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# **TECHNICAL REPORT 95-03**

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

**SEPTEMBER 27, 1995** 

Prepared for:

Broward County Board of County Commissioners Department of Natural Resources Protection Biological Resources Division 218 SW 1st Ave. Ft. Lauderdale, FL 33301

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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 Preconstruction 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 Preconstruction 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 Postconstruction 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-

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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 Postconstruction, and four-year Post-construction evaluations. The report of the four-year Postconstruction 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<sup>2</sup>/day could be dealt with effectively by three out of four species tested. Multiple (38 daily) applications of 200 mg/cm<sup>2</sup>/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<sup>2</sup>/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<sup>2</sup> 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 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:

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

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'<sub>max</sub>) 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  $100^{\circ}$ 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.

Unconsolidated sediment samples ware collected by divers with a band-bald county restrates. Ench onlyment sample was transferred underwater to a plastic hop and fixed to the - 1, 10% borate-baffered formalia solution containing Rase Bengat.



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<sup>2</sup> 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 Preconstruction 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<sup>2</sup> 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<sub>max</sub>, H'N/H<sub>max</sub>) 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.

An example the rescary indices of FC and HN, and spectra returness (times are not spectral states), the resides of the second states in the resides of the second states in the resides of the second states are second states. If the second states are spectral states. If the spectral states are spectral states are spectral states are spectral states are spectral states. If the spectral states are spectral states. If the spectral states are sp



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



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



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



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



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

Table 4.1.1 Repeated	d measures	ANOVA	results sur	nmary for	transects.
Treatments = Con	trol & Dree	dging; Tir	nes=Oct9	0. 91. 92	. & 94
<b>Regular Paramete</b>	ers:	*=p<.05	ns=not s	ignificant	The Press were seen charge a
Effect	%Cover	Density	H'C	H'N	# Species
Treatment	ns	ns	ns	ns	ns
Time	ns	*coluege	(*/) mile	ns	ns
Treatment x Time	ns	ns	ns	ns	ns de la
Treatments = Cont	trol & Dree	dging; Tin	nes=Oct9	1, 92, & 9	94
<b>Normalized Paran</b>	neters:	*=p,.05	ns=not s	ignificant	
Effect	%Cover	Density	H'C	H'N	# Species
Treatment	ns	ns	ns	ns	ns
Time	ns	* 0	* utbra	ns	ns
Treatment x Time	ns	ns	ns	ns	ns

# 4.2. Quadrat Results

A total of 60 m<sup>2</sup> 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<sup>2</sup>) and control sites (24 m<sup>2</sup>). 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<sup>2</sup> 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

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

Table 4.2.1 Summar	y of Indi	ividuals	on Dre	dge and	d Control Quadrats
action to the local	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
(act) house	a participa dona i se	(11.2) (11.2) (12.2)	a los de la	Lane chi	entra un complete concerne de policiens pode completant, participadant de mivelas M
Table 4.2.2 Repeated	d Measu	res AN	OVA re	sults su	ummary for Quadrats
Treatm	ents = 0	Control	& Dred	ging; Ti	imes=Oct90, 91, 92, & 94
Regula	r Para	neters:	*=p<.(	05	ns = not significant
Effect	# Spons	tes	# Gors	gonians	#Scleractinians

ns

ns

ns

ns

ns

ns

ns = not significant

#Scleractinians

ns \*

ns

ns

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

# Gorgonians

# 4.3. Results of Core Samples

Normalized Parameters:\*=p<.05

**#** Sponges

ns

ns

ns

4

ns

Treatment

Treatment x Time

Treatment x Time

Time

Effect

Time

Treatment

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 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 8.4.5) 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 Postconstruction high (1991) through the 1992 survey to a level about 10% lower than in the Preconstruction (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

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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  $268\pm106$  in 1992 to  $127\pm35$  in 1994. At the four treatment stations, means dropped from  $194\pm79$  in 1992 to  $28\pm9$  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 postdredging 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 postdredging 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. Llovd 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 postdredging 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 reestablishment 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 predredging 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 productatelson*, 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.

	INSH	ORE	CONTR	ROL		INSH	ORE T	REATM	<b>MENT</b>	OFFS	HORE
Year	T88	R90	R92	R94	,ter.	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	un	0.371	0.288	0.383	0.187	0.209	0.094
16 2											

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

nation: builted site Ryd and treatment are 11111 were clearly intrineers aron. Not do we block if while straining six sites. We do not know how catenate filters assemblages were. Not do we block if not parallel convergence with the remaining 'typical'' asion: assemblage (based on right errored taxa) over the course of this project was in any way related to beach remove hour in spectrom. Similarly, we do not know how important were the parallel changes (based errored taxa), but because the changes were observed only at two of four treatment sites of the transfer outly tests, but because the changes were observed only at two of four treatment sites. We do not built tests, but because the changes were observed only at two of four treatment sites. We do where accept not distains fill operations as the likely cause. Harricage Andrew, which taxa's over the area shortly before the PCP survey, may have impacted different sites to different inverses and generated different solution to be first to be stated to be burgered as the first state of the likely cause. Harricage Andrew, which taxa's inverses and generated different solution to be different sites to different inverses and generated different solution to be transfer to be associated with taxa's inverses and generated different solution to be different sites to be inverses.

Finally, although marging and futing save a well-documented series of attacks on octains of animation (Naqvi and Pullen, 1982; Malson, 1983; Harme and Pullen, 1983), we had detrifted information about acological requirements and toleranors of virtually all organisms ordected. As a result, we do not know how faunal clutiges actually derive from environmental charges of high party, we into no understanding of the circumstances serverending the about appearances and disappearances of a variety of true apparently unactualed to remainiment operations (e.g., the copied. Encodecement predectatives at R106 in 1094 or the polycinetre from on accuration at R50 in 1991, and Freedowing to, at R106 in 1992).

### 4.2.5. Core Selfmonts

Mass prior sizes of softenent samples fell chieffy between 0.150 and 0.300 mm with a few funct and courter measurements recorded at inshore treatment and offshore sites (Toble 1.5.1). Mean velocs exhibited the following changes over the course of the four surveys. At the instructs control sites (T&8, 8:90, R92, R94), mean grain size first decreased immediately found the fill (1944) then increased one year following construction at faces of four next



Figure 4.17 Turbellaria numerical abundance.







Figure 4.19 Nematoda numerical abundance.







Figure 4.21 Polychaeta numerical abundance.







Figure 4.23 Harpacticoida numerical abundance.











Figure 4.26 Tanaidacea numerical abundance.

























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 Preconstruction 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 Preconstruction 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 nonpolychaete 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

# CONTROL SITES - OCT., 1990





## CONTROL SITES - OCT., 1990

= JUL6 (1ST Reef) + JUL7 (2ND Reef) - JUL8 (3RD Reef) = JUL8 (3RD Reef) + JUL7 (2ND Reef) - JUL8 (3RD Reef) + JUL7 (2ND Reef)



### DREDGING SITES - OCT., 1990





# DREDGING SITES - OCT., 1990











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







### Coral H'C DIVERSITY Vs. Depth (m)

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



















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



Mean H'N/HMAX EVENNESS

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

8. Tables Appendix

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# 8.1. Transect Tables

Table 8.1. IPre-construction Trans	sect Dat	a Summ	ary: Cont	rol Reefs, (	October,	1990			
Reef	1ST	2ND	3RD	1ST	2ND	3RD			
SITE	J5	J10	J9	J6	17	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 REFF ARFA	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	
# CORAL S/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%	
# RI FACHED CORALS	1	8	11	0	10	1	5.2	5.0	
% # RI FACHED CORALS	3.2%	16.7%	6.0%	0.0%	15.6%	2.0%	7.3%	7.16%	
ARFA RI FACHED 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	2	8	13	9	6	8	6	2.4	
H	0.68	1.38	1.83	1.03	1.85	1.52	1.38	0.46	
N.H	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	

		1 % 000	
	AVC	74 30 4.60 2.5 4.5 7.6% 7.5% 7.5% 7.5% 7.5% 7.5%	9 1.53 1.72 2.13 0.70 0.80
ober, 1991	3RD J8 Oct-91 55'	53 30 3.954 1.8 1.32% 5.7% 1.80.6 4.6%	9 1.94 2.20 0.88 0.94
efs, Octo	2ND J7 Oct-91 30'	64 64 30 2.549 2.1 0.85% 3 329.9 12.9%	11 1.94 1.91 0.81 0.80
Control Re	1ST J6 Oct-91 10'	53 30 6.506 1.8 2.17% 0.0% 0.0%	5 0.80 1.04 0.49 0.65
ummary: (	3RD J9 Oct- 55'	169 30 5.812 5.6 1.94% 1.2 7.1% 336.2 5.8%	12 1.83 2.05 0.74 0.74
t Data S	2ND J10 Oct-	56 30 3.918 1.9 1.31% 9 16.1% 557.4 14.2%	10 1.63 1.80 2.30 0.71 0.71
Transec	1ST J5 Oct- 10'	50 30 1.7 1.62% 0.0% 0.0% 0.0%	6 1.07 1.79 0.59 0.81
Table 8.1.2 1st Post-construction	Reef SITE DATE DEPTH	TOTAL # CORALS SAMPLED TOTAL REEF AREA TOTAL CORAL COVERAGE # CORALS/M2 % CORALS/M2 % CORAL COVERAGE # BLEACHED CORALS % # BLEACHED CORALS % AREA BLEACHED CORALS % AREA BLEACHED CORALS % AREA BLEACHED CORALS	# SPECIES H'C H'N H'N H'N/HMAX H'N/HMAX

23.1 0.0 0.8 0.82% 0.82% 3.04% 3.04% 0.79% 2.5 0.63 0.31 0.31 0.24 SD 2.1 1.56% 1.3 2.1% 2.1% 0.7% AVG 4.675 1.34 1.73 1.73 0.61 0.80 30 62 Table 8.1.3 2nd Post-construction Transect Data Summary: Control Reefs, October, 1992 Oct-92 55' .87% 7.4% 5.614 0.8% 3RD 12 1.85 2.12 0.74 0.74 e 30 28 8 Oct-92 30' 0%00.1 2.988 0.0% 0.0% 2ND 10 1.77 1.77 0.82 0.77 2.5 0.0 202 Oct-92 10' 5.431 0.0% 0.0% 0.96 1.61 0.48 0.59 IST 0.0 30 16 43 0.91% 99 30 3.3 1.0% 1.4% 3RD 10 1.78 2.30 0.77 0.87 Oct-55' 6 0.82% 2.460 4.2% 1.8% 2ND 1.77 1.77 0.62 0.62 J10 Oct-1.6 308 8.838 1.3 2.95% 0%0.0 0.0% J5 Oct-IST 0.0 39 30 0 -TOTAL # CORALS SAMPLED TOTAL CORAL COVERAGE AREA BLEACHED CORALS % AREA BLEACHED # BLEACHED CORALS % # BLEACHED CORALS # CORALS/M2 % CORAL COVERAGE TOTAL REEF AREA H'C/HMAX H'N/HMAX DIVERSITY # SPECIES HMAX DEPTH DATE HC HN SITE Reef

0.64 3.16 0.19% 19.23 3436 SD 0.00% 1.4137 0.0007 .60% AVG 4.799 1.77 1.77 2.18 0.59 0.59 9. 30 6 Table 8.1.4 3rd Post-construction Transect Data Summary: Control Reefs, October, 1994 Oct-94 55' 1.51% 4.544 2.5 0.0% 0.0% 3RD 14 1.98 2.23 0.75 0.75 18 74 30 Oct-94 .17% 3.514 0.0% 2ND 0.0% 8. 1.64 1.90 0.68 0.68 0.79 30' 33 17 Oct-94 10' 6.214 0.8 2.07% 0.0% 0.0% IST 303 J6 5 2.1 0.70% 0.0% 63 30 2.091 0.0% 1.78 1.89 0.81 0.81 3RD Oct-55' 19 0 0.51% 1.528 0.0% 7.1 0.5% 2ND 1.44 1.99 2.30 0.62 0.87 J10 Oct-1.0 10 31 1.5 3.63% 10.90 0.0% 0.0% Oct-10' 0.73 1.47 1.95 0.37 0.37 0.37 IST 15 45 30 -TOTAL # CORALS SAMPLED TOTAL REEF AREA TOTAL CORAL COVERAGE AREA BLEACHED CORALS % AREA BLEACHED % # BLEACHED CORALS % CORAL COVERAGE # BLEACHED CORALS # CORALS/M2 H'C/HMAX H'N/HMAX DIVERSITY # SPECIES HMAX DEPTH DATE SITE HC H'N Reef

Table 8.1.5 Pre-construction Tran	nsect Da	ta Sumn	nary: Dredg	ging Reefs	, Octobe	r, 1990					
Reef	1ST	2ND	3RD	IST	2ND	3RD	1ST	2ND	3RD		
SITE	IH	J1	12	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	660.6	1.746	1.403	6.873	5.449	4.687	2.719
# CORALS/M2	3.0	2.6	2.5	1.8	3.1	6.0	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	2.209
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	3.879
DIVERSITY # SDECIES	11			•	13	r			12	101	00 0
# STECIES	11	14	11	4	13	~		11	10	1.01	2.70
HC	2.02	1.94	1.78	0.53	1.86	1.49	1.34	1.92	2.24	1.68	10.0
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

		and the second se	and a state of the	The second secon							
Reef	1ST	2ND	3RD	IST	2ND	3RD	IST	2ND	3RD		
SITE	HHI Oct-	JUL1 Oct-	JUL2 Oct-	HH2 Oct-91	HH4 Oct-91	HH6 Oct-91	HH3 Oct-91	HH5 Oct-91	HH7 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	5	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%
# CDECTES		0	1.1	¢		0	•			00	2 00
# SFECIES	1 04	0	107	010	1 70	01	2000	1 60	71	1.55	20.0
H.N.	1 74	1.90	1.01	0.40	1.10	1.00	00.0	1.00	+0.7 L1 C	CC-1	0.68
HMAX	2.20	2.08	256	0.00	248	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	160	0.55	1.05	0.87	0.83	0.16

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2327 1.5 0.78% 1.2 1.89% 371.7 5.44% 0.17 0.18 0.17 0.18 45.4 0.0 SD 86.3 30 3.847 2.9 1.28 2.0 2.79 1.88.8 1.88.8 AVG 9.3 1.43 0.66 0.82 Oct-92 3.278 2.0 1.09% 0.0% 0.0% **THH** 14 1.93 2.29 0.73 0.87 3RD 0.0 22 20 30 Oct-92 35' 7.841 6.3 2.61% 0.5% 19.63 0.3% 2ND HH5 11 1.48 2.51 2.40 0.62 1.05 30 Oct-92 14' 1.432 3.2 0.48% 2.1% 81.7 5.7% HH3 1.39 0.39 0.46 0.54 ST 30 Table 8.1.7 2nd Post Construction Transect Data Summary: Dredging Reefs, October, 1992 Oct-92 75' 0.46% .390 9HH 5.0% 19.6 3RD 1.32 1.32 1.32 0.78 0.95 0.7 Oct-92 40' .91% 3.2% 180.6 5.726 2ND 3.2% HH4 15 1.78 2.28 0.66 0.84 33 Oct-92 14' 2.971 3.0 0.99% 2.2% 22.8 0.8% HH2 0.42 0.67 0.67 0.38 0.38 0.61 ST 06 00 2.3% 1166. 6.676 JUL2 5.8% 3RD Oct-55' 12 1.80 2.24 0.72 0.90 69 30 0.91% 2.735 2.7% 148.8 5.4% 2ND IUL1 13 2.21 2.56 0.86 0.86 Oct-45' 34 2.571 2.8 0.86% 3.6% 60.3 % 1.721.720.800.83HHH Oct-IST 84 30 8 TOTAL # CORALS SAMPLED TOTAL REEF AREA TOTAL CORAL COVERAGE AREA BLEACHED CORALS % AREA BLEACHED # BLEACHED CORALS % # BLEACHED CORALS # CORALS/M2 % CORAL COVERAGE DIVERSITY # SPECIES HMAX DEPTH DATE HC H'N SITE Reef

H'C/HMAX H'N/HMAX

able 8.1.8 3rd Post-construction	Transec	t Data Su	immary: Dre	dging Re	efs, Octo	ber, 1994					
keef	IST	2ND	3RD	1ST	2ND	3RD	1ST	2ND	3RD		
SITE	IHH	IULI	JUL2	HH2	HH4	9HHe	HH3	HHS	HHT		
DEPTH	20'	45'	55'	Uct-94	40'	-12, 75'	Oct-94 14'	0ct-94 35'	0ct-94 65'	AVG	SD
TOTAL # CORALS SAMPLED	60	73	60	37	83	27	60	80	50	609	185
TOTAL REF 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
# SPECIES	10	12	12	3	13	8	5	11	12	9.6	3.50
HC	1.69	2.13	1.70	0.14	1.92	1.51	0.77	1.00	1.82	1.41	0.64
HN	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 Postconstruction, second Post-construction, and third Post-construction sampling periods.

STATION HH 1 20 feet	1990	1991	1992	1994	
Phylum Chlorophyta	2				1.2
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	la	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 aner	nones)			
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 Order Axinellida	4	5	4	3
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

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\*= colonies less than 3 cm in diameter

STATION HH #3	15-18 Fee	et 1990	1991	1992	1994	
Phylum Rhodophyt	a					
Ceramium sp. cf.	nitens	3	1	0	N	
Unidentified sp.		0	0	15	0	
Phylum Chlorophyt	a					
Udotea occidenta	lis	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	3	4* 24##	ŧ
		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	Ô	ĩ	3	
Ircinia campana	0	1	Ô	0	
Anhyeina campana	6	7	7	7	
Formily Dyreideidae	0		in the second		
Dusidea etheria	1	0	0	0	
Order Haplosolerida	-	0	v	0	
Family Haliolopidae					
Haliolona compressa	2	2	1	2	
Haliciona compressa	2	2	4	2 3	
Galbranangia waginalia	3	2	2	1	
Vinhotos eresta	1	0	1	1	
Niphates erecta	2	2	2	0	
Dasychalina cyathina	0	0	1	1	
Family Nepheliosponglidae			0	0	
Xestospongia muta	1	1	0	0	
Order Poecilosclerida					
Family Esperiopsidae				0	
lotrochota birotulata	1	1	1	2	
Desmapsamma anchorata	1	2	2	1	
Family Microcionidae	2	-			
Thalysias juniperina	1	2	1	1	
Family Mycalidae		Charles and			
Ulosa reutzleri	1	5	0	0	
Order Hadromerina					
Family Spirastrellidae			Sec. Dela		
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					1.1.1
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

		and the state of the second			
STATION HH # 5 32-35 Feet	1990	1991	1992	1994	
Phylum Phaeophyta		S PARA	and the second second		
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				Les and
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#
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	S. C. P.
Dhahara Davifara				10	
Class Democratic	45	64	35	49	
Class Demospongia					
Order Keratosa					
Family Sponglidae		-	-	-	
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					
Illosa reutzleri	0	1	1	1	
Family Microcionidae		1911			
Thalysias juniperina	0	0	1	1	
Order Avinellida					
Family Adelasidae					
A delas conifera	0	0	1	1	
Family Arinellidae	U	0	-		
Paniny Axinemuae	0	0	1	0	
Hemovinelle rudie	2	2	2	1	
Totakarinella marchelle	2	2	1	1	
Telchaxinella morchella	1	1	1	0	
Didiscus sp.	1	1	0	U	
Order Choristida					
Family Craniellidae		0			
Cinachyra alloclada	1	0	1	1	
Phylum Coelenterata					
Class Hydrozoa					
Order Milleporina		-	0.11	a second	
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 Class Demospongia Order Keratosa Family Spongiidae		50	84	55	46+	
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		1.4	1.4	
Dysidea etheria	0	11	2	2
Order Haplosclerida	3			-
Family Haliclonidae				
Haliclona sp.	1	1	1	1
Haliclona compressa	1	i	2	2
Callyspongia vaginalis	1	Ô	õ	1
Niphates erecta	7	12	10	7
Dascyhalina cyathina	3	2	3	2
Family Nepheliospongiidae		-		~
Xestospongia muta	0	1	1	0
Order Hadromeridae		1		0
Family Spirastrellidae				
Spirastrella coccinea	0	0	1	2
Order Poecilosclerida	0	U		4
Family Esperiopsiade				
Introchota birotulata	7	10	5	7
Desmansamma anchorata	5	6	2	1
Family Mycalidae		0	2	-
Mycale sp (undescribed)	3	1	0	0
Illoca reutzleri	1	4	0	1
Family Microsionidae	1	4	v	1
The hyperice impirering	0	0	2	1
Inalysias Juniperina	0	0	4	1
Order Axinellida				
Family Axineliidae			0	1
Teicnaxinella morchella	1	1	2	1
Pseudaxinella lunaecharta	0	3	2	1
No. 1				
Phylum Coelenterata				
Class Hydrozoa				
Order Milleporina	0		0	18
Millepora alcicornis	0	4	0	1
C1				
Class Anthozoa		10	c.	4.
Order Gorgonacea	11	12	0+	4+
Family Briareidae			N	NT
Briareum asbestinum	1	1	IN	IN
Family Plexauridae				0
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 Corgoniidae				
Pseudopterogorgia americana	1	1	1	Oa
r seudopter ogorgia americana	*	-	*	0

Order Scleractinia				
Dichocoenia stokesi	1	1	1 <sup>b</sup>	1 <sup>b</sup>
Eusmilia fastigiata	1	0	0	0
Montastrea cavernosa	$2^{\circ}$	2	3	2°
Siderastrea siderea	1	1	1	2°
Stephanocoenia michelini	1	1	1	1
Porites astreoides	0	0	1	0

N= Numerous thalli, unable to distinguish individuals

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

STATION JUL #1	40 Feet	1990	1991	1992	1994	
Phylum Phaeophyta						
Dictyota bartayresii		0	N	0	0	
Dhadaan Darifana			95	14	19	
Phylum Porliera		21	20	14	15	
Class Demospongia						
Order Keratosa					Contraction in the	
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	5	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 anche	orata	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		2ª	2	1	3	
Anthosigmella varian	s	1	0	0	0	
Order Axinellidae	Sec. 1	1.335				

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 <sup>b</sup>	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

<sup>a</sup> Not reported in 1990; probably overlooked

<sup>b</sup>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	o	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	1ª	0
Diploria clivosa	2 <sup>b</sup>	3 <sup>a,b</sup>	2°	2°
Madracis decactis	2	2	2	1
Montastrea cavernosa	2 <sup>d</sup>	2	2	2
Montastrea annularis	1 <sup>b</sup>	2 <sup>a,b</sup>	1	1
Stephanocoenia michelini	0	1 <sup>a</sup>	0	0
Phylum Chordata				
Class Tunicata				
Stolonicus sabulosa	0	0	4	0

N= Numerous colonies, unable to distinguish individual thalli or colonies

- <sup>a</sup>= specimens less than 3 cm diameter
- <sup>b</sup>= one specimen 2/3 dead
- <sup>c</sup>= one specimen 1/2 dead

<sup>d</sup>= 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					
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			6.5	and the second	
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		0	0	0	
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 aner	mones)			
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 Class Demospongia Order Keratosa Family Spongiidae	11	10	7	2	
Ircinia felix	2	1	1	0	
Aplysina fistularis Family Dysideidae	5	4	5	2	
Dysidea etheria Order Haplosclerida	1	0	0	0	
Family Haliclonidae Haliclona compressa Order Hadromerida	1	3	1	0	
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				1.25
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				1.5.5
Pseudopterogorgia americana	2	2	1	1
Pterogorgia citrina	1	0	2	1
Order Zoanthidea			1. T. 199	
Palvthoa 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

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STATION JUL # 728-30 Feet	1990	1991	1992	1994	
Phylum Phaeophyta	Section 2		2 2 M AV 8		1. 1. 2. 2.
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.

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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

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\*\*\*= 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 goreanii	N	N	N	N	
Dhylum Dhaeophyta	N	14			
Districto hortovresii	0	N	0	0	
Dictyota Dartayresh	0		· ·		
Phylum Porifera	33	28	23	21	
Class Demospongia			1.1.20.3		
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 calvculata	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***
Scolvmia sp.	0	1***	0	0
Stenhanocoenia 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	
Dhulum Dhaeonhuta						
Phylum Phaeophyta	-11	NT	N	0	N	
Dictyota bartayre	S11	IN	IN	0	IN	
Lobophora sp.		0	0	0	N	
Phylum Porifera		35	60	31	31	
Class Demospongia						
Order Keratasa						
CHUC INCIDIOSA						

Family Spongiidae				
Ircinia felix	3	3	1	0
Ircinia sp.	2	1	3	3
Aplysina cauliformis	4	5	3	3
Aplysina lacunosa	2	5 <sup>a</sup>	0	0
Family Dysideidae				
Dysidea etheria	0	1	0	0
Order Haplosclerida				
Family Haliclonidae				
Haliclona compressa	3	3	2	3
Dasvchalina cvathina	5	5	2	3
Niphates erecta	1	3	2	0
Callyspongia vaginalis	1	1	4 <sup>b</sup>	3
Callyspongia plicifera	1	3	2°	0
Order Hadromerida				
Family Spirastrellidae				
Spirastrella coccinea	1	1	1	0
Order Poecilosclerida	-	-	-	
Family Microcionidae				
Thalwsias juniperina	0	0	2	1
Family Agelasiade		v	2	
Adelas conifera	1	2	2	1
Agelas en	0	0	1	1
Family Esperiopsidae	U	U	-	
Introphoto birotulato	Q	8	6	9
Formily Mycolidae	0	0	0	5
Family Mycandae	1	17	1	3
Order Arinellide	-	17	-	0
Family Arinellidae				
Homorrinello rudio	1	1	1	1
Decudorinella lunaecharta	1	1	1	0
- includes 2 invenile eneriments	1		-	U
= includes 2 juvenine specimens				
a= includes 2 damaged				
De Includes 1 damaged				
Class Hadrense				
Class Hydrozoa				
Villegene eleicernie	0	2	0	2
Millepora alcicornis	3	2	0	4
Class Anthozoa	0.	0	0	2
Order Gorgonacea	5+	3	3	0
Paining Briareluae	NI	1	1	1
Bhareum aspestinum	IN	1	1	1
Family Plexauridae	1	1	1	1
Eunicea calyculata	1	1	1	1
Family Gorgonidae	,	1	1	1
Gorgonia ventalina	1	1	1	1
Order Scleractinia				-
Agaricia lamarcki	1*	1*	1	0
Dichocoenia stokesi	2*	2**	3	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	5 Feet 1990	1991	1992	1994	1.1
Phylum Phaeophyta			and a star		
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 Nepheliospongiida	ae				
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	la	1	1	0
Order Axinellida				
Family Axinellidae			1.	
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

lable 8.2.2 Nun	nbers of individuals at each	station a	t each	assessme	ent period	I.						
Reef		IST	2ND	3RD	IST	2ND	3RD					
		15	J10	J9	J6	17	J8					
DEPTH		10'	55'	55'	10'	30'	55'	AVG	SD			
#Sponges	CONTROL Oct, 1990	11	26	35	10	24	33	23.17	10.65			1
#Gorgonians		19	9	3	II	12	20	11.83	6.79			
#Scleractinians		9	14	15	9	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	9	20	7	7	9	8.83	5.49			
#Sponges	CONTROL Oct., 1992	11	20	31	7	19	23	18.50	8.57			
#Gorgonians		26	6	3	11	16	16	13.50	7.82			
#Scleractinians		9	17	23	7	9	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	97.79			
#Scleractinians		9	6	19	4	2	7	7.83	5.98			
Reef		1ST	2ND	3RD	IST	2ND	3RD	IST	2ND	3RD		
		IH	II	J2	H2	H4	H6	H3	H5	HT		
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	6	19	13	2	5	6	9	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	6	19	25.89	17.23
#Scleractinians		21	13	10	13	11	1	4	9	5	9.33	6.06
#Sponges	DREDGING Oct., 1992	4	14	40	15	27	35	56	46	55	32.44	18.69
#Gorgonians		09	20	17	51	9	15	34	21	22	27.33	17.71
#Scleractinians		28	7	8	9	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	*	4	2	15	1	A	L	2	4 NU	3 01

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# of Sites         # of Individuals           1990         1991         1992         1994         1990         1991         1992         1994           Algae         6 Species:         Phylum Cyanophyta         0         0         1         0         0         0         N           Phylum Daeophyta         2         7         0         5         N         N         0         N	Table 8.2.3 Cumulative species	list for quadrat	ts.			10.1		241	
1990       1991       1992       1994       1990       1991       1992       1994         Algae       6       6       Species:       Phylum Cyanophyta       0       0       1       0       0       0       N         Phylum Chaorophyta       2       7       0       5       N       N       0       N         Dictyota bartayresii       2       7       0       5       N       N       0       N         Phylum Chlorophyta       0       0       1       0 <td< th=""><th></th><th># of Sites</th><th>4.5</th><th></th><th>#</th><th>of Indiv</th><th>iduals</th><th></th><th></th></td<>		# of Sites	4.5		#	of Indiv	iduals		
Algae       6 Species:         Phylum Cyanophyta         Microcoleus sp.       0       0       1       0       0       N         Phylum Phaeophyta       2       7       0       5       N       N       0       N         Dictyota bartayresii       2       7       0       5       N       N       0       N         Udotea flabellum       1       0       0       1       0       0       0       0         Udotea flabellum       1       1       1       2       2       2       N       N       N       N         Valotea flabellum       1       1       1       0       1       3       1       0       N		1990 19	91	1992 1994	. 19	990 1	991 1	1992	1994
6 Špecies: 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 Halimeda fabellum 1 1 0 0 0 1 4 0 Halimeda goreauii 2 2 2 2 N N N N Halimeda goreauii 2 2 2 2 2 N N N N Halimeda goreauii 2 2 2 2 0 N N N N Halimeda goreauii 2 2 2 2 0 N N N N Phylum Chlorophyta Ceramium sp. 1 1 0 1 3 1 0 N Unidentified red 0 0 2 0 0 0 0 N Phylum Porifera (Sponges) 35 Species: Order Keratosa Ircinia campana 5 6 2 8 N 0 6 3 Ircinia strobilina 5 6 7 8 7 10 11 12 Ircinia felix 8 8 10 7 16 15 22 18 Ircinia strobilina 7 6 6 6 45 56 40 N Aplysina fistularis 2 2 5 5 6 5 14 8 Aplysina fistularis 2 2 2 2 8 7 3 3 Jas 2 3 3 3 2 3 3 11 Pseudocentina crassa 2 2 2 2 8 7 3 3 Dysidea etheria 7 6 1 1 15 23 2 2 Order Haplosclerida Halicona compressa 12 12 11 10 39 39 41 39 Halicona sp. 5 4 5 4 8 6 7 7 Niphates erecta 12 13 11 9 58 64 50 35 Dasychalina quitis 5 4 6 0 8 6 12 4 Callyspongia fallax 1 2 0 1 2 2 0 1 Malicona fallax 1 2 0 1 2 2 0 1 Number 12 13 11 9 58 64 50 35 Dasychalina cynthina 9 8 25 11 29 13 0 20 Order Maplosclerida Halicona compressa 12 13 11 9 58 64 50 35 Dasychalina cynthina 9 8 25 11 29 13 0 20 Order Maplosclerida Halicona fallax 1 2 0 1 2 2 0 1 Xestospongia muta 6 7 5 4 8 17 8 7 Callyspongia fallax 1 2 0 1 2 2 0 1 Xestospongia muta 6 7 5 4 8 10 7 6 Dasychalina cynthina 9 8 25 11 29 13 0 20 Order Poecilosclerida Dasychalina cynthina 9 8 25 11 29 13 0 20 Order Poecilosclerida Dasychalina cynthina 9 8 25 11 29 13 0 20 Order Poecilosclerida Dasychalina cynthina 9 8 25 11 29 13 0 20 Dasychalina cynthina 9 8 25 11 29 13 0 20 Order Poecilosclerida Dasychalina cynthina 6 7 5 4 8 17 8 7 Callyspongia fallax 1 2 0 1 2 2 2 0 1 Xestospongia muta 6 7 5 4 8 10 7 6 Dasychalina cynthina 6 7 5 4 8 10 7 5 Dasychalina cynthina 6 7 5 4 8 10 7 5 Dasychalina cynthina 6 7 5 4 8 10 7 5 Dasychalina cynthina 6 7 5 4 8 10 7 5 Dasychalina cynthina 6 7 5 4 8 10 7 5	Algae								
Phylum Cyanophyta         Microcoleus sp.       0       0       0       1       0       0       N         Phylum Phaeophyta       2       7       0       5       N       N       0       N         Dictyota bartayresii       2       7       0       5       N       N       0       N         Phylum Chlorophyta       0       0       1       0       0       1       4       0         Udotea occidentalis       0       1       1       0       0       1       4       0         Halimeda tuna       1       1       1       2       2       2       N       N       N       N         Phylum Chlorophyta       0       0       2       0       0       0       N<	6 Species:								
Microcoleus sp.       0       0       0       1       0       0       0       N         Phylum Phaeophyta       2       7       0       5       N       N       0       N         Dictyota bartayresii       2       7       0       5       N       N       0       N         Phylum Chlorophyta       0       0       1       0       0       1       4       0       0         Udotea flabellum       1       0       0       1       0       0       0       0         Udotea cocidentalis       0       1       1       0       1       4       0       0         Udotea goreauii       2       2       2       2       N       N       N       N         Phylum Chlorophyta	Phylum Cyanophyta							1	
Phylum Phaeophyta       2       7       0       5       N       N       0       N         Lobophora sp.       0       0       0       1       0       0       0       N         Phylum Chlorophyta       1       0       0       1       1       0       0       0       0         Udotea flabellum       1       0       0       1       4       0         Halimeda tuna       1       1       1       2       N       N       N       N         Phylum Chlorophyta       2       2       2       N	Microcoleus sp.	0	0	0	1	0	0	0	N
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Phylum Phaeophyta								
Lobophora sp.0001000NPhylum Chlorophyta100110000Udotea flabellum1100140Halimeda tuna1112NNNNHalimeda goreauii2222NNNNNPhylum ChlorophytaCeramium sp.1101310N0Ceramium sp.1101310N0Phylum Porifera (Sponges)35Species:00200N0S Species:00200N01111Ircinia campana562281063Ircinia strobilina5678777Aplysina cauliformis7666455640NAplysina lacunosa11021000Aplysina lacunosa11039394139Haliclona compressa1212111039394139Haliclona compressa1212111039394139Haliclona sp.5454867 <td< td=""><td>Dictyota bartayresii</td><td>2</td><td>7</td><td>0</td><td>5</td><td>N</td><td>N</td><td>0</td><td>N</td></td<>	Dictyota bartayresii	2	7	0	5	N	N	0	N
Phylum ChlorophytaUdatea filabellum10001000Udotea occidentalis011001400Halimeda tuna1112NNNNNHalimeda goreauii2222NNNNNPhylum Chlorophyta $        -$ Ceramium sp.1101310NN $-$ Unidentified red002000N0Phylum Porifera (Sponges) $     -$ 35 Species: $      -$ Order Keratosa $      -$ Ircinia sp.754313777Aplysina cauliformis7666455640NAplysina fistularis225565148Aplysina fistularis2222873311Pseudoceratina crassa222287777Milclona sp.545486777732201 <td>Lobophora sp.</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>N</td>	Lobophora sp.	0	0	0	1	0	0	0	N
Udotea flabellum       1       0       0       1       0       0       0         Udotea occidentalis       0       1       1       0       0       1       4       0         Halimeda tuna       1       1       1       2       N       Inditable field fiel	Phylum Chlorophyta								
Udotea occidentalis01100140Halimeda tuna11112NNNNNHalimeda goreauii2222NNNNNNPhylum Chlorophyta $$	Udotea flabellum	1	0	0	0	1	0	0	0
Halimeda tuna1112NNNNHalimeda goreauii2222NNNNPhylum Chlorophyta1101310NUnidentified red002000N0Phylum Porifera (Sponges)35 Species: </td <td>Udotea occidentalis</td> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>1</td> <td>4</td> <td>0</td>	Udotea occidentalis	0	1	1	0	0	1	4	0
Halimeda goreauii2222NNNNPhylum Chlorophyta1101310NUnidentified red002000N0Phylum Porifera (Sponges)35Species:00200N0Phylum Porifera (Sponges)35Species:06311112Ircinia campana56787101112Ircinia felix8810716152218Ircinia sp.754313777Aplysina cauliformis7666455640NAplysina fistularis222873311Pseudoceratina crassa22228733Dysidea etheria76111523222Order Haplosclerida12131195864503535Dasychalina cyathina9825112913020Callyspongia plicifera53546777142201214Callyspongia fallax120122011201	Halimeda tuna	1	1	1	2	N	N	N	N
Phylum ChlorophytaCeramium sp.1101310NUnidentified red002000N0Phylum Porifera (Sponges)35Species:0000N0Order KeratosaIrcinia campana562281063Ircinia strobilina56787101112Ircinia feix8810716152218Ircinia sp.754313777Aplysina cauliformis7666455640NAplysina fistularis225565148Aplysina fistularis22228733Dysidea etheria7611152322Order Haplosclerida7611152322Haliclona sp.54548677Niphates erecta121311958645035Dasychalina cyathina9825112913020Callyspongia pilicifera53548787Callyspongia fallax1201220 <td>Halimeda goreauii</td> <td>2</td> <td>2</td> <td>2</td> <td>2</td> <td>N</td> <td>N</td> <td>N</td> <td>N</td>	Halimeda goreauii	2	2	2	2	N	N	N	N
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:       0       0       2       0       0       0       N       0         Order Keratosa       Ircinia campana       5       6       2       2       8       10       6       3         Ircinia felix       8       8       10       7       16       15       22       18         Ircinia felix       8       8       10       7       16       15       22       18         Aplysina cauliformis       7       6       6       6       45       56       40       N         Aplysina fistularis       2       2       5       5       6       5       14       8         Aplysina fistularis       2       2       3       3       2       3       3       11       0       0         Aplysina aculiformis       7       6       1       1       15       23       2       2       0       0	Phylum Chlorophyta								
Unidentified red00200N0Phylum Porifera (Sponges) 35 Species: Order Keratosa Ircinia strobilina562281063Ircinia fastrobilina56787101112Ircinia strobilina56787101112Ircinia strobilina56787101112Ircinia sp.754313777Aplysina cauliformis7666455640NAplysina lacunosa1102100Aplysina sp.23323311Pseudoceratina crassa22228733Dysidea etheria7611152322Order Haplosclerida74548677Haliclona sp.5454861214Callyspongia vaginalis5460861214Callyspongia fallax12012201Xestospongia sp.00010001Order Haplosclerida675481076Callyspongia	Ceramium sp.	1	1	0	1	3	1	0	N
Phylum Porifera (Sponges) 35 Species: Order KeratosaIrcinia campana562281063Ircinia campana56787101112Ircinia strobilina56787101112Ircinia felix8810716152218Ircinia sp.754313777Aplysina cauliformis7666455640NAplysina fistularis225565148Aplysina sp.23323311Pseudoceratina crassa22228733Dysidea etheria7611152322Order Haplosclerida7611152322Order Haplosclerida121311958645035Dasychalina cyathina9825112913020Callyspongia plicifera53548787Callyspongia fallax12012201Xestospongia sp.00010001Order Poecilosclerida120001<	Unidentified red	0	0	2	0	0	0	N	0
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Phylum Porifera (Sponges)								
Order KeratosaIrcinia campana562281063Ircinia strobilina56787101112Ircinia felix8810716152218Ircinia sp.754313777Aplysina cauliformis7666455640NAplysina fistularis225565148Aplysina fistularis2222100Aplysina sp.23323311Pseudoceratina crassa22228733Dyside a etheria7611152322Order Haplosclerida1212111039394139Haliclona sp.54548677Niphates erecta121311958645035Dasychalina cyathina9825112913020Callyspongia plicifera53546787Callyspongia fallax12012201Xestospongia sp.00010001Order Poecilosclerida	35 Species:								
Ircinia campana562281063Ircinia strobilina56787101112Ircinia felix8810716152218Ircinia sp.754313777Aplysina cauliformis7666455640NAplysina fistularis225565148Aplysina fistularis223323311Pseudoceratina crassa22228733Dysidea etheria7611152322Order Haplosclerida76611152322Order Haplosclerida1212111039394139Haliclona compressa1212111039394139Haliclona sp.54548677Niphates erecta121311958645035Dasychalina cyathina9825112913020Callyspongia fallax120012201Vipspongia fallax120001001 <t< td=""><td>Order Keratosa</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	Order Keratosa								
Ircinia strobilina56787101112Ircinia felix8810716152218Ircinia sp.75431377Aplysina cauliformis7666455640NAplysina fistularis225565148Aplysina fistularis223323311Pseudoceratina crassa22228733Dysidea etheria7611152322Order Haplosclerida7611152322Order Haplosclerida1212111039394139Haliclona compressa1212111039394139Haliclona sp.54548677Niphates erecta121311958645035Dasychalina cyathina9825112913020Callyspongia plicifera535460861214Mathematic rest spongia sp.0012201Callyspongia sp.0012201Callyspongia sp.0 </td <td>Ircinia campana</td> <td>5</td> <td>6</td> <td>2</td> <td>2</td> <td>8</td> <td>10</td> <td>6</td> <td>3</td>	Ircinia campana	5	6	2	2	8	10	6	3
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       2       3       3       11       0       0         Aplysina sp.       2       2       2       2       8       7       3       3         Dysidea etheria       7       6       1       1       15       23       2       2         Order Haplosclerida       Italiclona 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	Ircinia strobilina	5	6	7	8	7	10	11	12
Ircinia sp.754313777Aplysina cauliformis7666455640NAplysina fistularis225565148Aplysina lacunosa1102100Aplysina sp.23323311Pseudoceratina crassa22228733Dysidea etheria7611152322Order HaploscleridaHaliclona compressa1212111039394139Haliclona sp.54548677Niphates erecta121311958645035Dasychalina cyathina9825112913020Callyspongia vaginalis5460861214Calyspongia fallax12012201Xestospongia sp.0010001001Order Poecilosclerida10966333917333255Desmapsamma anchorata57341524555	Ircinia felix	8	8	10	7	16	15	22	18
Aplysina cauliformis7666455640NAplysina fistularis225565148Aplysina lacunosa1102100Aplysina sp.23323311Pseudoceratina crassa22228733Dysidea etheria7611152322Order Haplosclerida7611152322Order Haplosclerida1212111039394139Haliclona compressa1212111039394139Haliclona sp.54548677Niphates erecta121311958645035Dasychalina cyathina9825112913020Callyspongia vaginalis5460861214Callyspongia fallax12012201Xestospongia sp.00010001Order Poecilosclerida0010001Desmapsamma anchorata5734152455	Ircinia sp.	7	5	4	3	13	7	7	7
Aplysina fistularis225565148Aplysina lacunosa1102100Aplysina sp.23323311Pseudoceratina crassa22228733Dysidea etheria7611152322Order Haplosclerida7611152322Haliclona compressa1212111039394139Haliclona sp.54548677Niphates erecta121311958645035Dasychalina cyathina9825112913020Callyspongia vaginalis5460861214Callyspongia fallax12012201Xestospongia sp.00010001Order Poecilosclerida0010001Desmapsamma anchorata5734152455	Aplysina cauliformis	7	6	6	6	45	56	40	N
Aplysina lacunosa1102100Aplysina sp.233323311Pseudoceratina crassa22228733Dysidea etheria7611152322Order Haplosclerida7611152322Order Haplosclerida754548677Niphates erecta1212111039394139Haliclona sp.54548677Niphates erecta121311958645035Dasychalina cyathina9825112913020Callyspongia vaginalis5460861214Callyspongia fallax12012201Xestospongia muta675481076Vestospongia sp.0001001001Order Poecilosclerida1096633391733Desmapsamma anchorata5734152455	Aplysina fistularis	2	2	5	5	6	5	14	8
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       7       6       1       1       15       23       2       2         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         Callyspongia fallax       1       2       0       1       2       0       1         Xestospongia sp.       0       0       0       1       0       0 </td <td>Aplysina lacunosa</td> <td>1</td> <td>1</td> <td>0</td> <td></td> <td>2</td> <td>1</td> <td>0</td> <td>0</td>	Aplysina lacunosa	1	1	0		2	1	0	0
Pseudoceratina crassa       2       2       2       2       8       7       3       3         Dysidea etheria       7       6       1       1       15       23       2       2         Order Haplosclerida       7       6       1       1       15       23       2       2         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         Callyspongia fallax       1       2       0       1       2       0       1         Xestospongia sp.       0       0       0       1       0       0       1       0       0       1         Order Poecilosclerida       10       9       6	Aplysina sp.	2	3	3	3	2	3	3	11
Dysidea etheria       7       6       1       1       15       23       2       2         Order Haplosclerida       Haliclona compressa       12       12       11       10       39       39       41       39         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         Callyspongia fallax       1       2       0       1       2       0       1         Xestospongia muta       6       7       5       4       8       10       7       6         Vestospongia sp.       0       0       0       1       0       0       1       0       0       1         Order Poecilosclerida       10	Pseudoceratina crassa	2	2	2	2	8	7	3	3
Order Haplosclerida       12       12       11       10       39       39       41       39         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         Callyspongia plicifera       5       3       5       4       8       7       8       7         Callyspongia fallax       1       2       0       1       2       0       1         Xestospongia sp.       0       0       0       1       0       0       1       0       0       1         Order Poecilosclerida       10       9       6       6       33       39       17       3         Desmapsamma anchorata       5       7       <	Dysidea etheria	7	6	1	1	15	23	2	2
Haliclona compressa1212111039394139Haliclona sp.54548677Niphates erecta121311958645035Dasychalina cyathina9825112913020Callyspongia vaginalis5460861214Calyspongia plicifera53548787Callyspongia fallax12012201Xestospongia sp.00010001Order Poecilosclerida109663339173Desmapsamma anchorata5734152455	Order Haplosclerida				1.5			-	-
Haliclona sp.54548677Niphates erecta121311958645035Dasychalina cyathina9825112913020Callyspongia vaginalis5460861214Calyspongia plicifera53548787Callyspongia fallax12012201Xestospongia sp.0001001Order Poecilosclerida109663339173Desmapsamma anchorata5734152455	Haliclona compressa	12	12	11	10	39	39	41	30
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         Callyspongia vaginalis       5       4       6       0       8       6       12       14         Callyspongia plicifera       5       3       5       4       6       0       8       6       12       14         Callyspongia fallax       1       2       0       1       2       2       0       1         Xestospongia muta       6       7       5       4       8       10       7       6         Norder Poecilosclerida       0       0       0       1       0       0       0       1         Desmapsamma anchorata       5       7       3       4       15       24       5       5	Haliclona sp.	5	4	5	4	8	6	7	7
Dasychalina cyathina9825112913020Callyspongia vaginalis5460861214Calyspongia plicifera53548787Callyspongia fallax12012201Xestospongia muta675481076Norder Poecilosclerida00010001Iotrochota birotulata109663339173Desmapsamma anchorata5734152455	Niphates erecta	12	13	11	9	58	64	50	35
Callyspongia vaginalis5460861214Callyspongia plicifera53548787Callyspongia fallax12012201Xestospongia muta675481076Xestospongia sp.00010001Order Poecilosclerida109663339173Desmapsamma anchorata5734152455	Dasychalina cyathina	9	8	25	11	29	13	0	20
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       10       9       6       6       33       39       17       3         Desmapsamma anchorata       5       7       3       4       15       24       5       5	Callyspongia vaginalis	5	4	6	0	8	6	12	14
Callyspongia fallax12012201Xestospongia muta675481076Xestospongia sp.0001001Order Poecilosclerida109663339173Desmapsamma anchorata5734152455	Calvspongia plicifera	5	3	5	4	8	7	8	7
Xestospongia muta675481076Xestospongia sp.0001001Order PoeciloscleridaIotrochota birotulata109663339173Desmapsamma anchorata5734152455	Callyspongia fallax	1	2	0	1	2	2	0	1
Xestospongia sp.       0       0       0       1       0       0       1         Order Poecilosclerida       10       9       6       6       33       39       17       3         Iotrochota birotulata       10       9       6       6       33       39       17       3         Desmapsamma anchorata       5       7       3       4       15       24       5       5	Xestospongia muta	6	7	5	4	8	10	7	6
Order Poecilosclerida109663339173Iotrochota birotulata5734152455	Xestospongia sp.	0	0	0	1	0	0	0	1
Iotrochota birotulata109663339173Desmapsamma anchorata5734152455	Order Poecilosclerida					U	0	0	1
Desmapsamma anchorata $5$ 7 3 4 15 24 5 5	Iotrochota birotulata	10	9	6	6	33	30	17	3
	Desmapsamma anchorata	5	7	3	4	15	24	5	5

Thalysias juniperina	4	3	4	7	5	4	6	7
	# of Sit	es			# of Ind	ividuals		
	1990 1	991	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

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Pseudonterogorgia americana	6	6	7		5	17	17	16	7
I seauopierogorgia anterteana	# of Site	es			#	t of Indi	ividuals		
	1990 1	991	1992	1994	1	990	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 Coraliomo	orphs								
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	1	9	11	19	21	16
Diploria clivosa	2	2	2		3	3	5	3	5
Diploria labyrinthiformis	1	1	0	1	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	1	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

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## 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.

							INSHO	DRE CO	NTROL	SITES	100		_			
STATION		T	88			R	90			R	92	1004	1000	R	94	1004
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						-			-			-	-	-		1
Unidentified hydrozoan														-		
Subphylum ANTHOZOA									-			-				
Class ZOANTHARIA	-											-	-			
Order SCLERACTINIA	-						-		-	-	-					
Sphenotrochus sp.	-		-		-		1		-	-	-		-			
Order ACTINIARIA	-			-			-	-	-				-			
Unidentified actiniarian	-			-			-		-			-		-		
Phylum PLATYHELMINTHES	-								-							
Class TURBELLARIA	-				-		-			-		-	-	-		
?Coelogynopora sp.	-				-	-				-	0		-			
Unidentified acoel	-				-				-	-			-		-	
Unidentified bothryoplanid	-				-				-				-			
Unidentified coelogynoporid	-				-				-	-			-		-	-
Unidentified Kalyptorhynchid	-			-	-	-							-			
Unidentified monocelid						-	-	-	-				-		-	
Unidentified nematoplanid	-			-			-		-	-			-			
Unidentified trablacia	-				-				-				-	-		
Unidentified shullowartid									-			1				
Unidentified provide	-	-	-	-		-	-		1		-	11	14	-		2
Unidentified turbelleries			2		2	64	1	-	-	-	1		14	-	1	1
Unidentified turbellarian		-	6		0	04		-	-	-			-	-		
Phylum NEMERTINA	-				-				-			-	-			
Order ARCHINEMERTINA					-		-	-	-	-			-		-	
Family CEPHALOTHRICIDAE	-		2		-		-	-			-	2	-		2	2
Cephalothnx sp. A	-	10	3	1	2	0	E	6	1	27	0	6	-	17	15	4
Cephalothnix sp. 114		10	0	-	0	9	5	0		61		0		17	10	-
Linidentified conhalothrigid	-	4		-			-	1	-	-			-	-	-	1
Unidentified archinomotion	-	4					-		-			-	-			
Order DALEONEMEDTINA	-	-			-			-				-	-	-		
Earnik CARINOMIDAE	-									-						
Cappoma en A	-		1		-		1								-	
Carinoma tramanhoros	-				-			1		-		-		-		
Carinomalia lactea	-	1			-		-		-	-	3	-		-		
Eamily HUBBECHTIDAE	-												-			
Hubrechtella dubia	-	1			1	1	-	-	1	-			1	1	-	
Family TUBULANIDAE									-							
Tubulanus pellucidus	-	2			1										-	
Tubularius rhabdotus	-	-														
Tubulanus sp.	-				-											
Paleonemertine sp. 103											2					
Unident, paleonemertine sp. A	-					1					-			1		
Unidentified paleonemertine			1	1	3		1									1
Order HETERONEMERTINA																
Family CEREBRATULIDAE												19.70				
?Cerebratulus leucopsis																
Cerebratulus lineolatus?																
Family BASEODISCIDAE																
Baseodiscus sp.?		-									1990					
Family MICRURIDAE																
Micrura sp.		1														
Unidentified heteronemertine																
Order HOPLONEMERTINA																
Family PROSTOMATELLIDAE															and the second	
Prostomatella enteroplecta?					2				1				1			
Family TETRASTEMMIDAE														1		
Tetrastemma worki		2	1			2				2				5	1	
Family DREPANOPHORIDAE																
Unident. drepanophorid													-			
4-eye hoplonemertine				3			1					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																

t

			1012			-	INSH	DRE CC	NTROL	SITES			-			
STATION		Т	88	1100		R	190			R	92			R	94	_
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Family TUBILUCHIDAE																
Tubiluchus corallicola					1	1										
Phylum ANNELIDA										1	1000					
Class POLYCHAETA																
Order OBBINIDA						-										
Eamily OBBINIDAE	-						-	-	-	-		-				-
Orbinia ricari	-		-		-		-	-				-	-			-
Croinia riseri	-					-	-	-	-	-			-			-
Scolopios acmeceps	-	-	-		-	-	-		-				-	-		
Scolopios sp. B	-	1				-				-			-			
Scolopios sp.																
Naineris bicornis				1.1.1.1	1.1.1	-										
Leitoscoloplos fragilis															1.00	
Leitoscoloplos sp.													2		1.00	
Family PARAONIDAE						1										1
Aricidea cf. catherinae																
Aricidea cerrutii									-	-			-	-	-	
Aricidaa fracilis	-		-				-		-				-			-
Arcidea philhinga	-		-		-		-						-			-
Anicidan taulori					-		-		-				-	-	-	-
Ancidea taylon					-			-	-		-		-	-	-	-
Ancidea suecica	-								-				-	-		
Aricidea sp.											1				-	
Cirrophorus lyra						1								2	1.50	
Levinsenia gracilis								1.2.2.4		12120						
Paraonis fulgens	5		30	21	1	13	19	59	12	29	28	61	6	18	16	12
Paraonis pygoenigmatica						34										
Family OUESTIDAE									-				-			-
Questa en					-	-	-		-	-						
Order CTENODRILIDA							-		-				-			-
Eamily OTENODRILIDAE					-				-				-			-
Pamily CTENODRILIDAE	-	-					-									
Raphionius nemasoma	_															
Ctenodnius serratus											1999					
Ctenodrilus sp. A					1		1									
Order COSSURIDA							1									
Family COSSURIDAE											11.	-				
Cossura soyeri							100.00	1.5.5			Sec. 2					
Order SPIONIDA					1000			0.00								
Family SPIONIDAE																
Apoprionospio davi		5							-	0					-	
Anontionospio pyomeea				4	-				-	-	-			1	4	
Dispis uppinets		-	000		-	-								2		
Displo unciriata	03	5	322	29	5	5	88	67	19	4	58	49	2	6	95	29
Malacoceros vanderhorstil		12		_					-							
Minuspio sp. A						1										
Paraprionospio pinnata												130 20	1.1.1			
Polydora comuta																
Polydora tetrabranchia																
Polydora websteri								-								
Polydora sp.				1												
Prionospio cristata		9				3				14				-	-	
Prionospio heterohranchia				-		0			-	14				0	1	
Prionospio multibranchiata				-			-									
Priorospio matubranchiata				5				11				22				57
Prioriospio steenstrupi								230				100				2.00
Prionospio sp.																-
Pseudopolydora sp.							COSSIN'								1	
Scolelepis acmeceps					3							100				
Scolelepis squamata		2						2								
Scolelepis texana		2	46	4			58	8	6	10	42	15		20	51	25
Spio pettiboneae	3	13	26			5	16	-	1	50	26	10	1	24	47	
Unidentified spionid						1	5	1	1	00	03			94	4/	-
Family MAGELONIDAE			-				0				1	8				
Magelone pettibonese				_												
Magalona pourorieae																
Magelona sp. B						-										
Mageiona sp. C		1	_													
Magelona sp. G																
Magelona sp. H						1000										
Magelona sp.																
Family POECILOCHAETIDAE																
Poecilochaetus iohnsoni				1	1			-				-				
Family CHAFTOPTERIDAE								-			-					
and a state for termone							1.1		1.1.1.1.1.1.1						1.00	

Hollywood-Hallandale Beach Renourishment: all surveys (1990-1994). INSHORE CONTROL SITES **R94** R92 R90 STATION **T88** 1991 1992 1994 1990 1991 1992 1994 1990 1991 1992 1994 1990 1991 1992 1994 1990 YEAR 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

1

2

2

1

2

Tharyx sp. Unidentified cirratulid Order CAPITELLIDA Family CAPITELLIDAE

Capitella capitata Dasybranchus lunatus Leiocapitella sp. A Mediomastus californiensis

Mediomastus sp. Notomastus americanus Notomastus latericeus Notomastus daueri Notomastus ?tenuis Notomastus hemipodus Notomastus sp. Scyphoproctus platyproctus

Unidentified capitellid Family MALDANIDAE Axiothella sp. A Axiothella sp. Unidentified maldanid Family ARENICOLIDAE Arenicola sp. Unidentified arenicolid Order OPHELIIDA

Table 8.4.1. Identification and enumeration of infauna by station and survey, including diversity indices, species richness and evenness values,

Family OPHELIIDAE												1.1			
Armandia agilis	3	4	22	1	1	2	13			7	19	1	13	31	
Armandia maculata															
Armandia sp. (juv)							1				-				
Polyophthalmus sp.															
Family SCALIBREGMIDAE															
Scierobregma stenocerum											-				
Unidentified scalibregmid															
Order PHYLLODOCIDA														8 ( C. )	
Family PHYLLODOCIDAE									1		2.0.1			1	
Genetyllis cf. castanea								200							
Genetyllis sp.		1			1.1.1				1000						
Hesionura elongata						1									
Mystides borealis		1000		1.5.50				1		1000		1000			
Phyllodoce arenae		1						-			100			-	
Unidentified phyllodocid			100				S				7 1 1 1	1			
Family SIGALIONIDAE							1.1.1.1								
Sigalion arenicola														1	
Sthenelais boa							25.0	22							
Sthenelais sp.		1	10000								1997				
Unidentified sigalionid											100				
Family CHRYSOPETALIDAE				1.00											
Bhawania heteroseta															
Family HESIONIDAE				-											
Gyptis vitatta												-			
Heteropodarke lysoni							1000								
Microphthalmus sp. A			1	1000								12.5.5			
Podarke obscura												1000			
Podarkeopsis levifuscina											1				
Family PILARGIIDAE												-			-

OTITION	-	-	00		-	P	90			B	R94					
STATION	1000	1001	1000	1004	1000	1001	1002	1004	1990	1991	1992	1994	1990	1991	1992	199
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1331	1002	1004	1000	1001	1002	
Litocorsa sp. A	_								-	-						-
Sigambra tentaculata									-					-		-
Synelmis sp. B		1				1						-	-			-
Family SYLLIDAE											-		-		-	-
Brania wellfleetensis									-	-						-
Dentatisyllis carolinae																_
Ehlersia comuta					1					-				-		
Exogone atlantica							1			1997				-		
Evonne disnar																
Evonone laurei	-															
Exogone inco			-													
Exogone sp.		-			-									-		-
Grubeosynis ciavata									-	-						-
Haplosyllis spongicola	_	-	-		-				-			-		-		-
Opisthodonta sp. B					-		-					-	-	-	-	-
Pionosyllis gesae								-	_					-	-	-
Sphaerosyllis longicauda																
Sphaerosyllis piriferopsis							-	1-1-1-1								
Sphaerosyllis riseri									-					1.11		
Sphaerosyllis taylori						1.5		-								
Streptosyllis pettiboneae																
Syllides floridanus								-								
Syllidae bancai				-	1											-
Tumonullin of Luton					-			-					-			-
Typosyms Ct. Inted	-	-		-	-				-			-	-	-	-	-
Unident, syllid			-		-		-	-	-		-		-	-	-	-
Family NEREIDAE					-	-			-	-		-	-		-	-
Ceratonereis irritabilis				1										-	-	
Ceratonereis longicirrata																
Ceratonereis mirabilis							1	1000					1000			
Ceratonereis versipedata										-			1900			
Ceratonereis sp. A																
Neanthes sp. A																
Neanthas en	-		-	-						-						
Nomatosarais bebos		-		-			-					-	-	-	-	-
Nematonereis nebes				-	-		-		-	-		-	-		-	-
Iverers taisa							-		-						-	-
Platynereis dumeniii	_		-	-	-				-			-	-	-		-
Unidentified nereid	_										1		-	-	-	
Family GLYCERIDAE			-						-							
Glycera abranchiata			2	1	5					1						
Glycera americana							1									
Givcera sp. A																
Glycinde solitaria											1					
Unidentified alvcerid																-
Eamily CONIADIDAE	-			-					-	-			-		-	-
Caniada littaraa	-			-		-		-	-	-			-	-		-
Goniada intorea	-			-	-			-	-	-			-	-		-
Goniada maculata	_	-				-			-			-	-		-	-
Goniada teres	-			-					-				-			
Family NEPHTYIDAE	_															
Inermonephtys inermis																
Order AMPHINOMIDA	and the second		2							-			1.1			
Family AMPHINOMIDAE										100	140.00					
Chloeia viridis																
Paramphinome sp. B		1														
Pseudeurvithoe sp.																-
Order FUNICIDA	-								-				-		-	-
Eamily ELINICIDAE	-								-		-		-			-
Family EUNICIDAE	-								-							
Eunice sp. A	-	-			-						_					
Lysidice ninetta																
Marphysa sp.							1000	-								
Nematonereis hebes					2	1						1.000				
Family ONUPHIDAE		1000		10000												
Diopatra cuprea																-
Kinbergonuphis sp													-			-
Mooreonunbis nallidula					1				-					-		-
Mooreopublic	-				1						-				-	_
Mooreonupriis sp.	-	_			-				-				-			
Unident. Onuphid	-								_	-	-					
Family LUMBRINERIDAE																
Lumbrinereis latreila					1									-		
Lumbrinargie tatraura	the second se	4												0		

	INSHORE CONTROL SITES T88 R90 R92 R94															-
STATION		T	88			R	90		-	R	92			R	94	100
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	199
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						12.65	-						-	-		-
Dorvillea sociabilis	-												-			-
Pettibonia duofurca					_	-		-	-				-			-
Protodorvillea kefersteini						1	-									-
Schistomeringos pectinata							40.0	-					-	-	-	-
Uunidentified dorvilleid													-			-
Order OWENIIDA					1.01	1.51							-			-
Famiy OWENIIDAE															-	-
Myriochele oculata																-
Order TEREBELLIDA																
Family PECTINARIIDAE												-				-
Pectinaria gouldii																-
Family TEREBELLIDAE																
Ameaena trilobata																
Pista quadrilobata																
Polycirrus plumosus														1		
Polycirrus sp. B														12.0		
Polycirrus sp.																
Scionella sp. A						1000			1					1990		
Thalanessa sp. A				1000				1.1.1								
Unidentified terebellid	-															
Family TRICHOBRANCHIDAE	-															
Terebellides stroemi																
Order SABELLIDA																
Family BOGUEIDAE						1000									1.1.1	
Boquea enigmatica														1.1.1		
Unidentified bogueid																
Family SABELLIDAE																
Branchiomma nigromaculata										-						
Chone cf. americana																
Demonax sp.	1						-				1000					
Fabricia sp. A	1															
Fabricinuda trilobata	1			1								1000				
Sabella melanostigma																
Sabellastarte sp. A	-															
Unidentified sabellid																
Family SERPULIDAE	-															
Unidentified serpulid	-		-													-
Order FLABELLIGERIDA																-
Family FLABELLIGERIDAE																-
Pherusa inflata																-
Unident. polychaete																-
Class OLIGOCHAETA						-										
Family TUBIFICIDAE																-
Bathydrilus adriaticus					1											
Heterodrilus bulbiporous					1											-
Heterodrilus pentcheffi		1			1											1
Inanidrilus leukodermatus	-		-		1								-			-
Limnodriloides monothecus		1		-	-									-	-	-
Olavius impartectus	-	-							-					-	-	-
Olavius/Inanidrilus en	-	-	-						-		-		-	-		-
Pactinodellus molastus		-	-	-	-					-			-	-	-	-
Cmitheonidritus Indestus	-			-	-	-	-	-	-	-	-	-	-		-	-
Smithsonidrilus luteolus	-	-	-	-	-			-	-	-	-	-	-	-	-	-
Smithsonianius mannus	-	-		-	-			-	-	-			-	-	-	-
Tectanius bon	-	-	-	-		-		-	-	-	-	-	-	-	-	-
Unidentified tubificid	-	2	-	-	1				-		-	-				-
EADING ENCLEY (BAEII)AE		1	1	1							1	1			1	1
Tanky ENONTITIALIDAE									-							-

0747001	-	T	88		-	P	90	112 00	T	P	92			B	94		
STATION	1000	1001	1000	1004	1000	1001	1002	1004	1990	1901	1992	1994	1990 1991 1992 1				
YEAR	1990	1991	1992	1994	1990	1991	1995	1994	1990	1991	1992	1004	1000	1001	1002	100	
Class SIPUNCULIDEA	-			-	-				-				-	-		-	
Order GOLFINGIIFORMES					-										-	-	
Family PHASCOLIONIDAE		-						-				-	-			-	
Phascolion sp. A						-			-				-			-	
Order ASPIDOSIPHONIFORMES						_		-					-			-	
Family ASPIDOSIPHONIDAE																-	
Aspidosiphon fischeri		and and			1												
Unidentified sipunculan A								No. Call									
Unidentified sipunculan			1000					See.									
Phylum MOLLUSCA											100						
Class POLVPLACOPHORA																	
Order NEOLOBICATA	-																
Acenthachitana en																	
Acanthochiona sp.					-		-						-		-	-	
Class GASTROPODA			-		-	-						-	-			-	
Family OLIVIDAE	-				-				-			-	-			-	
Olivella mutica	_					-			-				-			-	
Family CERITHIDAE												-				-	
Cerithiopsis emersoni																	
Cerithium litteratum		-															
Family VOLVATELLIDAE		1			-									1000	0.000		
Cylindrobulla beauii					1	-											
Family CAECIDAE		-								0.000				1000			
Caecum imbricatum						2											
Caecum pulchelium			1		36		20	1	1		1	2			1	-	
Meioceras cubitatum	-		-		~	-					-					-	
Meloceras oltidum	-						2		-				-			-	
Meloceras hildum	-				-		6		-	-			-	-		-	
Family HISSOIDAE		-	-		-				-	-		-	-	-		-	
Amphithalamus vallei	-				1				-								
Unidentified rissoid (juv.)																	
Family CYLICHNIDAE													-				
Cylichnella bidentata				-			1000							1000		-	
Family CYCLOSTREMATIDAE																	
Arene tricarinata																	
Family VITRINELLIDAE																	
Teinostoma clavium	-														1		
Teinostoma en	-															-	
Femily NATICIDAE	-				-				-				-			-	
Family NATICIDAE	-			-	-											-	
Unidentified naticid (juv)	-								-				-		-	-	
Family HAMINOEIDAE	-				-										-	-	
Atys sandersoni																	
Unidentified opisthobranch			-					-							1.1.1.1		
Class BIVALVIA																	
Family SOLEMYACIDAE										1000				1000	1000		
Solemya occidentalis							100										
Family ABCIDAE						_								-			
Ramatia candida					1												
Eamily SPORTELLIDAE	-			-												-	
Linidentified enotellid																-	
Unidentified sportellid											-			-		-	
Family CARDITIDAE				-						-			-		-	-	
Cyclocardia sp.			-									-	-			_	
Pleuromeris tridentata					2						100						
Family LEPTONIDAE																	
Unidentified leptonid																	
Family CARDIIDAE				1 Sector				2002									
Laevicardium sp.									1000						1		
Family LUCINIDAE											1						
Parvilucina multilineata																-	
Lucina sp													-			-	
Loidentified lucinid																-	
	-				1								-			-	
Family SEMELIDAE													-			_	
Cumingia tellinoides		-		_													
Semele bellastriata											-						
Family UNGULINIDAE						2233											
Diplodonta semiaspera									100			1246.23					
Diplodonta sp.												1000					
Family MESODESMATIDAE								1							-		
Ervilia concentrica														2		-	
Fruilia sp										1				-		-	
Living op.		and the second second	and the second	10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			and the second se	and the second	100 M	1		and the second second				-	
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STATION	1000	1001	1002	1004	1000	1001	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	
YEAR	1990	1991	1992	1334	1000	1991	1002	1004									
Family THRACIIDAE	-	-			-												
Bushia elegans		-		-				-									
Family VERTICORDIDAE	-			-													
Family VENERIDAE		-									1	5.5	100			1.1	
Chione cancellata																	
Parastarta triculatra																	
Tivela floridana	5	1		1	13	9	8	19	43	21	15	58	6	105	16	86	
Transennella sp.																	
Gouldia cerina									100								
Family MYTILIDAE																	
Brachiodontes modiolus								342.1									
Family TELLINIDAE													100				
Strigilla mirabilis		91	2			4				58		1		111	8		
Tellina iris?							-						-			-	
Tellina sybaritica									1		-						
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		1						_							-		
Class INARTICULATA			1000													-	
Lingula sp.				-													
Phylum ARTHROPODA											1.1.1.1						
Subphylum CHELICERATA											-			1			
Class PYCNOGONIDA																	
Unidentified pycnogonid						1											
Class ARACHNIDA															-		
Order ACARI					-												
Unidentified acarine									_				-		-		
Subphylum CRUSTACEA	-								-				-	-			
Class COPEPODA	-													-			
Order CYCLOPOIDA	-					-					-		-	-	-	-	
Order CALANOIDA	2				1		-		2		-		5	-	-	-	
Order HARPACTICOIDA	-	3			-	22	2			/	3		-	1	1	-	
Class OSTRACODA	-								-				-	-	-	-	
Subclass MYODOCOPIDA	-								-				-	-			
Pamily CYLINDROLEBERIDIDAE	-	-	-	-					-				-	-	-	-	
Parasterope muellen	-		-	1				-	-	-			-			-	
Acteropella purestata	-	-		-		-			-				-			-	
Eamily PHILOMEDIDAE	-	-			-				-								
Harbansus naurocholatus		B							-	3				11			
Family BUTIDERMATIDAE	-	0															
Butiderma darbyi	-																
Unidentified ostracodes															1		
Class MALACOSTRACA																	
Order AMPHIPODA																	
Family CAPRELLIDAE																	
Caprella pentantis																	
Caprella sp.														100			
Family AMPELISCIDAE						100											
Ampelisca abdita																	
Ampelisca bicarinata																	
Ampelisca sp.																	
Family AORIDAE																	
Acuminodeutopus sp.																	
Amphideutopus dolichocephalus																	
Amphideutopus sp.																	
Bemlos unifasciatus reductus																	
Bemlos sp.						-						-					
Family BATEIDAE					1.1.1												

OTATION	-	T	RR			R	90			B	92			R	94	
STATION	1000	1001	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
	1330	1001	1006	1004	1000											
	-															
Family GAMMARIDAE	-										-				1.0	
Elasmopus levis	-													-		
Elasmopus sp.	-															
Family HAUSTORIDAE	-					1										
Acanthonaustonus pansus	E		10	21	1		6	10	6	2	2	96		4	7	2
Haustonus n. sp.	0		10	13			-	10		-	-	1				
Bathyporeia parken	-				-											
Family ISAEIDAE	-				-				-							
									-							
Family MEGALOROPIDAE														2		-
Gibberosus myersi					-				-					-		
Family OEDICEHOTIDAE	-		-		-											-
Monoculodes sp.	-				-				-	-	-				-	-
Synchelidium americanum				-	-						-		-			-
Family PHOXOCEPHALIDAE		17	00		-	-	17	01	1	04	7	10	1	10	24	-
Metharpinia floridana	10	17	20	11	4	0	17	21	4	04	1	12		13	04	-
Family PLATYISCHNOPIDAE	-	-			-	-	-		-	-	-	-	-		0	-
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 corophild n. sp.													-	-		
Unidentified corophild			2										_			-
Family NEOMEGAMPHOPIDAE																
Unidentified neomegamphopid								-				1.0				
Order ISOPODA											-					
Family ANTHURIDAE		(									1. A.S.					
Amakusanthura magnifica								1000	1.00							
Family GNATHIDAE																
Gnathia sp.											Para					
Family HYSSURIDAE	-															
Xenanthura brevitelson	-															
Family CIBOLANIDAE	-															
Furvice convexa	-															-
Eurydice personata	-															-
Eurydice en	-								-	3						-
Earnin SPHAEROMATIDAE	-				-				-	-			-	-		-
Ancinus brazilioneis	-		2	-	-		-		-		-		-		-	-
Andrius braziliensis	-		2						-			0	-			-
Ancinus depressus	-											2		-		-
Ancinus sp.	6								1			-	4			-
Exosphaeroma diminutum	-								-				-			-
Exosphaeroma productateison	-				-								-			-
Order CUMACEA	-					-							-			
Family BODOTRIIDAE																
Cyclaspis cf. longipes			2								2			2	7	
Cyclaspis cf. pustulata				2				1				3				
Cyclaspis unicomis								-								
Cyclaspis cf. varians		10				2	1			4				4		
Cyclaspis cf. striata/bacescui					-										4	
Cyclaspis sp. B(?)				1	-					10.00						
Cyclaspis n. sp. D	5				11		1.1		7	3			4	4		
Cyclaspis n. sp. E					1											
Bodotriidae n. gen. A			11111		1. 2.	1000										
Family NANASTACIDAE																-
Cumella sp.																-
Unidentified cumacean fragment									-							-
Order TANAIDACEA												-				-
Family PARATANAIDAE	-							-					-			-
Lantachalia formati	-	-							-							-
L'entochelle en									-							-
Leptochella sp.	1								-				-			-
Family APSEUDIDAE	-				_	1			-		-					
Apseudes sp. A	-															
Family KALLIAPSEUDIDAE	-	-		-	_		-	-								
Cirratodactylus floridensis				_						-						
Kalliapseudes sp.						1. 1. 1.	10000			14 A A A	1000	1000				

	-	-	00		-	-	00	112 00	- Inter	P	92		R94					
STATION		Т	88			H	90	1004	1000	1001	1002	1004	1000	1001	1992	1994		
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1995	1994	1990	1001	1002	100		
Unidentified tanaidacean												-	-					
Order MYSIDACEA													-		-	-		
Uunidentified mysid					1			1			-		1		1			
Order DECAPODA			12 100								-							
Infraorder PENAEIDEA																		
Family SOLENOCERIDAE		1																
Solenocera sp.																		
Infraorder CARIDEA				-		1												
Family ALPHEIDAE																		
Automate sp.																		
Unidentified alpheid									1000			12000						
Family OGYBIDIDAE																		
Oovrides alphaerostris			2					-						2				
Eamily PROCESSIDAE	-		-															
Process en	-																	
Linidentified processid	-		-											1				
Unidentified caridean postlan/a	-	-	-	-		-						-						
Unidentified Alphooid	-		-	-	-				-	-					-	-		
Unidentified Alpheoid	-	-		-		-	-		-	-		-		-	-	-		
Intraorder THALASSINIDEA	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-		
Family CALLIANASSIDAE	-		-		-		-		-	-	-	-	-		-			
Callianassid new genus	-		-			1	-		-	-			-	-	-	-		
Unidentified callianassid larva				-			-		-	-		-	-		-	-		
Infraorder ASTACIDEA																-		
Family NEPHROPIDAE																		
Unidentified nephropid																		
Infraorder ANOMURA				1			1.2.3.4											
Family ALBUNEIDAE								1004										
Albunea gibbesii						1.2.1	1.1.1											
Zygopa michaelis																		
Family PAGURIDAE									1									
Unidentified pagurid	-		-															
Infraorder BBACHYUBA	-																	
Eamily I ELICOSIIDAE	-		-	-	-		-						-			-		
Ebalia etimpeonii	-		-	-	-				-			-	-		-	-		
Eomila Sumpsonin	-	-	-		-				-			-	-	-	-	-		
	-	-	-		-		-		-	-	-	-	-	-	-	-		
Batrachonotus sp.	-	-		-	-		-		-	-	-	-	-	-		-		
Family PINNOTHERIDAE	-	-	-	-								-		-	-	-		
Pinnixa cristata	3	-			-	-	-		1		-		-	-	-	-		
Pinnixa gorei	-		-		-	-	2		-				-		-	-		
Pinnixa sp.	-		-			-	-			-		-		1				
Unidentified pinnotherid					-				1		-		1					
Family CALAPPIDAE																		
Cycloes bairdii				1														
Unidentified megalopa														1				
Unidentified zoea																		
Unidentified decapods				4								1	1.5.2.7					
Phylum ECHINODERMATA	1								1									
Unidentified ophiuroid					-							-				-		
Unidentified bolothuroid	-				3											-		
Distant CHAETOCHATUA	-	-	-	-			-	-		-				-		-		
riyun onaeroginarna	3	-		-			-			-	-	-	-	-	-	-		
Phylum HEMICHORDATA	-				-													
Unidentified enteropneust	-																	
Phylum CHORDATA								1000										
Subphylum CEPHALOCHORDATA		-																
Branchiostoma caribaeum												1000						
Subphylum VERTEBRATA		1000	1000															
Class OSTEICHTHYES								-										
Unidentified labrid																-		
Unknown	1	2	1			E			e	1		-			1	-		
Total Number of Orcessions	-	6	-	110	0.00	0		-	0	1	-	-		5	1	-		
Total Number of Organisms	221	222	537	116	297	1185	310	214	380	343	241	367	387	440	354	28		
Number of Organisms for H" & J"	118	200	502	115	137	169	273	213	112	330	226	363	49	409	351	28		
Number of species for H' & J'	14	28	22	21	45	24	23	17	14	22	23	21	15	28	25	2		
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	2.09		
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	0.69		

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0.000	-		0.0		-	INS	HORE	REAT	MENT (F	PILL) SI	16			B	120	-
STATION	1000	R1	06	1004	1000	T1	11	1004	1000	H 1001	1002	1994	1990	1991	1992	1994
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1004	1330	1001	1002	100
Phylum PORIFERA					-											-
Unidentified sponge					-				-				-			
Phylum CNIDARIA	-				-	-							-			
Subphylum MEDUSOZOA			-		-	-			-				-			-
Unidentified hydrozoan	-							-	-	-			-			-
Subphylum ANTHOZOA	-							-	-			-		-		-
Class ZOANTHARIA	-				-				-			-				-
Order SCLERACTINIA	-				-		1		-		1			-		-
Order ACTINIARIA	-															
Unidentified actiniation	-	-			1											
Distance DI ATVIJEL MINITUES	-			-					-	-				1		
Class TURBELLARIA	-				-			-	-							
2Coalogupopora en	-				-				-							
Linidentified accel	-			2					-			1				
Unidentified bothoronlanid	-			-							1	1				
Unidentified coelogynoporid	-			3												
Linidentified kalvntorhynchid	-			3								4				
Unidentified monocelid	-			2	-							1				
Unidentified permatonlanid				4										1.1.1		
Linidentified atoplanid	-			2							1	3			1	
Unidentified typhionlanid	-			-								5			1	
Unidentified phylosyrtid	-							-				-				
Unidentified proseriate		3		3				100			4	1	1		1	
Unidentified turbellarian	1		1	5							3	2				
Phylum NEMERTINA				-	-				-							
Order ABCHINEMERTINA	-															
Family CEPHALOTHRICIDAE	-							-								
Cephalothrix sp. A			5	1							2					
Cephalothrix sp. 114		11	6			1	2			1	1				1	
Procephalothrix spiralis?			-				-		-							
Unidentified cephalothricid						1										
Unidentified archinemertine			1													
Order PALEONEMERTINA																
Family CARINOMIDAE																
Carinoma sp. A						1220	1									
Carinoma tremaphoros			1							100						
Carinomella lactea		-			2						1				1	
Family HUBRECHTIDAE																
Hubrechtella dubia		4			5		1									
Family TUBULANIDAE																
Tubulanus pellucidus		1			1	1			1000						1.1	
Tubulanus rhabdotus																
Tubulanus sp.		-											1.000	1		
Paleonemertine sp. 103																
Unident. paleonemertine sp. A						1										
Unidentified paleonemertine			4	3	1					1						
Order HETERONEMERTINA											1					
Family CEREBRATULIDAE																
?Cerebratulus leucopsis	-															
Cerebratulus lineolatus?			-		1											
Family BASEODISCIDAE	_			_												
Baseodiscus sp.?	-				1											
Family MICRURIDAE						-										
Micrura sp.									-				-			-
Order HOPI Child Provide Hope	-					-			-		-		-			
Family PROSTOLIATEL IDAT	-	_			-				-		-	-	-			-
Prostomatellio	-			-	-				-		-		-			
Prostomatella enteropiecta?	4				-	-		_					3			
Tetrastemma		-											-			
Ferrastemina Worki	-	1			-	-			-				-	1		
Pamily DREPANOPHORIDAE	-				-			_			-					-
Unident. drepanophorid	-			-	-				-	-			-			-
4-eye nopionementine	-			1					-							
Unidentified hopionemertine	-		-	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															100	

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STATION	-	RI	106	-		T1	11			R	16	1000		R	120	1000
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Family TUBILUCHIDAE	1				i				1	İ						
Tubiluchus corallicola											1000					
Phylum ANNELIDA	-				1				Î		1825					
Class POLYCHAETA																
Order OBBINIDA																
Family OBBINIIDAE											1					
Orbinia riseri	-										0.000					
Scolopios acmeceos												1				
Scoloplos sp. B																1.1.1.1.1
Scolopios sp.	-				1						1					
Naineris bicomis					1											2.4
Leitoscoloplos fragilis								10						100		
Leitoscoloplos sp.	-		2	4			1	6								2
Family PARAONIDAE			-											1		
Aricidea cf. catherinae	-				1											
Aricidea cerrutii																
Aricidea fragilis							199.0									
Aricidea philbinae																
Aricidea tavlori					1						0.00					
Aricidea suecica																
Aricidea sp.																
Cimphonie lura																
Levinsenia gracilie																
Paraonie fulgane	6	15	103	3			16	2	5	13	70	6	48	7	38	17
Paraonis nugeris	-	10	100	-			10	-	-			-				
Farabrills pygoenigmaaca	-				-											
Family QUESTIDAE	-				1											
Questa sp.	-				-				-	-			-			
Order CTENODRILIDA	-				-											
Family CTENODRILIDAE	-				-				-		-			-		-
Haphidnius nemasoma	-															
Ctenodrilus serratus	-													-		
Ctenoanius sp. A	-		-		-									-		
Order COSSURIDA	-				-					-						
Family COSSURIDAE	-				-		-	-		-			-			
Cossura soyen	-			-	-				-			-		-		
Order SPIONIDA	-			-	-				-	-			-	-		
Family SPIONIDAE	-	-		-	-	1	0			-			-			
Apoprionospio dayi	0		-		-	-	0	-	-			-				
Apoprionospio pygmaea		-	105	-	-	10	40	7	0	16	05	-	1	12	74	18
Dispio uncinata	18	/	185	3	4	19	40	1	3	10	30	-	· ·	16	14	10
Malacoceros vanderhorstii	-	-	-	-	-				-	-			-		-	
Minuspio sp. A	-		-		-	-			-	-			-	-		
Paraprionospio pinnata	-		-	-	-				-			-	-	-	-	
Polydora comuta	-			-	8				-	-			-	-		
Polydora tetrabranchia	-	-		-	3	-	-		-	-		-	-	-		-
Polydora websteri	-		-	-		-			-			-	-	-	-	-
Polydora sp.		-	-	-		-			-		1	-	-	-		-
Prionospio cristata	-	1		-	14	0	-		-	-			-	-	-	
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															-	-

						INS	HORE	TREAT	MENT (F	FILL) SI	TES		-	-	00	
STATION		Rt	106			T1	11			R1	16		1000	R	20	100
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	199
Unidentified chaetopterid (juv)																-
Family CIRRATULIDAE										_			-	-		-
Caulleriella ct. alata													-	-		-
Caulleriella killariensis																-
Caulleriella sp. A																-
Caulleriella sp.					7											-
Chaetozone setosa																
Chaetozone sp. B			1.0.2							1		1				
Chaetozone sp.													100			1
Cirriformia sp.	-						1000									
Dodecaceria sp. A																1.20
Tharvx dorsobranchialis					1				1.000							12
Tharvx marioni	-													1		
Thany sp	-														1.200	
Unidentified cirratulid	-							1								
Order CAPITELLIDA	-															
Eamily CARITELLIDAE	-															
Canitalla canitata	-		-					-								
Desubranchus lunatur	-		-		-											
Lasybranchus lunatus	-	-	-										-			-
Leiocapitella sp. A	-		-	-	10		-			-					-	-
Mediomastus californiensis	-		-	-	19			-	-	-		-	-	-	-	-
Mediomastus sp.	-		-	-	-		1		-	-		-	-	-	-	-
Notomastus americanus	-		-	-		-		-	-			-	-	-		-
Notomastus latericeus	-			-	2				-	-			-	-	-	-
Notomastus daueri												-			-	-
Notomastus ?tenuis															-	-
Notomastus hemipodus					1000	100										
Notomastus sp.																
Scyphoproctus platyproctus			2-1-1		2								1000			
Unidentified capitellid																
Family MALDANIDAE																
Axiothella sp. A				100					1000		2010					
Axiothella sp.						-		100	1.1.1.1				1			
Unidentified maldanid														-		
Family ARENICOLIDAE																
Arenicola sp.	-				1											
Linidentified arenicolid	-															
Order OPHELIDA	-		-	-		-										-
Eamily OPHELIDAE	-			-					-			-			-	-
Amandia agilia	17	14	1		0	11	E	1	2	17	1	-	0	41	0	
Amandia aguis	1/	14	4	-	9	- 11	0	1	0	17		-		41	6	-
Armandia macuiata	-	-	-					-	-			-	-		-	-
Armandia sp. (juv)	-			-				-	-			-	-		-	-
Polyophthalmus sp.	-		-	-		-			-			-	-		-	-
Family SCALIBREGMIDAE				-				-	-			-	-		-	
Sclerobregma stenocerum												-			-	-
Unidentified scalibregmid																
Order PHYLLODOCIDA																
Family PHYLLODOCIDAE																
Genetyllis cf. castanea																
Genetyllis sp.		100	10													
Hesionura elongata				8								11				
Mystides borealis			1	1	20.00	10.0	1.2.2.2		1.52.57						100	
Phyllodoce arenae						1			1							
Unidentified phyllodocid																
Family SIGALIONIDAE																
Sigalion arenicola						1										
Sthenelais boa	-															-
Sthenelais sp.	-															-
Unidentified sigalionid	-			-				1	-							-
Family CHRYSOPETAL IDAE	-	-	-	-				-				-		-	-	-
Rhawapia batamata	-		-	-	-				-				-	-	-	-
Enawaria heteroseta	-		-	-	-			-				-	-		-	-
Partin HESIONIDAE	-		-		-				-			-	-	-	-	-
Gypus vitalta	-		-	-	-							-	-		-	-
Heteropodarke lysoni	-											-			-	-
Microphthalmus sp. A									1	1			-			
Podarke obscura																
Podarkeopsis levifuscina																
Family PILARGIIDAE																

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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).

					-	INS	HORE	REAT	MENT (F	ILL) SI	16		-	BI	20	-
STATION		R1	06			T1	11	1001	1000	HI	10	1004	1000	1001	1992	1994
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1001	TOOL	1001
Litocorsa sp. A						-						-	-			
Sigambra tentaculata									-				-			
Synelmis sp. B					-				-							
Family SYLLIDAE	-									-			-	-		
Brania wellfleetensis					-				-				-			-
Dentatisyllis carolinae									-		-	0				
Ehlersia cornuta					2				-			2	-			
Exogone atlantica					1	-			-				-			
Exogone dispar									-				-			-
Exogone laurei					1				-						-	-
Exogone sp.					1											
Grubeosyllis clavata					1								-			-
Haplosyllis spongicola					1								-			
Opisthodonta sp. B												-				
Pionosyllis gesae																
Sphaerosyllis longicauda			10000											1		
Sphaerosyllis piriferopsis																
Sphaerosyllis riseri																
Sphaerosyllis taylori														200		
Streptosyllis pettiboneae																
Syllides floridanus																
Syllides bansei															1000	
Typosyllis cf. lutea	-				1				1							
Linident sullid	-			1								1.1				
Eamily NEREIDAE	-	-	-			-	-									
Ceretenersis irritabilis	-	-			-										-	-
Ceratonereis Imtabilis	-			-	-			-	-		-				-	-
Ceratonereis longicirrata	-	-	-	-	-	-			-			-	-	-	-	-
Ceratonereis mirabilis	-			-	-	-	-		-	-	-		-			-
Ceratonereis versipedata	-			-	-	-	-		-		-				-	-
Ceratonereis sp. A	-															-
Neanthes sp. A					5				_					-		
Neanthes sp.					2											
Nematonereis hebes																
Nereis falsa												1				
Platynereis dumerilii									1.1.27			100				
Unidentified nereid				1.00					100						11/100	
Family GLYCERIDAE																
Glycera abranchiata				1	5				1000							
Glycera americana							1								2	
Givcera sp. A	-															
Glycinde solitaria	-															
Unidentified alvcerid	-						1									
Family GONIADIDAE	-	-					-		-							-
Goniada littorea	-						-		-					-		
Goojada maculata	-				1	-			-	-	-	-			-	-
Goniada tasas	-						-		-				-			-
Eamily NEDUTVIDAE	-					-			-		-		-		-	-
Inamopanhtis inamic	-	-			-				-				-			-
Order AMPHINO 400 A	-			-					-				-	-		-
						-	-			-				-		
Charle vide	-					-	-		-				-			
Chioeia Vindis	-								-						-	-
Paramphinome sp. B	-				2				-							-
Pseudeurythoe sp.	-								-				-			
Order EUNICIDA									-							
Family EUNICIDAE																
Eunice sp. A					10											
Lysidice ninetta					1					1.1.1.1		-				
Marphysa sp.				1000	1											
Nematonereis hebes					7											
Family ONUPHIDAE								1.10								
Diopatra cuprea																
Kinbergonuphis sp																
Mooreonuphie pallidula	-				4											
Mooreonuphie en	-															
Loident opurbid	-					-			-				-			
		-	-						-				-			-
Family LUMBHINEHIDAE	-		-		-				-	-			-	-		
Lumprinereis latreila	-	-	-		-	-			-	-	-		-	-		-
Lumbrinereis tetraura	3									3						

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OTATION		P	06			TI	11			BI	16			R1	20	
STATION	1000	1001	1002	1004	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	199
YEAR	1990	1991	1992	1994	1990	1001	1002								-	
Lumbrinereis tenuis	-							-								
Lumbrinereis vernili	-	-											-			
Lumbrineris sp.	-															
Family ARABELLIDAE	-			-	-				-		-					
Arabella multidentata	-				3											
Arabella mutans	-			1	0				1							
Dnionereis longa	-			-	1											
Dhionereis sp. B	-															
Drionereis sp.	-				-											
Family DORVILLEIDAE	-	-														
Dorvinea sociabilis	-															
Petudonia duorurca		-														
Protodorvillea Kelerstell II	-	-														
Scriistomeningos pecunata	-	-														
Oundentified dorviteid	-				-											
Order OWENIIDA	-			-	-											
Marioshele ogylate	-	-		-					-							-
Order TEDEBELLIDA	-	-		-					-							
	-			-					-							-
Paniny FEOTINANIDAE Rectinaria pouldi	-	-		-					-							-
Family TEREBELLIDAE	-		-						-		-					-
Amosena trilohata	-		-			-			-							-
Pieta quadrilobata	-	-		-					-							-
Polynimus plumosus	-		-	-					-							-
Polycinus piumosus	-	-	-	-	-				-			-				-
Polycinus sp. b		-		-	-		-	-	-	-	-	-				-
Polyanus sp.	-			-	-				-		-		-		-	-
Thelesesses es A	-	-		-	-		-		-		-		-	-		-
Indianessa sp. A	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
Earribut TRICHORRANICHIDAE	-		-	-	-	-	-	-	-	-		-	-	-	-	-
Taminy TRICHODRANCHIDAE		-		-	-	-	-		-		-	-	-			-
Order CARELLIDA	-		-	-	-	-	-	-	-	-	-	-	-	-		-
Order SABELLIDA	-		-	-		-	-		-		-			-	-	-
Pamily BOGUEIDAE	-			-			-				-	-	-	-	-	-
Boguea enigmatica	-	-	-	-	-		-		-	-		-	-	-		-
Eamily SARELLIDAE	-	-							-	-	-	-	-			-
Pamily SADELLIDAE		-		-			-			-	-	-	-		-	-
Chone of americana	-	-		-			-			-			-	-	-	-
Domonay so	-	-		-	-		-					-	-		-	-
Eshicia so A	-				-				-	-		-				-
Fabricia sp. A	-	-		-			-			-			-	-		-
Pabricinuda thiobata	-				-				-		-				-	-
Sabellastarta en A	-			-			-		-	-			-	-		-
Sabellastarte sp. A	-					-			-			-	-	-		-
Chidentined sabeliid	-	-		-			-	-	-			-	-			-
Loidentified comulid	-	-			-		-		-		-		-			-
Order ELABELLIOEDIDA	-			-	1		-		-	-		-	-	-		-
Eamily ELABELLIGERIDA	-	-			-		-		-			-	-		-	-
Phones inflate	-			-	-		-		-				-			-
Loident polychaste		-			1	-	-					-	-		-	-
	-	-			-	-			-				-			-
Eamily TURIFICIDAE	-	-		-					-	-		-	-			-
Pathy TUBIFICIDAE	-			-	-			-			-					-
Bathyonius adnaticus	-			8	1							3	-			-
Heterodnius buibiporous	-					-		-	-			-	-			-
Heteroanius pentcheffi	-				-				-							-
manionius ieukodermatus	-			-		-		-	-							-
Limnoanioiaes monothecus	-					-										
Olavius imperfectus	-				-									-		
Olavius/Inanidnilus sp.	-				1	-							-			
Pectinodrilus molestus	-				-	-					_		-			
Smithsonidnlus luteolus	-				_				-				-			
Smithsonidnius marinus	-								-							
Tectidrilus bori	-				-		-		-				-			
Unidentified tubificid	-		1	2	5	2		-					1			
Family ENCHYTRAEIDAE								-	-						_	
Grania sp.					2											
hylum SIPUNCULA	-	1000					1.1.1.1									

	T					INS	HORE	TREAT	MENT (	FILL) SI	TES				-	
STATION	-	BI	106			TI	111			Bi	116			Bt	20	
VEAR	1990	1991	1992	1004	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
	1000	1001	TOOL	1004	1000	1001	1001	1004	1000	1001	1002	1001	1000		TOOL	1001
Order COLEINCHEORNES											-					
Earnik BHASCOLIONIDAE					-				-							
Particip PHASCOLIONIDAE					0				-							
Phascolion sp. A	-				2				-							-
Order ASPIDOSIPHONIFORMES									-					-		
Family ASPIDOSIPHONIDAE					-				-							
Aspidosiphon fischeri		_								-						_
Unidentified sipunculan A					-											-
Unidentified sipunculan																
Phylum MOLLUSCA									1000							
Class POLYPLACOPHORA		20020				100										
Order NEOLOBICATA							1.									
Acanthochitona sp	1															
Class GASTROPODA																
Eamily OLIVIDAE																
Parmiy OLIVIDAE													1			2
																-
Family CERITHIDAE	-			-	-				-							
Centhiopsis emersoni					-								-			
Cerithium litteratum					2											
Family VOLVATELLIDAE					-				-							
Cylindrobulla beauii					4										-	
Family CAECIDAE				-							-					
Caecum imbricatum		1000		-			1.7									
Caecum pulchellum				1	10		1					1				
Meioceras cubitatum																
Meioceras nitidum																
Family BISSOIDAE																
Amphithalamus vallai				1	1.11	1										
Linidentified rissoid (inv.)					1											
Earphy CVI ICHNIDAE				-					-							
Parmiy CTLICHNIDAE									-							
Cylichnella Didentata																
Family CYCLOSTREMATIDAE					-						-					
Arene tricarinata					-											
Family VITRINELLIDAE					-								-			
Teinostoma clavium					_											_
Teinostoma sp.								-								
Family NATICIDAE					-											
Unidentified naticid (juv)																
Family HAMINOEIDAE	1000															
Atys sandersoni				100	1000											
Unidentified opisthobranch																
Class BIVALVIA																
Eamily SOLEMYACIDAE							1						-			
Colomus opcidentalic																
Solernya occidentans					-											
Family ARCIDAE																
Barbatia candida					-							-				
Family SPORTELLIDAE					-				-					-		
Unidentified sportellid	-			-	-		-					1	-	-		
Family CARDITIDAE				-					-	-			-			
Cyclocardia sp.				-	-			-	-	-	-	-		-	-	-
Pleuromeris tridentata		_		1										-		
Family LEPTONIDAE														-		-
Unidentified leptonid													-			-
Family CARDIIDAE													-			
Laevicardium sp.							2000									
Family LUCINIDAE						233.0				1500						
Parvilucina multilineata															5000	
Lucina so														1		
Linidentified luninid																
Earribu CEMELIDAE	-		-				-		-							
Paminy SEMELIDAE	-	-			-		-		-	-	-	-	-		-	
Cumingia tellinoides	-			-	1	-	-	-	-		-	-	-	-	-	
Semele bellastriata	-			-	-	-		-	-	-	-	-	-	-	-	
Family UNGULINIDAE			-		-				-	-	-	-	-		-	
Diplodonta semiaspera									-	-	-	-	-		-	
Diplodonta sp.								-					-	-	-	
Family MESODESMATIDAE									-				-	-	-	
Ervilia concentrica														-		
Ervilia sp.																

					_	INS	HORE	REAT	MENT (F	FILL) SI	TES		-		00	
STATION	1000	RI	106	1001	1000	TI	11	1004	1000	H1	1000	1004	1000	1001	1002	1004
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Family THRACIIDAE				-	-				-							
Bushia elegans					-	-			-							
Family VERTICORDIDAE	-								-				-			
Venicordia omata	-				-					-						
Chione cancellate																
Paraetarte triguatra							1									
Tivela floridana	8	353	9	96	5	3	2	26	54	61	7	13		188	9	5
Transennella sp.	-		-													
Gouldia cerina																
Family MYTILIDAE										12.20						
Brachiodontes modiolus					24											
Family TELLINIDAE																
Strigilla mirabilis		7	1			2	1		1000	3			1			
Tellina iris?					7	2										
Tellina sybaritica																
Tellina texana					12.50											
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						1200		1882								
Lingula sp.																
Phylum ARTHROPODA								S. Carl								
Subphylum CHELICERATA							1000									
Class PYCNOGONIDA																
Unidentified pycnogonid								1								
Class ARACHNIDA									1							
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	-	-	-	-	-		-					-	-	-	-	-
Panity RUTIDERMATIDAE	-	-	-		-		-		-	-	-	-	-	-	-	
Lipideotified ostracodes	-	-	-		-	-	-				-				-	
Class MALACOSTRACA	-	-	-		-	-			-	-	-	-				
Order AMPHIPODA	-	-	-	-		-							-		-	
Eamily CAPBELLIDAE	-				-	-				-					-	
Canrella pentantis	-	-								-	-	-				
Caprella sp	-															
Family AMPELISCIDAE		-														
Ampelisca abdita	-	-				-					1		-			
Ampelisca bicarinata	-	-														
Ampelisca sp	-															
Family AOBIDAE		-				-				-	1		1			
Acuminodeutoous en	-	-			-											
Amphideutopus dolichocenhalus				-												
Amphideutopus sp.		-							1							
Bemlos unifasciatus reductus																
Bemlos sp.																
Family BATEIDAE						1000								1		

	-	-	00			TINS	11	INCAIN	ILINI (F	B1	16			BI	20	
STATION	1000	R1	1000	1004	1000	1001	1902	1994	1990	1991	1992	1994	1990	1991	1992	1994
YEAR	1990	1991	1995	1994	1990	1991	1992	2	1000	1001	1002					
Carinobatea catharinensis	-			3				-								
Family GAMMARIDAE	-	-		-	-									-		
Elasmopus levis	-													-		
Elasmopus sp.	-								-							
Acapthobaustorius papeus	-															
Acanthonaustonus pansus	9	5	8				2	3	2	9	5		3	14	3	4
Pathuporeia parkeri	-		-				-	-	4		-					
Eamily ISAEIDAE	-												1			
Chevalia aviculae	-					1.1.1			1					-		
Family MEGALLIBOPIDAE	-										1.5.12					
Gibberosus myersi	-			2			1									
Family OEDICEBOTIDAE													1			
Monoculodes sp.	-					1.00									-	
Synchelidium americanum	-							12.2.2								
Family PHOXOCEPHALIDAE	-															
Methaminia floridana	8	34	5		6	4	11		1	26	1		1	29	1	
Family PLATYISCHNOPIDAE													1.8.1			
Eudevanopus honduranus	3		2		1	3		1	3	8	6			4	4	
Family SYNOPIIDAE			1													
Synopia caraibica																
Family COROPHIIDAE																
Cerapus sp.																
Grandidierella bonnieroides								-								
Unidentified corophiid n. sp.				1										1		
Unidentified corophiid		-							1.1.2.					2000		
Family NEOMEGAMPHOPIDAE					1000				1990							
Unidentified neomegamphopid		1111														
Order ISOPODA						1.50			1000							
Family ANTHURIDAE			1000		100											
Amakusanthura magnifica												-				
Family GNATHIIDAE												1000				
Gnathia sp.								1.00								
Family HYSSURIDAE					204.35									1		
Xenanthura brevitelson														1000	10000	
Family CIROLANIDAE									1975					1.5		
Eurydice convexa																
Eurydice personata															1	1
Eurydice sp.								2				1				
Family SPHAEROMATIDAE																
Ancinus braziliensis			1.778												1	
Ancinus depressus	1															
Ancinus sp.			200									2			100	
Exosphaeroma diminutum				2												
Exosphaeroma productatelson				21								1				
Order CUMACEA																
Family BODOTRIIDAE											19.50					
Cyclaspis ct. longipes			5			1	2				5			4	2	
Cyclaspis cf. pustulata								8							2	
Cyclaspis unicomis																
Cyclaspis cf. varians		5				13				2				6		
Cyclaspis cf. striata/bacescui			1				1				3				2	
Cyclaspis sp. B(?)						1										
Cyclaspis n. sp. D	8	3			5	3			4	20				25		
Cyclaspis n. sp. E					1.1.1.1											
Bodotnidae n. gen. A					4						1					
Family NANASTACIDAE						-										
Cumeila sp.									199							
Unidentified cumacean fragment																
Order TANAIDACEA																
Family PARATANAIDAE																
Leptochelia forresti																
Leptochelia sp.																
Family APSEUDIDAE	12000															
Apseudes sp. A	1								-							
Family KALLIAPSEUDIDAE				1											-	
Cirratodactylus floridensis					-		-				-			-		
Kalliapseudes sp.																

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STATION	1000	R	106			T	111			R	16			B	120	
VEAD	1000	1001	1002	1004	1000	1001	1992	1994	1990	1991	1992	1994	1990	1991	1992	199
TEAR	1990	1991	1992	1994	1990	1991	1992	1334	1990	1551	1992	1004	1330	1001	1006	1.00
Unidentified tanaidacean	-		-		-								-			-
Order MYSIDACEA	-				-	-	-		-	-			-			-
Uunidentified mysid	1		1		1	-				3			-			-
Order DECAPODA									-			-	-	-		-
Infraorder PENAEIDEA					_				-					-		-
Family SOLENOCERIDAE											-		-			
Solenocera sp.				-	12.46											
Infraorder CARIDEA																
Family ALPHEIDAE												200				
Automate sp.			-													
Unidentified alpheid			1985												-	
Family OGYRIDIDAE			100													
Ogyrides alphaerostris																
Family PROCESSIDAE									1							
Processa sp.		1									1000		-	1		
Unidentified processid	-															
Linidentified caridean postlarva	-					1									1	
Unidentified Alphaoid	-					-								1		
Infraorder THALACCINIDEA	-				-	-	-									-
Eamily CALLIANA COIDAE	-				-	-			-				-			-
Pamily CALLIANASSIDAE	-				-	-	-						-		-	-
Calilanassid new genus	-				-					-						-
Unidentified callianassid larva	-				-	-		-					-		-	-
Infraorder ASTACIDEA	-			-	-	-	-		-				-	-	-	-
Family NEPHROPIDAE	-												-		-	-
Unidentified nephropid					-	-							-			-
Infraorder ANOMURA					-	-									-	-
Family ALBUNEIDAE															-	
Albunea gibbesii						10.20		1								
Zygopa michaelis	-									2						
Family PAGURIDAE			-		1.0						2			1.00		
Unidentified pagurid		2.5														
Infraorder BRACHYURA												-				
Family LEUCOSIIDAE											-					
Ebalia stimpsonii																
Family MAJIDAE	-															-
Batrachonotus sp	-								-							-
Eamily PINNOTHERIDAE	-				-									-		-
Diopiya crietata	-						-		1							-
Pinnika cristala	-				-		-		,		1					-
Pinnixa gorei	-				-				-		1		-		1	-
Pirinixa sp.	-		-				-		-							-
Unidentified pinnotherid	-	-			-	-			-	-		-	-	-		-
Family CALAPPIDAE	-						-		-				-			-
Cycloes bairdii	-						-		-					-		-
Unidentified megalopa	-					1			-	1			-			-
Unidentified zoea					-										-	-
Unidentified decapods								1	1.000							
Phylum ECHINODERMATA												1000				
Unidentified ophiuroid						1000					1	1				
Unidentified holothuroid					1											
Phylum CHAETOGNATHA	-												-			-
	-					-			-				-		-	-
TYUM HEMICHORDATA	-						-				-	-				-
Unidentified enteropneust	-								_		-					
Phylum CHORDATA		-			1								-		1000	
Subphylum CEPHALOCHORDATA				-					1					-		
Branchiostoma caribaeum																
Subphylum VERTEBRATA																
Class OSTEICHTHYES		1000			-				10.20							
Unidentified labrid																
Inknown	-	1			3						1		2			
Cotal Number of Organisme	100	504	000	704	207	201	101	110	000	040	0.00	450	170	050	400	-
otal Number of Organisms	162	524	399	734	307	321	191	118	202	243	246	450	1/3	356	159	6
number of Organisms for H' & J'	97	504	375	194	248	135	180	79	88	231	224	62	69	243	152	5
Number of species for H' & J'	17	18	22	30	70	21	27	15	11	17	23	21	11	13	21	1
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	1.91
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	0.74

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STATION	CONTROL BORROW AREA								TOT	ALS		
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Phylum POBIFEBA		1.1			10000				1.1			
Unidentified sponge					1				1			
Photom CNIDABIA												
Subshilum MEDI ISOZOA	-											
Lipidentified bydrozoan	1		1		-				1		1	1
Cubebulum ANTHOZOA				-								
Class ZOANTHARIA	-											
Order SCI EBACTINIA	-				-							
Cobacotrachus en			20	16			1				24	16
Order ACTINIARIA	-											
Linidentified actiniarian	-		2				8		1		10	1000
		-	-									-
Class TUPPELLADIA	-	-			-							
2Coelograpport en	-						1				4	
Lipidentified accel	-	-										3
Linidentified bothmonlanid	-				-				1		1	1
Unidentified confortmonorid	-				-							3
Unidentified kelveterburgshid	-		-		-	-						7
Linidentified managerid	-	-			-							3
Unidentified normatical acid		-							-			4
Unidentified stoplanid		-	-								2	5
Unidentified trablanid		-	-							-	- 1	E
Unidentified challocatid		-				-	-		-	-		2
Unidentified privilosyrtid	-	-	0		-	-		-	17	2	7	17
Unidentified to be lighted	-	-	6	1	1	-	-		6	EA.	15	0
Unidentified turbellarian	-		0		-	-	-	-	- 0	04	15	
Phylum NEMERTINA		-	-		-	-	-		-	-		
Order ARCHINEMERTINA	-	-	-			-	-		-			-
Family CEPHALOTHRICIDAE						-	-	-	-		00	
Cephalothrix sp. A	-	-	4		-		2			-	20	1
Cephalothnx 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									1			
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					1				-			
Prostomatella enteroplecta?									11			
Family TETRASTEMMIDAE												
Tetrastemma worki		1				1				15	2	
Family DREPANOPHORIDAE												3
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												
			-			1				-		_

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STATION		CON	TROL		E	BORRO	W ARE	4		TOT	TALS	
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Family TUBILUCHIDAE				100				120.2				
Tubiluchus corallicola					1			1.1.1.2	2			110
Phylum ANNELIDA												
Class POLYCHAETA							CO.					
Order ORBINIIDA						1.1						
Family ORBINIIDAE												
Orbinia riseri	1				1				2			
Scolopios acmeceps	1								1			
Scoloplos sp. B					1					1		
Scoloplos sp.			1						1		2	
Naineris bicomis				1					1			1
Leitoscoloplos fragilis					1							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		-	100
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					-			-	107	2	0.00	1
Dispio uncinata	-	-	2		-	-	1		127	14	960	202
Maiacoceros vandernorstii	-	1			1			-	1	1		
Minuspio sp. A	1	-	-		-	-	10		1	-	00	-
Paraphonospio pinnata	-	1	1			1	19	-		Z	20	
Polydora comuta	-				-	-			0			
Polydora tetrabranchia	-			-	-				3	-		-
Polydora websten	-			1	-		-					1
Priopospio prietoto	47	17	20	0	20	20		10	07	05	05	00
Prionospio cristata	4/	17	29	0	30	39	54	10	9/	95	65	22
Priopospio meterobranchia			-					0	-	-		07
Prioriospio multibranchiata	-				-	-		2	-	-		97
Prionospio sidenstrupi		-	-		1		0	-	1	-	-	
Previdence/previdence.		-	1	5	1	-	2		2	-	3	-
Scolelenie armanan		1	0	5	4	1	93		5	2	100	5
Scolelenis equemate	-								4	-		0
Scolelenie tevana	-		1	-	0	-	0		10	140	200	2
Spio pattihonaga	2	1	2		2	1	4	1	10	148	283	11
Unidentified eniopid		1	3		2	2	1		17	158	16/	10
Family MAGELONIDAE			2				2		5	2	11	10
Magelona pettibonese	2		1	1					2		1	
Magelona en R			-			-			2	-		-
Magelona en C	2	0				2	1			-	-	
Magelona en G	0	1				2	1		3	9	1	
Magelona sp. H							1			-	1	
Magelona sp. H				1			1	1			1	-
Family POECIL OCHAETIDAE				-			6	4			2	0
Poecilochaetus inhosoni		1	2	2	1				2	1	2	2
Family CHAETOPTERIDAE			-	-					-		-	0
	_								-			-

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STATION		CON	TROL		E	BORRO	W ARE	4		TOT	ALS	
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Unidentified chaetopterid (juv)							3				3	
Family CIRRATULIDAE									100			
Caulleriella cf. alata	2			100		1.2.2.1			2			
Caulleriella killariensis			2				1	1235113			3	
Caulleriella sp. A	1								1	1		
Caullorialla en	-					1			7	1		
Chasterene estera	1								1			
Chaetozone setosa			0				1				3	
Chaetozone sp. B			4								2	
Chaetozone sp.			2		-						6	
Cirríformia sp.	_				2				2			
Dodecaceria sp. A		1000			1				1	-		-
Tharyx dorsobranchialis	2		1		3				6		1	
Tharyx marioni			1	1.2.1							1	-
Tharyx sp.			1						1		1	
Unidentified cirratulid			5				2				7	
order CAPITELLIDA				1200		1.0.1	1					
Eamily CAPITELLIDAE	-									1.00		
Capitalla capitata	-			1						2		
Capitena Capitala	-			1						-		
Dasyorarichus Iunaius	-							-	1			-
Leiocapitella sp. A	-				1				10			
Mediomastus californiensis	-				-				19		-	-
Mediomastus sp.					-		1	1	2		2	-
Notomastus americanus		3	1	1		4	8	-		7	9	-
Notomastus latericeus				1	1			1	3			1
Notomastus daueri	2	1			3				5	1		
Notomastus ?tenuis	2			1	8			1	10			
Notomastus heminodus	-			1	1				1			
Alotomastus en	-		1	-	1				1		1	
Companyatus sp.	-			1		1			2	1		
Scyphoproctus platyproctus			0		-		1	1	2		3	
Unidentified capitellid	1		2				1	1	0			
Family MALDANIDAE	-			-					-			-
Axiothella sp. A					3				3			-
Axiothella sp.					1				1			
Unidentified maldanid			-	3		1.00	1				1	
Family ARENICOLIDAE												
Arenicola sp.						-	2.123		1			1
Linidentified arenicolid	-				2				2			
					-				-			
Joer OPHELIIDA	-										-	-
Family OPHELIIDAE	-		-	-	-		05	-	41	100	100	-
Armandia agilis	-		5	1			35	2	41	109	138	-
Armandia maculata	19	3		7	13	1		7	32	4		1
Armandia sp. (juv)							3				4	
Polyophthalmus sp.					1		1.1.1		1			
Family SCALIBREGMIDAE												
Sclerobregma stenocerum				1	1	1	1		1	1	1	
Unidentified scalibregmid					1				1		1.000	
order PHYLLODOCIDA												
Eamily PHYLLODOCIDAE	-											
Constitution of container	-	-	2	-	-		0				10	-
Generyms CI. castanea	-		6			-	0		-	-	10	-
Genetyllis sp.	-					1				1		-
Hesionura elongata										1		1
Mystides borealis	1								1			
Phyllodoce arenae							2			1	2	
Unidentified phyllodocid			1000	1000			1				1	
Family SIGALIONIDAE												
Sigalion arenicola			1				1				2	
Sthenelais boa	1		2		2		1		3		3	-
Sthenelais sn			-	1		1	-	2	1	1		
Linidentified electionid	-		-	1	-	-	1	2	-	-		-
Criticeriulied sigailonid	-					-	4		-		4	-
Family CHHYSOPETALIDAE	-				-							
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		
Podarkeonsis levituscina	5		1		E	1	2		10		2	-
Family DIL ADCIDAE				-	5		-		10		3	
Failing FILANGIIDAE				1.	Contraction of the later					1000		-

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STATION	-	CON	TROL			BORRO	WARE	A		TOT	ALS	
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
Sunalmie en B	7	8	5	1					7	10	5	1
Eamily SVI I DAE		0	0						- '	10	0	
Praniny STELIDAE	-				2		1		2		1	
Drania weimeetensis					6		1		6	-		
Dentatisyllis carolinae	1				-				1			
Ehlersia comuta	6			1	2				11		-	3
Exogone atlantica							-		1			
Exogone dispar		1		2		1	3			2	3	2
Exogone laurei									1			
Exogone sp.						1			1			
Grubeosyllis clavata	2			1	1			1	3			2
Haplosyllis spongicola					1				2		0.2	-
Opisthodonta sp. B				1	-							1
Pionosyllis gesae	4		-		2	1	1.0		6	1		
Sphaerosvilis longicauda			1				1				2	
Sphaerosvilis piriferopsis	-			1								1
Sohaerosyllis riseri	1								1			
Sphaoneyllie taylori							1				1	
Streptopullie pattibanese	-		-								1	
Sulposynis periodneae			4								4	
Sylides hondanus	1								1			
Syllides bansei	-				-	-			1	-		
Typosyllis ct. 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		2.1.2			2				2			
Ceratonereis sp. A	4				1	1000			5			
Neanthes sp. A									5			
Neanthes sp									2			
Mamatanaraje behae	-			1					-			1
Nernia false	-	-				1				1		
ivereis taisa	-				-	1	-				2	4
Platynereis dumenlii	-			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					1.1.1							
Goniada littorea			1		1.1.1		- Enerth				1	
Goniada maculata									1			
Goniada teres					3		-		3			
Family NEPHTYIDAE							-			-		
Inermonentive inermie						1	-			1		
Order AMPHINOMIDA	-											
	-											
Chloria visidia	-		-			0				0	1	
Chioeia vinois	-	-	1			2			-	2	1	
Paramphinome sp. B	-				-				2	1		
Pseudeurythoe sp.	-		1			-					1	
Order EUNICIDA								-			1	
Family EUNICIDAE						-			- 100			
Eunice sp. A									10			
Lysidice ninetta									1			
Marphysa sp.			1000	1					1	1000		
Nematonereis hebes						14464	1		9			
Family ONUPHIDAE												
Diopatra cuprea	-						1	1			1	1
Kinhamonunhia an	-				3				3			
Maaraanunhis sellistula	-	2			1				6	2		
Mooreonuphis pallidula	-	3							0	3		
Mooreonupnis sp.	-				1			-	1			-
Unident. onuphid	-							1				1
Family LUMBRINERIDAE	-						-			-		
Lumbrinereis latreila	-								1			_
Lumbrinereis tetraura						1		1.17.54	3	8	-	

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STATION	-	CON	TROI	101101		BORRO	WARE	4		TOT	ALS	
YEAR	1990	1991	1992	1994	1990	1991	1902	1994	1990	1991	1992	1994
	1000	1331	1995	1004	1550	1331	1002	1004	1000	1991	1002	100
Lumbrinaraie varrilli				3		1				1		
Lumbrinaris en			1				1				2	
Family ABABELLIDAE	-										-	
Arahella multidentata	-									1	1	
Arabella mutans									4			
Drilonereis longa	1				1				3			2
Drilonerais sp. B	-								1			-
Drilonereis sp.	-	1								1		
Family DORVILLEIDAE	-											
Dorvillea sociabilis				1								
Pettibonia duofurca	1				100				1			
Protodorvillea kefersteini										1		
Schistomeringos pectinata			1			-	1				2	
Uunidentified dorvilleid	1		1						1		1	
Order OWENIIDA					122.00						1000	
Famiy OWENIIDAE					2.01	1.1	120					
Myriochele oculata								1				
Order TEREBELLIDA												
Family PECTINARIIDAE												
Pectinaria gouldii	1								1			
Family TEREBELLIDAE												
Ameaena trilobata			2							-	2	
Pista quadrilobata				1						-		
Polycirrus plumosus		1				1				2		
Polycirrus sp. B						1				1		
Polycirrus sp.	1					1000			1			
Scionella sp. A	1						1992		1			
Thalanessa sp. A		1				100				1		
Unidentified terebellid			1	2		1000	1			1.50	2	
Family TRICHOBRANCHIDAE					100	100						
Terebellides stroemi		1			1				1	1	100	
Order SABELLIDA									1111			
Family BOGUEIDAE												
Boguea enigmatica			2				2				4	
Unidentified bogueid			2			3.200					2	
Family SABELLIDAE					2.2	000						
Branchiomma nigromaculata	1								1			
Chone cf. americana	6	3	12	5	4	41	18	17	10	44	30	2
Demonax sp.						2				2		
Fabricia sp. A			14		-	-	4				18	-
Fabricinuda trilobata	20	5	1	7	_			5	20	5	1	1
Sabella melanostigma				1								
Sabellastarte sp. A					1				1			_
Unidentified sabellid			3				1	_			4	_
Family SERPULIDAE									-			_
Unidentified serpulid				-					1	-	23.14	_
Order FLABELLIGERIDA				_		-				-		-
Family FLABELLIGERIDAE			-		-	_						_
Pherusa inflata					_				1			_
Unident. polychaete				5			_	1				
Class OLIGOCHAETA		-			-							
Family TUBIFICIDAE	-								-			-
Bathydrilus adriaticus					1	-			3			1
Heterodrilus bulbiporous				4	4				5			-
Heterodrilus pentcheffi				3				_	1			-
Inanidrilus leukodermatus	-				1				2			-
Limnodriloides monothecus	-		1		-						1	-
Olavius imperfectus	-			1					-			-
Olavius/Inanidrilus sp.	-		2	1			1		2		3	-
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	-
Family ENCHYTRAEIDAE	-						-		-			
Grania sp.					_	-	-		2		-	_
Phylum SIPUNCULA				10.77	1					1000		

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STATION		CON	THOL	1001	1000	JORHO	WARE/	1004	1000	1001	1002	1004
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			1.									
Aspidosiphon fischeri									1			
Unidentified sipunculan A		2				5	17			7	17	
Unidentified sipunculan				2								2
Phylum MOLLUSCA			1.25.5.5		1000					1.1.1		1000
Class POLVPLACOPHORA												1.1
Order NEOLOBICATA	-											
Acapthochitona en	-								1		1	
Acaminociniona sp.	-				-				-			
Class GASTROPODA	-					-						-
Family OLIVIDAE	-											
Olivella mutica	-				-				1			-
Family CERITHIDAE	-								-	-		
Cerithiopsis emersoni	-			1	-							1
Cerithium litteratum					-				2			-
Family VOLVATELLIDAE												
Cylindrobulla beauii					1				5			
Family CAECIDAE												
Caecum imbricatum				5								5
Caecum pulchellum							1000		47		24	5
Meioceras cubitatum				1								1
Meioceras nitidum	-										2	
Family BISSOIDAE	-										-	
Amphithalamus vallai	-								1			1
Lipidentified record (inu.)	-							-				-
Unidentified rissoid (juv.)	-				-				1			
Family CYLICHNIDAE	-						-	-		-		-
Cylichnella bidentata	-	-		-	1		-		1			
Family CYCLOSTREMATIDAE	-				-							
Arene tricarinata	1				-				1			
Family VITRINELLIDAE												
Teinostoma clavium											1	
Teinostoma sp.			-		1.5.25							1
Family NATICIDAE												1
Unidentified naticid (juv)							1				1	1.00
Family HAMINOEIDAE			1000	-	-				1000	200		
Atys sandersoni				1	-							1
Unidentified opisthobranch				2								2
Class BIVALVIA	-			-								
Eamily SOLEMYACIDAE										-		
Solamua occidentalia	-		1		-			4				-
Solernya occidentalis	-		1		-	-		1		-	1	-
Pamily ARCIDAE	-		-						-	-		_
Barbatia candida	-				-		-		1			-
Family SPORTELLIDAE									-			
Unidentified sportellid	-		_									1
Family CARDITIDAE	-			_						-		
Cyclocardia sp.				3						1		3
Pleuromeris tridentata									2			1
Family LEPTONIDAE				-						1		
Unidentified leptonid			2	-		10000		1000	1.0		2	1000
Family CARDIIDAE							-					-
Laevicardium sp.			1				1000				1	
Family LUCINIDAE										-		
Parvilucina multilineata	6	2				3			E	5		
Lucina sp	1	-			-	5		1	1	0		
Unidentified lucinid	-							1	1			1
Eamly CENELIDAE	-								1	-	-	
Parminy SEMELIDAE	-		_		-							
Cumingia tellinoides	-		_						1			-
Semele bellastriata	1		22.63.0	1	-				1			1
Family UNGULINIDAE					-							
Diplodonta semiaspera	1	3							1	3		
Diplodonta sp.	5			2				3	5			5
Family MESODESMATIDAE								100				
Ervilia concentrica	1		1						1	2	1	
Ervilia sp.		1								2		
	-	-	_								and the second s	

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STATION         CONTROL         BORDWAREA         TOTALS           YEAR         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1994         1990         1991         1992         1991         1992         1991         1992         1991         1992         1991         1992         1991         1992         1991         1992         1991         1992         1991         1992         1991         1992         1991         1992         1991         1992         1991         1991         1991         1992         1991		T	-	0	FFSHO	RE SITE	ES	51.00			-		-
YEAR         1990         1991         1992         1994         1990         1991         1992 <th1992< th="">         1992         1992         <th1< th=""><th>STATION</th><th>-</th><th>CON</th><th>TROL</th><th></th><th></th><th>BORRO</th><th>WARE</th><th>A</th><th></th><th>TOT</th><th>ALS</th><th>-</th></th1<></th1992<>	STATION	-	CON	TROL			BORRO	WARE	A		TOT	ALS	-
Partial apparies         2         1 <th1< th="">         1         <th1< th=""></th1<></th1<>	YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Burkin elegans         2         2         2         2         2         3         2         3	Family THRACIIDAE	-				-							
Family VERTICOPENDIDAE         Image: Constant of the second	Bushia elegans	2								2			
Werkportise anata         1 <th1< th="">         1         <th1< th=""></th1<></th1<>	Family VERTICORDIIDAE									-			
Family VENERIDAE         Image: Control of the constraint of the const	Verticordia ornata	1	1							1	1		
Othere anochitat         Image of the state of the	Family VENERIDAE												
Product instant         0         1         0         1         0         1         0         1         0         1         0         1         0         1         0         1         0         1         0         0         0         0         0         0         0         0         0         0         0         0         0         0         1         1         1         0         1         1         0         0         0         0         0         0         0         0         0         0         1         1         0         1 <th1< th="">         1         <th1< th="">         &lt;</th1<></th1<>	Chione cancellata								1			-	1
Travis foridars         6         1 <th1< th="">         1         1</th1<>	Parastarte triquetra											1	
Transennels sp.         I <thi< th="">         I         <thi< th="">         &lt;</thi<></thi<>	Tivela floridana	6								140	741	66	304
Goudial centra         1	Transennella sp.			1	1				1			1	2
Family MYTLIDAE         Image: Constraint and other models in the second se	Gouldia cerina	1							1	1			1
Brachiodontes modolus         24         24           Straylin trabilis         1         1         21         21           Tellina picatilia         1         4         1         1         26         1           Tellina picatilia         1         7         1         1         2         5         1           Tellina picatilia         1         7         1         1         1         2         5         1           Tellina picatilia         1         7         1         1         1         2         5         1           Tellina picatilia         1         1         1         2         16         3         2           Unidentified build         1         2         1         1         4         7         2           Cobula krabusa         1         2         2         1         1         4         4         7         2           Phytem BRACHOPODA         1         2         1         1         4         4         7         2           Casa SYMANCALEMATA         1         1         1         1         1         1         1         1         1         1	Family MYTILIDAE								1				
Family TELLNIDAE         Image: Stripting metable         Image: Striptin	Brachiodontes modiolus					-	1000			24	1		1.000
Ströjla mirabilis         Image: Strain	Family TELLINIDAE		1000						1000			1211	1.000
Tallina ins?         Image: Constraint of the second s	Strigilla mirabilis				1						276	12	1
Tailina systamica         1         4         1         1         1         2         5         1           Tailina sp.         1         7         1         1         1         1         8         1           Tailina sp.         1         1         1         2         16         3         2           Unidentified tailinid         1         1         2         1         1         4         7           Family CORDULDAE         1         2         2         1         1         4         7         2           Unidentified tailinid         1         2         2         1         1         4         7         2           Phytem BRX0202A         1         1         4         7         2         1         4         7         2           Class GYMNOLACEMATA         1         1         4         0         27         12         18         3         62         29         74         95           Phytem BRACHIOPODA         23         17         41         80         27         12         18         3         62         29         74         95           Unidentified catarine	Tellina iris?					100				7			100
Tailing feature         1         7         1         1         1         8         7           Tailing sp.         1         1         1         2         16         3         2           Unidentified telinid         1         1         2         1         1         2         1         1         2           Corbud krabelana         2         2         1         1         4         4         7         2           Corbud krabelana         2         2         1         1         4         4         7         2           Class GYMNOLAEMATA         1         2         2         1         1         4         7         2           Class GYMNOLAEMATA         1         1         2         1         1         4         7         2           Class GYMNOLAEMATA         1         1         1         2         1 <t< td=""><td>Tellina sybaritica</td><td>1</td><td></td><td>4</td><td>1</td><td>1</td><td></td><td>1</td><td></td><td>2</td><td></td><td>5</td><td>1</td></t<>	Tellina sybaritica	1		4	1	1		1		2		5	1
Tellina sp.         1         1         2         16         3         2           Unidentified tellind         1         2         1         1         2         1         1         2           Corbula krobsina         2         1         4         7         2           Corbula krobsina         2         1         4         7         2           Corbula krobsina         2         1         4         7         2           Cass GYMDALEMATA         2         1         4         7         2           Cass GYMDALEMATA         2         1         4         7         2           Cass GYMDALEMATA         23         17         41         80         27         12         18         3         62         29         74         95           Phylum BRACHIOPODA         1         1         1         1         1         1         1         1         1         2         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         1         1         1         1	Tellina texana	1	7				1			1	8		
Unidentified tellinid         1         1         1           Family CORBULIDAE         1         2         1         1         4         7         3           Unidentified twaive         1         2         2         1         1         4         4         7         2           Unidentified twaive         1         2         2         1         1         4         4         7         2           Order CHELICSTOMATA	Tellina sp.	1		1			2			16	3	2	
Family CORBULIDAE         Image: Construct Arebeana         Image: Construct Arebeana <thimage: arebaana<="" construct="" th="">         Image: Cons</thimage:>	Unidentified tellinid						-			1			
Corbula krebsiana         1         2         1         1         4         4         7         3           Unidentified Evalve         1         2         2         1         1         4         4         7         2           Class GYMNOLAEMATA   <	Family CORBULIDAE												2012
Unidentified bivalve         1         2         2         1         1         4         4         7         2           Phytum BRYOZOA         Image: Stress	Corbula krebsiana				2				1				3
Three Part (2020A)         Three Part (2020A)         Three Part (2020A)         Three Part (2020A)           Class GYMNOLAEMATA         Class GYMNOLAEMATA         Class GYMNOLAEMATA         Class (2020A)         Class (2020A) <td>Unidentified bivalve</td> <td></td> <td>1</td> <td>2</td> <td>-</td> <td>2</td> <td></td> <td>1</td> <td>1</td> <td>4</td> <td>4</td> <td>7</td> <td>2</td>	Unidentified bivalve		1	2	-	2		1	1	4	4	7	2
Instruction         Image of the second	Phylip BRY070A	-		-		-			-		-		-
Utality STRINC-Construction         Construction         Construction <t< td=""><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td></t<>		-								-			
Order CHELCOS FUNATA         23         17         41         80         27         12         18         3         62         29         74         96           Class INARTICULATA         1	Class GTMINOLAEMATA	-											
Copulation ap.         23         17         41         60         27         12         16         10         10           Class INARTICULATA         Image: Copulation of the second se	Order CHEILOSTOMATA	22	17	41	90	27	12	10	3	62	20	74	95
Phytum BRACHIOPODA         Image: Class INATROCULATA         Image: Class INATROCULATA <thimage: class="" inatroculata<="" th="">         Image: Cla</thimage:>	Cupuladna sp.	20	17	41	80	61	12	10	3	02	63	14	30
Class INARTICULATA       1       1         Linguis sp.       1       1         Phylum ARTHROPODA       1       1         Subphylum CHELICERATA       1       1         Class PYCNGGONIDA       1       1         Unidentified yenoponid       1       1         Class PYCNGGONIDA       1       1         Unidentified acarine       1       1         Class COPEPODA       1       1         Chass COPEPODA       2       2         Order CALANOIDA       2       2         Order CALANOIDA       2       2         Order CALANOIDA       2       2         Order CALANOIDA       2       2         Class OPEPODA       1       1         Order CALANOIDA       2       2         Order CALANOIDA       2       2         Subclass MYODOCOPIDA       31       9         Subclass MYODOCOPIDA       1       1         Parasterope muellei       1       1         Parasterope muellei       1       1         Parasterope muellei       1       2         Parasterope muellei       1       1         Parasterope muellei       1<	Phylum BRACHIOPODA									-			
Lingula sp.         1 <th1< th="">         1         1         <th1< td=""><td>Class INARTICULATA</td><td>-</td><td></td><td></td><td></td><td>_</td><td></td><td>-</td><td></td><td>-</td><td></td><td></td><td></td></th1<></th1<>	Class INARTICULATA	-				_		-		-			
Phytum ARTHROPODA	Lingula sp.	1								1		_	-
Subphytum CHELICERATA         Image: Construct of the second	Phylum ARTHROPODA			_									
Class PYCNOGONIDA         Image: Constraint of the system of the sys	Subphylum CHELICERATA												
Unidentified pycnogonid         1 <th1< th="">         1         1         1</th1<>	Class PYCNOGONIDA						100		1				
Class ARACHNIDA         Image: Class COPERDA         Image: Class Cla	Unidentified pycnogonid			1	1	1		1		1		2	1
Order ACARI         Imidentified acrine	Class ARACHNIDA												
Unidentified acarine         1         3           Subphylum CRUSTACEA         1	Order ACARI		1										
Subplytum CRUSTACEA         Image: Construction of the second	Unidentified acarine				1			. Com					3
Class COPEPODA       2       2       2       3         Order CYCLOPOIDA       2       2       1       14       2       1         Order CALANOIDA       2       2       1       14       2       1         Order CALANOIDA       31       9       11       3       15       26       1       48       190       43       69         Class OSTRACODA       1       1       2       1       14       2       1         Subclass MYODOCOPIDA       1       1       1       1       1       1       1         Parasterope muelleri       1       1       1       1       1       1       1         Asteropella punctata       1       1       1       1       1       1       1         Harbansus paucichelatus       1       20       1       1       1       1       1         Harbansus paucichelatus       1       20       20       1	Subphylum CRUSTACEA												
Order CYCLOPOIDA         2         2         1         2         3           Order CALANOIDA         2         2         1         14         2         1           Order CALANOIDA         31         9         11         3         15         26         1         48         190         43         69           Class OSTRACODA         1         1         3         15         26         1         48         190         43         69           Class OSTRACODA         1         <	Class COPEPODA												
Order CALANOIDA         2         2         1         14         2         1           Order HARRACTICOIDA         31         9         11         3         15         26         1         48         190         43         69           Class OSTRACODA                   69           Subclass MYODOCOPIDA	Order CYCLOPOIDA	2	2							2	3		
Order HARPACTICOIDA         31         9         11         3         15         26         1         48         190         43         69           Class OSTRACODA         1	Order CALANOIDA	2	2		1					14	2		1
Class OSTRACODA         Image: Class OSTRACODA	Order HARPACTICOIDA	31	9	11	3	15		26	1	48	190	43	69
Subclass MYODOCOPIDA         Image: Constraint of the subscript of the subsc	Class OSTRACODA					100							1000
Family CYLINDROLEBERIDIDAE       1       1       1       1         Parasterope muelleri       1       1       2       1         Asteropella punctata       1       1       1       1       1         Family PHILOMEDIDAE       1       1       1       1       1       1         Harbansus paucichelatus       20       20       1       1       1       1       1         Harbansus paucichelatus       4       4       4       4       6       1	Subclass MYODOCOPIDA												10.50
Parasterope muelleri       1       1       1       1         Prionotoleberis salomani       1       1       2       1         Asteropella punctata       1       1       1       1       1         Family PHILOMEDIDAE       1       1       1       1       1       1         Family PHILOMEDIDAE       20       20       1 <td>Family CYLINDROLEBERIDIDAE</td> <td></td>	Family CYLINDROLEBERIDIDAE												
Prionotoleberis salomani         1         2           Asteropella punctata         1         1         1         1           Family PHILOMEDIDAE         1         1         1         1         1           Harbansus paucichelatus         20         20         1	Parasterope muelleri					100				1			1
Asteropella punctata       1       1       1       1         Family PHILOMEDIDAE       20       20         Harbansus paucichelatus       4       20         Family RUTIDERMATIDAE       4       4         Rutiderma darbyi       4       4       1         Unidentified ostracodes       4       1       6         Class MALACOSTRACA       4       1       6         Order AMPHIPODA       2       3       2         Family CAPRELLIDAE       2       3       2         Caprella pentantis       1       2       4         Gaprella pentantis       1       2       4         Ampelisca abdita       2       2       4         Ampelisca abdita       1       1       9         Anmpelisca sp.       2       2       1       7         Ampelisca sp.       2       1       7       1       9         Family AORIDAE       1       1       1       1       1         Ampelisca sp.       2       2       1       7       1       9         Family AORIDAE       1       1       1       1       1       1         Am	Prionotoleberis salomani				100	1		1000	1000	2			
Family PHILOMEDIDAE       20         Harbansus paucichelatus       20         Family RUTIDERMATIDAE       4         Rutiderma darbyi       4         Unidentified ostracodes       4         Class MALACOSTRACA       1         Order AMPHIPODA       6         Caprella pentantis       1         1       2         Caprella pentantis       1         1       2         Ampelisca abcita       1         Ampelisca bicarinata       2         2       5         Ampelisca sp.       2         1       1         Ampelisca sp.       1         1       6         Ampelisca sp.       1         1       1         Ampelisca sp.       1         1       1         Ampelisca sp.       1         1       6         1       1         Ampelisca sp.       1         1       1         Ampelisca sp.       1         1       6         1       1         4       1         4       1         6       1	Asteropella punctata					1			1.1.1.	1			
Harbansus paucichelatus       20         Family RUTIDERMATIDAE       4       4         Rutiderma darbyi       4       4         Unidentified ostracodes       4       1         Class MALACOSTRACA       6         Order AMPHIPODA       6         Family CAPRELLIDAE       7         Caprella pentantis       1         1       2         Ampelisca abcita       1         Ampelisca bicarinata       2         2       1         Ampelisca sp.       2         Family AORIDAE       1         1       1         Ampelisca bicarinata       2         2       1         7       1         9       9         Ampelisca sp.       1         1       1         Ampelisca bicarinata       2         2       1         1       1         Ampelisca sp.       1         4       1         4       1         4       1         4       1         4       1         4       1         4       1         6<	Family PHILOMEDIDAE												
Family RUTIDERMATIDAE       4       4       4         Rutiderma darbyi       4       4       4       4         Unidentified ostracodes       4       1       6         Class MALACOSTRACA       4       1       6         Order AMPHIPODA       6       6         Family CAPRELLIDAE       6       6         Caprella pentantis       1       2       3         Caprella sp.       2       2       4         Family AMPELISCIDAE       1       1       1         Ampelisca abdita       1       1       1         Ampelisca bicarinata       2       2       1       7         Ampelisca sp.       2       1       7       1       9         Family AORIDAE       1       1       1       1       1         Ampelisca bicarinata       2       2       1       7       1       9         Family AORIDAE       1       1       1       1       1       1         Acuminodeutopus sp.       1       6       1       6       4         Bernios unifasciatus reductus       2       10       6       10       8         Bernios	Harbansus paucichelatus									1.000	20		
Rutiderma darbyi       4       4       4       4         Unidentified ostracodes       4       1       6         Class MALACOSTRACA       1       6         Order AMPHIPODA       1       6         Family CAPRELLIDAE       1       6         Caprella pentantis       1       2       3         Caprella pentantis       1       2       4         Ampelisca abdita       1       1       1         Ampelisca bicarinata       2       5       6       7       8         Ampelisca sp.       2       1       7       1       9         Family AORIDAE       1       1       1       1       4         Ampelisca sp.       2       1       7       1       9         Family AORIDAE       1       1       1       1       1         Ampelisca sp.       1       6       1       6       1         Ampelisca sp.       2       1       7       1       9         Family AORIDAE       1       1       6       1       6         Ampelisca sp.       1       6       1       6       4         Bemios unifa	Family BUTIDEBMATIDAE												
Unidentified ostracodes       4       1       6         Class MALACOSTRACA       1       6         Order AMPHIPODA       1       1       6         Family CAPRELLIDAE       1       2       3       1         Caprella pentantis       1       2       3       1       1         Caprella pentantis       1       2       3       1       1         Caprella sp.       2       2       4       1       1       1         Ampelisca abdita       1       1       1       1       1       1       1         Ampelisca bicarinata       2       2       5       6       7       8       1       9         Family AORIDAE       1       1       1       9       1       1       1       1         Ampelisca sp.       2       1       7       1       9       9       1<	Rutiderma darbvi					4				4			
Class MALACOSTRACA	Unidentified ostracodes			4				1				6	
Order AMPHIPODA       Image: Caprella pentantis       Image: Caprela pentantis       Image: Caprella p	Class MALACOSTRACA												
Family CAPRELLIDAE         I	Order AMPHIPODA					12							
Caprella pentantis     1     2     3     4       Caprella sp.     2     2     4       Family AMPELISCIDAE     1     1     1       Ampelisca abolita     1     1     1       Ampelisca bicarinata     2     2     5       Ampelisca sp.     2     1     7     1       Accuminodeutopus sp.     1     1     1       Amphideutopus dolichocephalus     1     6     1       Amphideutopus sp.     4     4     4       Bemios unifasciatus reductus     2     10     6     10       Bemios sp.     6     6     6	Family CAPRELLIDAE												
Caprella sp.         2         2         4           Family AMPELISCIDAE         1         1         1           Ampelisca abdita         1         1         1           Ampelisca bicarinata         2         2         5         6         7         8           Ampelisca sp.         2         1         7         1         9           Family AORIDAE         2         1         7         1         9           Family AORIDAE         1         1         1         1         1           Acuminodeutopus sp.         1         1         6         1         6         4           Amphideutopus sp.         4         4         4         4         4         4           Bemios unifasciatus reductus         2         10         6         10         8         6           Bemios sp.         6         6         6         6         6         6         6	Caprella pentantis	1				2				3			
Family AMPELISCIDAE         1         1           Ampelisca abcita         1         1         1           Ampelisca bicarinata         2         2         5         6         7         8           Ampelisca bicarinata         2         2         5         6         7         8           Ampelisca bicarinata         2         2         1         7         1         9           Family AORIDAE         1         7         1         9         1         1         1         1           Acuminodeutopus sp.         1         1         6         1         6         4           Amphideutopus sp.         4         4         4         4         4           Bemios unifasciatus reductus         2         10         6         10         8           Bemios sp.         6         6         6         6         6         6	Caprella sp				2	-			2				4
Ampelisca abdita         1         1           Ampelisca abdita         2         2         5         6         7         8           Ampelisca bicarinata         2         2         5         6         7         8           Ampelisca bicarinata         2         2         1         7         1         9           Family AORIDAE         1         7         1         9         1         1         1         9           Acuminodeutopus sp.         1         1         6         1         6         1 <td>Family AMPELISCIDAE</td> <td>1</td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td>-</td>	Family AMPELISCIDAE	1			-				-				-
Ampelisca bicarinata         2         2         5         6         7         8           Ampelisca sp.         2         1         7         1         9           Ampelisca sp.         2         1         7         1         9           Family AORIDAE         1         1         1         9           Acuminodeutopus sp.         1         1         6         1         6           Amphideutopus dolichocephalus         1         6         1         6         4           Bemios unifasciatus reductus         2         10         6         10         8           Bemios sp.         6         6         6         6         6	Ampelisca abdita	1						1				1	
Ampelisca sp.     2     1     7     1     9       Aampelisca sp.     2     1     7     1     9       Family AORIDAE     1     1     1     1       Acuminodeutopus sp.     1     1     6     1       Amphideutopus dolichocephalus     1     6     1     6       Amphideutopus sp.     4     1     6     4       Bemios unifasciatus reductus     2     10     6     10     8       Bemios sp.     6     6     6     6	Ampelisca hicarinata	2	2			5	6			7	8		
Family AORIDAE         1         0         1         0         1         0         1         0         1         1         0         1 <th1< th="">         1         <th1< th=""> <t< td=""><td>Ampalisca sp</td><td>-</td><td>-</td><td></td><td>2</td><td></td><td>1</td><td></td><td>7</td><td></td><td>1</td><td></td><td>9</td></t<></th1<></th1<>	Ampalisca sp	-	-		2		1		7		1		9
Acuminodeutopus sp.         1         1         1           Amphideutopus dolichocephalus         1         6         1         6           Amphideutopus sp.         4         1         6         4           Bemios unifasciatus reductus         2         10         6         10         8           Bemios sp.         6         6         6         6         6	Family AORIDAE	-				-	-		-		-		-
Amphideutopus dolichocephalus         1         6         1         6           Amphideutopus dolichocephalus         1         6         1         6           Amphideutopus sp.         4         4         4         4           Bemios unifasciatus reductus         2         10         6         10         8           Bemios sp.         6         6         6         6         6	Acuminodeutoous en	-	-		1	-	-			-	-		1
Amphideutopus sp.         4         1         6         4           Bemios unifasciatus reductus         2         10         6         10         8           Bemios sp.         6         6         6         6         6	Amphideutopus dolichoophalus	-				1	6			1	6		-
Bemios unifasciatus reductus     2     10     6     10     8       Bemios sp.     6     6     6     6       Family BATEIDAE     6     6     6	Amphideutopus sp	1			4	-							4
Bemios sp. 6 6 6	Bemlos unifasciatus raductus	-	2			10	6			10	8		
Family BATEIDAE	Bemios sp.		-		6								6
	Family BATEIDAE											1	

	T		0	FFSHO	RE SITE	ES	1000			-		
STATION		CON	TROL			BORRO	WARE	A		TOT	ALS	
YEAR	1990	1991	1992	1994	1990	1991	1992	1994	1990	1991	1992	1994
Carinobatea catharinensis	1											5
Family GAMMARIDAE											0.00	
Elasmopus levis						1			-	1		
Elasmopus sp.						1				1		
Family HAUSTORIIDAE		-										
Acanthohaustorius pansus										1		
Haustorius n. sn.				1	-	1			27	35	43	160
Bathvporeia parkeri									4			1
Family ISAEIDAE												
Chevalia aviculae								1				1
Family MEGALLIBOPIDAE					-							
Gibberoeue muerei						1				3	1	2
Eamily OEDICEDOTIDAE					-							-
Faining OEDIGEROTIDAE	-										1	
Monoculodes sp.	-		1	-		0		0	-	4	2	-
Synchelidium americanum	-	1	1	2	-	3	1	2		4	2	4
Family PHOXOCEPHALIDAE	-		-	-			-	-		010	101	
Metharpinia floridana	1	1	6	8	11		2	1	47	219	104	69
Family PLATYISCHNOPIDAE								1		-		
Eudevanopus honduranus									16	26	17	1
Family SYNOPIIDAE												
Synopia caraibica					1					1		
Family COROPHIIDAE												
Cerapus sp.											1	
Grandidierella bonnieroides				1				1	-			2
Unidentified corophiid n. sp.		1000		3								3
Unidentified corophild	1			6	2	1		4	3	1	2	10
Family NEOMEGAMPHOPIDAE					-			1000				
Linidentified neomenamphonid			4				4				8	
Order ISOPODA									-			
Eamily ANTHURIDAE					-							
Ameliusenthum megnifice			2		2	1	-		2	1	2	
Amakusantnura magninca			6		6	-			6			
Family GNATHIDAE					-					-	-	
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					100		-				3	
Ancinus depressus												2
Ancinus sp.									8			2
Exosphaeroma diminutum					100							4
Exosphaeroma productatelson												22
Order CUMACEA												
Family BODOTBIIDAE												
Cyclaspis cf. Iongines		1				5				13	25	
Cyclaspis cf. pustulata				1		-				10		21
Cuclaenie unicomie				1			-	-				1
Cyclaspis di variano		1				2	1	-	-	40	2	
Cyclaspis of ctriate/haceser		1				2	1			43	- 11	
Cyclaspis cr. sthata/bacescul											11	-
Cyclaspis sp. B(7)								2		50		2
Cyclaspis n. sp. D			_						44	28		
Cyclaspis n. sp. E				-					1			
Bodotnidae n. gen. A							1	1	4		1	
Family NANASTACIDAE							-					
Cumella sp.				-				1				1
Unidentified cumacean fragment	1								1			
Order TANAIDACEA												
Family PARATANAIDAE				3								
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
											-	

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STATION	-	CON	TROL		1000	BORRO	W AHE	A		101	ALS	1001
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.			1.5.5				1				1	
Infraorder CARIDEA											C	
Family ALPHEIDAE		1.1.1.1.1										
Automate sp.		1				1				2		
Unidentified alpheid							1		1		1	
Family OGYBIDIDAE				0.0								
Oovrides alphaerostris										2	2	
Family PROCESSIDAE	-											
Propess en	-									1.		
Loidentified processid	1								1			
Unidentified and doop postion in							-			1		
Unidentified Candean postarva	-								2			-
Unidentified Alpheold	2						-		6			-
INITAOIDET THALASSINIDEA	-											
Family CALLIANASSIDAE	-											
Callianassid new genus	-	2				2				5		
Unidentified callianassid larva		1			-		-			1		
Infraorder ASTACIDEA							-					
Family NEPHROPIDAE												
Unidentified nephropid	1								1		-	
Infraorder ANOMURA					1468		1200					
Family ALBUNEIDAE										-		
Albunea gibbesii						1				1		
Zygopa michaelis				1								1
Family PAGURIDAE				128203	1000							
Unidentified pagurid				100 M			1	2.0.03			1	
Infraorder BRACHYURA						1000		-				
Family LEUCOSIIDAE												
Ebalia stimosonii							1			1999	1	
Family MA IIDAE	-											
Patrachonatus en	-		1								1	
Family DININOTHEDIDAE	-						-					
Planky Plinkornehibae	-								5			
Pilinika cristata	-								-		3	
Pinnixa gorei	-									1	1	
Pinnixa sp.	-				1				3			-
Unidentified pinnotherio	-											
Family CALAPPIDAE	-				-	-	-			2		-
Cycloes bairdii					1	6				6		-
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		1.1.1		1	1.00	4		2	
Photom CHAETOGNATHA									3			
Phylan Chae Iodianna		-			_				-			
Phylum HEMICHORDATA	-				-	1	1			1	1	-
Unidentified enteropheust	-				_			-			-	
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	0000	6	
Total Number of Organisme	624	247	432	373	443	260	511	136	3196	4127	3383	2859
Number of Organisms for Life I	440	215	202	327	354	216	413	127	1712	2652	3018	1820
Number of Organisms for H' & J	440	215	022	027	004	60	97	40		LUCE	0010	- CEC
Number of species for H' & J'	90	54	90	32	00	2 000	2 700	3 400				-
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).

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			-	1.1.1	2.00	IN	ISHOF	RECO	NTRO	L SITE	S		-			
STATION		T	38			R	90			R	92			R	94	
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	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

A CONTRACTOR OF		-	-			INSHC	DRE T	REAT	MENT	(FILL)	SITES					
STATION		R1	06			T1	11			R1	16			R1	20	
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		26.4	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	1		
GASTROPODA			1213	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														12.13		
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

			OF	FSHO	RE SIT	TES		
STATION		CON	TROL		B	ORRO	WAR	EA
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

	TOT	ALS	
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).

re su consta				-		IN	SHOP	RE CO	NTRO	LSITE	S		1		-	
STATION		T	88			R	90			R	92			B	94	
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	33	36		03	10
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	55	5.6	35
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						-	12.0		20.1	00.0	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	00.0	0.6	00.0
HARPACTICOIDA		1.4				1.9	0.6			2.0	1.3		0.0	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			1 110
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

ALCONTRACTOR AND						INSHO	DRE TI	REAT	MENT	(FILL)	SITES	5	1			
STATION		R	106			T1	11			R1	16			R1	20	
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					1		3.7	4.0	0.6	1000	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			13/5-23
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	14 1			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													- and			
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

Contract of The Annual A			OF	FSHO	RE SIT	TES		3
STATION		CON	TROL		B	ORRO	W ARE	EA
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	12.67.5.	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

	TOT	ALS	
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).

					1.10	IN	SHOP	RE CO	NTRO	L SITE	S	2.88	1987	2.4.2		
STATION	1.000	T	88			R	90			R	92		1	R	94	
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	1000	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

		2015	1000	199	1000	INSHC	RE TR	REAT	MENT	(FILL)	SITES	;				
STATION		R1	06			T1	11			R1	16			R1	20	
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	1.1.1.1	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		100		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	1
TANAIDACEA																1
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

			OF	FSHO	RE SIT	ES		
STATION		CON	TROL		BC	DRRO	WARE	EA
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	1		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
	The second		1					
TOTALS	100	100	100	100	100	100	100	100

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	TOT	ALS	
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

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ON         EE.WINTHES         ON           64         EE.WINTHES         EE.WINTHES           FE.WINTHES         EE.WINTHES         EE.WINTHES           FE.WINTHES         EE.WINTHES         EE.WINTHES           CORREL         EE.WINTHES         EE.WINTHES           Millelin         EE.WINTHES	ON     N       NA     N       NA     N       S sp.     S       FELMINTHES     N       FELMINTHES     N       FELMINTHES     N       FELMINTHES     N       FARA     N       Colar     N       Oplanid     N       Synophorid     N       Oplanid     N       Oplanid     N       Itoplanid     N       Indid     N       Indid     N       Syntid     N       Indid     N       Indicid     N       Indicid     N       Indicid     N       Indicid     N       Indicid     N						N											
Image: Second	IIA IIA IIA S sp. AFIA Cell S sp. AFIA Cell gyrophorid gyrophorid gyrophorid gyrophorid gyrophorid gyrophorid gyrophorid gyrophorid gyrophorid gyrophorid forhynchid celld forhynchid forhy						N											
district     E.MiNIHES     I	id s sp. HELMINTHES HELMINTHES HELMINTHES LARIA coel gynophorid gynophorid gynophorid cola gynophorid forhynchid toplanid nid syrtid anid syrtid anid syrtid anid syrtid anid syrtid anid syrtid anid syrtid anid syrtid anid syrtid anid anid syrtid anid syrtid anid syrtid anid anid syrtid anid anid anid anid anid anid anid an						5										+	
Sec         Image: Sector	s sp. HELMINTHES						N				-							
LARIA     Image: Construction of the second of	HELMINTHES     HELMINTHES       LARIA     Coll       Lonynchid     Coll       gynophorid     Coll       anid     Coll       syrtid     Coll       anid     Coll       syrtid     Coll       anid     Coll       sp. 114     Coll       alothricid     1       Illucidus     1       Conemertine     1       Illucidus     1       Inucidus     1       Stragilis     Sp.       stragilis     Sp.       stragilis     Sp.       inae     Inae						N					-						
MARA         I	LARIA LARIA Collarity of the collarity o						5						-					
000       9	coel     coel       gynophorid     col       gynophorid     col       gynophorid     col       forhynchid     col       celid     col       toplanid     col       toplanid     col       toplanid     col       anid     col       syrtid     col       syrtid     col       anid     col       syrtid     col       anid     col       syrtid     col       anid     col       syrtid     col       syrtid     col       aniation     col       anaphoros     col       sp. 144     col       alothricid     1       fubia     1       nemertine     1       nemertine     1       onemertine     1       fubia     col       fubia     stragilis    s fragilis       s fragilis     s fragilis       s fragilis     col       s fragilis     col						N						-					
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	gynophorid orhynchid celid collynchid celid collynchid celid ind anid anid syrtid ind anid syrtid ind anid syrtid ind anid syrtid ind anid						~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~										-	
Offwindid         Image: Selection of the	orhynchid orhynchid celid celid celid celid celid nid syrtid riate hiate hiate helanid hiate helanid blanid blanid blanid blanid blanid blanid blanid blanic b A b A b b 114 helanic b 1				1		~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~					-					-	
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Syrtid         I <td>ssyrtid riate                                      </td> <td></td> <td></td> <td>-</td> <td>-</td> <td></td> <td>2</td> <td></td> <td></td> <td></td> <td></td> <td>-</td> <td>-</td> <td></td> <td></td> <td></td> <td>-</td> <td></td>	ssyrtid riate			-	-		2					-	-				-	
Midla         Midla <th< td=""><td>rifate polanid polanid polanid polanid polanid larian 711NA maphoros se. A second seco</td><td></td><td></td><td>-</td><td>-</td><td></td><td>2</td><td>-</td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td>-</td><td></td></th<>	rifate polanid polanid polanid polanid polanid larian 711NA maphoros se. A second seco			-	-		2	-				-					-	
oplanid         I </td <td>oplanid oplanid oplanid oplanid Ilarian ATINA ATINA naphoros sp. A sp. 114 b 1</td> <td></td> <td></td> <td>-</td> <td>-</td> <td></td> <td>5</td> <td>-</td> <td></td> <td></td> <td></td> <td>-</td> <td>-</td> <td></td> <td></td> <td></td> <td>-</td> <td>-</td>	oplanid oplanid oplanid oplanid Ilarian ATINA ATINA naphoros sp. A sp. 114 b 1			-	-		5	-				-	-				-	-
Indian         Indin         Indin         Indin <td>ATINA ATINA ATINA naphoros sp. A sp. A sp. 114 alothricid dubia onemertine illucidus mertine tonemerti</td> <td></td> <td></td> <td>-</td> <td>1</td> <td></td> <td>N</td> <td>-</td> <td></td> <td></td> <td></td> <td>-</td> <td>-</td> <td></td> <td></td> <td></td> <td>+</td> <td></td>	ATINA ATINA ATINA naphoros sp. A sp. A sp. 114 alothricid dubia onemertine illucidus mertine tonemerti			-	1		N	-				-	-				+	
TTNA         Interfere         In	RTINA     Raphoros     Rephoros       naphoros     Naphoros     Naphoros       sp. A     sp. A     Naphoros       sp. 114     Naphoros     Naphoros       sp. 114     Naphoros     Naphoros       alothricid     Naphoros     Naphoros       onemertine     1     1       nilucidus     1     1       simertine     1     1       nonemertine     1     1       conemertine     1     1       tODA     1     1       LIDA     Inde     1       stragilis     s.p.     1       stragilis     s.p.     1       intae     intae     1			-	-		5	-				-	-				$\vdash$	-
maphonos         i<	maphoros         maphoros         maphoros           sp. 114			-	-		2	-				-	-				-	
sp. A       sp. 1       1       1       1       1       2       1       1       2       5         sp. 114       1       1       1       1       1       1       1       2       5       5         sp. 114       1       1       1       1       1       1       1       2       5       5         sp. 114       1       1       1       1       1       1       1       1       2       5       5         sp. 114       1 </td <td>sp. A         sp. 114         sp. 114           alothricid         1         1           alothricid         1         1           onemertine         1         1           mertine         1         1           onemertine         1         1           IDA         1         1           AETA         5         5           s fragilis         5         5           s fragilis         5         5</td> <td></td> <td></td> <td>-</td> <td>-</td> <td></td> <td>2</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td>	sp. A         sp. 114         sp. 114           alothricid         1         1           alothricid         1         1           onemertine         1         1           mertine         1         1           onemertine         1         1           IDA         1         1           AETA         5         5           s fragilis         5         5           s fragilis         5         5			-	-		2						-					
sp. 114         l </td <td>sp. 114         sp. 114           alothricid         1           alothricid         1           nemertine         1           nemertine         1           nemertine         1           nonemertine         1           stragilis         1           sp.         1           nis         1</td> <td></td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td> <td>-</td> <td>-</td> <td></td> <td>2</td> <td></td> <td></td>	sp. 114         sp. 114           alothricid         1           alothricid         1           nemertine         1           nemertine         1           nemertine         1           nonemertine         1           stragilis         1           sp.         1           nis         1					-						-	-	-		2		
alothricid         al          a          a          al          a	alothricid         alothricid           dubia         1           nementine         1           nemertine         1           onemertine         1           onemertine         1           nonemertine         1           IDA         1           AETA         1           stragilis         1           sp.         1           mis         1											-						
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			Cyclasp	Cyclasp	Cyclasp	Cyclasp	Order Al	Acumin	Ampelis	Amphia	Bathypo	Bemlos	Unident	Carinot	Cheval	Eudeva	Grandic	Gibberd	Hausto	Methary	Synche	Unident	Uniden	Order T	Apseud	Leptoci	Cirrato	Kalliap	Order N	Uniden	Order D	Zygops	Uniden	Phylum	Uniden	Phylum	Branch	Unknow

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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).

			INS	HORE	CONTROL			
Deal	1000	0/	1001	0/	1992	%	1994	%
Hank 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) Haustorius sp.	18.3 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
5	Tivela fiondaria (B)	4.2	Cyclaspis Ci. valians (C)		Armandia agilis (P)	4.2	Prionospio multibranchiata (P)	4.3
				B	90			
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) Cephalothrix sp. 114 (N)	5.3 5.3	Paraonis fulgens (P)	7.0	Tivela floridana (B)	8.9
5	Glycera abranchiata (P)	3.6			Metharpinia floridana (A)	6.2	Prionospio multibranchiata (P)	5.2
		_		R	92			
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) Scolelepis texana (P)	5.4 5.4	Cephalothrix sp. 114 (N)	11.7	Armandia agilis (P)	8.4	Prionospio multibranchiata (P)	6.1
				R	94			
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) Paraonis fulgens (P)	12.2 12.2	Tivela floridana (B)	25.7	Scolelepis texana (P)	14.5	Prionospio multibranchiata (P)	20.1
			Spio pettiboneae (P)	8.3	Spio pettiboneae (P)	13.4	Scolelepis texana (P)	12.3
3			-		And a second second second second second second second second second second second second second second second		and the second second second second second second second second second second second second second second second	A CONTRACTOR
3	Ancinus sp. (I) Cyclaspis sp. D (C)	8.2 8.2	Scolelepis texana (P)	7.3	Metharpinia floridana (A)	9.7	Dispio uncinata (P)	10.2

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).

1		1.1.1	INSHOR	E TRE	ATMENT (FILL)			-
	A Company of the State		and a second second	R1	06	~	1004	0/
Rank	1990	.%	1991	%	1992	%	1994	10 5
1	Dispio uncinata (P)	18.6	Tivela floridana (B)	70.0	Dispio uncinata (P)	49.3	Tivela floridana (B)	49.0
2	Armandia agilis (P)	17.5	Metharpinia floridana (A)	6.7	Paraonis fulgens (P)	27.5	Exosphaeroma productatelson (I)	10.8
3	Haustorius sp. (A)	9.3	Scolelepis texana (P)	4.4	Scolelepis texana (P)	4.5	Hesionura elongata (P) Bathydrilus adriaticus (O)	4.1
4	Metharpinia floridana (A) Cyclaspis sp. D (C)	8.2 8.2	Spio pettiboneae (P)	3.4	Spio pettiboneae (P)	3.2		
5			Paraonis fulgens (P)	3.0	Tivela floridana (B)	2.4	Unident. hoplonemertine (N)	3.1
				TI	11			
Bank	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)	1,4.1	Spio pettiboneae (P)	13.3	Scolelepis texana (P) Cyclaspis pustulata (C)	10.1 10.1
4			Cyclaspis cf. varians (C)	9.6	Paraonis fulgens (P)	8.9	S. States	
5	Armandia agilis (P)	3.6	Armandia agilis (P)	8.1	Metharpinia floridana (A)	6.1	Dispio uncinata (P)	8.9
				R	116			
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) Bathyporeia parkeri (A)	4.5	Cyclaspis sp. D (C)	8.7	Tivela floridana (B)	3.1	Unident. typhloplanid (T)	8.1
5			Armandia agilis (P)	7.4	Eudevanopus honduranus (A)	2.7	Unident. kalyptorhych (T)	6.5
				R	120			
Rank	1990	%	1991	%	1992	%	1994	%
1	Paraonis fulgens (P)	69.6	Tivela floridana (B)	77.4	Dispio uncinata (P)	14-51	Dispio uncinata (P)	32.1

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Rank	1990	%	1991	%	1992	%	1994	%
1	Paraonis fulgens (P)	69.6	Tivela floridana (B)	77.4	Dispio uncinata (P)	14.5	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) Prostomatella enteroplecta (N	4.3	Metharpinia floridana (A)	11.9	Tivela floridana (B)		Tivela floridana (B)	8.9
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).

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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 (1)	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) Cupuladria sp.	7.9 7.9	Cirratodactylus floridensis (Ta)	6.8	Xenanthura brevitelson (I)	4.3
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

	Construction of the second	1.1.1. See	BO	RROW	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) Cupuladria sp. (By)	4.4 4.4		
5	Unident. tubificid (O)	5.6						