9-27-1995

Final Report Biological Monitoring of the Hollywood-Hallandale Beach Renourishment

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TECHNICAL REPORT 95-03

FINAL REPORT
BIOLOGICAL MONITORING OF THE HOLLYWOOD - HALLANDALE BEACH RENOURISHMENT

SEPTEMBER 27, 1995

Prepared for:

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FINAL REPORT: BIOLOGICAL MONITORING OF THE HOLLYWOOD - HALLANDALE BEACH RENOURISHMENT

1. Abstract

A four-year study was undertaken to survey Broward County, Florida (southeast Florida) coral communities and infaunal marine biota in relation to possible effects from the Hollywood-Hallandale Beach renourishment project. Beach restoration involves dredging sand from offshore deposits and placing it on eroded beaches, activities which may cause sedimentation and turbidity. Coral reefs were assessed using transect and quadrat surveys at a total of 15 stations, unevenly distributed between dredging impact (n=9) and control (n=6) areas to characterize and quantify populations of sponges, gorgonians, scleractinian corals, as well as other less well represented groups. In addition, the infauna of sand areas were analyzed using 150 core samples collected from both control and dredging impact areas. The first study was conducted in 1990, one year prior to construction of the beach in 1991. Other surveys were conducted immediately after construction in 1991, and then in 1992 and in 1994.

The issue of the response of coral reefs and coral reef organisms to sedimentation and turbidity is complicated. These ecosystems have adapted over long time periods to be able to deal with certain low levels of natural sedimentation and turbidity. However, excessive or chronic sedimentation causes documented adverse effects. These can include mortality, as well as changes in growth, coverage, density, and community composition. The difficulty is that all of these parameters, while linked, change at different rates and in other ways which are largely unquantified for individual species, let alone the broad combinations of species and growth forms which ultimately create ecosystems. Consequently, predicting (and assessing) the effects of a particular event or events (e.g., a beach renourishment project) can be particularly difficult when effects are less than catastrophic (e.g., complete mortality).

The most consistent result obtained by this study is that a long term decline, indicated by many key taxonomic groups and indices has occurred in the study areas. Statistical analyses using repeated measures Analysis of Variance (ANOVA) often show a time effect for both control and dredging treatments. Declines in both control and dredging stations are especially obvious when 1990 Pre-construction parameters are compared with those of 1994 (although there may be unexplained fluctuations in between these times). Percent cover by scleractinian corals, as well as their mean density and coverage diversity are all lower (often significantly) in 1994 than they were in 1990. Coral coverage at dredging sites dropped continuously and lost 20% of its Pre-construction value. However, the largest percent decline among gorgonians occurred between the 1992 and 1994 surveys in which dredge stations populations decreased by 28.5% and control populations declined by 27.8%. An overall decrease in the mean number of sponges and scleractinian corals also occurred in the study areas, similarly not limited to dredge stations, but encompassing control stations as well.

Differences among treatment means were not statistically significant and consequently insufficient to indicate dredging effects. In some cases, however, effects of dredging were noted, especially for the gorgonian populations. The number of gorgonian corals declined 15.8% at the dredging sites between 1991 and 1992, while remaining constant at control sites. Most of these gorgonian losses occurred on nearshore stations just offshore of the restored beach where many

colonies were found partially or completely dead and covered with a layer of silt. At the same time, however, the mean number of individual sponges and scleractinians increased at both control and dredging sites in the same period.

While the data do not demonstrate the absence of potential environmental impacts as a result of dredging and filling, the overall pattern is not consistent with a simple, single impact explanation. Storm events must also be factored into the pattern. During the study period, two major storms affected the area. Hurricane Andrew in August of 1992 occurred just a few weeks before the 1992 survey. The otherwise unnamed "Storm of the Century" took place in 1993, a year when no biological assessment was undertaken. In qualitative surveys following the storms, we specifically noted damage to the reef communities. Invertebrate populations were scoured from their points of attachment to the substrate and piled into crevices and depressions on the reef. Our data from the current study show that numbers of sponges, which had increased at both dredge and control sites in 1991, declined substantially after the storm, recovering slightly or leveling off in 1994. Gorgonian populationss declined twice at dredging sites, in 1991 and again between 1992 and 1994. The first decline had no parallel on control sites, but the second decline was mirrored by a population decrease at control stations. Stony coral colonies increased or remained the same at dredge sites during the first three surveys, then similarly decreased between 1992 and 1994. Mean coral density and coverage diversity followed the same pattern.

Inshore and offshore core sites supported different macroinfaunal assemblages during this project. Pre-construction faunal composition as reflected by most common organisms was generally similar at control and treatment sites both inshore and offshore, although one control (R90) and one treatment site (T111) differed considerably from the other inshore sites. With these two exceptions, macrofaunal abundances and species richness values increased at all inshore sites immediately post-dredging. By contrast, organism abundances, richness and diversity indices declined substantially at both offshore sites over the same period (1990-1991). In 1992, all inshore sites (except T111) recorded greater macrofaunal abundances than in the Pre-construction survey, although two control and three treatment stations declined from 1991 peaks. Similarly, species richness values continued to increase or at least remained higher than Pre-construction levels at six sites (again excepting R90 and T111). In 1994, organism abundances had declined to below Pre-construction levels at all sites with the exception of two inshore treatment stations (R106, R116) that had developed a different macrofaunal assemblage accompanied by peaks in nematode and harpacticoid numbers. Species richness declined at least slightly from 1991 or 1992 peaks at all inshore sites (except R106), but remained higher than before renourishment with two exceptions: richness at stations R90 and T111 declined roughly continuously through all four surveys so that, in 1994, these two sites supported assemblages similar to those at most of the other inshore sites (T88, R92, R94, R120). Diversity indices showed no recognizable trend relative to control versus treatment over the course of the four surveys.

Of the dominant inshore organisms, the polychaetes, *Dispio uncinata*, *Paraonis fulgens*, *Scolelepis texana*, *Spio pettiboneae* and *Armandia agilis,* generally increased in numbers from 1990 through 1992 and almost uniformly declined in 1994, with much greater declines at the four treatment sites. *S. texana* disappeared from all treatment sites, while *Prionospio multibranchiata* appeared at all control sites. *S. pettiboneae* disappeared from all eight inshore sites. The inshore amphipods, *Metharpinia floridana* and *Haustorius* sp., remained abundant or increased in numbers at control sites. At treatment sites, both exhibited at least some immediately Post-

construction increases and then declined, with the former species disappearing in 1994. The bivalve, *Tivela floridana*, also exhibited 1991 peaks at several stations, but, in contrast with the amphipods, declined at all sites in 1992 and rebounded at three control and three treatment sites in 1994. At the offshore sites, *Prionospio cristata* generally remained the most abundant polychaete although it decreased in numbers at both stations in 1994. Both *P. cristata* and another polychaete, *Chone* cf. *americana*, occurred in greater abundance in the borrow area than at the control site in all three Post-construction surveys. However, of the three common non-polychaete taxa, the bryozoan, *Cupuladria* sp., increased at the control site and decreased at the borrow area over the four surveys; the tanaidacean, *Cirratodactylus floridensis*, and the isopod, *Xenanthura brevitelson*, declined at the control site, though they remained in moderate numbers there, while both declined or disappeared at the borrow area after dredging.

The results of this assessment has indicated few major detrimental effects from the beach renourishment project. This would suggest that future renourishment projects could be expected to result in only minor impacts, if responsible construction practices were followed. However, it is also important to recognize the limitations of this study and possible confounding effects. These include small sample size (numbers of monitoring sites) within the dredging and control areas, confounding effects of reef community zonation with depth (e.g., First, Second, and Third Reefs), confounding effects of short-term disturbances (e.g., Hurricane Andrew) or long-term change (e.g., global warming, chronic pollution from other sources), and finally high natural variability of reef communities, which decrease the ability of statistical tests to detect differences, regardless of the replication.

2. INTRODUCTION

2.1. Hollywood-Hallandale Beach Renourishment Project

2.1.1. History

In 1990, Nova University (Contractor) with Coral Reef Associates and ERM-South, Inc. (Subcontractors) was awarded a contract to provide biological monitoring services for the Hollywood-Hallandale Beach Renourishment Project. A notice to proceed for the initial biological monitoring (Pre-construction) was issued in September, 1990. Pre-construction field monitoring took place in October, 1990. Renourishment dredging began in April and ended August, 1991. Approximately 1.2 million cubic yards of sediment were removed and subsequently emplaced on 5 miles of shoreline. The first Post-construction monitoring took place in October, 1991. The second Post-construction monitoring began in October, 1992. The third Post-construction monitoring began in October, 1994.

2.1.2. Contracted Scope of Services

Biological monitoring for the Hollywood-Hallandale Beach Renourishment Monitoring were organized in four separate evaluation periods:

(a) Once during Summer or early Fall before renourishment (= Pre-construction monitoring).
(b) Once approximately one (1) year after (a) (= First Post-construction monitoring).
(c) Once approximately two (2) years after (a) (= Second Post-construction monitoring).
(d) Once approximately four (4) years after (a) (=Third Post-construction monitoring).

The scope of services consisted of three tasks, as described below.

Task 1. - Transects: Contractor shall at reef areas adjacent to each of fifteen coral community stations conduct transects of a method to allow an assessment of the density of scleractinian (stony) coral colonies in each area (corals/square meter).

Task 2 - Quadrats: Contractor shall conduct an in situ qualitative (species identification) and quantitative (species counts) inventory of all sessile flora and fauna found within fifteen 2 x 2 meter (m), pre-established, coral community, monitoring stations.

Task 3 - Cores: Contractor shall sort and identify to the taxon as low as reasonably achievable, within any time constraints that may be imposed by Florida Department of Environmental Regulation, all specimens larger than 0.5 mm (millimeters) stained with Rose Bengal contained in sand core samples obtained from offshore soft bottom sites.

The sand coring infaunal study sites will be located and conducted as follows. Infauna at the fill site shall be collected from four transects from the fill area at least three hundred (300) meters apart. One station shall be established along each transect at an elevation of -5 to -7 feet mean low water (MLW). Control site infauna shall be collected from four (4) transects offshore J.U. Lloyd Beach as control sites. Fifteen (15) replicates shall be taken at each elevation along each transect. Infauna at the borrow sites shall be collected from five (5) randomly spaced sta-

tions from portions of the borrow area that are used for the project. For the Pre-construction samples, the stations should be placed in areas that are expected to be excavated. The stations must be at least twenty (20) meters apart. Three (3) samples shall be taken at each station. In addition, triplicate samples shall also be taken at five (5) stations in a comparable area not affected by the project. There will be a total not to exceed one hundred fifty (150) samples.

Nova Southeastern University shall prepare and submit to Broward County a separate report of the findings of the Pre-construction, one-year Post-construction, two-year Post-construction, and four-year Post-construction evaluations. The report of the four-year Post-construction evaluation shall be considered the final report and shall include, but not be limited to the detailed results of the four-year Post-construction evaluation and a comparative analysis of all four evaluations which will determine the existence of any detectable environmental effect in the examined marine environment directly or indirectly the result of the beach renourishment project.

2.1.3. Permit requirements: Grain Size & Organics

Broward County's permit for this project requires the following: "The grain-size distribution and organic content of the sediments shall be monitored at the same times and in the same locations indicated ... One sample shall be collected per station and each sample shall include the top 15 cm of sediment. The method used to determine the grain-size distribution and organic content can be any scientifically viable method. The results of this monitoring shall be submitted to the Department ... These reports shall include grain-size distribution curves for each sample and a table that lists the organic content of each sample."

Broward County personnel conducted the required sediment study. Methodology and a summary of results are reported here for completeness.

2.1.4. Rationale For Monitoring

Environmental regulations dealing with sedimentation and turbidity effects from beach nourishment may not be adequate to protect stony corals and coral reef communities (Telesnicki and Goldberg (1995a). One research objective of this project was to critically examine effects of beach renourishment (turbidity and siltation) on locally abundant and ecologically important scleractinian coral species, as well as other resident macroepifaunal and infaunal species. Southeastern Florida is a unique part of the Florida marine environment and deserves special attention. Coral communities here are at their northernmost limits on the North American continent, where, compared to more southern Caribbean and Atlantic reefs, they display reduced abundance, coverage, diversity, and growth due to naturally occurring decreases in light and water temperature (Goldberg, 1973; Jaap, 1984).

Since 1970 many beach restoration projects have been conducted in the Broward, Dade, and Palm Beach County area employing offshore sand supplies. Concern exists that turbidity and sedimentation from future projects may create additional stress for stony corals and their associated communities. It is important to document and quantify the impact of future beach renouishment projects to develop a proper database to assess the efficacy of the construction practices andmitigation techniques currently in use.

2.2. Literature Review of Effects

Among Florida's most valuable natural resources are its beaches. In 1984, for example, Florida beaches created $3.4 billion in salaries and nearly $99 million in State taxes. These, in turn, supported over 142,000 jobs with an annual payroll of over $860 million (Bell and Leaworthy, 1986). It has been estimated that in 1994 Florida's beaches contributed $15 billion to the state's economy (Stronge, 1994).

Beaches, however, suffer from natural processes such as storm erosion, littoral drift, and rising sea levels. Man-made structures such as inlets and improper beachfront development have accelerated the effects of these degratory natural processes. Thus, beach restoration projects have become increasingly common in Florida in recent years (Saunders, 1984). In southeast Florida, where beachfront development has been considerable, erosion has fueled the need for more frequent restoration projects. Broward County was the first in Florida to restore its beaches using an offshore sand source. Pompano Beach was restored in 1970 and again in 1983. The beaches at Hollywood/Hallandale were restored in 1971, 1979, and again in 1990 (this study). John U. Lloyd State Park was first restored in 1977 and again in 1989. In Palm Beach County, Delray Beach has been renourished four times (1973, 1978, 1984, and 1992). Dade County has had fewer repeat projects, but the size of a single restoration on Miami Beach in 1977 involved 10.5 miles of beach, 13 million cubic yards of fill and 5 years of dredging, the largest project to date in Florida history. Finkl (1993) reviews the needs for beach renourishment and sand bypassing options in Southeast Florida.

In a review of environmental problems associated with beach renourishment, Goldberg (1988) suggested that one of the principal causes of renourishment impact was the silt/clay content of the fill. For the nearshore environment, a restored beach with a high silt/clay content increases the potential for resuspension of fine particulate material, as the beach adjusts its grain size distribution to the local wave and current climate. As mobilization of the fines continues, areas beyond the immediate vicinity of the restored beach can be affected. Since resuspension can occur for some time after the project has been completed, an acute problem can become chronic. Resuspended fines contribute to a decrease in water quality in two ways. The first is by producing turbidity, considered here as a decrease in water clarity due to fine silt and clay particles that tend to have a relatively long residence time in the water column. The second is siltation or sedimentation, considered here as the precipitation and benthic accumulation of turbidity-producing fines along with larger grain sizes with a shorter residence time. Together these events can result in smothering benthic invertebrates, clogging fish gills, and decreasing light penetration to the detriment of algae and other photosynthetic organisms (e.g., Courtenay *et al.*, 1974; Pullen & Naqvi, 1983). Communities of organisms nearshore can be subjected to a plume of cloudy water for several weeks or months during the restoration, and to a varying extent afterwards as well.

The extent of offshore turbidity and its persistence after construction, and the manner in which these factors affect the health and longevity of reef corals are contentious issues for South Florida. Unfortunately, our ability to address these issues is further weakened as a result of the paucity of scientific data. Even the dimensions of the resuspension plume from the typical restored beach are often unknown, as is the length of time that the plume exists beyond the construction period. In at least one case, the long term effects of resuspension at Hallandale, Florida has resulted in persistent damage to a hardground community 50-60 meters from shore (Courte-

nay *et al.*, 1980). Seven years after the project, these authors noted continual turbidity nearshore where visibility continued to be less than two meters. Fine silt and sand apparently originating from the beach still covered much of the rock habitat. Whether such effects occurred farther offshore is unknown.

The known offshore effects of beach restoration are associated with the process of dredging sand from the borrow site. In southeast Florida, this usually occurs close to coral reef communities. Marszalek (1981) has divided such offshore effects into three types of impacts: 1) mechanical damage 2) sediment loading and 3) turbidity. Mechanical damage to hard bottom coral communities has occurred during several beach restoration projects. Careless handling of dredge equipment was responsible for damage to coral areas of Hallandale in 1971 (Courtenay *et al.*, 1974), John U. Lloyd State Park in 1977 (Britt & Associates, 1979), Sunny Isles in 1988 (Blair *et al.*, 1988), and in particular off Miami Beach in 1979-1980 (Marszalek, 1981). For the most part, however, mechanical damage appears to be limited in extent and in frequency of occurrence relative to the number of restorations that have taken place in southeast Florida.

Sediment loading may be defined as the rapid deposition of coarse silt and sand resulting from the dredging process. In spite of the fact that coral damage has occurred by sediment loading during several projects (Courtenay *et al.*,1974; Britt & Associates, 1979; Marszalek, 1981), such incidents are relatively minor. Many species of coral are able to deal effectively with sand sized sediment. For example, Hubbard & Pocock (1972) studied 26 species of coral from Florida by filming their ability to remove various sand size classes from their surfaces. As a rule most species were able to deal effectively with moderate amounts of sand. Further, more quantitative tests of moderately sorted coarse sand on several species (Rogers, 1983) has shown that single applications of up to 400 mg/cm^2/day could be dealt with effectively by three out of four species tested. Multiple (38 daily) applications of 200 mg/cm^2/day also produced no permanent damage in three out of four species tested. Similar tests and results on the star coral *Montastrea cavernosa* were obtained by Lasker (1980). While such tests cannot be considered definitive, they represent more quantitative information than is available for the effects of smaller grain sizes, especially that of silt. For comparison, normal sedimentation rates for reefs off southeast Florida (Pompano) at 15-20 ft are 4.3-325 mg/cm^2/day (Sullivan, 1983 letter to DER).

Southeast Florida coral communities are particularly vulnerable to latitude factors that reduce an already narrow window of optimal growth. Corals are under stress at this latitude and grow much more slowly than their Caribbean counterparts due to temperature limitations (Dodge and Fisher, 1988). The coral communities exist in relatively narrow bands, from 150 ft to 2 miles from shore, making shoreward activities potentially significant for them. Third, corals are photosynthetic organisms and are sensitive to reduced light penetration, such that even a cloudy day (in clear water) can reduce coral growth by as much as 50% (Goreau & Goreau, 1959). Reduced light levels alone also are known to produce morbidity and mortality. For example, simple shading for five weeks (simulating turbidity) resulted in the death of several stony coral species (Rogers, 1979). Bak (1978) found more specifically that decreased growth and increased mortality of corals were consistent with light reduction levels due to dredging activities.

In addition to light reduction, the physical presence of silt in the water clogs filter feeding mechanisms and causes continual energy losses sustained through the long term necessity of mucus secretion and continual ciliary activity employed as sediment removal mechanisms (Kendall *et al.*, 1985; Brown & Howard, 1985; Peters & Pilson, 1985, Telesnicki and Goldberg, 1995). A number of other studies have more generally documented the relationship between

turbidity and siltation and coral morbidity and mortality (Dodge *et al.*, 1974; Loya, 1976; Dodge & Vaisnys, 1977; Marszalek, 1981; Dallmayer *et al.*, 1982). Bacterial infection may become a problem as well (Hodgson, 1990). Rogers (1990) provides an extensive review of responses of coral reefs and reef organisms to sedimentation.

During the 1979-1980 Miami Beach project, silt layers 0.5-1.3 inches thick (1.3-3.3 cm) were noted on the patch reef systems in the vicinity of the borrow areas. DERM (Metro-Dade County Department of Environmental Resources Management) estimates at least 167 acres of hardground were affected with up to 39.7% (Marszalek, 1980; 1981) of the stony corals showing loss of color due to expulsion of plant cell symbionts ("bleaching"), recent polyp death, excessive mucus secretion, or partial burial by silt. There is reason to believe that the primary problem was caused by the quality of the fill. A total of 31 core borings were made in the borrow areas for this portion of the project, only seven of which contained less than 11% silt and clay throughout the entire length of the boring. Overall, the silt/clay content ranged from 4-46%, with an average value of 15.2% (DERM, Internal Report,1981).

A number of questions arise from the information at hand, particularly with respect to environmental regulation. The State of Florida has standards for turbidity. Under the Florida Administrative Code Rules 62-3.051(1)(c) and 62-3.061(2)(r), coastal construction in Class Three Waters may not exceed a turbidity level of 29 Nephelometric Turbidity Units (NTU's) above background. During the Miami Beach project cited above, there were no turbidity violations noted (DERM, 1981 Internal Report). If it can be assumed that the biological damage noted above resulted from turbidity, one can conclude that either the process of turbidity monitoring was faulty (ie., violations went undetected) or the standards themselves are biologically meaningless, especially with respect to sensitive organisms such as stony corals.

Telesnicki and Goldberg (1995 a, b) investigated photosynthetic and respiratory responses of two scleractinian coral species from Florida (*Dichocoenia stokesii* and *Meandrina meandrites*) subjected to elevated turbidity conditions for up to 3 weeks. Results suggested that adherence to turbidity-related water quality standards as presently defined in Florida (less than 29 NTU) may result in short term stress and long term decline in some coral species. Morris (1993) examined growth of two species of corals (*Solenastrea bournoni* and *Dichocoenia stokesii*) at Hollywood-Hallandale dredging and non-dredging sites. One species (*S. bournoni*) showed a significant decrease in extension growth at dredging affected sites.

Given the documented and potential detrimental effects of dredging related sedimentation and turbidity to coral and coral reefs, monitoring of reef resources that will be exposed to a dredging project constitutes a sound management decision.

3. METHODS AND MATERIALS

3.1. Field Assessments

Southeast Florida coral reefs are considered to be inactive, primarily fossil structures (Lighty *et al.*, 1978). Their surfaces are veneered by a variety of living organisms, characterized as octocoral-dominated hardground communities (Goldberg, 1973; Jaap, 1984). In comparison, with reefs of the Caribbean, stony coral coverage is low; however, the scleractinian coral fauna probably forms the most valuable and sensitive component of the reef.

Extending from Dade County through mid-Palm Beach County, southeast Florida reefs are typically comprised of three separate, parallel, and sequentially deeper hardground communities. The First Reef is 10 ft - 20 ft deep and ranges from 100 ft to 2,000 ft from shore. The Second Reef is 10 ft - 55 ft deep and 3,000 ft to 6,500 ft offshore. The Third Reef is 45 ft- 90 ft deep and roughly 8,000 ft or more offshore. Extensive sand deposits are present between the second and third reefs (General Design Memorandum J.U.Lloyd Beach Renourishment, 1987).

3.1.1. Sites

3.1.1.1. Transects and Quadrats

Fifteen Broward County reef sites were selected for detailed biological monitoring of the stony coral community. Figure 3.1 Map of site locations. shows monitoring sites off the beach fill area and sites near the borrow area. Six (6) previously existing study sites offshore of John U. Lloyd Park were chosen as control sites (JUL5 & JUL6 - First Reef, JUL7 & JUL10 - Second Reef, and JUL8 & JUL9 - Third Reef). Three sites were established on the First Reef adjacent to the Construction Beach (sites HH1, HH2, and HH3). Three sites were chosen on the Second Reef adjacent to and west of the primary and secondary borrow areas (JUL1, HH4, and HH5). JUL1 was also a prior J.U. Lloyd assessment site. Three sites were chosen on the Third Reef adjacent to and east of the primary and secondary borrow areas (JUL2, HH6, and HH7). JUL2 was a prior J.U. Lloyd assessment site. Station depths at each reef were approximately as follows: First Reef 10-20 ft; Second Reef 30-50 ft; Third Reef 45-75 ft.

3.1.1.2. Cores

Stations were selected for monitoring the effects of dredging and beach renourishment on infaunal communities inhabiting unconsolidated substrates (Figure 3.1 Map of site locations.). Each station consisted of 15 replicate core samples. Eight stations were chosen approximately 300 ft seaward of the current shoreline in depths of about 8 ft. Four of these span the fill site at approximately 5000-ft intervals just beyond the anticipated "toe-of-fill" at the beach discharge offshore of state plane coordinate benchmarks R106 (Sheridan Street), T111 (north of Johnson Street), R116 (Hollywood Blvd.), and R120. Four control stations were located at a similar depth and distance offshore of state plane coordinate benchmarks spanning the northern half of John U. Lloyd State Recreation Area (T88, R90, R92, R94).

Two stations were chosen in the vicinity of the Borrow Area to monitor the direct effects of dredging on these infaunal communities. Station HHBA was located near the center of the

northern Borrow Area. The pre-dredging depth was approximately 60 ft. Station HHBAC (Borrow Area Control) was located about 1 mile due north of the northern borrow area on an unconsolidated substrate between the Second and Third Reefs in approximately 60 ft depth. At these two stations, the 15 replicate cores were taken as five sets of three cores each with each set collected approximately 60 ft apart. All sampling methods and locations were in accordance with permit requirements.

3.1.1.3. Sediments

Two sediment samples were taken at each infaunal core site by SCUBA divers using hand-driven core samplers. Sediment samples were collected and analyzed by the staff of Broward County Department of Natural Resources Protection, Marine Resource Section.

3.1.2. Field Methods

3.1.2.1. Belt Quadrat Transects

Following an initial cross-section survey of each site with a recording fathometer, a 2 x 2 m, weighted, PVC frame was deployed over the side of the survey vessel at the crest of the reef in the survey area. Broward County SCUBA divers drove metal stakes (rebar) into the reef to define 2 x 2 m quadrats and 20 m transects along the reef surface. One corner stake of the 2 x 2 m quadrat was used as the start stake of each transect. Another stake was placed at 10 m and a final stake at 20 m. Transects were oriented in an approximate north-south direction by securing a tape measure, graduated in centimeters (cm), between the 10 m interval metal stakes. Each reef site transect was assessed using a 0.75 m^2 quadrat sequentially along first one side and then the opposing side of the 20 m transect line. Consequently, a total area of 30 m was inspected. The stony corals within each frame were identified to species and sized (either approximate diameter for hemispherical or length and width for subrectangular colonies). Corals with diameters less than 1 cm were not surveyed. The species *Siderastrea siderea* and *Siderastrea radians* were grouped as *Siderastrea* spp. because of difficulties with precise field identification. The hydrozoan *Millepora alcicornis* also was included in the assessment. Corals, if bleached, were so noted.

Shannon-Weaver Diversity Indices for stony corals (including *Millepora alcicornis*) were calculated for each transect. Two indices were calculated, one based on numerical abundance, H'N, and one based on coverage abundance, H'C. The calculation procedure for H' is provided in section.3.1.2.3.

3.1.2.2. Quadrats

At each of the fifteen quadrat stations, four metal stakes, previously installed by hand, defined the corners of the 2 x 2 m quadrat. Initial examination by SCUBA divers indicated if any stakes were dislocated or lost. Following replacement of stakes where necessary, SCUBA divers tied a length of yellow polypropylene line around the stakes to define the quadrat perimeter. Macroepibenthic organisms were identified and counted *in situ*. When specific identifications could not be made, samples of the same organisms from outside the quadrat were collected,

transferred to plastic bags, preserved in 70% ethanol or fixed in 10% borate-buffered formalin, and transported to the laboratory for subsequent identification. Color photographs were taken of each quadrat, using a tripod mounted Nikonos V camera with 28 mm or 20 mm lens. Photographs were used for reference only, not quantitative data extraction.

Some taxa of algae, sponges, encrusting alcyonarians, and zoanthideans, were difficult to enumerate because, in many cases, it was not clear whether a single colony or cluster of separate colonies was present. Similarly, it sometimes was difficult to assess if loose associates of ascidians represented colonies or isolated zooids. In these cases, the level of abundance was noted as numerous with the symbol N. Quadrat stations in which the encrusting gorgonian *Briareum asbestinum* was found posed similar quantitative problems associated with distinguishing discrete colonies. Therefore this species was counted as one colony when it occurred in a quadrat regardless of size. The N designation also was used when it was evident that *Briareum* was the dominant gorgonian (i.e., the number of apparent colonies >20). The number of separate colonies was estimated and is designated by a "+" symbol to indicate "no less than" the indicated number of colonies. The same convention was used at HH1 where the encrusting chicken liver sponge, *Chondrosia reniformis,* occurred.

The major taxonomic groups of organisms identified were as follows: Porifera, Cnidaria (Alcyonaria, Scleractinia, Zoanthidea), and algae (Chlorophyta, Rhodophyta, and Phaeophyta). Minor components included Ascidiacea, Hydrozoa, and Polychaeta.

3.2. Laboratory Assessment Methods

3.2.1. Statistical Analysis: Transect and Quadrat data

Data for each station and each assessment period were entered onto a computer spreadsheet program and tabulated in various ways. For certain parameters and in order to formally compare treatment sites with dredging sites over time, repeated measures Analysis of Variance (ANOVA) was employed to test for differences among treatments (dredging versus control), among times (each of the assessment periods), and the interaction of treatments with time. Because replication for each reef was small, this grouping was not included in the ANOVA. Two kinds of data were utilized for statistical testing: actual and normalized. Actual data consisted of the parameter values for each station and each time period. Normalized data for each station was calculated by dividing each Post-construction value by the Pre-construction value. This procedure expressed all Post-construction values as a percentage of the Pre-construction and therefore removed pre-existing differences among stations. Repeated measures ANOVA utilized the Pre-construction period and the three Post-construction periods for the regular data. For the normalized data, repeated measures ANOVA utilized only the three Post-construction periods.

3.2.2. Cores

Unconsolidated sediment samples were collected by divers with a hand-held coring apparatus. Each sediment sample was transferred underwater to a plastic bag and fixed on ship with 10% borate-buffered formalin solution containing Rose Bengal.

At the laboratory, each core sample was washed separately with sea water through a 0.5 mm mesh Nalgene screen. Organisms and sediment retained on the screen were decanted into a 70% ethanol solution and stored in glass jars for sorting.

Organisms were sorted initially to phylum or general morphological form (e.g., Mollusca, Crustacea, "worm", "other") and subsequently to lowest recognizably distinct taxa. Only organisms apparently alive at the time of collection were counted (i.e., dead bryozoan colonies and mollusk shells were not considered). Specimen identifications were undertaken by Nova Southeastern University staff and various taxonomic specialists recognized as authorities for the specific taxa they were asked to identify (Appendix Table 8.3.1).

Shannon-Weaver Diversity Indices were calculated for each core site 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 ($p_1 = p_2 = p_3...$), 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') also has been calculated for each core site at each period using the equation:

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

As a ratio between the Diversity Index (H') for a given station and the maximum possible diversity index (H'.) for the number of species and specimens at that station, Evenness (J') gives an indication of how close the data come to maximum possible diversity.

3.2.3. Sediments

Grain Size Analysis: Samples were washed once in tap water and allowed to settle for 24-48 hr. The colloidal suspension was siphoned off, and the remaining sediment was dried at 100°C. Samples then were split in a standard Humboldt splitter until representative samples of 30-70 g were obtained. Each representative sample then was shaken in a standard sieve series for 15 min. Each fraction was weighed to the nearest 10 mg and average grain sizes for each core were determined by the moment method (Folk, 1966). The average value for each site was the mean of the values of the two samples taken at each site.

Organic Content Analysis: Two sediment samples per infaunal core site were heated at 500°C for 10 min. before and after weighing to the nearest mg. The percentage of organic matter in the sample was calculated by dividing the difference in weight before and after heating by the weight before heating and multiplying by 100. The average value for the site was the mean of the two samples taken at each site.

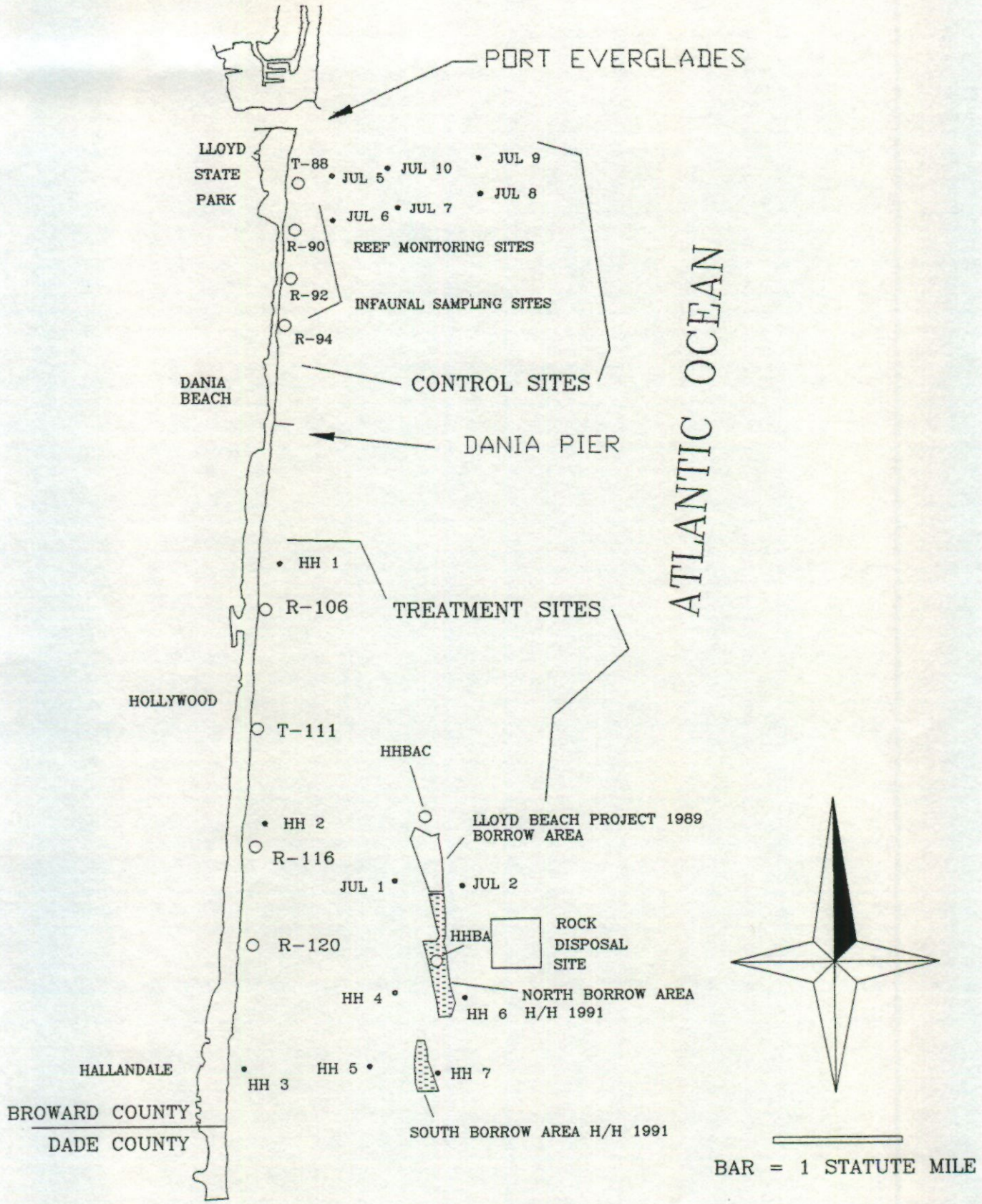

Figure 3.1Map of site locations.

4. RESULTS

4.1. Transect Results

4.1.1. General Pre-construction Reef Ecology

A bottom area of 30 m^2 was assessed at each reef site. Appendix Figure 7.1, Figure 7.2, Figure 7.3, Figure 7.4, and Figure 7.5 show the species-area curves calculated from the 15 Pre-construction belt-quadrat transects at each site in the Pre-construction assessment. These curves plot the cumulative number of coral species encountered versus the cumulative number of square meters of reef sampled. When the curve showed pronounced leveling, a sufficient area of reef had been assessed to obtain a representative sample. The fifteen curves were grouped by a set of First, Second, and Third Reefs within a Control or Dredging designation. The curves of each site showed pronounced leveling by approximately 20 m, confirming that the 30 m^2 area was sufficient for assessment.

Appendix Figure 7.6, Figure 7.7, Figure 7.8, Figure 7.9, Figure 7.10, and Figure 7.11 depict population parameters versus depth of each individual station for the Pre-construction data. Data points are identified with a station abbreviation. Coral coverage was generally positively correlated with increasing station depth, although some deeper stations had low coverage (*e.g.*, HH6). Coral density was more variable with depth, showing no clear pattern. There was a general trend of increasing Diversity (H'C, H'N) and increasing Evenness ($H'C/H_{max}$, $H'N/H_{max}$) with depth, although variability was high.

Appendix Figure 7.12, Figure 7.13, Figure 7.14, Figure 7.15, Figure 7.16, and Figure 7.17 show the means of Pre-construction parameters over the five stations on each reef. Variability among the means was very high as indicated by the long error bars (+/- 1 standard deviation). Mean coral cover and mean density were lowest on the First Reef and roughly equal on the Second and Third Reefs. Diversity indices (H'C and H'N) were lowest on the First Reef and roughly equal on the Second and Third Reefs. A similar pattern was evident for Evenness.

4.1.1.1. Comparison Among Assessment Periods

Appendix Table 8.1.2, Table 8.1.3, Table 8.1.4, Table 8.1.5, Table 8.1.6, Table 8.1.7, and Table 8.1.8 provide summary statistics from the belt-quadrats transects describing the coral community for the Pre-construction, the first, second, and third Post-construction assessments. Included are total numbers of corals sampled, percent coral coverage, density, and diversity. Diversity statistics included both the number of species and Shannon-Weaver Diversity Indices (calculated both on coral abundance, H'N, and coral coverage, H'C) as well as Evenness, using the two methods. The averages and standard deviations for stations grouped by control and dredged classification are provided as well.

To visualize the changes of stony coral population parameters between Pre-construction and Post-construction assessments, figures were constructed for the averaged parameters of coverage, density, the diversity indices of H'C and H'N, and species richness. These are presented at the end of this section. From inspection of these figures and data in the tables, it was obvious that there were changes between assessment periods for all parameters. However, it was not immediately obvious that changes were significant, and whether they were treatment related. To

formally address the issue of significant change, Repeated measures ANOVA comparing treatments and times were performed on the data for each of the five parameters. These results are provided in Table 4.1.1 and summarized below.

Stony coral **coverage** (Figure 4.2, Figure 4.2) did not demonstrate through ANOVA any significant differences among treatments or times for both the actual and normalized data. Nevertheless, there was a continuous decline in dredging sites compared to control over the long term and compared to control in 1992 and 1994. This difference was greatest in 1994 when dredging sites fell to 80% of their Pre-construction coverage.

Stony coral **density** (Figure 4.3, Figure 4.4, ANOVA Table 4.1.1) showed significant differences over time for both control and dredge sites, but there was no significant difference between treatments. Results were the same for actual and normalized data. A decline at both dredging and control sites was evident from 1991 to 1994.

Shannon-Weaver **coverage diversity** (H'C) for corals (Figure 4.5, Figure 4.6, ANOVA Table 4.1.1) showed significant time differences without significant treatment effects. This was true for both the actual and normalized data. Dredging site values declined from 1990 to 1994.

Stony coral Shannon-Weaver **abundance diversity** (H'N) (Figure 4.7, Figure 4.8, ANOVA Table 4.1.1) showed no significant differences with respect to treatment or time for both actual and normalized data. Normalized data of dredging sites were depressed relative to control sites for 1991 and 1992, but rebounded in 1994.

Species richness of stony corals (Figure 4.9, Figure 4.10, ANOVA Table 4.1.1) showed no significant differences over time or between treatments for actual and normalized data. Control values steadily rose throughout the study. Dredging site values declined for the first two periods following dredging and then rebounded in 1994.

In summary, the statistical tests employed did not detect significant differences that appeared related to treatment (dredging - control) over time (Pre-construction, first, second, third Post-construction). While this "lack of detection" does not mean that adverse effects did not occur, it does suggest that effects, if any, were below the sensitivity limits of this type of analysis.

There are many factors which contribute to the power of the analysis or the ability to detect significant differences. These include site location (closeness to the treatment), the number of replicates, pre-existing site differences, and natural environmental variability or events (*e.g.*, hurricanes and storms) which may produce confounding effects. It should be noted that on August 24, 1992 the eye of Hurricane Andrew passed some 30 miles to the south of the project area. High winds and heavy seas affected Broward County reefs. In October, 1993, Broward County reefs were again subject to high winds and heavy seas of the so-called "Storm of the Century". For example, Blair *et al.* (1994) found significant decreases in the coverage of Dade County, Florida algal communities, soft corals, and hard corals following Hurricane Andrew in 1992. The effects of the "Storm of the Century" are unassessed or quantified.

The data of this study do suggest a general decline in some of the parameters (coral coverage, density, and H'C diversity) over the period of this study, which appears more pronounced for the dredging sites. This is consistent with an environment under stress. Continued monitoring should be a priority.

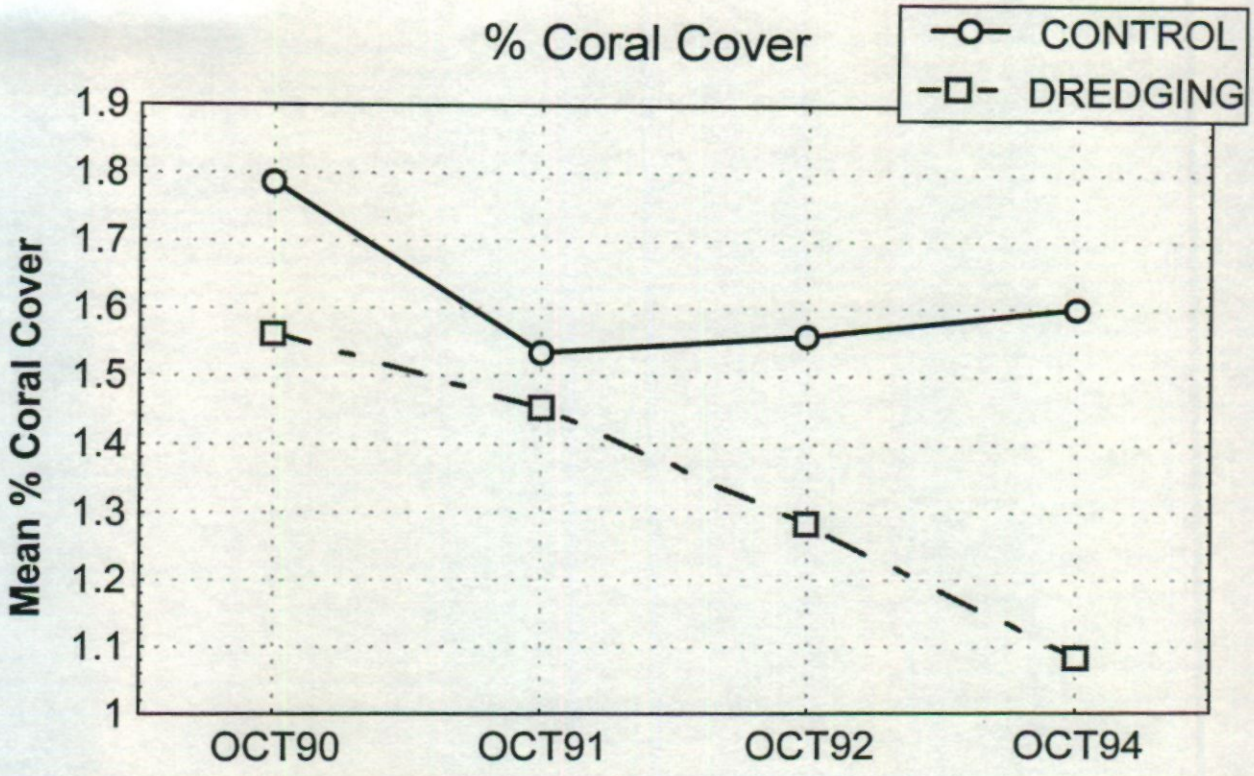

Figure 4.1 Mean % coral cover among treatments over time.

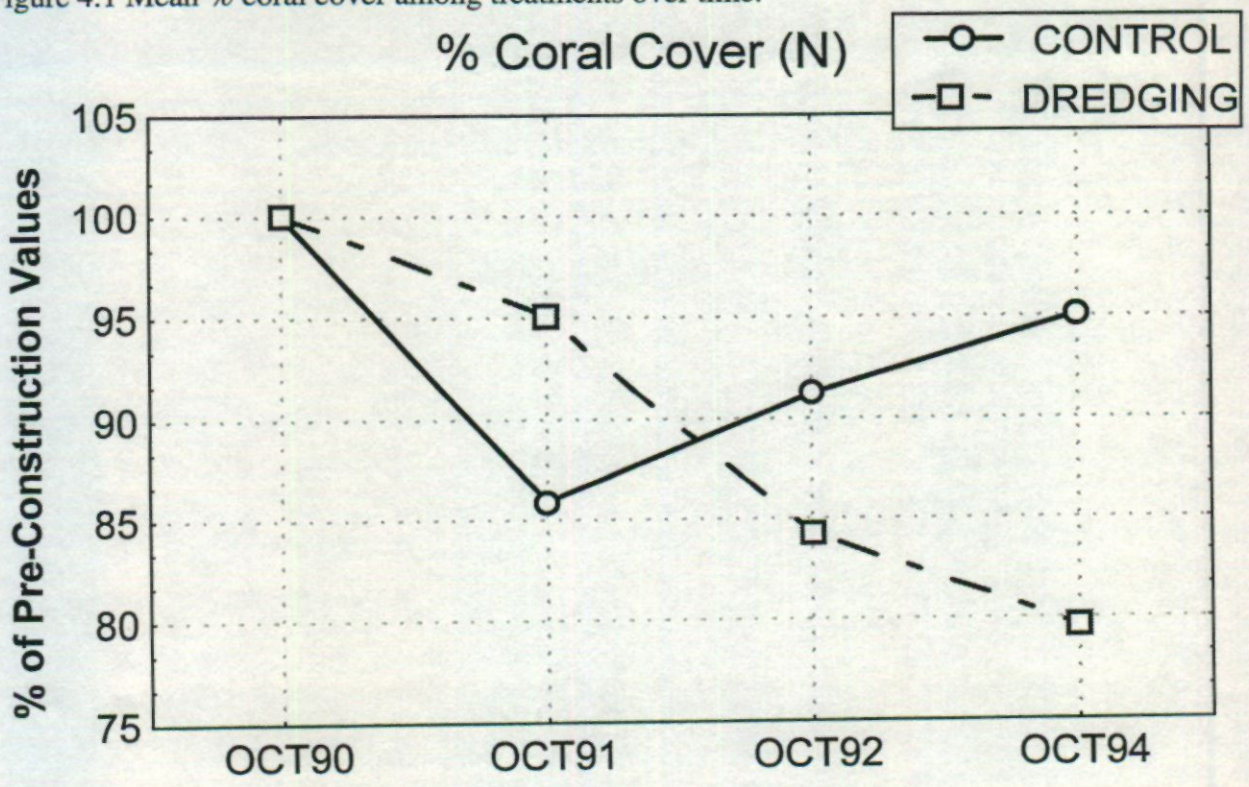

Figure 4.2 Mean % coral cover (normalized to Pre-construction values)

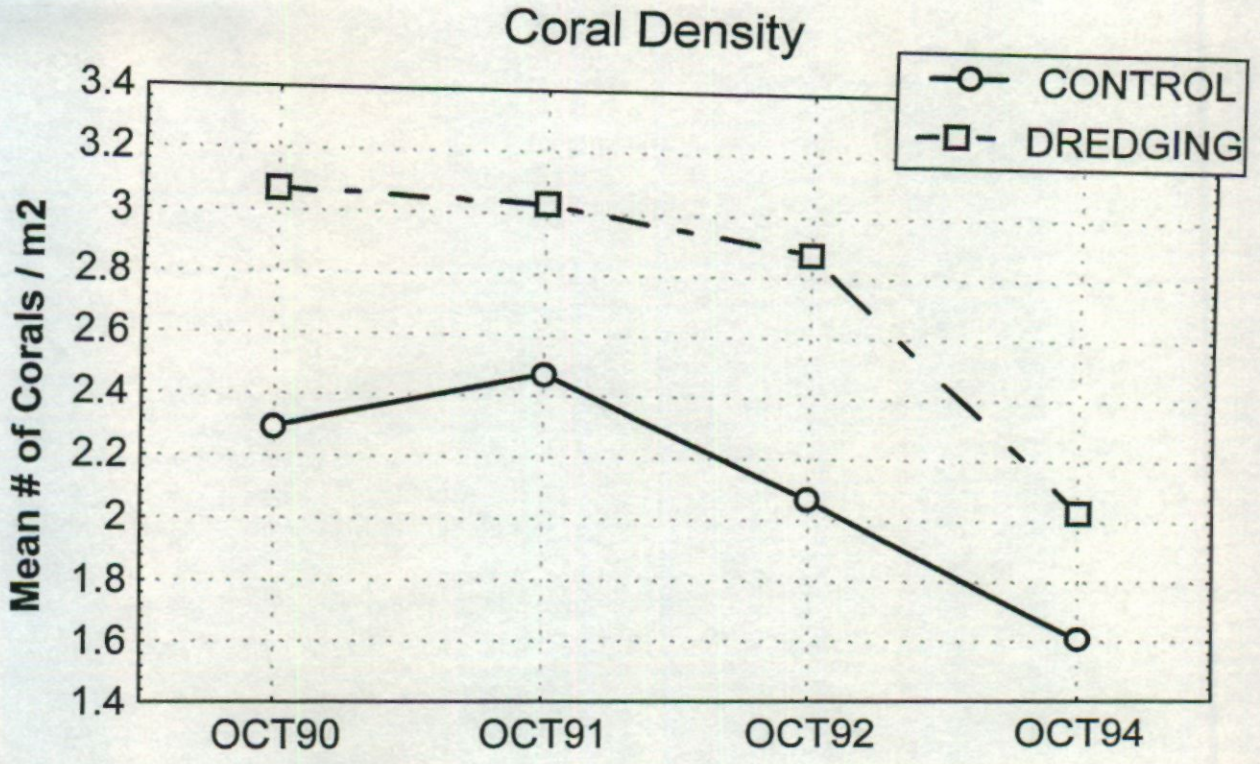

Figure 4.3 Mean # corals / m2 among treatments over time.

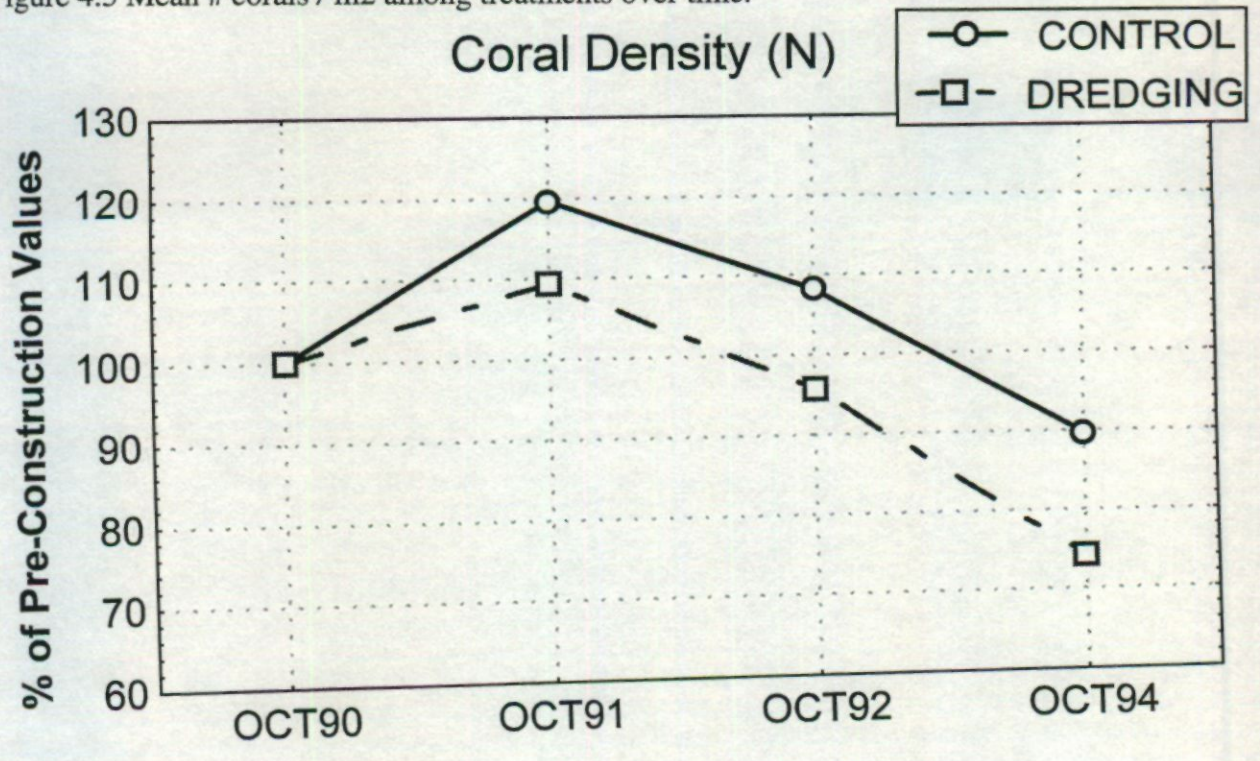

Figure 4.4 Mean # corals / m2 (normalized to Pre-construction values)

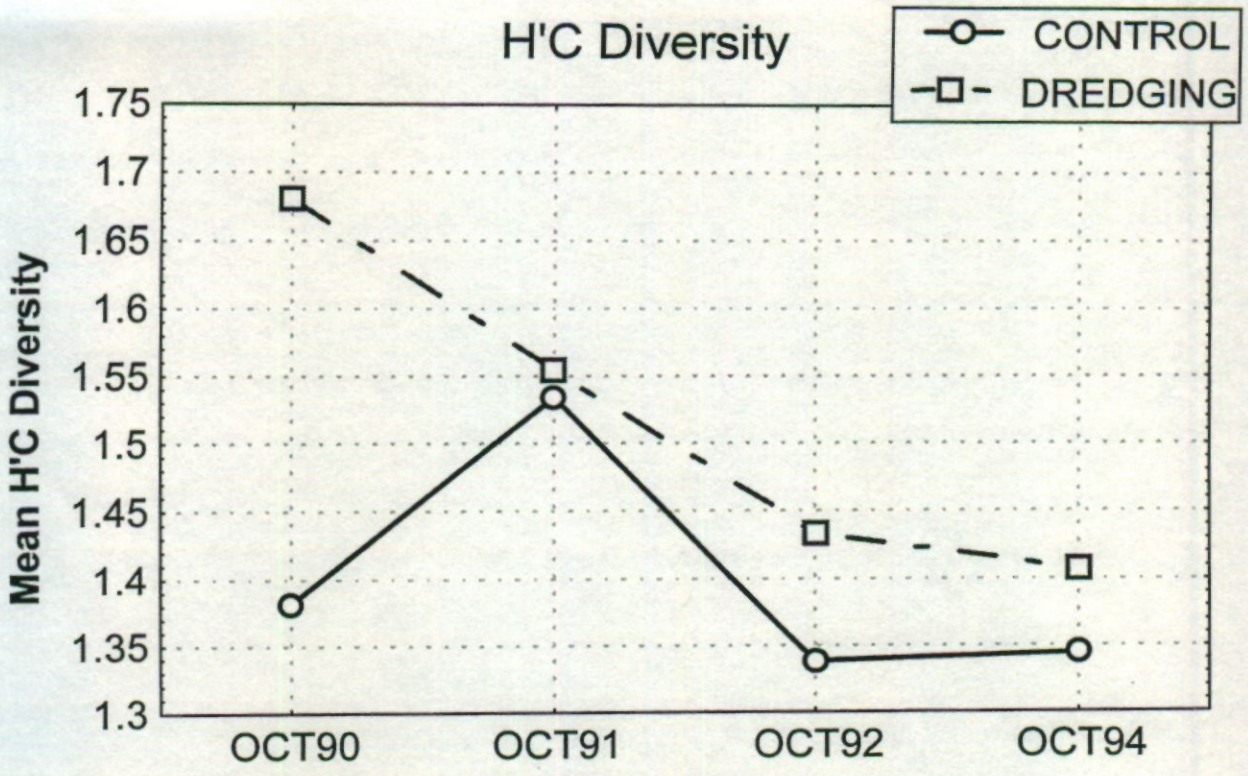

Figure 4.5 Mean H'C Diversity among treatments over times.

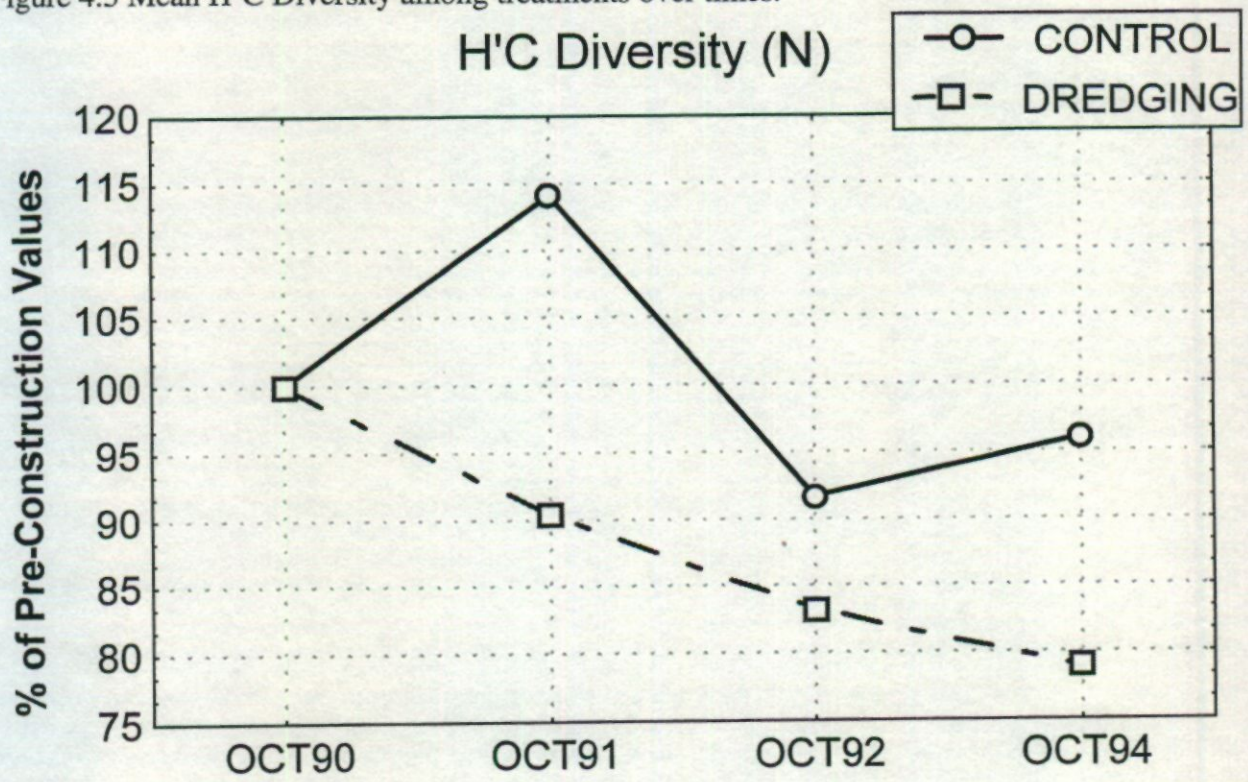

Figure 4.6 Mean H'C Diversity (normalized to Pre-construction values).

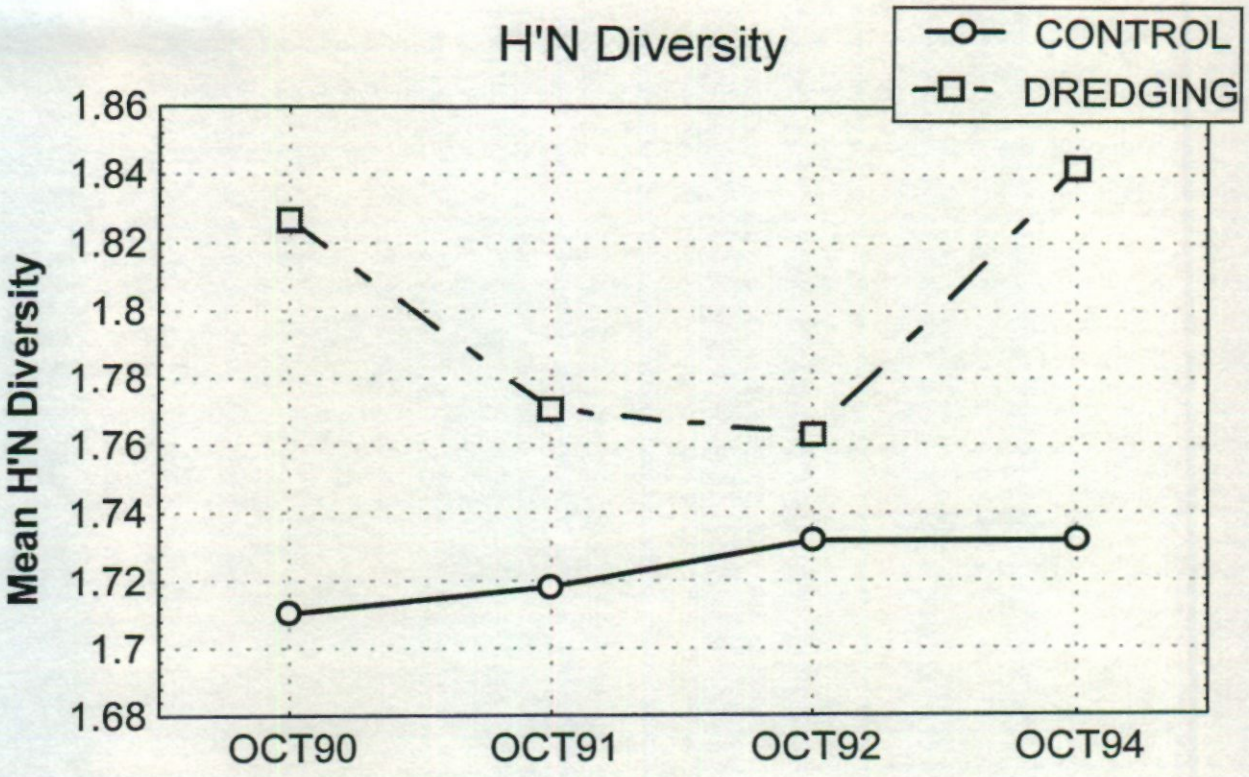

Figure 4.7 H'N Diversity among treatments over time.

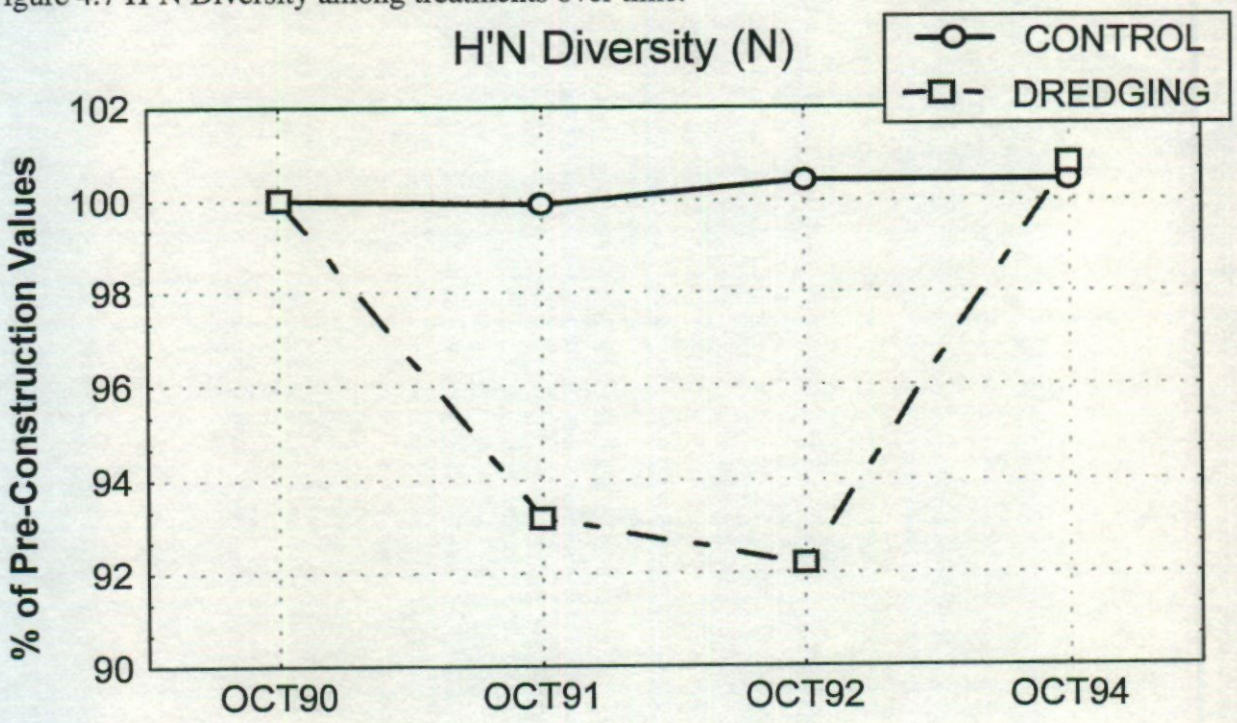

Figure 4.8 H'N Diversity (normalized to Pre-construction values).

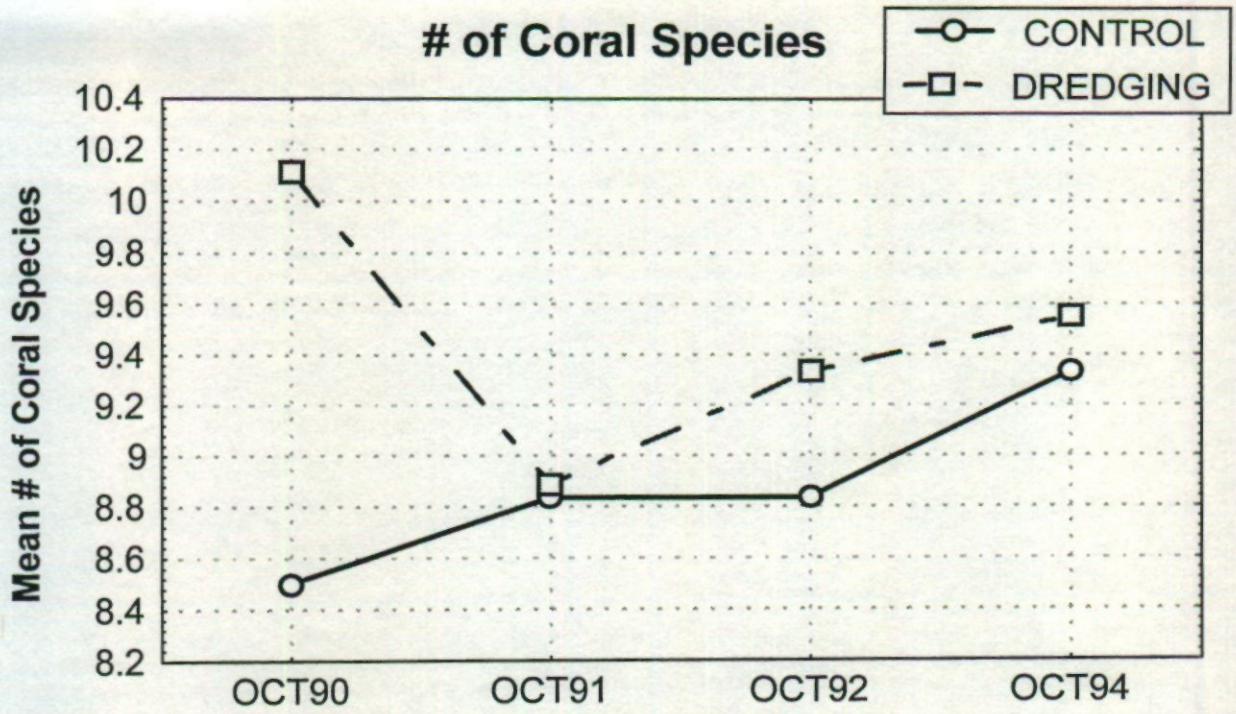

Figure 4.9 Mean # of coral species among treatments over time.

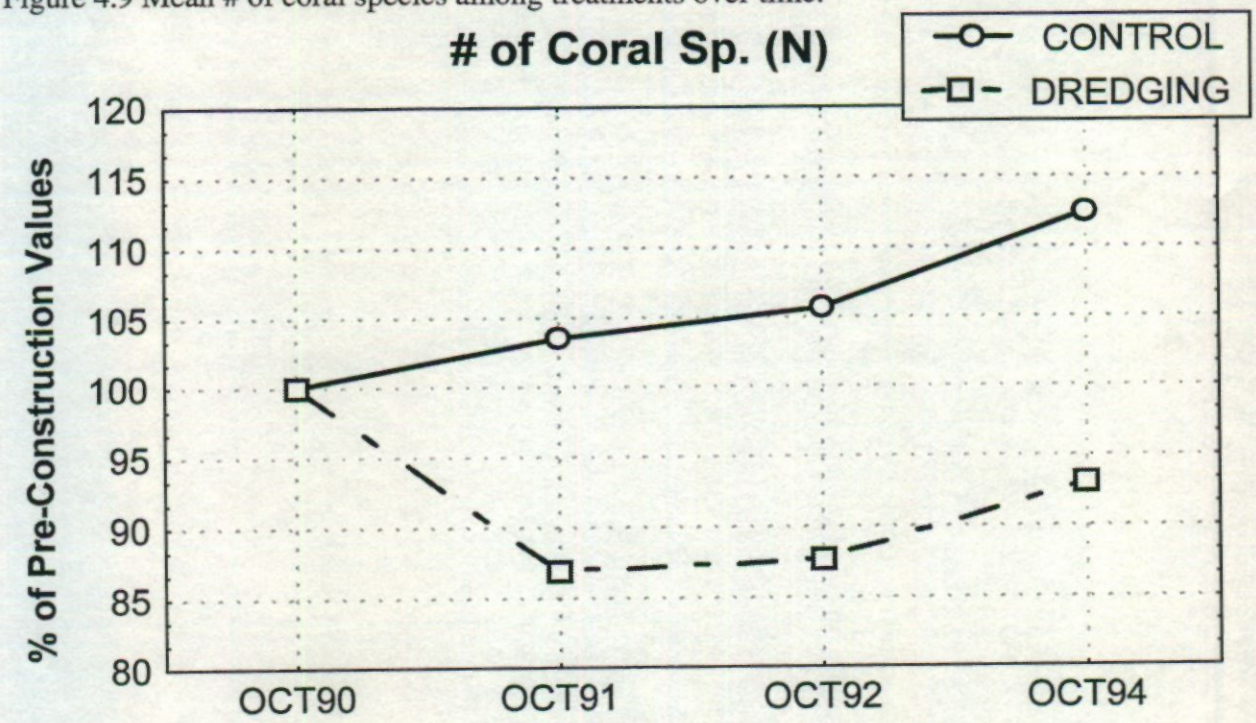

Figure 4.10 Mean # of coral species (normalized to Pre-construction values).

Table 4.1.1 Repeated measures ANOVA results summary for transects.

Treatments = Control & Dredging; Times=Oct90, 91, 92, & 94					
Regular Parameters:	*=p<.05	ns=not significant			
Effect	%Cover	Density	H'C	H'N	# Species
Treatment	ns	ns	ns	ns	ns
Time	ns	*	*	ns	ns
Treatment x Time	ns	ns	ns	ns	ns
Treatments = Control & Dredging; Times=Oct91, 92, & 94					
Normalized Parameters:	*=p,.05	ns=not significant			
Effect	%Cover	Density	H'C	H'N	# Species
Treatment	ns	ns	ns	ns	ns
Time	ns	*	*	ns	ns
Treatment x Time	ns	ns	ns	ns	ns

4.2. Quadrat Results

A total of 60 m^2 of benthic habitat was analyzed for this study during each of four study events. Each site was a 2 x 2 meter area unevenly distributed between dredge sites (36 m^2) and control sites (24 m^2). Appendix Table 8.2.2 shows the average number of sponges, gorgonians, and scleractinian corals recorded at each site for dredging and control areas.

It is apparent from these data that there was high variability among sites within assessment periods as well as over time between assessment periods. Figures 3-11 to 3-16 depict mean numbers of sponges, gorgonians, and scleractinians at each site, grouped by treatment (dredging or control) for each assessment period. Table 4.2.2 presents summary results of repeated measures ANOVA, which tested differences among treatments (dredging and control) and times (Pre-construction, first, second, and third Post-construction) for both regular and normalized data. For sponges abundance (see Figure 4.11 and Figure 4.12) ANOVA showed a significant time effect for both regular and normalized data. Both dredging and control stations appeared to be varying in concert. For gorgonians abundance (see Figure 4.13 and Figure 4.14), there were significant time differences in both regular and normalized data. The normalized data also showed a significant treatment effect. This was due to the relatively greater difference of dredging versus control means in the Post-construction periods. For Scleractinians, (see Figure 4.15 and Figure 4.16) there were no significant differences between treatments or times.

Appendix Table 8.2.3 provides a species list for all sites from 1990 to 1994. Hard bottom in the vicinity of the restored beach and control areas were dominated by sponges. The cumulative number of sponge species found during the four years of quadrat analysis was 36. A total of 33 of these 36 species were identified from the 60m^2 of hard bottom examined by quadrat analysis in 1994 (see Figure 4.11 and Figure 4.12). The most abundant and widespread species were *Haliclona compressa*, *Niphates erecta,* and *Iotrochota birotulata* with 39, 35 and 31 individuals, respectively. The purple rope sponge *Aplysina cauliformis* was locally abundant, as was the yellow ball sponge, *Cinachyra alloclada*. At all sites, 407 sponges were found in the final year of this study (1994), compared to the 481 sponges initially. This constituted a 15% loss of population during the five year period. However, if dredge sites are compared to control sites

from 1990 to 1994 (Table 4.2.1), the losses were proportionately greater for control sites (-23.0%) than for dredge sites (-12.3%).

There were clear changes in a number of taxonomic categories. A number of sponge species appeared to have suffered population declines between 1991 and 1992. These included *Aplysina cauliformis*, *Dasychalina cyathina, Iotrochota birotulata, Desmapsamma anchorata, Dysidea etheria* and *Ulosa reutzleri*. The latter two species experienced large population decreases of 23 to 2 individuals and 53 to 6 individuals, respectively. Conversely, in 1991 populations of *Ulosa reutzleri* more than tripled and occurred at many more stations.

In 1994 the decline was not as dramatic in terms of individual species. At individual stations where sponges declined (JUL1, 5, 6, 8 and HH1, 2 and 3) it was more often the result of several species losing individuals rather than a large decline in a single species. Nonetheless, at HH1 the yellow ball sponge, *Cinachyra alloclada,* declined from 77 to 46 from 1990 to 1994. Similarly, at HH2 this species declined from 15 individuals to 0 and from 62 to 45 at HH3 during the same period of time. The chicken liver sponge, *Chondrosia reniformis,* decreased from "numerous" (>20) individuals in 1990 to only 6 in 1994. Conversely, populations of *Aplysina cauliformis* increased from 814 at HH5 and from 0 to 8 at JUL8.

Twenty- two species of gorgonians occurred in the quadrats (see Figure 4.13 and Figure 4.14). In 1994, all but one species were recorded. As in previous years, the most widespread and abundant species were *Briareum asbestinum*, *Plexaura flexuosa*, and *Eunicea fusca*. *Eunicea succinea* was the dominant species at shallower stations. A total of 219 gorgonian colonies were counted at all sites in 1994 compared with 331 colonies in 1990, 290 in 1991 and 281 in 1992 (Table 4.2.1). This steady decline represents a population decrease of 34% since 1990. A 23.9% decline was noted in the control gorgonian population from 1990 to 1994, while a 36.5% decline was noted at the dredge sites. The dredge site population loss of 95 individual colonies occurred in two main phases. The first loss (41 individuals) occurred during the year of the dredging project (1990-1991). The second loss (47 individuals) occurred from 1992-1994. An additional 7 colonies were lost between 1991 and 1992.

Of the gorgonian taxa, three species exhibited population declines from 1991 to 1992: including *Eunicea palmeri* (3 stations to 1 and 16 to 2 colonies), *Muricea muricata* (6 stations to 4 and 51 to 34 colonies) and *Plexaura flexuosa* (no change in number of stations, but a decline from 46 to 27 colonies). In 1994, population decline among the gorgonians continued, particularly in the *Muricea muricata* population, a dominant in shallow water. This species was represented by only 17 colonies at 4 stations in 1994, declining >73% from the original 64 colonies at 6 stations in 1990, 51 colonies at 6 stations in 1991, and 51 at 4 stations in 1992. Another shallow water species, *Pseudopterogorgia americana,* declined from 16 colonies among 7 stations in 1992 to 7 colonies at 5 stations in 1994.

The shallow-water stations (<20 ft) appeared to bear the brunt of the losses. At JUL1 *Pseudopterogorgia americana* declined from 8 colonies in 1990 to 2 in 1994. At JUL2, *Briareum asbestinum* declined from >20 in 1990 and 1991 to 8 in 1992, and 4 in 1994. Similarly, *Eunicea fusca* declined from 9 in 1990 to 4 or 5, thereafter. However, at JUL5, a control site, the situation was similar. *B. asbestinum* declined from >20 in 1990 and 1991, to 6 in 1992 and 1 in 1994. *Eunicea succinea* numbered 5-7 colonies from 1990 to 1992, but fell to 1 colony in 1994. Similar patterns were seen among the same species at control sites JUL7, JUL8. *B. asbestinum* alone declined at JUL9 and JUL10. Among the HH stations (all dredging sites), the gorgonian population at HH 1 declined from 77 to 46 colonies; at HH2, the decline was from 52 to 37

colonies, and at HH3 from 64 to 24 colonies. Not all of these decreases can be attributed to the same cause. Changes in populations of *B. asbestinum*, for example, cannot be considered significant since colonies of this encrusting species fuse and separate over time, and appear to fluctuate for other reasons not clearly understood. Annual fluctuations between N colonies and 1 or 0 were characteristic of most stations. At HH2, on the other hand, the gorgonian *Eunicea succinea* was stable until 1992 and 1994 when a decrease from 35 to 20 colonies was noted, possibly as a result of storm damage. The clearest evidence of dredge-related damage was noted on station HH2 where, in 1991, colonies of *Muricea muricata* decreased from 51 to 34. Also, many gorgonian colonies were noted laden with sediment, but without tissue. The characteristic *M. muricata* skeleton was still recognizable under the sediment. Some of the remaining 34 colonies were partly rather than completely dead, but still retained evidence of sediment damage. Only 24 colonies remained after the 1992 post-hurricane assessment, and of these, only 10 remained alive in 1994.

Nineteen scleractinian species were documented in the quadrats cumulatively. The most abundant species in 1992 were as in previous years: *Siderastrea siderea,* followed by *Montastrea cavernosa*, *Stephanocoenia michelini,* and *Dichocoenia stokesi,* in that order. In 1994, the dominants were *M. cavernosa, D. stokesi, S. siderea,* and *S. michelini* in that order. However, only 12 of 19 species were found in 1994. The total coral population displayed an increase from 135 colonies in 1990 to 140 in 1991, and 159 in 1992. In 1994, only 101 colonies were counted, a decrease of 25% from 1990, or a loss of 57% from the previous survey. An examination of the dredge versus control sites shows a similar pattern of increasing number of coral colonies from 1990 to 1992, then declining in 1994. Overall, the dredge sites lost a greater proportion of colonies, (-31.6%) compared to control sites (-16.1%) (Figure 4.9 and Figure 4.10). An examination of the station-by-station pattern revealed small (3 cm) colonies of *Siderastera siderea* were numerous at many stations during 1990 and 1991, indicating a substantial recruitment had occurred the previous year. In particular the *S. siderea* populations at HH1 declined from 12 to 10 to 1 and 1 over the four years of study. Similarly, at HH 2 the *S. siderea* population declined from 17 to 12 to 3 to 2 from 1990 to 1994, as they did at JUL7 (10,2,5,2). At HH3, a peak recruitment in 1992 resulted in a population increase, but one that was not sustained (3,4,26 and 2 colonies, respectively). Thus, the star coral *S.siderea* had a dominant influence on the flux of shallow-water scleractinian populations, by having relatively large recruitment populations that failed to survive.

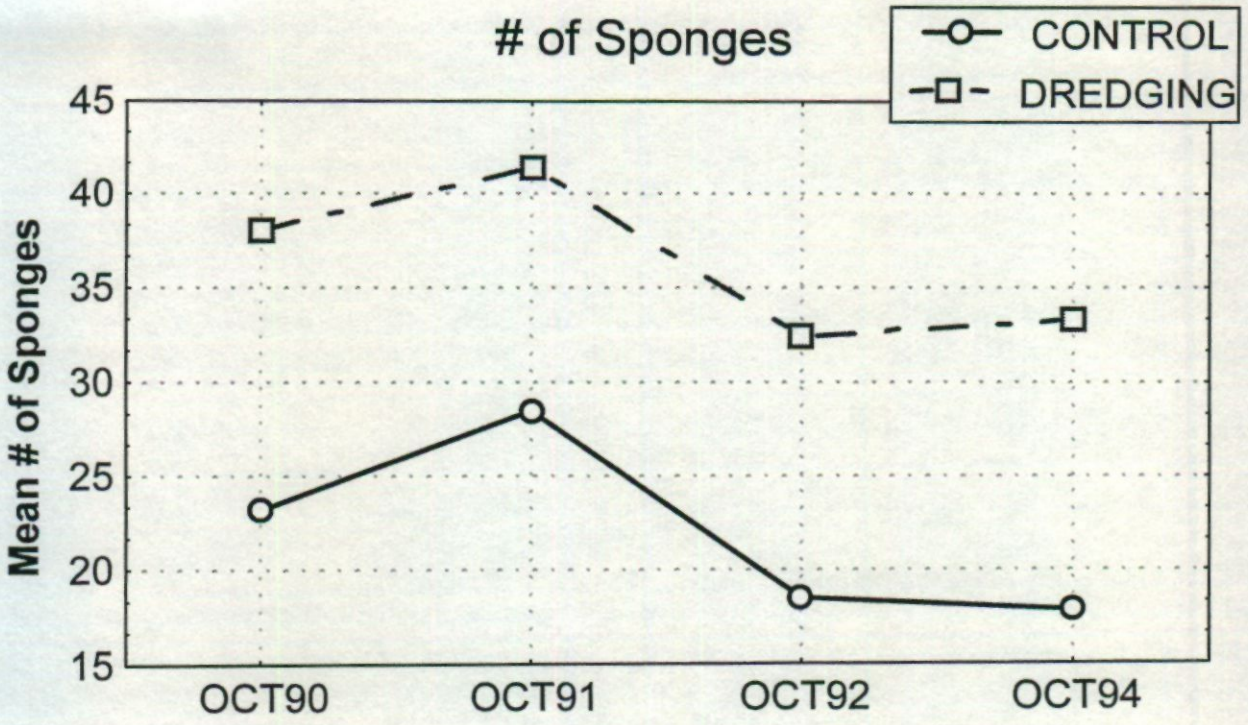

Figure 4.11 Mean # of sponges per site among treatments over time.

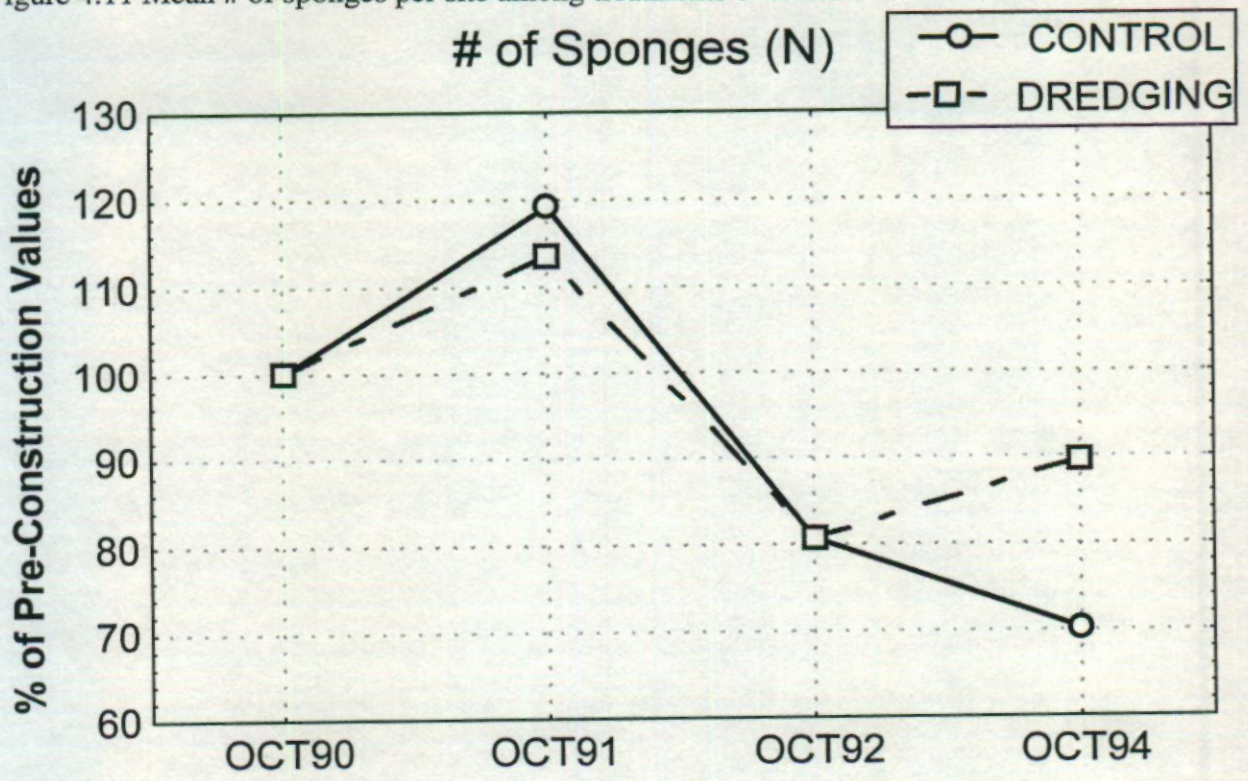

Figure 4.12 Mean # of sponges (normalized to Pre-construction values).

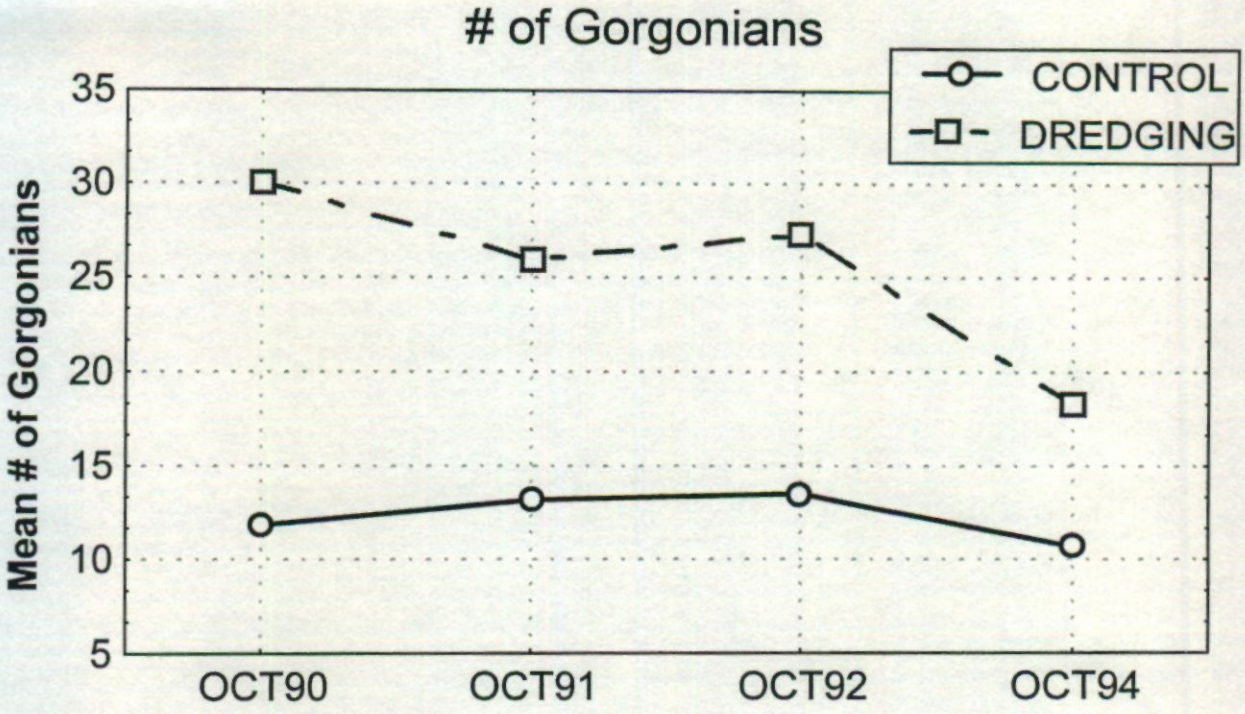

Figure 4.13 Mean # of gorgonians among treatments over time.

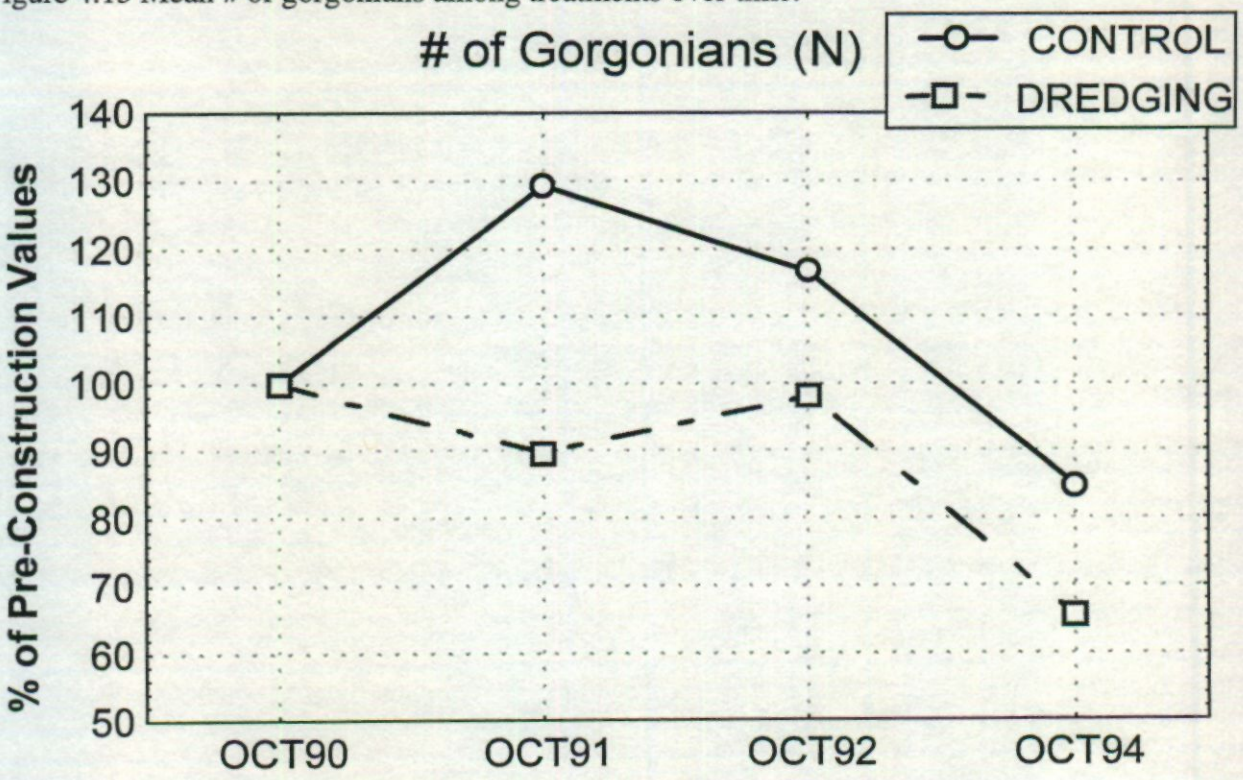

Figure 4.14 Mean # of gorgonians (normalized to Pre-construction values).

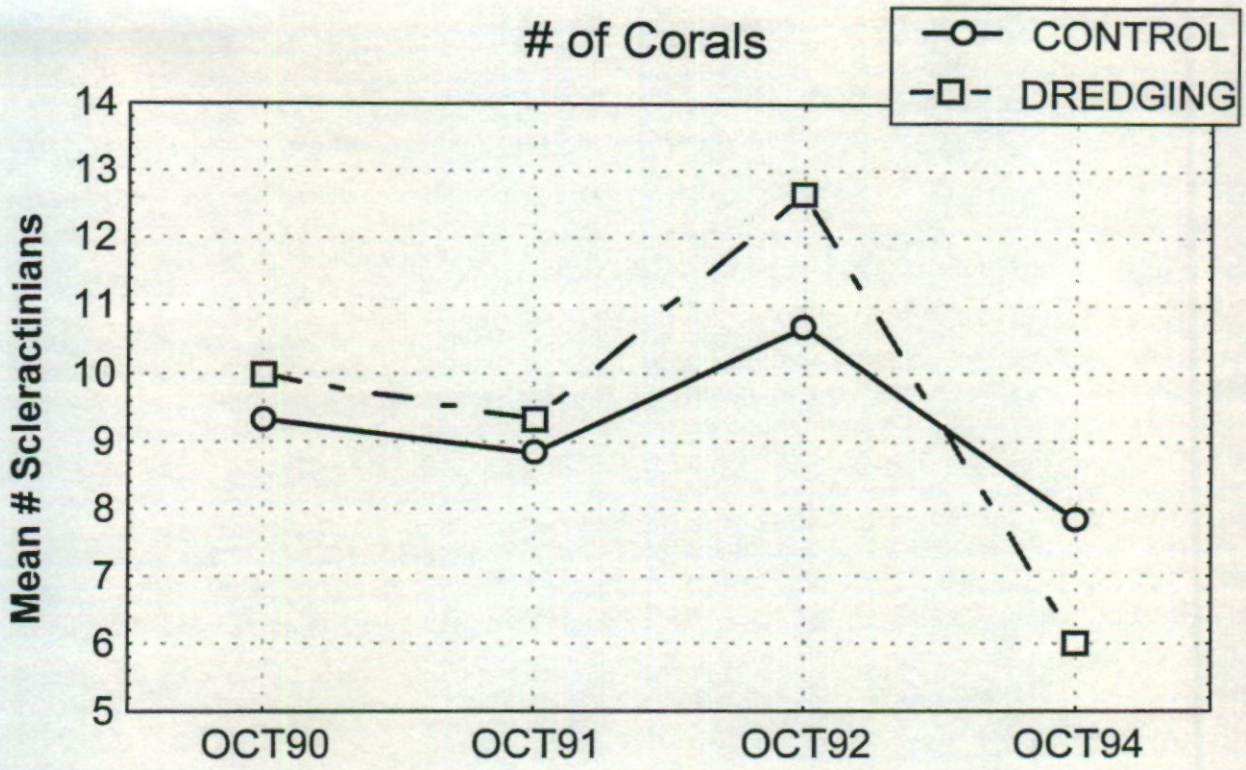

Figure 4.15 Mean # of scleractinians among treatments over time.

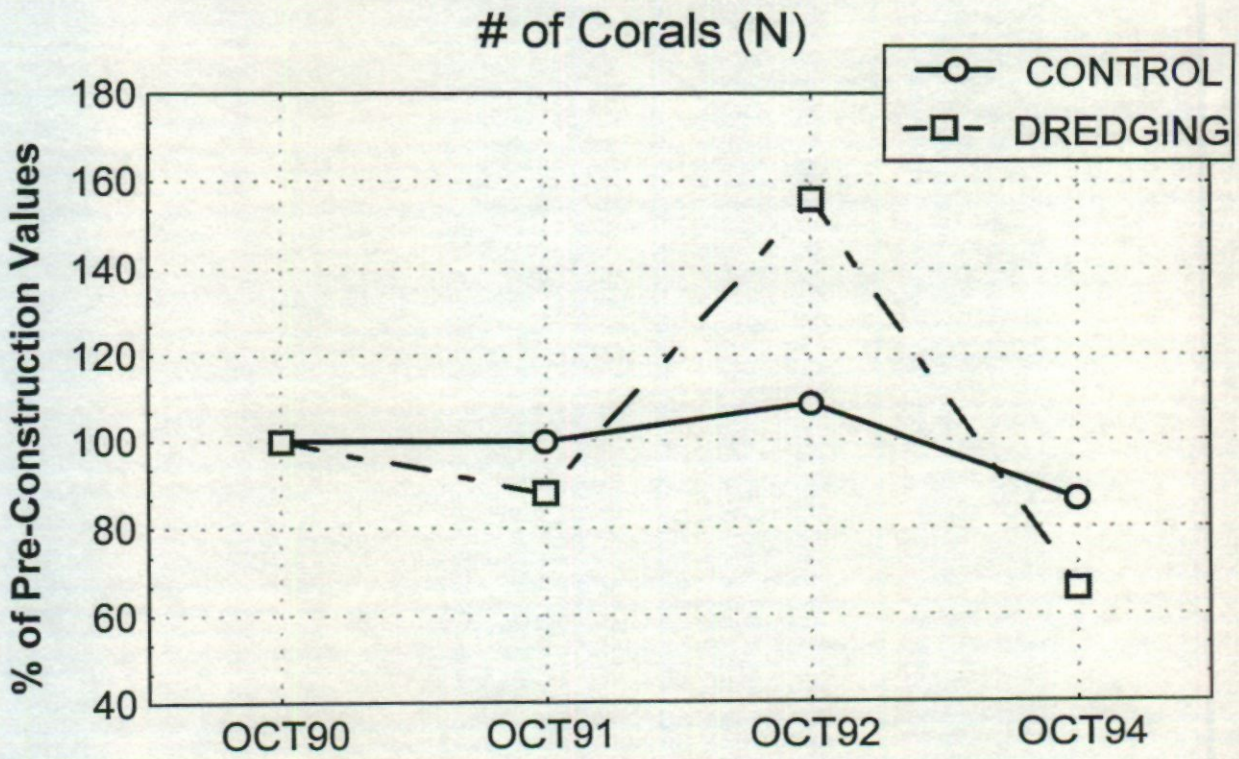

Figure 4.16 Mean # of scleractinians (normalized to Pre-construction values).

Table 4.2.1 Summary of Individuals on Dredge and Control Quadrats

	1990	1991	1992	1994	% Change 1990 to 1994
Dredge Sites					
Sponges	342	373	292	300+	-12.3
Gorgonians	260	219	212	165+	-36.5
Corals	79	86	90	54	-31.6
Control Sites					
Sponges	139	171	111	107	-23.0
Gorgonians	71	71	69	54	-23.9
Corals	56	54	69	47	-16.1

Table 4.2.2 Repeated Measures ANOVA results summary for Quadrats

Treatments = Control & Dredging; Times=Oct90, 91, 92, & 94

Regular Parameters: *=p<.05 ns = not significant

Effect	# Sponges	# Gorgonians	#Scleractinians
Treatment	ns	ns	ns
Time	*	*	ns
Treatment x Time	ns	ns	ns

Treatments = Control & Dredging; Times=Oct91, 92, & 94

Normalized Parameters:*=p<.05 ns = not significant

Effect	# Sponges	# Gorgonians	#Scleractinians
Treatment	ns	*	ns
Time	*	*	ns
Treatment x Time	ns	ns	ns

4.3. Results of Core Samples

Data for core samples are given in appendix tables as follows: Table 8.4.1 identifies and enumerates all taxa collected by station for all four monitoring surveys (1990: Pre-construction; 1991: 90-day Post-construction; 1992: one-year Post-construction, and 1994: three-years Post-construction). Shannon-Weaver diversity indices (H'), species richness and Evenness values (J') are included at the end of each station listing in the table. Table 8.4.2 lists numerical abundances of major taxonomic groups by station for all surveys. Figures 4.17 to 4.26 illustrate numerical abundances (derived from Table 8.4.2) for the ten most abundant major groups. Table 8.4.3 lists percentage abundances of major taxonomic groups by station for all surveys. Table 8.4.4 lists similar percentage abundance data, but omits the primarily meiofaunal nematodes and harpacticoids. Figures 4.27 to 4.32 illustrate percentage abundances (derived from Table 8.4.4) for the six major groups that occur in greatest relative abundances (omitting the contribution of nematodes and harpacticoids). Table 8.4.5 lists raw data by replicate for the most recent 1994

monitoring survey. Finally, Table 8.4.6 ranks the five most common species for each station and survey (omitting nematodes and copepods) with their percentage abundance.

As in previous monitoring reports, diversity and Evenness measurements do not include the following categories of organisms: 1) nematodes and harpacticoid copepods, normally treated as meiofauna, 2) organisms normally treated as members of sessile communities (e.g., most hydroids, bryozoans and sponges), 3) planktonic organisms (e.g., calanoid and cyclopoid copepods and chaetognaths), and 4) specimens (probably fragments) unassignable to any phylum ("unknowns").

4.3.1. Comparison of Major Faunal Groups

In the Pre-construction survey (1990), nematodes dominated the fauna (43.7% of organisms in all samples), followed by polychaetes (24.0%), peracarid crustaceans (amphipods, isopods, cumaceans, tanaidaceans & mysids) (12.9%), bivalves (6.9%) and nemertines (2.6%), with no other group accounting for more than 2% of the fauna (Table 8.4.3). If the macrofauna alone are considered (e.g., omitting the two chiefly meiofaunal groups--nematodes and harpacticoid copepods), polychaetes contributed 43.8%, peracarids 23.6% and bivalves 12.5% (Table 8.4.4).

The first Post-construction survey (1991) exhibited a 30% increase in organisms overall, dominated by an almost five-fold increase in bivalve mollusks (chiefly *Tivela floridana* and *Strigilla mirabilis*), and an increase in nematodes at one station (R90) accounting for almost a quarter of all organisms collected (Table 8.4.2). Thus, nematodes (28.3%) and bivalves (23.5%) dominated, followed by polychaetes (21.8%) and peracarid crustaceans (12.3%). Despite their relative decreases, both polychaetes and peracarid crustaceans increased in absolute numbers, and the former was the dominant faunal component at both offshore sites. Three less abundant groups exhibited both absolute and relative increases: harpacticoid copepods (1.5 to 4.6%), nemertines (2.6 to 3.5%) and turbellarians (0.7 to 1.6%). Oligochaetes and bryozoans declined in numbers and gastropod mollusks disappeared. Among the macrofauna alone, bivalves and polychaetes account for 36.3% and 33.6% of organisms, respectively, while peracarids contributed 18.8%.

In the 1992 survey, a year following dredge and fill operations, the total number of organisms collected declined to about pre-dredging levels. However, if the chiefly meiofaunal nematodes and harpacticoids are omitted, as they are from diversity and Evenness calculations, overall organism abundance increased from the first through the third surveys. Polychaetes (68.3%; chiefly Spionidae) exhibited a major increase in both absolute and relative numbers in 1992 and dominated the fauna; omission of meiofaunal groups boosts their contribution to 76.4%. The nematode peak at station R90 disappeared so that, despite modest increases at several stations, nematodes contributed only 9.3% of the fauna to the 1992 survey. Peracarids (7.8%) continued an overall decline, due largely to decreases at the two offshore sites. Bivalves dropped in absolute and relative numbers by an order of magnitude from 1991 (to 2.6%), and harpacticoid copepods and turbellarians returned to low pre-dredging levels. Only gastropods and bryozoans exhibited increases following immediately post-dredging (1991) declines, but both remained minor components of the fauna.

Three years following construction (1994), nematodes again constituted the largest component of the fauna (33.9%) due to great abundances at two inshore treatment sites (R106 and R116). Polychaetes accounted for 27.6% of the fauna overall, but were the most abundant

faunal component at all remaining sites except a third inshore treatment station (T111) where nematodes were slightly more numerous (Table 8.4.2). Harpacticoid copepods, though only slightly more abundant than in 1992 (2.4% versus 1.3%) occurred almost exclusively at the same two stations at which nematodes dominated (R106 and R116). Apart from these two meiofaunal groups, polychaetes dominated the macrofauna and occurred in almost identical absolute and relative numbers as in the Pre-construction survey (767 versus 788 specimens; 43.8% and 43.3%)(Tables 8.4.2, 8.4.4). Peracarids (chiefly amphipods) and bivalves (chiefly *Tivela floridana*) followed at 21.3% and 18.0%, respectively. Remaining groups each accounted for about 3% or less of the total fauna. Overall abundance decreased from the immediately Post-construction high (1991) through the 1992 survey to a level about 10% lower than in the Pre-construction (1990) survey (Table 8.4.2). However, omitting nematodes and harpacticoids as meiofauna, remaining macrofaunal abundance at all stations combined increased over the first three surveys and then dropped in 1994 to a level slightly higher than in the Pre-construction survey (1990: 1,751 specimens; 1991: 2,801; 1992: 3,021; 1994: 1,820). Overall organism abundance can be extremely misleading, however. The eight inshore and two offshore sites represent distinct habitats characterized by very different faunas. The overall increase in relative abundance of peracarid crustaceans from 1992 to 1994, for example, masked a continued decline of two important groups (isopods and tanaidaceans) at the offshore sites.

4.3.2. Variations within Major Faunal Groups

Substantial changes occurred from survey to survey among the most abundant taxa in each major group; a few suggest movement toward pre-dredging conditions.

Turbellarian flatworms occurred in moderate numbers (>10 specimens) at two control stations in two previous surveys (R94 in 1990 and R90 in 1991). Poor preservation of these delicate organisms precluded detailed identification in either case and it is not clear how many taxa were represented. In the 1994 survey, however, two inshore treatment sites (R106, R116) recorded twice as many taxa (8) as found at any station in any previous survey. As a group, turbellarians showed no distributional trends relative either to survey or to control versus treatment areas.

Among nemertine worms, *Cephalothrix* sp. 114 increased in numbers from 1990 to 1991 at all inshore control sites and declined in 1992. In 1994, it disappeared from all inshore treatment sites, but remained in generally smaller numbers at three of four inshore control sites. *Hubrechtella dubia* declined from the first to the second survey and disappeared in the third from both offshore stations (BAC and BA). It remained absent at BAC in 1994, but a single specimen occurred at the borrow area.

The five dominant polychaete species at the inshore stations (*Paraonis fulgens*, *Dispio uncinata*, *Scolelepis texana*, *Spio pettiboneae* and *Armandia agilis*) exhibited, with minor local variations, substantial increases in numbers through the first three surveys. One exception was the decline of *A. agilis* at all four treatment sites between 1991 and 1992. Of the others, *D. uncinata* suggested a trend toward pre-fill conditions in that it was among the five most abundant taxa at four inshore stations (two treatment and two control) before filling, was not among the dominants immediately post-fill, and returned to dominance at all four stations a year later. In the 1992 survey, it exhibited impressive population increases of two- to eighteen-fold at all eight inshore stations, ranking as the most abundant organism at seven and second at the eighth. It was

also the second most abundant organism (25.6% of the fauna) and the most abundant polychaete at the inshore Dania Beach site before renourishment began for the John U. Lloyd project (Dodge, *et al.*, 1991).

The 1994 survey, however, painted a different picture. Numbers of polychaetes declined at all inshore sites from 1992 to 1994, but the decline was much stronger at the treatment sites. Mean numbers ($+\sigma_n$) of polychaetes at the four control stations dropped from 268±106 in 1992 to 127±35 in 1994. At the four treatment stations, means dropped from 194±79 in 1992 to 28±9 in 1994. Dominant species remained similar, but with some important exceptions. *Paraonis fulgens* and *Dispio uncinata* remained at both control and treatment stations although only the former increased at any site (R90, R92). *Scolelepis texana* remained at all four control sites but disappeared from the treatment sites. *Spio pettiboneae* and *Armandia agilis* disappeared from all inshore sites (with the exception of a single *A. agilis* at T88). In contrast, two new species appeared in relative abundance: *Prionospio multibranchiata* at all four control sites and *Hesionura elongata* at two treatment sites (R106, R116).

At the two offshore stations, the polychaetes *Prionospio cristata* and *Chone* cf. *americana* appeared throughout all four surveys, although the former declined at both sites in 1994. *Armandia maculata*, apparently replaced by *A. agilis* in 1992, returned to both sites in 1994. Similarly, *Fabricinuda* (formerly *Fabriciola*) *trilobata*, which declined through the first three surveys at BAC and was never present at BA, in 1994 increased in numbers at the former site and appeared for the first time at the latter. *Pseudopolydora* sp. and *Paraprionospio pinnata*, two species abundant at the borrow area in 1992, have since disappeared from that site.

Gastropods were never common in any of the four surveys. The most abundant species, *Caecum pulchellum*, occurred in numbers at two inshore stations (one control and one treatment) before filling (1990), disappeared from all sites in 1991, and returned to the same control site (R90) in numbers in 1992.

The bivalve fauna has been dominated by two taxa: the venerid, *Tivela floridana*, and the tellinid, *Strigilla mirabilis*. It is not clear, however, whether or how their variations were related to fill operations. *T. floridana* was moderately abundant inshore in 1990 and increased substantially in the 1991 survey at one control (R94) and three treatment (R106, R116, R120) sites. In 1992, it declined at all sites, chiefly to below 1990 levels. In 1994, it increased at all eight inshore sites, substantially at two control (R92, R94) and two treatment stations (R106, T111). During the John U. Lloyd renourishment, it was the most abundant organism at both inshore stations before construction began (Dodge, *et al.*, 1991).

By contrast, *S. mirabilis* appeared for the first time at seven inshore sites following filling in 1991, and in large numbers at three of the four control sites (T88, R92, R94). In 1992, it declined precipitously, and was represented by only a single specimen in 1994. It was not recorded at any time during the John U. Lloyd project.

The bryozoan, *Cupuladria* sp., found chiefly at the offshore sites, exhibited a post-dredging decline (1991) and resurgence (1992) at both stations, similar to the pattern recorded at the borrow area and offshore control stations for the John U. Lloyd project. In the current project, however, three years following dredging, it doubled in numbers at the control site, but almost disappeared from the borrow area.

Because many, if not most, harpacticoid copepods pass through the 0.5-mm mesh screens used as standard macroinfaunal sampling tools, their recorded numbers probably do not accurately reflect population sizes. For the record, however, peak abundances were recorded

inshore at one control and one treatment site immediately following dredging, and at two other treatment sites in the 1994 survey. Nothing in this project approached the enormous numbers of harpacticoids recorded post-dredging at the John U. Lloyd fill site (Dodge, et al., 1991). Offshore, harpacticoids generally declined through the four surveys at the control site and exhibited peaks in 1990 and 1992 in the borrow area.

Three amphipods, *Metharpinia floridana*, *Haustorius* sp. and *Eudevanopus honduranus*, occurred in numbers at inshore stations during this project. *M. floridana* occurred at all control sites throughout the project with an immediately post-fill peak at one station. It exhibited similar post-fill peaks at three treatment sites, but then declined in 1992 and disappeared from all treatment sites in 1994. *Haustorius* sp. occurred in generally low numbers at all eight inshore sites during the first three surveys. In 1994, however, it increased substantially at all four control sites and disappeared from three of four treatment sites. *E. honduranus*, similarly present in low numbers throughout the first three surveys, disappeared almost completely in the fourth. Several offshore species have disappeared since 1991 (*Ampelisca bicarinata*, *Bemlos unifasciatus reductus*, *Amphideutopus dolichocephalus*), while at least one (*Synchelidium americanum*) appeared at both sites in every post-dredging survey, although in minimal numbers.

Cumaceans increased substantially in numbers in 1991 with peak occurrences at three of the four inshore treatment sites. They declined at all four in 1992 and disappeared from three in 1994. Numbers also declined at the control sites, but were never high in any survey. Difficulties with their taxonomy prevent accurate assessment of faunal changes, although a distinct species, *Cyclaspis* cf. *pustulata* appeared for the first time in 1994 and accounted for the majority of specimens collected.

The tanaidacean, *Cirratodactylus floridensis*, an offshore dominant before dredging, remained at low post-dredging levels at both control (BAC) and borrow area (BA) sites. Similarly, the isopod, *Xenanthura brevitelson*, the second most numerous offshore species in 1990, continued a post-dredging decline at the control site. It has not been collected in the borrow area since 1991.

4.3.3. Comparison of Faunal Changes by Location

4.3.3.1.Inshore Sites

If meiofaunal nematodes and harpacticoid copepods are excluded, seven of eight inshore sites exhibited increases in organism abundance from the pre-dredging to immediately post-dredging surveys. From 1991 to 1992, abundance at four sites (two control and two treatment) declined, two control sites increased (T88, R90), and one treatment site (R116) remained about the same. As of the 1994 survey, control site T88 and treatment sites R116 and R120 declined to low pre-dredging organism abundances. Control sites R90 and R94 and treatment site R106 declined but remained well above pre-dredging levels. Macrofaunal organism abundance reached a peak at control site R92, while treatment site T111 declined continuously throughout the project. This is an anomalous site in several ways, however, and will be discussed below in greater detail.

Shannon-Weaver diversity indices (H') showed no consistent trend with respect either to survey or to control versus treatment sites. Over the course of the four surveys, H' exhibited a net increase at two control and two treatment sites, and a net decrease at two other control and

treatment sites. Interestingly, each of two pairs of sites that showed the same trend through the four surveys included one control and one treatment site. At sites T88 and R116, H' increased from 1990 to 1991, decreased in 1992 and increased again in 1994 with net increases. At sites R90 and T111, H' followed the opposite sequence with net decreases. By contrast, species richness values increased at three control and three treatment sites from 1990 to 1994. Five of these six, however, exhibited peak richness values either in 1991 or 1992, with at least slight declines in 1994. Only treatment site R106 displayed a continuous increase in richness over the four-year project, a change not reflected by any increase in diversity. As with site T111, this site represented one kind of assemblage "anomaly" observed during this project that illustrates why conclusions about effects of dredging and filling on the environment must be made with great care.

As mentioned in the previous section, inshore stations were largely characterized by a small number of macrofaunal taxa (the polychaetes *Paraonis fulgens*, *Dispio uncinata*, *Scolelepis texana*, *Armandia agilis* and *Spio pettiboneae*, the amphipods *Metharpinia floridana* and *Haustorius* sp., and the bivalve *Tivela floridana*). Although important changes occurred during the project (e.g., the disappearance of *S. pettiboneae* in 1994), these eight species accounted for 71% of the 160 possible positions of five most abundant taxa (5 rankings x 8 sites x 4 surveys)(Table 8.4.6). The "anomalies" refer to those sites that differ substantially from this typical assemblage. In one case, at treatment sites R106 and R116, the initial assemblage was typical and remained so through the first three surveys, but richness increased at both sites (with a very slight decline at R116 in 1994), almost doubling by 1994, with the added result that both sites exhibited similar changes in their faunas reflective of some habitat modification: large increases in numbers of nematodes and harpacticoid copepods, large increases in numbers of turbellarian species, and the unique appearances of the polychaete *Hesionura elongata* and the oligochaete *Bathydrilus adriaticus*.

By contrast, Pre-construction assemblages at control site R90 and treatment site T111 differed substantially in species composition, richness and diversity from those at all other inshore sites. Specifically, both exhibited anomalously high polychaete, nemertine and bivalve richness values relative to other sites. T111 supported 40 polychaete, 6 nemertine and 7 bivalve species; R90 had 12, 6 and 5, respectively. The other inshore sites supported only 3-7 polychaete, 0-3 nemertine, and one bivalve species each in the Pre-construction survey. Richness declined greatly at R90 and T111 following fill operations and continued to decline through 1992 and 1994. By 1992 and continuing through 1994, assemblage compositions at both were far more similar to the other inshore sites than they were before fill operations commenced, and their lower richness values reflect this convergence.

On a group-by-group basis, polychaete abundances increased at all inshore stations through the first three surveys while nematodes generally decreased. However, in 1994, polychaetes declined at all eight stations, and to uniformly and significantly low levels at the four treatment sites. By contrast, nematodes exhibited abrupt peaks at two treatment sites (R106, R116). Harpacticoids exhibited much smaller peaks at the same two sites. The immediately post-fill increase of bivalves at three control and two treatment sites has been mentioned already. This was followed in 1992 by uniformly low abundances at all stations and, in 1994, substantial resurgences (due to *T. floridana*) at two control (R92, R94) and one treatment site (R106).

Nemertine, polychaete, oligochaete, bivalve and peracarid species richness values generally were similar at inshore control and treatment sites before filling, with the two

exceptions noted above (R90, T111). Following fill operations, numbers of polychaete species increased substantially at three control sites (T88, R92, R94), and slightly at two treatment sites (R116, R120), remained about the same at two sites (R90, R106) and dropped precipitously at station T111. A year later, richness values remained roughly the same, dropping to or below pre-fill levels only at T88 and R90. In 1994, polychaete richness decreased further to or below Pre-construction levels at all stations except T88.

Despite substantial variations in organism abundances, peracarid crustaceans maintained roughly the same richness levels at all inshore sites throughout the first three surveys. Eighteen of the 24 samples (3 surveys of 8 sites) included 5-6 taxa (to which the great majority of specimens belong). The 1994 survey revealed some declines, however. The four control sites recorded only 3, 4, 5 and 4 species, and the four treatment sites 4, 5, 3 and 3 species.

4.3.3.2.Offshore sites

The two offshore sites initially showed consistent parallel variations in organism abundances, diversity and species richness values, dropping from Pre-construction levels to lower immediately Post-construction values, and approaching or exceeding Pre-construction levels a year later (1992) for all three parameters. In 1994, the control site (BAC) maintained similar values, but all three parameters declined to below Pre-construction levels at the borrow area (BA). Only abundances of polychaetes and nematodes and polychaete richness values followed common trends at both sites through all four surveys: a Post-construction drop (1991) followed successively by increases in 1992 and decreases to below Pre-construction numbers in 1994. Bryozoan abundances at both sites also followed the same pattern, but only through the first three surveys. In 1994, numbers at the control site jumped to double previous levels, while the animals almost vanished from the borrow area.

Among peracarid crustaceans, amphipod abundances and richness increased substantially at the control site over the course of the four surveys, while showing no clear trend at the borrow area. By contrast, several pre-dredging dominants have not yet recovered. As mentioned earlier, isopods disappeared completely after 1991 at the borrow area and declined but remained present at the control site over the same interval. Tanaidaceans displayed a similar trend though they did not disappear completely from the borrow area.

Also as mentioned earlier, species composition also altered substantially. Before dredging, *Cirratodactylus floridensis* accounted for 94% of tanaidaceans and 13.8% of all organisms collected at the control site. By 1994, those figures dropped to 30% and 2.7%, respectively. Among polychaetes, both borrow area and control site each had about 50 species in both the 1990 and 1992 surveys. However, fewer than a third (26-29%) of the species were common to both surveys at either station. In 1994, of the 46 polychaetes collected at the control site, similarly few were common to either the 1992 (30%) or 1990 (26%) surveys. The smaller number of species found at the borrow area in 1994 (22) had somewhat more taxa in common with former surveys: 41% with 1992 and 27% with 1990. Fewer than ten species were common to any three surveys, and no more than five species were common to all four surveys at either station.

4.3.4. Infauna Discussion

The composition and organization of macroinfaunal assemblages on soft-bottoms depend on a wide range of physicochemical and biological factors that include water characteristics (*e.g.*, temperature, salinity, dissolved gases, nutrient and organic material concentrations and gradients, and pore water chemistry), circulation (*e.g.*, exposure to wave action, tidal, long-shore or benthic boundary currents), bottom configuration (*e.g.*, slope and topography), sediment texture (*e.g.*, grain size and shape, sorting, porosity and packing) and composition (*e.g.*, quartz versus carbonate), environmental variability and periodicity (*e.g.*, diurnal and seasonal patterns of productivity and nutrient cycling, periodic and aperiodic disturbances), and biological interactions (*e.g.*, competition, predation) and patterns (*e.g.*, settlement, recruitment, reproductive and life history strategies, zoogeography and historic contingency) (Parr *et al.*, 1978; Gray, 1981; Thistle, 1981; Eagle, 1983; McLachlan, 1983; Nelson, 1985; Brown & McLachlan, 1990; Alongi, 1990). In many cases, the physical, and sometimes the biological, parameters that set limits on organism distributions are known. However, controversy remains concerning the relative roles that various physical and biological processes play in structuring, maintaining, and altering benthic assemblages on unconsolidated substrates (*e.g.*, Gray, 1981; Thistle, 1981; Schoener, 1982; see also Lewin, 1986). Perhaps more importantly, the extent of the natural variability that derives from the interplay of these processes remains poorly understood at best. for many marine environments. This variability may be expressed as temporal or spatial environmental heterogeneity, the latter typically recognized as patchiness. Both occur across a spectrum of scales and can generate false distinctions between similar assemblages (Parr, *et al.*, 1978; Saloman & Naughton, 1984; Hodda, 1990). Care must thus be taken in distinguishing between natural variability and the effects of anthropogenic disturbance.

Sediment substrates sampled during this project represent two benthic environments that support distinct infaunal assemblages: a shallow (1.5-2.1 m depth), inshore habitat (stations T88, R90, R92, R94, R106, T111, R116, R120) subjected to considerable wave action, resuspension of sediment, and turbidity, and a physically more stable, offshore habitat (12-18 m depth) between the second and third reefs below normal wave base (Borrow Area and Borrow Area Control). The inshore sites were dominated in large part by the same taxa found before dredging at John U. Lloyd State Recreation Area: the spionid polychaetes *Paraonis fulgens* and *Dispio uncinata*, the bivalve *Tivela floridana*, and the amphipods *Haustorius* sp. and *Metharpinia floridana*, although their numbers were generally smaller in the present pre-dredging survey. Also as in the pre-dredging John U. Lloyd project, the offshore sites exhibited much higher species richness values than the inshore sites (although not as high as at John U. Lloyd) with many of the same species (*e.g.*, the polychaetes *Prionospio cristata* and *Armandia maculata*, and the tanaidacean *Cirratodactylus floridensis*). Although at least several common species occurred at all or most sites in each of the two habitats, important differences were evident. Inshore, the polychaete, Armandia agilis, occurred at all treatment sites before dredging, but at only one control site. Control station R90 and treatment station T111 exhibited much higher diversity indices and richness values before dredging than any of the other inshore sites. Similarly, two treatment sites (R106, R116) differed from the remaining inshore stations in the final survey. Offshore, the nemertine *Hubrechtella dubia*, and the polychaete *Fabricinuda* (formerly *Fabriciola*) *trilobata* were common before dredging at the control site, but rare or absent at the borrow area. Although species-area curves suggested that the fifteen replicate cores taken per

station adequately reflected within-station assemblage diversity (see Gray, 1981), larger scale spatial heterogeneity may have generated important faunal differences between sites supposedly representing the same benthic community.

Dredging and filling associated with beach renourishment have a well-documented series of effects on benthic communities. Deposition and dredging reduces and may eliminate, at least temporarily, entire assemblages via physical disruption and burial; changes in sediment composition may alter subsequently established populations, either via direct changes in sediment texture or indirectly via increased turbidity and resuspension, and reduced sediment stability; changes in bottom configuration may alter beach drainage patterns and affect deposition and circulation at the borrow area (Naqvi and Pullen, 1982; Nelson, 1985; Hurme and Pullen, 1988). Nourishment operations also may generate an "edge-effect" faunal depletion in adjacent areas up to 400 m from the dredge site (Reilly and Bellis, 1983; Poiner and Kennedy, 1984). By contrast, dredging and filling also may result in at least temporary faunal enrichment of adjacent habitats. Poiner and Kennedy (1984) observed such enrichment beyond a depleted edge-effect area up to 2000 m from the dredge site. Such enrichments have been attributed to invasion of opportunistic species following defaunation of affected areas (Naqvi and Pullen, 1982; Hurme and Pullen, 1988) and to the release of nutrients associated with suspension of fine sediments (Poiner and Kennedy, 1984). It remains important, however, to interpret these disturbances in the context of the natural range of environmental variability and the relative fragility or resiliency of the affected fauna. Shallow and intertidal assemblages subject to natural cycles of erosion and accretion associated with seasonal weather patterns and storms will likely recover more rapidly than deeper-water offshore assemblages (Naqvi and Pullen, 1982; Hurme and Pullen, 1988).

Much of the monitoring of renourishment operations in the southeastern United States indicates that recovery of benthic macrofaunal assemblages is rapid once dredging and filling have ceased (Saloman, 1974; Taylor Biological Co., 1978; Culter and Mahadevan, 1982; Naqvi and Pullen, 1982; Gorzelany, 1983; Reilly & Bellis, 1983; Gorzelany & Nelson, 1987; Hurme & Pullen, 1988). However, these studies primarily treated intertidal and immediately subtidal beach habitats dominated by organisms adapted to a rigorous, unstable environment (e.g., hippid decapod crustaceans and donacid bivalves). Their results are, therefore, not directly comparable to the current investigation. In contrast, Goldberg (1985), analyzed, in addition to beach habitats, a series of offshore soft-bottom environments to a depth of 20-25 m. Although he recorded post-dredging increases and decreases in faunal diversity followed by recovery to pre-dredging levels, he also reported major between-year variations in faunal composition and broad-based declines in overall faunal abundance. He invoked a variety of ecological processes and biological interactions as factors potentially contributing to the elongated recovery time, but discovered no pattern of faunal change directly related to replenishment. In addition to recognizing that environmental heterogeneity is too great relative to the study data base to identify re-establishment of faunal equilibrium, he suggested that the "time scale for achieving populations similar to those found prior to restoration is apparently more than one year" (Goldberg, 1985).

Results of the current study reflected those of the preceding John U. Lloyd project in suggesting that subtidal nearshore and offshore benthic assemblages do not respond identically to renourishment operations, nor have they recovered from the disturbance associated with dredging and filling.

Of the changes observed in benthic assemblages from survey to survey, some displayed patterns that may be attributable to dredging and filling, while others did not. The declines in

richness at R90 and T111 and the corresponding general increases in richness and organism abundance at the other inshore stations, for example, did not appear to be related to fill operations because the trends affected control and treatment sites similarly. Likewise, polychaetes exhibited major increases in absolute and relative abundances (due chiefly to several important taxa: *Dispio uncinata*, *Paraonis fulgens*, *Scolelepis texana* and *Spio pettiboneae*) while nematodes declined at all inshore sites in 1992 relative to both earlier surveys (with the exception of the 1991 nematode peak at R90). Declines in polychaete abundances at all inshore stations from 1992 to 1994 included the disappearances of *S. pettiboneae* and (all but one specimen of) *Armandia agilis* (but see below). Diversity indices exhibited no recognizable trend over the course of the four surveys relative to inshore treatment or control areas.

On the other hand, several taxa followed trends that varied with location, possibly in response to fill operations. Although, as mentioned above, polychaetes exhibited a general decline at all inshore stations from 1992 to 1994, they dropped to far smaller numbers at the four treatment sites. Over the same period, *Scolelepis texana* remained in reduced numbers at the four control sites while disappearing from three of four treatment sites. *Armandia agilis* increased in abundance at seven of eight sites from 1990 to 1991, but continued to increase in numbers in 1992 only at control sites while declining at three of four treatment sites. The amphipod *Metharpinia floridana* showed a similar pattern during the first three surveys. In 1994, it increased in numbers or at least remained common at all four control sites, but disappeared from all four treatment sites. Another amphipod, *Haustorius* sp., increased at all four control sites from 1992 to 1994, while disappearing from two treatment sites and remaining in small numbers at the other two. The nemertine *Cephalothrix* sp. 114 occurred in substantial numbers (for a nemertine) at all control stations in almost every survey. At the treatment sites, however, it appeared only in 1991 and 1992 and disappeared again in 1994. On the other hand, while the bivalve, *Tivela floridana*, remained common at three of four control sites and all four treatment sites throughout the project, another bivalve, *Strigilla mirabilis,* appeared abruptly in large numbers only at three of four control sites immediately following construction (1991) and virtually disappeared again by the following year.

At the offshore sites, recovery was even less obvious. The bryozoan *Cupuladria* sp., the isopod, *Xenanthura brevitelson* and the tanaidacean *Cirratodactylus floridensis* all remained in numbers at the control site in all four surveys, although the latter two never returned to pre-dredging levels. At the borrow area, all three declined substantially, and the isopod disappeared. Species abundances, richness, diversity and evenness all declined from 1990 to 1991 and then rebounded at both sites in 1992. These parallel variations in three important parameters at both sites through the first three surveys suggested that the control site may also have been affected by the dredging, although more regional-scale changes unrelated to dredging could not be ruled out. In the 1994 survey, organism abundance and species richness remained high at the offshore control site, while declining again at the borrow area. One possible sign of very limited recovery at the borrow area may be the reappearance in the 1994 survey of the polychaete *Fabricinuda trilobata*, which had been moderately abundant at the control site in 1990.

As described below, mean sediment grain size varied over similar ranges at control and treatment sites both inshore and offshore. A few extreme measurements, however, may account for some observed differences in assemblage composition. In the 1994 survey, inshore treatment sites R106 and R116 supported substantially different faunas than the remaining inshore sites as follows: large numbers of nematodes, relatively large numbers of harpacticoids, and the unique

occurrences of the polychaete, *Hesionura elongata*, and the oligochaete, *Bathydrilus adriaticus*. Both samples were characterized by coarser mean grain sizes (Table 4.3.1) than at any other site in any survey. The peak grain sizes recorded during the 1990 and 1992 surveys at the offshore control site correspond to increased numbers of the tube-building tanaidacean Cirratodactylus floridensis. Finer grain sizes in the borrow area may have prevented colonization by this species.

Three important points remain that must be kept in mind with respect to recovery of both inshore and offshore assemblages. Firstly, organisms vary widely in their generation times and ability to disperse and, by extension, recolonize disturbed areas. Many polychaetes and bivalves produce planktonic larvae which vastly increases opportunities for recolonization. Peracarid crustaceans, on the other hand, are all brooders that release relatively small numbers of benthic offspring, a strategy that must delay recolonization. Within this group, however, recolonization abilities also vary widely. Cumaceans in particular are often important nocturnal meroplankton, swarming in the water column at night and dwelling in the sediment during the day (Corey, 1970; Akiyama & Yoshida, 1990). Many tanaidaceans are, by contrast, sedentary tube-dwellers tied to particular sediment profiles (Hassack & Holdich, 1987). It is, therefore, not unlikely that some components of a faunal assemblage will re-establish themselves well before others.

Secondly, as Goldberg (1985) observed, environmental heterogeneity may seriously compromise any attempt to attribute changes in assemblage structure or composition to specific environmental perturbations such as dredging and filling. Pre-construction assemblages at inshore control site R90 and treatment site T111 were clearly different from the faunas at the remaining six sites. We do not know how extensive these assemblages were. Nor do we know if their parallel convergence with the remaining "typical" inshore assemblage (based on eight dominant taxa) over the course of this project was in any way related to beach renourishment operations. Similarly, we do not know how important were the parallel changes observed at treatment sites R106 and R116 as of the final survey. Both appeared to be associated with coarser sediments, but because the changes were observed only at two of four treatment sites, we can neither accept nor dismiss fill operations as the likely cause. Hurricane Andrew, which passed over the area shortly before the 1992 survey, may have impacted different sites to different degrees and generated different sedimentological responses with different time frames.

Finally, although dredging and filling have a well-documented series of effects on benthic communities (Naqvi and Pullen, 1982; Nelson, 1985; Hurme and Pullen, 1988), we lack detailed information about ecological requirements and tolerances of virtually all organisms collected. As a result, we do not know how faunal changes actually derive from environmental changes. Similarly, we have no understanding of the circumstances surrounding the abrupt appearances and disappearances of a variety of taxa apparently unrelated to renourishment operations (e.g., , the isopod, *Exosphaeroma producatelson*, at R106 in 1994, or the polychaetes *Paraonis pygoenigmatica* at R90 in 1991, and *Pseudopolydora* sp. at BA in 1992).

4.3.5. Core Sediments

Mean grain sizes of sediment samples fell chiefly between 0.150 and 0.300 mm with a few finer and coarser measurements recorded at inshore treatment and offshore sites (Table 4.3.1). Mean values exhibited the following changes over the course of the four surveys. At the inshore control sites (T88, R90, R92, R94), mean grain size first decreased immediately following fill (1991) then increased one year following construction at three of four sites.

However, by 1994, mean grain size again decreased and returned to lower than pre-dredging values at three of four sites. At the inshore treatment sites, mean grain size also decreased immediately following fill at three of four sites, but then increased substantially so that in 1994, three of four stations recorded higher than pre-construction mean grain sizes. At the offshore control site, mean grain size dropped, rose and dropped again over the course of the four surveys. At the borrow area, however, mean grain size declined almost continuously. With the exception of the borrow area and one inshore control site (R90), mean grain size increased between 1991 and 1992. The possibility exists that hurricane Andrew, which occurred immediately before the 1992 survey, may have had a significant impact on sediment distribution.

Table 4.3.1. Infaunal sample sites: Mean sediment grain size (n=2) in mm.

	INSHORE CONTROL				INSHORE TREATMENT				OFFSHORE	
Year	T88	R90	R92	R94	R106	T111	R116	R120	BAC	BA
1990	0.168	0.218	0.221	0.297	0.239	0.147	0.215	0.221	0.288	0.213
1991	0.145	0.262	0.183	0.150	0.187	0.109	0.267	0.183	0.148	0.147
1992	0.231	0.255	0.287	0.187	0.232	0.354	0.272	0.287	0.307	0.198
1994	0.241	0.155	0.187	0.168	0.371	0.288	0.383	0.187	0.209	0.094

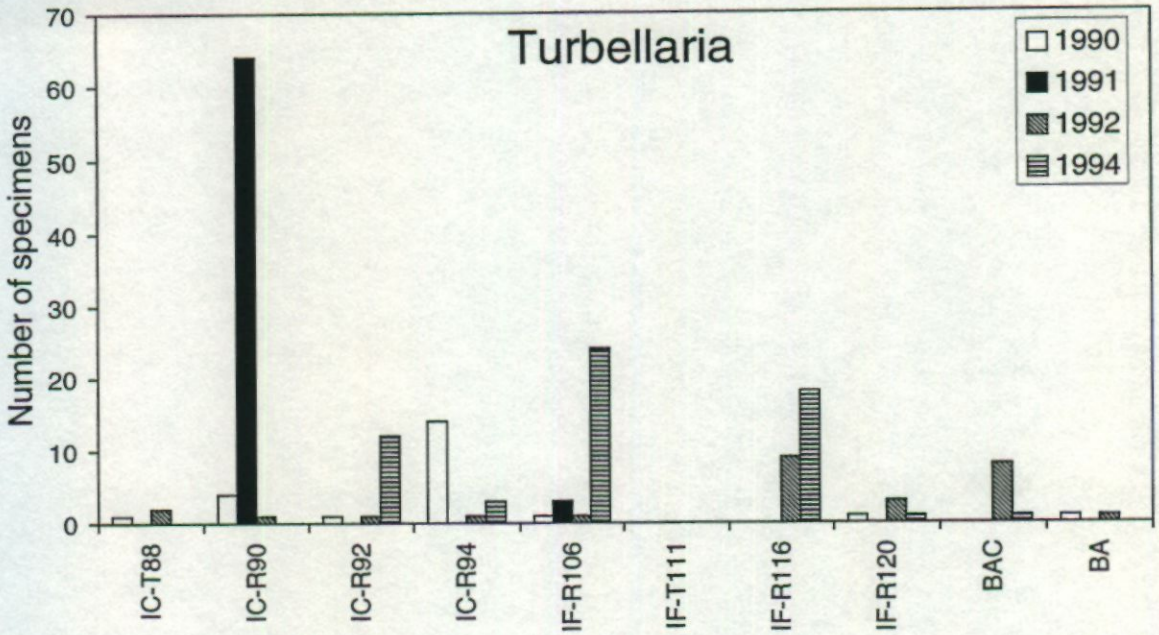

Figure 4.17 Turbellaria numerical abundance.

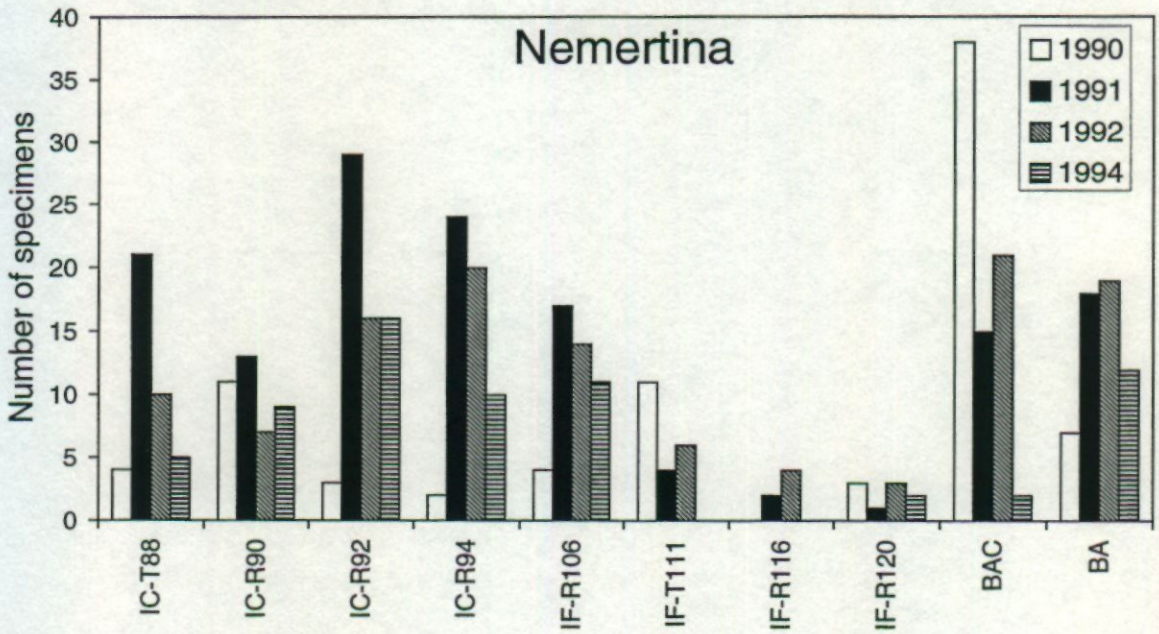

Figure 4.18 Nemertina numerical abundance.

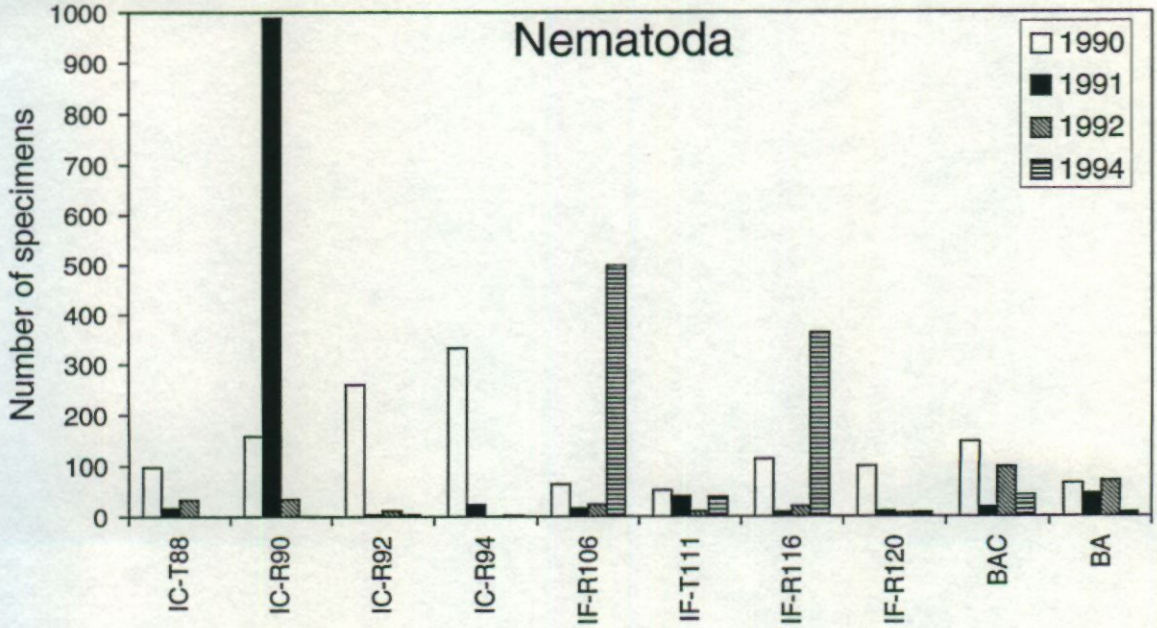

Figure 4.19 Nematoda numerical abundance.

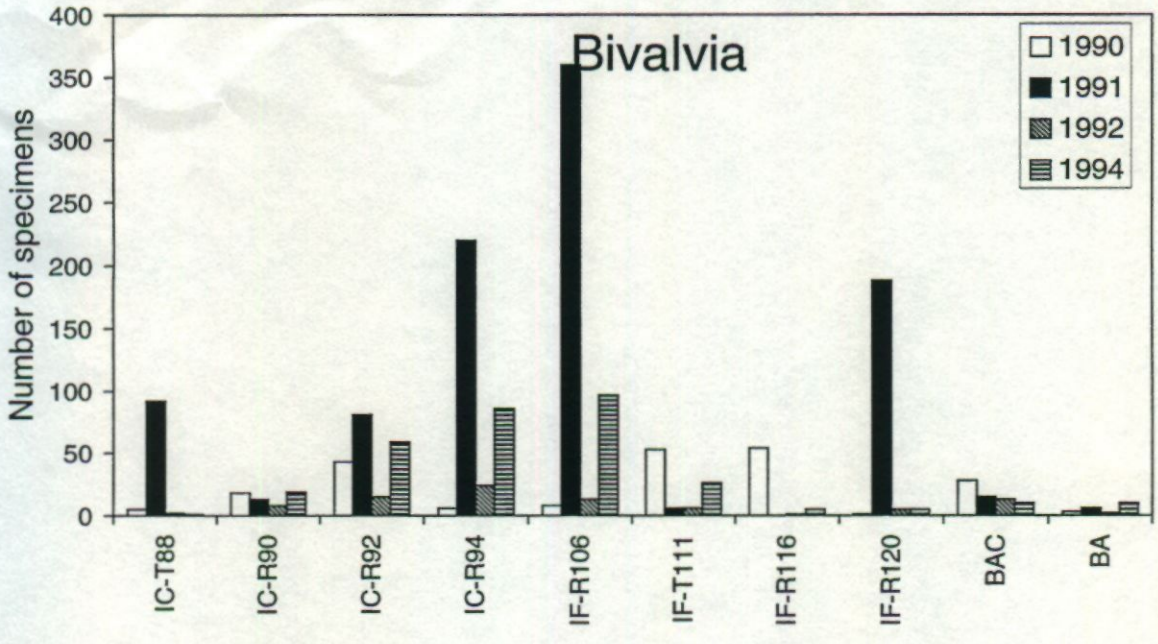

Figure 4.20 Bivalvia numerical abundance.

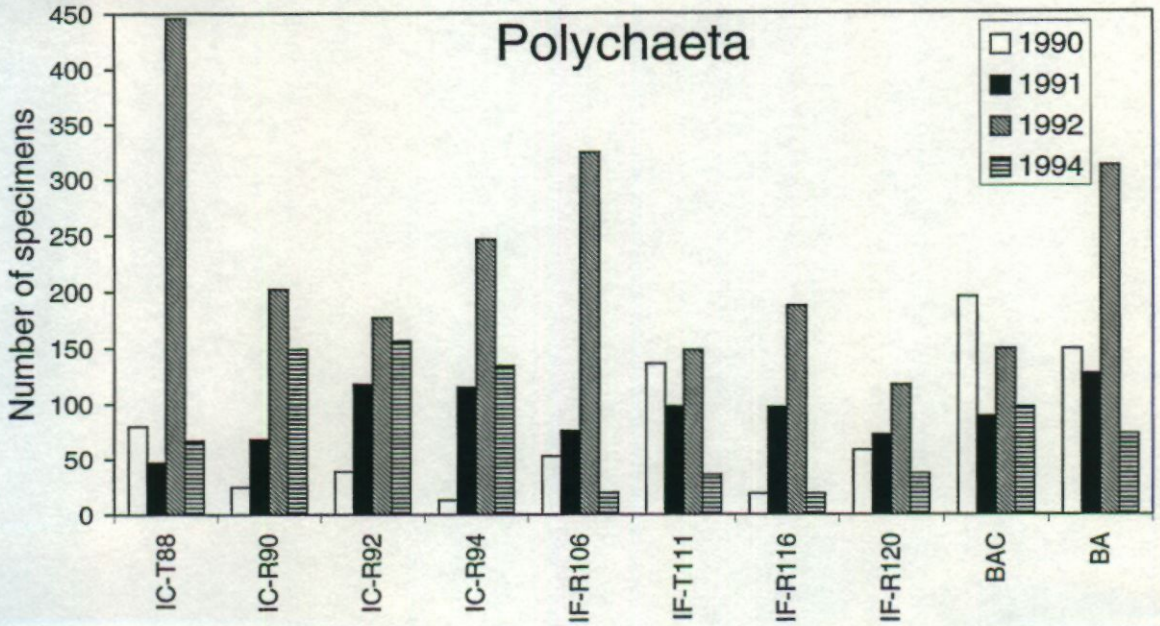

Figure 4.21 Polychaeta numerical abundance.

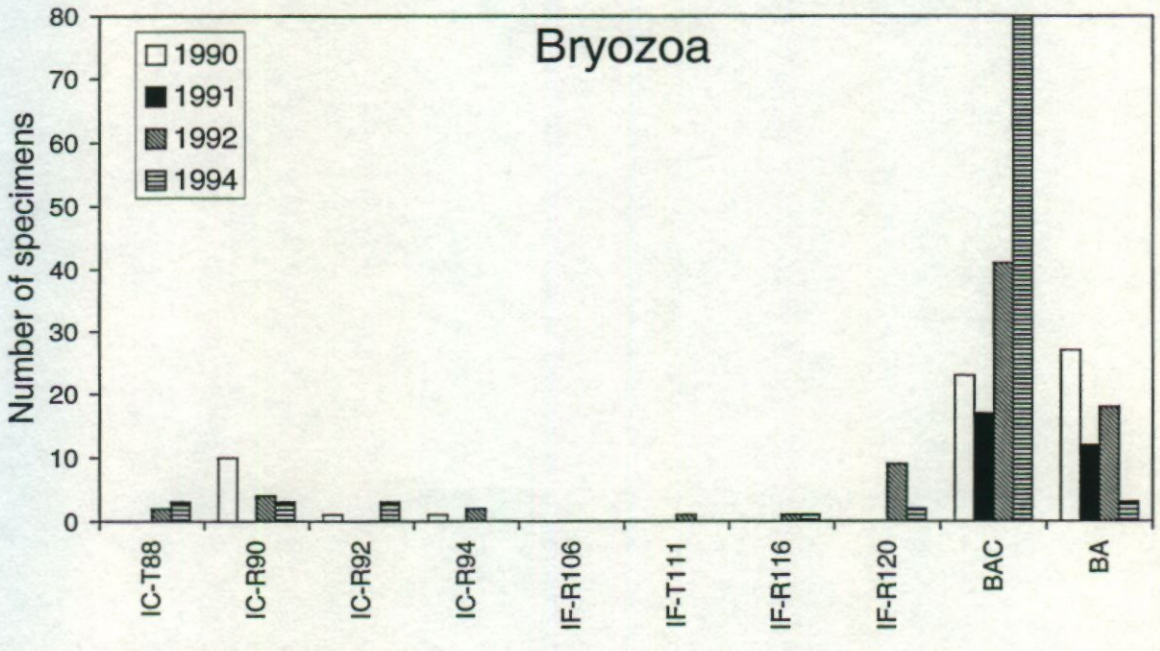

Figure 4.22 Bryozoa numerical abundance.

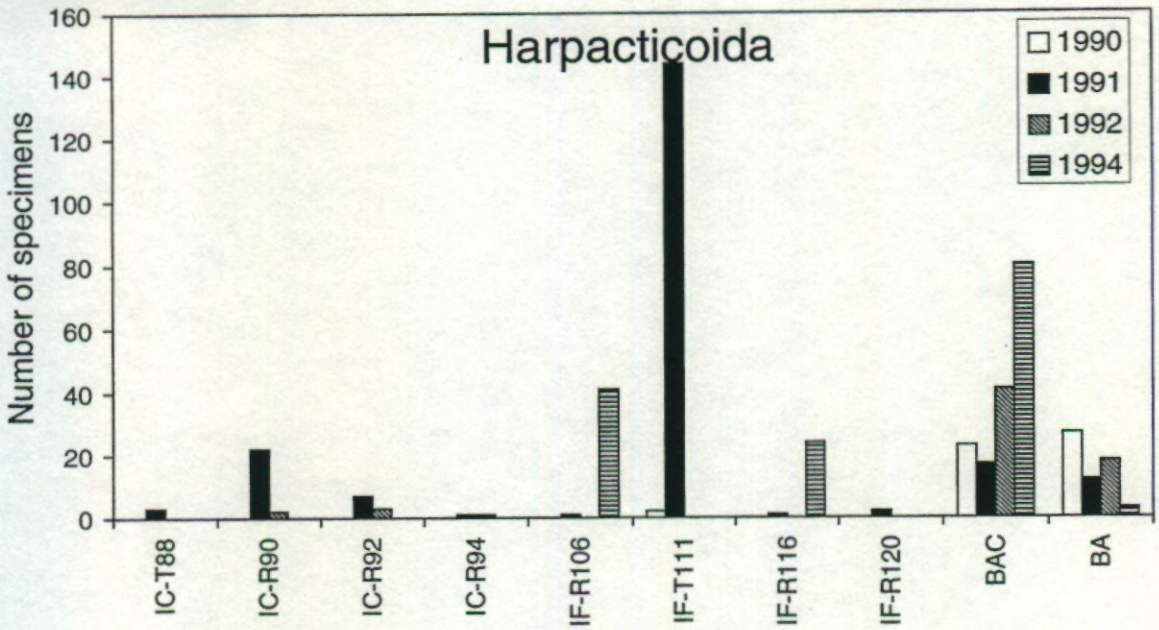

Figure 4.23 Harpacticoida numerical abundance.

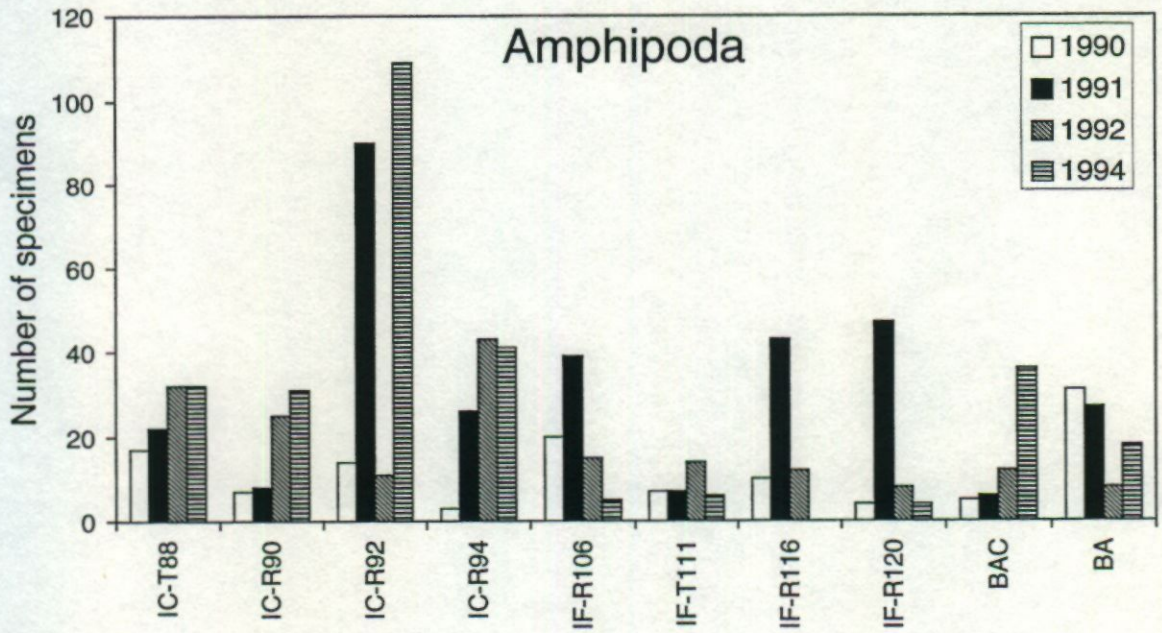

Figure 4.24 Amphipoda numerical abundance.

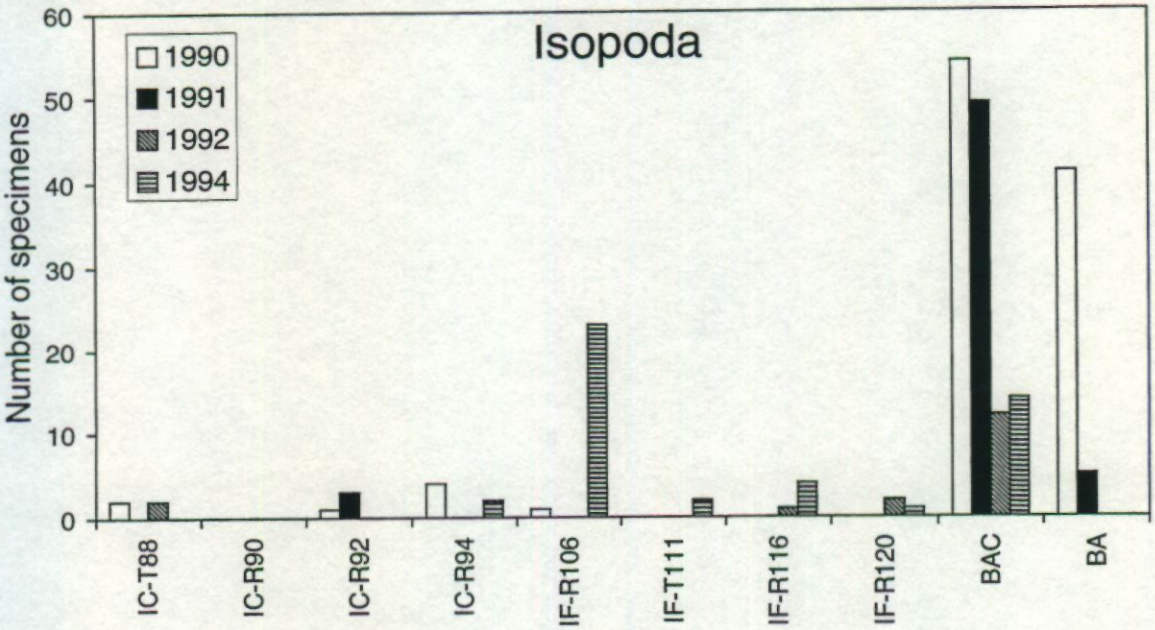

Figure 4.25 Isopoda numerical abundance.

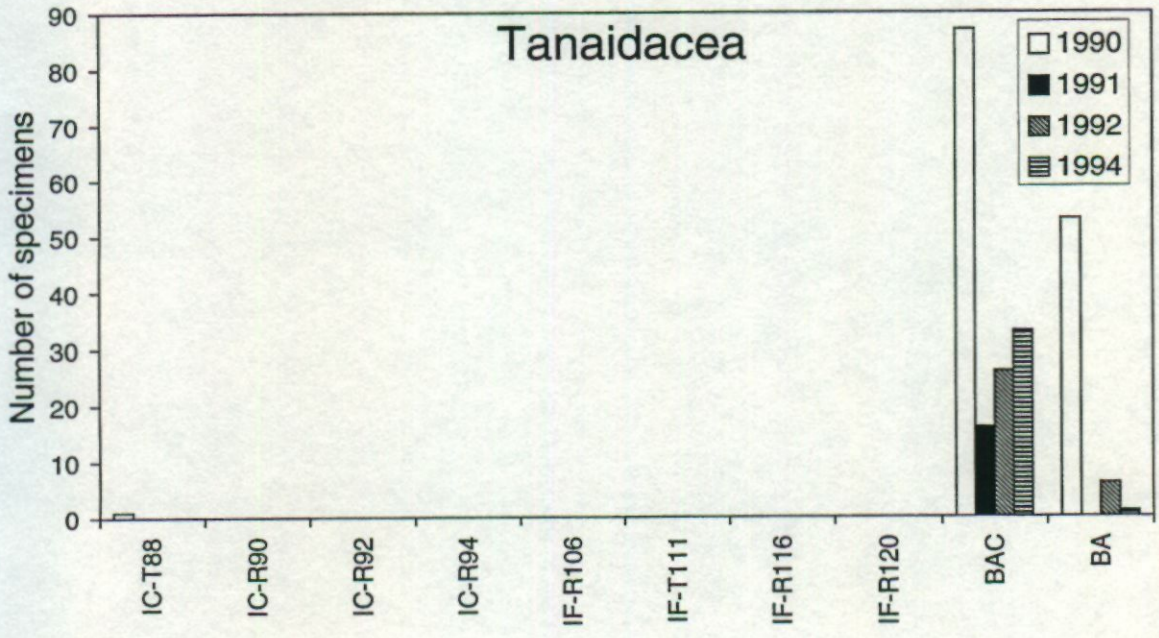

Figure 4.26 Tanaidacea numerical abundance.

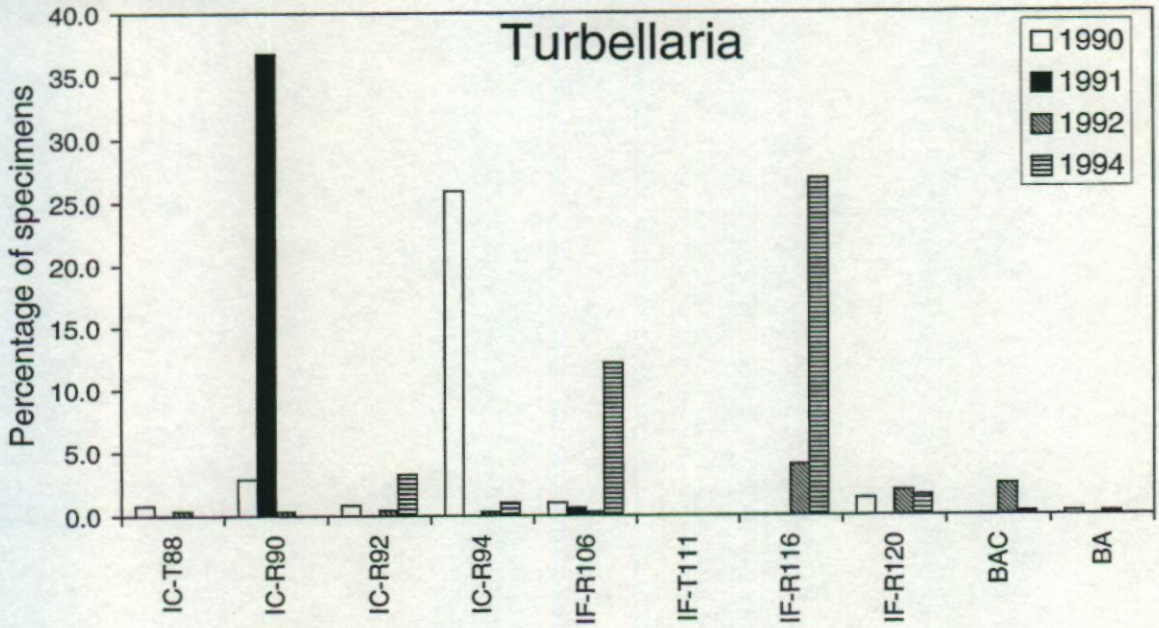

Figure 4.27 % Abundance of Turbellaria.

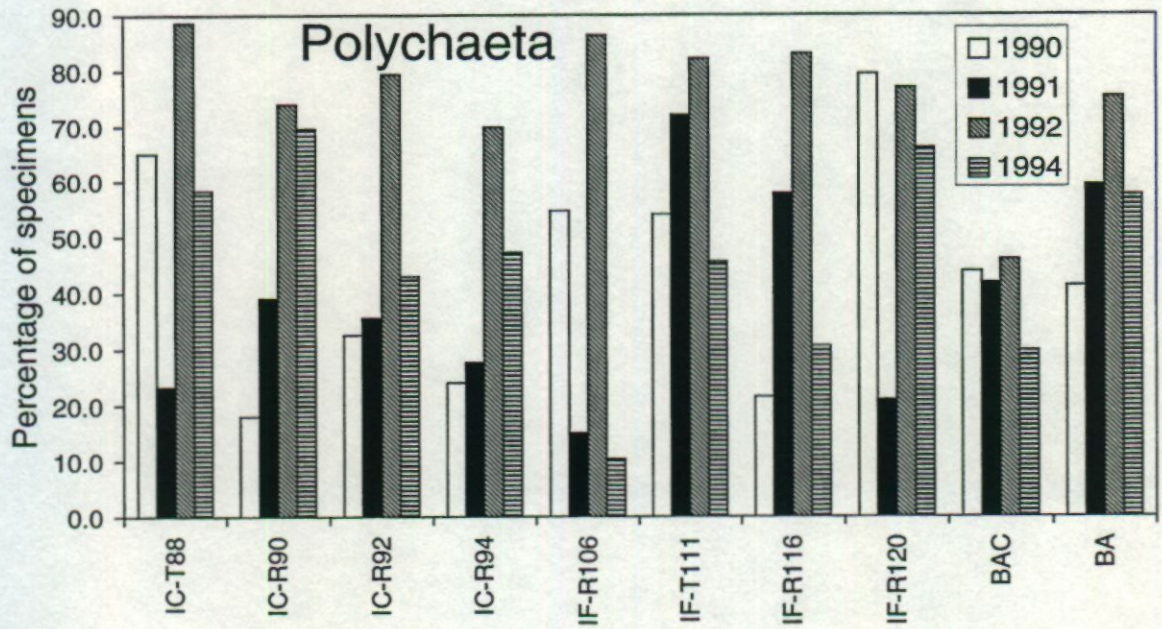

Figure 4.28 % Abundance of Polychaeta.

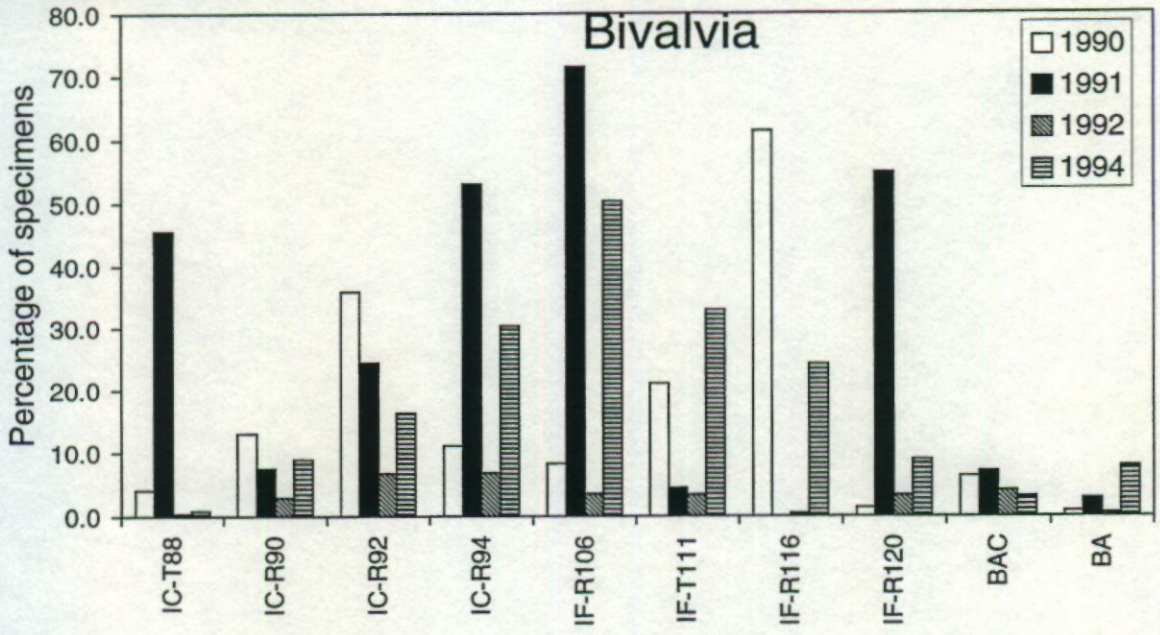

Figure 4.29 % Abundance of Bivalvia

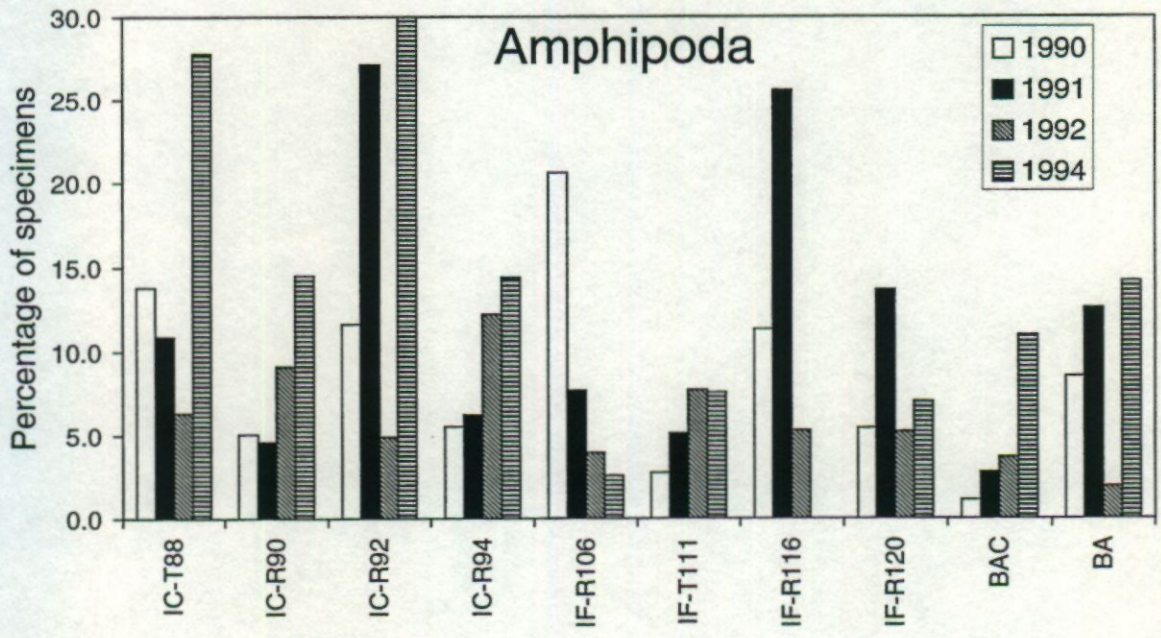

Figure 4.30 % Abundance of Amphipoda.

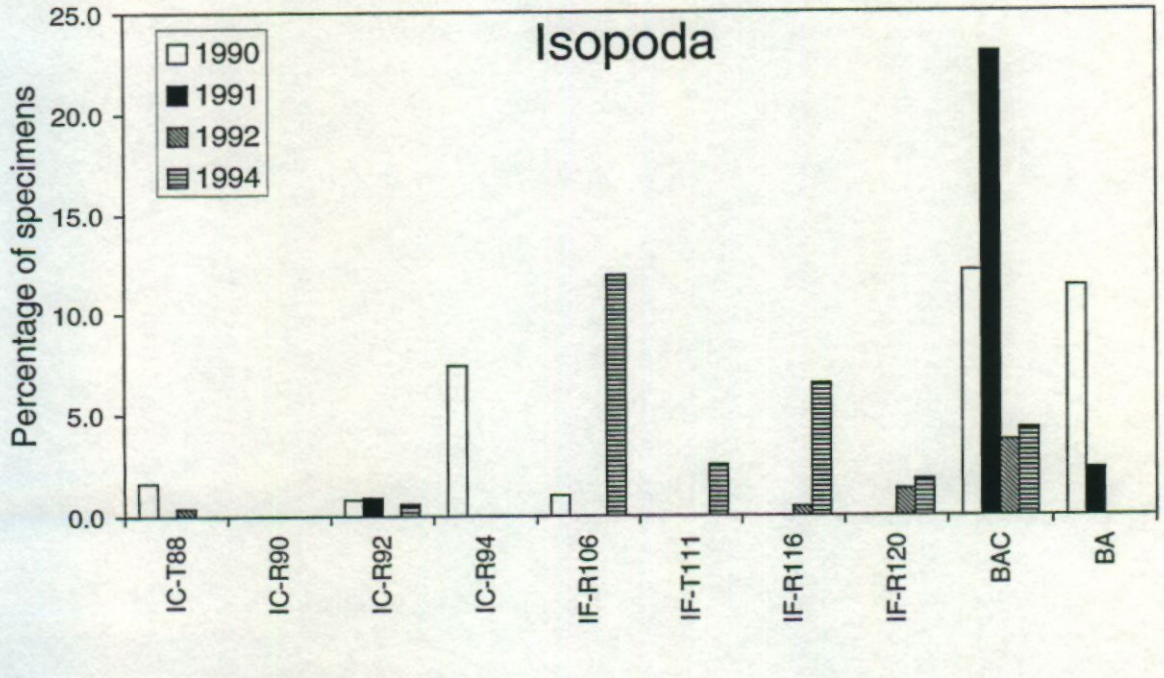

Figure 4.31 % Abundance Isopoda.

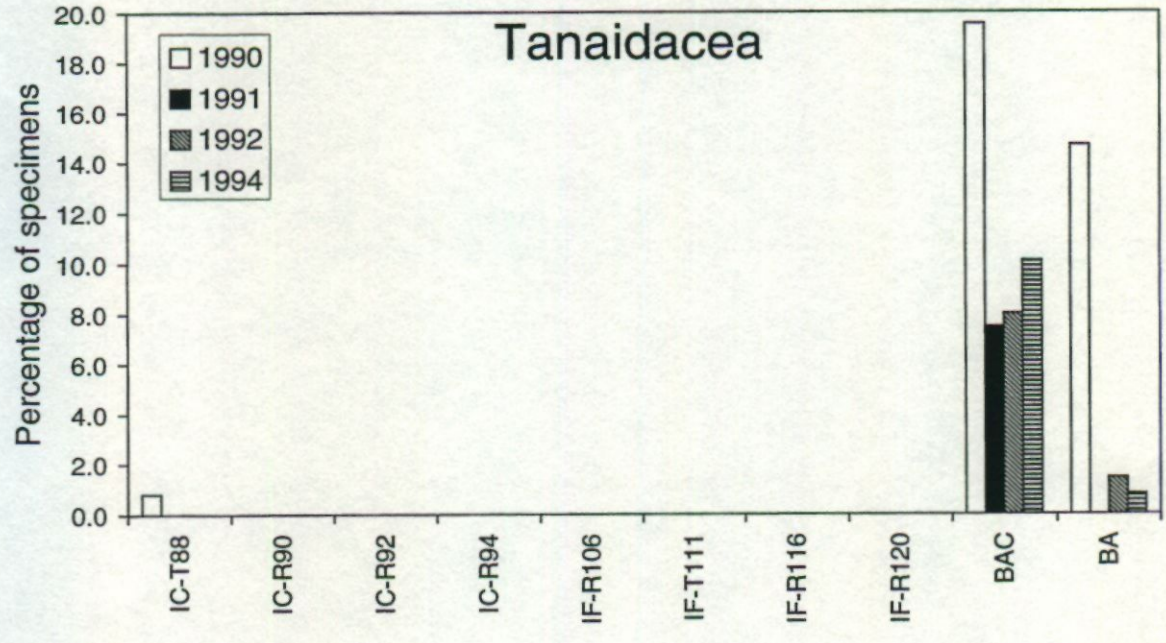

Figure 4.32 % Abundance Tanaidacea.

5. SUMMARY & CONCLUSIONS

5.1. Transects and Quadrats

A four-year study was undertaken to survey Broward County, Florida (southeast Florida) coral communities and infaunal marine biota in relation to possible effects from the Hollywood-Hallandale Beach renourishment project. Beach restoration involves dredging sand from offshore deposits and placing it on eroded beaches, activities which may cause sedimentation and turbidity. Coral reefs were assessed using transect and quadrat surveys at a total of 15 stations, unevenly distributed between dredging impact (n=9) and control (n=6) areas to characterize and quantify populations of sponges, gorgonians, scleractinian corals, as well as other less well represented groups. In addition, the infauna of sand areas were analyzed using 150 core samples collected from both control and dredging impact areas. The first study was conducted in 1990, one year prior to construction of the beach in 1991. Other surveys were conducted immediately after construction in 1991, and then in 1992 and in 1994.

The most consistent result obtained by this study is that a long term decline, indicated by many key taxonomic groups and indices has occurred in the study areas. Statistical analyses using repeated measures Analysis of Variance (ANOVA) often show a time effect for both control and dredging treatments. Declines in both control and dredging stations are especially obvious when 1990 pre-construction parameters are compared with those of 1994 (although there may be unexplained fluctuations in between these times). Percent cover by scleractinian corals, as well as their mean density and coverage diversity are all lower (often significantly) in 1994 than they were in 1990. Coral coverage at dredging sites dropped continuously and lost 20% of its pre-construction value. However, the largest percent decline among gorgonians occurred between the 1992 and 1994 surveys in which dredge stations populations decreased by 28.5% and control populations declined by 27.8%. An overall decrease in the mean number of sponges and scleractinian corals also occurred in the study areas, similarly not limited to dredge stations, but encompassing control stations as well.

Differences among treatment means were not statistically significant and consequently insufficient to indicate dredging effects. In some cases, however, effects of dredging were noted, especially for the gorgonian populations. The number of gorgonian corals declined 15.8% at the dredging sites between 1991 and 1992, while remaining constant at control sites. Most of these gorgonian losses occurred on nearshore stations just offshore of the restored beach where many colonies were found partially or completely dead and covered with a layer of silt. At the same time, however, the mean number of individual sponges and scleractinians increased at both control and dredging sites in the same period.

While the data do not exonerate or minimize the potential environmental impact of dredging and filling for beach restoration, the overall pattern is not consistent with a simple, single impact explanation. Storm events must also be factored into the pattern. During the study period, two major storms affected the area. Hurricane Andrew in August of 1992 occurred just a few weeks before the 1992 survey. The otherwise unnamed "Storm of the Century" took place in 1993, a year when no biological assessment was undertaken. In qualitative surveys following the storms, we specifically noted damage to the reef communities. Invertebrate populations were scoured from their points of attachment to the substrate and piled into crevices and depressions on the reef. Our data from this study show that numbers of sponges, which had increased at both

dredge and control sites in 1991, declined substantially after the storm, recovering slightly or leveling off in 1994. Gorgonians declined twice at dredging sites, in 1991 and again between 1992 and 1994. The first decline had no parallel on control sites but the second decline was mirrored by a population decrease at control stations. Stony coral colonies increased or remained the same at dredge sites during the first three surveys, then similarly decreased between 1992 and 1994. Mean coral density and coverage diversity followed the same pattern.

5.2. Cores

Inshore and offshore core sites supported different macroinfaunal assemblages during this project. Pre-construction faunal composition as reflected by most common organisms was generally similar at control and treatment sites both inshore and offshore, although one control (R90) and one treatment site (T111) differed considerably from the other inshore sites. With these two exceptions, macrofaunal abundances and species richness values increased at all inshore sites immediately post-dredging. By contrast, organism abundances, richness and diversity indices declined substantially at both offshore sites over the same period (1990-1991). In 1992, all inshore sites (except T111) recorded greater macrofaunal abundances than in the Pre-construction survey, although two control and three treatment stations declined from 1991 peaks. Similarly, species richness values continued to increase or at least remained higher than Pre-construction levels at six sites (again excepting R90 and T111). In 1994, organism abundances had declined to below Pre-construction levels at all sites with the exception of two inshore treatment stations (R106, R116) that had developed a different macrofaunal assemblage accompanied by peaks in nematode and harpacticoid numbers. Species richness declined at least slightly from 1991 or 1992 peaks at all inshore sites (except R106), but remained higher than before renourishment with two exceptions: richness at stations R90 and T111 declined roughly continuously through all four surveys so that, in 1994, these two sites supported assemblages similar to those at most of the other inshore sites (T88, R92, R94, R120). Diversity indices showed no recognizable trend relative to control versus treatment over the course of the four surveys.

Of the dominant inshore organisms, the polychaetes, *Dispio uncinata*, *Paraonis fulgens*, *Scolelepis texana*, *Spio pettiboneae* and *Armandia agilis,* generally increased in numbers from 1990 through 1992 and almost uniformly declined in 1994, with much greater declines at the four treatment sites. *S. texana* disappeared from all treatment sites, while *Prionospio multibranchiata* appeared at all control sites. *S. pettiboneae* disappeared from all eight inshore sites. The inshore amphipods, Metharpinia floridana and Haustorius sp., remained abundant or increased in numbers at control sites. At treatment sites, both exhibited at least some immediately Post-construction increased and then declined, with the former species disappearing in 1994. The bivalve, Tivela floridana, also exhibited 1991 peaks at several stations, but, in contrast with the amphipods, declined at all sites in 1992 and rebounded at three control and three treatment sites in 1994. At the offshore sites, *Prionospio cristata* generally remained the most abundant polychaete although it decreased in numbers at both stations in 1994. Both *P. cristata* and another polychaete, *Chone* cf. *americana*, occurred in greater abundance in the borrow area than at the control site in all three Post-construction surveys. However, of the three common non-polychaete taxa, the bryozoan, *Cupuladria* sp., increased at the control site and decreased at the borrow area over the four surveys; the tanaidacean, *Cirratodactylus floridensis*, and the isopod,

Xenanthura brevitelson, declined at the control site, though remaining in numbers, while both declined or disappeared at the borrow area after dredging.

5.3. Overall

The issue of the response of coral reefs and coral reef organisms to sedimentation and turbidity is complicated. These ecosystems have adapted over long time periods to be able to deal with certain low levels of natural sedimentation and turbidity. However, excessive or chronic sedimentation causes documented adverse effects. These can include outright mortality as well as changes in growth, coverage, density, and community composition. The difficulty is that all of these parameters, while linked, change at different rates and in other ways which are largely unquantified for individual species, let alone the broad combinations of species and growth forms which ultimately create ecosystems. Consequently, predicting (and assessing) the effects of a particular event or events (e.g., a beach renourishment project) can be particularly difficult when effects are less than catastrophic (e.g., complete mortality).

The results of this monitoring study for the parameters measured and the sites inspected has indicated few major detrimental effects from the beach renourishment project. While this is potentially good news for the ability to conduct future projects in an environmentally responsible manner, it is also important to recognize the limitations of this study and possible confounding effects. These include small sample size (numbers of monitoring sites) within the dredging and control areas, confounding effects of reef community zonation with depth (e.g., First, Second, and Third Reefs), confounding effects of short-term disturbances (e.g., Hurricane Andrew) or long-term change (e.g., global warming, chronic pollution from other sources), and finally high natural variability of reef communities which decreases power of statistical tests to detect differences, regardless of the replication.

There are certain actions and re-actions that can and should be undertaken in response to the above information. Some actions must be taken on a broad ecumenical scale and some can be undertaken at the local ground roots level. The problem is summarized well below.

> Currently, we are unable to rigorously predict the responses of coral reefs and reef organisms to excessive sedimentation from coastal development and other sources. Given information on the amount of sediment which will be introduced into the reef environment, the coral community composition, the depth of the reef, the percent coral cover, and the current patterns, we should be able to predict the consequences of a particular activity. Models of physical processes (e.g., sediment transport) must be complemented with better understanding of organism and ecosystem responses to sediment stress. Specifically, we need data on the threshold levels for reef organism and for the reef ecosystem as a whole - the levels above which sedimentation has lethal effects for particular species and above which normal functioning of the reef ceases. Additional field studies on the responses of reef organisms to both terrigenous and calcium carbonate sediments are necessary. To effectively assess trends on coral reefs, e.g., changes in abundance and spatial arrangement of dominant benthic organisms, scientists must start using standardized monitoring methods. Long-term data sets are critical for tracking these complex ecosystems (Rogers, 1990).

Broward County should continue its vigilant pursuit of environmental protection and management. Long-term environmental monitoring should be maintained in a standardized fashion to encompass the range of off-shore environment which exist along the coast. These will be useful for documentation of long term changes and as baseline information against which future natural (e.g., storms) or man-induced (e.g., additional renourishment projects) events or processes may be gauged. Monitoring stations should be replicated sufficiently to allow adequate statistical testing. Broward is fortunate to have maintained several stations for many years which now can be of value for documentation. More stations need to be added to the network and regularly assessed. The coral reefs of Broward County represent a significant environmental and economic resource which with proper stewardship, will benefit the citizenry well into the next millennia.

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7. Figures Appendix

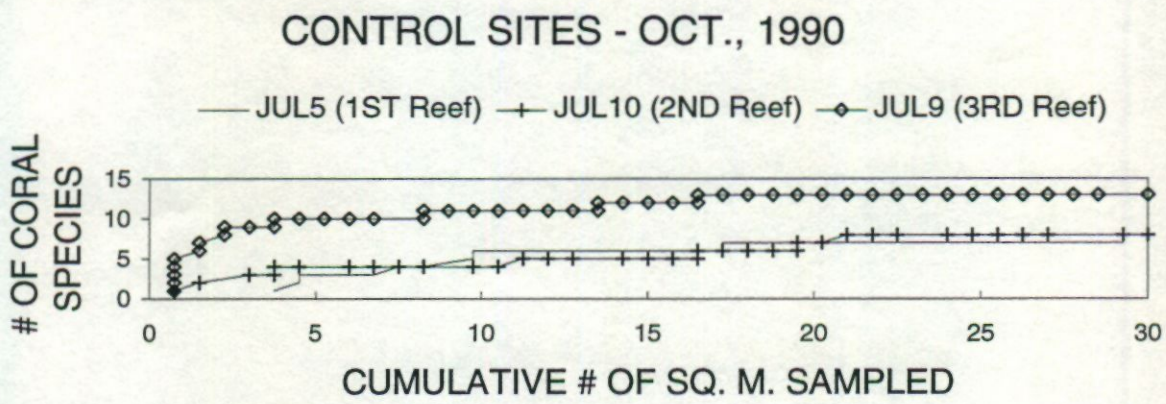

Figure 7.1 Species-Area Curves For Transects at pre-construction Control Sites J5,J10, and J9.

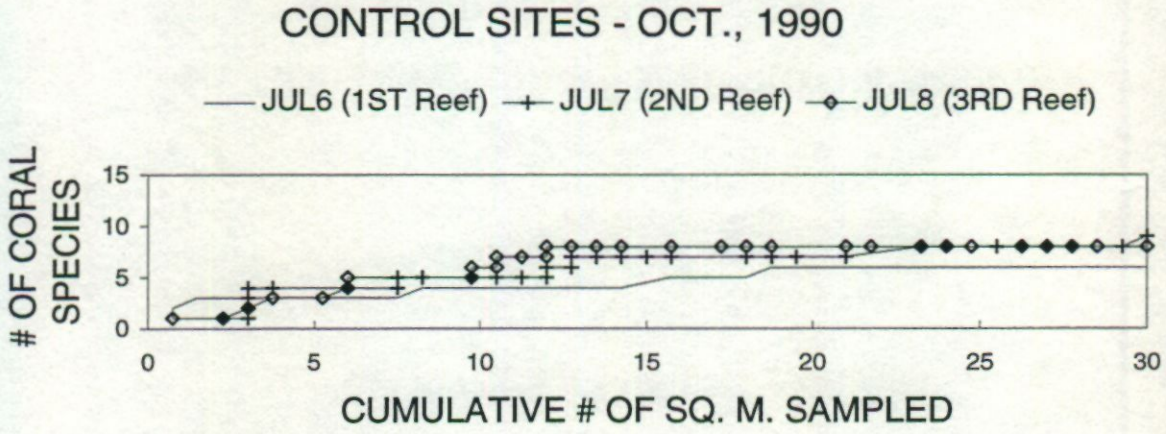

Figure 7.2 Species-Area Curves For Transects at pre-construction Control Sites J6, J7, and J8.

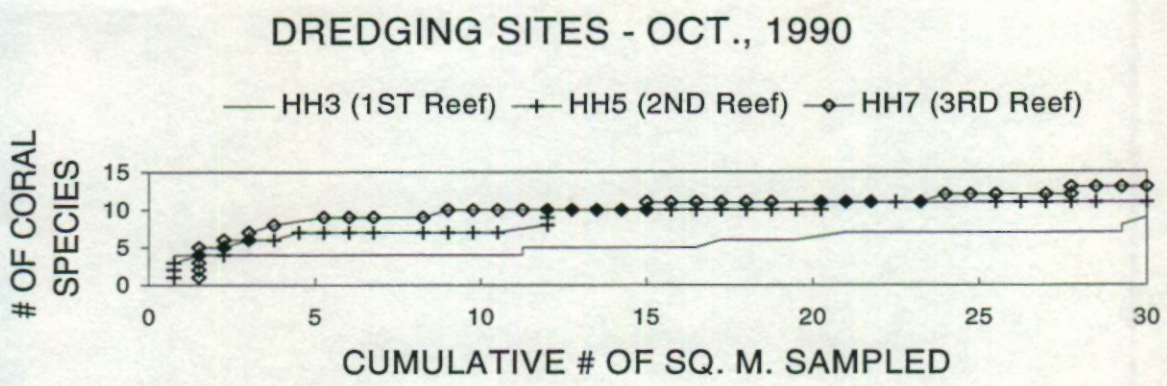

Figure 7.3 Species-Area Curves For Transects at pre-construction Dredging Sites H3, H5, and H7.

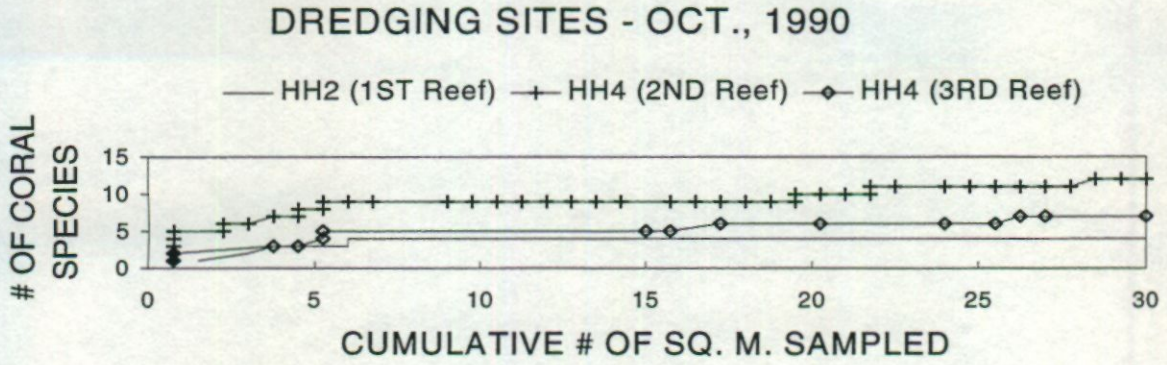

Figure 7.4 Species-Area Curves For Transects at pre-construction Dredging Sites H2, H4, and H7.

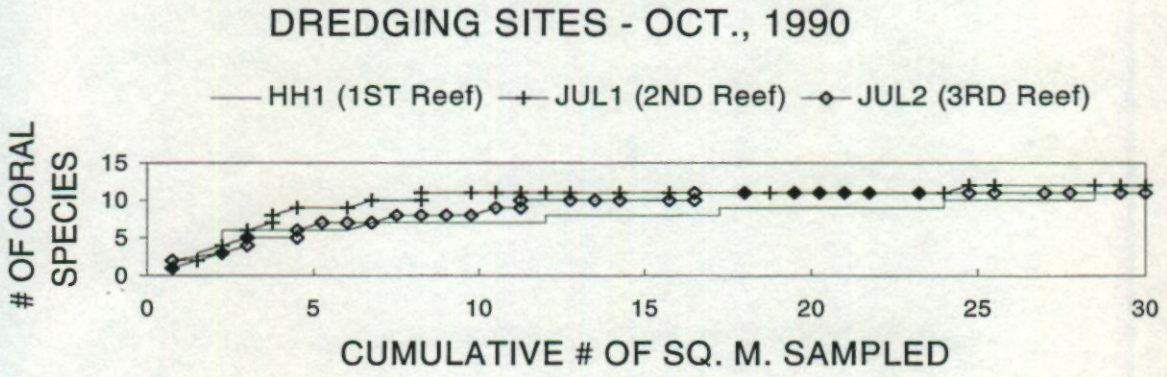

Figure 7.5 Species-Area Curves For Transects at pre-construction Dredging Sites H1, J1, and J2.

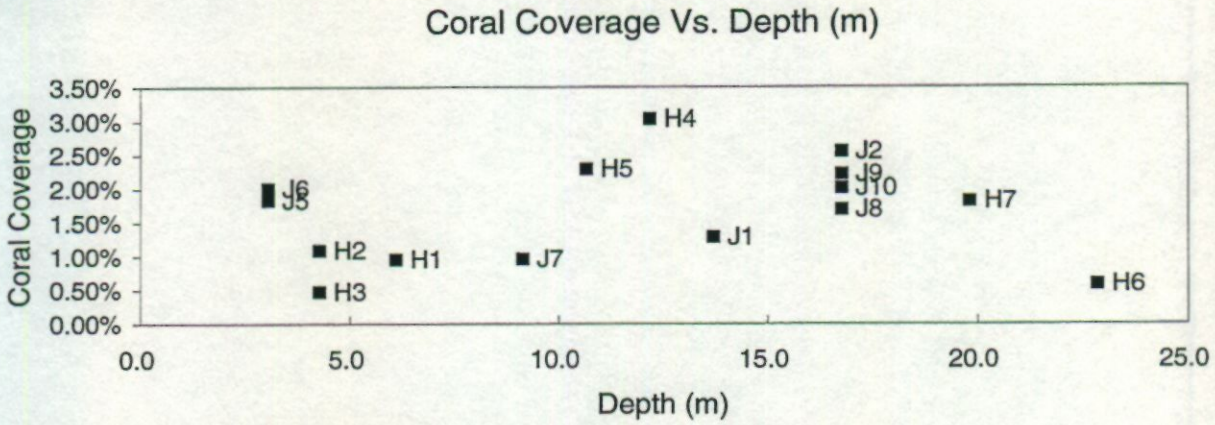

Figure 7.6 Pre-Treatment Coral Coverage at each Site versus depth.

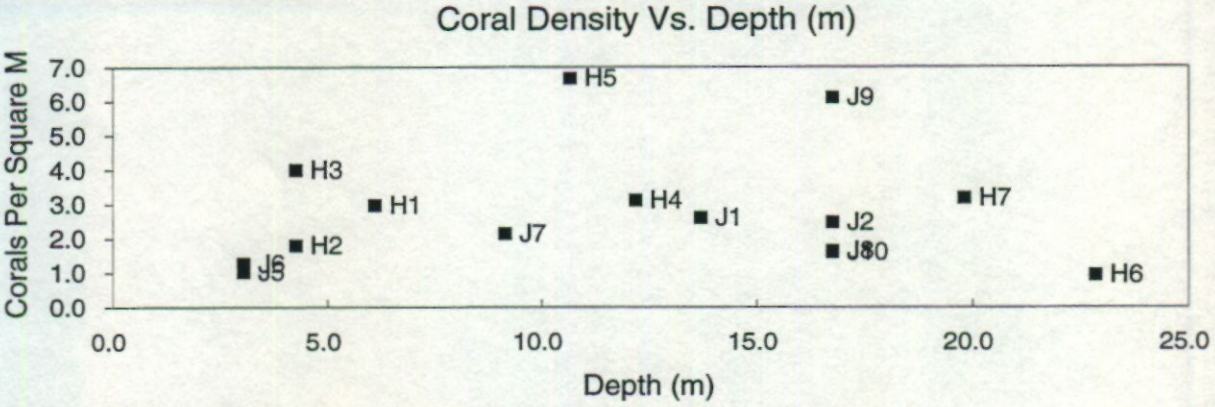

Figure 7.7 Pre-Treatment Coral Density at each Site versus depth

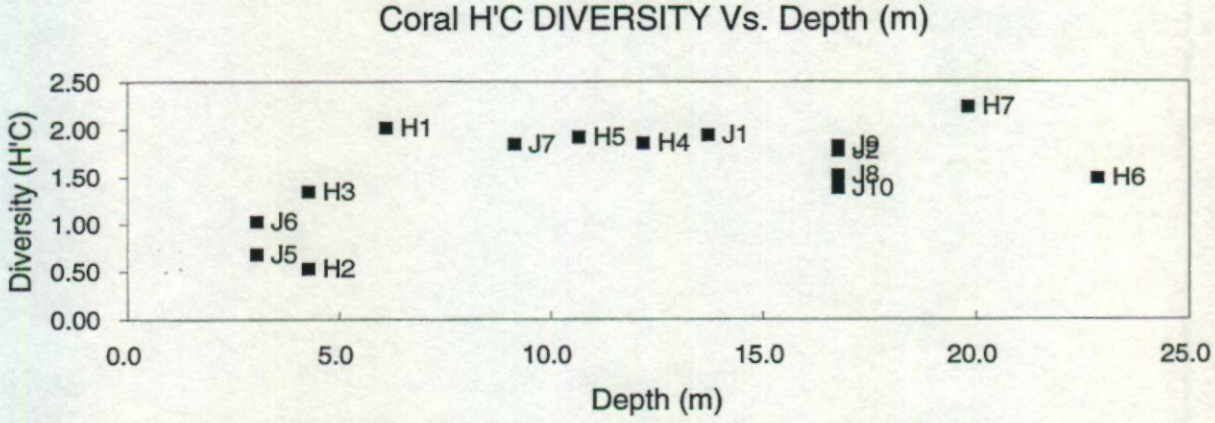

Figure 7.8 Pre-Treatment Coral H'C Diversity at each Site versus depth

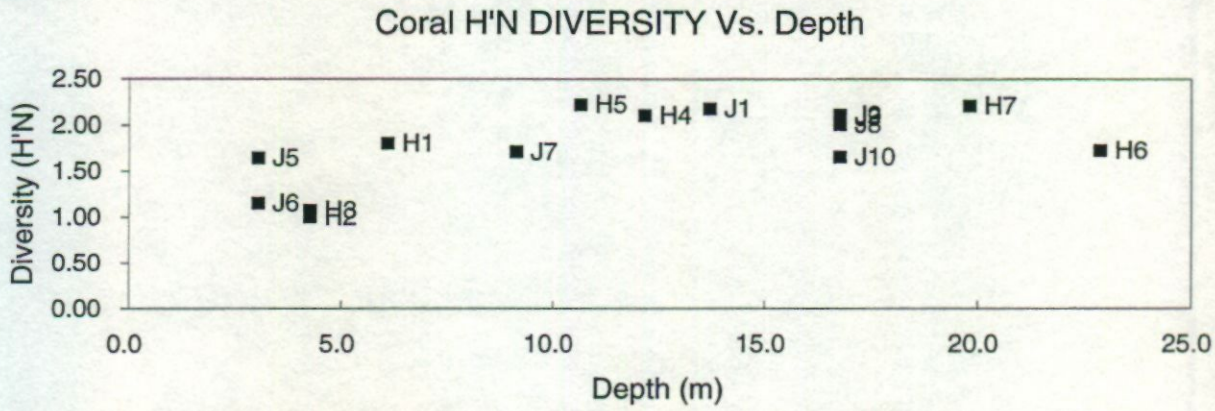

Figure 7.9 Pre-Treatment Coral H'N Diversity at each Site versus depth.

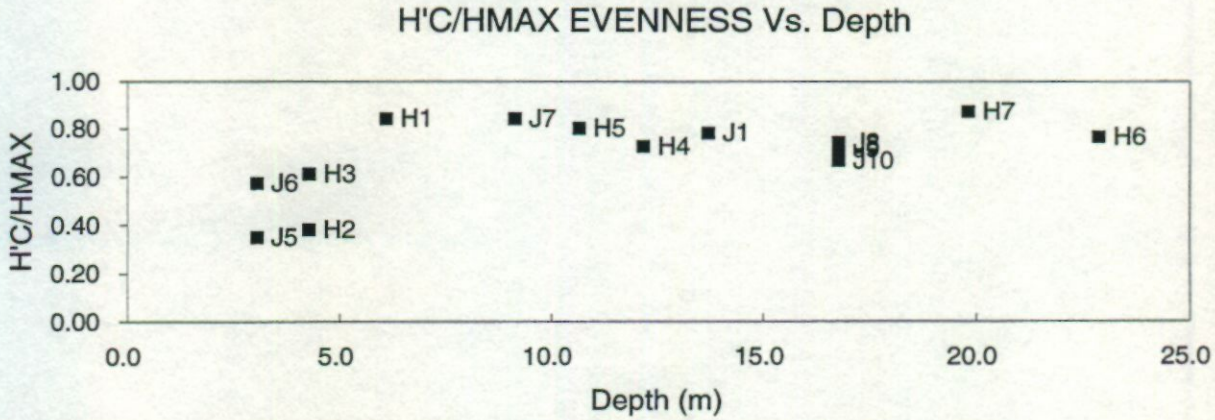

Figure 7.10 Pre-Treatment Coral H'C/HMAX Evenness at each Site vs. depth.

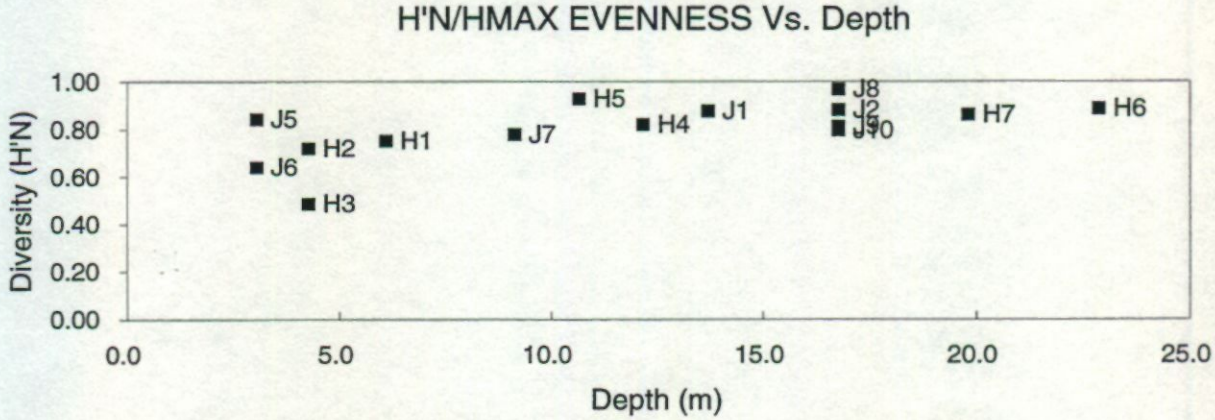

Figure 7.11 Pre-Treatment Coral H'N/Hmax Evenness at each Site vs. depth.

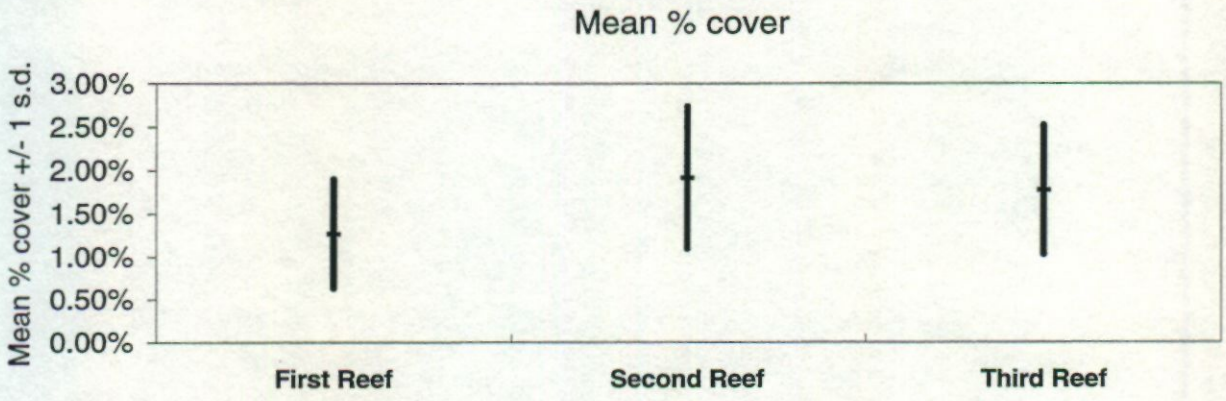

Figure 7.12 Mean Percent Coral Cover for Pre-Treatment Reefs (N=5).

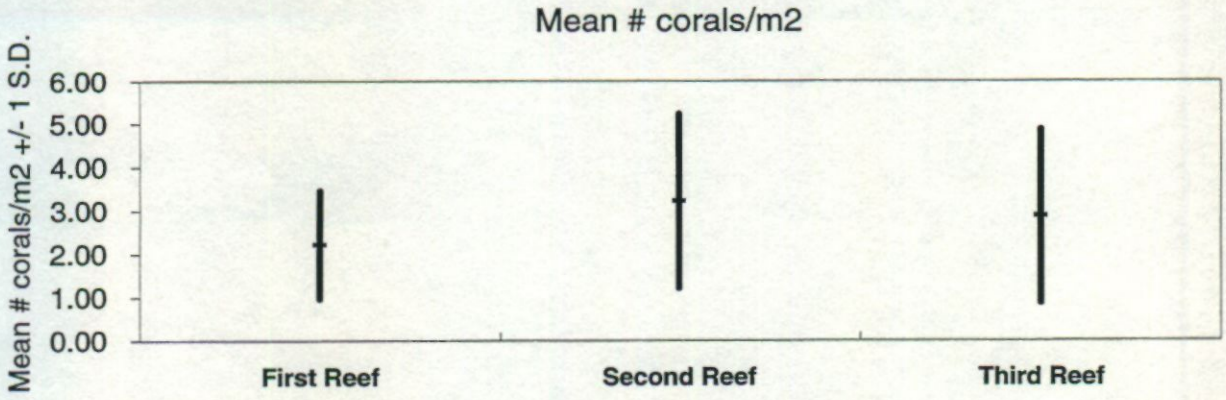

Figure 7.13 Mean Coral Density (#/m2) for Pre-Treatment Reefs (N=5).

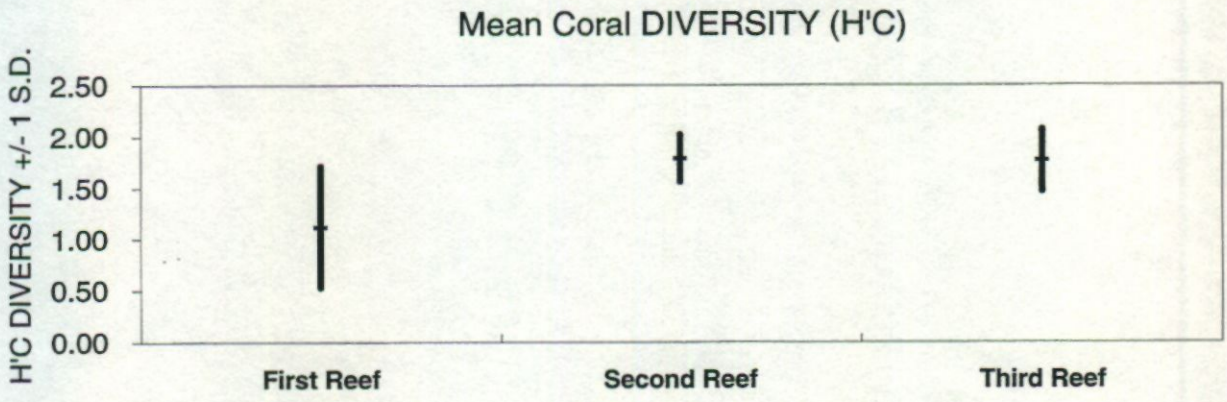

Figure 7.14 Mean Coral H'C Diversity for Pre-Treatment Reefs (N=5).

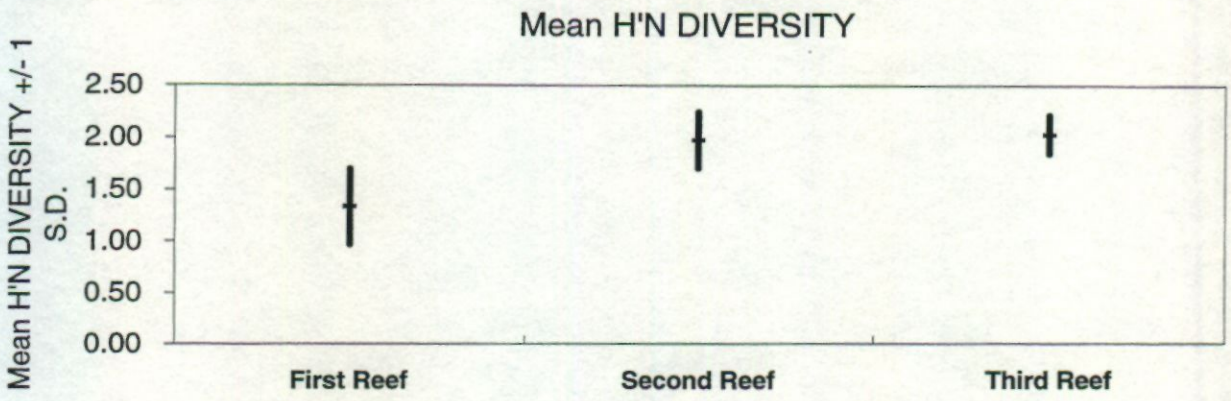

Figure 7.15 Mean Coral H'N Diversity for Pre-Treatment Reefs (N=5).

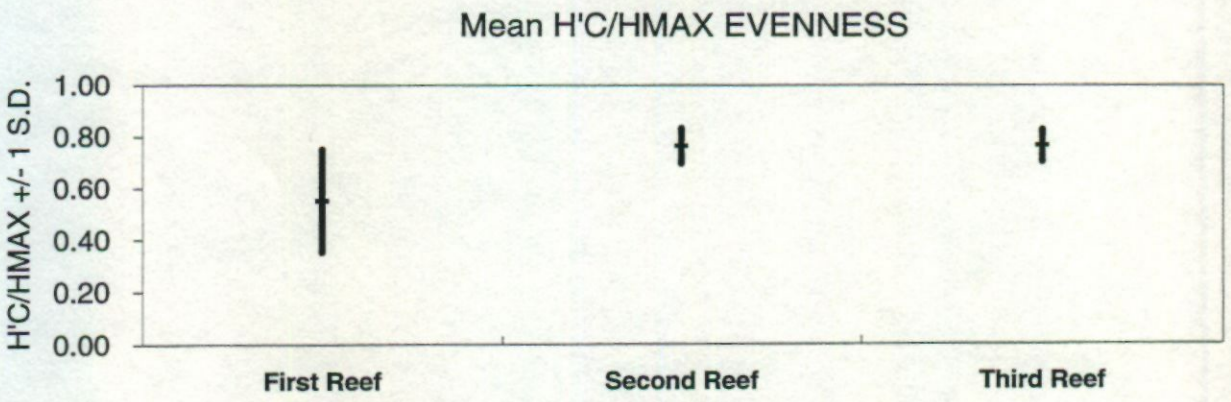

Figure 7.16 Mean Coral H'C/Hmax Evenness for Pre-Treatment Reefs (N=5).

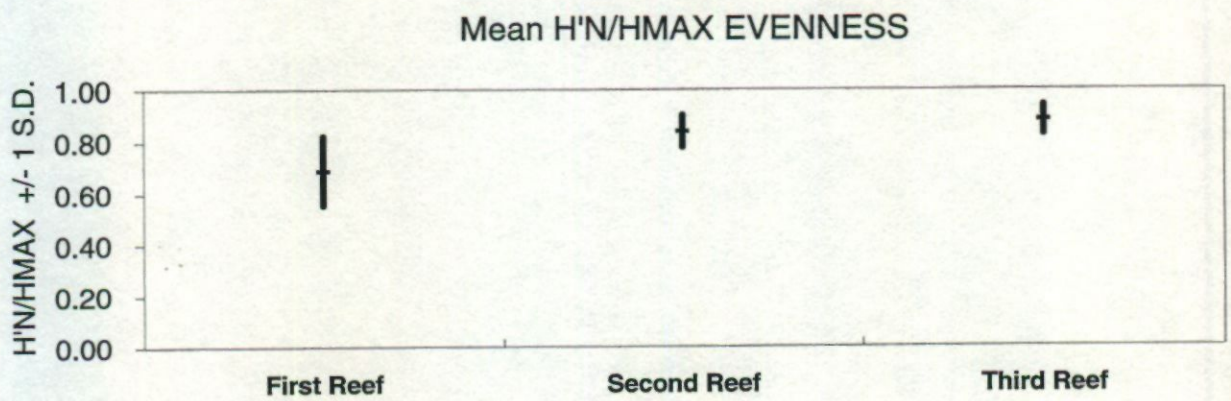

Figure 7.17 Mean Coral H'N/HMAX Evenness for Pre-Treatment Reefs (N=5).

8. Tables Appendix

8.1. Transect Tables

Table 8.1.1Pre-construction Transect Data Summary: Control Reefs, October, 1990

Reef	1ST	2ND	3RD	1ST	2ND	3RD		
SITE	J5	J10	J9	J6	J7	J8		
DATE	Oct-	Oct-	Oct-	Oct-90	Oct-90	Oct-90		
DEPTH	10'	35'	55'	10'	30'	55'	AVG	SD
TOTAL # CORALS SAMPLED	31	48	183	38	64	49	69	57.0
TOTAL REEF AREA	30	30	30	30	30	30	30	0.0
TOTAL CORAL COVERAGE	5.477	6.046	6.664	6.011	2.879	5.083	5.360	1330
# CORALS/M2	1.0	1.6	6.1	1.3	2.1	1.6	2.3	1.9
% CORAL COVERAGE	1.83%	2.02%	2.22%	2.00%	0.96%	1.69%	1.79%	0.44%
# BLEACHED CORALS	1	8	11	0	10	1	5.2	5.0
% # BLEACHED CORALS	3.2%	16.7%	6.0%	0.0%	15.6%	2.0%	7.3%	7.16%
AREA BLEACHED CORALS	0.0	50.3	369.4	50.3	536.6	19.6	171.0	225.5
% AREA BLEACHED	0.0%	0.8%	5.5%	0.8%	18.6%	0.4%	4.4%	7.28%
DIVERSITY								
# SPECIES	7	8	13	6	9	8	9	2.4
H'C	0.68	1.38	1.83	1.03	1.85	1.52	1.38	0.46
H'N	1.64	1.66	2.09	1.15	1.71	2.01	1.71	0.33
HMAX	1.95	2.08	2.56	1.79	2.20	2.08	2.11	0.26
H'C/HMAX	0.35	0.67	0.71	0.57	0.84	0.73	0.65	0.17
H'N/HMAX	0.84	0.80	0.81	0.64	0.78	0.97	0.81	0.11

Table 8.1.2 1st Post-construction Transect Data Summary: Control Reefs, October, 1991

Reef	1ST	2ND	3RD	1ST	2ND	3RD	
SITE	J5	J10	J9	J6	J7	J8	
DATE	Oct-	Oct-	Oct-	Oct-91	Oct-91	Oct-91	
DEPTH	10'	35'	55'	10'	30'	55'	AVG
TOTAL # CORALS SAMPLED	50	56	169	53	64	53	74
TOTAL REEF AREA	30	30	30	30	30	30	30
TOTAL CORAL COVERAGE	4.868	3.918	5.812	6.506	2.549	3.954	4.601
# CORALS/M2	1.7	1.9	5.6	1.8	2.1	1.8	2.5
% CORAL COVERAGE	1.62%	1.31%	1.94%	2.17%	0.85%	1.32%	1.53%
# BLEACHED CORALS	0	9	12	0	3	3	4.5
% # BLEACHED CORALS	0.0%	16.1%	7.1%	0.0%	4.7%	5.7%	5.6%
AREA BLEACHED CORALS	0.0	557.4	336.2	0.0	329.9	180.6	234.0
% AREA BLEACHED	0.0%	14.2%	5.8%	0.0%	12.9%	4.6%	6.3%
DIVERSITY							
# SPECIES	6	10	12	5	11	9	9
H'C	1.07	1.63	1.83	0.80	1.94	1.94	1.53
H'N	1.44	1.80	2.05	1.04	1.91	2.06	1.72
HMAX	1.79	2.30	2.48	1.61	2.40	2.20	2.13
H'C/HMAX	0.59	0.71	0.74	0.49	0.81	0.88	0.70
H'N/HMAX	0.81	0.78	0.83	0.65	0.80	0.94	0.80

Table 8.1.3 2nd Post-construction Transect Data Summary: Control Reefs, October, 1992

Reef	1ST	2ND	3RD	1ST	2ND	3RD		
SITE	J5	J10	J9	J6	J7	J8		
DATE	Oct-	Oct-	Oct-	Oct-92	Oct-92	Oct-92		
DEPTH	10'	35'	55'	10'	30'	55'	AVG	SD
TOTAL # CORALS SAMPLED	39	48	99	43	75	68	62	23.1
TOTAL REEF AREA	30	30	30	30	30	30	30	0.0
TOTAL CORAL COVERAGE	8.838	2.460	2.717	5.431	2.988	5.614	4.675	2465
# CORALS/M2	1.3	1.6	3.3	1.4	2.5	2.3	2.1	0.8
% CORAL COVERAGE	2.95%	0.82%	0.91%	1.81%	1.00%	1.87%	1.56%	0.82%
# BLEACHED CORALS	0	2	1	0	0	5	1.3	2.0
% # BLEACHED CORALS	0.0%	4.2%	1.0%	0.0%	0.0%	7.4%	2.1%	3.04%
AREA BLEACHED CORALS	0.0	43.1	38.5	0.0	0.0	45.6	21.2	23.3
% AREA BLEACHED	0.0%	1.8%	1.4%	0.0%	0.0%	0.8%	0.7%	0.79%
DIVERSITY								
# SPECIES	7	9	10	5	10	12	9	2.5
H'C	0.38	1.37	1.78	0.77	1.89	1.85	1.34	0.63
H'N	1.78	1.77	2.00	0.96	1.77	2.12	1.73	0.41
HMAX	1.95	2.20	2.30	1.61	2.30	2.48	2.14	0.31
H'C/HMAX	0.20	0.62	0.77	0.48	0.82	0.74	0.61	0.24
H'N/HMAX	0.91	0.81	0.87	0.59	0.77	0.85	0.80	0.11

Table 8.1.4 3rd Post-construction Transect Data Summary: Control Reefs, October, 1994

Reef	1ST	2ND	3RD	1ST	2ND	3RD		
SITE	J5	J10	J9	J6	J7	J8		
DATE	Oct-	Oct-	Oct-	Oct-94	Oct-94	Oct-94		
DEPTH	10'	35'	55'	10'	30'	55'	AVG	SD
TOTAL # CORALS SAMPLED	45	31	63	23	53	74	48	19.23
TOTAL REEF AREA	30	30	30	30	30	30	30	0
TOTAL CORAL COVERAGE	10.90	1.528	2.091	6.214	3.514	4.544	4.799	3436
# CORALS/M2	1.5	1.0	2.1	0.8	1.8	2.5	1.6	0.64
% CORAL COVERAGE	3.63%	0.51%	0.70%	2.07%	1.17%	1.51%	1.60%	1.15%
# BLEACHED CORALS	0	0	0	0	0	0	0	0
% # BLEACHED CORALS	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.00%	0
AREA BLEACHED CORALS	0.0	7.1	0.0	0.0	0.0		1.4137	3.16
% AREA BLEACHED	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0007	0.19%
DIVERSITY								
# SPECIES	7	10	9	5	11	14	9	3.14
H'C	0.73	1.44	1.78	0.51	1.64	1.98	1.34	0.60
H'N	1.47	1.99	1.89	1.12	1.90	2.23	1.77	0.40
HMAX	1.95	2.30	2.20	1.61	2.40	2.64	2.18	0.36
H'C/HMAX	0.37	0.62	0.81	0.31	0.68	0.75	0.59	0.20
H'N/HMAX	0.75	0.87	0.86	0.69	0.79	0.84	0.80	0.07

Table 8.1.5 Pre-construction Transect Data Summary: Dredging Reefs, October, 1990

Reef	1ST	2ND	3RD	1ST	2ND	3RD	1ST	2ND	3RD		
SITE	H1	J1	J2	H2	H4	H6	H3	H5	H7		
DATE	Oct-	Oct-	Oct-	Oct-90	Oct-90	Oct-90	Oct-90	Oct-90	Oct-90		
DEPTH	20'	45'	55'	14'	40'	75'	14'	35'	65'	AVG	SD
TOTAL # CORALS SAMPLED	89	78	74	54	93	28	120	200	95	92.3	48.1
TOTAL REEF AREA	30	30	30	30	30	30	30	30	30	30	0.0
TOTAL CORAL COVERAGE	2.856	3.850	7.656	3.253	9.099	1.746	1.403	6.873	5.449	4.687	2.719.
# CORALS/M2	3.0	2.6	2.5	1.8	3.1	0.9	4.0	6.7	3.2	3.1	1.6
% CORAL COVERAGE	0.95%	1.28%	2.55%	1.08%	3.03%	0.58%	0.47%	2.29%	1.82%	1.56	0.91%
# BLEACHED CORALS	5	3	3	1	4	0	0	2	5	2.6	1.9
% # BLEACHED CORALS	5.6%	3.8%	4.1%	1.9%	4.3%	0.0%	0.0%	1.0%	5.3%	2.88	2.20%
AREA BLEACHED CORALS	146.7	289.8	235.5	360.0	186.9	0.0	0.0	59.5	389.2	185.2	146.4
% AREA BLEACHED	5.1%	7.5%	3.1%	11.1%	2.1%	0.0%	0.0%	0.9%	7.1%	4.10	3.87%
DIVERSITY											
# SPECIES	11	12	11	4	13	7	9	11	13	10.1	2.98
H'C	2.02	1.94	1.78	0.53	1.86	1.49	1.34	1.92	2.24	1.68	0.51
H'N	1.80	2.18	2.11	1.00	2.11	1.73	1.07	2.23	2.21	1.83	0.48
HMAX	2.40	2.48	2.40	1.39	2.56	1.95	2.20	2.40	2.56	2.26	0.38
H'C/HMAX	0.84	0.78	0.74	0.38	0.73	0.76	0.61	0.80	0.87	0.72	0.15
H'N/HMAX	0.75	0.88	0.88	0.72	0.82	0.89	0.49	0.93	0.86	0.80	0.14

Table 8.1.6 1st Post-construction Transect Data Summary: Dredging Reefs, October, 1991

Reef	1ST	2ND	3RD	1ST	2ND	3RD	1ST	2ND	3RD		
SITE	HH1	JUL1	JUL2	HH2	HH4	HH6	HH3	HH5	HH7		
DATE	Oct-	Oct-	Oct-	Oct-91	Oct-91	Oct-91	Oct-91	Oct-91	Oct-91		
DEPTH	20'	45'	55'	14'	40'	75'	14'	35'	65'	AVG	SD
TOTAL # CORALS SAMPLED	63	104	95	108	95	33	93	158	70	91.0	34.6
TOTAL REEF AREA	30	30	30	30	30	30	30	30	30	30	0.0
TOTAL CORAL COVERAGE	2.987	4.815	6.091	2.896	8.896	1.362	1.568	6.532	4.067	4.357	2.484.
# CORALS/M2	2.1	3.5	3.2	3.6	3.2	1.1	3.1	5.3	2.3	3.0	1.2
% CORAL COVERAGE	1.00%	1.61%	2.03%	0.97%	2.97%	0.45%	0.52%	2.18%	1.36%	1.45	0.83%
# BLEACHED CORALS	2	5	1	3	2	1	1	10	0	2.8	3.1
% # BLEACHED CORALS	3.2%	4.8%	1.1%	2.8%	2.1%	3.0%	1.1%	6.3%	0.0%	2.71	1.97%
AREA BLEACHED CORALS	6.3	625.2	113.1	7.1	35.3	38.5	3.1	310.09	0.0	126.5	211.7
% AREA BLEACHED	0.2%	13.0%	1.9%	0.2%	0.4%	2.8%	0.2%	4.7%	0.0%	2.61	4.21%
DIVERSITY											
# SPECIES	9	8	13	3	12	8	3	12	12	8.9	3.82
H'C	1.84	1.96	1.87	0.40	1.78	1.82	0.60	1.68	2.04	1.55	0.61
H'N	1.74	1.95	2.15	0.68	2.13	1.90	0.60	2.61	2.17	1.77	0.68
HMAX	2.20	2.08	2.56	1.10	2.48	2.08	1.10	2.48	2.48	2.06	0.58
H'C/HMAX	0.84	0.94	0.73	0.36	0.72	0.88	0.55	0.68	0.82	0.72	0.18
H'N/HMAX	0.79	0.94	0.84	0.62	0.86	0.91	0.55	1.05	0.87	0.83	0.16

Table 8.1.7 2nd Post Construction Transect Data Summary: Dredging Reefs, October, 1992

Reef	1ST	2ND	3RD	1ST	2ND	3RD	1ST	2ND	3RD		
SITE	HH1	JUL1	JUL2	HH2	HH4	HH6	HH3	HH5	HH7		
DATE	Oct-	Oct-	Oct-	Oct-92	Oct-92	Oct-92	Oct-92	Oct-92	Oct-92		
DEPTH	20'	45'	55'	14'	40'	75'	14'	35'	65'	AVG	SD
TOTAL # CORALS SAMPLED	84	74	69	90	93	20	97	190	60	86.3	45.4
TOTAL REEF AREA	30	30	30	30	30	30	30	30	30	30	0.0
TOTAL CORAL COVERAGE	2.571	2.735	6.676	2.971	5.726	1.390	1.432	7.841	3.278	3.847	2327
# CORALS/M2	2.8	2.5	2.3	3.0	3.1	0.7	3.2	6.3	2.0	2.9	1.5
% CORAL COVERAGE	0.86%	0.91%	2.23%	0.99%	1.91%	0.46%	0.48%	2.61%	1.09%	1.28	0.78%
# BLEACHED CORALS	3	2	4	2	3	1	2	1	0	2.0	1.2
% # BLEACHED CORALS	3.6%	2.7%	5.8%	2.2%	3.2%	5.0%	2.1%	0.5%	0.0%	2.79	1.89%
AREA BLEACHED CORALS	60.3	148.8	1166.	22.8	180.6	19.6	81.7	19.63	0.0	188.8	371.7
% AREA BLEACHED	2.3%	5.4%	17.5%	0.8%	3.2%	1.4%	5.7%	0.3%	0.0%	4.06	5.44%
DIVERSITY											
# SPECIES	8	13	12	3	15	4	4	11	14	9.3	4.69
H'C	1.66	2.21	1.80	0.42	1.78	1.08	0.54	1.48	1.93	1.43	0.62
H'N	1.72	2.21	2.24	0.67	2.28	1.32	0.64	2.51	2.29	1.76	0.72
HMAX	2.08	2.56	2.48	1.10	2.71	1.39	1.39	2.40	2.64	2.08	0.63
H'C/HMAX	0.80	0.86	0.72	0.38	0.66	0.78	0.39	0.62	0.73	0.66	0.17
H'N/HMAX	0.83	0.86	0.90	0.61	0.84	0.95	0.46	1.05	0.87	0.82	0.18

Table 8.1.8 3rd Post-construction Transect Data Summary: Dredging Reefs, October, 1994

Reef	1ST	2ND	3RD	1ST	2ND	3RD	1ST	2ND	3RD		
SITE	HH1	JUL1	JUL2	HH2	HH4	HH6	HH3	HH5	HH7		
DATE	Oct-94	Oct-94	Oct-94	Oct-94	Oct-94	Oct-	Oct-94	Oct-94	Oct-94		
DEPTH	20'	45'	55'	14'	40'	75'	14'	35'	65'	AVG	SD
TOTAL # CORALS SAMPLED	69	73	60	32	83	32	60	80	59	60.9	18.5
TOTAL REEF AREA	30	30	30	30	30	30	30	30	30	30	0.0
TOTAL CORAL COVERAGE	2.488	3.002	6.456	2.767	4.655	1.340	2.044	2.857	3.665	3.253	1523
# CORALS/M2	2.3	2.4	2.0	1.1	2.8	1.1	2.0	2.7	2.0	2.0	0.6
% CORAL COVERAGE	0.83%	1.00%	2.15%	0.92%	1.55%	0.45%	0.68%	0.95%	1.22%	1.08	0.51
# BLEACHED CORALS	0	0	0	0	0	0	0	0	0	0.0	0.0
% # BLEACHED CORALS	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.00	0.00
AREA BLEACHED CORALS	19.6	155.1	1470.0	0.0	72.2	15.0	19.6	5.00	0.0	195.1	480.6
% AREA BLEACHED	0.8%	5.2%	22.8%	0.0%	1.6%	1.1%	1.0%	0.2%	0.0%	3.61	7.36
DIVERSITY											
# SPECIES	10	12	12	3	13	8	5	11	12	9.6	3.50
H'C	1.69	2.13	1.70	0.14	1.92	1.51	0.77	1.00	1.82	1.41	0.64
H'N	1.98	1.79	2.33	0.86	2.26	1.81	1.17	2.46	1.91	1.84	0.53
HMAX	2.30	2.48	2.48	1.10	2.56	2.08	1.61	2.40	2.48	2.17	0.50
H'C/HMAX	0.73	0.86	0.69	0.13	0.75	0.72	0.48	0.42	0.73	0.61	0.23
H'N/HMAX	0.86	0.72	0.94	0.79	0.88	0.87	0.73	1.03	0.77	0.84	0.10

8.2. Quadrat Tables

Table 8.2.1 Macroepibenthos abundances for each station for the Pre-construction, first Post-construction, second Post-construction, and third Post-construction sampling periods.

STATION HH 1 20 feet	1990	1991	1992	1994
Phylum Chlorophyta				
Halimeda tuna	9	0	0	0
Phylum Porifera	16+	23	28	23
Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia felix	2	1	0	1
Ircinia campana	2	1	0	0
Family Dysideidae				
Dysidea etheria	0	1	0	0
Order Haplosclerida				
Family Haliclonidae				
Haliclona compressa	1	1	2	2
Niphates erecta	0	1	0	0
Dasychalina cyathina	0	0	0	2
Order Poecilosclerida				
Family Esperiopsidae				
Desmapsamma anchorata	0	1	1	2
Family Mycalidae				
Ulosa reutzleri	0	3	0	0
Order Hadromerida				
Family Spirastrellidae				
Anthosigmella varians	3	5	7	3
Order Axinellida				
Family Axinellidae				
Teichaxinella morchella	0	3	2	1
Pseudaxinella lunaecharta	0	0	2	0
Order Choristida				
Family Craniellidae				
Cinachyra alloclada	7	5	12	6
Family Chondrillidae				
Chondrosia reniformis	N	1a	2	6
Phylum Coelenterata				
Class Anthozoa				
Order Gorgonacea	58+	51	60	41
Family Briaeridae				
Briareum asbestinum	N	1	1	1
Family Plexauridae				
Eunicea succinea	10	10	20	19

Eunicea sp.	6	8	3	2
Muricea muricata	4	5	4	2
Plexaurella fusifera	11	10	12	6
Plexaurella grisea	4	2	0	0
Plexaura flexuosa	4	1	2	1
Family Gorgoniidae				
Pseudopterogorgia acerosa	3	2	4	1
Pseudopterogorgia american	1	1	2	1
Pterogorgia guadalupensis	14	11	11	9
Pterogorgia citrina	0	0	1	0
Order Zoanthidea (colonial anemones)				
Palythoa caribea	1	0	0	0
Zoanthus sociatus	0	1	0	0
Order Scleractinia				
Dichócoenia stokesi	0	3	0	1
Porites astreoides	2	3	1	2
Siderastrea siderea	12	10	1	1
Solenastrea bournoni	1	1	1	1
Stephanocoenia micheleni	0	4	0	0
Meandrina meandrites	0	0	1	2

* colonies less than 3 cm in diameter
N= numerous colonies, unable to distinguish individuals
a Apparent individuals had fused into one large colony in 1991.

STATION HH 2 12-15 Feet	1990	1991	1992	1994
Phylum Chlorophyta				
Udotea flabellum	1	0	0	0
Halimeda tuna	N	N	N	N
Phylum Rhodophyta				
Unidentified sp.	0	0	N	N
Phylum Porifera	30	24	15	8
Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia campana	1	1	0	0
Family Dysideidae				
Dysidea etheria	5*	0	0	0
Order Haplosclerida				
Family Haliclonidae				
Haliclona compressa	0	2	0	3
Niphates erecta	3	2	0	1
Order Hadromerida				
Family Spirastrellidae				

Anthosigmella varians	4	5	4	3
Order Axinellida				
Family Axinellidae				
Pseudaxinella lunaecharta	0	0	1	1
Order Choristida				
Family Craniellidae				
Cinachyra alloclada	15	14	10	0?
Family Chondrillidae				
Chondrilla nucula	2	0	0	0
Phylum Coelenterata				
Class Anthozoa				
Order Gorgonacea	51	51	51	36
Family Briareidae				
Briareum asbestinum	1	1	0	0
Family Plexauridae				
Eunicea succinea	32	34	35	20
Eunicea asperula	4	3	5	5
Muricea muricata	6	4	5	4
Plexaurella fusifera	7	6	6	6
Plexaura flexuosa	0	2	0	0
Family Gorgoniidae				
Pseudopterogorgia acerosa	1	1	1	1
Order Zoantharia				
Zoanthus sociatus	0	1	0	1
Order Scleractinia				
Siderastrea siderea	17	12	2	1
Solenastrea bournoni	1	1	2	1
Stephanocoenia michelini	1	0	0	0
Porites cf. P. branneri	0	0	1	0
Phylum Echinodermata				
Eucidaris tribuloides	0	5	0	0

N= numerous clumps

*= colonies less than 3 cm in diameter

STATION HH #3 15-18 Feet	1990	1991	1992	1994
Phylum Rhodophyta				
Ceramium sp. cf. nitens	3	1	0	N
Unidentified sp.	0	0	15	0
Phylum Chlorophyta				
Udotea occidentalis	0	1	4	0
Phylum Porifera	75	50	56	55

Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia strobilina	3	2	2	1
Family Dyseidae				
Dysidea etheria	6	0	0	2
Order Haplosclerida				
Family Haliclonidae				
Haliclona sp.	2	2	1	0
Niphates erecta	0	0	1	5
Order Poecilosclerida				
Family Esperiopsidae				
Iotrochota birotulata	1	0	0	0
Order Hadromerida				
Family Spirastrellidae				
Anthosigmella varians	1	1	1	1
Order Choristida				
Family Craniellidae				
Cinachyra alloclada	62	44	51	45
Family Chondrillidae				
Chondrilla nucula	0	1	0	0
Phylum Coelenterata				
Class Anthozoa				
Order Gorgonacea	64	43	34#	24
Family Plexauridae				
Eunicea fusca	7	4	1	
Eunicea succinea	1	1	5	7
Muricea muricata	51	34*	24##	
	10###			
Plexaurella fusifera	1	1	1	1
Family Gorgoniidae				
Pseudopterogorgia acerosa	3	2	2	3
Pterogorgia guadalupensis	1	1**	1	1
Order Zoanthidea				
Palythoa caribea	1 0	0	0	
Zoanthus sociatus	0	1	1	1
Order Scleractinia				
Astrangia solitaria	2	0	2	0
Siderastrea siderea	3***	4***	26####	2?
Solenastrea sp.	0	0	0	1

*= 11 colonies damaged in 1991
**= colony damaged
*** = colonies less than 3 cm in diameter
# = 12 gorgonian colonies dead
= 9 colonies damaged in 1992
= damaged colonies died ??
= 25/26 colonies are new recruits 1-2 cm diameter

STATION HH 4 37-40 Feet	1990	1991	1992	1994
Phylum Phaeophyta				
Dictyota bartayresii	0	N	0	0
Phylum Porifera	27	30	27	25
Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia strobilina	2	1	2	2
Ircinia sp.	3	0	1	3
Ircinia campana	0	1	0	0
Aplysina cauliformis	6	7	7	7
Family Dysideidae				
Dysidea etheria	1	0	0	0
Order Haplosclerida				
Family Haliclonidae				
Haliclona compressa	3	2	4	2
Haliclona sp.	3	2	2	3
Callyspongia vaginalis	1	0	1	1
Niphates erecta	2	2	2	0
Dasychalina cyathina	0	0	1	1
Family Nepheliospongiidae				
Xestospongia muta	1	1	0	0
Order Poecilosclerida				
Family Esperiopsidae				
Iotrochota birotulata	1	1	1	2
Desmapsamma anchorata	1	2	2	1
Family Microcionidae				
Thalysias juniperina	1	2	1	1
Family Mycalidae				
Ulosa reutzleri	1	5	0	0
Order Hadromerina				
Family Spirastrellidae				
Anthosigmella varians	0	3	0	0
Spirastrella coccinea	0	0	1	2
Order Axinellida				
Family Axinellidae				
Teichaxinella morchella	1	1	0	0
Pseudaxinella lunaecharta	0	0	2	0
Phylum Coelenterata				
Class Hydrozoa				
Order Milleporina				
Millepora alcicornis	4	2	3	4
Class Anthozoa				
Order Gorgonacea	14+	11	6+	7+
Family Briareidae				
Briareum asbestinum	N	1	N	N

Family Plexauridae				
Eunicea fusca	5	4	2	2
Eunicea calyculata	1	1	1	0
Eunicea knighti	1	0	0	0
Muricea muricata	1	1	0	0
Plexaura flexuosa	3	2	2	2
Plexaurella fusifera	1	1	0	0
Family Gorgoniidae				
Gorgonia ventalina	1	1	0	0
Pseudoplexaura acerosa	0	0	0	2
Order Scleractinia				
Dichocoenia stokesi	1	1	2	2
Diploria labyrinthiformis	1	1	0	0
Porites branneri	1	1	1	1
Montastrea cavernosa	3	2	1	1
Montastrea annularis	1*	1	1	1
Siderastrea siderea	3**	2**	3#	3
Stephanocoenia michelini	3***	3	4##	3##
Solenastrea bournoni	0	0	1	1
Dichoecoenia stokesi	0	0	2	2
Scolymia sp.	0	0	1##	0
Meandrina meandrites	0	0	1##	1

N= numerous colonies, unable to distinguish individuals

*= Small colony missed in first survey
**= colony less than 3 cm diameter
***= damaged by abrasion at time of observation
= 2 colonies less than 3 cm
= 1 colony with deads spots; in 1994 this colony was ~25% dead

STATION HH # 5 32-35 Feet	1990	1991	1992	1994
Phylum Phaeophyta				
Dictyota bartayresii	0	N	0	18
Phylum Porifera	45	38	46	47
Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia strobilina	1	1	1	1
Ircinia felix	0	0	1	0
Aplysina cauliformis	8	7	6	14
Aplysina sp.	1	0	1	0
Family Dysideidae				
Dysidea etheria	1	0	0	0
Order Haplosclerida				
Family Haliclonidae				

Haliclona compressa	12	7	13	11	
Niphates erecta	9	7	9	6	
Dasychalina cyathina	2	4	3	3	
Callyspongia plicifera	1	0	1	2	
Family Nepheliospongiidae					
Xestospongia muta	1	1	1	1	
Order Poecilosclerida					
Family Esperiopsidae					
Iotrochota birotulata	7	5	6	5	
Desmapsamma anchorata	2	2	0	0	
Family Mycalidae					
Ulosa reutzleri	0	1	1	1	
Family Microcionidae					
Thalysias juniperina	0	1	1	1	
Order Hadromerida					
Family Spirastrellidae					
Anthosigmella varians	2	2	2	2	
Phylum Coelenterata					
Class Anthozoa					
Order Gorgonacea	13	8	10	10+	
Family Briareidae					
Briareum asbestinum	1	1	1	N	
Family Plexauridae					
Eunicea calyculata	3*	1	0	2	
Eunicea tourneforti	1	0	0	0	
Eunicea knighti	1	1	0	0	
Eunicea fusca	1	1	4	2	
Muricea sp.	0	1*	1	1	
Plexaura flexuosa	2*	1	3	3	
Plexaurella fusifera	2	0	0	0	
Family Gorgoniidae					
Pseudopterogorgia acerosa	2	2	1	1	
Order Zoanthidea					
Palythoa caribea	1	2	3	3	
Order Scleractinia					
Agaricia sp.	0	1**	0	0	
Dichocoenia stokesi	2**		1	3#	1
Meandrina meandrites	1	0	1##	1##	
Montastrea cavernosa	3**	2	2	2	
Siderastrea siderea	2**	1	2	1	
Stephanocoenia michelini	1**	1	1	1	
Porites cf., P. branneri	0	0	1	1	

*= colonies 5 cm in length or less in diameter
**= number includes one colony 3 cm or less in diameter
= 1 colony 1/3 dead; 1 colony 3 cm or less in diameter
= 12 cm colony bleached since 1992??

STATION HH #6 75-77 Feet	1990	1991	1992	1994
Phylum Porifera	45	64	35	49
Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia campana	1	3	3	2
Ircinia strobilina	2	1	1	0
Ircinia felix	0	0	1	2
Aplysina cauliformis	12	18	12	22
Pseudoceratina crassa	3	2	2	2
Family Dysideidae				
Dysidea etheria	2	8	0	0
Order Haplosclerida				
Family Haliclonidae				
Haliclona sp.	1	1	0	2
Callyspongia plicifera	0	0	1	0
Callyspongia vaginalis	3	1	2	2
Callyspongia fallax	0	0	0	1
Niphates erecta	5	6	3	4
Dasychalina cyathina	0	0	0	1
Callyspongia plicifera	2	2	0?	2
Family Nepheliospongiidae				
Xestospongia muta	1	1	1	1
Order Poecilosclerida				
Family Esperiopsidae				
Iotrochota birotulata	2	4	1	1
Desmapsamma anchorata	6	11	0	1
Family Mycalidae				
Ulosa reutzleri	0	1	1	1
Family Microcionidae				
Thalysias juniperina	0	0	1	1
Order Axinellida				
Family Agelasidae				
Agelas conifera	0	0	1	1
Family Axinellidae				
Pseudaxinella lunaecharta	0	0	1	0
Homaxinella rudis	2	2	2	1
Teichaxinella morchella	1	2	1	1
Didiscus sp.	1	1	0	0
Order Choristida				
Family Craniellidae				
Cinachyra alloclada	1	0	1	1
Phylum Coelenterata				
Class Hydrozoa				
Order Milleporina				
Millepora alcicornis	0	0	2#	1

Class Anthozoa				
Order Gorgonacea	12+	13+	15+	13+
Family Briareidae				
Briareum asbestinum	N	N	N	N
Family Plexauridae				
Eunicea palmeri	5	3a	2	4
Eunicea calyculata	1	0	1	1
Eunicea asperula	0	0	2	1
Eunicea fusca	0	2	0	0
Muricea elongata	3	2	0	0
Plexaura flexuosa	2	2	1	2
Muriceopsis petila	0	0	4	1
Pseudoplexaura sp.	0	1	2	1
Family Gorgoniidae				
Pseudopterogoriga americana	0	1	1	1
Pseudopterogorgia acerosa	0	1	1	1
Order Scleractinia				
Meandrina meandrites	1*	1	1	0
Montastrea annularis	1**	1**	1**	1

= growing on too dead gorgonians

a This species tends to anastomose with nearby colonies of the same species, possibly accounting for the apparent decrease.

*= Colony 3 cm in diameter or less

**= Colony dead at the top

N= Numerous colonies, unable to distinguish individual colonies

Note: The bottom in this area, approximately 200m from the borrow area,was covered with silt at the time of the 1991 survey.

STATION HH #7 60-65 Feet	1990	1991	1992	1994
Phylum Chlorophyta				
Halimeda goreauii	N	N	N	N
Phylum Porifera	50	84	55	46+
Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia strobilina	2	2	1	1
Ircinia felix	0	2	4	2

Aplysina cauliformis	13	18	11	10
Aplysina fistularis	0	1	4	1
Aplysina sp.	0	0	0	2
Pseudoceratina crassa	5	5	1	1
Family Dysideidae				
Dysidea etheria	0	11	2	2
Order Haplosclerida				
Family Haliclonidae				
Haliclona sp.	1	1	1	1
Haliclona compressa	1	1	2	2
Callyspongia vaginalis	1	0	0	1
Niphates erecta	7	12	10	7
Dascyhalina cyathina	3	2	3	2
Family Nepheliospongiidae				
Xestospongia muta	0	1	1	0
Order Hadromeridae				
Family Spirastrellidae				
Spirastrella coccinea	0	0	1	2
Order Poecilosclerida				
Family Esperiopsiade				
Iotrochota birotulata	7	10	5	7
Desmapsamma anchorata	5	6	2	1
Family Mycalidae				
Mycale sp.(undescribed)	3	4	0	0
Ulosa reutzleri	1	4	0	1
Family Microcionidae				
Thalysias juniperina	0	0	2	1
Order Axinellida				
Family Axinellidae				
Teichaxinella morchella	1	1	2	1
Pseudaxinella lunaecharta	0	3	2	1
Phylum Coelenterata				
Class Hydrozoa				
Order Milleporina				
Millepora alcicornis	0	4	0	1[a]
Class Anthozoa				
Order Gorgonacea	11	12	6+	4+
Family Briareidae				
Briareum asbestinum	1	1	N	N
Family Plexauridae				
Eunicea calyculata	1	1	2	2
Eunicea knighti	1	1	0	0
Eunicea succinea	1	1	0	0
Eunicea fusca	3	4	2	1
Plexaura flexuosa	3	3	1	0
Family Gorgoniidae				
Pseudopterogorgia americana	1	1	1	0[a]

Order Scleractinia				
Dichocoenia stokesi	1	1	1[b]	1[b]
Eusmilia fastigiata	1	0	0	0
Montastrea cavernosa	2[c]	2	3	2[c]
Siderastrea siderea	1	1	1	2[c]
Stephanocoenia michelini	1	1	1	1
Porites astreoides	0	0	1	0

N= Numerous thalli, unable to distinguish individuals

[a]= Pseudopterogorgia americana, mostly covered with M. alcicornis
[b]= 1colony >99% dead
[c]=Includes 1 individual 3 cm in diameter

STATION JUL #1 40 Feet	1990	1991	1992	1994
Phylum Phaeophyta				
Dictyota bartayresii	0	N	0	0
Phylum Porifera	21	25	14	13
Class Demospongia				
Order Keratosa				
Family Spongiidae	1	1	1	1
Ircinia campana	1	1	0	0
Ircinia felix	1	2	2	2
Aplysina cauliformis	1	1	0	0
Aplysina fistularis	1	0	1	1
Aplysina sp.	1	1	1	1
Order Haplosclerida				
Family Haliclonidae				
Haliclona compressa	1	2	1	0
Haliclona sp.	1	0	1	1
Callyspongia vaginalis	1	1	0	0
Dasychalina cyathina	4	5	0	1
Niphates erecta	2	2	4	1
Order Poecilosclerida				
Family Esperiopsidae				
Iotrochota birotulata	1	1	0	0
Desmapsamma anchorata	1	1	0	0
Family Mycalidae				
Ulosa reutzleri	0	1	1	1
Family Microcionidae				
Thalysias juniperina	2	1	0	1
Order Hadromerida				
Family Spirastrellidae				
Spirastrella coccinea	2[a]	2	1	3
Anthosigmella varians	1	0	0	0
Order Axinellidae				

Family Axinellidae				
Pseudaxinella lunaecharta	0	3	1	0
Phylum Coelenterata				
Class Hydrozoa				
Millepora alcicornis	0	1	1	3
Class Anthozoa				
Order Gorgonacea	22+	19	20+	16
Family Briareidae				
Briareum asbestinum	N	1	N	1
Family Plexauridae				
Eunicea calyculata	2	2	2	1
Eunicea asperula	4[b]	2	2	1
Eunicea fusca	2	3	3	3
Plexaura flexuosa	4	4	2	2
Family Gorgoniidae				
Pseudopterogorgia acerosa	1	1	3	5
Pseudopterogorgia americana	8	6	6	2
Gorgonia ventalina	0	0	1	1
Order Scleractinia				
Dichocoenia stokesi	3*	3*	2#	1
Meandrina meandrites	1*	2*++	0?	1
Montastrea cavernosa	1	1	0	0
Montastrea annularis	0	1*	1	0
Porites astreoides	1	0	0	0
Siderastrea radians	1	2*	1	1
Solenastrea hyades	1	0	0	0
Stephanocoenia michelini	4**	4**+	3##	2

N= Numerous colonies, unable to distinguish individuals
[a] Not reported in 1990; probably overlooked
[b]Not reported in 1990; erroneously referred to other Eunicea spp.
*= includes one individual less than 3 cm diameter
**= includes one individual 3/4 dead
+ = includes 2 specimens bleached at time of observation
++ = specimen damaged at time of observation
N.B. not included in above totals: 1 colony D. stokesi and 1 colony M. cavernosa completely dead and covered with Briareum.
#= one 3 cm specimen and one 12 cm specimen 1/2 dead
##= One 3 cm individual and one 15 cm individual 1/2 dead

STATION JUL # 2 45-50 feet	1990	1991	1992	1994
Phylum Phaeophyta				
Dictyota bartayresii	N	N	0	0
Phylum Porifera	40	34	33	35

Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia felix	4	3	6	5
Ircinia strobilina	1	3	4	3
Ircinia sp.	1	0	1	0
Family Dysideidae				
Dysidea etheria	0	1	0	0
Order Haplosclerida				
Family Haliclonidae				
Haliclona compressa	9	5	6	6
Niphates erecta	1	5	5	0
Dasychalina cyathina	1	1	0?	1
Callyspongia vaginalis	2	2	2	5
Callyspongia plicifera	3	2	3	2
Family Nepheliospongiidae				
Xestospongia muta	2	3*	3	3
Order Hadromerina				
Family Spirastrellidae				
Anthosigmella varians	0	1	0	0
Spirastrella coccinea	0	0	0	1
Order Poecilosclerida				
Family Agelasidae				
Agelas clathrodes	1	1	1	1
Agelas conifera	0	0	2	1
Family Esperiopsidae				
Iotrochota birotulata	2	1	1	1
Desmapsamma anchorata	0	1		0
Family Microcionidae				
Thalysias juniperina	1	0	0	1
Family Mycalidae				
Ulosa reutzleri	1	2	0	1
Order Axinellida				
Family Axinellidae				
Pseudaxinella lunaecharta	4	4	3	3
Order Choristida				
Family Craniellidae				
Cinachyra alloclada	0	0	1	0
Phylum Coelenterata				
Class Hydrozoa				
Millepora alcicornis	0	1	1	2
Class Anthozoa				
Order Gorgonacea	15+	11+	10	14
Family Briareidae				
Briareum asbestinum	N	N	1	1
Family Plexauridae				
Eunicea calyculata	1	1	1	1
Eunicea fusca	9	5	4	5
Plexaura flexuosa	1	1	2	2

Family Gorgoniidae				
Gorgonia ventalina	1	1	0	0
Pseudopterogorgia americana	2	2	2	5
Order Zoanthidea				
Palythoa caribea	2	2	2	2
Order Scleractinia				
Dichocoenia stokesi	2[a]	0	1[a]	0
Diploria clivosa	2[b]	3[a,b]	2[c]	2[c]
Madracis decactis	2	2	2	1
Montastrea cavernosa	2[d]	2	2	2
Montastrea annularis	1[b]	2[a,b]	1	1
Stephanocoenia michelini	0	1[a]	0	0
Phylum Chordata				
Class Tunicata				
Stolonicus sabulosa	0	0	4	0

N= Numerous colonies, unable to distinguish individual thalli or colonies
[a]= specimens less than 3 cm diameter
[b]= one specimen 2/3 dead
[c]= one specimen 1/2 dead
[d]= does not include 1 specimen dead and encrusted at time of observation. Five other dead and encrusted coral colonies (unidentified) were also noted in the quadrat

STATION JUL # 5 12 Feet	1990	1991	1992	1994
Phylum Porifera	11	12	11	7
Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia campana	3	3	3	1
Aplysina fistularis	2*	1	2	3
Aplysina sp.	0	1	1	0
Dysidea etheria	0	1	0	0
Order Haplosclerida				
Family Haliclonidae				
Callyspongia vaginalis	0	0	0	1
Niphates erecta	2	4	5	2
Haliclona compressa	1	0	0	0
Order Poecilosclerida				
Family Mycalidae				
Ulosa reutzleri	2	2	0	0
Order Choristida				
Family Chondrillidae				
Chondrilla nucula	1	0	0	0

Phylum Coelenterata				
Class Hydrozoa				
Order Milleporina				
Millepora alcicornis	1	2	0	0
Class Anthozoa				
Order Gorgonacea	19+	19+	21	16
Family Briareidae				
Briareum asbestinum	N	N	1	1
Family Plexauridae				
Eunicea succinea	7	5	6	1
Eunicea tourneforti	1	1	1	1
Plexaura flexuosa	7	9	11	11
Family Gorgoniidae				
Pseudopterogorgia acerosa	3	3	2	2
Order Zoanthidea (colonial anemones)				
Palythoa caribea	1	1	1	1
Zoanthus sociatus	5	5	0	1
Order Scleractinia				
Dichocoenia stokesi	1*	1*	1*	1*
Diploria clivosa	1	2	2	2
Porites astreoides	2	2	2	2
Porites branneri	0	0	1	1*
Siderastrea siderea	2**	2**	1**	0

N= Numerous colonies,unable to distinguish individuals
*= Specimen with dead spot on upper surface; 1/2 dead in 1994
**= Specimen(s) less than 3 cm diameter

STATION JUL #6 10-12 FEET	1990	1991	1992	1994
Phylum Phaeophyta				
Dictyota bartayresii	0	N	0	4
Phylum Porifera	11	10	7	2
Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia felix	2	1	1	0
Aplysina fistularis	5	4	5	2
Family Dysideidae				
Dysidea etheria	1	0	0	0
Order Haplosclerida				
Family Haliclonidae				
Haliclona compressa	1	3	1	0
Order Hadromerida				
Family Spirastrellidae				
Spirastrella coccinea	1*	1	0	0

Order Poecilosclerida				
Family Mycalidae				
Ulosa reutzleri	1	1	0	0
Phylum Coelenterata				
Class Anthozoa				
Gorgonacea	11	10+	11	8
Family Briareidae				
Briareum asbestinum	0	N	1	0
Family Plexauridae				
Eunicea succinea	4	2	2	3
Eunicea knighti	0	1	1	1
Eunicea sp.	2	2	2	0
Muricea muricata	1	1	1	1
Plexaura flexuosa	1	1	1	1
Family Gorgoniidae				
Pseudopterogorgia americana	2	2	1	1
Pterogorgia citrina	1	0	2	1
Order Zoanthidea				
Palythoa caribea	1	1	1	1
Zoanthus sociatus	0	1	0	0
Order Scleractinia				
Acropora cervicornis	0	1**	2	0
Porites astreoides	5	5	5	4
Porites branneri	0	0	1	0
Siderastrea radians	1**	1**	3	0

*= Not reported and probably overlooked in 1990
**= Specimen(s) less than 3 cm diameter

STATION JUL # 728-30 Feet	1990	1991	1992	1994
Phylum Phaeophyta				
Dictyota bartayresii	0	N	0	N
Phylum Porifera	24	25	19	26
Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia strobilina	1	0	0	2
Ircinia felix	2	1	1	1
Aplysina cauliformis	1	4	1	4
Aplysina fistularis	0	0	2	1
Family Dysideidae				
Dysidea etheria	2	0	0	0

Order Haplosclerida				
Family Haliclonidae				
Haliclona compressa	3	4	3	4
Haliclona sp.	0	0	2	0
Callyspongia vaginalis	3	2	2	0
Callyspongia fallax	0	1	0	0
Niphates erecta	4	3	2	5
Dasychalina cyathina	3	6	2	4
Family Nepheliopongiidae				
Xestospongia muta	1	1	1	1
Xestospongia sp.	0	0	0	1
Order Hadromerina				
Family Spirastrellidae				
Spirastrella coccinea	0	0	1	0
Anthosigmella varians	0	0	1	0
Order Poecilosclerida				
Family Esperiopsidae				
Iotrochota birotulata	1	1	0	0
Family Microcionidae				
Thalysias juniperina	1	0	0	0
Family Mycalidae				
Ulosa reutzleri	1	1	0	2
Order Axinellida				
Family Axinellidae				
Pseudaxinella lunaecharta	1	1	1	1
Phylum Coelenterata				
Class Anthozoa				
Order Corallimorpharia				
Ricordea florida	0	1	0	0
Order Gorgonacea	12+	15+	14	13
Family Briareidae				
Briareum asbestinum	N	N	1	1
Family Plexauridae				
Eunicea fusca	7	8	8	6
Eunicea calyculata	1	1	1	0
Eunicea asperula	2*	2	0	0
Eunicea knighti	0	0	1	0
Plexaura flexuosa	0	2	1	5
Pseudoplexaura sp.	0	0	1	0
Family Gorgoniidae				
Pseudopterogorgia acerosa	1	1	1	1
Order Zoanthidea				
Palythoa caribea	N	N	6	0
Order Scleractinia				
Dichocoenia stokesi	0	1***	1***	0
Montastrea cavernosa	0	1	0	0
Siderastrea siderea	10	2***	5***	2
Stephanocoenia michelini	0	2	0	0

Phylum Urochordata				
Distaplia sp.	0	1	0	0

N= Numerous colonies, unable to distinguish individuals

*= Species mis-identified and lumped with E. calyculata in 1990

**= 9/10 of these colonies were less than 3 cm diameter; easily overlooked

***= colonies less than 3 cm diameter

N.B. Several dead (unidentified) scleractinian colonies were found within and around the quadrat in 1990.

STATION JUL # 8 50-55 Feet	1990	1991	1992	1994
Phylum Chlorophyta				
Halimeda goreauii	N	N	N	N
Phylum Phaeophyta				
Dictyota bartayresii	0	N	0	0
Phylum Porifera	33	28	23	21
Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia felix	2	1	1	0
Ircinia sp.	1	1	0	1
Aplysina sp. A	0	0	1	1
Aplysina sp. B	0	0	0	7
Family Dysideidae				
Dysidea etheria	2	0	0	0
Order Haplosclerida				
Family Haliclonidae				
Haliclona compressa	2	1	2	3
Niphates erecta	15	11	7	1
Dasychalina cyathina	2	0	1	1
Callyspongia plicifera	0	0	1	1
Order Hadromerina				
Family Spirastrellidae				
Spirastrella coccinea	4a	4	5	2
Order Pocilosclerida				
Family Agelasidae				
Agelas conifera	1	2*	2	2
Family Mycalidae				
Ulosa reutzleri	3	4	2	2
Order Axinellida				
Family Axinellidae				

Pseudaxinella lunaecharta	1	2	1	0
Teichaxinella morchella	0	1	0	0
Phylum Coelenterata				
Class Hydrozoa				
Millepora alcicornis	0	1	1	1
Class Anthozoa				
Order Gorgonacea	20+	19	16+	22
Family Briareidae				
Briareum asbestinum	N	1	N	1
Family Plexauridae				
Eunicea fusca	5	5	3	8
Eunicea calyculata	1	1	0?	1
Eunicea knighti	1	1	1	1
Eunicea sp. cf. mammosa	0	0	0	1
Plexaura flexuosa	9	8	8	5
Family Gorgoniidae				
Pseudopterogorgia americana	3	3	3#	3
Pseudopterogorgia acerosa	0	0	0	2
Order Scleractinia				
Dichocoenia stokesi	3**	4**	3**	3
Montastrea annularis	1***	1***	1***	1***
Montastrea cavernosa	0	0	0	2***
Scolymia sp.	0	1***	0	0
Stephanocoenia michelini	1**	1**	1**	1**

N= Numerous thalli or colonies, unable to distinguish individuals
a= Species overlooked in 1990 survey
*= Includes one juvenile specimen
**= Colonies all small, 10-15 cm diameter
*** = colony or colonies 3-5 cm diameter
N.B. There were 8 dead and encrusted coral colonies in this quadrat,30-60 cm in diameter, most of which appeared to be M. cavernosa in 1990.
= one specimen damaged, 1992

STATION JUL # 9 50-55 Feet	1990	1991	1992	1994
Phylum Phaeophyta				
Dictyota bartayresii	N	N	0	N
Lobophora sp.	0	0	0	N
Phylum Porifera	35	60	31	31
Class Demospongia				
Order Keratosa				

Family Spongiidae				
Ircinia felix	3	3	1	0
Ircinia sp.	2	1	3	3
Aplysina cauliformis	4	5	3	3
Aplysina lacunosa	2	5[a]	0	0
Family Dysideidae				
Dysidea etheria	0	1	0	0
Order Haplosclerida				
Family Haliclonidae				
Haliclona compressa	3	3	2	3
Dasychalina cyathina	5	5	2	3
Niphates erecta	1	3	2	0
Callyspongia vaginalis	1	1	4[b]	3
Callyspongia plicifera	1	3	2[c]	0
Order Hadromerida				
Family Spirastrellidae				
Spirastrella coccinea	1	1	1	0
Order Poecilosclerida				
Family Microcionidae				
Thalysias juniperina	0	0	2	1
Family Agelasiade				
Agelas conifera	1	2	2	1
Agelas sp.	0	0	1	1
Family Esperiopsidae				
Iotrochota birotulata	8	8	6	9
Family Mycalidae				
Ulosa reutzleri	1	17	1	3
Order Axinellida				
Family Axinellidae				
Homaxinella rudis	1	1	1	1
Pseudaxinella lunaecharta	1	1	1	0

a= includes 2 juvenile specimens
a= includes 2 damaged
b= includes 1 damaged

Phylum Coelenterata				
Class Hydrozoa				
Order Milleporina				
Millepora alcicornis	3	2	0	2
Class Anthozoa				
Order Gorgonacea	3+	3	3	3
Family Briareidae				
Briareum asbestinum	N	1	1	1
Family Plexauridae				
Eunicea calyculata	1	1	1	1
Family Gorgoniidae				
Gorgonia ventalina	1	1	1	1
Order Scleractinia				
Agaricia lamarcki	1*	1*	1	0
Dichocoenia stokesi	2*	2**	3[a]	4***
Eusmilia fastigiata	1***	0	0	0

Madracis decactis	1*	1*	3	2
Meandrina meandrites	1	1	0	0
Montastrea annularis	2*	1*	0	0
Montastrea cavernosa	2*	9**	9**	6*
Porites astreoides	2*	2*	2	4
Siderastrea siderea	1*	2*	4	0
Stephanocoenia michelini	2*	1*	0	2
Diploria clivosa	0	0	1**	1

N= Numerous thalli or colonies, unable to distinguish individuals
a= colony damaged
*= colonies less than 10 cm diameter
**= all colonies less than 6cm diameter
***= colony less than 5 cm diameter

N.B. In 1990 this site has many dead coral colonies outside the quadrat. Except for some scattered colonies of M. cavernosa and M. meanrites attaining 30 cm diameter, most living colonies are much smaller.This pattern is reflected in the quadrat.

STATION JUL # 10 25 Feet	1990	1991	1992	1994
Phylum Phaeophyta				
Dictyota bartayresii	0	N	0	N
Microcoleus sp.	0	0	0	N
Phylum Porifera	26	36	36	20
Class Demospongia				
Order Keratosa				
Family Spongiidae				
Ircinia felix	1	4	4	5
Ircinia strobilina	1	2	1	1
Order Haplosclerida				
Family Haliclonidae				
Haliclona compressa	2	3	5	3
Niphates erecta	7	5	0?	4
Dasychalina cyathina	2	1	1	1
Callyspongia fallax	2	1	0	0
Callyspongia vaginalis	0	0	1	1
Family Nepheliospongiidae				
Xestospongia muta	2	2	0	0
Order Poecilosclerida				
Family Esperiopsidae				
Iotrochota birotulata	3	3	2	2
Family Mycalidae				
Ulosa reutzleri	1	8	1	2
Order Hadromerida				
Family Spirastrellidae				
Anthosigmella varians	2	2	1	2

Spirastrella coccinea	1a	1	1	0
Order Axinellida				
Family Axinellidae				
Homaxinella rudis	1	1	0	0
Pseudaxinella lunaecharta	1	1	1	1
Order Choristida				
Family Chondrillidae				
Chondrilla nucula	0	2	2	1
Phylum Coelenterata				
Class Anthozoa				
Order Gorgonacea	6+	5+	4	2
Family Briareidae				
Briareum asbestinum	N	N	1	1
Family Plexauridae				
Eunicea calyculata	2	2	2	1
Eunicea sp.*	1	1	1	0
Muricea muricata	1	1	0	0
Plexaura flexuosa*	1	0	0	0
Order Zoanthidea				
Palythoa caribea	6	N	N	N
Order Scleractinia				
Agaricia agaricites	1**	0	0	0
Agaricia lamarcki	1**	0	0	0
Dichocoenia stokesi	4**	0	3#	1
Montastrea annularis	1	0	0	0
Montastrea cavernosa	5***	4	4	3
Solenastrea bournoni	1	1	1	1
Stephanocoenia michelini	1	1	3	1
Siderastrea siderea	0	0	6##	3##

N= Numerous colonies, unable to distinguish individuals
a= Specimen overlooked in 1990
*= colonies damaged
**= specimens all 5 cm diameter or less
***= 3 of 5 specimens are 5 cm or less in diameter
= Specimens less than 4 cm in diameter
= specimens less than 6 cm in diameter

Table 8.2.2 Numbers of individuals at each station at each assessment period.

Reef		1ST	2ND	3RD	1ST	2ND	3RD					
		J5	J10	J9	J6	J7	J8					
DEPTH		10'	55'	55'	10'	30'	55'	AVG	SD			
#Sponges	CONTROL Oct, 1990	11	26	35	10	24	33	23.17	10.65			
#Gorgonians		19	6	3	11	12	20	11.83	6.79			
#Scleractinians		6	14	15	6	10	5	9.33	4.37			
#Sponges	CONTROL Oct., 1991	12	36	60	11	25	27	28.50	18.12			
#Gorgonians		19	5	8	10	15	22	13.17	6.62			
#Scleractinians		7	6	20	7	7	6	8.83	5.49			
#Sponges	CONTROL Oct., 1992	11	20	31	7	19	23	18.50	8.57			
#Gorgonians		26	9	3	11	16	16	13.50	7.82			
#Scleractinians		6	17	23	7	6	5	10.67	7.50			
#Sponges	CONTROL Oct., 1994	7	20	31	2	26	21	17.83	11.16			
#Gorgonians		16	2	3	8	13	22	10.67	7.79			
#Scleractinians		6	9	19	4	2	7	7.83	5.98			
Reef		1ST	2ND	3RD	1ST	2ND	3RD	1ST	2ND	3RD		
		H1	J1	J2	H2	H4	H6	H3	H5	H7		
DEPTH		20'	45'	55'	14'	40'	75'	14'	35'	65'	AVG	SD
#Sponges	DREDGING Oct., 1990	16	21	33	30	27	45	75	45	50	38.00	18.01
#Gorgonians		58	21	15	52	14	12	64	16	18	30.00	21.36
#Scleractinians		15	12	9	19	13	2	5	9	6	10.00	5.32
#Sponges	DREDGING Oct., 1991	23	25	35	24	30	64	50	38	84	41.44	20.89
#Gorgonians		51	23	11	50	14	13	43	9	19	25.89	17.23
#Scleractinians		21	13	10	13	11	1	4	6	5	9.33	6.06
#Sponges	DREDGING Oct., 1992	4	14	40	15	27	35	56	46	55	32.44	18.69
#Gorgonians		60	20	17	51	6	15	34	21	22	27.33	17.71
#Scleractinians		28	7	8	6	17	2	29	10	7	12.67	9.82
#Sponges	DREDGING Oct., 1994	23	13	34	8	25	49	55	47	46	33.33	16.93
#Gorgonians		41	16	14	36	7	13	24	10	4	18.33	12.82
#Scleractinians		7	5	6	3	15	1	4	7	6	6.00	3.91

Table 8.2.3 Cumulative species list for quadrats.

	# of Sites				# of Individuals			
	1990	1991	1992	1994	1990	1991	1992	1994
Algae								
6 Species:								
Phylum Cyanophyta								
Microcoleus sp.	0	0	0	1	0	0	0	N
Phylum Phaeophyta								
Dictyota bartayresii	2	7	0	5	N	N	0	N
Lobophora sp.	0	0	0	1	0	0	0	N
Phylum Chlorophyta								
Udotea flabellum	1	0	0	0	1	0	0	0
Udotea occidentalis	0	1	1	0	0	1	4	0
Halimeda tuna	1	1	1	2	N	N	N	N
Halimeda goreauii	2	2	2	2	N	N	N	N
Phylum Chlorophyta								
Ceramium sp.	1	1	0	1	3	1	0	N
Unidentified red	0	0	2	0	0	0	N	0
Phylum Porifera (Sponges)								
35 Species:								
Order Keratosa								
Ircinia campana	5	6	2	2	8	1O	6	3
Ircinia strobilina	5	6	7	8	7	10	11	12
Ircinia felix	8	8	10	7	16	15	22	18
Ircinia sp.	7	5	4	3	13	7	7	7
Aplysina cauliformis	7	6	6	6	45	56	40	N
Aplysina fistularis	2	2	5	5	6	5	14	8
Aplysina lacunosa	1	1	0		2	1	0	0
Aplysina sp.	2	3	3	3	2	3	3	11
Pseudoceratina crassa	2	2	2	2	8	7	3	3
Dysidea etheria	7	6	1	1	15	23	2	2
Order Haplosclerida								
Haliclona compressa	12	12	11	10	39	39	41	39
Haliclona sp.	5	4	5	4	8	6	7	7
Niphates erecta	12	13	11	9	58	64	50	35
Dasychalina cyathina	9	8	25	11	29	13	0	20
Callyspongia vaginalis	5	4	6	0	8	6	12	14
Calyspongia plicifera	5	3	5	4	8	7	8	7
Callyspongia fallax	1	2	0	1	2	2	0	1
Xestospongia muta	6	7	5	4	8	10	7	6
Xestospongia sp.	0	0	0	1	0	0	0	1
Order Poecilosclerida								
Iotrochota birotulata	10	9	6	6	33	39	17	3
Desmapsamma anchorata	5	7	3	4	15	24	5	5

Thalysias juniperina	4	3	4	7	5	4	6	7
	# of Sites				# of Individuals			
	1990	1991	1992	1994	1990	1991	1992	1994
Ulosa reutzleri	9	13	5	9	13	53	6	14
Mycale n.sp.	1	1	0	0	3	4	0	0
Agelas clathrodes	1	1	1	1	1	1	1	1
Agelas conifera	2	2	4	4	2	4	7	5
Agelas sp.	0	0	1	1	0	0	1	1
Order Hadromerida								
Anthosigmella varians	6	7	5	5	13	19	15	11
Spirastrella coccinea	5	5	8	5	9	9	15	10
Order Axinellida								
Teichaxinella morchella	2	4	3	3	2	5	5	3
Homaxinella rudis	3	3	2	2	4	4	3	2
Pseudaxinella lunaecharta	6	7	11	5	9	15	16	8
Didiscus sp.	1	1	0	0	1	1	0	0
Order Choristida								
Cinachyra alloclada	4	3	5	3	84	63	75	52
Chondrosia reniformis	1	1	2	1	N	1	4	6
Chondrilla nucula	2	2	0	1	3	3	0	6
Phylum Coelenterata								
Order Milleporina (Fire coral)								
1 species								
Millepora alcicornis	3	6	5	0	8	9	9	0
Order Gorgonacea (Gorgonians)								
21 Species:								
Briareum asbestinum	13	14	13	12	N	N	N	N
Eunicea calyculata	9	10	8	8	15	12	12	10
Eunicea fusca	4	7	8	8	19	23	27	29
Eunicea knighti	4	5	2	2	4	5	2	2
Eunicea mammosa	1	0	0	1	1	0	0	1
Eunicea palmeri	4	3	1	1	23	16	2	4
Eunicea succinea	7	5	5	5	56	53	71	50
Eunicea tourneforti	4	2	1	1	8	8	1	1
Eunicea asperula	3	3	3	3	10	16	9	7
Eunicea sp. indet.	3	1	3	2	5	9	6	3
Muricea elongata	1	1	1	1	3	2	1	1
Muricea muricata	6	6	4	4	64	51	34	17
Plexaura flexuosa	10	11	11	10	35	46	27	34
Plexaurella fusifera	5	3	3	3	21	24	19	13
Plexaurella grisea	1	1	0	0	4	3	0	0
Muriceopsis petila	0	0	1	1	0	0	4	0
Gorgonia ventalina	3	3	2	2	3	3	2	2
Pterogorgia citrina	1	0	2	1	1	0	3	1
Pterogorgia guadalupensis	2	2	2	2	15	12	12	10

Pseudopterogorgia americana	6	6	7	5	17	17	16	7
	# of Sites				# of Individuals			
	1990	1991	1992	1994	1990	1991	1992	1994
Pseudopterogorgia acerosa	7	7	8	11	14	14	15	24
Pseudoplexaura sp.	0	1	2	1	0	1	2	1
Colonial Anemones and Coraliomorphs								
3 Species:								
Palythoa caribea	8	6	6	4	13+	8+	23+	N
Zoanthus sociatus	1	5	1	4	5	9	1	6
Ricordea florida	0	1	0	0	0	1	0	0
Order Scleractinia (Stony Corals)								
19 Species:								
Acropora cervicornis	0	1	1	0	0	1	2	0
Agaricia agaricites	1	0	0	0	1	0	0	0
Agaricia lamarcki	1	1	1	0	1	1	1	0
Astrangia solitaria	1	0	1	0	2	0	1	0
Dichocoenia stokesi	7	9	10	9	11	19	21	16
Diploria clivosa	2	2	2	3	3	5	3	5
Diploria labyrinthiformis	1	1	0	0	1	1	0	0
Eusmilia fastigiata	1	0	0	0	12	21	0	0
Madracis decactis	2	2	2	2	2	2	2	3
Meandrina meandrites	0	0	1	3	0	0	1	3
Montastrea annularis	1	1	1	3	1	1	1	3
Montastrea cavernosa	3	2	1	7	3	2	1	18
Porites astreoides	5	4	4	3	12	12	9	10
Porites branneri	1	1	4	3	1	1	4	3
Siderastrea radians	1	2	2	1	1	3	4	1
Siderastrea siderea	4	9	9	15	4	36	51	7
Solenastrea bournoni	4	3	4	4	4	3	5	4
Stephanocoenia michelini	7	10	6	8	13	19	14	12
Scolymia sp.	0	1	1	0	0	1	1	0

8.3. Appendix: Taxonomic Specialists for Cores

Table 8.3.1 Taxonomic Specialists

Nemertea, Platyhelminthes & Unknown worms: Dr. Jon Norenburg, Division of Worms, Smithsonian Inst., Washington, DC 20560.

Annelida: Dr. Michael Milligan, Center for Systematics and Taxonomy, Sarasota, FL.

Cnidaria: Dr. Stephen D. Cairns, Division of Echinoderms, NHB-163, Smithsonian Inst., Washington, DC 20560,

Mollusca: Dr. Donald R. Moore, Rosenstiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Cswy., Miami, FL 33149

Ostracoda: Dr. Louis Kornicker, Division of Crustacea, NHB-163, Smithsonian Inst., Washington, DC 20560

Isopoda: Dr. Brian Kensley & Dr. Marilyn Schotte, Div. of Crustacea, Natural History Museum, Smithsonian Inst., Washington, DC 20560.

Amphipoda: Dr. James D. Thomas, Div. of Crustacea, Natural History Museum, Smithsonian Inst., Washington, DC 20560.

Cumacea: Dr. Les Watling, Darling Marine Center, Univ. of Maine, Walpole, ME 04573. Barbara Maloney, Florida International University, Miami, FL. Dr. Richard Heard, Gulf Coast Research Lab., Ocean Springs, MS

Decapoda: Dr. Austin B. Williams, Natl. Marine Fish. Service. Systematics Lab, Smithsonian Inst., Washington, DC 20560. Dr. Rafael Lemaitre, Div. of Crustacea, Natural History Museum, Smithsonian Inst., Washington, DC 20560.

Sipuncula: Drs. Mary Rice & Julie Piraino, Smithsonian Marine Station, 5612 Old Dixie Highway, Ft. Pierce, FL 34946.

8.4. Core Infauna Tables

Tables which follow this page include:

Table 8.4.1 Identification and enumeration of infauna by station and survey (1990-1994).

Table 8.4.2 Numerical abundance of major taxonomic groups by station and survey (1990-1994).

Table 8.4.3 Percentage abundance of major taxonomic groups.

Table 8.4.4 Percentage abundance of major groups excluding nematodes and harpacticoid copepodss.

Table 8.4.5 Identification and enumeration of infauna by replicate, 1994.

Table 8.4.6 Five most abundant species by station and survey with percentage abundance (nematodes and copepods excluded.

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE CONTROL SITES															
STATION	T88				R90				R92				R94			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Phylum PORIFERA																
Unidentified sponge																
Phylum CNIDARIA																
Subphylum MEDUSOZOA																
Unidentified hydrozoan																1
Subphylum ANTHOZOA																
Class ZOANTHARIA																
Order SCLERACTINIA																
Spheniotrochus sp.							1									
Order ACTINIARIA																
Unidentified actiniarian																
Phylum PLATYHELMINTHES																
Class TURBELLARIA																
?*Coelogynopora* sp.											3					
Unidentified acoel																
Unidentified bothryoplanid																
Unidentified coelogynoporid																
Unidentified kalyptorhynchid																
Unidentified monocelid																
Unidentified nematoplanid																
Unidentified otoplanid																
Unidentified typhloplanid																
Unidentified phyllosyrtid												1				
Unidentified proseriate					1				1			11	14			2
Unidentified turbellarian	1		2		3	64	1				1				1	1
Phylum NEMERTINA																
Order ARCHINEMERTINA																
Family CEPHALOTHRICIDAE																
Cephalothrix sp. A			3	1				1			1	2			3	2
Cephalothrix sp. 114	4	10	3		3	9	5	6	1	27	9	6		17	15	4
Procephalothrix spiralis?					1											
Unidentified cephalothricid		4						1								1
Unidentified archinemertine																
Order PALEONEMERTINA																
Family CARINOMIDAE																
Carinoma sp. A			1				1									
Carinoma tremaphoros								1								
Carinomella lactea		1									3					
Family HUBRECHTIDAE																
Hubrechtella dubia		1			1	1			1				1	1		
Family TUBULANIDAE																
Tubulanus pellucidus		2			1											
Tubulanus rhabdotus																
Tubulanus sp.																
Paleonemertine sp. 103											2					
Unident. paleonemertine sp. A						1								1		
Unidentified paleonemertine			1	1	3		1									1
Order HETERONEMERTINA																
Family CEREBRATULIDAE																
?*Cerebratulus leucopsis*																
Cerebratulus lineolatus?																
Family BASEODISCIDAE																
Baseodiscus sp.?																
Family MICRURIDAE																
Micrura sp.		1														
Unidentified heteronemertine																
Order HOPLONEMERTINA																
Family PROSTOMATELLIDAE																
Prostomatella enteroplecta?					2				1				1			
Family TETRASTEMMIDAE																
Tetrastemma worki		2	1			2				2				5	1	
Family DREPANOPHORIDAE																
Unident. drepanophorid																
4-eye hoplonemertine				3								8				2
Unidentified hoplonemertine			1								1				1	
Unidentified nemertine																
Phylum NEMATODA	98	17	34	1	159	989	35	1	260	4	12	4	333	24	1	3
Phylum PRIAPULA																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE CONTROL SITES															
STATION	T88				R90				R92				R94			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Family TUBILUCHIDAE																
Tubiluchus corallicola					1											
Phylum ANNELIDA																
Class POLYCHAETA																
Order ORBINIIDA																
Family ORBINIIDAE																
Orbinia riseri																
Scoloplos acmeceps																
Scoloplos sp. B		1														
Scoloplos sp.																
Naineris bicornis																
Leitoscoloplos fragilis																
Leitoscoloplos sp.													2			
Family PARAONIDAE																
Aricidea cf. *catherinae*																
Aricidea cerrutii																
Aricidea fragilis																
Aricidea philbinae																
Aricidea taylori																
Aricidea suecica																
Aricidea sp.											1					
Cirrophorus lyra						1								2		
Levinsenia gracilis																
Paraonis fulgens	5		30	21	1	13	19	59	12	29	28	61	6	18	16	12
Paraonis pygoenigmatica						34										
Family QUESTIDAE																
Questa sp.																
Order CTENODRILIDA																
Family CTENODRILIDAE																
Raphidrilus nemasoma																
Ctenodrilus serratus																
Ctenodrilus sp. A					1											
Order COSSURIDA																
Family COSSURIDAE																
Cossura soyeri																
Order SPIONIDA																
Family SPIONIDAE																
Apoprionospio dayi		5								2				1	4	
Apoprionospio pygmaea				1										2		
Dispio uncinata	69	5	322	29	5	5	88	67	19	4	58	49	2	6	95	29
Malacoceros vanderhorstii																
Minuspio sp. A																
Paraprionospio pinnata																
Polydora cornuta																
Polydora tetrabranchia																
Polydora websteri																
Polydora sp.				1												
Prionospio cristata		9				3				14				6	1	
Prionospio heterobranchia																
Prionospio multibranchiata				5				11				22				57
Prionospio steenstrupi																
Prionospio sp.																
Pseudopolydora sp.															1	
Scolelepis acmeceps					3											
Scolelepis squamata		2						2								
Scolelepis texana		2	46	4			58	8	6	10	42	15		30	51	35
Spio pettiboneae	3	13	26			5	16		1	50	26		1	34	47	
Unidentified spionid						1	5	1	1		1	8				
Family MAGELONIDAE																
Magelona pettiboneae																
Magelona sp. B																
Magelona sp. C		1														
Magelona sp. G																
Magelona sp. H																
Magelona sp.																
Family POECILOCHAETIDAE																
Poecilochaetus johnsoni				1	1											
Family CHAETOPTERIDAE																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE CONTROL SITES															
STATION	T88				R90				R92				R94			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Unidentified chaetopterid (juv)																
Family CIRRATULIDAE																
Caulleriella cf. *alata*																
Caulleriella killariensis																
Caulleriella sp. A																
Caulleriella sp.																
Chaetozone setosa																
Chaetozone sp. B																
Chaetozone sp.																
Cirriformia sp.																
Dodecaceria sp. A																
Tharyx dorsobranchialis																
Tharyx marioni																
Tharyx sp.																
Unidentified cirratulid																
Order CAPITELLIDA																
Family CAPITELLIDAE																
Capitella capitata						1				1						
Dasybranchus lunatus																
Leiocapitella sp. A																
Mediomastus californiensis																
Mediomastus sp.				2	2											
Notomastus americanus																
Notomastus latericeus																
Notomastus daueri																
Notomastus ?*tenuis*																
Notomastus hemipodus																
Notomastus sp.																
Scyphoproctus platyproctus																
Unidentified capitellid													2			
Family MALDANIDAE																
Axiothella sp. A																
Axiothella sp.																
Unidentified maldanid																
Family ARENICOLIDAE																
Arenicola sp.																
Unidentified arenicolid																
Order OPHELIIDA																
Family OPHELIIDAE																
Armandia agilis	3	4	22	1		2	13			7	19			13	31	
Armandia maculata																
Armandia sp. (juv)							1									
Polyophthalmus sp.																
Family SCALIBREGMIDAE																
Sclerobregma stenocerum																
Unidentified scalibregmid																
Order PHYLLODOCIDA																
Family PHYLLODOCIDAE																
Genetyllis cf. *castanea*																
Genetyllis sp.																
Hesionura elongata						1										
Mystides borealis																
Phyllodoce arenae		1														
Unidentified phyllodocid																
Family SIGALIONIDAE																
Sigalion arenicola																
Sthenelais boa																
Sthenelais sp.																
Unidentified sigalionid																
Family CHRYSOPETALIDAE																
Bhawania heteroseta																
Family HESIONIDAE																
Gyptis vitatta																
Heteropodarke lysoni																
Microphthalmus sp. A																
Podarke obscura																
Podarkeopsis levifuscina																
Family PILARGIIDAE																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE CONTROL SITES															
STATION	T88				R90				R92				R94			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Litocorsa sp. A																
Sigambra tentaculata																
Synelmis sp. B		1				1										
Family SYLLIDAE																
Brania wellfleetensis																
Dentatisyllis carolinae																
Ehlersia comuta					1											
Exogone atlantica																
Exogone dispar																
Exogone laurei																
Exogone sp.																
Grubeosyllis clavata																
Haplosyllis spongicola																
Opisthodonta sp. B																
Pionosyllis gesae																
Sphaerosyllis longicauda																
Sphaerosyllis piriferopsis																
Sphaerosyllis riseri																
Sphaerosyllis taylori																
Streptosyllis pettiboneae																
Syllides floridanus																
Syllides bansei					1											
Typosyllis cf. *lutea*																
Unident. syllid																
Family NEREIDAE																
Ceratonereis irritabilis				1												
Ceratonereis longicirrata																
Ceratonereis mirabilis																
Ceratonereis versipedata																
Ceratonereis sp. A																
Neanthes sp. A																
Neanthes sp.																
Nematonereis hebes																
Nereis falsa																
Platynereis dumerilii																
Unidentified nereid											1					
Family GLYCERIDAE																
Glycera abranchiata					5					1						
Glycera americana							1									
Glycera sp. A																
Glycinde solitaria											1					
Unidentified glycerid																
Family GONIADIDAE																
Goniada littorea																
Goniada maculata																
Goniada teres																
Family NEPHTYIDAE																
Inermonephtys inermis																
Order AMPHINOMIDA																
Family AMPHINOMIDAE																
Chloeia viridis																
Paramphinome sp. B		1														
Pseudeurythoe sp.																
Order EUNICIDA																
Family EUNICIDAE																
Eunice sp. A																
Lysidice ninetta																
Marphysa sp.																
Nematonereis hebes					2											
Family ONUPHIDAE																
Diopatra cuprea																
Kinbergonuphis sp.																
Mooreonuphis pallidula					1											
Mooreonuphis sp.																
Unident. onuphid																
Family LUMBRINERIDAE																
Lumbrinereis latreila					1											
Lumbrinereis tetraura		1												3		

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE CONTROL SITES															
STATION	T88				R90				R92				R94			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Lumbrinereis tenuis																
Lumbrinereis verrilli																
Lumbrineris sp.																
Family ARABELLIDAE																
Arabella multidentata		1					1									
Arabella mutans					1											
Drilonereis longa								1				1				
Drilonereis sp. B																
Drilonereis sp.																
Family DORVILLEIDAE																
Dorvillea sociabilis																
Pettibonia duofurca																
Protodorvillea kefersteini						1										
Schistomeringos pectinata																
Uunidentified dorvilleid																
Order OWENIIDA																
Family OWENIIDAE																
Myriochele oculata																
Order TEREBELLIDA																
Family PECTINARIIDAE																
Pectinaria gouldii																
Family TEREBELLIDAE																
Ameaena trilobata																
Pista quadrilobata																
Polycirrus plumosus																
Polycirrus sp. B																
Polycirrus sp.																
Scionella sp. A																
Thalanessa sp. A																
Unidentified terebellid																
Family TRICHOBRANCHIDAE																
Terebellides stroemi																
Order SABELLIDA																
Family BOGUEIDAE																
Boguea enigmatica																
Unidentified bogueid																
Family SABELLIDAE																
Branchiomma nigromaculata																
Chone cf. *americana*																
Demonax sp.																
Fabricia sp. A																
Fabricinuda trilobata				1												
Sabella melanostigma																
Sabellastarte sp. A																
Unidentified sabellid																
Family SERPULIDAE																
Unidentified serpulid																
Order FLABELLIGERIDA																
Family FLABELLIGERIDAE																
Pherusa inflata																
Unident. polychaete																1
Class OLIGOCHAETA																
Family TUBIFICIDAE																
Bathydrilus adriaticus					1											
Heterodrilus bulbiporous					1											
Heterodrilus pentcheffi					1											
Inanidrilus leukodermatus					1											
Limnodriloides monothecus																
Olavius imperfectus																
Olavius/Inanidrilus sp.					1											
Pectinodrilus molestus			1													
Smithsonidrilus luteolus																
Smithsonidrilus marinus																
Tectidrilus bori																
Unidentified tubificid		2			1											1
Family ENCHYTRAEIDAE																
Grania sp.																
Phylum SIPUNCULA																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE CONTROL SITES															
STATION	T88				R90				R92				R94			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Class SIPUNCULIDEA																
Order GOLFINGIIFORMES																
Family PHASCOLIONIDAE																
Phascolion sp. A																
Order ASPIDOSIPHONIFORMES																
Family ASPIDOSIPHONIDAE																
Aspidosiphon fischeri					1											
Unidentified sipunculan A																
Unidentified sipunculan																
Phylum MOLLUSCA																
Class POLYPLACOPHORA																
Order NEOLORICATA																
Acanthochitona sp.																
Class GASTROPODA																
Family OLIVIDAE																
Olivella mutica																
Family CERITHIDAE																
Cerithiopsis emersoni																
Cerithium litteratum																
Family VOLVATELLIDAE																
Cylindrobulla beauii					1											
Family CAECIDAE																
Caecum imbricatum																
Caecum pulchellum			1		36		20	1	1		1	2			1	
Meioceras cubitatum																
Meioceras nitidum							2									
Family RISSOIDAE																
Amphithalamus vallei					1											
Unidentified rissoid (juv.)																
Family CYLICHNIDAE																
Cylichnella bidentata																
Family CYCLOSTREMATIDAE																
Arene tricarinata																
Family VITRINELLIDAE																
Teinostoma clavium															1	
Teinostoma sp.																1
Family NATICIDAE																
Unidentified naticid (juv)																
Family HAMINOEIDAE																
Atys sandersoni																
Unidentified opisthobranch																
Class BIVALVIA																
Family SOLEMYACIDAE																
Solemya occidentalis																
Family ARCIDAE																
Barbatia candida					1											
Family SPORTELLIDAE																
Unidentified sportellid																
Family CARDITIDAE																
Cyclocardia sp.																
Pleuromeris tridentata					2											
Family LEPTONIDAE																
Unidentified leptonid																
Family CARDIIDAE																
Laevicardium sp.																
Family LUCINIDAE																
Parvilucina multilineata																
Lucina sp.																
Unidentified lucinid					1											
Family SEMELIDAE																
Cumingia tellinoides																
Semele bellastriata																
Family UNGULINIDAE																
Diplodonta semiaspera																
Diplodonta sp.																
Family MESODESMATIDAE																
Ervilia concentrica														2		
Ervilia sp.										1						

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE CONTROL SITES															
STATION	T88				R90				R92				R94			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Family THRACIIDAE																
Bushia elegans																
Family VERTICORDIIDAE																
Verticordia ornata																
Family VENERIDAE																
Chione cancellata																
Parastarte triquetra																
Tivela floridana	5	1		1	13	9	8	19	43	21	15	58	6	105	16	86
Transennella sp.																
Gouldia cerina																
Family MYTILIDAE																
Brachiodontes modiolus																
Family TELLINIDAE																
Strigilla mirabilis		91	2			4				58		1		111	8	
Tellina iris?																
Tellina sybaritica																
Tellina texana																
Tellina sp.					1											
Unidentified tellinid																
Family CORBULIDAE																
Corbula krebsiana																
Unidentified bivalve										1				2		
Phylum BRYOZOA																
Class GYMNOLAEMATA																
Order CHEILOSTOMATA																
Cupuladria sp.			2	3	10		4	3	1			3	1		2	
Phylum BRACHIOPODA																
Class INARTICULATA																
Lingula sp.																
Phylum ARTHROPODA																
Subphylum CHELICERATA																
Class PYCNOGONIDA																
Unidentified pycnogonid																
Class ARACHNIDA																
Order ACARI																
Unidentified acarine																
Subphylum CRUSTACEA																
Class COPEPODA																
Order CYCLOPOIDA																
Order CALANOIDA	2				1				2				5			
Order HARPACTICOIDA		3				22	2			7	3			1	1	
Class OSTRACODA																
Subclass MYODOCOPIDA																
Family CYLINDROLEBERIDIDAE																
Parasterope muelleri				1												
Prionotoleberis salomani																
Asteropella punctata																
Family PHILOMEDIDAE																
Harbansus paucichelatus		6								3				11		
Family RUTIDERMATIDAE																
Rutiderma darbyi																
Unidentified ostracodes															1	
Class MALACOSTRACA																
Order AMPHIPODA																
Family CAPRELLIDAE																
Caprella pentantis																
Caprella sp.																
Family AMPELISCIDAE																
Ampelisca abdita																
Ampelisca bicarinata																
Ampelisca sp.																
Family AORIDAE																
Acuminodeutopus sp.																
Amphideutopus dolichocephalus																
Amphideutopus sp.																
Bemlos unifasciatus reductus																
Bemlos sp.																
Family BATEIDAE																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE CONTROL SITES															
STATION	T88				R90				R92				R94			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Carinobatea catharinensis																
Family GAMMARIDAE																
Elasmopus levis																
Elasmopus sp.																
Family HAUSTORIIDAE																
Acanthohaustorius pansus						1										
Haustorius n. sp.	6		10	21	1		6	10	6	2	2	96		4	7	25
Bathyporeia parkeri												1				
Family ISAEIDAE																
Chevalia aviculae																
Family MEGALUROPIDAE																
Gibberosus myersi														2		
Family OEDICEROTIDAE																
Monoculodes sp.																
Synchelidium americanum																
Family PHOXOCEPHALIDAE																
Metharpinia floridana	10	17	20	11	4	5	17	21	4	84	7	12	1	19	34	16
Family PLATYISCHNOPIDAE																
Eudevanopus honduranus	1	5			2	2	2		4	4	1		2		2	
Family SYNOPIIDAE																
Synopia caraibica														1		
Family COROPHIIDAE																
Cerapus sp.											1					
Grandidierella bonnieroides																
Unidentified corophiid n. sp.																
Unidentified corophiid			2													
Family NEOMEGAMPHOPIDAE																
Unidentified neomegamphopid																
Order ISOPODA																
Family ANTHURIDAE																
Amakusanthura magnifica																
Family GNATHIIDAE																
Gnathia sp.																
Family HYSSURIDAE																
Xenanthura brevitelson																
Family CIROLANIDAE																
Eurydice convexa																
Eurydice personata																
Eurydice sp.										3						
Family SPHAEROMATIDAE																
Ancinus braziliensis			2													
Ancinus depressus												2				
Ancinus sp.	2								1				4			
Exosphaeroma diminutum																2
Exosphaeroma productatelson																
Order CUMACEA																
Family BODOTRIIDAE																
Cyclaspis cf. *longipes*			2								2			2	7	
Cyclaspis cf. *pustulata*				2				1				3				6
Cyclaspis unicornis																
Cyclaspis cf. *varians*		10				2	1			4				4		
Cyclaspis cf. *striata/bacescui*															4	
Cyclaspis sp. B(?)																
Cyclaspis n. sp. D	5				11				7	3			4	4		
Cyclaspis n. sp. E					1											
Bodotriidae n. gen. A																
Family NANASTACIDAE																
Cumella sp.																
Unidentified cumacean fragment																
Order TANAIDACEA																
Family PARATANAIDAE																
Leptochelia forresti																
Leptochelia sp.	1															
Family APSEUDIDAE																
Apseudes sp. A																
Family KALLIAPSEUDIDAE																
Cirratodactylus floridensis																
Kalliapseudes sp.																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE CONTROL SITES															
STATION	T88				R90				R92				R94			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Unidentified tanaidacean																
Order MYSIDACEA																
Uunidentified mysid					1			1					1		1	
Order DECAPODA																
Infraorder PENAEIDEA																
Family SOLENOCERIDAE																
Solenocera sp.																
Infraorder CARIDEA																
Family ALPHEIDAE																
Automate sp.																
Unidentified alpheid																
Family OGYRIDIDAE																
Ogyrides alphaerostris			2											2		
Family PROCESSIDAE																
Processa sp.																
Unidentified processid																
Unidentified caridean postlarva																
Unidentified Alpheoid																
Infraorder THALASSINIDEA																
Family CALLIANASSIDAE																
Callianassid new genus						1										
Unidentified callianassid larva																
Infraorder ASTACIDEA																
Family NEPHROPIDAE																
Unidentified nephropid																
Infraorder ANOMURA																
Family ALBUNEIDAE																
Albunea gibbesii																
Zygopa michaelis																
Family PAGURIDAE																
Unidentified pagurid																
Infraorder BRACHYURA																
Family LEUCOSIIDAE																
Ebalia stimpsonii																
Family MAJIDAE																
Batrachonotus sp.																
Family PINNOTHERIDAE																
Pinnixa cristata	3								1							
Pinnixa gorei							2									
Pinnixa sp.														1		
Unidentified pinnotherid									1				1			
Family CALAPPIDAE																
Cycloes bairdii																
Unidentified megalopa														1		
Unidentified zoea																
Unidentified decapods				4								1				1
Phylum ECHINODERMATA																
Unidentified ophiuroid																
Unidentified holothuroid					3											
Phylum CHAETOGNATHA	3															
Phylum HEMICHORDATA																
Unidentified enteropneust																
Phylum CHORDATA																
Subphylum CEPHALOCHORDATA																
Branchiostoma caribaeum																
Subphylum VERTEBRATA																
Class OSTEICHTHYES																
Unidentified labrid																
Unknown		2	1			5			6	1				5	1	
Total Number of Organisms	221	222	537	116	297	1185	310	214	380	343	241	367	387	440	354	287
Number of Organisms for H' & J'	118	200	502	115	137	169	273	213	112	330	226	363	49	409	351	284
Number of species for H' & J'	14	28	22	21	45	24	23	17	14	22	23	21	15	28	25	20
Diversity Index (H')	1.661	2.245	1.641	2.307	3.045	2.186	2.523	1.964	2.096	2.294	2.487	2.217	2.360	2.326	2.388	2.090
Evenness (J')	0.634	0.674	0.531	0.758	0.800	0.600	0.804	0.693	0.794	0.742	0.793	0.728	0.871	0.698	0.742	0.698

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE TREATMENT (FILL) SITES															
STATION	R106				T111				R116				R120			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Phylum PORIFERA																
Unidentified sponge																
Phylum CNIDARIA																
Subphylum MEDUSOZOA																
Unidentified hydrozoan																
Subphylum ANTHOZOA																
Class ZOANTHARIA																
Order SCLERACTINIA																
Sphenotrochus sp.							1				1					
Order ACTINIARIA																
Unidentified actiniarian					1											
Phylum PLATYHELMINTHES																
Class TURBELLARIA																
?*Coelogynopora* sp.																
Unidentified acoel				2								1				
Unidentified bothryoplanid											1	1				
Unidentified coelogynoporid				3												
Unidentified kalyptorhynchid				3								4				
Unidentified monocelid				2								1				
Unidentified nematoplanid				4												
Unidentified otoplanid				2							1	3			1	
Unidentified typhloplanid												5			1	
Unidentified phyllosyrtid																1
Unidentified proseriate		3		3							4	1	1		1	
Unidentified turbellarian	1		1	5							3	2				
Phylum NEMERTINA																
Order ARCHINEMERTINA																
Family CEPHALOTHRICIDAE																
Cephalothrix sp. A			5	1							2					
Cephalothrix sp. 114		11	6			1	2			1	1				1	
Procephalothrix spiralis?																
Unidentified cephalothricid						1										1
Unidentified archinemertine			1													
Order PALEONEMERTINA																
Family CARINOMIDAE																
Carinoma sp. A							1									
Carinoma tremaphoros																
Carinomella lactea					2						1				1	
Family HUBRECHTIDAE																
Hubrechtella dubia		4			5		1									
Family TUBULANIDAE																
Tubulanus pellucidus		1			1	1										
Tubulanus rhabdotus																
Tubulanus sp.																
Paleonemertine sp. 103																
Unident. paleonemertine sp. A						1										
Unidentified paleonemertine			*	3	1					1						
Order HETERONEMERTINA																
Family CEREBRATULIDAE																
?*Cerebratulus leucopsis*																
Cerebratulus lineolatus?					1											
Family BASEODISCIDAE																
Baseodiscus sp.?					1											
Family MICRURIDAE																
Micrura sp.																
Unidentified heteronemertine																
Order HOPLONEMERTINA																
Family PROSTOMATELLIDAE																
Prostomatella enteroplecta?	4												3			
Family TETRASTEMMIDAE																
Tetrastemma worki		1												1		
Family DREPANOPHORIDAE																
Unident. drepanophorid																
4-eye hoplonemertine				1												1
Unidentified hoplonemertine				6			1									
Unidentified nemertine			2				1								1	
Phylum NEMATODA	65	17	24	499	53	41	11	39	114	10	21	364	100	11	7	8
Phylum PRIAPULA																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE TREATMENT (FILL) SITES															
STATION	R106				T111				R116				R120			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Family TUBILUCHIDAE																
Tubiluchus corallicola																
Phylum ANNELIDA																
Class POLYCHAETA																
Order ORBINIIDA																
Family ORBINIIDAE																
Orbinia riseri																
Scoloplos acmeceps																
Scoloplos sp. B																
Scoloplos sp.					1						1					
Naineris bicornis					1											
Leitoscoloplos fragilis								10								
Leitoscoloplos sp.			2	4			1	6								2
Family PARAONIDAE																
Aricidea cf. *catherinae*					1											
Aricidea cerrutii																
Aricidea fragilis																
Aricidea philbinae																
Aricidea taylori					1											
Aricidea suecica																
Aricidea sp.																
Cirrophorus lyra																
Levinsenia gracilis																
Paraonis fulgens	6	15	103	3			16	2	5	13	70	6	48	7	38	17
Paraonis pygoenigmatica																
Family QUESTIDAE																
Questa sp.					1											
Order CTENODRILIDA																
Family CTENODRILIDAE																
Raphidrilus nemasoma																
Ctenodrilus serratus																
Ctenodrilus sp. A																
Order COSSURIDA																
Family COSSURIDAE																
Cossura soyeri																
Order SPIONIDA																
Family SPIONIDAE																
Apoprionospio dayi	6					1	3									
Apoprionospio pygmaea																
Dispio uncinata	18	7	185	3	4	19	40	7	9	16	95		1	12	74	18
Malacoceros vanderhorstii																
Minuspio sp. A																
Paraprionospio pinnata																
Polydora cornuta					8											
Polydora tetrabranchia					3											
Polydora websteri																
Polydora sp.																
Prionospio cristata		1			14	6					1					
Prionospio heterobranchia																
Prionospio multibranchiata																
Prionospio steenstrupi																
Prionospio sp.																
Pseudopolydora sp.																
Scolelepis acmeceps					1											
Scolelepis squamata																
Scolelepis texana	1	22	17		1	40	56	8		32	8			11	2	
Spio pettiboneae	2	17	12		5	20	24			15	5			1	1	
Unidentified spionid			1		3	1		1								
Family MAGELONIDAE																
Magelona pettiboneae																
Magelona sp. B																
Magelona sp. C																
Magelona sp. G																
Magelona sp. H																
Magelona sp.																
Family POECILOCHAETIDAE																
Poecilochaetus johnsoni																
Family CHAETOPTERIDAE																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE TREATMENT (FILL) SITES															
STATION	R106				T111				R116				R120			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Unidentified chaetopterid (juv)																
Family CIRRATULIDAE																
Caulleriella cf. *alata*																
Caulleriella killariensis																
Caulleriella sp. A																
Caulleriella sp.					7											
Chaetozone setosa																
Chaetozone sp. B																
Chaetozone sp.																
Cirriformia sp.																
Dodecaceria sp. A																
Tharyx dorsobranchialis					1											
Tharyx marioni																
Tharyx sp.																
Unidentified cirratulid																
Order CAPITELLIDA																
Family CAPITELLIDAE																
Capitella capitata																
Dasybranchus lunatus																
Leiocapitella sp. A																
Mediomastus californiensis					19											
Mediomastus sp.							1									
Notomastus americanus																
Notomastus latericeus					2											
Notomastus daueri																
Notomastus ?tenuis																
Notomastus hemipodus																
Notomastus sp.																
Scyphoproctus platyproctus					2											
Unidentified capitellid																
Family MALDANIDAE																
Axiothella sp. A																
Axiothella sp.																
Unidentified maldanid																
Family ARENICOLIDAE																
Arenicola sp.					1											
Unidentified arenicolid																
Order OPHELIIDA																
Family OPHELIIDAE																
Armandia agilis	17	14	4		9	11	6	1	3	17	1		9	41	2	
Armandia maculata																
Armandia sp. (juv)																
Polyophthalmus sp.																
Family SCALIBREGMIDAE																
Sclerobregma stenocerum																
Unidentified scalibregmid																
Order PHYLLODOCIDA																
Family PHYLLODOCIDAE																
Genetyllis cf. *castanea*																
Genetyllis sp.																
Hesionura elongata				8								11				
Mystides borealis																
Phyllodoce arenae																
Unidentified phyllodocid																
Family SIGALIONIDAE																
Sigalion arenicola																
Sthenelais boa																
Sthenelais sp.																
Unidentified sigalionid								1								
Family CHRYSOPETALIDAE																
Bhawania heteroseta																
Family HESIONIDAE																
Gyptis vitatta																
Heteropodarke lysoni																
Microphthalmus sp. A									1	1						
Podarke obscura																
Podarkeopsis levifuscina																
Family PILARGIIDAE																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE TREATMENT (FILL) SITES															
STATION	R106				T111				R116				R120			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Litocorsa sp. A																
Sigambra tentaculata																
Synelmis sp. B																
Family SYLLIDAE																
Brania wellfleetensis																
Dentatisyllis carolinae																
Ehlersia cornuta					2							2				
Exogone atlantica					1											
Exogone dispar																
Exogone laurei					1											
Exogone sp.					1											
Grubeosyllis clavata																
Haplosyllis spongicola					1											
Opisthodonta sp. B																
Pionosyllis gesae																
Sphaerosyllis longicauda																
Sphaerosyllis piriferopsis																
Sphaerosyllis riseri																
Sphaerosyllis taylori																
Streptosyllis pettiboneae																
Syllides floridanus																
Syllides bansei																
Typosyllis cf. *lutea*					1											
Unident. syllid				1												
Family NEREIDAE																
Ceratonereis irritabilis																
Ceratonereis longicirrata																
Ceratonereis mirabilis																
Ceratonereis versipedata																
Ceratonereis sp. A																
Neanthes sp. A					5											
Neanthes sp.					2											
Nematonereis hebes																
Nereis falsa																
Platynereis dumerilii																
Unidentified nereid																
Family GLYCERIDAE																
Glycera abranchiata					5											
Glycera americana																
Glycera sp. A																
Glycinde solitaria																
Unidentified glycerid							1									
Family GONIADIDAE																
Goniada littorea																
Goniada maculata					1											
Goniada teres																
Family NEPHTYIDAE																
Inermonephtys inermis																
Order AMPHINOMIDA																
Family AMPHINOMIDAE																
Chloeia viridis																
Paramphinome sp. B					2											
Pseudeurythoe sp.																
Order EUNICIDA																
Family EUNICIDAE																
Eunice sp. A					10											
Lysidice ninetta					1											
Marphysa sp.					1											
Nematonereis hebes					7											
Family ONUPHIDAE																
Diopatra cuprea																
Kinbergonuphis sp.																
Mooreonuphis pallidula					4											
Mooreonuphis sp.																
Unident. onuphid																
Family LUMBRINERIDAE																
Lumbrinereis latreila																
Lumbrinereis tetraura	3									3						

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE TREATMENT (FILL) SITES															
STATION	R106				T111				R116				R120			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Lumbrinereis tenuis																
Lumbrinereis verrilli																
Lumbrineris sp.																
Family ARABELLIDAE																
Arabella multidentata																
Arabella mutans					3											
Drilonereis longa				1					1							
Drilonereis sp. B					1											
Drilonereis sp.																
Family DORVILLEIDAE																
Dorvillea sociabilis																
Pettibonia duofurca																
Protodorvillea kefersteini																
Schistomeringos pectinata																
Uunidentified dorvilleid																
Order OWENIIDA																
Famiy OWENIIDAE																
Myriochele oculata																
Order TEREBELLIDA																
Family PECTINARIIDAE																
Pectinaria gouldii																
Family TEREBELLIDAE																
Ameaena trilobata																
Pista quadrilobata																
Polycirrus plumosus																
Polycirrus sp. B																
Polycirrus sp.																
Scionella sp. A																
Thalanessa sp. A																
Unidentified terebellid																
Family TRICHOBRANCHIDAE																
Terebellides stroemi																
Order SABELLIDA																
Family BOGUEIDAE																
Boguea enigmatica																
Unidentified bogueid																
Family SABELLIDAE																
Branchiomma nigromaculata																
Chone cf. *americana*																
Demonax sp.																
Fabricia sp. A																
Fabricinuda trilobata																
Sabella melanostigma																
Sabellastarte sp. A																
Unidentified sabellid																
Family SERPULIDAE																
Unidentified serpulid					1											
Order FLABELLIGERIDA																
Family FLABELLIGERIDAE																
Pherusa inflata					1											
Unident. polychaete																
Class OLIGOCHAETA																
Family TUBIFICIDAE																
Bathydrilus adriaticus				8	1							3				
Heterodrilus bulbiporous																
Heterodrilus pentcheffi																
Inanidrilus leukodermatus																
Limnodriloides monothecus																
Olavius imperfectus																
Olavius/Inanidrilus sp.					1											
Pectinodrilus molestus																
Smithsonidrilus luteolus																
Smithsonidrilus marinus																
Tectidrilus bori																
Unidentified tubificid			1	2	5	2							1			
Family ENCHYTRAEIDAE																
Grania sp.					2											
Phylum SIPUNCULA																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE TREATMENT (FILL) SITES															
STATION	R106				T111				R116				R120			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Class SIPUNCULIDEA																
Order GOLFINGIIFORMES																
Family PHASCOLIONIDAE																
Phascolion sp. A					2											
Order ASPIDOSIPHONIFORMES																
Family ASPIDOSIPHONIDAE																
Aspidosiphon fischeri																
Unidentified sipunculan A																
Unidentified sipunculan																
Phylum MOLLUSCA																
Class POLYPLACOPHORA																
Order NEOLORICATA																
Acanthochitona sp.	1															
Class GASTROPODA																
Family OLIVIDAE																
Olivella mutica													1			2
Family CERITHIDAE																
Cerithiopsis emersoni																
Cerithium litteratum					2											
Family VOLVATELLIDAE																
Cylindrobulla beauii					4											
Family CAECIDAE																
Caecum imbricatum																
Caecum pulchellum				1	10		1					1				
Meioceras cubitatum																
Meioceras nitidum																
Family RISSOIDAE																
Amphithalamus vallei				1												
Unidentified rissoid (juv.)					1											
Family CYLICHNIDAE																
Cylichnella bidentata																
Family CYCLOSTREMATIDAE																
Arene tricarinata																
Family VITRINELLIDAE																
Teinostoma clavium																
Teinostoma sp.																
Family NATICIDAE																
Unidentified naticid (juv)																
Family HAMINOEIDAE																
Atys sandersoni																
Unidentified opisthobranch																
Class BIVALVIA																
Family SOLEMYACIDAE																
Solemya occidentalis																
Family ARCIDAE																
Barbatia candida																
Family SPORTELLIDAE																
Unidentified sportellid												1				
Family CARDITIDAE																
Cyclocardia sp.																
Pleuromeris tridentata				1												
Family LEPTONIDAE																
Unidentified leptonid																
Family CARDIIDAE																
Laevicardium sp.																
Family LUCINIDAE																
Parvilucina multilineata																
Lucina sp.																
Unidentified lucinid																
Family SEMELIDAE																
Cumingia tellinoides					1											
Semele bellastriata																
Family UNGULINIDAE																
Diplodonta semiaspera																
Diplodonta sp.																
Family MESODESMATIDAE																
Ervilia concentrica																
Ervilia sp.																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE TREATMENT (FILL) SITES															
STATION	R106				T111				R116				R120			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Family THRACIIDAE																
Bushia elegans																
Family VERTICORDIIDAE																
Verticordia ornata																
Family VENERIDAE																
Chione cancellata																
Parastarte triquetra							1									
Tivela floridana	8	353	9	96	5	3	2	26	54	61	7	13		188	9	5
Transennella sp.																
Gouldia cerina																
Family MYTILIDAE																
Brachiodontes modiolus					24											
Family TELLINIDAE																
Strigilla mirabilis		7	1			2	1			3						
Tellina iris?					7											
Tellina sybaritica																
Tellina texana																
Tellina sp.					14	1	1									
Unidentified tellinid					1											
Family CORBULIDAE																
Corbula krebsiana																
Unidentified bivalve			3		1		1					1	1			
Phylum BRYOZOA																
Class GYMNOLAEMATA																
Order CHEILOSTOMATA																
Cupuladria sp.							1				1	1			5	2
Phylum BRACHIOPODA																
Class INARTICULATA																
Lingula sp.																
Phylum ARTHROPODA																
Subphylum CHELICERATA																
Class PYCNOGONIDA																
Unidentified pycnogonid																
Class ARACHNIDA																
Order ACARI																
Unidentified acarine				1								1				
Subphylum CRUSTACEA																
Class COPEPODA																
Order CYCLOPOIDA		1														
Order CALANOIDA					1								1			
Order HARPACTICOIDA		1		41	2	144				1		24		2		
Class OSTRACODA																
Subclass MYODOCOPIDA																
Family CYLINDROLEBERIDIDAE																
Parasterope muelleri																
Prionotoleberis salomani					1											
Asteropella punctata																
Family PHILOMEDIDAE																
Harbansus paucichelatus																
Family RUTIDERMATIDAE																
Rutiderma darbyi																
Unidentified ostracodes																
Class MALACOSTRACA																
Order AMPHIPODA																
Family CAPRELLIDAE																
Caprella pentantis																
Caprella sp.																
Family AMPELISCIDAE																
Ampelisca abdita																
Ampelisca bicarinata																
Ampelisca sp.																
Family AORIDAE																
Acuminodeutopus sp.																
Amphideutopus dolichocephalus																
Amphideutopus sp.																
Bemlos unifasciatus reductus																
Bemlos sp.																
Family BATEIDAE																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE TREATMENT (FILL) SITES															
STATION	R106				T111				R116				R120			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Carinobatea catharinensis				3				2								
Family GAMMARIDAE																
Elasmopus levis																
Elasmopus sp.																
Family HAUSTORIIDAE																
Acanthohaustorius pansus																
Haustorius n. sp.	9	5	8				2	3	2	9	5		3	14	3	4
Bathyporeia parkeri									4							
Family ISAEIDAE																
Chevalia aviculae																
Family MEGALUROPIDAE																
Gibberosus myersi				2			1									
Family OEDICEROTIDAE																
Monoculodes sp.																
Synchelidium americanum																
Family PHOXOCEPHALIDAE																
Metharpinia floridana	8	34	5		6	4	11		1	26	1		1	29	1	
Family PLATYISCHNOPIDAE																
Eudevanopus honduranus	3		2		1	3		1	3	8	6			4	4	
Family SYNOPIIDAE																
Synopia caraibica																
Family COROPHIIDAE																
Cerapus sp.																
Grandidierella bonnieroides																
Unidentified corophiid n. sp.																
Unidentified corophiid																
Family NEOMEGAMPHOPIDAE																
Unidentified neomegamphopid																
Order ISOPODA																
Family ANTHURIDAE																
Amakusanthura magnifica																
Family GNATHIIDAE																
Gnathia sp.																
Family HYSSURIDAE																
Xenanthura brevitelson																
Family CIROLANIDAE																
Eurydice convexa																
Eurydice personata															1	1
Eurydice sp.								2				1				
Family SPHAEROMATIDAE																
Ancinus braziliensis															1	
Ancinus depressus	1															
Ancinus sp.												2				
Exosphaeroma diminutum				2												
Exosphaeroma productatelson				21								1				
Order CUMACEA																
Family BODOTRIIDAE																
Cyclaspis cf. *longipes*			5			1	2				5			4	2	
Cyclaspis cf. *pustulata*								8								
Cyclaspis unicornis																
Cyclaspis cf. *varians*		5				13				2				6		
Cyclaspis cf. *striata/bacescui*			1				1				3				2	
Cyclaspis sp. B(?)																
Cyclaspis n. sp. D	8	3			5	3			4	20				25		
Cyclaspis n. sp. E																
Bodotriidae n. gen. A					4											
Family NANASTACIDAE																
Cumella sp.																
Unidentified cumacean fragment																
Order TANAIDACEA																
Family PARATANAIDAE																
Leptochelia forresti																
Leptochelia sp.																
Family APSEUDIDAE																
Apseudes sp. A																
Family KALLIAPSEUDIDAE																
Cirratodactylus floridensis																
Kalliapseudes sp.																

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	INSHORE TREATMENT (FILL) SITES															
STATION	R106				T111				R116				R120			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Unidentified tanaidacean																
Order MYSIDACEA																
Uunidentified mysid	1		1		1					3						1
Order DECAPODA																
Infraorder PENAEIDEA																
Family SOLENOCERIDAE																
Solenocera sp.																
Infraorder CARIDEA																
Family ALPHEIDAE																
Automate sp.																
Unidentified alpheid																
Family OGYRIDIDAE																
Ogyrides alphaerostris																
Family PROCESSIDAE																
Processa sp.		1														
Unidentified processid																
Unidentified caridean postlarva						1										
Unidentified Alpheoid																
Infraorder THALASSINIDEA																
Family CALLIANASSIDAE																
Callianassid new genus																
Unidentified callianassid larva																
Infraorder ASTACIDEA																
Family NEPHROPIDAE																
Unidentified nephropid																
Infraorder ANOMURA																
Family ALBUNEIDAE																
Albunea gibbesii																
Zygopa michaelis																
Family PAGURIDAE																
Unidentified pagurid																
Infraorder BRACHYURA																
Family LEUCOSIIDAE																
Ebalia stimpsonii																
Family MAJIDAE																
Batrachonotus sp.																
Family PINNOTHERIDAE																
Pinnixa cristata									1							
Pinnixa gorei											1					
Pinnixa sp.															1	
Unidentified pinnotherid																
Family CALAPPIDAE																
Cycloes bairdii																
Unidentified megalopa						1				1						
Unidentified zoea																
Unidentified decapods								1								1
Phylum ECHINODERMATA																
Unidentified ophiuroid																
Unidentified holothuroid					1											
Phylum CHAETOGNATHA																
Phylum HEMICHORDATA																
Unidentified enteropneust																
Phylum CHORDATA																
Subphylum CEPHALOCHORDATA																
Branchiostoma caribaeum																
Subphylum VERTEBRATA																
Class OSTEICHTHYES																
Unidentified labrid																
Unknown		1			3						1		3			
Total Number of Organisms	162	524	399	734	307	321	191	118	202	243	246	450	173	356	159	64
Number of Organisms for H' & J'	97	504	375	194	248	135	180	79	88	231	224	62	69	243	152	56
Number of species for H' & J'	17	18	22	30	70	21	27	15	11	17	23	21	11	13	21	13
Diversity Index (H')	2.462	1.329	1.824	2.192	3.735	2.297	2.366	2.182	1.497	2.324	2.023	2.598	1.159	1.629	1.883	1.919
Evenness (J')	0.869	0.460	0.590	0.645	0.878	0.755	0.718	0.806	0.246	0.382	0.645	0.853	0.190	0.268	0.619	0.748

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	OFFSHORE SITES											
STATION	CONTROL				BORROW AREA				TOTALS			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Phylum PORIFERA												
Unidentified sponge					1				1			
Phylum CNIDARIA												
Subphylum MEDUSOZOA												
Unidentified hydrozoan	1		1						1		1	1
Subphylum ANTHOZOA												
Class ZOANTHARIA												
Order SCLERACTINIA												
Sphenotrochus sp.			20	16			1				24	16
Order ACTINIARIA												
Unidentified actiniarian			2				8		1		10	
Phylum PLATYHELMINTHES												
Class TURBELLARIA												
?*Coelogynopora* sp.							1				4	
Unidentified acoel												3
Unidentified bothryoplanid											1	1
Unidentified coelogynoporid												3
Unidentified kalyptorhynchid												7
Unidentified monocelid												3
Unidentified nematoplanid												4
Unidentified otoplanid											2	5
Unidentified typhloplanid											1	5
Unidentified phyllosyrtid												2
Unidentified proseriate			2						17	3	7	17
Unidentified turbellarian			6	1	1				6	64	15	9
Phylum NEMERTINA												
Order ARCHINEMERTINA												
Family CEPHALOTHRICIDAE												
Cephalothrix sp. A			4				2				20	7
Cephalothrix sp. 114			2		2	3	1		10	79	45	16
Procephalothrix spiralis?	4								5			
Unidentified cephalothricid										5		3
Unidentified archinemertine											1	
Order PALEONEMERTINA												
Family CARINOMIDAE												
Carinoma sp. A			1								4	
Carinoma tremaphoros												1
Carinomella lactea	1	1	7		2	2	6		5	4	18	
Family HUBRECHTIDAE												
Hubrechtella dubia	32	11			3	5		1	43	23	1	1
Family TUBULANIDAE												
Tubulanus pellucidus			2	2		5	2	7	2	9	4	9
Tubulanus rhabdotus						1	1			1	1	
Tubulanus sp.							1				1	
Paleonemertine sp. 103											2	
Unident. paleonemertine sp. A										3		
Unidentified paleonemertine		1	1			1			4	3	3	5
Order HETERONEMERTINA												
Family CEREBRATULIDAE												
?*Cerebratulus leucopsis*		1								1		
Cerebratulus lineolatus?									1			
Family BASEODISCIDAE												
Baseodiscus sp.?							1		1		1	
Family MICRURIDAE												
Micrura sp.							1			1	1	
Unidentified heteronemertine								1				1
Order HOPLONEMERTINA												
Family PROSTOMATELLIDAE												
Prostomatella enteroplecta?									11			
Family TETRASTEMMIDAE												
Tetrastemma worki		1				1				15	2	
Family DREPANOPHORIDAE												
Unident. drepanophorid			1				1				2	
4-eye hoplonemertine								3				18
Unidentified hoplonemertine	1		3						1		7	6
Unidentified nemertine							3				7	
Phylum NEMATODA	148	19	99	43	67	46	72	8	1397	1178	316	970
Phylum PRIAPULA												

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	OFFSHORE SITES											
STATION	CONTROL				BORROW AREA				TOTALS			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Family TUBILUCHIDAE												
Tubiluchus corallicola					1				2			
Phylum ANNELIDA												
Class POLYCHAETA												
Order ORBINIIDA												
Family ORBINIIDAE												
Orbinia riseri	1				1				2			
Scoloplos acmeceps	1								1			
Scoloplos sp. B										1		
Scoloplos sp.			1						1		2	
Naineris bicornis				1					1			1
Leitoscoloplos fragilis												10
Leitoscoloplos sp.									2		3	12
Family PARAONIDAE												
Aricidea cf. *catherinae*	2								3			
Aricidea cerrutii			2		1	5	1		1	5	3	
Aricidea fragilis	8	3			2				10	3		
Aricidea philbinae	1	18						4	1	18		4
Aricidea taylori	1	1							2	1		
Aricidea suecica			2	1							2	1
Aricidea sp.			1	2							2	2
Cirrophorus lyra	3								3	3		
Levinsenia gracilis	1								1			
Paraonis fulgens			1	2			2	1	83	95	323	184
Paraonis pygoenigmatica				1						34		1
Family QUESTIDAE												
Questa sp.									1			
Order CTENODRILIDA												
Family CTENODRILIDAE												
Raphidrilus nemasoma	1				1				2			
Ctenodrilus serratus						1				1		
Ctenodrilus sp. A									1			
Order COSSURIDA												
Family COSSURIDAE												
Cossura soyeri				2								2
Order SPIONIDA												
Family SPIONIDAE												
Apoprionospio dayi	3	1			1	2	1		10	12	8	
Apoprionospio pygmaea										2		1
Dispio uncinata			2				1		127	74	960	202
Malacoceros vanderhorsti		1			1				1	1		
Minuspio sp. A	1								1			
Paraprionospio pinnata		1	1			1	19			2	20	
Polydora comuta									8			
Polydora tetrabranchia									3			
Polydora websteri				1								1
Polydora sp.												1
Prionospio cristata	47	17	29	6	36	39	54	16	97	95	85	22
Prionospio heterobranchia	1								1			
Prionospio multibranchiata								2				97
Prionospio steenstrupi					1				1			
Prionospio sp.	1		1		1		2		2		3	
Pseudopolydora sp.	1	1	6	5	4	1	93		5	2	100	5
Scolelepis acmeceps									4			
Scolelepis squamata										2		2
Scolelepis texana			1		2	1	2	1	10	148	283	71
Spio pettiboneae	3	1	3		2	2	7		17	158	167	
Unidentified spionid	1		2				2		5	2	11	10
Family MAGELONIDAE												
Magelona pettiboneae	2		1	1					2		1	1
Magelona sp. B						1				1		
Magelona sp. C	3	6				2	1		3	9	1	
Magelona sp. G		1								1		
Magelona sp. H							1				1	
Magelona sp.				1			2	4			2	5
Family POECILOCHAETIDAE												
Poecilochaetus johnsoni		1	2	2	1				2	1	2	3
Family CHAETOPTERIDAE												

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	OFFSHORE SITES											
STATION	CONTROL				BORROW AREA				TOTALS			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Unidentified chaetopterid (juv)							3				3	
Family CIRRATULIDAE												
Caulleriella cf. *alata*	2								2			
Caulleriella killariensis			2				1				3	
Caulleriella sp. A	1								1			
Caulleriella sp.						1			7	1		
Chaetozone setosa	1								1			
Chaetozone sp. B			2				1				3	
Chaetozone sp.			2								2	
Cirriformia sp.					2				2			
Dodecaceria sp. A					1				1			
Tharyx dorsobranchialis	2		1		3				6		1	
Tharyx marioni			1								1	
Tharyx sp.			1								1	
Unidentified cirratulid			5				2				7	
Order CAPITELLIDA												
Family CAPITELLIDAE												
Capitella capitata				1						2		1
Dasybranchus lunatus				1								1
Leiocapitella sp. A					1				1			
Mediomastus californiensis									19			
Mediomastus sp.							1	1	2		2	3
Notomastus americanus		3	1	1		4	8			7	9	1
Notomastus latericeus				1	1			1	3			2
Notomastus daueri	2	1			3				5	1		
Notomastus ?tenuis	2			1	8			1	10			2
Notomastus hemipodus				1	1				1			1
Notomastus sp.			1		1				1		1	
Scyphoproctus platyproctus				1		1			2	1		1
Unidentified capitellid	1		2				1	1	3		3	1
Family MALDANIDAE												
Axiothella sp. A					3				3			
Axiothella sp.					1				1			
Unidentified maldanid				3			1				1	3
Family ARENICOLIDAE												
Arenicola sp.									1			
Unidentified arenicolid					2				2			
Order OPHELIIDA												
Family OPHELIIDAE												
Armandia agilis			5	1			35	2	41	109	138	5
Armandia maculata	19	3		7	13	1		7	32	4		14
Armandia sp. (juv)							3				4	
Polyophthalmus sp.					1				1			
Family SCALIBREGMIDAE												
Sclerobregma stenocerum				1	1	1	1		1	1	1	1
Unidentified scalibregmid					1				1			
Order PHYLLODOCIDA												
Family PHYLLODOCIDAE												
Genetyllis cf. *castanea*			2				8				10	
Genetyllis sp.						1				1		
Hesionura elongata										1		19
Mystides borealis	1								1			
Phyllodoce arenae							2			1	2	
Unidentified phyllodocid							1				1	
Family SIGALIONIDAE												
Sigalion arenicola			1				1				2	
Sthenelais boa	1		2		2		1		3		3	
Sthenelais sp.	1			1		1		2	1	1		3
Unidentified sigalionid							4				4	1
Family CHRYSOPETALIDAE												
Bhawania heteroseta			1				2				3	
Family HESIONIDAE												
Gyptis vitatta	2	1							2	1		
Heteropodarke lysoni	1								1			
Microphthalmus sp. A									1	1		
Podarke obscura						1				1		
Podarkeopsis levifuscina	5		1		5	1	2		10	1	3	
Family PILARGIIDAE												

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	OFFSHORE SITES											
STATION	CONTROL				BORROW AREA				TOTALS			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Litocorsa sp. A				1				1				2
Sigambra tentaculata	4				1	1		1	5	1		1
Synelmis sp. B	7	8	5	1					7	10	5	1
Family SYLLIDAE												
Brania wellfleetensis					2		1		2		1	
Dentatisyllis carolinae	1								1			
Ehlersia cornuta	6			1	2				11			3
Exogone atlantica									1			
Exogone dispar		1		2		1	3			2	3	2
Exogone laurei									1			
Exogone sp.									1			
Grubeosyllis clavata	2			1	1			1	3			2
Haplosyllis spongicola					1				2			
Opisthodonta sp. B				1								1
Pionosyllis gesae	4				2	1			6	1		
Sphaerosyllis longicauda			1				1				2	
Sphaerosyllis piriferopsis				1								1
Sphaerosyllis riseri	1								1			
Sphaerosyllis taylori							1				1	
Streptosyllis pettiboneae			4								4	
Syllides floridanus	1								1			
Syllides bansei									1			
Typosyllis cf. *lutea*									1			
Unident. syllid				1								2
Family NEREIDAE												
Ceratonereis irritabilis	1	2		2	5	1			6	3		3
Ceratonereis longicirrata			3	1	1	2	5		1	2	8	1
Ceratonereis mirabilis	4	1		8	9	2			13	3		8
Ceratonereis versipedata					2				2			
Ceratonereis sp. A	4				1				5			
Neanthes sp. A									5			
Neanthes sp.									2			
Nematonereis hebes				1								1
Nereis falsa						1				1		
Platynereis dumerilii				1			3				3	1
Unidentified nereid			5				1				7	
Family GLYCERIDAE												
Glycera abranchiata	1	1		2	2				13	2		2
Glycera americana			1	3		1		1		1	2	4
Glycera sp. A					1				1			
Glycinde solitaria											1	
Unidentified glycerid	2	1	2				2		2	1	5	
Family GONIADIDAE												
Goniada littorea			1								1	
Goniada maculata									1			
Goniada teres					3				3			
Family NEPHTYIDAE												
Inermonephtys inermis						1				1		
Order AMPHINOMIDA												
Family AMPHINOMIDAE												
Chloeia viridis			1			2				2	1	
Paramphinome sp. B									2	1		
Pseudeurythoe sp.			1								1	
Order EUNICIDA												
Family EUNICIDAE												
Eunice sp. A									10			
Lysidice ninetta									1			
Marphysa sp.									1			
Nematonereis hebes									9			
Family ONUPHIDAE												
Diopatra cuprea							1	1			1	1
Kinbergonuphis sp.					3				3			
Mooreonuphis pallidula		3			1				6	3		
Mooreonuphis sp.					1				1			
Unident. onuphid								1				1
Family LUMBRINERIDAE												
Lumbrinereis latreilla									1			
Lumbrinereis tetraura						1			3	8		

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	OFFSHORE SITES											
STATION	CONTROL				BORROW AREA				TOTALS			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Lumbrinereis tenuis	1								1			
Lumbrinereis verrilli				3		1				1		3
Lumbrineris sp.			1				1				2	
Family ARABELLIDAE												
Arabella multidentata										1	1	
Arabella mutans									4			
Drilonereis longa	1				1				3			3
Drilonereis sp. B									1			
Drilonereis sp.		1								1		
Family DORVILLEIDAE												
Dorvillea sociabilis				1								1
Pettibonia duofurca	1								1			
Protodorvillea kefersteini										1		
Schistomeringos pectinata			1				1				2	
Uunidentified dorvilleid	1		1						1		1	
Order OWENIIDA												
Family OWENIIDAE												
Myriochele oculata								1				1
Order TEREBELLIDA												
Family PECTINARIIDAE												
Pectinaria gouldii	1								1			
Family TEREBELLIDAE												
Ameaena trilobata			2								2	
Pista quadrilobata				1								1
Polycirrus plumosus		1				1				2		
Polycirrus sp. B						1				1		
Polycirrus sp.	1								1			
Scionella sp. A	1								1			
Thalanessa sp. A		1								1		
Unidentified terebellid			1	2			1				2	2
Family TRICHOBRANCHIDAE												
Terebellides stroemi		1			1				1	1		
Order SABELLIDA												
Family BOGUEIDAE												
Boguea enigmatica			2				2				4	
Unidentified bogueid			2								2	
Family SABELLIDAE												
Branchiomma nigromaculata	1								1			
Chone cf. *americana*	6	3	12	5	4	41	18	17	10	44	30	22
Demonax sp.						2				2		
Fabricia sp. A			14				4				18	
Fabricinuda trilobata	20	5	1	7				5	20	5	1	13
Sabella melanostigma				1								1
Sabellastarte sp. A					1				1			
Unidentified sabellid			3				1				4	
Family SERPULIDAE												
Unidentified serpulid									1			
Order FLABELLIGERIDA												
Family FLABELLIGERIDAE												
Pherusa inflata									1			
Unident. polychaete				5				1				7
Class OLIGOCHAETA												
Family TUBIFICIDAE												
Bathydrilus adriaticus					1				3			11
Heterodrilus bulbiporous				4	4				5			4
Heterodrilus pentcheffi				3					1			3
Inanidrilus leukodermatus					1				2			
Limnodriloides monothecus			1								1	
Olavius imperfectus				1								1
Olavius/Inanidrilus sp.			2	1			1		2		3	1
Pectinodrilus molestus											1	
Smithsonidrilus luteolus			1								1	
Smithsonidrilus marinus			1								1	
Tectidrilus bori			1		1				1		1	
Unidentified tubificid			1	3	20				27	4	2	6
Family ENCHYTRAEIDAE												
Grania sp.									2			
Phylum SIPUNCULA												

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	OFFSHORE SITES											
STATION	CONTROL				BORROW AREA				TOTALS			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Class SIPUNCULIDEA												
Order GOLFINGIIFORMES												
Family PHASCOLIONIDAE												
Phascolion sp. A									2			
Order ASPIDOSIPHONIFORMES												
Family ASPIDOSIPHONIDAE												
Aspidosiphon fischeri									1			
Unidentified sipunculan A		2				5	17			7	17	
Unidentified sipunculan				2								2
Phylum MOLLUSCA												
Class POLYPLACOPHORA												
Order NEOLORICATA												
Acanthochitona sp.									1			
Class GASTROPODA												
Family OLIVIDAE												
Olivella mutica									1			2
Family CERITHIDAE												
Cerithiopsis emersoni				1								1
Cerithium litteratum									2			
Family VOLVATELLIDAE												
Cylindrobulla beaui									5			
Family CAECIDAE												
Caecum imbricatum				5								5
Caecum pulchellum									47		24	5
Meioceras cubitatum				1								1
Meioceras nitidum											2	
Family RISSOIDAE												
Amphithalamus vallei									1			1
Unidentified rissoid (juv.)									1			
Family CYLICHNIDAE												
Cylichnella bidentata					1				1			
Family CYCLOSTREMATIDAE												
Arene tricarinata	1								1			
Family VITRINELLIDAE												
Teinostoma clavium											1	
Teinostoma sp.												1
Family NATICIDAE												
Unidentified naticid (juv)							1				1	
Family HAMINOEIDAE												
Atys sandersoni				1								1
Unidentified opisthobranch				2								2
Class BIVALVIA												
Family SOLEMYACIDAE												
Solemya occidentalis			1					1			1	1
Family ARCIDAE												
Barbatia candida									1			
Family SPORTELLIDAE												
Unidentified sportellid												1
Family CARDITIDAE												
Cyclocardia sp.				3								3
Pleuromeris tridentata									2			1
Family LEPTONIDAE												
Unidentified leptonid			2								2	
Family CARDIIDAE												
Laevicardium sp.			1								1	
Family LUCINIDAE												
Parvilucina multilineata	6	2				3			6	5		
Lucina sp.	1							1	1			1
Unidentified lucinid									1			
Family SEMELIDAE												
Cumingia tellinoides									1			
Semele bellastriata	1			1					1			1
Family UNGULINIDAE												
Diplodonta semiaspera	1	3							1	3		
Diplodonta sp.	5			2				3	5			5
Family MESODESMATIDAE												
Ervilia concentrica	1		1						1	2	1	
Ervilia sp.		1								2		

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	OFFSHORE SITES											
STATION	CONTROL				BORROW AREA				TOTALS			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Family THRACIIDAE												
Bushia elegans	2								2			
Family VERTICORDIIDAE												
Verticordia ornata	1	1							1	1		
Family VENERIDAE												
Chione cancellata								1				1
Parastarte triquetra											1	
Tivela floridana	6								140	741	66	304
Transennella sp.			1	1				1			1	2
Gouldia cerina	1							1	1			1
Family MYTILIDAE												
Brachiodontes modiolus									24			
Family TELLINIDAE												
Strigilla mirabilis										276	12	1
Tellina iris?									7			
Tellina sybaritica	1		4	1	1		1		2		5	1
Tellina texana	1	7				1			1	8		
Tellina sp.	1		1			2			16	3	2	
Unidentified tellinid									1			
Family CORBULIDAE												
Corbula krebsiana				2				1				3
Unidentified bivalve		1	2		2		1	1	4	4	7	2
Phylum BRYOZOA												
Class GYMNOLAEMATA												
Order CHEILOSTOMATA												
Cupuladria sp.	23	17	41	80	27	12	18	3	62	29	74	95
Phylum BRACHIOPODA												
Class INARTICULATA												
Lingula sp.	1								1			
Phylum ARTHROPODA												
Subphylum CHELICERATA												
Class PYCNOGONIDA												
Unidentified pycnogonid			1	1	1		1		1		2	1
Class ARACHNIDA												
Order ACARI												
Unidentified acarine				1								3
Subphylum CRUSTACEA												
Class COPEPODA												
Order CYCLOPOIDA	2	2							2	3		
Order CALANOIDA	2	2		1					14	2		1
Order HARPACTICOIDA	31	9	11	3	15		26	1	48	190	43	69
Class OSTRACODA												
Subclass MYODOCOPIDA												
Family CYLINDROLEBERIDIDAE												
Parasterope muelleri												1
Prionotoleberis salomani					1				2			
Asteropella punctata					1				1			
Family PHILOMEDIDAE												
Harbansus paucichelatus										20		
Family RUTIDERMATIDAE												
Rutiderma darbyi					4				4			
Unidentified ostracodes			4				1				6	
Class MALACOSTRACA												
Order AMPHIPODA												
Family CAPRELLIDAE												
Caprella pentantis	1				2				3			
Caprella sp.				2				2				4
Family AMPELISCIDAE												
Ampelisca abdita							1				1	
Ampelisca bicarinata	2	2			5	6			7	8		
Ampelisca sp.				2		1		7		1		9
Family AORIDAE												
Acuminodeutopus sp.				1								1
Amphideutopus dolichocephalus					1	6			1	6		
Amphideutopus sp.				4								4
Bemlos unifasciatus reductus		2			10	6			10	8		
Bemlos sp.				6								6
Family BATEIDAE												

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	OFFSHORE SITES											
STATION	CONTROL				BORROW AREA				TOTALS			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Carinobatea catharinensis												5
Family GAMMARIDAE												
Elasmopus levis						1				1		
Elasmopus sp.						1				1		
Family HAUSTORIIDAE												
Acanthohaustorius pansus										1		
Haustorius n. sp.				1		1			27	35	43	160
Bathyporeia parkeri									4			1
Family ISAEIDAE												
Chevalia aviculae								1				1
Family MEGALUROPIDAE												
Gibberosus myersi						1				3	1	2
Family OEDICEROTIDAE												
Monoculodes sp.			1								1	
Synchelidium americanum		1	1	2		3	1	2		4	2	4
Family PHOXOCEPHALIDAE												
Metharpinia floridana	1	1	6	8	11		2	1	47	219	104	69
Family PLATYISCHNOPIDAE												
Eudevanopus honduranus									16	26	17	1
Family SYNOPIIDAE												
Synopia caraibica										1		
Family COROPHIIDAE												
Cerapus sp.											1	
Grandidierella bonnieroides				1				1				2
Unidentified corophiid n. sp.				3								3
Unidentified corophiid	1			6	2	1		4	3	1	2	10
Family NEOMEGAMPHOPIDAE												
Unidentified neomegamphopid			4				4				8	
Order ISOPODA												
Family ANTHURIDAE												
Amakusanthura magnifica			2		2	1			2	1	2	
Family GNATHIIDAE												
Gnathia sp.			1								1	
Family HYSSURIDAE												
Xenanthura brevitelson	54	49	8	14	39	1			93	50	8	14
Family CIROLANIDAE												
Eurydice convexa			1								1	
Eurydice personata											1	1
Eurydice sp.						3				6		3
Family SPHAEROMATIDAE												
Ancinus braziliensis											3	
Ancinus depressus												2
Ancinus sp.									8			2
Exosphaeroma diminutum												4
Exosphaeroma productatelson												22
Order CUMACEA												
Family BODOTRIIDAE												
Cyclaspis cf. *longipes*		1				5				13	25	
Cyclaspis cf. *pustulata*				1								21
Cyclaspis unicornis				1								1
Cyclaspis cf. *varians*		1				2	1			49	2	
Cyclaspis cf. *striata/bacescui*											11	
Cyclaspis sp. B(?)								2				2
Cyclaspis n. sp. D									44	58		
Cyclaspis n. sp. E									1			
Bodotriidae n. gen. A							1		4		1	
Family NANASTACIDAE												
Cumella sp.								1				1
Unidentified cumacean fragment	1								1			
Order TANAIDACEA												
Family PARATANAIDAE												
Leptochelia forresti					1				1			
Leptochelia sp.	1	1	2	8			1		2	1	3	8
Family APSEUDIDAE												
Apseudes sp. A	4		2	2	2				6		2	2
Family KALLIAPSEUDIDAE												
Cirratodactylus floridensis	81	15	22	10	49		5	1	130	15	27	11
Kalliapseudes sp.				13	1				1			13

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values, Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994).

	OFFSHORE SITES											
STATION	CONTROL				BORROW AREA				TOTALS			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Unidentified tanaidacean	1								1			
Order MYSIDACEA												
Uunidentified mysid	1				1				6	3	2	2
Order DECAPODA												
Infraorder PENAEIDEA												
Family SOLENOCERIDAE												
Solenocera sp.							1				1	
Infraorder CARIDEA												
Family ALPHEIDAE												
Automate sp.		1				1				2		
Unidentified alpheid							1				1	
Family OGYRIDIDAE												
Ogyrides alphaerostris										2	2	
Family PROCESSIDAE												
Processa sp.										1		
Unidentified processid	1								1			
Unidentified caridean postlarva										1		
Unidentified Alpheoid	2								2			
Infraorder THALASSINIDEA												
Family CALLIANASSIDAE												
Callianassid new genus		2				2				5		
Unidentified callianassid larva		1								1		
Infraorder ASTACIDEA												
Family NEPHROPIDAE												
Unidentified nephropid	1								1			
Infraorder ANOMURA												
Family ALBUNEIDAE												
Albunea gibbesii						1				1		
Zygopa michaelis				1								1
Family PAGURIDAE												
Unidentified pagurid							1				1	
Infraorder BRACHYURA												
Family LEUCOSIIDAE												
Ebalia stimpsonii							1				1	
Family MAJIDAE												
Batrachonotus sp.			1								1	
Family PINNOTHERIDAE												
Pinnixa cristata									5			
Pinnixa gorei											3	
Pinnixa sp.										1	1	
Unidentified pinnotherid					1				3			
Family CALAPPIDAE												
Cycloes bairdii					1	2			1	2		
Unidentified megalopa										3		
Unidentified zoea					1				1			
Unidentified decapods				3				3				14
Phylum ECHINODERMATA												
Unidentified ophiuroid	1		3	1	3	frag	8	2	4		11	3
Unidentified holothuroid			1				1		4		2	
Phylum CHAETOGNATHA									3			
Phylum HEMICHORDATA												
Unidentified enteropneust						1	1			1	1	
Phylum CHORDATA												
Subphylum CEPHALOCHORDATA												
Branchiostoma caribaeum	1			4			1		1		1	4
Subphylum VERTEBRATA												
Class OSTEICHTHYES												
Unidentified labrid					1				1			
Unknown			2		4		1		16		6	
Total Number of Organisms	624	247	432	373	443	260	511	136	3196	4127	3383	2859
Number of Organisms for H' & J'	440	215	322	327	354	216	413	127	1712	2652	3018	1820
Number of species for H' & J'	90	54	96	92	85	69	87	49				
Diversity Index (H')	3.351	3.123	4.333	3.643	3.643	3.368	3.783	3.408				
Evenness (J')	0.550	0.513	0.949	0.806	0.820	0.795	0.847	0.876				

Table 8.4.2. Numerical abundances of major taxonomic groups by station and survey (1990-1994).

	INSHORE CONTROL SITES															
STATION	T88				R90				R92				R94			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
TURBELLARIA	1		2		4	64	1		1		1	12	14		1	3
NEMERTINA	4	21	10	5	11	13	7	9	3	29	16	16	2	24	20	10
NEMATODA	98	17	34	1	159	989	35	1	260	4	12	4	333	24	1	3
POLYCHAETA	80	47	446	67	25	68	202	149	39	118	177	156	13	115	246	134
OLIGOCHAETA		2	1		6											1
GASTROPODA			1		38		22	1	1		1	2			2	1
BIVALVIA	5	92	2	1	18	13	8	19	43	81	15	59	6	220	24	86
BRYOZOA			2	3	10		4	3	1			3	1		2	
HARPACTICOIDA		3				22	2			7	3			1	1	
AMPHIPODA	17	22	32	32	7	8	25	31	14	90	11	109	3	26	43	41
ISOPODA	2		2						1	3		2	4			
CUMACEA	5	10	2	2	12	2	1	1	7	7	2	3	4	10	11	6
TANAIDACEA	1															
OTHERS	8	8	3	5	7	6	3	1	10	4		1	7	20	3	2
TOTALS	221	222	537	116	297	1185	310	214	380	343	238	367	387	440	354	287

	INSHORE TREATMENT (FILL) SITES															
STATION	R106				T111				R116				R120			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
TURBELLARIA	1	3	1	24							9	18	1		3	1
NEMERTINA	4	17	14	11	11	4	6			2	4		3	1	3	2
NEMATODA	65	17	24	499	53	41	11	39	114	10	21	364	100	11	7	8
POLYCHAETA	53	76	324	20	136	98	148	36	19	97	187	19	58	72	117	37
OLIGOCHAETA			1	10	9	2						3	1			
GASTROPODA				2	17		1					1	1			2
BIVALVIA	8	360	13	97	53	6	6	26	54		1	15	1	188	5	5
BRYOZOA							1				1	1			9	2
HARPACTICOIDA		1		41	2	144				1		24		2		
AMPHIPODA	20	39	15	5	7	7	14	6	10	43	12		4	47	8	4
ISOPODA	1			23				2			1	4			2	1
CUMACEA	8	8	6		9	17	3	8	4	22	8			35	4	
TANAIDACEA																
OTHERS	2	1	1	1	10	2	1	1	1	4	2	1	4		1	2
TOTALS	162	522	399	734	307	421	191	118	202	179	246	450	173	356	159	64

	OFFSHORE SITES							
STATION	CONTROL				BORROW AREA			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994
TURBELLARIA			8	1	1		1	
NEMERTINA	38	15	21	2	7	18	19	12
NEMATODA	148	19	99	43	67	46	72	8
POLYCHAETA	195	89	149	97	149	127	312	73
OLIGOCHAETA			7	12	27		1	
GASTROPODA	1			10	1		1	
BIVALVIA	28	15	13	10	3	6	2	10
BRYOZOA	23	17	41	80	27	12	18	3
HARPACTICOIDA	31	9	11	3	15		26	1
AMPHIPODA	5	6	12	36	31	27	8	18
ISOPODA	54	49	12	14	41	5		
CUMACEA	1	2		2		7	2	3
TANAIDACEA	87	16	26	33	53		6	1
OTHERS	13	4	35	30	21	12	44	7
TOTALS	624	241	434	373	443	260	512	136

TOTALS			
1990	1991	1992	1994
23	67	27	59
83	144	120	67
1397	1178	316	970
767	907	2308	788
43	4	10	26
59		28	19
219	981	89	328
62	29	78	95
48	190	43	69
118	315	180	282
103	57	17	46
50	120	39	25
141	16	32	34
83	61	93	51
3196	4169	3380	2859

Table 8.4.3. Percentage abundances of major taxonomic groups by station and survey (1990-1994).

	INSHORE CONTROL SITES															
STATION	T88				R90				R92				R94			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
TURBELLARIA	0.5		0.4		1.3	5.4	0.3		0.3		0.4	3.3	3.6		0.3	1.0
NEMERTINA	1.8	9.5	1.9	4.3	3.7	1.1	2.3	4.2	0.8	8.5	6.7	4.4	0.5	5.5	5.6	3.5
NEMATODA	44.3	7.7	6.3	0.9	53.5	83.5	11.3	0.5	68.4	1.2	5.0	1.1	86.0	5.5	0.3	1.0
POLYCHAETA	36.2	21.2	83.1	57.8	8.4	5.7	65.2	69.6	10.3	34.4	74.4	42.5	3.4	26.1	69.5	46.7
OLIGOCHAETA		0.9	0.2		2.0											0.3
GASTROPODA			0.2		12.8		7.1	0.5	0.3		0.4	0.5			0.6	0.3
BIVALVIA	2.3	41.4	0.4	0.9	6.1	1.1	2.6	8.9	11.3	23.6	6.3	16.1	1.6	50.0	6.8	30.0
BRYOZOA			0.4	2.6	3.4		1.3	1.4	0.3			0.8	0.3		0.6	
HARPACTICOIDA		1.4				1.9	0.6			2.0	1.3			0.2	0.3	
AMPHIPODA	7.7	9.9	6.0	27.6	2.4	0.7	8.1	14.5	3.7	26.2	4.6	29.7	0.8	5.9	12.1	14.3
ISOPODA	0.9		0.4						0.3	0.9		0.5	1.0			
CUMACEA	2.3	4.5	0.4	1.7	4.0	0.2	0.3	0.5	1.8	2.0	0.8	0.8	1.0	2.3	3.1	2.1
TANAIDACEA	0.5															
OTHERS	3.6	3.6	0.6	4.3	2.4	0.5	1.0	0.5	2.6	1.2		0.3	1.8	4.5	0.8	0.7
TOTALS	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

	INSHORE TREATMENT (FILL) SITES															
STATION	R106				T111				R116				R120			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
TURBELLARIA	0.6	0.6	0.3	3.3							3.7	4.0	0.6		1.9	1.6
NEMERTINA	2.5	3.3	3.5	1.5	3.6	1.0	3.1			1.1	1.6		1.7	0.3	1.9	3.1
NEMATODA	40.1	3.3	6.0	68.0	17.3	9.7	5.8	33.1	56.4	5.6	8.5	80.9	57.8	3.1	4.4	12.5
POLYCHAETA	32.7	14.6	81.2	2.7	44.3	23.3	77.5	30.5	9.4	54.2	76.0	4.2	33.5	20.2	73.6	57.8
OLIGOCHAETA			0.3	1.4	2.9	0.5						0.7	0.6			
GASTROPODA				0.3	5.5		0.5					0.2	0.6			3.1
BIVALVIA	4.9	69.0	3.3	13.2	17.3	1.4	3.1	22.0	26.7		0.4	3.3	0.6	52.8	3.1	7.8
BRYOZOA							0.5				0.4	0.2			5.7	3.1
HARPACTICOIDA		0.2		5.6	0.7	34.2				0.6		5.3		0.6		
AMPHIPODA	12.3	7.5	3.8	0.7	2.3	1.7	7.3	5.1	5.0	24.0	4.9		2.3	13.2	5.0	6.3
ISOPODA	0.6			3.1				1.7			0.4	0.9			1.3	1.6
CUMACEA	4.9	1.5	1.5		2.9	4.0	1.6	6.8	2.0	12.3	3.3			9.8	2.5	
TANAIDACEA																
OTHERS	1.2	0.2	0.3	0.1	3.3	0.5	0.5	0.8	0.5	2.2	0.8	0.2	2.3		0.6	3.1
TOTALS	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

	OFFSHORE SITES							
STATION	CONTROL				BORROW AREA			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994
TURBELLARIA			1.8	0.3	0.2		0.2	
NEMERTINA	6.1	6.2	4.8	0.5	1.6	6.9	3.7	8.8
NEMATODA	23.7	7.9	22.8	11.5	15.1	17.7	14.1	5.9
POLYCHAETA	31.3	36.9	34.3	26	33.6	48.8	60.9	53.7
OLIGOCHAETA			1.61	3.22	6.09		0.2	
GASTROPODA	0.2			2.7	0.2			
BIVALVIA	4.5	6.2	3.0	2.7	0.7	2.3	0.4	7.4
BRYOZOA	3.7	7.1	9.4	21.4	6.1	4.6	3.5	2.2
HARPACTICOIDA	5.0	3.7	2.5	0.8	3.4		5.1	0.7
AMPHIPODA	0.8	2.5	2.8	9.7	7.0	10.4	1.6	13.2
ISOPODA	8.7	20.3	2.8	3.8	9.3	1.9		
CUMACEA	0.2	0.8		0.5		2.7	0.4	2.2
TANAIDACEA	13.9	6.6	6.0	8.8	12.0		1.2	0.7
OTHERS	2.1	1.7	8.1	8.0	4.7	4.6	8.6	5.1
TOTALS	100	100	100	100	100	100	100	100

TOTALS			
1990	1991	1992	1994
0.7	1.6	0.8	2.1
2.6	3.5	3.6	2.3
43.7	28.3	9.3	33.9
24.0	21.8	68.3	27.6
1.3	0.1	0.3	0.9
1.8		0.8	0.7
6.9	23.5	2.6	11.5
1.9	0.7	2.3	3.3
1.5	4.6	1.3	2.4
3.7	7.6	5.3	9.9
3.2	1.4	0.5	1.6
1.6	2.9	1.2	0.9
4.4	0.4	0.9	1.2
2.6	1.5	2.8	1.8
100	100	100	100

Table 8.4.4. Percentage abundances of major taxonomic groups excluding nematodes and harpacticoid copepods, by station and survey (1990-1994).

	INSHORE CONTROL SITES															
STATION	T88				R90				R92				R94			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
TURBELLARIA	0.8		0.4		2.9	36.8	0.4		0.8		0.4	3.3	25.9		0.3	1.1
NEMERTINA	3.3	10.4	2.0	4.3	8.0	7.5	2.6	4.2	2.5	8.7	7.2	4.4	3.7	5.8	5.7	3.5
POLYCHAETA	65.0	23.3	88.7	58.3	18.1	39.1	74.0	69.6	32.5	35.5	79.4	43.0	24.1	27.7	69.9	47.2
OLIGOCHAETA		1.0	0.2		4.3											0.4
GASTROPODA			0.2		27.5		8.1	0.5	0.8		0.4	0.6			0.6	0.4
BIVALVIA	4.1	45.5	0.4	0.9	13.0	7.5	2.9	8.9	35.8	24.4	6.7	16.3	11.1	53.0	6.8	30.3
BRYOZOA			0.4	2.6	7.2	0.0	1.5	1.4	0.8			0.8	1.9		0.6	
AMPHIPODA	13.8	10.9	6.4	27.8	5.1	4.6	9.2	14.5	11.7	27.1	4.9	30.0	5.6	6.3	12.2	14.4
ISOPODA	1.6		0.4						0.8	0.9		0.6	7.4			
CUMACEA	4.1	5.0	0.4	1.7	8.7	1.1	0.4	0.5	5.8	2.1	0.9	0.8	7.4	2.4	3.1	2.1
TANAIDACEA	0.8															
OTHERS	6.5	4.0	0.6	4.3	5.1	3.4	1.1	0.5	8.3	1.2		0.3	13.0	4.8	0.9	0.7
TOTALS	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

	INSHORE TREATMENT (FILL) SITES															
STATION	R106				T111				R116				R120			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
TURBELLARIA	1.0	0.6	0.3	12.4							4.0	29.0	1.4		2.0	1.8
NEMERTINA	4.1	3.4	3.7	5.7	4.4	2.9	3.3			1.2	1.8		4.1	0.3	2.0	3.6
POLYCHAETA	54.6	15.1	86.4	10.4	54.0	72.1	82.2	45.6	21.6	57.7	83.1	30.6	79.5	21.0	77.0	66.1
OLIGOCHAETA			0.3	5.2	3.6	1.5						4.8	1.4			
GASTROPODA				1.0	6.7		0.6					1.6	1.4			3.6
BIVALVIA	8.2	71.4	3.5	50.3	21.0	4.4	3.3	32.9	61.4		0.4	24.2	1.4	54.8	3.3	8.9
BRYOZOA							0.6				0.4	1.6			5.9	3.6
AMPHIPODA	20.6	7.7	4.0	2.6	2.8	5.1	7.8	7.6	11.4	25.6	5.3		5.5	13.7	5.3	7.1
ISOPODA	1.0			11.9				2.5			0.4	6.5			1.3	1.8
CUMACEA	8.2	1.6	1.6		3.6	12.5	1.7	10.1	4.5	13.1	3.6			10.2	2.6	
TANAIDACEA																
OTHERS	2.1	0.2	0.3	0.5	4.0	1.5	0.6	1.3	1.1	2.4	0.9	1.6	5.5		0.7	3.6
TOTALS	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

	OFFSHORE SITES							
STATION	CONTROL				BORROW AREA			
YEAR	1990	1991	1992	1994	1990	1991	1992	1994
TURBELLARIA			2.5	0.3	0.3		0.2	
NEMERTINA	8.5	7.0	6.5	0.6	1.9	8.4	4.6	9.4
POLYCHAETA	43.8	41.8	46.0	29.8	41.3	59.3	75.4	57.5
OLIGOCHAETA			2.2	3.7	7.5		0.2	
GASTROPODA	0.2			3.1	0.3		0.2	
BIVALVIA	6.3	7.0	4.0	3.1	0.8	2.8	0.5	7.9
BRYOZOA	5.2	8.0	12.7	24.5	7.5	5.6	4.3	2.4
AMPHIPODA	1.1	2.8	3.7	11.0	8.6	12.6	1.9	14.2
ISOPODA	12.1	23.0	3.7	4.3	11.4	2.3		
CUMACEA	0.2	0.9		0.6		3.3	0.5	2.4
TANAIDACEA	19.6	7.5	8.0	10.1	14.7		1.4	0.8
OTHERS	2.9	1.9	10.8	8.9	5.8	5.6	10.6	5.5
TOTALS	100	100	100	100	100	100	100	100

TOTALS			
1990	1991	1992	1994
1.3	2.5	0.9	3.2
4.7	5.3	4.0	3.7
43.8	33.6	76.4	43.3
2.5	0.1	0.3	1.4
3.4		0.9	1.0
12.5	36.3	2.9	18.0
3.5	1.1	2.6	5.2
6.7	11.7	6.0	15.5
5.9	2.1	0.6	2.5
2.9	4.4	1.3	1.4
8.1	0.6	1.1	1.9
4.7	2.3	3.1	2.8
100	100	100	100

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	T88																R90														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Phylum CNIDARIA																																
Unident. hydroid																																
Sphenotrochus sp.																																
Phylum PLATYHELMINTHES																																
Class TURBELLARIA																																
Unidentified acoel																																
Unident. bothrioplanid																																
Unident. coelogynophorid																																
Unident. kalyptorhynchid																																
Unident. monocelid																																
Unident. nematoplanid																																
Unident. otoplanid																																
Unident. phyllosyrtid																																
Unident. proseriate																																
Unident. typhloplanid																																
Unident. turbellarian																																
Phylum NEMERTINA																																
Carinoma tremaphoros																				1												1
Cephalothrix sp. A														1		1		2								1	1		2			6
Cephalothrix sp. 114																																
Unident. cephalothricid																				1												1
Hubrechtella dubia																																
Unident. paleonemertine					1											1																
Tubulanus pellucidus																																
4-eye hoplonemertine	1					1	1									3																
Unident. hoplonemertine																																
Unident. heteronemertine																																
Phylum NEMATODA					1											1	1															1
Phylum ANNELIDA																																
Class POLYCHAETA																																
Leitoscoloplos fragilis																																
Leitoscoloplos sp.																																
Naineris bicornis																																
Aricidea philbinae																																
Aricidea suecica																																
Aricidea sp.																																
Paraonis fulgens	2			3	2	2	2	1	2			3	1	2	1	21	6	5	3	3	2	6	10				4	13	4	2	1	59
Paraonis pygoenigmatica																																
Cossura soyeri																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	T88																R90														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Apoprionospio pygmaea								1								1																
Dispio uncinata	2	2	2	7	1	7	4	1		3						29	6	2	2	2	7	7	6	4	5		8	12	4	2		67
Polydora websteri																																
Polydora sp.	1															1																
Prionospio cristata																																
Prionospio multibranchiata	2						1		2							5		1						3	2		3		1	1		11
Pseudopolydora sp. A																																
Scolelepis squamata																															2	2
Scolelepis texana	1				1	1		1								4						3	1					2	1	1		8
Unident. spionid																															1	1
Magelona pettiboneae																																
Magelona sp.																																
Poecilochaetus johnsoni													1			1																
Capitella capitata																																
Dasybranchus lunatus																																
Mediomastus sp.														2		2																
Notomastus americanus																																
Notomastus hemipodus																																
Notomastus latericeus																																
Notomastus cf. *tenuis*																																
Scyphoproctus playproctus																																
Unident. capitellid																																
Unident. maldanid																																
Armandia agilis												1				1																
Armandia maculata																																
Sclerobregma stenocerum																																
Hesionura elongata																																
Sthenelais sp.																																
Unident. sigalionid																																
Litocorsa sp. A																																
Sigambra tentaculata																																
Synelmis sp. B																																
Ehlersia cornuta																																
Exogone dispar																																
Grubeosyllis clavata																																
Opisthodonta sp. B																																
Sphaerosyllis piriferopsis																																
Unident. syllid																																
Ceratonereis irritabilis													1			1																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	T88																R90														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Ceratonereis longicirrata																																
Ceratonereis mirabilis																																
Nematonereis hebes																																
Platynereis dumerilii																																
Glycera abranchiata																																
Glycera americana																																
Diopatra cuprea																																
Unident. onuphid																																
Lumbrineris verrilli																																
Drilonereis longa																									1							1
Dorvillea sociabilis																																
Myriochele oculata																																
Pista quadrilobata																																
Unident. terebellid																																
Chone cf. *americana*																																
Fabricinuda trilobata	1															1																
Sabella melanostigma																																
Unident. polychaete																																
Class OLIGOCHAETA																																
Bathydrilus adriaticus																																
Heterodrilus bulbiporus																																
Heterodrilus pentcheffi																																
Olavius imperfectus																																
Olavius sp.																																
Unident. tubificid																																
Phylum SIPUNCULA																																
Unident. sipunculans																																
Phylum MOLLUSCA																																
Class GASTROPODA																																
Amphithalamus vallei																																
Teinostoma sp.																																
Caecum imbricatum																																
Caecum pulchellum																												1				1
Meioceras cubitatum																																
Cerithiopsis emersoni																																
Olivella mutica																																
Atys sandersoni																																
Unidentified opisthobranch																																
Class BIVALVIA																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	T88																R90														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Solemya occidentalis																																
Lucina sp.																																
Diplodonta sp.																																
Unidentified sportellid																																
Pleuromeris tridentata																																
Cyclocardia sp.																																
Tellina sybaritica																																
Strigilla mirabilis																																
Semele bellastriata																																
Chione cancellata																																
Tivela floridana				1												1	1	4		2			1	2	2		1		4	1	1	19
Transenella sp.																																
Gouldia cerina																																
Corbula krebsiana																																
Unidentified bivalve																																
Phylum BRYOZOA																																
Cupuladria sp.			1						1	1						3				1	1					1						3
Phylum ARTHROPODA																																
Subphylum CHELICERATA																																
Class PYCNOGONIDA																																
Unidentified pycnogonid																																
Class ARACHNIDA																																
Unidentified acarine																																
Subphylum CRUSTACEA																																
Class COPEPODA																																
Unidentified harpacticoids																																
Unidentified cyclopoids																																
Class OSTRACODA																																
Parasterope muelleri														1		1																
Class MALACOSTRACA																																
Order ISOPODA																																
Ancinus depressus																																
Eurydice personata																																
Eurydice sp. (juv.)																																
Exosphaeroma diminutum																																
Exosphaeroma productatelson																																
Xenanthura brevitelson																																
Order CUMACEA																																
Cumella sp.																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	T88																R90														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Cyclaspis cf. *pustulata*	1											1				2		1														1
Cyclaspis unicornis																																
Cyclaspis sp. B(?)																																
Cyclaspis sp.																																
Order AMPHIPODA																																
Acuminodeutopus sp.																																
Ampelisca sp.																																
Amphideutopus sp.																																
Bathyporeia parkeri																																
Bemlos sp.																																
Unidentified caprellid																																
Carinobatea catherinensis																																
Chevalia aviculae																																
Eudevanopus honduranus																																
Grandidierella bonnieroides																																
Gibberosus myersi																																
Haustorius sp.			2	1		1	7	3		4	1				2	21		1		1			4						1	3		10
Metharpinia floridana			2					2				1	1	3	2	11		2			1	3	3	3		1	2		3	2	1	21
Synchelidium americanum																																
Unidentified corophiid																																
Unident. corophiid n. sp.																																
Order TANAIDACEA																																
Apseudes sp.																																
Leptochelia sp.																																
Cirratodactylus floridensis																																
Kalliapseudes sp.																																
Order MYSIDACEA																																
Unidentified mysid																															1	1
Order DECAPODA																																
Zygopa michaelis																																
Unidentified decapods							2		1	1						4																
Phylum ECHINODERMATA																																
Unidentified ophiuroid																																
Phylum CHORDATA																																
Branchiostoma caribaeum																																
Unknown																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R92																R94															
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Phylum CNIDARIA																																
Unident. hydroid																					1											1
Sphenotrochus sp.																																
Phylum PLATYHELMINTHES																																
Class TURBELLARIA																																
Unidentified acoel																																
Unident. bothrioplanid																																
Unident. coelogynophorid																																
Unident. kalyptorhynchid																																
Unident. monocelid																																
Unident. nematoplanid																																
Unident. otoplanid																																
Unident. phyllosyrtid								1								1																
Unident. proseriate			3		3	1	1		1	1			1			11					2											2
Unident. typhloplanid																																
Unident. turbellarian																												1				1
Phylum NEMERTINA																																
Carinoma tremaphoros																																
Cephalothrix sp. A		1	1													2					2											2
Cephalothrix sp. 114		2		1	1				1				1			6	1				1					2						4
Unident. cephalothricid																		1														1
Hubrechtella dubia																																
Unident. paleonemertine																													1			1
Tubulanus pellucidus																																
4-eye hoplonemertine		1			1		3	1					1	1		8				1									1			2
Unident. hoplonemertine																																
Unident. heteronemertine																																
Phylum NEMATODA															4	4		1											2			3
Phylum ANNELIDA																																
Class POLYCHAETA																																
Leitoscoloplos fragilis																																
Leitoscoloplos sp.																																
Naineris bicornis																																
Aricidea philbinae																																
Aricidea suecica																																
Aricidea sp.																																
Paraonis fulgens	6	5		3	4	2	1	6	4	6	3	2	6	3	10	61	2			2		1	1	1				3	1	1		12
Paraonis pygoenigmatica																																
Cossura soyeri																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R92																R94														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Apoprionospio pygmaea																																
Dispio uncinata	3	2	3	4	4	5		3	2	2	2	5	6	2	6	49	1	1	2	5				3		1	11	1	1	1	2	29
Polydora websteri																																
Polydora sp.																																
Prionospio cristata																																
Prionospio multibranchiata	1		2	4	2	3			1	1		3	2	2	1	22	2	2	2	5	5	7	2	2	4	4	6	8	6	2		57
Pseudopolydora sp. A																																
Scolelepis squamata																																
Scolelepis texana	2	1	1	1	1	1	1		1		4		2			15	1	2	6	9	5		3		1		3	2	2	1		35
Unident. spionid		2				3	1						2			8															
Magelona pettiboneae																																
Magelona sp.																																
Poecilochaetus johnsoni																																
Capitella capitata																																
Dasybranchus lunatus																																
Mediomastus sp.																																
Notomastus americanus																																
Notomastus hemipodus																																
Notomastus latericeus																																
Notomastus cf. *tenuis*																																
Scyphoproctus playproctus																																
Unident. capitellid																																
Unident. maldanid																																
Armandia agilis																																
Armandia maculata																																
Sclerobregma stenocerum																																
Hesionura elongata																																
Sthenelais sp.																																
Unident. sigalionid																																
Litocorsa sp. A																																
Sigambra tentaculata																																
Synelmis sp. B																																
Ehlersia cornuta																																
Exogone dispar																																
Grubeosyllis clavata																																
Opisthodonta sp. B																																
Sphaerosyllis piriferopsis																																
Unident. syllid																																
Ceratonereis irritabilis																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R92																R94															
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Ceratonereis longicirrata																																
Ceratonereis mirabilis																																
Nematonereis hebes																																
Platynereis dumerilii																																
Glycera abranchiata																																
Glycera americana																																
Diopatra cuprea																																
Unident. onuphid																																
Lumbrineris verrilli																																
Drilonereis longa	1															1																
Dorvillea sociabilis																																
Myriochele oculata																																
Pista quadrilobata																																
Unident. terebellid																																
Chone cf. *americana*																																
Fabricinuda trilobata																																
Sabella melanostigma																																
Unident. polychaete																															1	1
Class OLIGOCHAETA																																
Bathydrilus adriaticus																																
Heterodrilus bulbiporus																																
Heterodrilus pentcheffi																																
Olavius imperfectus																																
Olavius sp.																																
Unident. tubificid																								1								1
Phylum SIPUNCULA																																
Unident. sipunculans																																
Phylum MOLLUSCA																																
Class GASTROPODA																																
Amphithalamus vallei																																
Teinostoma sp.																						1										1
Caecum imbricatum																																
Caecum pulchellum										1					1	2																
Meioceras cubitatum																																
Cerithiopsis emersoni																																
Olivella mutica																																
Atys sandersoni																																
Unidentified opisthobranch																																
Class BIVALVIA																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R92																R94														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Solemya occidentalis																																
Lucina sp.																																
Diplodonta sp.																																
Unidentified sportellid																																
Pleuromeris tridentata																																
Cyclocardia sp.																																
Tellina sybaritica																																
Strigilla mirabilis		1														1																
Semele bellastriata																																
Chione cancellata																																
Tivela floridana	7	6	2	4	4	10	6	4	1	2	3	1	7	1		58	6	7	8	4	8	6	6	5	1	10	2	7	6	3	7	86
Transenella sp.																																
Gouldia cerina																																
Corbula krebsiana																																
Unidentified bivalve																																
Phylum BRYOZOA																																
Cupuladria sp.															3	3																
Phylum ARTHROPODA																																
Subphylum CHELICERATA																																
Class PYCNOGONIDA																																
Unidentified pycnogonid																																
Class ARACHNIDA																																
Unidentified acarine																																
Subphylum CRUSTACEA																																
Class COPEPODA																																
Unidentified harpacticoids																																
Unidentified cyclopoids																																
Class OSTRACODA																																
Parasterope muelleri																																
Class MALACOSTRACA																																
Order ISOPODA																																
Ancinus depressus		1						1								2																
Eurydice personata																																
Eurydice sp. (juv.)																																
Exosphaeroma diminutum																																
Exosphaeroma productatelson																																
Xenanthura brevitelson																																
Order CUMACEA																																
Cumella sp.																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R92																R94															
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Cyclaspis cf. *pustulata*						1							2			3						1							1	3	1	6
Cyclaspis unicornis																																
Cyclaspis sp. B(?)																																
Cyclaspis sp.																																
Order AMPHIPODA																																
Acuminodeutopus sp.																																
Ampelisca sp.																																
Amphideutopus sp.																																
Bathyporeia parkeri		1														1																
Bemlos sp.																																
Unidentified caprellid																																
Carinobatea catherinensis																																
Chevalia aviculae																																
Eudevanopus honduranus																																
Grandidierella bonnieroides																																
Gibberosus myersi																																
Haustorius sp.		17	6	12	2	4	19	17		4	11		1	1	2	96			1	2	1	1	2	5		1	1	1	1	8	1	25
Metharpinia floridana	4	1			2		1					1	2	1		12				1		1	3		1		2	2	2	2	2	16
Synchelidium americanum																																
Unidentified corophiid																																
Unident. corophiid n. sp.																																
Order TANAIDACEA																																
Apseudes sp.																																
Leptochelia sp.																																
Cirratodactylus floridensis																																
Kalliapseudes sp.																																
Order MYSIDACEA																																
Unidentified mysid																																
Order DECAPODA																																
Zygopa michaelis																																
Unidentified decapods		1														1												1				1
Phylum ECHINODERMATA																																
Unidentified ophiuroid																																
Phylum CHORDATA																																
Branchiostoma caribaeum																																
Unknown																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R106																T111														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Phylum CNIDARIA																																
Unident. hydroid																																
Sphenotrochus sp.																																
Phylum PLATYHELMINTHES																																
Class TURBELLARIA																																
Unidentified acoel					1								1			2																
Unident. bothrioplanid																																
Unident. coelogynophorid						3										3																
Unident. kalyptorhynchid															3	3																
Unident. monocelid					1										1	2																
Unident. nematoplanid						3						1				4																
Unident. otoplanid						2										2																
Unident. phyllosyrtid																																
Unident. proseriate					2		1									3																
Unident. typhloplanid																																
Unident. turbellarian										1			4			5																
Phylum NEMERTINA																																
Carinoma tremaphoros																																
Cephalothrix sp. A											1					1																
Cephalothrix sp. 114																																
Unident. cephalothricid																																
Hubrechtella dubia																																
Unident. paleonemertine					2									1		3																
Tubulanus pellucidus																																
4-eye hoplonemertine	1															1																
Unident. hoplonemertine					1	2	1			1	1					6																
Unident. heteronemertine																																
Phylum NEMATODA	12	5		49	104	57	60	23	9	8	21	16	56	15	64	499			2			2	4	7	1	1		16	5		1	39
Phylum ANNELIDA																																
Class POLYCHAETA																																
Leitoscoloplos fragilis																				3		1			1	1	3				1	10
Leitoscoloplos sp.	1					1	1				1					4						4									2	6
Naineris bicornis																																
Aricidea philbinae																																
Aricidea suecica																																
Aricidea sp.																																
Paraonis fulgens							1						1	1		3	1										1					2
Paraonis pygoenigmatica																																
Cossura soyeri																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R106																T111															
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Apoprionospio pygmaea																																
Dispio uncinata					2				1							3	1	2	1					1			1		1			7
Polydora websteri																																
Polydora sp.																																
Prionospio cristata																																
Prionospio multibranchiata																																
Pseudopolydora sp. A																																
Scolelepis squamata																																
Scolelepis texana																							2		2	1		2		1		8
Unident. spionid																						1										1
Magelona pettiboneae																																
Magelona sp.																																
Poecilochaetus johnsoni																																
Capitella capitata																																
Dasybranchus lunatus																																
Mediomastus sp.																																
Notomastus americanus																																
Notomastus hemipodus																																
Notomastus latericeus																																
Notomastus cf. *tenuis*																																
Scyphoproctus playproctus																																
Unident. capitellid																																
Unident. maldanid																																
Armandia agilis																										1						1
Armandia maculata																																
Sclerobregma stenocerum																																
Hesionura elongata	3						1			1		2	1			8																
Sthenelais sp.																																
Unident. sigalionid																								1								1
Litocorsa sp. A																																
Sigambra tentaculata																																
Synelmis sp. B																																
Ehlersia cornuta																																
Exogone dispar																																
Grubeosyllis clavata																																
Opisthodonta sp. B																																
Sphaerosyllis piriferopsis																																
Unident. syllid						1										1																
Ceratonereis irritabilis																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R106																T111															
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Ceratonereis longicirrata																																
Ceratonereis mirabilis																																
Nematonereis hebes																																
Platynereis dumerilii																																
Glycera abranchiata																																
Glycera americana																																
Diopatra cuprea																																
Unident. onuphid																																
Lumbrineris verrilli																																
Drilonereis longa						1										1																
Dorvillea sociabilis																																
Myriochele oculata																																
Pista quadrilobata																																
Unident. terebellid																																
Chone cf. *americana*																																
Fabricinuda trilobata																																
Sabella melanostigma																																
Unident. polychaete																																
Class OLIGOCHAETA																																
Bathydrilus adriaticus					4		4									8																
Heterodrilus bulbiporus																																
Heterodrilus pentcheffi																																
Olavius imperfectus																																
Olavius sp.																																
Unident. tubificid						2										2																
Phylum SIPUNCULA																																
Unident. sipunculans																																
Phylum MOLLUSCA																																
Class GASTROPODA																																
Amphithalamus vallei							1									1																
Teinostoma sp.																																
Caecum imbricatum																																
Caecum pulchellum												1				1																
Meioceras cubitatum																																
Cerithiopsis emersoni																																
Olivella mutica																																
Atys sandersoni																																
Unidentified opisthobranch																																
Class BIVALVIA																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R106																T111															
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Solemya occidentalis																																
Lucina sp.																																
Diplodonta sp.																																
Unidentified sportellid																																
Pleuromeris tridentata												1				1																
Cyclocardia sp.																																
Tellina sybaritica																																
Strigilla mirabilis																																
Semele bellastriata																																
Chione cancellata																																
Tivela floridana	2	3	2	15	12	4	11	6	2		6	11	2	14	6	96	6	2		2		4		4	1	2		1		1	3	26
Transenella sp.																																
Gouldia cerina																																
Corbula krebsiana																																
Unidentified bivalve																																
Phylum BRYOZOA																																
Cupuladria sp.																																
Phylum ARTHROPODA																																
Subphylum CHELICERATA																																
Class PYCNOGONIDA																																
Unidentified pycnogonid																																
Class ARACHNIDA																																
Unidentified acarine											1					1																
Subphylum CRUSTACEA																																
Class COPEPODA																																
Unidentified harpacticoids	1				11		2	5		9		1	11		1	41																
Unidentified cyclopoids																																
Class OSTRACODA																																
Parasterope muelleri																																
Class MALACOSTRACA																																
Order ISOPODA																																
Ancinus depressus																																
Eurydice personata																																
Eurydice sp. (juv.)																		2														2
Exosphaeroma diminutum							1				1					2																
Exosphaeroma productatelsor			1	1	4	2						9		4		21																
Xenanthura brevitelson																																
Order CUMACEA																																
Cumella sp.																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R106																T111															
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Cyclaspis cf. *pustulata*																	1	3			1	1			1	1						8
Cyclaspis unicornis																																
Cyclaspis sp. B(?)																																
Cyclaspis sp.						1										1																
Order AMPHIPODA																																
Acuminodeutopus sp.																																
Ampelisca sp.																																
Amphideutopus sp.																																
Bathyporeia parkeri																																
Bemlos sp.																																
Unidentified caprellid																																
Carinobatea catherinensis										1		2				3															2	2
Chevalia aviculae																																
Eudevanopus honduranus																		1														1
Grandidierella bonnieroides																																
Gibberosus myersi							2									2																
Haustorius sp.																					1							2				3
Metharpinia floridana																																
Synchelidium americanum																																
Unidentified corophiid																																
Unident. corophiid n. sp.																																
Order TANAIDACEA																																
Apseudes sp.																																
Leptochelia sp.																																
Cirratodactylus floridensis																																
Kalliapseudes sp.																																
Order MYSIDACEA																																
Unidentified mysid																																
Order DECAPODA																																
Zygopa michaelis																																
Unidentified decapods																										1						1
Phylum ECHINODERMATA																																
Unidentified ophiuroid																																
Phylum CHORDATA																																
Branchiostoma caribaeum																																
Unknown																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R116																R120															
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Phylum CNIDARIA																																
Unident. hydroid																																
Sphenotrochus sp.																																
Phylum PLATYHELMINTHES																																
Class TURBELLARIA																																
Unidentified acoel		1														1																
Unident. bothrioplanid		1														1																
Unident. coelogynophorid																																
Unident. kalyptorhynchid								3						1		4																
Unident. monocelid	1															1																
Unident. nematoplanid																																
Unident. otoplanid								3								3																
Unident. phyllosyrtid																								1								1
Unident. proseriate					1											1																
Unident. typhloplanid								5								5																
Unident. turbellarian						2										2																
Phylum NEMERTINA																																
Carinoma tremaphoros																																
Cephalothrix sp. A																																
Cephalothrix sp. 114																																
Unident. cephalothricid																		1														1
Hubrechtella dubia																																
Unident. paleonemertine																																
Tubulanus pellucidus																																
4-eye hoplonemertine																									1							1
Unident. hoplonemertine																																
Unident. heteronemertine																																
Phylum NEMATODA	3	48	22	30	44	28	22	65	11	11	2	1		76	1	364		1			1	1		1					1	1	2	8
Phylum ANNELIDA																																
Class POLYCHAETA																																
Leitoscoloplos fragilis																																
Leitoscoloplos sp.																			1				1									2
Naineris bicornis																																
Aricidea philbinae																																
Aricidea suecica																																
Aricidea sp.																																
Paraonis fulgens						1		3					1	1		6	5	1	1			2	2	1	1				1	1	2	17
Paraonis pygoenigmatica																																
Cossura soyeri																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R116																R120														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Apoprionospio pygmaea																																
Dispio uncinata																	2	1		1		2	2	1		2	2	1	3	1		18
Polydora websteri																																
Polydora sp.																																
Prionospio cristata																																
Prionospio multibranchiata																																
Pseudopolydora sp. A																																
Scolelepis squamata																																
Scolelepis texana																																
Unident. spionid																																
Magelona pettiboneae																																
Magelona sp.																																
Poecilochaetus johnsoni																																
Capitella capitata																																
Dasybranchus lunatus																																
Mediomastus sp.																																
Notomastus americanus																																
Notomastus hemipodus																																
Notomastus latericeus																																
Notomastus cf. *tenuis*																																
Scyphoproctus playproctus																																
Unident. capitellid																																
Unident. maldanid																																
Armandia agilis																																
Armandia maculata																																
Sclerobregma stenocerum																																
Hesionura elongata						1		4	1					3	2	11																
Sthenelais sp.																																
Unident. sigalionid																																
Litocorsa sp. A																																
Sigambra tentaculata																																
Synelmis sp. B																																
Ehlersia cornuta				1	1											2																
Exogone dispar																																
Grubeosyllis clavata																																
Opisthodonta sp. B																																
Sphaerosyllis piriferopsis																																
Unident. syllid																																
Ceratonereis irritabilis																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R116																R120														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Ceratonereis longicirrata																																
Ceratonereis mirabilis																																
Nematonereis hebes																																
Platynereis dumerilii																																
Glycera abranchiata																																
Glycera americana																																
Diopatra cuprea																																
Unident. onuphid																																
Lumbrineris verrilli																																
Drilonereis longa																																
Dorvillea sociabilis																																
Myriochele oculata																																
Pista quadrilobata																																
Unident. terebellid																																
Chone cf. *americana*																																
Fabricinuda trilobata																																
Sabella melanostigma																																
Unident. polychaete																																
Class OLIGOCHAETA																																
Bathydrilus adriaticus							1	1					1			3																
Heterodrilus bulbiporus																																
Heterodrilus pentcheffi																																
Olavius imperfectus																																
Olavius sp.																																
Unident. tubificid																																
Phylum SIPUNCULA																																
Unident. sipunculans																																
Phylum MOLLUSCA																																
Class GASTROPODA																																
Amphithalamus vallei																																
Teinostoma sp.																																
Caecum imbricatum																																
Caecum pulchellum									1							1																
Meioceras cubitatum																																
Cerithiopsis emersoni																																
Olivella mutica																			1	1												2
Atys sandersoni																																
Unidentified opisthobranch																																
Class BIVALVIA																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R116																R120														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Solemya occidentalis																																
Lucina sp.																																
Diplodonta sp.																																
Unidentified sportellid					1											1																
Pleuromeris tridentata																																
Cyclocardia sp.																																
Tellina sybaritica																																
Strigilla mirabilis																																
Semele bellastriata																																
Chione cancellata																																
Tivela floridana		2					5	2		1		1	2			13	1			2				2								5
Transenella sp.																																
Gouldia cerina																																
Corbula krebsiana																																
Unidentified bivalve											1					1																
Phylum BRYOZOA																																
Cupuladria sp.											1					1	1										1					2
Phylum ARTHROPODA																																
Subphylum CHELICERATA																																
Class PYCNOGONIDA																																
Unidentified pycnogonid																																
Class ARACHNIDA																																
Unidentified acarine						1										1																
Subphylum CRUSTACEA																																
Class COPEPODA																																
Unidentified harpacticoids		3	2	2	3	11						1		2		24																
Unidentified cyclopoids																																
Class OSTRACODA																																
Parasterope muelleri																																
Class MALACOSTRACA																																
Order ISOPODA																																
Ancinus depressus														1	1	2																
Eurydice personata																						1										1
Eurydice sp. (juv.)	1															1																
Exosphaeroma diminutum																																
Exosphaeroma productatelson														1		1																
Xenanthura brevitelson																																
Order CUMACEA																																
Cumella sp.																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	R116																R120														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Cyclaspis cf. *pustulata*																																
Cyclaspis unicornis																																
Cyclaspis sp. B(?)																																
Cyclaspis sp.																																
Order AMPHIPODA																																
Acuminodeutopus sp.																																
Ampelisca sp.																																
Amphideutopus sp.																																
Bathyporeia parkeri																																
Bemlos sp.																																
Unidentified caprellid																																
Carinobatea catherinensis																																
Chevalia aviculae																																
Eudevanopus honduranus																																
Grandidierella bonnieroides																																
Gibberosus myersi																																
Haustorius sp.																						1	1				1		1			4
Metharpinia floridana																																
Synchelidium americanum																																
Unidentified corophiid																																
Unident. corophiid n. sp.																																
Order TANAIDACEA																																
Apseudes sp.																																
Leptochelia sp.																																
Cirratodactylus floridensis																																
Kalliapseudes sp.																																
Order MYSIDACEA																																
Unidentified mysid																	1															1
Order DECAPODA																																
Zygopa michaelis																																
Unidentified decapods																											1					1
Phylum ECHINODERMATA																																
Unidentified ophiuroid																																
Phylum CHORDATA																																
Branchiostoma caribaeum																																
Unknown																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	BORROW AREA CONTROL																BORROW AREA														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Phylum CNIDARIA																																
Unident. hydroid																																
Sphenotrochus sp.	6		3	2						1		2	1	1		16																
Phylum PLATYHELMINTHES																																
Class TURBELLARIA																																
Unidentified acoel																																
Unident. bothrioplanid																																
Unident. coelogynophorid																																
Unident. kalyptorhynchid																																
Unident. monocelid																																
Unident. nematoplanid																																
Unident. otoplanid																																
Unident. phyllosyrtid																																
Unident. proseriate																																
Unident. typhloplanid																																
Unident. turbellarian									1							1																
Phylum NEMERTINA																																
Carinoma tremaphoros																																
Cephalothrix sp. A																																
Cephalothrix sp. 114																																
Unident. cephalothricid																																
Hubrechtella dubia																						1										1
Unident. paleonemertine																																
Tubulanus pellucidus		1									1					2								2	2			1	1		1	7
4-eye hoplonemertine																																
Unident. hoplonemertine																		1											1		1	3
Unident. heteronemertine																											1					1
Phylum NEMATODA	3	1	4	3	3	3	1	3	1	2	4	4	2	2	7	43		2	1	2			1						2			8
Phylum ANNELIDA																																
Class POLYCHAETA																																
Leitoscoloplos fragilis																																
Leitoscoloplos sp.																																
Naineris bicornis						1										1																
Aricidea philbinae																			1	1		1								1		4
Aricidea suecica				1												1																
Aricidea sp.								1					1			2																
Paraonis fulgens					1						1					2								1								1
Paraonis pygoenigmatica													1			1																
Cossura soyeri			2													2																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	BORROW AREA CONTROL																BORROW AREA														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Apoprionospio pygmaea																																
Dispio uncinata																																
Polydora websteri					1											1																
Polydora sp.																																
Prionospio cristata	3	1					1			1						6		3	1	1		6	1	1	1				2			16
Prionospio multibranchiata																									2							2
Pseudopolydora sp. A			2		1				1	1						5																
Scolelepis squamata																																
Scolelepis texana																														1		1
Unident. spionid																																
Magelona pettiboneae											1					1																
Magelona sp.		1														1		1	1	2												4
Poecilochaetus johnsoni			1						1							2																
Capitella capitata												1				1																
Dasybranchus lunatus															1	1																
Mediomastus sp.																						1										1
Notomastus americanus									1							1																
Notomastus hemipodus					1											1																
Notomastus latericeus											1					1													1			1
Notomastus cf. *tenuis*													1			1				1												1
Scyphoproctus playproctus													1			1																
Unident. capitellid																											1					1
Unident. maldanid					1							1	1			3																
Armandia agilis					1											1			1		1											2
Armandia maculata							4	1		1		1				7		2		1		1	1		1		1					7
Sclerobregma stenocerum				1												1																
Hesionura elongata																																
Sthenelais sp.															1	1			1	1												2
Unident. sigalionid																																
Litocorsa sp. A														1		1															1	1
Sigambra tentaculata																						1										1
Synelmis sp. B											1					1																
Ehlersia cornuta														1		1																
Exogone dispar			1											1		2																
Grubeosyllis clavata					1											1		1														1
Opisthodonta sp. B														1		1																
Sphaerosyllis piriferopsis													1			1																
Unident. syllid				1												1																
Ceratonereis irritabilis										1				1		2																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	BORROW AREA CONTROL																BORROW AREA														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Ceratonereis longicirrata							1									1																
Ceratonereis mirabilis											2	1	4	1		8																
Nematonereis hebes	1															1																
Platynereis dumerilii		1														1																
Glycera abranchiata					1									1		2																
Glycera americana								1		1	1					3		1														1
Diopatra cuprea																													1			1
Unident. onuphid																													1			1
Lumbrineris verrilli					2									1		3																
Drilonereis longa																																
Dorvillea sociabilis															1	1																
Myriochele oculata																													1			1
Pista quadrilobata	1															1																
Unident. terebellid		1							1							2																
Chone cf. *americana*		2							1			1		1		5			6	6							4		1			17
Fabricinuda trilobata		1			1				1	2			1	1		7		2		1			1							1	5
Sabella melanostigma		1														1																
Unident. polychaete	1												3	1		5														1		1
Class OLIGOCHAETA																																
Bathydrilus adriaticus																																
Heterodrilus bulbiporus			1		1		1					1				4																
Heterodrilus pentcheffi		1									1				1	3																
Olavius imperfectus										1						1																
Olavius sp.										1						1																
Unident. tubificid				1			1							1		3																
Phylum SIPUNCULA																																
Unident. sipunculans	1	1														2		1									1					2
Phylum MOLLUSCA																																
Class GASTROPODA																																
Amphithalamus vallei																																
Teinostoma sp.																																
Caecum imbricatum				1			1			1			1	1		5																
Caecum pulchellum																																
Meioceras cubitatum														1		1																
Cerithiopsis emersoni			1													1																
Olivella mutica																																
Atys sandersoni	1															1																
Unidentified opisthobranch								1				1				2																
Class BIVALVIA																																

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	BORROW AREA CONTROL																BORROW AREA														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Solemya occidentalis																							1									1
Lucina sp.																									1							1
Diplodonta sp.		1													1	2									1					1	1	3
Unidentified sportellid																																
Pleuromeris tridentata																																
Cyclocardia sp.										1	1			1		3																
Tellina sybaritica										1						1																
Strigilla mirabilis																																
Semele bellastriata														1		1																
Chione cancellata																											1					1
Tivela floridana																																
Transenella sp.									1							1												1				1
Gouldia cerina																						1										1
Corbula krebsiana	1										1					2											1					1
Unidentified bivalve																						1										1
Phylum BRYOZOA																																
Cupuladria sp.	5	2	6	5		1	2	5	3	3	5	15	12	13	3	80				1	1						1					3
Phylum ARTHROPODA																																
Subphylum CHELICERATA																																
Class PYCNOGONIDA																																
Unidentified pycnogonid														1		1																
Class ARACHNIDA																																
Unidentified acarine											1					1																
Subphylum CRUSTACEA																																
Class COPEPODA																																
Unidentified harpacticoids	1	1			1											3		1														1
Unidentified cyclopoids													1			1																
Class OSTRACODA																																
Parasterope muelleri																																
Class MALACOSTRACA																																
Order ISOPODA																																
Ancinus depressus																																
Eurydice personata																																
Eurydice sp. (juv.)																																
Exosphaeroma diminutum																																
Exosphaeroma productatelson																																
Xenanthura brevitelson		2		1	1	1			2	2		1	1		3	14																
Order CUMACEA																																
Cumella sp.																											1					1

Table 8.4.5. Identification and enumeration of infauna by replicate, Hollywood-Hallandale Beach Renourishment: 1994.

STATION	BORROW AREA CONTROL																BORROW AREA														
REPLICATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	tot
TAXON																																
Cyclaspis cf. *pustulata*					1											1																
Cyclaspis unicornis							1									1																
Cyclaspis sp. B(?)																			1								1					2
Cyclaspis sp.																																
Order AMPHIPODA																																
Acuminodeutopus sp.				1												1																
Ampelisca sp.					1						1					2		1	1	1									4			7
Amphideutopus sp.							2		1					1		4																
Bathyporeia parkeri																																
Bemlos sp.	4				2											6																
Unidentified caprellid					1						1					2				1			1									2
Carinobatea catherinensis																																
Chevalia aviculae																				1												1
Eudevanopus honduranus																																
Grandidierella bonnieroides										1						1				1												1
Gibberosus myersi																																
Haustorius sp.					1											1																
Metharpinia floridana			1		1	1	1			1		1	2			8						1										1
Synchelidium americanum					1	1										2				1										1	2
Unidentified corophiid		1				1		1					3			6				4												4
Unident. corophiid n. sp.												3				3																
Order TANAIDACEA																																
Apseudes sp.								1							1	2																
Leptochelia sp.	1	2		1				2				1		1		8																
Cirratodactylus floridensis			4			1				2			1	2		10													1			1
Kalliapseudes sp.	1	2				1	4	1	4							13																
Order MYSIDACEA																																
Unidentified mysid																																
Order DECAPODA																																
Zygopa michaelis												1				1																
Unidentified decapods					1			2								3				1			1							1		3
Phylum ECHINODERMATA																																
Unidentified ophiuroid									1							1								1	1							2
Phylum CHORDATA																																
Branchiostoma caribaeum		1	1						1				1			4																
Unknown																																

Table 8.4.6. Five most abundant species by station and survey with percentage abundance (nematodes and copepods omitted)(A=amph., B=bivalv., By=bryo., C=cumac., I=isopod, N=nemert., O=oligo., P=poly., S=scleract., T=turbel., Ta=tanaid).

INSHORE CONTROL

T88

Rank	1990	%	1991	%	1992	%	1994	%
1	*Dispio uncinata* (P)	58.5	*Strigilla mirabilis* (B)	45.5	*Dispio uncinata* (P)	61.9	*Dispio uncinata* (P)	25.2
2	*Metharpinia floridana* (A)	8.5	*Metharpinia floridana* (A)	8.5	*Scolelepis texana* (P)	8.8	*Paraonis fulgens* (P)	18.3
							Haustorius sp.	18.3
3	*Haustorius* sp. (A)	5.1	*Spio pettiboneae* (P)	6.5	*Paraonis fulgens* (P)	5.8		
4	*Paraonis fulgens* (P)	4.2	*Cephalothrix* sp. 114 (N)	5	*Spio pettiboneae* (P)	5.0	*Metharpinia floridana* (A)	9.6
	Tivela floridana (B)	4.2	*Cyclaspis* cf. *varians* (C)	5				
5					*Armandia agilis* (P)	4.2	*Prionospio multibranchiata* (P)	4.3

R90

Rank	1990		1991	%	1992	%	1994	%
1	*Caecum pulchellum* (G)	26.3	Unident. turbellarian	37.9	*Dispio uncinata* (P)	32.2	*Dispio uncinata* (P)	31.5
2	*Tivela floridana* (B)	9.5	*Paraonis pygoenigmatica* (P)	20.1	*Scolelepis texana* (P)	21.2	*Paraonis fulgens* (P)	27.7
3	*Cyclaspis* sp. D (C)	8.0	*Paraonis fulgens* (B)	7.7	*Caecum pulchellum* (G)	7.3	*Metharpinia floridana* (A)	9.9
4	*Cupuladria* sp. (By)	7.3	*Tivela floridana* (B)	5.3	*Paraonis fulgens* (P)	7.0	*Tivela floridana* (B)	8.9
			Cephalothrix sp. 114 (N)	5.3				
5	*Glycera abranchiata* (P)	3.6			*Metharpinia floridana* (A)	6.2	*Prionospio multibranchiata* (P)	5.2

R92

Rank	1990	%	1991	%	1992	%	1994	%
1	*Tivela floridana* (B)	38.4	*Metharpinia floridana* (A)	36.5	*Dispio uncinata* (P)	25.7	*Haustorius* sp. (A)	26.4
2	*Dispio uncinata* (P)	17.0	*Strigilla mirabilis* (B)	25.2	*Scolelepis texana* (P)	18.6	*Paraonis fulgens* (P)	16.8
3	*Paraonis fulgens* (P)	10.7	*Spio pettiboneae* (P)	21.7	*Paraonis fulgens* (P)	12.4	*Tivela floridana* (B)	16.0
4	*Cyclaspis* sp. D (C)	6.3	*Paraonis fulgens* (P)	12.6	*Spio pettiboneae* (P)	11.5	*Dispio uncinata* (P)	13.5
5	*Haustorius* sp. (A)	5.4	*Cephalothrix* sp. 114 (N)	11.7	*Armandia agilis* (P)	8.4	*Prionospio multibranchiata* (P)	6.1
	Scolelepis texana (P)	5.4						

R94

Rank	1990	%	1991	%	1992	%	1994	%
1	Unident. proseriate (Tu)	28.6	*Strigilla mirabilis* (B)	27.1	*Dispio uncinata* (P)	27.1	*Tivela floridana* (B)	30.3
2	*Tivela floridana* (B)	12.2	*Tivela floridana* (B)	25.7	*Scolelepis texana* (P)	14.5	*Prionospio multibranchiata* (P)	20.1
	Paraonis fulgens (P)	12.2						
3			*Spio pettiboneae* (P)	8.3	*Spio pettiboneae* (P)	13.4	*Scolelepis texana* (P)	12.3
4	*Ancinus* sp. (I)	8.2	*Scolelepis texana* (P)	7.3	*Metharpinia floridana* (A)	9.7	*Dispio uncinata* (P)	10.2
	Cyclaspis sp. D (C)	8.2						
5			*Metharpinia floridana* (A)	4.6	*Armandia agilis* (P)	8.8	*Haustorius* sp. (A)	8.8

Table 8.4.6. Five most abundant species by station and survey with percentage abundance (nematodes and copepods omitted)(A=amph., B=bivalv., By=bryo., C=cumac., I=isopod, N=nemert., O=oligo., P=poly., S=scleract., T=turbel., Ta=tanaid).

INSHORE TREATMENT (FILL)

R106

Rank	1990	%	1991	%	1992	%	1994	%
1	*Dispio uncinata* (P)	18.6	*Tivela floridana* (B)	70.0	*Dispio uncinata* (P)	49.3	*Tivela floridana* (B)	49.5
2	*Armandia agilis* (P)	17.5	*Metharpinia floridana* (A)	6.7	*Paraonis fulgens* (P)	27.5	*Exosphaeroma producta*telson (I)	10.8
3	*Haustorius* sp. (A)	9.3	*Scolelepis texana* (P)	4.4	*Scolelepis texana* (P)	4.5	*Hesionura elongata* (P)	4.1
							Bathydrilus adriaticus (O)	4.1
4	*Metharpinia floridana* (A)	8.2	*Spio pettiboneae* (P)	3.4	*Spio pettiboneae* (P)	3.2		
	Cyclaspis sp. D (C)	8.2						
5			*Paraonis fulgens* (P)	3.0	*Tivela floridana* (B)	2.4	Unident. hoplonemertine (N)	3.1

T111

Rank	1990	%	1991	%	1992	%	1994	%
1	*Brachidontes modiolus* (B)	9.7	*Scolelepis texana* (P)	29.6	*Scolelepis texana* (P)	31.1	*Tivela floridana* (B)	32.9
2	*Tellina* sp. (B)	5.6	*Spio pettiboneae* (P)	14.8	*Dispio uncinata* (P)	22.2	*Leitoscoloplos fragilis* (P)	12.7
3	*Caecum pulchellum* (G)	4.0	*Dispio uncinata* (P)	14.1	*Spio pettiboneae* (P)	13.3	*Scolelepis texana* (P)	10.1
	Eunice sp. A (P)	4.0					*Cyclaspis pustulata* (C)	10.1
4			*Cyclaspis* cf. *varians* (C)	9.6	*Paraonis fulgens* (P)	8.9		
5	*Armandia agilis* (P)	3.6	*Armandia agilis* (P)	8.1	*Metharpinia floridana* (A)	6.1	*Dispio uncinata* (P)	8.9

R116

Rank	1990	%	1991	%	1992	%	1994	%
1	*Tivela floridana* (B)	61.4	*Tivela floridana* (B)	26.4	*Dispio uncinata* (P)	42.4	*Tivela floridana* (B)	21.0
2	*Dispio uncinata* (P)	10.2	*Scolelepis texana* (P)	13.9	*Paraonis fulgens* (P)	31.3	*Hesionura elongata* (P)	17.7
3	*Paraonis fulgens* (P)	5.7	*Metharpinia floridana* (A)	11.3	*Scolelepis texana* (P)	3.6	*Paraonis fulgens* (P)	9.7
4	*Cyclaspis* sp. D (C)	4.5	*Cyclaspis* sp. D (C)	8.7	*Tivela floridana* (B)	3.1	Unident. typhloplanid (T)	8.1
	Bathyporeia parkeri (A)	4.5						
5			*Armandia agilis* (P)	7.4	*Eudevanopus honduranus* (A)	2.7	Unident. kalyptorhych (T)	6.5

R120

Rank	1990	%	1991	%	1992	%	1994	%
1	*Paraonis fulgens* (P)	69.6	*Tivela floridana* (B)	77.4	*Dispio uncinata* (P)		*Dispio uncinata* (P)	32.1
2	*Armandia agilis* (P)	13.0	*Armandia agilis* (P)	16.9	*Paraonis fulgens* (P)		*Paraonis fulgens* (P)	30.4
3	*Haustorius* sp. (A)	4.3	*Metharpinia floridana* (A)	11.9	*Tivela floridana* (B)		*Tivela floridana* (B)	8.9
	Prostomatella enteroplecta (N	4.3						
4			*Cyclaspis* sp. D (C)	10.3	*Cupuladria* sp. (By)		*Haustorius* sp. (A)	7.1
5	Several taxa	1.4	*Haustorius* sp. (A)	5.8	*Eudevanopus honduranus* (A)		Several taxa	3.6

Table 8.4.6. Five most abundant species by station and survey with percentage abundance (nematodes and copepods omitted)(A=amph., B=bivalv., By=bryo., C=cumac., I=isopod, N=nemert., O=oligo., P=poly., S=scleract., T=turbel., Ta=tanaid).

	OFFSHORE SITES							
	CONTROL (BAC)							
Rank	1990	%	1991	%	1992	%	1994	%
1	*Cirratodactylus floridensis* (Ta)	18.4	*Xenanthura brevitelson* (I)	22.8	*Cupuladria* sp. (By)	12.7	*Cupuladria* sp. (By)	24.5
2	*Xenanthura brevitelson* (I)	12.3	*Aricidea philbinae* (P)	8.4	*Prionospio cristata* (P)	9.0	*Sphenotrochus* n. sp.(S)	4.9
3	*Prionospio cristata* (P)	10.7	*Prionospio cristata* (P)	7.9	*Cirratodactylus floridensis* (Ta)	6.8	*Xenanthura brevitelson* (I)	4.3
			Cupuladria sp.	7.9				
4	*Hubrechtella dubia* (N)	7.3			*Sphenotrochus* n. sp.(S)	6.2	*Kalliapseudes* sp. (Ta)	4.0
5	*Cupuladria* sp. (By)	5.2	*Cirratodactylus floridensis* (Ta)	7.0	*Fabricia* sp. (P)	4.3	*Cirratodactylus floridensis* (Ta)	3.1

	BORROW AREA (BA)							
Rank	1990	%	1991	%	1992	%	1994	%
1	*Cirratodactylus floridensis* (Ta)	13.8	*Chone* cf. *americana* (P)	19.0	*Pseudopolydora* sp. (P)	22.5	*Chone* cf. *americana* (P)	13.4
2	*Xenanthura brevitelson* (I)	11.0	*Prionospio cristata* (P)	18.1	*Prionospio cristata* (P)	13.1	*Prionospio cristata* (P)	12.6
3	*Prionospio cristata* (P)	10.2	*Cupuladria* sp. (By)	5.6	*Armandia agilis* (P)	8.5	Several taxa	5.5
4	*Cupuladria* sp. (By)	7.6	Several taxa	2.8	*Chone* cf. *americana* (P)	4.4		
					Cupuladria sp. (By)	4.4		
5	Unident. tubificid (O)	5.6						