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Port Everglades Macroinvertebrate Monitoring: Monitoring of Benthic Macroinvertebrate Assemblages at the Southport Turning Basin and Adjacent Areas of John U. Lloyd State Recreation Area: August 1992 (With a Summary of the August 1991 and January 1992 Surveys)

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PORT EVERGLADES MACROINVERTEBRATE MONITORING

MONITORING OF BENTHIC MACROINVERTEBRATE ASSEMBLAGES

AT THE SOUTHPORT TURNING BASIN AND ADJACENT AREAS OF

JOHN U. LLOYD STATE RECREATION AREA: AUGUST 1992

(WITH A SUMMARY OF THE AUGUST 1991 AND JANUARY 1992 SURVEYS)

Prepared for:

Port Everglades Authority

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A. INTRODUCTION

This report documents the August 1992 monitoring of benthic macroinvertebrate assemblages in the Port Everglades Southport turning basin vicinity and adjacent areas of John U. Lloyd State Recreation Area. This is the third monitoring effort of the series carried out by Nova University Oceanographic Center. Sampling was carried out chiefly during the first two weeks of August 1992. Hurricane Andrew and its aftermath resulted in delays in sampling at several sites and in analyzing data. A two-week postponement in submission deadline was requested and granted. An additional postponement, to 31 January 1992, was requested due to a move at the Smithsonian Institution that prevented some consultants from returning identifications on time.

A history of the monitoring project since its inception in 1988 was given in the report submitted December 1991 and is included here again for reference. This report also includes the tabular data for the two previous surveys (August 1991 and January 1992) together with a discussion of all three surveys carried out by Nova University.

Please note modifications to the Ponar grab sample data for the January 1992 survey. In the original report for that survey, we inadvertently omitted doubling the dataset from large-volume samples of which we sorted 50% (following the methodology described below). Diversity indices were not affected.

A.1. History

Benthic macroinvertebrate communities at the Southport Turning Basin site and adjacent areas of John U. Lloyd State Recreation Area were initially monitored in March, May, and September, 1988, before basin dredging and mangrove mitigation began. Only results of the September 1988 sampling have been reported. Nineteen stations were occupied during the September 1988 and January 1989 sampling periods as follows: eight stations in two transects north of the proposed turning basin and 11 stations in four transects in John U. Lloyd State Recreation Area on the east side of the Intracoastal Waterway (ICWW)(Figure 1). Tree removal for mitigation began on the east side of the ICWW in late 1988, but scraping to intertidal level began only after the January 1989 sampling period. Dredging of the turning basin began in the

summer of 1989. Between January and August 1989, dredging destroyed several stations sites along the northern margin of the turning basin. These stations were relocated approximately 10 m to the north for the August 1989 sampling period. Also in August 1989, four additional stations were added (two on the west side and two on the east side of the ICWW). In January 1990, the turning basin approached final size; planting of mangrove seedlings and cord grass was underway in some mitigation areas. By the August 1990 sampling period, extensive mitigation and emplacement of rip-rap was completed along the east side of the ICWW; dredging continued in the turning basin but the margin was almost completely lined with rip-rap. Monitoring was carried out biannually by S. Dobkin through January 1991.

B. METHODOLOGY

Figure 1 illustrates locations of stations occupied for the August 1992 sampling period and the kind of sample (Ponar grab, crab census, or hand collection) taken at each.

Shannon-Weaver Diversity Indices are calculated for each station and, at Ponar grab stations, for each replicate as well using the following equation:

$$H' = -\sum_{i=1}^S p_i \ln p_i$$

where p_i is the relative abundance of species i . H' increases with increasing number of species S . For any given S , H' reaches a maximum value (H'_{\max}) when all values of p are equal ($p_1=p_2=p_3=\dots$), and H' equals $\ln S$. Because H' is primarily affected by species number rather than by abundances of common or rare species, or by species of moderate abundance, evenness (J') has also been calculated for each station and replicate using the equation:

$$J' = H'/H'_{\max} = H'/\ln S$$

As a ratio between the diversity index (H') for a given sample and the maximum possible diversity index (H'_{\max}) for the number of species and specimens in that sample, evenness (J') gives an indication of how close the data come to maximum possible diversity.

B.1. Grab Samples

Benthic grab samples are taken according to contract specifications with a 225 cm² grab sampler¹ at stations 1, 8, 8a, 9, 10a, 11, 13a, 14, 17, 18 and 19a, with three replicate samples at each station. All samples are fixed in 5% seawater buffered formalin with rose bengal stain and sieved through a 0.5 mm mesh screen. Organisms and sediment retained on the screen are transferred to 70% ethanol and sorted to most specific distinguishable taxa. Taxa are either identified or sent to recognized experts for identification (Table 7). Nematodes and harpacticoid copepods have not been enumerated or included in diversity calculations. These organisms are normally treated as meiofauna, not macrofauna. The relatively few large specimens retained by a 0.5 mm mesh screen do not accurately reflect their true abundances. Similarly, a small number of planktonic organisms (e.g., calanoid copepods) accidentally collected by the grab sampler have likewise not been included in counts and diversity calculations.

Modifications in sampling and handling protocols instituted during the August 1991 survey to improve sampling accuracy in conformity with contract specifications are described in a previous report (submitted December 1991) and have been maintained.

1) Mixed rocky and unconsolidated substrates at several stations adjacent to rip-rap along the ICWW require that the grab sampler be operated by a diver in order to ensure consistent sample size.

2) Shallow-water stations (10a, 17 and 19a) are sampled via hand-emplaced grab sampler rather than shovel. This ensures that all samples collected at stations specified for grab sampler will cover equal areas of substrate.

3) The previous contractor sieved and sorted through one-third of each sample. We sieve all samples completely. Samples including up to approximately 0.5 liter of sediment retained on the 0.5 mm screen are sorted completely. When a larger volume is retained, we sort through half

1. Contract specifications call for a 225 cm³ grab sampler, but this is clearly an error. Such a grab sampler, about 6 cm on a side, was not used by the previous contractor and is not, to our knowledge, manufactured.

the sample (and double the recorded number of each taxon). This protocol guarantees more accurate enumeration of collected organisms.

Depths recorded for Ponar stations below may differ from those recorded previously because of tidal variations.

B.2. Crab Collections

Three 1.0-m² replicate quadrats are randomly placed within about 2.0m of each other at stations 1a, 2, 3, 4, 5, 6, 7, 10, 12, 13, 15 and 16. Within each quadrat, all crab burrows are counted and 10% excavated, and the inhabitants counted and identified in the field or collected and identified in the laboratory, according to contract specifications.

Modifications in sampling and handling protocols instituted during the August 1991 survey to improve sampling accuracy in conformity with contract specifications are described in a previous report (submitted December 1991) and have been maintained.

1) Contract specifications require that "Arboreal crabs are to be noted and abundance recorded within a specified observation area..." The previous contractor recorded arboreal crabs only as "few," "moderate" or "abundant" without indicating the quantitative range of each term. Observations were made in a circle of trees "approximately 3-4 meters in diameter." Because these crabs crawl out of sight (into the canopy and around the far side of trunks and branches) upon approach, we have reduced the observation area in order to make more accurate counts. We count crabs on trees arising from a 1.0-m² quadrat selected randomly within about 2.0 m of the burrow-census quadrats. Arboreal censuses are carried out first at each site to minimize disturbance.

B.3 Hand Collections

Hand collections are taken at stations 9, 13, and 17, with three replicates at each station. Each replicate sample covers an area of 0.1m². Justification for this sampling area is discussed in the survey report for August 1991. Organisms identifiable in the field are counted and released. Taxa unidentifiable in the field are collected by hand, with forceps, or by agitating algae-covered rocks in a bag of seawater. Collected specimens are placed in plastic bags with seawater, fixed in 10% buffered seawater formalin in the laboratory, and finally stored in 70% ethanol.

Modifications in sampling and handling protocols instituted during the August 1991 survey to improve sampling accuracy in conformity with contract specifications are described in a previous report (submitted December 1991) and have been maintained. They are included here again for reference: 1) Contract specifications require that "hand collections are to be performed within a measured area..." The previous contractor made no mention of the area sampled. Our samples consist of 1.0m transects 0.1m wide and parallel to the local waterline. Replicates at each station are taken at about the same distance from the water's edge and no more than about one meter apart. Each replicate sample covers an area of 0.1m². Intertidal environments are often highly patchy and vertically zoned with distinct assemblages of organisms occupying immediately adjacent areas of substrate. While a larger area would reduce inter-replicate variability due to local environmental patchiness and zonation (e.g., such samples would include fauna on rocks with and without algal cover, and both high and low intertidal zone assemblages), it would also severely expand sampling time, especially in densely populated areas. For example, a 1.0 m² quadrat may be large enough to include both low intertidal oysters and high intertidal periwinkle snails, but requires either counting several thousand barnacles or implementing statistically sophisticated subsampling protocols.

2) Contract specifications state that "organisms collected within a specified sampling area shall be enumerated..." The previous contractor explicitly does not count the several species of barnacles listed. Resulting diversity indices, therefore, do not accurately reflect community structure. Our samples include an enumeration of all visible organisms as well as qualitative notes on additional organisms observed on adjacent substrates.

Because the vast majority of barnacles enumerated in this survey were small juveniles, they were not identified below the level of genus.

C. RESULTS

C.1. Grab Samples (August 1992)

Table 1 lists raw data, Shannon-Weaver Diversity Indices (H') and evenness (J') for all

samples by station and by replicate. Table 2 summarizes numbers of specimens by major taxonomic group; Table 3 summarizes relative abundances of major taxonomic groups (percent occurrence).

A total of 9,039 specimens were sorted and identified from the 33 grab samples (11 stations with three replicates each). Polychaete worms remain the most abundant group (40.8%), followed by peracarid crustaceans (31.6%) and oligochaete worms (15.8%). These three major taxa account for 88% of all specimens collected. Peracarid crustaceans remain in second place entirely as a result of the overwhelming abundance of the tanaidacean crustacean, *Kalliapseudes aliciae* (previously reported as *Kalliapseudes* sp.), at station 17. These specimens account for 24% of all organisms collected at all stations in this survey. The five next most abundant taxa (the polychaetes *Capitella capitata*, *Aricidea philbinae*, *Sphaerosyllis* sp.; oligochaetes *Smithsondrilus hummelincki*, *Tubificoides motei*) together account for 27.7% of all organisms collected. Species occurring at the majority of stations include one mollusc (*Caecum pulchellum* at 8 stations), seven polychaetes [*Sphaerosyllis* sp. (10 stations), *Prionospio heterobranchiata*, *Mediomastus californiensis*, *Tharyx dorsobranchialis* (9 stations each), *Aricidea taylori*, *Lumbrineris testudinum* (8 each), *Capitella capitata* (7)], two oligochaetes [*Smithsondrilus hummelincki*, *Tubificoides motei* (8 each)], and two nemertine worms [*Hubrechtella dubia* (9) and *Carinomella lactea* (8)].

We are able to identify podocopan ostracodes for the first time in this survey. Specimens previously reported as a single unidentified species actually represent two distinct species (*Cyprideis americana* and *Peratocytheridea setipunctata*). Numbers given in Table 1 again represent our best estimate of the specimens alive when collected. Substantial numbers of apparently very recently dead individuals were again taken.

Following is a brief description of results for each station.

Station 1: West side of Intracoastal Waterway (ICWW) at NE corner of Southport Turning Notch. Depth: approx. 3m. Bottom: fine muddy sand with finely divided mangrove detritus and algae-covered rocks. Faunal totals: 207 specimens, 38 species. Shannon-Weaver Diversity

Index (H'): 2.667. Evenness (J'): 0.733.

Polychaetes dominate the station (69.7%) to a greater degree than in August 1991, but much less than in January 1992. Oligochaetes (22.4%) are still the second most abundant group, but have increased substantially in relative abundance. The most abundant species are now the polychaetes, *Mediomastus californiensis* and *Lumbrineris testudinum* and the oligochaete *Tubificoides motei*. Of these, only the latter was present in any numbers in August 1991. Species richness and diversity, and organism abundance have increased sharply from January 1992 values but remain well below those recorded in August 1991.

Station 8: West side of ICWW approximately 30 m north of station 1. Depth: approximately 3m. Bottom: fine muddy sand with finely divided mangrove detritus and scattered hand-sized, algae-covered rocks. Faunal totals: 452 specimens, 52 species. H' : 2.974. J' : 0.753.

Polychaetes are still most abundant (50%), but are now closely followed by oligochaetes (41.8%). The most abundant taxa are the oligochaetes, *Tubificoides motei*, *Smithsondrilus hummelincki*, and *Tectidrilus gabriellae*, and the polychaetes, *Mediomastus californiensis*, *Sphaerosyllis* sp. and *Aricidea taylori*. Organism abundance has tripled and species richness has more than doubled relative to August 1991; diversity has also increased.

Station 8a: West side of ICWW approximately 50 m north of station 8. Depth and bottom: similar to station 8. Faunal totals: 386 specimens, 38 species. H' : 2.304. J' : 0.633.

Polychaete dominance has declined from the January 1992 level (81%) to slightly less than in August 1991 (62.7 versus 67.4%). As at station 8, oligochaetes have increased substantially in abundance and now account for 30.8% of the fauna. Other groups have either declined or remained about the same relative to the previous two surveys. The most abundant taxa are the polychaete *Aricidea taylori* and the oligochaetes *Tubificoides motei* and *Smithsondrilus hummelincki*. Organism abundance is twice as great and species richness 36% greater than in the August 1991 survey. The diversity index, however, has declined due to dominance by the three most abundant taxa.

Station 9: East side of ICWW at the SW corner of a mangrove island north of the northern entrance to Whiskey Creek. Depth: approximately 1 m. Bottom: Fine muddy sand with

filamentous algal turf and *Arenicola* (lugworm) burrows. Faunal totals: 698 specimens, 41 species. H' : 2.129. J' : 0.573.

Polychaetes exhibit a much greater dominance (85.7%) relative to the previous two surveys. All other groups have declined in relative abundance with one exception: oligochaetes have increased in importance and numbers relative to both preceding surveys (now accounting for 8.5%). The most abundant taxa are the polychaetes, *Capitella capitata*, *Aricidea philbinae*, *Leitoscoloplos robustus*, *Ophryotrocha* sp. A, and the oligochaete *Thalassodrilides gurwitschi*. Of these, only *A. philbinae* was present in substantial numbers in August 1991. Species richness is higher than in August 1991 although diversity has declined slightly, due to dominance by the two most abundant polychaete species. Organism abundance is almost three times that for August 1991.

Station 10a: Middle of shallow creek behind Environmental Education Bldg., John U. Lloyd State Recreation Area, east side of ICWW. Depth: approximately 0.1m (exposed at low tide). Bottom: Sandy mud. Faunal totals: 1130 specimens, 23 species. H' : 1.712. J' : 0.546.

Polychaetes are more important than in August 1991 or January 1992 (80.7% versus 43.8% and 65.9%, respectively). Ostracodes again contribute a substantial proportion to the fauna (14.7%) although not nearly as much as in August 1991 (52.4%). Peracarid crustaceans have declined from their January 1992 peak (22.3%) to the previous August's level (<1%). The five most abundant taxa, the polychaetes *Aricidea philbinae*, *Capitella capitata*, *Sphaerosyllis* sp. and the podocopan ostracodes *Cyprideis americana* and *Peratocytheridea setipunctata*, overwhelmingly dominate the fauna and account for the lowered diversity index relative to the two preceding surveys. The polychaetes *Leitoscoloplos fragilis*, *L. foliosus* and *Laeonereis culveri*, each abundant in one previous survey, have disappeared. Species richness is slightly greater than in August 1991, but half that in January 1992. Organism abundance is almost three times as great as in August 1991 and about the same as in January 1992.

Station 11: At north corner of the northern entrance to Whiskey Creek. Depth: approximately 5 m. Bottom: Pockets of fine muddy sand with finely divided mangrove detritus on steep

slope among large boulders (rip-rap). Faunal totals: 486 specimens, 72 species. H' : 3.326. J' : 0.778.

Polychaetes and oligochaetes each account for 45.5% of the fauna; the latter has increased and the former decreased in relative abundance with respect to the last two surveys. The most abundant taxa are the oligochaetes, *Smithsondrilus hummelincki* and *Tubificoides motei*, and the polychaetes *Tharyx* spp. and *Mediomastus californiensis*. The most abundant species in the previous two surveys have declined substantially or disappeared. Species richness has almost tripled relative to the previous two surveys and diversity has correspondingly increased. Organism abundance is more than twice that for August 1991 and four times greater than in January 1992.

Station 13a: East side of ICWW opposite the Florida Power & Light discharge canal. Depth: approximately 1.5 m. Bottom: Fine muddy sand with algal turf and algae-covered rocks. Faunal totals: 563 specimens, 48 species. H' : 2.571. J' : 0.664.

Polychaetes contribute a greater percentage of the fauna than in January 1992 (51.9 versus 43.2%), but still a much smaller proportion than in August 1991 (83.9%). Oligochaetes are the next most abundant (32.0%). Peracarid crustaceans have declined, especially relative to January 1992 (41.5% down to 1.8%), while nemertine worms and molluscs have increased at least slightly relative to both previous surveys. The most abundant taxa are the oligochaete, *Smithsondrilus hummelincki*, and the polychaetes *Aricidea catherinae* and *Sphaerosyllis* sp. *Aricidea catherinae* has apparently largely replaced *A. philbinae*. (The text of the report for August 1991 referred incorrectly to *A. taylori* as the abundant *Aricidea* at this station; Table 1 in that report has the species correctly identified as *A. philbinae*.) Organism abundance is much greater than in both preceding surveys; species richness is about the same as in January and twice that for August 1991. Diversity is correspondingly much greater than last August and slightly lower than in January.

Station 14: East side of ICWW opposite northern margin of Southport Turning Notch. Depth: approximately 1.5 m. Bottom: Fine muddy sand with algal turf and numerous algae-covered rocks. Faunal totals: 278 specimens, 51 species. H' : 3.024. J' : 0.769.

Oligochaetes are the dominant organisms (58.3%), although they are not numerically more abundant than at several other stations. Polychaetes account for 24.5% of the fauna. Peracarid and ostracode crustaceans have declined substantially relative to January 1992 back to levels similar to August 1991. The most abundant species are the oligochaetes *Smithsondrilus hummelincki* and *Tubificoides motei*. Previously abundant species, *Aricidea* spp. and several crustaceans, occur in much smaller numbers or have disappeared. Species richness is more than double that for August 1991 and is greater than in January 1992; diversity has increased correspondingly. Organism abundance is about twice that for August but has declined to 82% of the January value.

Station 17: Whiskey Creek on a line directly east of station 14. Depth: 0.2 m. Bottom: Coarse shelly sand (incorrectly reported for August 1991 as fine muddy sand) with large shallow depressions and scattered clumps of filamentous algae. Faunal totals: 3650 specimens, 36 species. H' : 1.612. J' : 0.450.

This station continues to exhibit a fauna that differs strongly from all other stations. Peracarid crustaceans dominate overwhelmingly (76.4%). Polychaetes and molluscs have increased in importance relative to the January 1992 survey but still account for about a third of their August 1991 contribution. The tanaidacean *Kalliapseudes aliciae* (previously reported as *Kalliapseudes* sp.) is by far the most abundant organism (59.3% of all specimens); although occurring in greater numerical abundance than previously, its relative contribution is lower than in January and approaches that reported for last August. Other abundant taxa include the gastropod molluscs, *Caecum pulchellum* and *C. imbricatum*, the polychaete *Ehlersia cornuta*, the sipunculan *Aspidosiphon* sp. (probably the same as the species identified previously as *A. albus*), the tanaidacean *Leptochelia rapax*, the isopod *Exosphaeroma productitelson* and the amphipod *Cerapus* n. sp. The polychaete *Nematonereis hebes* again occurs here in greater numbers than at any other station, and the oligochaete *Pectinodrilus molestus* is reported in numbers for the first time. The ostracode, *Rutiderma darbyi*, reported last August, has returned, while another species, *Harbansus paucichelatus*, recorded during the winter, has disappeared. Organism abundance is

twice that for August 1991 and 4.5x that for January. Although species richness is more than half again as great as in August 1991 and triple that recorded in January, diversity remains low due to the overwhelming dominance by a few taxa.

Station 18: East side of ICWW opposite Southport Everglades container dock. Depth: approximately 1 m. Bottom: Fine muddy sand with finely divided mangrove detritus, and algae-covered rocks. Faunal totals: 839 specimens, 65 species. H' : 3.026. J' : 0.725.

Polychaetes dominate (56.5%) followed by oligochaetes (33.7%). Nemertine worms contribute more to this station than any other (5.7%). The most abundant taxa include the oligochaetes, *Tectidrilus gabriellae* and *Tubificoides motei*, and the polychaetes *Scoloplos rubra* and *Lumbrineris testudinum*. Molluscs and peracarid and ostracode crustaceans remain at low levels relative to the previous two surveys. The most abundant species recorded previously either occur in much smaller numbers or have disappeared. Organism abundance has increased dramatically relative to both preceding surveys. Species richness continues to increase (65 species relative to 51 in Jan 1992 and 24 in August 1991), although diversity is slightly lower than in January.

Station 19a: Whiskey Creek on a line due east of station 18. Depth: 0.2 m. Bottom: Fine peaty mud with some sand and shell debris. Faunal totals: 285 specimens, 23 species. H' : 1.459. J' : 0.465.

Polychaetes are the overwhelmingly dominant group (82.1%), suggesting either that the habitat has changed or that a different localized microhabitat may have been sampled. In the previous two surveys, polychaetes accounted for no more than 25% of the fauna. All other groups have, as a result, declined in importance. A few groups have increased slightly in numerical abundance, however, as a result of the great increase in total abundance. The polychaete, *Capitella capitata*, is the most abundant species and accounts for 68.1% of the fauna. Organism abundance continues to increase; it is more than twice that reported for January 1992 and six times that for August 1991. Species richness (23) is about the same as in January and twice that for the preceding August. Diversity has decreased, however, due to the overwhelming abundance of *C. capitata*.

C.2. Grab Samples (August 1991 & January 1992 Surveys)

Tables 4 and 5 list raw data, Shannon-Weaver Diversity Indices (H') and evenness (J') for all samples by station and by replicate for the August 1991 and January 1992 surveys, respectively. These data were submitted in previous reports but have been included here for reference.

Please note that numbers of specimens recorded in the January 1992 survey for stations 1, 8, 8a, 11 and 17 are twice those reported previously (report submitted April 1992). Due to their large volume, only 50% of the samples collected at these stations were sorted, in accordance with the methods described above (and in previous reports), but the data were inadvertently not doubled as they should have been to reflect the total abundance in each sample. The data now reflect our best estimate of organism abundances in those samples; discussions of the data incorporate this modification.

C.3. Crab Census (August 1992)

Table 6 lists all crab census data including numbers of burrows, species and specimens, diversity indices and evenness values. Of ground-dwelling crabs, *Sesarma curacaoense* is by far the most abundant taxon and occurs at all 7 stations west of the ICWW and one on the east side (sta. 16). The next most abundant species, *Uca thayeri*, is also largely restricted to stations west of the ICWW. The remaining species occur in similar small numbers and are found either west (*Uca speciosa*, *Eurytium limosum*) or east (*U. rapax*, *U. pugilator*) of the ICWW.

Tree crab (*Aratus pisonii*) counts are lower than in either of the two preceding surveys (Aug. 1991, Jan. 1992); crabs were recorded at only one station adjacent to the turning notch (west of the ICWW), but were found at all three stations further north, away from the edge of the forest. East of the ICWW, *A. pisonii* was recorded inside the designated sampling area at stations 10 and 16. All crab census results are summarized below.

Station 1a: Edge of red mangrove fringe adjacent to rip-rap at northeast corner of Southport Turning Notch. Crab census data: *Sesarma curacaoense* (13), *U. thayeri* (1), *Uca speciosa* (1), *Uca* sp. (juveniles) (2); *Aratus pisonii* (0 specimens in 1 tree/m²). Number of burrows by replicate: 170, 52, 179. Shannon-Weaver Diversity Index (H'): 0.800. Evenness (J'): 0.497.

Station 2: In dense red mangrove fringe 10 m north of Turning Notch and 10 m west of ICWW. Crab census data: *S. curacaoense* (13), *U. thayeri* (1), *Uca* sp. (juveniles)(1), *Eurytium limosum* (1); *A. pisonii* (0 in 1 tree/m²). Number of burrows by replicate: 128, 103, 174. H': 0.689. J': 0.497.

Station 3: In dense red mangrove fringe 3 m east of natural drainage canal, 10 m north of Turning Notch. Crab census data: *S. curacaoense* (16), *Uca thayeri* (1), *Uca* sp. (juveniles)(1); *A. pisonii* (1 in 2 trees/m²). Number of burrows by replicate: 167, 140, 158. H': 0.426. J': 0.388.

Station 4: In dense red mangrove fringe 10 m north of Turning Notch and approximately 40 m west of drainage canal. Crab census data: *S. curacaoense* (12), *Uca thayeri* (1), *Uca speciosa* (3), *Uca* sp. (juveniles)(1), *Eurytium limosum* (2); *A. pisonii* (0 in 3 trees/m²). Number of burrows by replicate: 134, 185, 135. H': 0.822. J': 0.511.

Station 5: In dense red mangrove fringe 30 m north of station 4. Crab census data: *S. curacaoense* (6), *Uca thayeri* (3); *A. pisonii* (1 on ground)(4 on 4 trees/m²). Number of burrows by replicate: 144, 112, 120. H': 0.898. J': 0.817.

Station 6: In dense red mangrove fringe 3 m east of natural drainage canal and 10 m north of station 3. Crab census data: *Sesarma curacaoense* (10), *Uca* sp. (juvenile)(1); *A. pisonii* (2 in 4 trees/m²). Number of burrows by replicate: 200, 108, 162. H': 0.305. J': 0.439.

Station 7: In dense red mangrove fringe 30 m north of station 2. Crab census data: *S. curacaoense* (12), *U. thayeri* (1), *Eurytium limosum* (1); *A. pisonii* (1 on ground)(4 in 4 trees/m²). Number of burrows by replicate: 186, 124, 145. H': 0.720. J': 0.519.

Station 10: In open area among scattered large red mangroves east of the center of small island on east side of ICWW north of northern entrance to Whiskey Creek. Crab census data: *Uca thayeri* (1); *A. pisonii* (1 in 1 tree/m²). Number of burrows by replicate: 17, 33, 53. H': 0. J': 0.

Station 12: On high ground among Australian pine trees at a point intersected by lines running due east from station 11 (north side of northern entrance to Whiskey Creek) and due north of station 13. Crab census data: no crabs, no burrows.

Station 13: On sand among shrubby white mangroves north side of Whiskey Creek

approximately 20 m west of North Ocean Drive bridge. Crab census data: *Uca pugilator* (6), *U. rapax* (1). No tree crabs. Number of burrows by replicate: 10, 67, 16. H' : 0.410. J' : 0.592.

Station 15: Among dense red mangrove fringe 35 m west of North Ocean Drive on line running east of north side of Turning Notch. Crab census data: No crabs in burrows or trees. Two unidentified juvenile crabs were seen on the ground. Number of burrows by replicate: 38, 38, 20. H' : 0. J' : 0.

Station 16: Among red mangroves 110 m east of North Ocean Drive on line running due east of north side of Turning Notch. Crab census data: *Sesarma curacaoense* (1), *Uca rapax* (3, possibly 8); *A. pisonii* (3 on 1 trees/m²). H' : 0.349. J' : 0.503. The specimens from replicates 2 and 3 (3 and 2 specimens, respectively) were lost during a move; they were most likely also *U. rapax* and have been treated as such in the diversity calculations.

C.4. Crab Census (August 1991 and January 1992)

Tables 7 and 8 list all crab census data including numbers of burrows, species and specimens, diversity indices and evenness values for the August 1991 and January 1992 surveys. These data were submitted in previous reports but have been included here for reference.

C.5. Hand Collections (August 1992)

A total of 455 specimens representing 15 taxa were collected at the three hand collection stations. Table 9 lists all raw data, diversity indices and evenness values by station and by replicate. Apart from barnacles, the two most abundant taxa at all three stations taken together are the same as in the last two surveys (August 1991 and January 1992): the gastropod *Batillaria minima* and the springtail insect *Anurida maritima*. The third taxon abundant in previous surveys, the barnacle *Chthamalus fragilis*, occurs in much smaller numbers in the current study and only at station 9. Results are summarized below.

Station 9: Intertidal rubble in a red mangrove fringe protected from heavy wave action by adjacent rip-rap on the southwestern corner of a small island along the east side of the ICWW just north of the northern entrance to Whiskey Creek. Filamentous green and red algal mats cover portions of the shoreline. H' : 1.395. J' : 0.561.

Juvenile barnacles apparently belonging chiefly to the genus *Balanus*, and the gastropod *Batillaria minima* are the most abundant organisms, followed by the insect *Anurida maritima*. Barnacle cover varies widely due to variations in rock size and algal cover among replicates.

Adjacent boulders (rip-rap) appear to support the same intertidal fauna as recorded in previous surveys (e.g., barnacles *Chthamalus fragilis*, *Balanus* spp. and *Tetraclita squamosa*; gastropods *Siphonaria pectinata* and *Petalochonchus ?varians*, and the bivalves *Isognomon alatus*, *Crassostrea virginica* and *?Brachidontes exustus*).

Station 13: Intertidal muddy sand with numerous small rocks, pebbles and shells on the north side of Whiskey Creek, about 15m west of the North Ocean Drive bridge; replicates taken between fringe of shrubby white mangroves and row of four mangrove seedlings closest to water's edge. H' : 1.475. J' : 0.615.

The springtail insect *Anurida maritima* is the most abundant organism, followed by the gastropod *Batillaria minima*.

Station 17: Intertidal, coarse shelly sand and gravel with filamentous green algae, among partly algae-covered red mangrove roots and white mangrove pneumatophores with partly buried rocks, west side of Whiskey Creek, on a line running due east of the north side of the Turning Notch and about 500 m north of the footbridge. Meter transects were taken along the mangrove roots closest to the water's edge. H' : 1.124. J' : 0.578.

The springtail insect *Anurida maritima* is the most abundant organism, followed by numbers of minute juvenile crabs probably belonging to the genus *Uca*. The possibility exists that these tiny brachyurans may be juvenile *Sesarma* or *Aratus pisonii*.

The flat oysters, *Isognomon alatus*, attach to mangrove prop roots.

C.6. Hand Collections (August 1991 and January 1992)

Tables 10 and 11 list all raw data, diversity indices and evenness values by station and by replicate. These data were submitted in previous reports but have been included here for reference.

D. DISCUSSION

D.1. Grab samples

Tables 12 and 13 summarize numbers and percent abundances, respectively, for major taxonomic groups by station for all three surveys. Table 14 summarizes numbers of most common taxa by station for all three surveys. A total of 9,039 specimens were sorted and identified from the 33 grab samples (11 stations with three replicates each) in the August 1992 survey, more than twice as many as collected in either of the preceding two surveys (August 1991: 3981; January 1992: 4069). Relative to the August 1991 survey, all stations exhibit substantial increases in total organism numbers (2x to 6x) with one exception: only half as many specimens were collected at station 1 (adjacent to the Turning Notch). Numbers of specimens per station increased similarly (1.4x to 4.4x) relative to the January 1992 survey with two exceptions: numbers remained at about the same high level at station 10a, and declined by 17% at station 14. As another indication of the breadth of increased abundance, during the previous two surveys four or six stations included fewer than 200 specimens each; in August 1992, none did.

Polychaete worms remain the most abundant group but have declined slightly in relative importance from the last two surveys (40.8% down from 46.1% in January 1992 and 43.7% in August 1991) although they have doubled in absolute numbers. Oligochaetes have increased in numbers (and diversity) enormously relative to the last two surveys and now represent the third most abundant major taxonomic group. Peracarid crustaceans doubled in absolute and relative terms from August 1991 to January 1992; they have doubled again in numbers but constitute about the same proportion of the fauna as in January. They remain the second most important group (31.6%) as a result of the overwhelming abundance of the tanaidacean crustacean, *Kalliapseudes aliciae* (previously reported as *Kalliapseudes* sp.), at station 17. These specimens account for 24% of all organisms collected at all stations in this survey. Of the other major groups, the number and percentage of molluscs declined from August 1991 to January 1992 and increased again in the current survey, but have not reached last summer's levels. Numbers of sipunculans exhibit a similar pattern, but their relative contribution to the fauna remains as low as in January. Ostracodes exhibited slight absolute and relative increases from August 1991 to

January, but have declined in the current survey to below last August's levels. Nemertine worms doubled in numbers in the current survey but still represent, along with decapod crustaceans and echinoderms (list under "Others"), a very small component of the samples.

Individual taxa exhibit substantial variations both among stations and surveys. Some of this is clearly habitat-related and some is probably seasonal. It is a strong possibility, however, that substantial between-station spatial patchiness and both within- and between-station temporal patchiness exists that cannot be identified with only three replicate samples per station and two surveys per year.

With respect to habitat, station 17 in Whiskey Creek differs substantially from all others. It is a shallow, coarse sand bottom subject to rapid, bottom-winnowing tidal currents. Most taxa found here in abundance are rare or absent at other stations: *Caecum imbricatum* (Mollusca), *Ehlersia cornuta* and *Nematonereis hebes* (Polychaeta), *Aspidosiphon ?albus* (Sipuncula), and *Exosphaeroma productitelson* (Isopoda). The tanaidacean *Kalliapseudes aliciae* is also almost unique to this station; it is by far the most abundant organism here and generates, as a result, this station's low diversity.

Station 10a, adjacent to the ICWW in a shallow creek exposed at extreme low tide, also exhibits several dominant taxa either rare elsewhere [*Laeonereis culveri* (Polychaeta)] or shared only with adjacent station 9 at the mouth of the creek [*Leitoscoloplos fragilis* (Polychaeta), *Cyprideis americana* and *Peratocytheridea setipunctata* (Ostracoda)]. The latter two almost certainly represent the "unidentified podocopan" ostracode of the first two surveys. Stations 9, 10a and 19a are the only stations ever exhibiting large numbers of the polychaete *Capitella capitata*, a species typical of disturbed habitats.

Several taxa are widespread among ICWW stations (including station 9) but rare or absent from stations in the adjacent creeks: *Mediomastus* spp., *Lumbrineris testudinum*, *Aricidea taylori* (Polychaeta), and several tubificid oligochaetes. The polychaete *Aricidea philbiniae* is largely restricted to the east side of the ICWW (including station 10a). A few taxa occur at most stations or in most habitats (usually excepting station 17): *Caecum pulchellum* (Mollusca), *Pseudopolydora* spp. (Polychaeta), *Cerapus* n. sp. and *Grandidierella bonnieroides* (Amphipo-

da).

Several features of the dataset suggest seasonal variations, although we have too few samples to be certain. At the three stations west of the ICWW, polychaetes constitute 81-86% of the fauna in January but only 50-70% in August. Similarly, at the five shallow east side stations (9, 10a, 13a, 14 and 18; the deeper station 11 excepted), peracarids constitute 20-41% of the fauna in January but only 0.3-6.7% in August. Only four stations, however, exhibit seasonal variations in total numbers of organisms with fewer as expected in January (1, 8a, 11, 17).

Station 17 appears to exhibit the strongest seasonal signal. *Caecum imbricatum*, *C. pulchellum* (Mollusca), *Ehlersia cornuta* (Polychaeta), and *Aspidosiphon albus* (Sipuncula) are either absent or much less abundant in January. The ostracode *Harbansus paucichelatus*, by contrast, occurs here only in January.

Diversity indices exhibit no consistent seasonal signal. August peaks occur at stations 1, 8, and 17, while stations 10a, 13a, 18 and 19a exhibit highest indices in January. Diversity indices decline at stations 8a and 9 but increase at stations 11 and 14 over the three surveys.

As mentioned above, more than twice as many organisms were collected during the August 1992 survey as in either preceding survey. Although eight of the stations exhibit substantial increases in total organism abundances relative to both preceding surveys, the overall increase can be traced to major increases in oligochaetes and polychaetes at six stations each, and an almost five-fold increase in peracarids at station 17 in August 1992. Accompanying increases in oligochaete and peracarid species richness does not uniformly translate into increased diversity indices due to the often overwhelming numbers of relatively few taxa. We have no definite explanation at present for the appearance in numbers for the first time of most of these taxa (e.g., the oligochaetes *Pectinodrilus molestus*, *Smithsondrilus hummelincki*, *Tectidrilus gabriellae*; the isopod *Exosphaeroma productitelson*), nor is it clear why others have declined or disappeared (e.g., the polychaetes *Glycera abbranchiata*, *Leitoscoloplos fragilis*). A few variations may be traced to the vagaries of taxonomic identification. Thus, many specimens identified as the polychaete *Mediomastus* sp. in the first two surveys may actually be *Mediomastus californiensis*

which is abundant in the current survey. Similarly, as mentioned previously, ostracodes reported as "unidentified podocopan" in the first two surveys almost certainly belong to the same two species identified in the August 1992 survey (*Cyprideis americana* and *Peratocytheridea setipunctata*).

Variations not due to habitat, season or taxonomy have several potential sources: 1) Three replicates/station may not be enough to accurately represent the spatial heterogeneity, or patchiness, of local populations. Although the most abundant taxa at any given station are usually found in all three replicates, their numbers may vary by an order of magnitude. Replicates are taken within about 3 m of each other at each station. (Low visibility limits this precision.) Local habitat heterogeneity or, perhaps, patchiness of larval recruitment may vary on a larger but still highly localized scale. As a result, taxa such as *Caecum pulchellum*, *Mediomastus californiensis*, *Pseudopolydora* spp., *Aricidea philbinae* and *Aricidea taylori*, found in numbers at many but not all stations along the ICWW, may be recorded more uniformly if sampled on a larger scale.

2) Little is known about the life-history strategies and reproductive periodicities of most local taxa that may produce nonseasonal temporal variations. Some species likely maintain relatively constant populations over multi-year periods while others are rapidly-cycling opportunists.

3) Substantial faunal variations between surveys may, alternatively, reflect responses to changing environments. Potential natural sources of local environmental change include longer-term variations in freshwater run-off or the exposure over time of different sediments (e.g., sand versus mangrove peat) due to erosion by waves and tidal currents. Anthropogenic sources include the obvious candidates in a heavily-trafficked port facility: pollution, dredging, turbulence.

Anthropogenic disturbance may play a role in the appearance of large numbers of oligochaetes (ICWW stations) and the polychaete *Capitella capitata* (stations 9, 10a and 19) as these taxa are typical opportunists in disturbed habitats. No identifiable source of disturbance, however, accounts for their pattern of appearance. Dredging of the Southport Turning Notch, mangrove mitigation, and emplacement of rip-rap was largely completed in 1990. It is unlikely that this pattern of faunal variation, first appearing in August 1992, is associated with those modifications to the local environment.

We cannot definitely assess the possibility that the overall increase in organism abundance is a response to more stable conditions following the cessation of dredging, mitigation and rip-rap emplacement because our data is not directly comparable with that of the previous contractor. A limited comparison can be made, however. The following data treats only ICWW stations--those most likely to have been affected by the dredging--and omits stations 8a and 13a which were not sampled before August 1989. The previous contractor's figures are tripled (he sieved and sorted one-third of each sample). Total organism numbers are thus as follows:

Before dredging: September 1988: 4233; January 1989: 1764.

During dredging: August 1989: 1917; January 1990: 705; August 1990: 606.

Post-dredging: January 1991: 1092; August 1991: 1331; January 1992: 1645; August 1992: 2954.

Taking into account apparent seasonal variations, organism abundances drop substantially during the dredging period and remain relatively low a year afterward (through August 1991). The data for the current year suggest a return toward estimated pre-dredging values. This apparent trend will be examined in subsequent surveys. Incomplete taxonomic data in the previous contractor's reports prevents us from comparing variations in faunal composition over the course of these surveys.

D.2. Crab Censuses

Crab census stations on the west side of the ICWW north of the Turning Notch continue to be dominated by the grapsid *Sesarma curacaoense*, accompanied by smaller numbers of the ocypodids *Uca thayeri* and *U. speciosa*, the xanthid *Eurytium limosum* and ground-collected tree crabs, *Aratus pisonii*. Numbers are similar to those recorded in August 1991 except that *S. curacaoense* occurs in greater and *U. thayeri* in lesser abundance. *U. speciosa*, absent during the January 1992 survey, is again present. The tree crab, *Aratus pisonii*, occurs at fewer stations and in smaller numbers than in August 1991. Only a single specimen was collected at one station of the four immediately adjacent to the Turning Notch; we found it at all four stations of the transect further north within the mangrove forest (stations 4-7), although in smaller numbers than

during August 1991.

The August 1992 sampling at station 10 (on a small mangrove island north of Whiskey Creek) records a single *Uca thayeri*. Station 12 again records no crabs. As mentioned in the last report, it is not clear that the spot identified as station 12 in August 1991 is the same as that used previously. Earlier sampling efforts recorded both *Uca rapax* and *U. pugilator* and the grapsid *Sesarma ricordi* here. Directions provided to us by the previous contractor place this station on high ground where no crabs were observed.

Station 13 continues to maintain a population of *Uca pugilator* and *U. rapax*. We collected no crabs at station 15 although two unidentified specimens were seen on the ground.

Species definitely identified at station 16 are *S. curacaoense* and *U. rapax*. The former was last collected here by the previous contractor in January 1991, the latter in August 1990.

D.3. Hand Collections

Station 9 continues to maintain a typical intertidal fauna. This survey records most of the species found in August 1991 and January 1992, although the barnacle *Chthamalus fragilis* occurs in much smaller numbers than previously (at least within the area sampled). The number of species is about the same as previously and diversity is very slightly lower.

Station 13 exhibits more species and a much higher diversity index than previously, the latter apparently due to the far fewer specimens (and reduced dominance) of *Batillaria minima* and barnacles. Fewer barnacles may be the result of the patchy distribution of the larger rocks that barnacles appear to prefer. Brachyuran crabs are more abundant and diverse (although still in small numbers) and the oyster, *Crassostrea virginica*, appears here for the first time.

Station 17 exhibits substantial increases in numbers of *Anurida maritima* and juvenile crabs, now the two most abundant taxa here, and now records a greater number of specimens than station 13. Species richness remains lower than at the other two stations, but slightly higher than in the previous two surveys. Species diversity has declined slightly due to dominance by the two most abundant taxa.

The pattern of diversity indices among the three hand stations has changed: station 13 now exhibits the highest index, followed closely by stations 9 and 17. The total number of organ-

isms is about the same as in August 1991, but is only 74% of that recorded in January 1992.

TABLE 1. Grab Collection Stations: raw data, diversity (H') and evenness (J'); August 1992.

STATION	1	1	8	8a	9	10a	11	13a	14	17	18	19a	
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	
TAXON													
Phylum CNIDARIA													
Order ACTINIARIA													
Unidentified actinian											1		1
Phylum PLATYHELMINTHES													
Unidentified kalyptorhynch								2	1		1		4
Unidentified turbellarian									2				2
Phylum NEMERTINA													
Order ARCHINEMERTEA													
Unidentified archinemertine					2		1	1	1	2	3	3	31
Order PALEONEMERTEA													
Family CARINOMIDAE													
Carinomella lactea	2		1	1	2	1	1		1	3	2	2	26
Family HUBRECHTIDAE													
Hubrechtella dubia	3	1	3	4	1	3	4		1	1	4	4	64
Family TUBULANIDAE													
Tubulanus ?pellucidus				4	2	1			1				12
Tubulanus rhabdotus											1	1	1
Tubulanus sp.?							1						1
Paleonemertine n. sp. JLN 114									1				1
Unidentified paleonemertine				3			3						6
Order HETERONEMERTEA													
Heteronemertine sp. A		1							1				2
Heteronemertine sp. B									1				1
Order HOPLONEMERTEA													
Family TETRASTEMMIDAE													
Tetраstemma worki											1	1	3
Hoplonemertine sp. A			1						1				2
Phylum MOLLUSCA													
Class GASTROPODA													
Family CAECIDAE													
Caecum pulchellum				8		1		4	1	14	3	16	229
Caecum imbricatum													170
Meioceras nitidum				2					1		2	1	6
Family VITRINELLIDAE													
Pleuromalaxis balesi	1												1
Family NASSARIIDAE													
Nassarius vibex								1					

TABLE 1. Grab Collection Stations: raw data, diversity (H') and evenness (J'); August 1992.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
TAXON																																		
Class BIVALVIA																																		
Family CARDIIDAE																																		
Laevicardium mortoni																													1		1			
Family CORBULIDAE																																		
Corbula contracta						2			1																						3			
Family LUCINIDAE																																		
Parvilucina multilineata															2							1									3			
Family MESODESMATIDAE																																		
Ervilia sp.																										1					1			
Family MYTILIDAE																																		
Brachidontes exustus																													1		1			
Unidentified mytilid																									1						1			
Family PETRICOLIDAE																																		
?Petricola sp. (juv.)																	1														1			
Family SOLECURTIDAE																																		
Tagelus divinus															1	1						1									3			
Family SPORTELLIDAE																																		
Unidentified sportellid						2																									2			
Family TELLINIDAE																																		
Macoma constricta											3	4	10	2	3	1				1	2	1		1	1				1		1	31		
Tellina texana											1																				1			
Family VENERIDAE																																		
Chione cancellata						2									2																4			
Parastarte triquetra																														6	6			
Phylum ANNELIDA																																		
Class POLYCHAETA																																		
Order ORBINIDA																																		
Family ORBINIIDAE																																		
Leitoscoloplos robustus											5	27	11																		43			
Proscoplops sp.												1									1										2			
Scoloplos rubra		1			1												1											28	58	28		117		
Unidentified orbinid																											1				1			
Family PARAONIDAE																																		
Aricidea catherinae		5															1	1	1	73	19	37									137			
Aricidea philibinae											1		26	56	98	130	174	94			3		2		2					1	527			
Aricidea taylori		4	9	7	10	8	27	81	53		1					5							9	3			1	2		3	223			
Cirrophorus sp.					1	4																						1		1	7			

TABLE 1. Grab Collection Stations: raw data, diversity (H') and evenness (J'); August 1992.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
TAXON																																		
Unidentified paraonid					1	2																										3		
Order COSSURIDA																																		
Family COSSURIDAE																																		
Cossura soyeri		1			1	2			1								6	8										1		18			38	
Order SPIONIDA																																		
Family SPIONIDAE																																		
Paraprionospio longicirrata																								1	4							5		
Polydora socialis																		2														2		
Polydora sp.												1																				1		
Prionospio cristata						2											2	1										4	1				10	
Prionospio heterobranchiata			1	2	2			6	2		2	3					2		1	3	2	3					4	7	11	1		2	54	
Prionospio sp. A			1																														1	
Prionospio sp.									1								1																2	
Pseudopolydora sp. A						2																	1						2				5	
Pseudopolydora sp. B			1			2				1	3	14		3				1			1	1		1						4			32	
Scolecipis squamata																1																	1	
Scolecipis texana												1																					1	
Spio pettiboneae			2			4		1		2	3						1				1						3	1					18	
Family CHAETOPTERIDAE																	1																1	
Spiochaetopterus costarum																																		
Family CIRRATULIDAE																																		
Caulerella killariensis																		1															1	
Caulerella sp. A																												1		5			6	
Caulerella sp.								1				1					4	1											1	3			11	
Chaetozone sp.																		2															2	
Cirriiformia sp. A	1																														1		2	
Cirriiformia sp.					1													1	1														3	
Tharyx dorsobranchialis			3			6				2		1					21	2	12			1	3					37		11		1	20	120
Tharyx sp. A	1					3		1	1									19				2			1			1	12	4	1		46	
Unidentified cirratulid			2																5	1	16		1										25	
Family ACROCIRRIDAE																																		
Macrochaeta sp.	1																																1	
Unidentified acrocirrid																	1																1	
Order CAPITELLIDA																																		
Family CAPITELLIDAE																																		
Capitella capitata		1								1	196	50	49	137	120	83						5					1				49	48	97	837
Mediomastus californiensis	17	38	7	16	12	38	2	11			1					15	3	32	8	19	6	1	7			1	1	12	5	11			263	

TABLE 1. Grab Collection Stations: raw data, diversity (H') and evenness (J'); August 1992.

[illegible]

TABLE 1. Grab Collection Stations: raw data, diversity (H') and evenness (J'); August 1992.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
TAXON																																		
Family EUNICIDAE																																		
Eunice vittata															1																		1	
Marphysa sp.															1																		1	
Nematonereis hebes	3	1													11						1		16	6	17								55	
Family LUMBRINERIDAE																																		
Lumbrineris tenuis														1	3	1																	5	
Lumbrineris testudinum	13	9	6	8	9	8				1	9	3	1		1	6	2	3	1	7	3	3					24	38	34				189	
Lumbrineris verrilli															1				1										6			8		
Lumbrineris sp. B			2	1			1	11												1						2	1						19	
Lumbrineris sp.															3				1													4		
Family ARABELLIDAE																																		
Arabella multidentata																						1											1	
Family DORVILLEIDAE																																		
Ophryotrocha sp. A									12	3	51																						66	
Pettiboneia duofurca								1		1						1												1	1				5	
Pettiboneia sp. B																1																	1	
Schistomeringos pectinata						8									4			2	1										1				16	
Order TERESELLIDA																																		
Family PECTINARIIDAE																																		
Pectinaria gouldii																					1												1	
Family TERESELLIDAE																																		
Polycirrus plumosus																													1				1	
Family TRICHOBRANCHIDAE																																		
Terebellides stroemi									1						1	1																	3	
Terebellides sp.																1																	1	
Family BOGUEIDAE																																		
Boguesia enigmatica				1	2	2				1					1	1		6				1	1					1					17	
Order SABELLIDA																																		
Family SABELLIDAE																																		
Branchiomma nigromaculata																	1																1	
Branchiomma sp.					1																												1	
Fabriciella sp. A					2	6									1	1												7	11		7		35	
Sabellastarte sp. A										1						3		2															6	
Unidentified sabellid		1		2	1	4	1	12					1	4						1	1					2	9	3					42	
Class OLIGOCHAETA																																		
Family CTENODRILIDAE																																		
Raphodrilus nemasoma																								2									2	

TABLE 1. Grab Collection Stations: raw data, diversity (H') and evenness (J'); August 1992.

[illegible]

TABLE 1. Grab Collection Stations: raw data, diversity (H') and evenness (J'); August 1992.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3			
TAXON																																	
Family Sarsiellidae																																	
Sarsiella disparalis																												1			1		
Sarsiella zostericola															1						1										2		
Family Rutidermatidae																																	
Rutiderma darbyi																											4	3			7		
Rutiderma cohenae																					1										1		
Family Philomedidae																																	
Harbansus paucichelatus																													1			1	
Harbansus sp.																						1										1	
Subclass PODOCOPA																																	
Family CYTHERIDIDAE																																	
Cyprideis americana																																78	
Peratocytheridea setipunctata												2																		4		93	
Family BAIRDIIDAE																																	
Neonesidea sp.																						1										1	
Class MALACOSTRACA																																	
Order MYSIDACEA																																	
Unidentified mysid												2																			5	7	
Order CUMACEA																																	
Family DIASTYLIDAE																																	
Oxyurostylis smithii																							1									1	
Family NANASTACIDAE																																	
Cumella sp.																								1	1							2	
Family PSEUDOCUMIDAE																																	
Vaunthomsonia cf. floridana																																1	
Vaunthomsonia cf. minor																																1	
Order TANAIDACEA																																	
Family KALLIAPSEUDIDAE																																	
Kalliapseudes aliciae																								3			416	915	830			2166	
Family PARATANAIDAE																																	
Leptochelia rapax																									1			35	107	139			283
Order ISOPODA																																	
Family HYSSURIDAE																																	
Xenanthura brevitelson																											1					2	
Family ANTHURIDAE																																	
Amakusanthura magnifica																													3	1	4		8
Family SPHAEROMATIDAE																																	

TABLE 1. Grab Collection Stations: raw data, diversity (H') and evenness (J'); August 1992.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
TAXON																																		
Exosphaeroma productitelson																							43	115	60							218		
Order AMPHIPODA																																		
Family AMPELISCIDAE																																		
Ampelisca abdita																													2		2			
Family AMPITHOIDAE																																		
Unidentified amphithoid									2									2													4			
Family AORIDAE																																		
Lembos unicornis															1													1			2			
Rutilemboides naglei																				5											5			
Family COROPHIIDAE																																		
Cerapus n. sp.													2								2			3	69	50						126		
Grandidierella bonnieroides						2																								3	7	12		
Unidentified corophiid										1								2	2									2	2			9		
Family LILJEBORGIIDAE																																		
Unidentified liljeborgiid																					2											2		
Family OEDICEROTIDAE																																		
Monoculodes nyei								2																						1		3		
Order NEBALIACEA																																		
Unidentified neballacean															1																	1		
Order DECAPODA																																		
Infraorder CARIDEA																																		
Family ALPHEIDAE																																		
Alpheus floridanus	1		1	1																												3		
Unidentified alpheid	1	1		1																												3		
Family PROCESSIDAE																																		
Processa sp. (juv.)										1																						2		
Infraorder ANOMURA																																		
Unidentified anomuran																					1											1		
Infraorder THALASSINIDEA																																		
Upogebia vasquezi		1	1	1																												3		
Infraorder BRACHYURA																																		
Family MAJIDAE																																		
Pitho herminieri															1																	1		
Unidentified brachyuran	1																															1		
Phylum ECHINODERMATA																																		
Class OPHIUROIDEA																																		
Unidentified ophiuroid				1																	2			1			1			2		7		

TABLE 1. Grab Collection Stations: raw data, diversity (H') and evenness (J'); August 1992.

STATION		1			8			8a			9			10a			11			13a			14			17			18			19a		
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
TAXON																																		
Class HOLOTHUROIDEA																																		
Unidentified holothuroid					1						1											1		1			1		1				7	
UNKNOWN			1					3			7			2		1			9	8		4			10			3		2			50	
TOTAL	56	92	53	130	117	276	53	243	90	270	219	209	328	500	302	229	86	171	181	187	195	156	69	53	725	1433	1492	197	282	360	61	60	164	9039
Total # species (by replicate)	18	18	20	25	24	33	13	26	19	14	32	19	10	19	11	33	37	40	24	26	32	36	18	16	18	20	25	35	36	42	10	9	13	179
H' (by replicate)	2.259	2.661	2.661	2.530	2.625	2.885	1.832	2.277	1.833	1.122	2.465	2.159	1.249	1.815	1.679	2.664	3.185	2.851	2.102	2.465	2.491	2.859	2.236	2.342	1.644	1.470	1.696	2.745	2.632	2.944	0.847	0.896	1.541	
J' (by replicate)	0.782	0.921	0.888	0.786	0.826	0.825	0.714	0.699	0.622	0.425	0.711	0.733	0.542	0.616	0.700	0.762	0.882	0.773	0.662	0.757	0.719	0.798	0.774	0.845	0.558	0.491	0.521	0.772	0.735	0.788	0.368	0.408	0.601	
Total # species (by station)		38			52			38			41			23			72			48			51			36			65			23		
H' (by station)		2.667			2.974			2.304			2.129			1.712			3.326			2.571			3.024			1.612			3.026			1.459		
J' (by station)		0.733			0.753			0.633			0.573			0.546			0.778			0.664			0.769			0.450			0.725			0.465		

TABLE 2. Summary of Major Taxonomic Groups in Grab Collections; August 1992.

STATION	1	8	8a	9	10a	11	13a	14	17	18	19a	TOT
NEMERTINA	7	21	10	11	0	12	30	5	5	48	1	150
MOLLUSCA	1	8	3	17	16	18	31	14	326	22	1	465
POLYCHAETA	140	226	242	598	912	221	292	68	278	474	234	3685
OLIGOCHAETA	45	189	119	59	30	221	180	162	61	283	19	1431
SIPUNCULA	0	0	0	0	0	1	0	0	176	0	4	181
OSTRACODA	0	0	0	2	166	0	2	2	7	2	4	185
PERACARIDA	0	3	9	2	3	1	10	13	2790	3	20	2854
OTHER	8	5	3	9	3	12	18	14	7	7	2	88
TOTALS	201	452	386	698	1130	486	563	278	3650	839	285	9039

TABLE 4. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Aug. 1991.

[illegible]

TABLE 4. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Aug. 1991.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
TAXON																																		
Order CAENOCASTROPODA																																		
Family PYRAMIDELLIDAE																																		
Turbonilla sp.			2																												2			
Subclass OPISTHOBRANCHIA																																		
Family BULLIDAE																																		
Bulla striata			4	10						1	1	2																			18			
Bulla sp.?																		1													1			
Family HAMINOEIDAE																																		
Haminoea antillarum																					1										1			
Haminoea elegans																											2		2		4			
Haminoea succinea	2		6							1	3																				12			
Unidentified gastropod																													2		2			
Class BIVALVIA																																		
Order PTEROIDA																																		
Family LUCINIDAE																																		
Unidentified lucinid			2																												2			
Family TELLINIDAE																																		
Tellina consobrina																												2			2			
Tellina mera			2								1																				3			
Tellina sp.? (broken)																					1										1			
Macoma sp.			4						2				2		3																11			
Family SOLECURTIDAE																																		
Tagelus divisus														1																	1			
Family VENERIDAE																																		
Anomalocardia auberiana														1																	1			
Order MYOIDA																																		
Family CORBULIDAE																																		
Corbula contracta			2																												2			
Unidentified juvenile bivalve	2																														2			
Phylum ANNELIDA																																		
Class POLYCHAETA																																		
Order ORBINIIDA																																		
Family ORBINIIDAE																																		
Leitoscoloplos fragilis										5	1		7	26	32																71			
Leitoscoloplos sp.														2	2																4			
Family PARAONIDAE																																		
Aricidea philbiniae	6		2					4		6	7	29	7	31	60	28	4	20	9	1	66	14	44	2			2	6	4		6	358		

TABLE 4. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Aug. 1991.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
TAXON																																		
Aricidea taylori	10	4		30	6	20	2	12	18	1	2																				105			
Order SPIONIDA																																		
Family SPIONIDAE																																		
Dispio uncinata			2															2													4			
Polydora socialis	2	2					8																								10			
Prionospio heterobranchiata	26	12	14	4		4	2	4	8	5	5	10			2		2		1	1		10	1				2	2	2		117			
Prionospio multibranchiata	2	2			2																										6			
Pseudopolydora sp.				2				6		8	11	7	1	1	1	2	2		1	16	32	2	14	7							113			
Spio pettiboneae	2																														2			
Unidentified spionid			2					2		1										5								2			12			
Family CIRRATULIDAE																																		
Caulerietta killariensis	4	2																					2				2				10			
Cirriformia sp. A	2	2																													4			
Cirriformia sp.?		4					2																						4		10			
Unidentified cirratulid	10		2												8	2															22			
Order CAPITELLIDA																																		
Family CAPITELLIDAE																																		
Capitella capitata	6									1	1	19		1	3				1										2		34			
Dasybranchus lumbricoides											4																				4			
Decamastus sp.												1																			1			
Heteromastus filiformis											1																				1			
Mediomastus californiensis								2																							2			
Mediomastus sp.	48	38		4	2	14	10	26		2	1				24		4		2		6		2					2			185			
Notomastus hemipodus				2																											2			
Order PHYLLODOCIDA																																		
Family SYLLIDAE																																		
Exogone atlantica											2																				2			
Exogone dispar		4																1	5	1				8		6					25			
Odontosyllis enopla															2																2			
Sphaerosyllis longicauda			4						2																						6			
Sphaerosyllis piriropsis																													2		2			
Sphaerosyllis riseri			2																					6	2			2			12			
Sphaerosyllis taylori		2							4																						6			
Sphaerosyllis sp.														3																	3			
Streptosyllis pettiboneae	4																		1		4										9			
Syllis cornuta							2	2							12	4				3			1	152	28	148					352			
Unidentified syllid		2																													2			

TABLE 4. Grab Collection Stations; raw data, diversity (H') and evenness (J'); Aug. 1991.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
TAXON																																		
Family NEREIDAE																																		
Laonereis culveri														3																				3
Family GLYCERIDAE																																		
Glycera abbranchiata	2							2		1	1	1	1		1	4	2	4		2	3		6	1										31
Order AMPHINOMIDA																																		
Family AMPHINOMIDAE																																		
Paramphinoe sp.																									4									4
Order EUNICIDA																																		
Family EUNICIDAE																																		
Nematonereis hebes									2							2				2					24	12	52							94
Family LUMBRINERIDAE																																		
Lumbrineris verilli		4	4		4	4		2		3	2	2									2								10					37
Lumbrineris sp.																	2												2					4
Family ARABELLIDAE																																		
Arabella mutans																											2							2
Family DORVILLEIDAE																																		
Ophryotrocha sp. A			2																															2
Petiboneia sp. A	2																																	2
Order TEREbellIDA																																		
Family TRICHOBRANCHIDAE																																		
Terebellides stroemi																2																		2
Order SABELLIDA																																		
Family SABELLIDAE																																		
Branchiomma nigromaculata	2										2	2				6	32	4					1	2		6								57
Fabriziella trilobata			2																															2
Unidentified sabelid																			1										2					3
Class OLIGOCHAETA																																		
Family TUBIFICIDAE																																		
Bathydrilus adriaticus												1																						1
Limnodriloides baculatus											1	1																						2
Limnodriloides bamardi												1							1	1	1											2	6	
Limnodriloides rubicundis											3	9																				2	14	
Unidentified limnodriloidine																																4	4	
Parakakelio longiprostatus												2																						2
Smithsondrilus sp.	4		2			2				2	4	1				2																		17
Tectidrilus verrucosus	18		6	2		2																						2	2	2				36
Tubificoides motel	10	2	8		2	2		4															1							8				37

TABLE 4. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Aug. 1991.

[illegible]

TABLE 4. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Aug. 1991.

[illegible]

TABLE 4. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Aug. 1991.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
TAXON																																		
Amphiodia trychna*						2		4													2					2					10			
Class HOLOTHUROIDEA																																		
Unidentified holothuroid (juv)	4			2	4				2									2													14			
TOTAL	194	116	112	68	26	56	32	92	54	40	63	141	24	201	191	126	50	46	17	36	133	17	100	32	898	116	808	14	28	102	4	20	24	3981
Total # species (by replicate)	26	22	22	11	10	10	9	17	12	15	23	23	9	13	9	21	8	10	8	13	16	3	12	13	17	5	15	7	8	19	1	4	6	
H' (by replicate)	2.716	2.514	2.566	1.876	2.098	1.875	1.977	2.456	2.133	2.415	2.849	2.446	1.870	1.194	1.281	2.548	1.334	1.893	1.588	1.974	1.674	0.578	1.893	2.022	1.975	1.375	1.903	1.946	1.909	2.417	0.000	1.280	1.474	
J' (by replicate)	0.834	0.813	0.830	0.782	0.911	0.814	0.900	0.867	0.859	0.892	0.909	0.780	0.851	0.465	0.583	0.837	0.641	0.822	0.764	0.769	0.604	0.526	0.762	0.788	0.697	0.854	0.703	1.000	0.918	0.821	0.000	0.923	0.822	
Total # species (by station)		51			21			28			34			19			26			23			21			21			24			10		117
H' (by station)		3.162			2.306			2.808			2.868			1.397			2.549			1.985			2.129			1.961			2.679			2.109		
J' (by station)		0.804			0.757			0.843			0.813			0.474			0.782			0.633			0.699			0.644			0.843			0.916		

TABLE 5. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Jan. 1992.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
TAXON																																		
Phylum PLATYHELMINTHES																																		
Class TURBELLARIA																																		
unidentified turbellarian														3																	3			
Phylum NEMERTINA																																		
Order ARCHINEMERTEA																																		
Family CEPHALOTHRICIDAE																																		
Cephalothricid sp. (JLN 114)																							2								2			
Order PALEONEMERTEA																																		
Family CARINOMIDAE																																		
Carinomella lactea?					2																										2			
Family HUBRECHTIDAE																																		
Hubrechtella dubia?					6																										20			
Paleonemertine n. sp. A (?JLN 114)								2		2		1					2												1		7	17		
Paleonemertine n. sp. B																	2															2		
Paleonemertine n. sp. JLN 103						2														1	1			2			2	1				9		
Unident. paleonemertine					2															2								1		3	1	9		
Order HOPLONEMERTINA																																		
Unident. hoplonemertine sp. A										2										1		1										4		
Unidentified nemertine sp. A															1			2				1	1					1	2			8		
Phylum MOLLUSCA																																		
Class GASTROPODA																																		
Subclass PROSOBRANCHIA																																		
Family NERITIDAE																																		
Neritina virginea																														7		7		
Family CAECIDAE																																		
Caecum pulchellum						4																	1		2	6				6	3		22	
Family POTAMIDIDAE																																		
Batillaria minima																														2		2		
Subclass OPISTHOBRANCHIA																																		
Family ACTEOCINIDAE																																		
Acteocina candei																																1		
Family BULLIDAE																																		
Bulla striata											1	1																				2		
Family HAMINOEIDAE																																		
Haminoea ?antillarum															1																	2		
Haminoea succinea											9	8	10				1															28		
Class BIVALVIA																																		

TABLE 5. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Jan. 1992.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
TAXON																																		
Order ARCOIDA																																		
Family ARCIDAE																																		
Arcopsis adamsi																		2													2			
Order PTEROIDA																																		
Family LUCINIDAE																																		
Linga sp.?														1																	1			
Family TELLINIDAE																																		
Macoma constricta										2	1			8	3	7				1		1		3				3			29			
Family VENERIDAE																																		
Anomalocardia auberiana																		1													1			
Chione cancellata			2																												2			
Order MYOIDA																																		
Family LYONSIIDAE																																		
Lyonsia hyalina																1															1			
Phylum ANNELIDA																																		
Class POLYCHAETA																																		
Order ORBINIIDA																																		
Family ORBINIIDAE																																		
Leitoscoloplos foliosus														1	19	19															39			
Leitoscoloplos fragilis										10	1	5		1																	17			
Leitoscoloplos sp.											15																				15			
Family PARAONIDAE																																		
Aricidea catherinae																2	6	18			5										31			
Aricidea philinae					4				2	31	21	20		73	83	97				2	13	11	14	18	20			9	4	6	1	2	431	
Aricidea taylori	18	20	16	36	104	40	2		2												1	1					2	2	3			247		
Aricidea sp.																					1										1			
Order SPIONIDA																																		
Family SPIONIDAE																																		
Polydora socialis																						1									1			
Polydora sp. A																						2									2			
Prionospio cristata				2	4			2	6	1		1				12	10	4	3	3	1			1				1	1		52			
Prionospio heterobranchiata										2		1	3		2						1	3	1	1				1			15			
Prionospio sp. A			2						2													1									5			
Prionospio sp.																													1		1			
Pseudopolydora sp. A					2			2	2	2	4	1	1	2					1				2				1		1		21			
Scolecipis squamata													1																1		2			
Spio pettiboneae										1		1				2													1	1		6		

TABLE 5. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Jan. 1992.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
TAXON																																		
Unidentified spionid																		1													1			
Family CIRRATULIDAE																																		
Caulerietta sp. A					4					9	1			1	2				1	3	7	4				6	6	1				45		
Caulerietta sp. B										1										1								1				3		
Cirriformia sp. A								2	2	8																							12	
Cirriformia sp. S															2																		2	
Tharyx dorsobranchialis			2	2				2							2						2					2							12	
Tharyx sp. A																				1													1	
Unidentified cirratulid	2												2																				4	
Order CAPITELLIDA																																		
Family CAPITELLIDAE																																		
Capitella capitata											2		8	79	51				1						3				10				154	
Mastobranchius sp.										1																							1	
Mediomastus californiensis								4																			1						5	
Mediomastus sp.	2	6	4	2	6	8	20		2							14	2			2	3	1	3			3	1	2				81		
Notomastus americanus					6																												6	
Order OPHELIIDA																																		
Family OPHELIIDAE																																		
Armandia maculata												1							1	1													3	
Order PHYLLODOCIDA																																		
Family POLYNOIDAE																																		
Harmothoe sp. B																																		
Family SIGALIONIDAE																																		
Sthenelais boa																											1						1	
Family SYLLIDAE																2																	2	
Brania wellfleetensis										2																							2	
Brania sp. A											1	2																					3	
Brania sp.																					1												1	
Ehlersia cornuta																			2	1	1		1	12	4	2							23	
Exogone dispar				2									1																				3	
Exogone sp.																				1													1	
Odontosyllis enopla															2												1	1					4	
Sphaerosyllis longicauda													3	13																			16	
Sphaerosyllis piriferopsis																													1				1	
Sphaerosyllis riseri					2		2															1							1				6	
Sphaerosyllis taylori					8		2						2	3	1						1												17	
Sphaerosyllis sp.													6							1	1						1						9	

TABLE 5. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Jan. 1992.

[illegible]

TABLE 5. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Jan. 1992.

[illegible]

TABLE 5. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Jan. 1992.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		2	3	1	2	3				
TAXON																																		
Limnodriloides baculatus																								1				2				3		
Limnodriloides barnardi															1					2									1	3		7		
Limnodriloides rubicundis		6												1	5									2								14		
Limnodriloides sp.														1																		1		
Unidentified limnodriloidine					6																									1		7		
Smithsondrilus marinus																6				6		3	5	1				2	7			30		
Smithsondrilus sp.																2																2		
Tectidrilus sp.					2											2													1			5		
Thalassodrilides gurwitschi											1	1		8	2		2								3			2				1	26	
Tubificoides bermudae																								1								1		
Tubificoides motel					2	2			2						1														3	1			11	
Tubificoides sp. HS																2																2		
Unidentified tubificid					2			8			1	1		1		1	4			3	4	2	3	1	3		12	4		8	3	1	1	63
Phylum SIPUNCULA																																		
Class PHASCOLOSOMATIDEA																																		
Order ASPIDOSIPHONIFORMES																																		
Family ASPIDOSIPHONIDAE																																		
Aspidosiphon albus																										22	34	12			1		69	
Class SIPUNCULIDEA																																		
Order GOLFINGIIFORMES																																		
Family PHASCOLIONIDAE																																		
Phascolion sp.																														4		4		
Unidentified sipunculan A											1			3	3																	7		
Unidentified sipunculan B						2																										2		
Phylum ARTHROPODA																																		
Subphylum CRUSTACEA																																		
Class CEPHALOCARIDA																																		
Unidentified cephalocarid			2																													2		
Class OSTRACODA																																		
Subclass MYODOCOPA																																		
Order MYODOCOPINA																																		
Family SARSIELLIDAE																																		
Eusarsiella disparalis																														1	2		3	
Family CYLINDROLEBERIDIDAE																																		
Asteropterygion oculitristis																								1								1		
Family PHILOMEDIDAE																																		
Harbansus paucichelatus												1															32	26	20				79	

TABLE 5. Grab Collection Stations: raw data, diversity (H') and evenness (J'); Jan. 1992.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a				
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3					
TAXON																																			
Family ALPHEIDAE																																			
Alpheus floridanus			2			4			2							2			1	1												12			
Alpheus nuttingi													1																				1		
Alpheus sp.																		2															2		
Family PALAEMONIDAE																																			
Brachycarpus biunguiculatus							2																										2		
Periclimenes sp.																					1												1		
Family PASIPHAEIDAE																																			
Leptochela serratorbita																					1												1		
Intraorder ANOMURA																																			
Family DIOGENIDAE																																			
Clibanarius cubensis																			1														1		
Family PAGURIDAE																																			
Pagurus stimpeoni																2					2							2					6		
Pagurus sp.																			1				1										2		
Intraorder BRACHYURA																																			
Family GONEPLACIDAE																																			
Unidentified goneplacid				2																													2		
Family XANTHIDAE																																			
Dyspanopeus sayi																			1		1												2		
Phylum ECHINODERMATA																																			
Class OPHIUROIDEA																																			
Unidentified ophiuroid					2		2		2						1	2		4					1										14		
UNKNOWN															1																		1		
TOTAL	24	32	30	70	180	70	52	16	48	220	136	144	230	519	405	60	26	36	71	66	77	71	119	147	324	294	200	111	98	68	49	16	47	4076	
Total # species (by replicate)	4	3	7	13	20	8	15	7	14	23	20	22	19	29	31	16	7	8	14	28	26	25	26	26	7	10	9	30	28	27	12	6	10	140	
H' (by replicate)	0.837	0.921	1.507	1.841	1.870	1.447	2.266	1.906	2.417	2.212	2.177	2.223	2.091	2.473	2.541	2.433	1.892	1.638	1.569	2.848	2.582	2.839	2.588	2.360	0.936	1.333	0.983	3.031	2.794	2.898	1.948	1.488	1.786		
J' (by replicate)	0.604	0.839	0.774	0.718	0.624	0.696	0.837	0.980	0.916	0.705	0.727	0.719	0.710	0.735	0.740	0.877	0.870	0.788	0.594	0.855	0.793	0.882	0.794	0.724	0.481	0.579	0.447	0.891	0.838	0.879	0.784	0.831	0.776		
Total # species (by station)		10			28				23					36			25						47				12			51			21		
H' (by station)		1.365			2.057				2.800					2.364			2.614						2.831			1.139			3.282			2.408			
J' (by station)		0.593			0.617				0.893					0.860			0.812						0.733			0.744			0.458			0.835			0.791

Table 6. Crab census data. Numbers in parentheses indicate numbers of trees inside 1.0 square meter sampling area; Aug. 1992.

STATION	1a			2			3			4			5			6			7			10			12			13			15			16			TOT
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
CRAB BURROWS	170	52	179	128	103	174	167	140	158	134	185	135	144	112	120	200	108	162	186	124	145	17	33	53	0	0	0	10	67	16	38	38	20	67	65	94	
CRAB CENSUS																																					
Family GRAPSIDE																																					
Aratus pisonii (juv)														1							1												2				
Sesarma curacaoense	3	4	6	2	2	9	5	6	5	2	5	5		3	3	4	1	5	5	3	4									1			83				
Family XANTHIDAE																																					
Eurytium limosum		1			1						1	1								1													5				
Family OCYPODIDAE																																					
Uca pugilator																											5	1					6				
Uca rapax																											1			3			4				
Uca thayeri	1			1				1			1			2	1						1		1										9				
Uca speciosa			1							3																							4				
Uca sp. (juv.)	1		1	1					1	1					1																		6				
Unidentified crabs*																															3*	2*	5				
Total # specimens	5	5	8	4	3	9	5	6	7	6	7	6	0	6	4	5	1	5	5	4	6	0	1	0	0	0	0	5	2	0	0	0	4	3	2	124	
Total # species (by station)		5			4			3			5			3			2			4		1			0		2			0		2*					
H' (by station)		0.800			0.689			0.426			0.822			0.898			0.305			0.720		0			0		0.410			0		0.349					
J' (by station)		0.497			0.497			0.388			0.511			0.817			0.439			0.519		0			0		0.592			0		0.503					
TREE CRAB CENSUS																																					
Family GRAPSIDAE																																					
Aratus pisonii*	0(2)			0(1)			1(2)			0(3)			4(4)			2(4)			4(4)			1(1)			0(0)		0(0)			0(4)		3(1)					

* Samples from sta. 16-2 and 16-3 were lost; specimens were probably *U. rapax* and are treated as such in diversity calculations.

TABLE 7. Crab census data. Numbers in parentheses indicate numbers of trees inside 1.0 square meter sampling area; Aug. 1991.

STATION	1a			2			3			4			5			6			7			10			12			13			15			16			TOT
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
CRAB BURROWS	169	80	175	164	142	97	197	156	165	147	115	125	149	152	153	161	148	155	148	199	291	22	26	12	0	0	0	45	51	32	42	12	9	180	170	149	
CRAB CENSUS																																					
Family GRAPSIDAE																																					
Sesarma curacaoense	1	4	2	2	4	3		2	3	1	5	3	4	3	5	1	2	1	4	4	6															60	
Family XANTHIDAE																																					
Eurytium limosum				1	1	1										1	1	1																		6	
Family OCYPODIDAE																																					
Uca pugilator																											1	2	1							4	
Uca pugnax																											6				5					11	
Uca speciosa								2	1					1						2																6	
Uca thayeri							1	1	2		2	1	1	1	2	1	1				1	1	1	1				1	2	1				2		23	
Uca sp. (juv.)													1						1																	2	
Total # specimens	1	4	2	3	5	4	1	5	6	1	7	4	6	5	7	3	4	2	5	4	9	1	1	1	0	0	0	7	3	3	1	0	5	0	0	2	112
Total # species (by station)	1			2				3			2			4			3		4			1			0			3			2			1			
H' (by station)	0			0.562				1.076			0.562			0.926			1.061		0.761			0			0			1.058		0.451			0				
J' (by station)	0			0.811				0.981			0.811			0.668			0.966		0.549			0			0			0.962		0.65			0				
TREE CRAB CENSUS																																					
Family GRAPSIDAE																																					
Aratus pisoni	13 (3)			3 (3)			4 (4)			11 (5)			6 (3)			10 (4)			8 (3)			0		0			0			0			6 (7)				

Table 8. Crab census data. Numbers in parentheses indicate numbers of trees inside 1.0 square meter sampling area; Jan. 1992.

STATION	1a			2			3			4			5			6			7			10			12			13			15			16			TOT
REPLICATE	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3				
CRAB BURROWS	145	66	137	189	87	142	236	192	120	137	101	107	171	110	103	123	163	139	181	173	187	22	26	12	0	0	0	41	23	25	5	10	10	68	32	77	
CRAB CENSUS																																					
Family GRAPSIDAE																																					
Aratus pisonii (juv)				1		1								1		1		1																5			
Sesarma curacaoense		3	1			2	1			2	1	2		1	3			1																	17		
Family XANTHIDAE																																					
Eurytium limosum																			1	1															2		
Family OCYPODIDAE																																					
Uca pugilator																												2								2	
Uca rapax																											2			2					4		
Uca thayeri		1			1												1																		3		
Uca sp. (juv.)	4		2	1	1	3	1		2	3									2	2	1	1	1										1	25			
Total # specimens	4	4	3	2	2	6	2	0	2	5	1	2	0	2	3	0	1	0	3	3	3	1	1	1	0	0	0	2	2	0	2	0	0	0	0	1	58
Total # species (by station)		3			4			2			2			2			1			5			1			0		2		1			1				
H' (by station)		0.916			1.220			0.562			0.662			0.500			0			1.427			0			0		0.693		0			0				
J' (by station)		0.834			0.880			0.811			0.954			0.722			0			0.887			0			0		1.000		0			0				
TREE CRAB CENSUS																																					
Family GRAPSIDAE																																					
Aratus pisonii*	9(1)			7(1)			5(2)			4(2)			7(2)			7(2)		5(5)			0(1)			0(0)		0(0)			0				1(5)				

TABLE 9. Hand collection stations: raw data, diversity (H') and evenness (J'); Aug. 1992.

STATION	9			13			17			TOT
REPLICATE	1	2	3	1	2	3	1	2	3	
TAXON										
Phylum SIPUNCULA										
Phascolosoma sp.		4			1					5
Phylum MOLLUSCA										
Class GASTROPODA										
Family POTAMIDIDAE										
Batillaria minima	33	29	9		8	10	6		4	99
Family VERMETIDAE										
?Petalconchus varians	6	2	4							12
Family NASSARIIDAE										
Nassarius vibex									2	2
Class BIVALVIA										
Family ISOGNOMONIDAE										
Isognomon alatus									3	3
Family OSTREIDAE										
?Crassostrea virginica			1			4				5
Family MYTILIDAE										
Brachidontes exustus					2	1				3
Phylum ARTHROPODA										
Subphylum CRUSTACEA										
Class CIRRIPIEDIA										
Family BALANIDAE										
Balanus sp. (juv.*)	19	29	74			1			1	124
Family CHTHAMALIDAE										
Chthamalus ?fragilis	2		3							5
Class MALACOSTRACA										
Order AMPHIPODA										
Family HYALIDAE										
?Hyalo grandicomis						1		1		2
Order DECAPODA										
Family GRAPSIDAE										
Unident. grapsid		1								1
Family XANTHIDAE										
Panopeus sp.		1		1		1				3
Cataleptodius floridanus					1					1
Unident. Brachyura (juv.**)	1	1		2	1	1	16	4	15	41
Subphylum UNIRAMIA										
Class INSECTA										
Order COLLEMBOLA										
Family ANURIDIDAE										
Anurida maritima	19	7	10	9	20	13	36	15	18	147
Order DIPTERA										
Unident. fly larva	1					1				2
Total # of specimens	81	74	101	12	33	33	58	20	43	455
Total # species (by replicate)	7	8	6	3	6	9	3	3	6	15
H' (by replicate)	1.439	1.229	0.95	0.721	1.029	1.62	0.886	0.687	1.369	
J' (by replicate)	0.739	0.591	0.53	0.657	0.574	0.737	0.806	0.626	0.764	
Total # species (by station)		11			11			7		
H' (by station)		1.395			1.475			1.1241		
J' (by station)		0.561			0.615			0.578		

* Probably mostly *B. amphitrite*. ** Minute; probably *Uca* sp. (possibly *Sesarma* or *Aratus*).

TABLE 10. Hand Collection stations: raw data, diversity (H') and evenness (J'); Aug. 1991.

STATION		9			13			17		TOT
REPLICATE	1	2	3	1	2	3	1	2	3	
TAXON										
Phylum MOLLUSCA										
Class GASTROPODA										
Family POTAMIDIDAE										
Batillaria minima	47	28	13	36	32	32	2		1	191
Family NASSARIIDAE										
Nassarius vibex	2						2			4
Family VERMETIDAE										
?Petalococonchus varians	3									3
Phylum ANNELIDA										
Class POLYCHAETA										
Order EUNICIDA										
Family EUNICIDAE										
Unidentified euniciid			3							3
Phylum ARTHROPODA										
Subphylum CRUSTACEA										
Class CIRRIPIEDIA										
Family BALANIDAE										
Balanus amphitrite	7	9	1							17
Balanus reticulatus	5	6								11
Unidentified balanid				18	37	16				71
Family CHTHAMALIDAE										
Chthamalus fragilis	54	68	4		2					128
Class MALACOSTRACA										
Order AMPHIPODA										
Family TALITRIDAE										
Unidentified talitrid			4							4
Order DECAPODA										
Family GRAPSIDAE										
Aratus pisoni(?)								2		2
Sesarma sp. (juv.)						1				1
Unidentified grapsid		1	2							3
Family XANTHIDAE										
Panopeus sp.	1	2	2							5
Family OCYPODIDAE										
Uca sp. (juv.)							4	3	3	10
Subphylum UNIRAMIA										
Class INSECTA										
Order COLLEMBOLA										
Family ANURIDIDAE										
Anurida maritima	5	1	3				1	6	2	18
Total # specimens	124	115	32	54	71	49	9	11	6	471
Total # species (by replicate)	8	7	8	2	3	3	4	3	3	15
H' (by replicate)	1.346	1.161	1.785	0.637	0.799	0.723	1.273	0.995	1.011	
J' (by replicate)	0.647	0.597	0.858	0.918	0.728	0.658	0.918	0.906	0.921	
Total # species (by station)		11			4			5		
H' (by station)		1.460			0.759			1.379		
J' (by station)		0.609			0.547			0.857		

TABLE 11. Hand collection stations: raw data, diversity (H') and evenness (J'); Jan. 1992.

STATION	9			13			17			TOT
REPLICATE	1	2	3	1	2	3	1	2	3	
TAXON										
Phylum MOLLUSCA										
Class GASTROPODA										
Family POTAMIDIDAE										
Batillaria minima	31	47	11	61	62	32	2	11		257
Family VERMETIDAE										
?Petalocochus varians	1	9								10
Class BIVALVIA										
Family ISOGNOMONIDAE										
Isognomon alatus								8		8
Family OSTREIDAE										
?Crassostrea virginica								1		1
Family MYTILIDAE										
Brachidontes exustus				1	1					2
Phylum ARTHROPODA										
Subphylum CRUSTACEA										
Class CIRRIPIEDIA										
Family BALANIDAE										
Balanus amphitrite		12	3			4		24		43
Balanus reticulatus		3								3
Family CHTHAMALIDAE										
Chthamalus fragilis		149	14							163
Class MALACOSTRACA										
Order AMPHIPODA										
Family HYALIDAE										
Hyalae grandicornis	1	12	18	2		1				34
Order DECAPODA										
Family DIOGENIDAE										
Clibanarius tricolor		4								4
Clibanarius sp. ?				7						7
Family GRAPSIDAE										
Aratus pisonii (juv)	1	1								2
Family XANTHIDAE										
unident. juv. xanthid	2	1				1			1	5
Subphylum UNIRAMIA										
Class INSECTA										
Order COLLEMBOLA										
Family ANURIDIDAE										
Anurida maritima	16	9	5	23	9	6				68
Phylum PORIFERA										
unident. juv. sponge									1	1
Total # of specimens	52	247	51	94	72	44	2	44	2	608
Total # species (by replicate)	6	10	5	5	3	5	1	4	2	15
H' (by replicate)	1.024	1.321	1.448	0.949	0.448	0.893	0	1.073	0.693	
J' (by replicate)	0.572	0.574	0.899	0.589	0.408	0.555	0	0.774	1	
Total # species (by station)		10			7			6		
H' (by station)		1.528			0.853			1.241		
J' (by station)		0.664			0.438			0.692		

TABLE 12. Summary of Major Taxonomic Groups in Grab Collections; August 1991-2.

STATION	1			8			8a			9			10a			11		
SURVEY	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92
TAXON																		
NEMERTINA	24	0	7	10	12	21	10	6	10	7	1	11	0	3	0	14	6	12
MOLLUSCA	62	2	1	14	4	8	12	0	3	9	33	17	8	22	16	16	2	18
POLYCHAETA	242	74	140	98	258	226	120	86	242	144	202	598	182	760	912	174	84	221
OLIGOCHAETA	74	6	45	16	22	189	12	2	119	34	7	59	0	21	30	8	18	221
SIPUNCULA	0	0	0	0	2	0	0	0	0	0	1	0	0	6	0	0	0	1
OSTRACODA	2	0	0	0	0	0	0	0	0	31	158	2	218	79	166	0	0	0
PERACARIDA	10	0	0	0	14	3	12	4	9	16	101	2	3	257	3	2	2	1
OTHER	8	4	8	12	8	5	12	8	3	3	0	9	5	6	3	8	10	12
TOTALS	422	86	201	150	320	452	178	106	386	244	503	698	416	1154	1130	222	122	486
DIVERSITY	3.162	1.365	2.667	2.306	2.057	2.974	2.808	2.800	2.304	2.868	2.364	2.129	1.387	2.555	1.712	2.549	2.614	3.326
RICHNESS	51	10	38	21	28	52	28	23	38	34	36	41	19	46	23	26	25	72

STATION	13a			14			17			18			19a			TOT		
SURVEY	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92
TAXON																		
NEMERTINA	0	3	30	2	5	5	2	16	5	6	10	48	0	11	1	75	73	150
MOLLUSCA	8	6	31	15	9	14	404	0	326	56	12	22	0	10	1	604	100	465
POLYCHAETA	156	101	292	115	127	68	454	46	278	44	119	474	12	18	234	1741	1875	3685
OLIGOCHAETA	11	21	180	3	21	162	12	16	61	20	34	283	8	7	19	198	175	1431
SIPUNCULA	0	0	0	0	0	0	328	68	176	0	0	0	8	5	4	336	82	181
OSTRACODA	0	0	2	0	45	2	52	78	7	10	14	2	12	29	4	325	403	185
PERACARIDA	10	97	10	10	122	13	570	594	2790	4	86	3	8	32	20	645	1309	2854
OTHER	1	6	18	4	8	14	0	0	7	4	2	7	0	0	2	57	52	88
TOTALS	186	234	563	149	337	278	1822	818	3650	144	277	839	48	112	285	3981	4069	9039
DIVERSITY	1.985	2.823	2.571	2.129	2.831	3.024	1.961	1.139	1.612	2.679	3.282	3.026	2.109	2.408	1.459			
RICHNESS	23	47	48	21	45	51	21	12	36	24	51	65	10	21	23			

TABLE 14. Summary of Abundances of Most Common Taxa in Grab Collections by Station and Survey; Aug. 1991-2.

STATION	1			8			8a			9			10a			11			13a			14			17			18			19a			
SURVEY	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92	8/91	1/92	8/92				
Phylum MOLLUSCA																																		
Caecum imbricatum																									210		170							
Caecum pulchellum	36			4	4	8	10		1						5	12		14	7	3	25	13	6	9	190		153	42	9	14				
Phylum ANNELIDA																																		
Class POLYCHAETA																																		
Leitoscoloplos fragilis										6	16		65	1																				
Aricidea catherinae			5													26	3			5	129													
Aricidea philinae	8				4		4	2	1	42	72	120	98	253	398	52			76	26	5	60	52	2				12	19	1	6	3		
Aricidea taylori	14	54	13	56	180	25	32	4	161	3		1			5				2					12			1		7	5				
Pseudopolydora spp.			1	2	2	2	6	6		26	6	18	3	2	3	4		1	49	1	1	23	2	2					2	4				
Capitella capitata	6		1						1	21	2	295	4	138	340				1	1				5					3	1	2	10	194	
Mediomastus californiensis			62			66	2	4	13			1						50			33			8			2		1	28				
Mediomastus sp.	86	12		20	16		36	22		3						28	16		2	2		6	7		2			2	6					
Ehlersia comuta						2	4		1							16		10	3	3	1	1	2		328	18	212			4		3		
Sphaerosyllis sp.			3			35			21			3		6	157			5		2	67			8			8		1	21				
Laeonereis culveri											1		3	210																				
Glycera abbranchiata	2		3		8	2	2	14		3	57	1	2	8		10	2		5	6	1	7	10	1					15	2		1		
Nematoneis hebes			4				2	6								2		11	2					1	88	28	39							
Lumbrineris testudinum			28			25						13			1			7			6			13						96				
Branchioma nigromaculata	2									4						42				2	1	1	1		8									
Class OLIGOCHAETA																																		
Pectinodrilus molestus																								2			58							
Smithsonodrilus hummelincki			6			40			36			3			2			70			145			67										
Tectidrilus gabriellae			5			52			23									5						18						75				
Tubificoides motai	20		24	4	4	97	4	2	46				1					76			4	1		39				8	4	157		2		
Phylum SIPUNCULA																																		
Aspidosiphon albus																		1							328	68	172				1	1		
Phylum ARTHROPODA																																		
Class OSTRACODA																																		
Harbansus paucichelatus											1															78				1				
Cyprideis americana															78																			
Peratocytheridea setipunctat												2			87																			
Unidentified podocopan*										31	157		218	79									44		6			10	11		12	29		
Class MALACOSTRACA																																		
Kaliapseudes aliciae						1			1															3	544	578	2161				2			
Leptochelia rapax											6		1	52	1				1	2	1	6	7						4					
Exosphaeroma productifoliso																																		
Cerapus n. sp.	2						8			14	1			104	2				6	69		3	62	2		2	122		4					
Grandidierella bonnieroides	6				12	2	4	4			36		2	79				2		1	21			44			10		4	50		6	23	10

TABLE 15. List of outside taxonomic experts consulted and their area(s) of expertise.

Dr. Jon F. Norenburg, Smithsonian Institution (Nemertina)
Dr. Donald R. Moore, University of Miami (Mollusca)
Dr. Michael Milligan, Mote Marine Laboratory (Polychaeta and Oligochaeta)
Dr. Julie Piraino, Harbor Branch Oceanographic Institute (Sipuncula)
Dr. Louis Kornicker, Smithsonian Institution (Ostracoda)
Dr. Rosalie Maddocks, University of Houston (Ostracoda)
Dr. James D. Thomas, Newfound Harbor Marine Institute (Amphipoda)
Dr. Raphael LeMaitre, Smithsonian Institution (Decapoda)
Dr. Julio Garcia-Gomez, Miami-Dade Community College (Decapoda)
Dr. Austin Williams, Smithsonian Institution (Decapoda)
Dr. Patsy A. McLaughlin, Sedro Woolley, WA (Cirripedia)
Dr. David L. Pawson, Smithsonian Institution (Echinodermata)