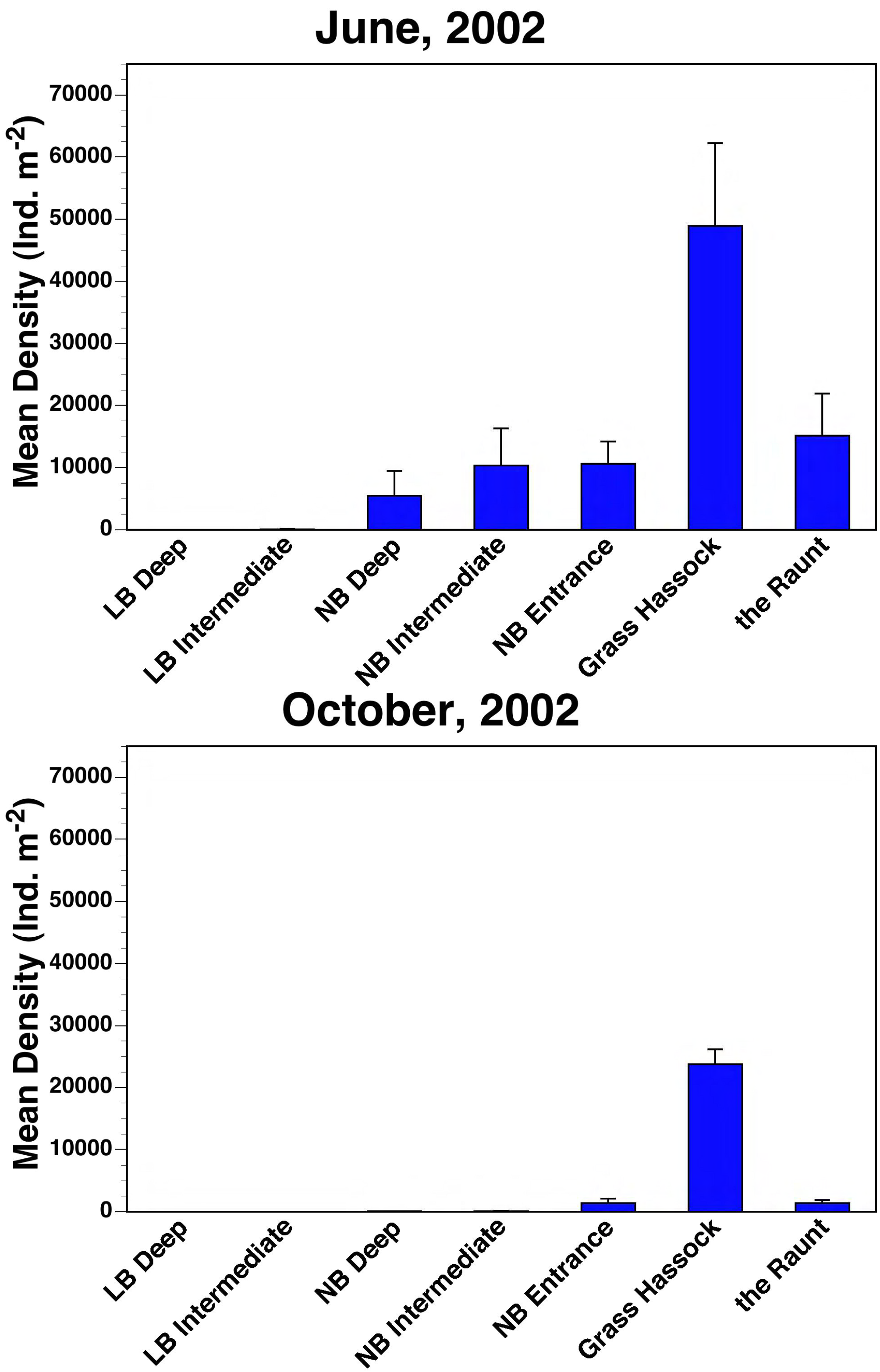


Figure 4.1.3.3.1 Arthropod density (ind. m^{-2}), Norton Basin study and reference areas, June and October 2002.

density at stations located within the Raunt reference area was significantly less than the deeper Grass Hassock Channel reference area (ANOVA, p=0.0001) (**Figure 4.1.3.3.1**).

4.2 Gill Net Sampling

4.2.1 May, 2002

Gill net collections from the bottom of Norton Basin during May (18 to 20 hrs duration, n=2) yielded 256 individuals representing 6 species (**Table 4.2.1.1**). The dominant species was striped searobin (*Prionotus evolans*). Gill nets deployed at mid-depth in Norton Basin (20 to 21 hrs duration, n=2) yielded 85 individuals representing 3 species (**Table 4.2.1.1**). The dominant species again was striped searobin. Gill nets deployed at the surface of Norton Basin (20 to 22 hrs duration, n=2) yielded 98 individuals representing 3 species (**Table 4.2.1.1**). The dominant species was Atlantic menhaden (*Brevoortia tyrannus*). Gill net collections from the shallow areas of Norton Basin (18 to 20 hrs duration, n=4) yielded 359 individuals representing 10 species (**Table 4.2.1.1**). The dominant species was striped searobin. Throughout the May gill net sampling in Norton Basin, the dominant species was striped searobin, representing 75.2% of the total collection. Atlantic menhaden represented 18.3%, and all other species represented less than 5% (**Figure 4.2.1.1**).

Gill net collections from the bottom of Little Bay during May (16 to 24 hours duration, n=4) yielded no fish (**Table 4.2.1.2**). Gill nets deployed at mid-depth in Little Bay (16 to 24 hrs duration, n=4) yielded 26 individuals representing 2 species (**Table 4.2.1.2**). The dominant species was the Atlantic menhaden. Gill nets deployed at the surface of Little Bay (17 to 23 hours duration, n=4) yielded 178 individuals representing 5 species (**Table 4.2.1.2**). The dominant species again was Atlantic menhaden. Gill nets deployed from the shallow areas of Little Bay (17 to 24 hrs duration, n=4) yielded 271 individuals representing 7 species (**Table 4.2.1.2**). The dominant species was the striped searobin. Throughout the May gill net sampling in Little Bay, the dominant species was Atlantic menhaden representing 51.3% of the total collection. Striped searobin represented 39.1%, Atlantic horseshoe crab (*Limulus polyphemus*) represented 5.4%, and all other species represented less than 5% (**Figure 4.2.1.1**).

Gill net collections from the bottom of the Grass Hassock Channel during May (5.5 hrs duration, n=2) yielded 33 individuals representing 6 species (**Table 4.2.1.3**). The dominant species was striped searobin. CPUE at the bottom of Grass Hassock Channel (6400.0 g/hr) was greater than at the bottom of Norton Basin (3115.4 g/hr) or the bottom of Little Bay (0.0 g/hr). Gill nets deployed at mid-depth in Grass Hassock Channel (6.5 hrs duration, n=2) yielded 110 individuals representing 4 species (**Table 4.2.1.3**). The dominant species was Atlantic menhaden. CPUE at mid-depth in Grass Hassock Channel (4037.6 g/hr) was greater than at mid-depth in Norton Basin (898.5 g/hr) or at mid-depth in Little Bay (140.5 g/hr). Gill net collections from the surface of Grass Hassock Channel (6.5 hrs duration, n=2) yielded 42 individuals representing 2 species (**Table 4.2.1.3**). The species again was Atlantic menhaden. Mean CPUE at the surface of Grass Hassock Channel (1597.8 g/hr) was greater than at the surface of Norton Basin (900.6 g/hr) or the surface of Little Bay (768.7 g/hr). Throughout the May gill net sampling in Grass Hassock Channel, the dominant species was Atlantic menhaden representing 54.7% of the total collection. Striped searobin represented 40.9%, and all other species represented less than 5% (**Figure 4.2.1.1**).

Gill nets deployed at the bottom of the Raunt during May (7.3 hrs duration, n=2) yielded 32 individuals representing 12 species (**Table 4.2.1.4**). The dominant species in the Raunt were the Atlantic horseshoe crab and the striped searobin. CPUE in the shallow areas of the Raunt (1676.7 g/hr) was slightly lower than in the shallow areas of Norton Basin (1767.6 g/hr) but slightly greater than at the shallow areas of Little Bay (1669.7 g/hr). Throughout the May gill net sampling in the Raunt, the dominant species was Atlantic horseshoe crab representing 30.3% of the total collection. Striped searobin represented 24.2%: striped bass (*Morone saxatilis*); summer flounder (*Paralichthys*

Table 4.2.1.1 Total abundance, mean CPUE (biomass in g/hr), and total length range of fish and macrocrustaceans collected in gill nets from Norton Basin, May 2002.

Norton Basin, Bottom (n=2)
Duration of set: 18 to 20 hrs

Scientific Name	Common Name	Total Abund.	Mean CPUE (g/hr)	TL Range (mm)
Prionotus evolans	Striped Searobin	232	2520.62	240-430
Brevoortia tyrannus	Atlantic Menhaden	8	114.61	330-370
Libinia emarginata	Common Spider Crab	6	352.59	65-80
Tautoga onitis	Tautog	5	46.89	210-290
Morone saxatilis	Striped Bass	4	10.18	170-250
Raja eglanteria	Clearnose Skate	1	70.49	720
Total:		256	3115.39	65-720

Norton Basin, Mid-Depth (n=2)
Duration of set: 20 to 21 hrs

Scientific Name	Common Name	Total Abund.	Mean CPUE (g/hr)	TL Range (mm)
Prionotus evolans	Striped Searobin	61	697.34	220-390
Brevoortia tyrannus	Atlantic Menhaden	23	197.72	300-380
Libinia emarginata	Common Spider Crab	1	3.44	70
Total:		85	898.50	70-390

Norton Basin, Surface (n=2)
Duration of set: 20 to 22 hrs

Scientific Name	Common Name	Total Abund.	Mean CPUE (g/hr)	TL Range (mm)
Brevoortia tyrannus	Atlantic Menhaden	84	748.76	**270-380**
Prionotus evolans	Striped Searobin	13	151.82	310-400
Morone saxatilis	Striped Bass	1	n/a	n/a
Total:		98	900.57	270-400

Norton Basin, Shallow Area (n=4)
Duration of set: 18 to 20 hrs

Scientific Name	Common Name	Total Abund.	Mean CPUE (g/hr)	TL Range (mm)
Prionotus evolans	Striped Searobin	294	1457.10	230-460
Brevoortia tyrannus	Atlantic Menhaden	31	174.32	300-390
Morone saxatilis	Striped Bass	9	11.35	125-265
Limulus polyphemus	Atlantic Horseshoe Crab	7	64.93	185-255
Libinia emarginata	Common Spider Crab	8	12.55	60-110
Tautoga onitis	Tautog	3	12.66	220-330
Callinectes sapidus	Blue Crab	4	7.64	110-150
Cynoscion regalis	Weakfish	1	24.78	660
Stenotomus chrysops	Scup	1	2.18	210
Alosa pseudoharengus	Alewife	1	0.11	115
Total:		359	1767.64	60-660

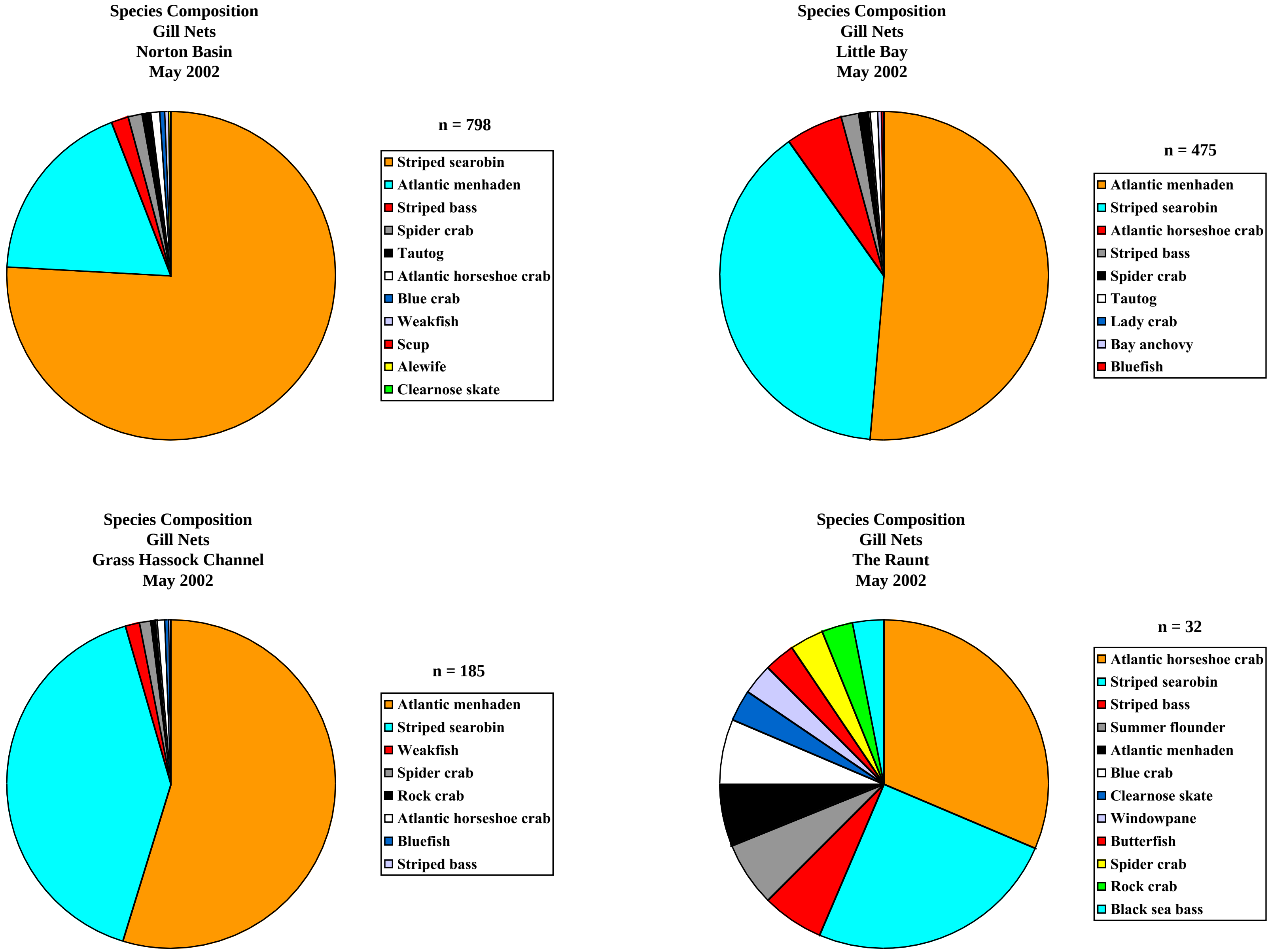


Figure 4.2.1.1 Species composition from gill net sampling efforts, May 2002.

Table 4.2.1.2 Total abundance, mean CPUE (biomass in g/hr), and total length range of fish and macrocrustaceans collected in gill nets from Little Bay, May 2002.

Little Bay, Bottom (n=4)
Duration of set: 16 to 24 hrs

Scientific Name	Common Name	Total Abund.	Mean CPUE (g/hr)	TL Range (mm)
Total:		0	0.00	0

Little Bay, Mid-Depth (n=4)
Duration of set: 16 to 24 hrs

Scientific Name	Common Name	Total Abund.	Mean CPUE (g/hr)	TL Range (mm)
Brevoortia tyrannus	Atlantic Menhaden	24	131.28	275-370
Prionotus evolans	Striped Searobin	2	9.25	240-310
Total:		26	140.54	240-370

Little Bay, Surface (n=4)
Duration of set: 17 to 23 hrs

Scientific Name	Common Name	Total Abund.	Mean CPUE (g/hr)	TL Range (mm)
Brevoortia tyrannus	Atlantic Menhaden	165	707.65	170-380
Prionotus evolans	Striped Searobin	13	51.61	300-380
Pomatomus saltatrix	Bluefish	1	7.18	430
Morone saxatilis	Striped Bass	1	1.68	220
Anchoa mitchilli	Bay Anchovy	1	0.57	70
Total:		178	768.68	70-430

Little Bay, Shallow Area (n=4)
Duration of set: 17 to 24 hrs

Scientific Name	Common Name	Total Abund.	Mean CPUE (g/hr)	TL Range (mm)
Prionotus evolans	Striped Searobin	172	879.12	245-450
Brevoortia tyrannus	Atlantic Menhaden	56	327.58	280-385
Limulus polyphemus	Atlantic Horseshoe Crab	26	410.49	175-270
Morone saxatilis	Striped Bass	7	26.01	110-260
Libinia emarginata	Common Spider Crab	6	11.67	45-80
Tautoga onitis	Tautog	3	14.41	160-345
Ovalipes ocellatus	Lady Crab	1	0.37	40
Total:		271	1669.65	40-450

Table 4.2.1.3 Total abundance, mean CPUE (biomass in g/hr), and total length range of fish and macrocrustaceans collected in gill nets from Grass Hassock Channel, May 2002.

Grass Hassock Channel, Bottom (n=2)
Duration of set: 5.5 hrs

Scientific Name	Common Name	Total Abund.	Mean CPUE (g/hr)	TL Range (mm)
Prionotus evolans	Striped Searobin	112	4504.50	240-405
Brevoortia tyrannus	Atlantic Menhaden	25	1328.83	340-390
Cynoscion regalis	Weakfish	3	180.18	380-405
Libinia emarginata	Common Spider Crab	3	58.56	70-90
Cancer irroratus	Rock Crab	2	41.44	80-120
Morone saxatilis	Striped Bass	1	286.49	680
Total:		33	6400.00	70-680

Grass Hassock Channel, Mid-Depth (n=2)
Duration of set: 6.5 hrs

Scientific Name	Common Name	Total Abund.	Mean CPUE (g/hr)	TL Range (mm)
Brevoortia tyrannus	Atlantic Menhaden	97	3471.20	310-405
Prionotus evolans	Striped Searobin	10	367.20	250-360
Limulus polyphemus	Atlantic Horseshoe Crab	2	136.00	185-190
Cynoscion regalis	Weakfish	1	63.20	410
Total:		110	4037.60	185-410

Grass Hassock Channel, Surface (n=2)
Duration of set: 6.5 hrs

Scientific Name	Common Name	Total Abund.	Mean CPUE (g/hr)	TL Range (mm)
Brevoortia tyrannus	Atlantic Menhaden	41	1522.60	295-395
Pomatomus saltatrix	Bluefish	1	75.20	445
Total:		42	1597.80	295-445

Table 4.2.1.4 Total abundance, mean CPUE (biomass in g/hr), and total length range of fish and macrocrustaceans collected in gill nets from the Raunt, May 2002.

The Raunt, Shallow Area (n=2)
Duration of set: 7.3 hrs

Scientific Name	Common Name	Total Abund.	Mean CPUE (g/hr)	TL Range (mm)
Limulus polyphemus	Atlantic Horseshoe Crab	10	753.42	175-260
Prionotus evolans	Striped Searobin	8	256.85	260-350
Morone saxatilis	Striped Bass	2	271.23	230-710
Paralichthys dentatus	Summer Flounder	2	154.11	370-530
Brevoortia tyrannus	Atlantic Menhaden	2	61.64	300-340
Callinectes sapidus	Blue Crab	2	27.40	50-150
Raja eglanteria	Clearnose Skate	1	102.74	630
Scopthalmus aquosus	Windowpane	1	19.18	260
Libinia emarginata	Butterfish	1	11.64	240
Libinia emarginata	Common Spider Crab	1	8.90	60
Cancer irroratus	Rock Crab	1	7.53	80
Centropristis striata	Black Sea Bass	1	2.05	80
Total:		32	1676.71	50-710

dentatus); Atlantic menhaden; and blue crab (*Callinectes sapidus*) each represented 6.1%; and all other species represented less than 5% (**Figure 4.2.1.1**).

4.2.2. June, 2002

Gill net collections from the bottom of Norton Basin during June (7 hrs duration, n=2) yielded 65 individuals representing 4 species (**Table 4.2.2.1**). The dominant species was striped searobin. Gill net collections at mid-depth in Norton Basin (7 hrs duration, n=2) yielded 16 individuals representing 2 species (**Table 4.2.2.1**). The dominant species was Atlantic menhaden. Gill nets deployed at the surface of Norton Basin (7 hrs duration, n=2) yielded 6 individuals representing 3 species (**Table 4.2.2.1**). The dominant species was blue crab. Gill net collections from the shallow areas of Norton Basin (7 to 8 hrs duration, n=4) yielded 119 individuals representing 7 species (**Table 4.2.2.1**). The dominant species was striped searobin. Throughout the June gill net sampling in Norton Basin, the dominant species was striped searobin representing 63.1% of the total collection. Atlantic menhaden represented 12.6%, blue crab represented 11.7%, bluefish (*Pomatomus saltatrix*) represented 6.3%, and all other species represented less than 5% (**Figure 4.2.2.1**).

Gill net collections from the bottom, mid-depth, and surface of Little Bay during June (7-8 hrs duration, n=2) yielded no fish (**Table 4.2.2.2**). Gill net collections from the shallow areas of Little Bay (6 to 6.5 hrs duration, n=2) yielded a total of 9 individuals, all of which were striped searobin.

Gill nets deployed on the bottom of the Grass Hassock Channel during June (6 hrs duration, n=2) yielded 94 individuals representing 6 species (**Table 4.2.2.3**). The dominant species was striped searobin. Mean CPUE at the bottom of the Grass Hassock Channel (2524.2 g/hr) was greater than at the bottom of Norton Basin (1913.2 g/hr) or the bottom of Little Bay (0.0 g/hr). Gill net collections at mid-depth in Grass Hassock Channel (6.5 hrs duration, n=2) yielded 8 individuals representing 3 species (**Table 4.2.2.3**). The dominant species was bluefish. Mean CPUE at mid-depth in Grass Hassock Channel (227.6 g/hr) was lower than that observed at mid-depth in Norton Basin (635.7 g/hr) but greater than at mid-depth in Little Bay (0.0 g/hr). Gill nets deployed from the surface of the Grass Hassock Channel during June (6.5 hrs duration, n=2) yielded 21 individuals representing 4 species (**Table 4.2.2.3**). The dominant species again was bluefish. Mean CPUE at the surface of Grass Hassock Channel (562.5 g/hr) was greater than at the surface of Norton Basin (185.7 g/hr) or at the surface of Little Bay (0.0 g/hr). Throughout the June gill net sampling in Grass Hassock Channel, the dominant species was striped searobin, which represented 56.9% of the total collection. Bluefish represented 17.1%, blue crab represented 14.6%, Atlantic menhaden represented 7.3% and all other species represented less than 5 % (**Figure 4.2.2.1**).

Gill nets deployed at the bottom of the Raunt during June (4.5 hrs duration, n=2) yielded 125 individuals representing 9 species (**Table 4.2.2.4**). The dominant species in the Raunt was lady crab (*Ovalipes ocellatus*). Mean CPUE at the shallow areas of the Raunt (2800.6 g/hr) was markedly greater than at the shallow areas of Norton Basin (1522.8 g/hr) or the shallow areas of Little Bay (325.2 g/hr). Throughout the June gill net sampling in the Raunt, the dominant species was lady crab representing 58.4% of the total collection. Common spider crab (*Libinia emarginata*) represented 15.2%, striped searobin represented 9.6%, blue crab represented 7.2%, Atlantic horseshoe crab represented 6.4%, and all other species represented less than 5% (**Figure 4.2.2.1**).

4.2.3. August, 2002

Gill net collections from the bottom of Norton Basin during August (5.5 hrs duration, n=2) yielded 23 individuals representing 7 species (**Table 4.2.3.1**). The dominant species was searobin. Gill nets deployed at mid-depth in Norton Basin (5.5 hrs duration, n=2) 1 Atlantic menhaden (**Table 4.2.3.1**). Gill nets deployed at the surface of Norton Basin (5 to 5.5 hrs duration, n=2) yielded 2 blue crabs and 1 Atlantic menhaden (**Table 4.2.3.1**). Gill net collections from the shallow areas of Norton Basin (5.5 to 6 hrs duration, n=4) yielded 19 individuals representing 6 species (**Table 4.2.3.1**). The

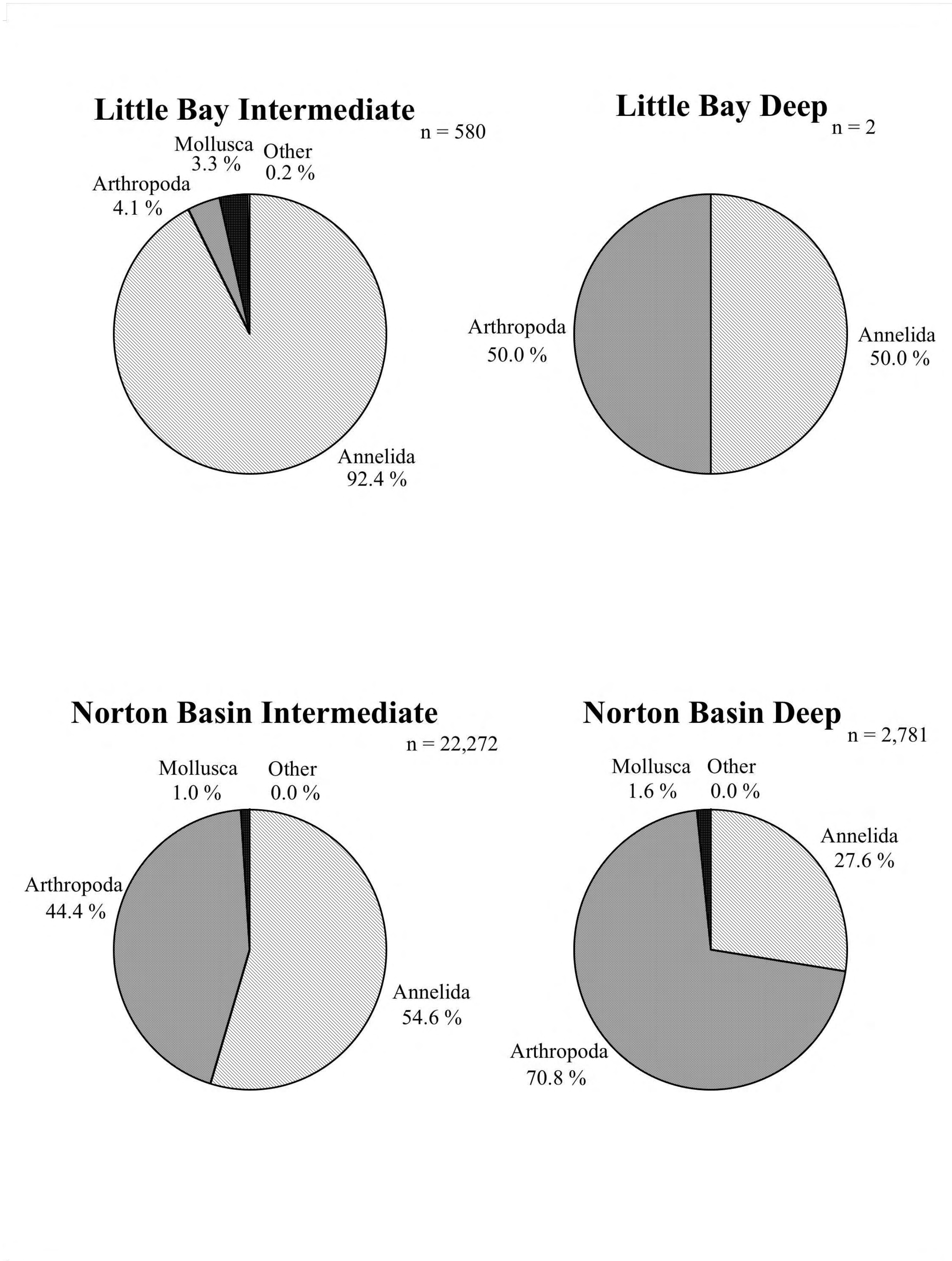


Figure 4.1.1.3 Benthic community composition, Norton Basin and Little Bay deep and intermediate depth study areas, June 2002.

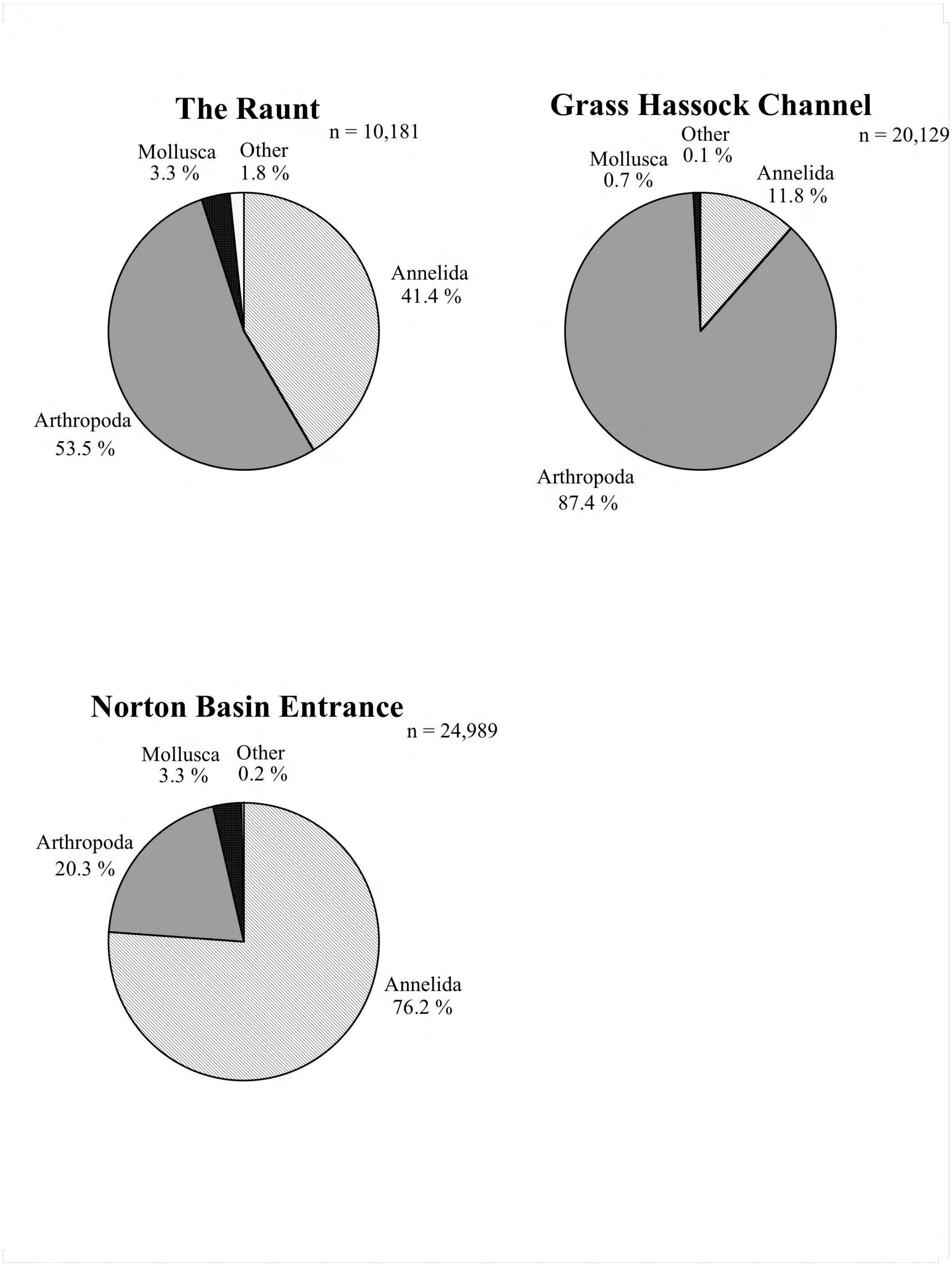


Figure 4.1.1.4 Benthic community composition, Norton Basin entrance channel, Grass Hassock channel, and the Raunt reference areas, June 2002.

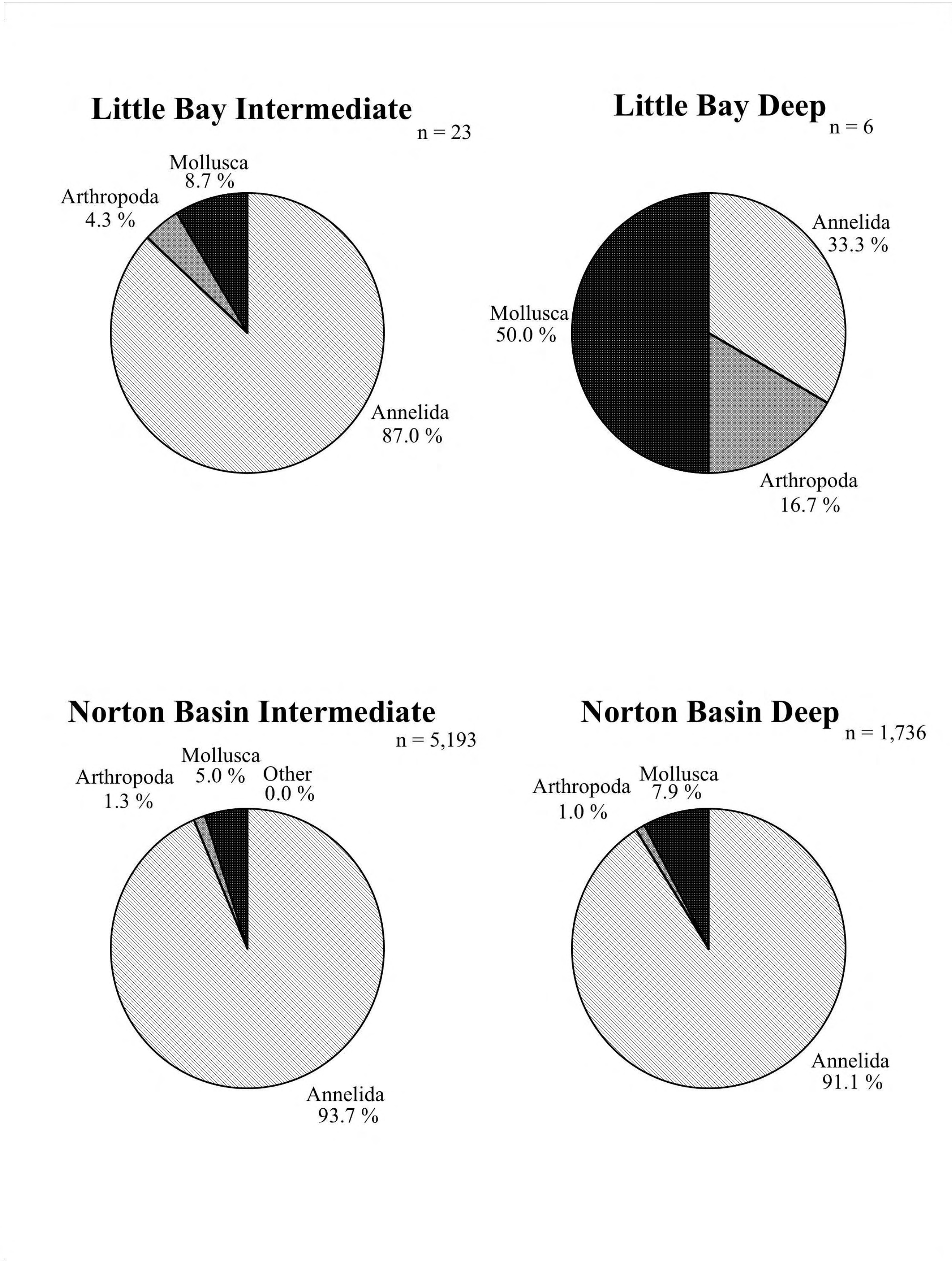


Figure 4.1.2.3 Benthic community composition, Norton Basin and Little Bay deep and intermediate depth study areas, October 2002.

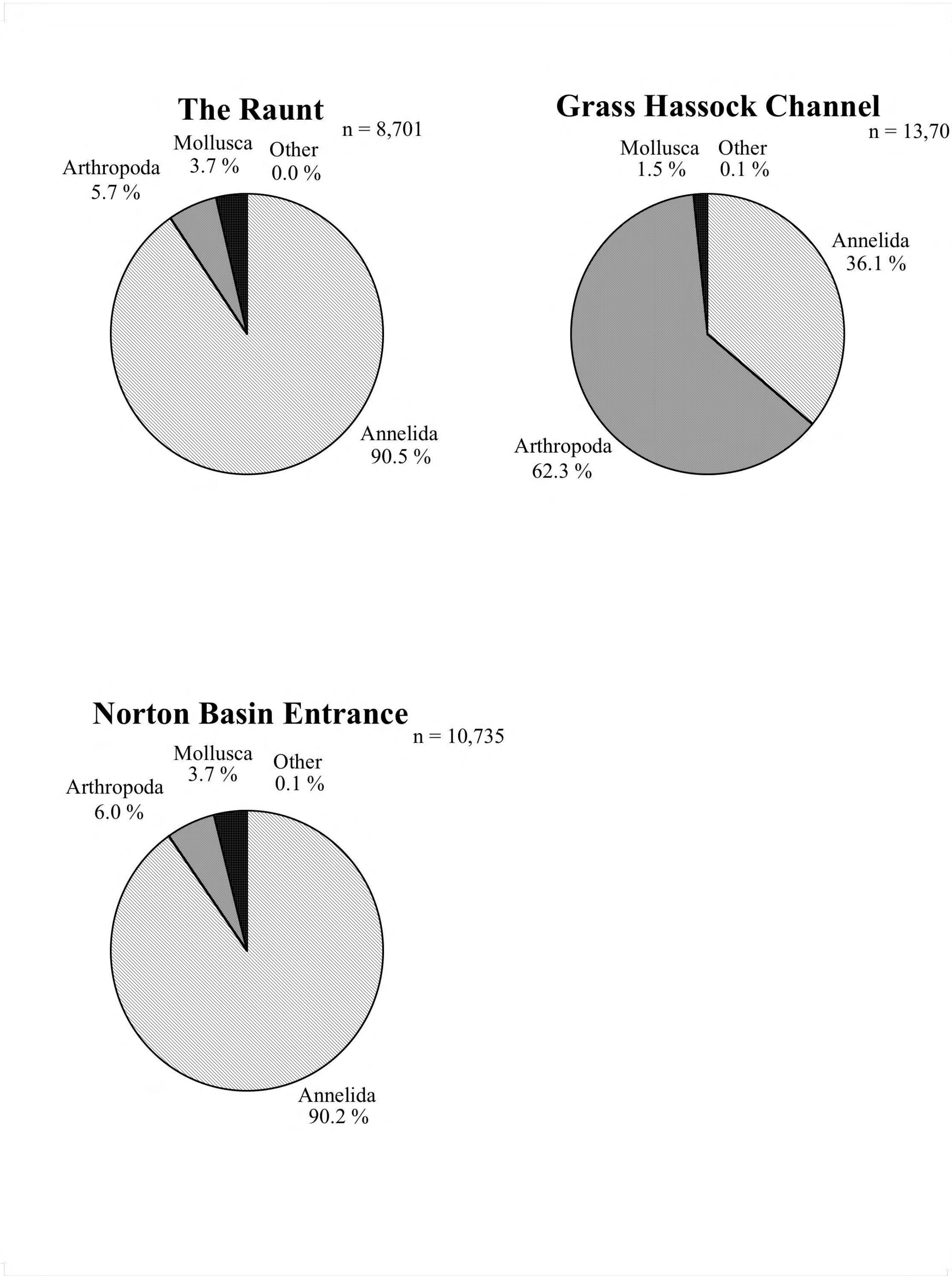


Figure 4.1.2.4 Benthic community composition, Norton Basin entrance channel, Grass Hassock channel, and the Raunt reference areas, October 2002.

APPENDIX I-A: TAXONOMIC SPECIES LIST, JUNE 2002

Appendix I-A: Taxonomic Species List, June 2002

TAXONOMIC SPECIES LIST

Client: Port Authority of New York and New Jersey — Project Date: 06/01/2002
Project: Norton Basin - NYSDEC
Location: — Total Number of Taxa: 127

ANNELIDA
CLASS OLIGOCHAETA
Order TUBIFICIDA
FAMILY ENCHYTRAEIDAE
Enchytraeidae (LPIL)
FAMILY TUBIFICIDAE
Tubificidae (LPIL)
CLASS POLYCHAETA
Order CAPITELLIDA
FAMILY CAPITELLIDAE
Capitellidae (LPIL)
Capitella (LPIL)
Capitella capitata
Capitella jonesi
Heteromastus filiformis
Mediomastus (LPIL)
Mediomastus ambiseta
FAMILY MALDANIDAE
Maldanidae (LPIL)
Order EUNICIDA
FAMILY DORVILLEIDAE
Schistomeringos pectinata
Schistomeringos rudolphi
FAMILY OENONIDAE
Arabella multidentata
Drilonereis longa
Order FLABELLIGERIDA
FAMILY FLABELLIGERIDAE
Flabelligeridae (LPIL)
Pherusa affinis
Order ORBINIIDA
FAMILY ORBINIIDAE
Leitoscoloplos (LPIL)
Leitoscoloplos robustus

Appendix I-A: Taxonomic Species List, June 2002

ANNELIDA
CLASS POLYCHAETA
Order PHYLLODOCIDA
FAMILY GLYCERIDAE
Glyceridae (LPIL)
Glycera americana
FAMILY HESIONIDAE
Hesionidae (LPIL)
Podarke obscura
Podarkeopsis levifuscina
FAMILY NEPHTYIDAE
Nephtys incisa
Nephtys picta
FAMILY NEREIDAE
Nereididae (LPIL)
Nereis (LPIL)
Nereis succinea
FAMILY PHYLLODOCIDAE
Phyllodocidae (LPIL)
Eumida sanguinea
Hypereteone heteropoda
Paranaitis speciosa
FAMILY POLYNOIDAE
Polynoidae (LPIL)
Harmothoe imbricata
FAMILY SYLLIDAE
Syllidae (LPIL)
Autolytus (LPIL)
Exogone rolani
Order SABELLIDA
FAMILY SABELLIDAE
Sabellidae (LPIL)
Demonax microphthalmus
FAMILY SERPULIDAE
Serpulidae (LPIL)
Hydroides dianthus
Order SPIONIDA
FAMILY CIRRATULIDAE
Cirratulidae (LPIL)
Tharyx acutus

Appendix I-A: Taxonomic Species List, June 2002

ANNELIDA
CLASS POLYCHAETA
Order SPIONIDA
FAMILY SPIONIDAE
Spionidae (LPIL)
Polydora (LPIL)
Polydora cornuta
Spio (LPIL)
Spio filicornis
Spio pettiboneae
Streblospio benedicti
Order TEREBELLIDA
FAMILY AMPHARETIDAE
Ampharetidae (LPIL)
Asabellides oculata
FAMILY PECTINARIIDAE
Pectinaria gouldii
FAMILY SABELLARIIDAE
Sabellaria vulgaris
FAMILY TEREBELLIDAE
Terebellidae (LPIL)
Polycirrus (LPIL)
Polycirrus sp. G

ARTHROPODA
CLASS MALACOSTRACA
Order AMPHIPODA
FAMILY AEGINELLIDAE
Aeginellidae (LPIL)
Paracaprella tenuis
FAMILY AMPELISCIDAE
Ampeliscidae (LPIL)
Ampelisca vadorum
FAMILY AORIDAE
Aoridae (LPIL)
Microdeutopus gryllotalpa
Unciola irrorata
Unciola serrata
FAMILY COROPHIIDAE
Corophiidae (LPIL)
Monocorophium tuberculatum
FAMILY GAMMARIDAE
Gammaridae (LPIL)
Gammarus annulatus
Gammarus mucronatus

Appendix I-A: Taxonomic Species List, June 2002

ARTHROPODA
- CLASS MALACOSTRACA
  - Order AMPHIPODA
    - FAMILY ISAEIDAE
      - *Photis macrocoxa*
    - FAMILY ISCHYROCERIDAE
      - *Erichthonius brasiliensis*
    - FAMILY LILJEBORGIIDAE
      - *Listriella barnardi*
    - FAMILY LYSIANASSIDAE
      - *Lysianopsis alba*
    - FAMILY MELITIDAE
      - *Elasmopus levis*
      - *Melita* (LPIL)
      - *Melita nitida*
    - FAMILY PHOXOCEPHALIDAE
      - *Eobrolgus spinosus*
      - *Rhepoxynius hudsoni*
  - Order DECAPODA
    - FAMILY CANCRIDAE
      - *Cancer irroratus*
    - FAMILY CRANGONIDAE
      - *Crangon septemspinosa*
    - FAMILY MAJIDAE
      - *Libinia dubia*
    - FAMILY PAGURIDAE
      - *Pagurus longicarpus*
    - FAMILY XANTHIDAE
      - *Xanthidae* (LPIL)
      - *Dyspanopeus sayi*
      - *Panopeus herbstii*
      - *Rhithropanopeus harrisii*
  - Order ISOPODA
    - FAMILY ANTHURIDAE
      - *Cyathura burbancki*
    - FAMILY IDOTEIDAE
      - *Edotea triloba*
  - Order MYSIDACEA
    - FAMILY MYSIDAE
      - *Mysidae* (LPIL)
- CLASS OSTRACODA
  - Order MYODOCOPINA
    - FAMILY CYLINDROLEBERIDIDAE
      - *Parasterope pollex*

Appendix I-A: Taxonomic Species List, June 2002

BRACHIOPODA
Brachiopoda (LPIL)

BRYOZOA
Bryozoa (LPIL)

CHORDATA
CLASS ASCIDIACEA
Ascidiacea (LPIL)

MOLLUSCA
CLASS BIVALVIA
Bivalvia (LPIL)
Order ARCOIDA
FAMILY ARCIDAE
Anadara transversa
Order MYOIDA
FAMILY MYIDAE
Mya arenaria
Order MYTILOIDA
FAMILY MYTILIDAE
Mytilidae (LPIL)
Mytilus edulis
Order NUCULOIDA
FAMILY NUCULIDAE
Nucula proxima
Order OSTREOIDA
FAMILY ANOMIIDAE
Anomia simplex
Order VENEROIDA
FAMILY MACTRIDAE
Mulinia lateralis
FAMILY MONTACUTIDAE
Montacutidae (LPIL)
Mysella planulata
FAMILY PETRICOLIDAE
Petricola pholadiformis
FAMILY SOLENIDAE
Ensis directus
FAMILY TELLINIDAE
Tellinidae (LPIL)
Tellina (LPIL)
Tellina agilis

Appendix I-A: Taxonomic Species List, June 2002

MOLLUSCA
- CLASS BIVALVIA
  - Order VENEROIDA
    - FAMILY VENERIDAE
      - *Chione cancellata*
      - *Gemma gemma*
      - *Mercenaria mercenaria*
- CLASS GASTROPODA
  - *Gastropoda* (LPIL)
  - Order CEPHALASPIDEA
    - FAMILY ACTEONIDAE
      - *Rictaxis punctostriatus*
    - FAMILY SCAPHANDRIDAE
      - *Acteocina canaliculata*
  - Order MESOGASTROPODA
    - FAMILY CALYPTRAEIDAE
      - *Crepidula* (LPIL)
      - *Crepidula fornicata*
      - *Crepidula plana*
    - FAMILY RISSOIDAE
      - *Rissoidae* (LPIL)
  - Order NEOGASTROPODA
    - FAMILY COLUMBELLIDAE
      - *Mitrella lunata*
    - FAMILY NASSARIIDAE
      - *Ilyanassa obsoleta*
      - *Ilyanassa trivittata*
  - Order NUDIBRANCHIA
    - FAMILY CORAMBIDAE
      - *Doridella obscura*
  - Order PYRAMIDELLOIDA
    - FAMILY PYRAMIDELLIDAE
      - *Odostomia trifida*

PLATYHELMINTHES
- CLASS TURBELLARIA
  - *Turbellaria* (LPIL)

RHYNCHOCOELA
- *Rhynchocoela* (LPIL)

SIPUNCULA
- *Sipuncula* (LPIL)

APPENDIX I-B: SUMMARY OF COMMUNITY PARAMETERS, JUNE 2002

Appendix I-B: Summary of Community Parameters, June 2002

Client: Port Authority of New York and New Jersey
Project: Norton Basin - NYSDEC 6/02
Sample Date: 6/02

FAUNAL PARAMETERS

Station	Date (m/d/y)	Total No. Taxa	Total No. Individuals	Mean Density (No. m-2)	Density (Std Err)	Mean Biomass [g(wet wt.)m-2]	Biomass (Std Err)	H' Shannon (log e)	J' Pielou Evenness
R1	6/1/02	53	5023	41858.3	11206.6	497.460	150.386	2.20	0.56
R2	6/1/02	37	2659	22158.3	12038.3	4942.737	4881.041	1.72	0.48
R3	6/1/02	27	2499	20825.0	17206.7	88.601	84.379	1.62	0.49
GH1	6/1/02	33	8842	73683.3	36224.9	74.713	42.228	1.01	0.29
GH2	6/1/02	30	8386	69883.3	12596.6	107.316	57.274	1.25	0.37
GH3	6/1/02	29	2901	24175.0	8941.2	4579.005	2089.772	1.86	0.55
LB1	6/1/02	2	7	58.3	22.0	0.004	0.001	0.68	0.99
LB2	6/1/02	1	1	8.3	8.3	0.001	0.001	0.00	0.00
LB3	6/1/02	0	0	0.0	0.0	0.000	0.000	0.00	0.00
LB4	6/1/02	0	0	0.0	0.0	0.000	0.000	0.00	0.00
LB5	6/1/02	0	0	0.0	0.0	0.000	0.000	0.00	0.00
LB6	6/1/02	1	1	8.3	8.3	0.001	0.001	0.00	0.00
LB7	6/1/02	0	0	0.0	0.0	0.000	0.000	0.00	0.00
LB8	6/1/02	0	0	0.0	0.0	0.000	0.000	0.00	0.00
LB9	6/1/02	26	573	4775.0	3632.3	2034.618	2006.126	1.65	0.51
NB1	6/1/02	33	3945	32875.0	17147.3	8183.217	4573.326	2.01	0.58
NB2	6/1/02	10	923	7691.7	2273.5	11.366	2.704	0.34	0.15
NB3	6/1/02	16	1782	14850.0	4824.0	25.737	11.545	1.04	0.37
NB4	6/1/02	1	1	8.3	8.3	0.040	0.040	0.00	0.00
NB5	6/1/02	4	531	4425.0	398.7	8.667	0.885	0.45	0.32
NB6	6/1/02	8	1148	9566.7	1558.5	10.591	4.159	1.27	0.61
NB7	6/1/02	16	1751	14591.7	5306.2	13.297	5.544	1.34	0.48
NB8	6/1/02	10	380	3166.7	1665.2	2.318	1.167	1.31	0.57
NB9	6/1/02	30	2928	24400.0	10726.8	111.632	33.036	1.78	0.52
NB10	6/1/02	35	9264	77200.0	47495.9	5785.038	1145.274	1.57	0.44
NB11	6/1/02	32	2400	20000.0	11441.0	2011.135	1013.833	1.70	0.49
NB12	6/1/02	48	7496	62466.7	23463.3	1186.653	977.337	1.97	0.51
NB13	6/1/02	56	3433	28608.3	9512.9	9567.200	5581.167	2.72	0.68
NB14	6/1/02	50	10937	91141.7	31473.5	1315.320	1007.254	2.62	0.67
NB15	6/1/02	48	3123	26025.0	12122.1	2881.228	399.461	2.56	0.66

N/A: Not Applicable

APPENDIX I-C: TAXONOMIC SPECIES LIST, OCTOBER 2002

Appendix I-C: Taxonomic Species List, October 2002

TAXONOMIC SPECIES LIST

Client: Port Authority of New York and New Jersey — Project Date: 10/10/2002
Project: Norton Basin - NYSDEC 10/02
Location: — Total Number of Taxa: 109

ANNELIDA
- CLASS OLIGOCHAETA
  - Order TUBIFICIDA
    - FAMILY TUBIFICIDAE
      - *Tubificidae* (LPIL)
- CLASS POLYCHAETA
  - Order CAPITELLIDA
    - FAMILY CAPITELLIDAE
      - *Capitellidae* (LPIL)
      - *Capitella* (LPIL)
      - *Capitella capitata*
      - *Capitella jonesi*
      - *Heteromastus filiformis*
      - *Mediomastus* (LPIL)
      - *Mediomastus ambiseta*
  - Order EUNICIDA
    - FAMILY DORVILLEIDAE
      - *Schistomeringos pectinata*
      - *Schistomeringos rudolphi*
    - FAMILY OENONIDAE
      - *Drilonereis longa*
    - FAMILY ONUPHIDAE
      - *Diopatra cuprea*
  - Order ORBINIIDA
    - FAMILY ORBINIIDAE
      - *Leitoscoloplos* (LPIL)
      - *Leitoscoloplos robustus*
  - Order PHYLLODOCIDA
    - FAMILY GLYCERIDAE
      - *Glyceridae* (LPIL)
      - *Glycera* (LPIL)
      - *Glycera americana*
      - *Glycera dibranchiata*
    - FAMILY GONIADIDAE
      - *Glycinde solitaria*

Appendix I-C: Taxonomic Species List, October 2002

ANNELIDA
CLASS POLYCHAETA
Order PHYLLODOCIDA
FAMILY HESIONIDAE
Hesionidae (LPIL)
Podarke obscura
Podarkeopsis levifuscina
FAMILY NEPHTYIDAE
Nephtyidae (LPIL)
Nephtys picta
FAMILY NEREIDAE
Nereididae (LPIL)
Nereis (LPIL)
Nereis succinea
FAMILY PHYLLODOCIDAE
Phyllodocidae (LPIL)
Eumida sanguinea
Hypereteone (LPIL)
Hypereteone fauchaldi
Hypereteone heteropoda
Phyllodoce (LPIL)
Phyllodoce longipes
Phyllodoce mucosa
FAMILY POLYNOIDAE
Polynoidae (LPIL)
FAMILY SYLLIDAE
Syllidae (LPIL)
Autolytus (LPIL)
Exogone rolani
Order SABELLIDA
FAMILY SABELLIDAE
Demonax microphthalmus
FAMILY SERPULIDAE
Serpulidae (LPIL)
Hydroides dianthus
Order SPIONIDA
FAMILY CHAETOPTERIDAE
Spiochaetopterus oculatus
FAMILY CIRRATULIDAE
Cirratulidae (LPIL)
Caulleriella sp. J
Tharyx acutus

Appendix I-C: Taxonomic Species List, October 2002

ANNELIDA
- CLASS POLYCHAETA
  - Order SPIONIDA
    - FAMILY SPIONIDAE
      - *Spionidae* (LPIL)
      - *Apoprionospio pygmaea*
      - *Dipolydora socialis*
      - *Polydora cornuta*
      - *Spio filicornis*
      - *Streblospio benedicti*
  - Order TEREBELLIDA
    - FAMILY PECTINARIIDAE
      - *Pectinaria gouldii*
    - FAMILY SABELLARIIDAE
      - *Sabellaria vulgaris*
    - FAMILY TEREBELLIDAE
      - *Polycirrus* (LPIL)
      - *Polycirrus* sp. G

ARTHROPODA
- CLASS MALACOSTRACA
  - Order AMPHIPODA
    - FAMILY AEGINELLIDAE
      - *Paracaprella tenuis*
    - FAMILY AMPELISCIDAE
      - *Ampelisca* (LPIL)
      - *Ampelisca vadorum*
    - FAMILY AORIDAE
      - *Microdeutopus gryllotalpa*
      - *Unciola serrata*
    - FAMILY COROPHIIDAE
      - *Monocorophium tuberculatum*
    - FAMILY ISCHYROCERIDAE
      - *Ischyroceridae* (LPIL)
      - *Erichthonius brasiliensis*
    - FAMILY LYSIANASSIDAE
      - *Lysianopsis alba*
    - FAMILY MELITIDAE
      - *Elasmopus levis*
      - *Melita nitida*
    - FAMILY PHOXOCEPHALIDAE
      - *Rhepoxynius hudsoni*

Appendix I-C: Taxonomic Species List, October 2002

ARTHROPODA
- CLASS MALACOSTRACA
  - Order DECAPODA
    - FAMILY PAGURIDAE
      - *Pagurus* (LPIL)
      - *Pagurus longicarpus*
    - FAMILY PALAEMONIDAE
      - *Palaemonidae* (LPIL)
      - *Palaemonetes pugio*
    - FAMILY PINNOTHERIDAE
      - *Pinnixa* (LPIL)
    - FAMILY XANTHIDAE
      - *Xanthidae* (LPIL)
      - *Dyspanopeus sayi*
      - *Panopeus herbstii*
      - *Rhithropanopeus harrisii*
  - Order MYSIDACEA
      - *Mysidacea* (LPIL)

CHORDATA
- CLASS ASCIDIACEA
      - *Ascidiacea* (LPIL)

CNIDARIA
- CLASS HYDROZOA
      - *Hydrozoa* (LPIL)

MOLLUSCA
- CLASS BIVALVIA
      - *Bivalvia* (LPIL)
  - Order MYOIDA
    - FAMILY MYIDAE
      - *Mya arenaria*
  - Order VENEROIDA
    - FAMILY MACTRIDAE
      - *Mulinia lateralis*
      - *Spisula solidissima*
    - FAMILY MONTACUTIDAE
      - *Mysella planulata*
    - FAMILY PETRICOLIDAE
      - *Petricola pholadiformis*
    - FAMILY TELLINIDAE
      - *Tellinidae* (LPIL)
      - *Tellina* (LPIL)
      - *Tellina agilis*

Appendix I-C: Taxonomic Species List, October 2002

MOLLUSCA
- CLASS BIVALVIA
  - Order VENEROIDA
    - FAMILY VENERIDAE
      - *Gemma gemma*
      - *Mercenaria mercenaria*
- CLASS GASTROPODA
      - *Gastropoda* (LPIL)
  - Order CEPHALASPIDEA
    - FAMILY ACTEONIDAE
      - *Rictaxis punctostriatus*
    - FAMILY SCAPHANDRIDAE
      - *Acteocina canaliculata*
  - Order MESOGASTROPODA
    - FAMILY CALYPTRAEIDAE
      - *Crepidula* (LPIL)
      - *Crepidula fornicata*
      - *Crepidula plana*
    - FAMILY RISSOIDAE
      - *Rissoidae* (LPIL)
  - Order NEOGASTROPODA
    - FAMILY COLUMBELLIDAE
      - *Anachis obesa*
    - FAMILY MELONGENIDAE
      - *Busycon carica*
    - FAMILY NASSARIIDAE
      - *Nassariidae* (LPIL)
      - *Ilyanassa obsoleta*
  - Order NUDIBRANCHIA
    - FAMILY CORAMBIDAE
      - *Doridella obscura*
  - Order PYRAMIDELLOIDA
    - FAMILY PYRAMIDELLIDAE
      - *Odostomia* (LPIL)
      - *Odostomia trifida*

PHORONIDA
    - FAMILY PHORONIDAE
      - *Phoronis* (LPIL)

PLATYHELMINTHES
- CLASS TURBELLARIA
      - *Turbellaria* (LPIL)

Appendix I-C: Taxonomic Species List, October 2002

PORIFERA

Porifera (LPIL)

RHYNCHOCOELA

Rhynchocoela (LPIL)

APPENDIX I-D: SUMMARY OF COMMUNITY PARAMETERS, OCTOBER 2002

Appendix I-D: Summary of Community Parameters, October 2002

Client: Port Authority of New York and New Jersey
Project:Norton Basin - NYSDEC 10/02
Sample Date: 10/02

FAUNAL PARAMETERS

Station	Date (m/d/y)	Total No. Taxa	Total No. Individuals	Mean Density (No. m-2)	Density (Std Err)	Mean Biomass [g(wet wt.)m-2]	Biomass (Std Err)	H' Shannon (log e)	J' Pielou Evenness
R1	10/10/02	39	2601	21675.0	1925.9	451.3	124.2	1.20	0.33
R2	10/10/02	34	3877	32308.3	12080.2	4127.6	3815.7	1.27	0.36
R3	10/10/02	24	2223	18525.0	2224.9	175.6	152.7	1.20	0.38
GH1	10/10/02	30	4692	39100.0	6445.4	131.2	94.3	1.46	0.43
GH2	10/10/02	27	5549	46241.7	6432.3	277.7	115.1	1.26	0.38
GH3	10/10/02	15	3460	28833.3	1257.4	392.6	93.5	0.67	0.25
LB1	10/10/02	3	3	25.0	0.0	0.0	0.0	1.10	1.00
LB2	10/10/02	1	1	8.3	8.3	0.000	0.000	0.00	0.00
LB3	10/10/02	2	2	16.7	16.7	9.0	9.0	0.69	1.00
LB4	10/10/02	1	1	8.3	8.3	0.0	0.0	0.00	0.00
LB5	10/10/02	2	2	16.7	8.3	0.0	0.0	0.69	1.00
LB6	10/10/02	0	0	0.0	0.0	0.0	0.0	0.00	0.00
LB7	10/10/02	0	0	0.0	0.0	0.0	0.0	0.00	0.00
LB8	10/10/02	0	0	0.0	0.0	0.0	0.0	0.00	0.00
LB9	10/10/02	3	20	166.7	96.1	0.1	0.1	0.39	0.36
NB1	10/10/02	24	1091	9091.7	2904.4	11824.9	9409.0	1.46	0.46
NB2	10/10/02	17	402	3350.0	3250.0	240.1	240.1	1.35	0.48
NB3	10/10/02	0	0	0	0.0	0.0	0.0	0.00	0.00
NB4	10/10/02	8	21	175.0	104.1	0.5	0.5	1.76	0.84
NB5	10/10/02	4	20	166.7	58.3	0.9	0.5	1.24	0.89
NB6	10/10/02	8	16	133.3	84.6	0.2	0.2	1.84	0.88
NB7	10/10/02	31	2843	23691.7	11286.4	319.0	11.4	1.14	0.33
NB8	10/10/02	11	159	1325.0	215.5	2.9	1.2	1.53	0.64
NB9	10/10/02	15	188	1566.7	423.9	1.4	0.6	1.69	0.62
NB10	10/10/02	28	633	5275.0	1081.2	6599.1	4542.0	1.73	0.52
NB11	10/10/02	41	1556	12966.7	1419.4	392.6	93.2	1.97	0.53
NB12	10/10/02	42	1673	13941.7	1879.2	122.6	53.6	1.93	0.52
NB13	10/10/02	44	2037	16975.0	1650.3	1349.9	1071.5	1.77	0.47
NB14	10/10/02	52	4795	39958.3	16035.9	428.9	210.6	2.76	0.70
NB15	10/10/02	26	2230	18583.3	8526.9	54.1	46.0	1.26	0.39

APPENDIX I-E: ANOVA TABLES, JUNE 2002

Appendix I-E: ANOVA Tables, June 2002

ANOVA comparing total macroinvertebrate density among Norton Basin study and reference areas, June 2002.

Source	SS	df	MS	F	P
Sampling Area	132.942	6	22.157	61.355	0.0001

Student-Newman-Keuls
Effect: Sampling Area
Dependent: Log Abundance
Significance level: .05

	Vs.	Diff.	Crit. diff.	
LB Deep	LB Int	.794	.506	S
	NB Deep	1.471	.608	S
	NB Int	2.678	.668	S
	R	2.782	.710	S
	NB Ent	3.153	.743	S
	GH	3.202	.769	S
LB Int	NB Deep	.677	.506	S
	NB Int	1.883	.608	S
	R	1.987	.668	S
	NB Ent	2.359	.710	S
	GH	2.408	.743	S
NB Deep	NB Int	1.207	.506	S
	R	1.310	.608	S
	NB Ent	1.682	.668	S
	GH	1.731	.710	S
NB Int	R	.104	.506	
	NB Ent	.475	.608	
	GH	.524	.668	
R	NB Ent	.372	.506	
	GH	.421	.608	
NB Ent	GH	.049	.506	

S = Significantly different at this level.

Code:	**Sampling Area:**	**Stations within Area:**
LB Deep	Little Bay Deep	LB2-6, LB8
LB Int	Little Bay Intermediate	LB1, LB7, LB9
NB Deep	Norton Basin Deep	NB4, NB8, NB11
NB Int	Norton Basin Intermediate	NB1-3, NB5-7, NB9, NB10
NB Ent	Norton Basin Entrance Channel	NB12-15
GH	Grass Hassock Channel	GH1-3
R	the Raunt	R1-3

Appendix I-E: ANOVA Tables, June 2002

ANOVA comparing annelid density among Norton Basin study and reference areas, June 2002.

Source	SS	df	MS	F	P
Sampling Area	110.008	6	18.335	66.512	0.0001

Student-Newman-Keuls
Effect: Sampling Area
Dependent: Log Annelida
Significance level: .05

	Vs.	Diff.	Crit. diff.	
LB Deep	LB Int	.748	.442	S
	NB Deep	1.273	.531	S
	GH	2.375	.584	S
	R	2.408	.621	S
	NB Int	2.563	.649	S
	NB Ent	3.059	.672	S
LB Int	NB Deep	.525	.442	S
	GH	1.627	.531	S
	R	1.660	.584	S
	NB Int	1.815	.621	S
	NB Ent	2.311	.649	S
NB Deep	GH	1.102	.442	S
	R	1.136	.531	S
	NB Int	1.290	.584	S
	NB Ent	1.787	.621	S
GH	R	.033	.442	
	NB Int	.187	.531	
	NB Ent	.684	.584	S
R	NB Int	.154	.442	
	NB Ent	.651	.531	S
NB Int	NB Ent	.497	.442	S

S = Significantly different at this level.

Code:	Sampling Area:	Stations within Area:
LB Deep	Little Bay Deep	LB2-6, LB8
LB Int	Little Bay Intermediate	LB1, LB7, LB9
NB Deep	Norton Basin Deep	NB4, NB8, NB11
NB Int	Norton Basin Intermediate	NB1-3, NB5-7, NB9, NB10
NB Ent	Norton Basin Entrance Channel	NB12-15
GH	Grass Hassock Channel	GH1-3
R	the Raunt	R1-3

Appendix I-E: ANOVA Tables, June 2002

ANOVA comparing arthropod density among Norton Basin study and reference areas, June 2002.

Source	SS	df	MS	F	P
Sampling Area	89.439	6	14.906	22.748	0.0001

Student-Newman-Keuls
Effect: Sampling Area
Dependent: Log Arthropoda
Significance level: .05

	Vs.	Diff.	Crit. diff.	
LB Deep	LB Int	.287	.682	
	NB Deep	1.040	.819	S
	NB Int	1.484	.900	S
	R	2.082	.957	S
	NB Ent	2.352	1.001	S
	GH	3.124	1.036	S
LB Int	NB Deep	.753	.682	S
	NB Int	1.197	.819	S
	R	1.795	.900	S
	NB Ent	2.065	.957	S
	GH	2.837	1.001	S
NB Deep	NB Int	.444	.682	
	R	1.043	.819	S
	NB Ent	1.312	.900	S
	GH	2.084	.957	S
NB Int	R	.599	.682	
	NB Ent	.868	.819	S
	GH	1.640	.900	S
R	NB Ent	.270	.682	
	GH	1.041	.819	S
NB Ent	GH	.772	.682	S

S = Significantly different at this level.

Code:	**Sampling Area:**	**Stations within Area:**
LB Deep	Little Bay Deep	LB2-6, LB8
LB Int	Little Bay Intermediate	LB1, LB7, LB9
NB Deep	Norton Basin Deep	NB4, NB8, NB11
NB Int	Norton Basin Intermediate	NB1-3, NB5-7, NB9, NB10
NB Ent	Norton Basin Entrance Channel	NB12-15
GH	Grass Hassock Channel	GH1-3
R	the Raunt	R1-3

APPENDIX I-F: ANOVA TABLES, OCTOBER 2002

Appendix I-F: ANOVA Tables, October 2002

ANOVA comparing total macroinvertebrate density among Norton Basin study and reference areas, October 2002.

Source	SS	df	MS	F	P
Sampling Area	112.525	6	18.754	46.281	0.0001

Student-Newman-Keuls
Effect: Sampling Area
Dependent: Log Abundance
Significance level: .05

	Vs.	Diff.	Crit. diff.	
LB Deep	LB Int	.258	.536	
	NB Int	1.444	.644	S
	NB Deep	1.638	.708	S
	NB Ent	2.762	.753	S
	R	2.858	.787	S
	GH	3.074	.815	S
LB Int	NB Int	1.187	.536	S
	NB Deep	1.380	.644	S
	NB Ent	2.505	.708	S
	R	2.600	.753	S
	GH	2.817	.787	S
NB Int	NB Deep	.193	.536	
	NB Ent	1.318	.644	S
	R	1.413	.708	S
	GH	1.630	.753	S
NB Deep	NB Ent	1.125	.536	S
	R	1.220	.644	S
	GH	1.436	.708	S
NB Ent	R	.095	.536	
	GH	.312	.644	
R	GH	.217	.536	

S = Significantly different at this level.

Code:	Sampling Area:	Stations within Area:
LB Deep	Little Bay Deep	LB2-6, LB8
LB Int	Little Bay Intermediate	LB1, LB7, LB9
NB Deep	Norton Basin Deep	NB4, NB8, NB11
NB Int	Norton Basin Intermediate	NB1-3, NB5-7, NB9, NB10
NB Ent	Norton Basin Entrance Channel	NB12-15
GH	Grass Hassock Channel	GH1-3
R	the Raunt	R1-3

Appendix I-F: ANOVA Tables, October 2002

ANOVA comparing annelid density among Norton Basin study and reference areas, October 2002.

Source	SS	df	MS	F	P
Sampling Area	102.594	6	17.099	39.493	0.0001

Student-Newman-Keuls
Effect: Sampling Area
Dependent: Log Annelida
Significance level: .05

	Vs.	Diff.	Crit. diff.	
LB Deep	LB Int	.217	.554	
	NB Int	1.469	.665	S
	NB Deep	1.626	.732	S
	GH	2.579	.778	S
	NB Ent	2.785	.813	S
	R	2.868	.842	S
LB Int	NB Int	1.252	.554	S
	NB Deep	1.409	.665	S
	GH	2.362	.732	S
	NB Ent	2.567	.778	S
	R	2.651	.813	S
NB Int	NB Deep	.157	.554	
	GH	1.110	.665	S
	NB Ent	1.315	.732	S
	R	1.398	.778	S
NB Deep	GH	.953	.554	S
	NB Ent	1.158	.665	S
	R	1.242	.732	S
GH	NB Ent	.205	.554	
	R	.289	.665	
NB Ent	R	.083	.554	

S = Significantly different at this level.

Code:	**Sampling Area:**	**Stations within Area:**
LB Deep	Little Bay Deep	LB2-6, LB8
LB Int	Little Bay Intermediate	LB1, LB7, LB9
NB Deep	Norton Basin Deep	NB4, NB8, NB11
NB Int	Norton Basin Intermediate	NB1-3, NB5-7, NB9, NB10
NB Ent	Norton Basin Entrance Channel	NB12-15
GH	Grass Hassock Channel	GH1-3
R	the Raunt	R1-3

Appendix I-F: ANOVA Tables, October 2002

ANOVA comparing arthropod density among Norton Basin study and reference areas, October 2002.

Source	SS	df	MS	F	P
Sampling Area	68.530	6	11.422	48.422	0.0001

Student-Newman-Keuls
Effect: Sampling Area
Dependent: Log Arthropoda
Significance level: .05

	Vs.	Diff.	Crit. diff.	
LB Deep	LB Int	.017	.409	
	NB Deep	.260	.491	
	NB Int	.261	.540	
	NB Ent	.891	.574	S
	R	1.368	.600	S
	GH	2.935	.622	S
LB Int	NB Deep	.244	.409	
	NB Int	.245	.491	
	NB Ent	.874	.540	S
	R	1.352	.574	S
	GH	2.918	.600	S
NB Deep	NB Int	.001	.409	
	NB Ent	.631	.491	S
	R	1.108	.540	S
	GH	2.674	.574	S
NB Int	NB Ent	.630	.409	S
	R	1.107	.491	S
	GH	2.673	.540	S
NB Ent	R	.477	.409	S
	GH	2.044	.491	S
R	GH	1.566	.409	S

S = Significantly different at this level.

Code:	**Sampling Area:**	**Stations within Area:**
LB Deep	Little Bay Deep	LB2-6, LB8
LB Int	Little Bay Intermediate	LB1, LB7, LB9
NB Deep	Norton Basin Deep	NB4, NB8, NB11
NB Int	Norton Basin Intermediate	NB1-3, NB5-7, NB9, NB10
NB Ent	Norton Basin Entrance Channel	NB12-15
GH	Grass Hassock Channel	GH1-3
R	the Raunt	R1-3

APPENDIX II-A: GILL NET DATA, MAY 2002

Appendix II-A: Gill Net Data, May 2002

LB 1 Bottom Deployed 16:00 Collected 8:00
No Fish

LB 2 Bottom Deployed 16:05 Collected 8:07
No Fish

LB 3 Mid Deployed 16:10 Collected 8:15

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
menhaden	10	350	310	290	310	370	330	290	4.196
		320	340	340					
striped sea robin	1	240							0.176

LB 4 Mid Deployed 16:15 Collected 8:20

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
striped sea robin	1	310							0.567
menhaden		330	340	360	340	340	350	350	3.856
		330							

LB 5 Surface Deployed 16:25 Collected 9:20

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
anchovy	1	70							0.045
striped sea robin	5	310	350	340	340	300			0.068
menhaden	50	350	300	340	360	340	330	340	14.515
		320	290	340	300	340	350	310	
		350	310	340	320	300	290	350	
		290	340	300	300	310	310	340	
		330	320	350	300	350	310	310	
		270	360	360	360	300	350	350	
		310	290	300	330	350	350	340	
		290							

Appendix II-A: Gill Net Data, May 2002

LB 6 Surface Deployed 16:20 Collected 9:00

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
striped sea robin	2	380	350						0.567
striped bass	1	220							0.133
menhaden		370	360	290	340	300	340	280	
		350	330	330	310	340	340	310	
		310	340	290	300	310	330	290	
		290	290	300	350	280	330	290	
		300	320	320	290	180	170	300	
		290	340	300	320	350	320	310	
		350	320	340	300	300	280	320	
		310	300	280	300	300	300	280	
		310	320	310	360	300	310	330	
bluefish	1	430							0.567

LB 7 Shallow Deployed 16:30 Collected 9:45

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
striped sea robin	60	330	320	320	330	370	340	250	20.412
		380	290	320	320	310	280	330	
		360	380	310	330	310	340	280	
		310	290	310	330	320	350	370	
		330	340	290	350	340	300	340	
		310	340	350	340	320	320	360	
		290	320	270	310	340	360	320	
		310	310	310	310	330	310	310	
		320	310	290	320				
tautog	1	160							0.057
menhaden	14	330	330	280	360	330	340	290	5.443
		330	310	320	300	340	350	350	
horseshoe crab	9	190	220	190	200	190	200	270	8.981
		210	240						
striped bass	2	150	230						1.417

Appendix II-A: Gill Net Data, May 2002

LB 8 Shallow Deployed 16:35 Collected 10:10

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
striped bass	3	110	230	260					0.34
horseshoe crab	3	210	180	270					3.629
spider crab	1	60							0.085
striped sea robin	18	310	330	330	260	310	310	320	5.897
		280	270	320	340	310	330	370	
		350	330	350	320				
menhaden	27	330	370	380	350	340	370	360	12.701
		290	320	340	380	360	320	370	
		360	370	370	370	370	380	360	
		340	340	370	340	380	290		

LB 1 Bottom Deployed 8:00 Collected 10:26
No Fish

LB 2 Bottom Deployed 8:07 Collected 10:34
No Fish

LB 8 Shallow Deployed 1o:10 Collected 9:38

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
tautog	2	345	200						1.11
striped bass	2	235	260						0.35
sea robin	42	335	310	385	340	340	365	350	20.41
		345	340	335	325	325	310	345	
		325	355	400	310	320	325	355	
		370	320	315	315	335	340	350	
		325	280	325	380	370	380	360	
		345	360	315	315	320	340	285	
menhaden		360	335	385	380	360	355	375	6.35
		350	370	340	330	335			
spider crab	1	70							0.18
horseshoe crab	2	250	205						3.4

Appendix II-A: Gill Net Data, May 2002

NB 1 Bottom   Deployed 16:55   Collected 11:15

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
clearnose skate	1	720							2.721
striped bass	2	170	180						0.113
menhaden	2	330	370						0.794
striped sea robin	116	320	280	340	320	360	360	330	50.576
		360	350	330	340	330	340	300	
		280	320	330	320	340	320	360	
		340	320	350	430	330	370	330	
		360	360	250	330	320	390	330	
		350	260	330	300	360	350	420	
		330	330	270	260	320	380	330	
		330	320	330	340	320	290	330	
		310	350	350	340	330	280	320	
		350	330	350	390	290	270	320	
		260	330	350	360	340	320	320	
		320	320	340	310	310	310	310	
		340	350	330	340	350	360	320	
		310	330	310	320	320	290	350	
		350	340	270	350	330	360	250	
		360	330	330	330	360	320	350	
		310	310	330	370				

Appendix II-A: Gill Net Data, May 2002

NB 2 Bottom Deployed 17:10 Collected 13:30

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
striped sea robin	116	320	380	360	290	350	340	320	46.72
		270	330	310	360	300	350	270	
		320	360	240	320	300	320	360	
		350	340	360	330	310	350	340	
		340	340	370	330	320	330	300	
		320	330	340	400	330	310	350	
		300	320	280	270	320	330	330	
		320	320	320	390	350	300	300	
		320	320	310	280	330	360	290	
		340	290	270	330	270	290	270	
		310	360	330	300	300	330	320	
		340	310	290	370	290	330	320	
		310	310	310	320	330	280	270	
		390	320	320	290	340	320	330	
		310	330	290	320	360	340	340	
		360	340	330	330	340	330	310	
		320	330	330	300				
spider crabs	6	80	80	65	70	70	70		13.61
striped bass	2	250	250						0.28
tautog	5	270	210	240	290	240			1.81
menhaden	6	370	350	340	340	370	360		3.63

NB 3 Mid Deployed 17:15 Collected 14:30

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
striped sea robin	28	370	290	350	340	300	310	340	11.79
		250	360	310	330	340	340	360	
		390	350	360	360	340	330	290	
		310	340	330	300	340	340	280	
menhaden	7	350	350	360	380	360	350	320	3.63

Appendix II-A: Gill Net Data, May 2002

NB 4 Mid Deployed 17:05 Collected 13:00

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
striped sea robin	33	270	340	340	340	310	330	390	17.01
		390	220	330	300	330	320	330	
		350	290	320	310	330	350	320	
		310	250	300	310	330	330	330	
		360	370	300	330	330			
menhaden		340	350	380	340	380	340	380	4.536
		350	340	330	330	360	300	320	
		340	330						
spider crab	1	70							0.142

NB 5 Surface Deployed 17:20 Collected 15:00

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
menhaden	36	300	310	300	310	300	280	290	11.34
		290	300	300	300	290	300	310	
		320	380	330	300	290	340	350	
		350	330	330	310	370	340	310	
		350	320	320	330	310	310	290	
		270							
striped sea robin	12	310	320	370	340	330	320	400	6.12
		390	350	340	360	360			

NB 6 Surface Deployed 17:00 Collected 12:30

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
striped bass	1	large - got away							
menhaden	48	310	340	300	310	310	320	350	19.958
		300	300	330	310	280	300	330	
		290	300	350	310	300	370	350	
		290	330	360	340	360	320	340	
		340	370	360	350	340	340	340	
		350	340	370	340	350	370	360	
		350	320	350	280	330	360		
striped sea robin	1	350							0.226

Appendix II-A: Gill Net Data, May 2002

NB 7 Shallow   Deployed 17:30   Collected 16:15

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Alewife	1	115							0.01
menhaden	6	340	350	360	370	300	350		2.722
striped sea robin	105	330	300	340	320	320	380	340	51.71
		300	310	360	310	420	320	330	
		320	350	370	370	350	430	350	
		310	340	350	280	320	260	280	
		350	350	330	320	310	350	340	
		330	330	330	340	340	310	330	
		350	370	330	390	330	300	270	
		360	340	330	330	290	360	340	
		340	290	260	320	320	300	350	
		370	270	350	320	350	340	330	
		290	320	330	330	310	300	320	
		330	330	320	320	320	280	290	
		330	280	320	280	290	310	320	
		330	320	360	340	310	350	390	
		310	340	310	290	300	330	330	
horseshoe crab	2	200	255						3.63
striped bass	6	265	260	230	180	250	230		0.66

Appendix II-A: Gill Net Data, May 2002

NB 8 Shallow Deployed 17:25 Collected 15:35

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
striped sea robin	91	330	320	330	300	340	290	330	35.83
		300	330	290	320	330	330	330	
		330	310	320	350	330	350	320	
		270	350	330	230	320	380	350	
		340	360	360	340	340	350	340	
		320	320	320	320	330	320	300	
		320	330	270	340	300	400	330	
		330	360	350	320	300	300	300	
		300	340	280	330	320	320	320	
		310	310	310	320	320	350	360	
		300	280	310	320	310	350	350	
		320	310	310	310	270	350	340	
		340	300	310	340	280	320	320	
menhaden	13	350	360	350	380	330	350	350	7.26
		330	390	380	370	370	350		
horseshoe crab	1	185							0.05
striped bass	125	130							0.24

NB 9 Shallow Deployed 17:40 Collected 17:10

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
striped sea robins	48	310	350	320	330	350	320	420	22.68
		320	330	330	320	350	330	340	
		280	310	300	370	330	400	330	
		320	350	320	280	340	340	370	
		400	340	360	340	340	350	320	
		360	330	280	320	270	360	280	
		320	300	370	270	300	300		
horseshoe crab	4	190	195	210	185				2.268
spider crab	2	65	80						0.38
blue crab (male)	2	110	130						0.3
tautog	2	220	230						0.48

Appendix II-A: Gill Net Data, May 2002

NB 10 Shallow Deployed 17:45 Collected 18:00

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
weakfish	1	660							2.27
scup	1	210							0.2
tautog	1	330							0.68
striped sea robins	50	400	340	280	250	320	270	280	23.25
		280	350	300	340	330	430	300	
		300	300	300	330	360	340	340	
		300	280	360	290	310	320	430	
		460	310	320	270	320	320	300	
		370	310	310	360	360	310	330	
		370	310	330	280	340	330	280	
		340							
menhaden	12	360	330	320	340	330	340	320	5.986
		370	300	330	330	370			
spider crabs	6	70	110	65	70	65	60		0.77
blue crabs	2	150	130						0.4
striped bass	1	220							0.14

Appendix II-A: Gill Net Data, May 2002

GH 1 Bottom Deployed 8:10 Collected 13:35

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
striped bass	1	680							3.18
sea robin	51	290	320	325	330	305	380	335	24.5
		405	280	330	320	320	290	295	
		320	360	320	320	250	330	320	
		370	300	325	315	310	360	280	
		350	280	270	355	340	345	260	
		350	315	320	320	330	385	345	
		360	355	270	335	315	335	340	
		330	325						
weakfish	3	400	405	380					2
menhaden	12	390	360	385	390	340	345	340	7.25
		380	380	350	375	370			
spider crab	2	70	90						0.47
rock crab	1	80							0.11

GH 2 Mid Deployed 8:20 Collected 14:00

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
menhaden	58	390	405	380	350	400	370	370	33.75
		360	375	340	325	320	390	380	
		390	405	375	370	350	380	385	
		360	365	395	330	350	325	360	
		340	380	365	380	360	375	380	
		345	345	360	360	370	365	340	
		345	360	375	370	380	370	345	
		375	380	370	340	360	385	360	
		370	375						
sea robin	2	360	335						1.34

GH 3 Surface Deployed 8:30 Collected 15:05

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
bluefish	1	445							1
menhaden	20	370	340	330	340	350	350	365	10.5
		335	330	365	330	310	380	380	
		320	360	390	355	395	380		

Appendix II-A: Gill Net Data, May 2002

GH 4 Bottom — Deployed 8:40 — Collected 14:29

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
sea robin	61	305	305	360	270	285	400	300	25.5
		330	310	330	315	360	280	285	
		330	345	350	260	310	270	290	
		320	270	320	305	330	305	325	
		305	260	295	300	330	280	265	
		360	325	330	350	345	300	240	
		340	320	310	340	330	335	330	
		275	300	340	375	300	360	320	
		285	300	320	340	330			
menhaden	13	380	380	360	370	370	375	350	7.5
		380	380	355	350	380	350		
spider crab	1	70							0.18
rock crab	1	120							0.35

GH 5 Mid — Deployed 8:50 — Collected 15:23

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
menhaden	39	325	345	310	350	340	330	360	9.64
		370	350	340	385	330	335	340	
		335	390	350	330	360	370	340	
		395	380	390	330	345	380	330	
		370	400	370	380	340	330	365	
		350	365	360	330				
horseshoe crab	2	190	185						1.7
weakfish	1	410							0.79
sea robin	8	300	290	250	350	345	340	330	3.25
		300							

GH 6 Surface — Deployed 9:00 — Collected 15:46

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
menhaden	21	345	310	330	340	325	370	330	9.75
		355	340	370	320	295	380	340	
		340	360	340	370	315	350	320	

Appendix II-A: Gill Net Data, May 2002

R 1 Bottom Deployed 9:25 Collected 16:45

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
clearnose skate	1	630							1.5
summer flounder	1	530							1.75
window pane	1	260							0.28
menhaden	1	300							0.45
sea robin	3	330	320	325					1.5
horseshoe crab	7	190	250	175	195	185	205	185	7.5

R 2 Bottom Deployed 9:35 Collected 16:47

Species	Number of Individuals	Total Length (mm)					Biomass (kg)
striped bass	2	710	230				3.96
summer flounder	1	370					0.5
black sea bass	1	80					0.03
butterfish	1	240					0.17
menhaden	1	340					0.45
sea robin	5	260	300	310	350	340	2.25
horseshoe crab	3	190	195	260			3.5
spider crab	1	60					0.13
welk	1						0.14
blue crab	2	50	150				0.4
rock crab	1	80					0.11

APPENDIX II-B: GILL NET DATA, JUNE 2002

Appendix II-B: Gill Net Data, June 2002

LB 1 Shallow Deployed 9:20 Collected 15:40

Species	Number of Individuals	Total Length (mm)						Biomass (kg)
Sea Robin	6	325	363	327	353	318	336	1.3

LB 2 Shallow Deployed 9:30 Collected 15:30

Species	Number of Individuals	Total Length (mm)			Biomass (kg)
Sea Robin	3	335	312	330	1.3

LB 3 Surface Deployed 9:05 Collected 16:03
No Fish

LB 4 Mid Deployed 8:55 Collected 16:08
No Fish

LB 5 Surface Deployed 8:40 Collected 16:11
No Fish

LB 6 Mid Deployed 8:25 Collected 16:16
No Fish

LB 7 Bottom Deployed 8:15 Collected 16:22
No Fish

LB 8 Bottom Deployed 8:50 Collected 16:26
No Fish

Appendix II-B: Gill Net Data, June 2002

NB 1 Bottom Deployed 7:42 Collected 14:34

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Menhaden	3	360	375	370					1.9
Silver Hake	1	185							0.085
Sea Robin	42	350	305	265	280	310	365	305	17.4
		405	325	320	300	320	325	325	
		395	285	335	335	340	290	310	
		290	345	370	345	245	305	345	
		285	250	315	295	330	325	345	
		330	270	310	340	260	315	310	
Blue Crab	3	155	160	155					0.7

NB 2 Bottom Deployed 7:50 Collected 14:53

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Menhaden	3	370	370	375					120
Sea Robin	13	310	330	345	335	335	330	295	4.9
		275	315	310	280	300	280		

NB 3 Mid Deployed 8:00 Collected 15:07

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Bluefish	1	295							0.3
Menhaden	13	375	370	365	360	355	380	370	7.3
		380	365	395	375	380	390		

NB 4 Mid Deployed 8:11 Collected 15:14

Species	Number of Individuals	Total Length (mm)		Biomass (kg)
Menhaden	2	360	370	1.3

NB 5 Surface Deployed 8:18 Collected 15:24

Species	Number of Individuals	Total Length (mm)				Biomass (kg)
Horseshoe Crab	1	200				1.1
Blue Crab	4	155	160	135	150	0.9

NB 6 Surface Deployed 8:24 Collected 15:34

Species	Number of Individuals	Total Length (mm)	Biomass (kg)
Menhaden	1	370	0.6

Appendix II-B: Gill Net Data, June 2002

NB 7 Shallow Deployed 8:30 Collected 15:50

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Menhaden	1	380							0.7
Striped bass	5	350	345	325	345	240			2
Sea Robins	24	345	320	355	255	280	385	310	9.55
		325	290	345	320	275	320	250	
		270	320	275	340	350	270	300	
		310	300	310					
Blue Crab	3	125	125	120					0.4

NB 8 Shallow Deployed 8:35 Collected 16:14

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Horseshoe Crab	1	210							1.1
Sea Robin	10	305	290	330	325	365	365	265	4.3
		275	265	310	325				
Striped Bass	1	295							0.4
Menhaden	1	400							0.9
Summer Flounder	1	330							0.5
Blue Crab	5	145	160	145	170	155			1.1

NB 9 Shallow Deployed 8:45 Collected 16:29

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Menhaden	2	355	385						1.3
Bluefish	5	325	320	330	290	310			1.6
Sea Robin	8	260	350	320	310	265	290	265	2.9
		335							
Blue Crab	1	140							0.3

NB 10 Shallow Deployed 8:52 Collected 16:50

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Horseshoe Crab	3	270	190	175					4.2
Sea Robin	32	350	320	260	345	280	325	280	11.3
		360	255	310	225	245	350	330	
		260	295	315	340	290	270	290	
		330	245	310	245	320	280	340	
		260	270	345	295				
Bluefish	7	410	320	295	280	305	290	275	2.2
Blue Crab	8	190	165	175	160	145	140	125	2
		165							

Appendix II-B: Gill Net Data, June 2002

GH 1 Bottom Deployed 9:30 Collected 15:02

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Horseshoe	1	230							1.6
Sea Robins	33	240	320	270	330	325	250	260	8.8
		240	285	320	215	285	325	350	
		250	245	250	285	245	295	295	
		245	320	260	280	240	250	240	
		240	265	240	255	260			
Blue Crab	8	150	110	180	140	155	145	155	1.5
		140							

GH 2 Mid Deployed 9:40 Collected 15:30

Species	Number of Individuals	Total Length (mm)		Biomass (kg)
Bluefish	2	310	315	0.7
Blue Crab	1	155		0.35
Sea Robin	2	255	260	0.65

GH 3 Surface Deployed 10:10 Collected 16:30

Species	Number of Individuals	Total Length (mm)				Biomass (kg)
Striped Bass	1	457				1.05
Menhaden	2	357	340			1.1
Bluefish	4	293	312	355	330	1.4

GH 4 Bottom Deployed 9:50 Collected 16:00

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Blue Crab	4	155	135	160	165				0.9
Menhaden	7	85	95	380	376	385	320	365	2.8
Bluefish	3	375	430	338					1.5
Weakfish	1	235							0.128
Horseshoe Crab	2	270	205						3.6
Sea Robin	35	260	350	255	250	260	215	390	8.2
		245	238	235	210	275	245	185	
		250	240	310	275	300	215	270	
		265	235	255	335	245	235	270	
		265	235	255	230	240	215	275	

Appendix II-B: Gill Net Data, June 2002

GH 5 Mid Deployed 10:00 Collected 16:20

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Bluefish	3	310	330	322					1.1

GH 6 Surface Deployed 10:15 Collected 16:40

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Blue Crab	5	125	140	135	158	115			0.95
Bluefish	9	300	320	295	340	305	305	290	2.7
		325	290						

Appendix II-B: Gill Net Data, June 2002

R 1 Deployed 9:10 Collected 13:35

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Smooth Dogfish	1	820							1.85
Horseshoe Crab	1	230							1.6
Sea Robin	2	388	270						1
Summer Flounder	1	335							0.4
Blue Crab	2	141	146						0.28
Lady Crab	70	50	60	65	55	55	55	90	0.9
		70	55	50	45	55	45	55	
		70	40	50	70	60	50	50	
		50	55	50	55	55	55	55	
		60	60	55	45	50	50	55	
		60	70	55	55	55	50	50	
		60	55	45	45	55	55	55	
		40	55	45	40	50	50	55	
		60	60	60	40	40	45	45	
		50	55	45	55	35	45	45	
Spider Crab	14	80	65	55	60	70	70	85	2.3
		80	60	55	75	70	50	80	

R 2 Deployed 9:10 Collected 14:14

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Sea Robin	10	230	240	225	225	220	195	245	1.6
		268	215	235					
Horseshoe Crab	7	285	255	260	200	250	190	260	13.1
Weakfish	1	260							0.128
Scup	1	120							0.019
Blue Crab	7	138	134	145	130	135	155	136	1.1
Lady Crab	3	70	65	50					0.128
Spider Crab	5	75	80	65	65	65			0.8

APPENDIX II-C: GILL NET DATA, AUGUST 2002

Appendix II-C: Gill Net Data, August 2002

LB 1 Bottom Deployed 9:00 Collected 15:32
No Fish

LB 2 Bottom Deployed 9:05 Collected 15:37
No Fish

LB 3 Mid Deployed 9:05 Collected 15:00

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Menhaden	2	117	114						0.54

LB 4 Mid Deployed 9:15 Collected 15:15

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Menhaden	5	330	133	88	76	120			0.5
Bluefish	2	330	336						0.8
Alewife	1	95							0.3

LB 5 Surface Deployed 9:20 Collected 14:42
No Fish

LB 6 Surface Deployed 9:25 Collected 14:46

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Menhaden	7	133	133	133	133	133	133	133	0.21

LB 7 Shallow Deployed 9:30 Collected 14:15

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Horseshoe Crab	1	215							1.3
Menhaden	4	76	82	82	88				0.029
Spot	2	158	146						0.095

LB 8 Shallow Deployed 9:35 Collected 14:30

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Menhaden	6	82	82	88	92	82	76		0.045

Appendix II-C: Gill Net Data, August 2002

NB 1 Bottom Deployed 8:55 Collected 14:09

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Striped Bass	2	488	412						2
Bluefish	1	361							0.5
Northern Searobin	1	203							0.2
Weakfish	1	317							0.4
Menhaden	4	88	82	82	88				0.03
Blue Crab	2	190	63						0.5

NB 2 Mid Deployed 9:02 Collected 14:29

No Fish

NB 3 Surface Deployed 9:08 Collected 14:36

No Fish

NB 4 Bottom Deployed 9:13 Collected 14:43

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Striped Searobin	7	304	279	330	330	361	279	304	2.9
Bluefish	1	349							0.5
Blue Crab	1	88							0.018
Weakfish	2	88	101						0.02
Menhaden	1	381							0.5

NB 7 Shallow Deployed 9:32 Collected 15:17

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Striped Bass	2	317	266						0.7
Bluefish	3	381	330	355					1.4
Blue Crab	2	152	88						0.4
Menhaden	3	82	82	82					0.017

Appendix II-C: Gill Net Data, August 2002

NB 8 Shallow Deployed 9:28 Collected 15:25

Species	Number of Individuals	Total Length (mm)				Biomass (kg)
Spot	1	139				0.046
Bluefish	4	355	355	406	400	2.1
Spider Crab	1	82				0.225
Menhaden	3	76	88	82		0.02

NB 5 Mid Deployed 8:55 Collected 14:13

Species	Number of Individuals	Total Length (mm)	Biomass (kg)
Menhaden	1	127	0.022

NB 6 Surface Deployed 9:01 Collected 14:01

Species	Number of Individuals	Total Length (mm)		Biomass (kg)
Menhaden	1	82		0.005
Blue Crab	2	152	101	0.3

Appendix II-C: Gill Net Data, August 2002

GH 1 Bottom Deployed 9:16 Collected 14:29

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Weakfish	1	482							1.1
Striped Searobin	1	285							0.3
Blue Crab	4	139	107	158	101				0.6
Spot	2	152	184						0.2

GH 2 Mid Deployed 9:21 Collected 14:42

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Bluefish	2	361	381						1
Menhaden	13	88	88	82	82	82	88	88	0.085
		88	82	88	88	88	82		
Blue Crab	1	101							0.075

GH 3 Surface Deployed 9:27 Collected 14:58

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Menhaden	3	88	88	88					0.03
Blue Crab	1	50							0.008

GH 4 Bottom Deployed 9:39 Collected 15:09

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Smooth Dogfish	1	533							0.7
Horseshoe Crab	2	241	203						2.9
Striped Searobin	8	266	330	292	279	330	279	292	2.8
		266							
Northern Searobin	1	203							0.008
Blue Crab	9	165	120	177	127	177	165	171	2
		139	82						
Weakfish	13	304	304	336	508	304	146	304	4.5
		342	330	304	381	114	101		
Bluefish	2	355	374						1.1
Menhaden	5	342	82	88	76	76			0.506

Appendix II-C: Gill Net Data, August 2002

GH 5 Mid Deployed 9:45 Collected 15:36

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Bluefish	16	342	374	381	368	381	368	381	8.6
		355	393	342	368	381	381	355	
		368	400						
Blue Crab	2	165	177						0.6

GH 6 Surface Deployed 9:59 Collected 15:55

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Menhaden	31	88	82	88	88	88	88	88	0.275
		88	88	88	88	88	88	88	
		95	88	92	88	82	88	88	
		92	88	88	101	88	88	88	
		92	88	92					

Appendix II-C: Gill Net Data, August 2002

R 1 Shallow Deployed 10:27 Collected 16:18

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Spider Crab	1	76							0.075
Blue Crab	12	127	139	127	146	146	177	139	1.7
		139	114	101	101	10			
Bluefish	1	431							0.7
Horseshoe Crab	1	203							1
Striped Searobin	1	82							0.006
Black Sea Bass	1	184							0.12
Weakfish	5	101	133	101	114	107			0.185
Menhaden	1	63							0.003

R 2 Shallow Deployed 11:05 Collected 16:41

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Horseshoe Crab	13	152	203	203	203	241	203	177	12.7
		177	190	190	203	203	171		
Blue Crab	21	107	177	171	165	152	139	120	4
		158	139	158	152	152	152	107	
		158	139	139	165	152	152	101	
Summer Flounder	1	381							0.8
Striped Searobin	3	254	304	88					0.7
Northern Searobin	3	203	177	177					0.3
Bluefish	1	361							0.5
Black Sea Bass	1	190							0.8
Scup	7	184	228	190	171	165	158	158	0.765
Menhaden	6	139	152	88	88	88	82		0.105
Spider Crab	1	50							0.037
Lady Crab	4	55	57	57	30				0.145
Weakfish	9	114	114	114	114	95	114	88	0.105
		114	114						

APPENDIX II-D: OTTER TRAWL DATA, MAY 2002

Appendix II-D: Otter Trawl Data, May 2002

NB 1 5 min trawl

Species	Number of Individuals	Total Length (mm)		Biomass (kg)
horseshoe crab	1	460		2.72

NB 2 5 min trawl
No Fish

NB 3 5 min trawl

Species	Number of Individuals	Total Length (mm)		Biomass (kg)
horseshoe crab	2	210	255	3.4
sea robin	1	330		0.45

GH 1 10 min trawl
no catch

GH 2 10 min trawl
no catch

GH 3 10 min trawl
no catch

Appendix II-D: Otter Trawl Data, May 2002

R 1 10 min trawl

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
horseshoe crab	1	210							0.91
summer flounder	1	445							0.79
sea robin	1	370							0.91
spider crab	1	50							0.09
blue crab	2	145	120						0.37
window pane	1	230							0.21
striped bass	2	180	210						0.26
diamondback terrapin	2	95	145						1.9

R 2 10 min trawl
no catch

R 3 10 min trawl

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
seahorse	1	8							<0.001
horseshoe crab		210	180	160	135	170	200	120	16.78
		140	200	260	130	145	140	230	
		120	135	175	200	170	130	165	
		160	170						
blue crab	2	140	120						0.43
winter flounder	6	380	230	190	340	320	180		2.72
spider crab	2	70	75						0.3

APPENDIX II-E: OTTER TRAWL DATA, JUNE 2002

Appendix II-E: Otter Trawl Data, June 2002

R1 9 min trawl

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Winter Flounder	1	250							0.26
Lady Crab	2	50	45						0.046
Spider Crab	1	65							0.067
Blue Crab	1	155							0.2
Pipefish	1	150							< 0.001

R2 5 min trawl

Species	Number of Individuals	Total Length (mm)	Biomass (kg)
Blue Crab	1	145	0.15

R3 2 min trawl

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Lady Crab	22	70	65	75	65	60	70	70	0.624
		60	65	50	65	70	70	65	
		65	60	60	55	65	60	60	
		65							

R4 hung up

R 5 10 min trawl

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Horseshoe Crab	1	209							1.1
Summer Flounder	1	465							1.05
Scup	2	120	84						0.035
Seaboard Gobbi	3	40	48	55					0.014
Seahorse	2	120	60						0.014
Sea Robin	1	120							0.043
Lady Crab	46	65	75	50	85	80	70	65	1.389
		80	70	50	90	60	60	75	
		85	85	70	50	60	100	95	
		65	50	80	65	75	70	70	
		65	65	75	60	65	60	70	
		70	55	60	80	60	60	70	
		70	50	62	65				

Appendix II-E: Otter Trawl Data, June 2002

GH 1 10 min trawl
no catch

GH 2 10 min trawl
no catch

GH 3 10 min trawl
no catch

GH 4 10 min trawl
no catch

GH 5 10 min trawl
no catch

NB 1 6 min trawl
no catch

NB2 8 min trawl

Species	Number of Individuals	Total Length (mm)				Biomass (kg)
Summer Flounder	1	425				0.95
Blue Crab	3	155	135	145		0.7

NB 3 8 min trawl

Species	Number of Individuals	Total Length (mm)				Biomass (kg)
Blue Crab	4	145	150	140	20	0.75

NB 4 9 min trawl

Species	Number of Individuals	Total Length (mm)				Biomass (kg)
Horseshoe Crab	1	160				0.75
Blue Crab	1	140				0.13

NB 5 8 min trawl

Species	Number of Individuals	Total Length (mm)				Biomass (kg)
Winter Flounder	1	260				0.298
Blue Crab	2	140	140			0.411

APPENDIX II-F: OTTER TRAWL DATA, AUGUST 2002

Appendix II-F: Otter Trawl Data, August 2002

R 1 10 min trawl

Species	Number of Individuals	Total Length (mm)					Biomass (kg)
Cunner	1	60					0.003
Blue Crab	3	114.3	107.95	95.25			0.3

R 2 10 min trawl

Species	Number of Individuals	Total Length (mm)					Biomass (kg)
Winter Flounder	2	88.9	63.5				0.007
Blue Crab	3	120.65	146.05	107.95			1.6
Rock crab	1	25.4					0.004

R 3 10 min trawl

Species	Number of Individuals	Total Length (mm)					Biomass (kg)
Blue Crab	1	76.2					0.041
Lady Crab	1	19.05					0.002
Pipefish	1	107.95					

R 4 10 min trawl

Species	Number of Individuals	Total Length (mm)					Biomass (kg)
Winter Flounder	1	120.65					0.016
Horseshoe Crab	3	209.55	203.2	203.2			3
Spider Crab	1	63.5					0.065
Blue Crab	3	133.35	146.05	146.05			0.6
Lady Crab	2	63.5	63.5				0.2

R 5 10 min trawl

Species	Number of Individuals	Total Length (mm)					Biomass (kg)
Blue Crab	1	152.4					0.2
Lady Crab	5	69.85	50.8	57.15	38.1	25.4	0.2
Winter Flounder	1	69.85					0.004
Striped Sea Robin	1	73.025					0.006
Black Sea Bass	1	44.45					0.001

Appendix II-F: Otter Trawl Data, August 2002

GH 1 10 min trawl

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Menhaden	1	76.2							0.005
Bay Anchovie	1	44.45							

GH 2 10 min trawl
no catch

GH 3 10 min trawl
no catch

GH 4 10 min trawl
no catch

GH 5 10 min trawl

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Weakfish	1	82.55							0.006

NB 1 8 min trawl

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Horseshoe Crab	2	203.2	254						6.1
Blue Crab	8	152.2	127	88.9	88.9	133.35	101.6	88.9	0.8
		76.2							

NB 2 9 min trawl
no catch

NB 3 8 min trawl

Species	Number of Individuals	Total Length (mm)							Biomass (kg)
Horseshoe Crab	2	266.7	228.6						3.3
Summer Flounder	1	330.2							0.5
Blue Crab	6	177.8	101.6	127	101.6	152.2	177.8		1.3
Spider crab	1	50.8							0.037

Appendix II-F: Otter Trawl Data, August 2002

NB 4 9 min trawl

Species	Number of Individuals	Total Length (mm)						Biomass (kg)
Blue Crab	6	101.6	101.6	101.6	101.6	107.95	88.9	237

NB 5 8 min trawl

Species	Number of Individuals	Total Length (mm)	Biomass (kg)
Blue Crab	1	114.2	0.085
Cunner	1	69.85	0.006

APPENDIX III-A: SEDIMENT PROFILE IMAGERY INTERACTIVE DATABASE

Appendix III-A: Sediment Profile Imagery Interactive Database

Please refer to CD-ROM attached to the back cover of this report. The CD-ROM is an interactive HTML database for viewing the benthic, trawl, gill net, and the SPI data and images collected in 2002. To access the data:

Click on the folder labeled **Norton Basin HTML Database 2002**

Then click the file **Index.html**

This brings you to the main navigation page that allows you to click on any of the data links.

Created for:

New York State Department of Environmental Conservation
47-70 21st Street
Long Island City, NY 11101

And

Port Authority of New York and New Jersey
225 Park Avenue South
New York, NY 10003

Sediment Profile Imagery was collected and processed by:

Robert J. Diaz, Ph.D
R. J. Diaz and Daughters
6198 Driftwood Lane
P. O. Box 114
Ware Neck, VA 23178

Benthic, Trawl, and Gill Net data was collected and processed by:

Barry A. Vittor & Associates, Inc.
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(845) 382-2087

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cmiller@bvaenviro.com

APPENDIX III-B: SEDIMENT PROFILE IMAGERY DATA DICTIONARY

Data Dictionary for 2002 Nearfield SPI Data File

	Variable		Description	Units
A	STATION		Station Name	
B	REP		Replicate image	
C	DAY		Day image collected	day/mon/year
D	PRISM	TIME	Time when image was taken, based on sediment profile camera clock	hours:minutes
E	Pen Min	Qual	Qualifier for minimum prism penetration	
F	Pen	Min	Minimum prism penetration depth in cm	cm
G	Pen Max	Qual	Qualifier for maximum prism penetration	
H	Pen	Max	Maximum prism penetration depth in cm	cm
I	Ave Pen	Qual	Qualifier for average prism penetration depth	
J	ave	Pen	Average prism penetration depth in cm	cm
K	Sur Rel	Qual	Qualifier for surface relief	
L	SUR	REL	Surface relief across the 15 cm width of the prism face plate	cm
M	RPD Min	Qual	Qualifier for minimum RPD	
N	RPD	Min	Minimum RPD depth in cm	cm
O	RPD Max	Qual	Qualifier for maximum RPD	
P	RPD	max	Maximum RPD depth in cm	cm
Q	RPD Ave	Qual	Qualifier for average RPD depth	
R	RPD	ave	Average RPD depth in cm	cm
S	GRAIN SIZE		Sediment grain size estimate	
T	SURFACE	FEATURES	Predominant factor structuring surface sediments	
U	Sedi Layer	Qual	Qualifier for sediment layers	
V	SEDI.	LAYER	Number of sediment layers in image	count
W	AMPHIPOD	TUBES	Number of amphipod tubes in image	ordered category
X	WORM	TUBES	Number of worm tubes in image	ordered category
Y	SURFACE FAUNA	OTHER	Description of other fauna on surface of sediment	
Z	Worm	Qual	Qualifier for infaunal worms	
AA	SUB. FAUNA	WORMS	Number of infaunal worms	count
AB	Burrow	Qual	Qualifier for burrows	
AC	BURROWS		Number of burrows	count
AD	Oxic Void	Qual	Qualifier for oxic voids	
AE	OXIC	VOIDS	Number of water filled inclusions in the sediment that appear oxic	count
AF	Anaerobic Void	Qual	Qualifier for anaerobic voids	
AG	ANAEROBIC	VOIDS	Number of water filled inclusions in the sediment that appear anaerobic	count
AH	Gas Void	Qual	Qualifier for gas voids	
AI	ANAEROBIC	VOIDS	Number of gas filled inclusions in the sediment	count
AJ	SUCC.	STAGE	Estimate of community successional stage	
AK	OSI	Qual	Qualifier for Organism Sediment Index	
AL	OSI		Organism Sediment Index of Rhoads and Germano (1986)	
AM	OTHER		Other comments	

Qualifiers:

IND	Value could not be estimated from slide
INDmin	Prism penetration too shallow to estimate value
INDvid	Value could not be estimated from video tape image
NOcon	Maximum penetration estimated from sediment not in contact with prism faceplate
NObkg	Excludes sediment not in contact with prism faceplate
POOR	Value estimated from poor quality image
>	Value was greater than prism penetration

Ordered Category Classes:	Range of Numbers
NONE	0
FEW	1 to 5
SOME	6 to 20
MANY	>20
MAT	>100

Sediment Categories:	Class	Phi Scale Range	Modal Phi	er Limit Size (	ains/cm of image
CB	Cobble	-6 to -8	-7	256	<<1
PB	Pebble	-2 to -6	-4	64	<1
GR	Gravel	-1 to -2	-1.5	4	2.5
VCS	Very-coarse-sand	0 to -1	-0.5	2	5
CS	Coarse-sand	1 to 0	0.5	1	10
MS	Medium-sand	2 to 1	1.5	0.5	20
FS	Fine-sand	4 to 2	3	0.25	40
VFS	Very-fine-sand	4 to 3	3.5	0.12	80
FSSI	Fine-sand with Silt	5 to 4	4.5	0.06	160
FSSICL	Fine-sand-silt-clay	6 to 4	5	0.06	160
SI	Silt	8 to 5	6.5	0.0039	>320
SIFS	Silt with Fine-sand	6 to 5	5.5	0.0039	>320
CL	Clay	>8	10	<0.0005	>2560
/	Layered Sediment				

Surface Features Categories:

BIO	Biogenic processes dominant
BIO/PHY	Combination of both Biogenic and Physical processes
PHY	Physical processes dominant