EPA Water Quality Protection Program
CORAL REEF / HARDBOTTOM MONITORING PROJECT
1997 Annual Report

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FLORIDA KEYS NATIONAL MARINE SANCTUARY
WATER QUALITY PROTECTION PLAN

CORAL REEF AND HARDBOTTOM MONITORING PROJECT

ANNUAL (10/1/96-9/30/97)
AND FOURTH QUARTERLY (7/1/97-9/30/97) REPORT

submitted by

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INTRODUCTION

A comprehensive introductory rationale for the Coral Reef/Hardbottom Monitoring Project (CRMP) was presented in the First Annual Report (November 1995). The Florida Keys National Marine Sanctuary and Protection Act (HR5909) designated over 2,800 square nautical miles of coastal waters as the Florida Keys National Marine Sanctuary (FKNMS). The Act required the US Environmental Protection Agency and the State of Florida to implement a Water Quality Protection Program in cooperation with NOAA. Programs in monitoring seagrass habitats, coral reefs and hardbottom communities, and water quality were instituted with the intent of integrating information with water quality as the central focus.

The primary goal of the monitoring project is to measure the status and trends of these communities to assist managers in understanding, protecting, and restoring the living marine resources of the Florida Keys National Marine Sanctuary. Data from the project will be used to determine (1) overall net increase or decrease in stony coral percent cover and stony coral species richness, (2) overall net change in measurable reef community parameters, (3) changes observed in individual reef communities with no overall change on a landscape scale (decreases in one location balanced by increases elsewhere) or changes that are linked to specific regions of the landscape. Each of these potential mechanisms of change will result in different spatial patterns of change. A Sanctuary-wide, rather than a single-location survey, is necessary to detect ecosystem change.

This Sanctuary-wide project is documenting the status of reef habitats at 40 reef sites located within 5 of the 9 EPA Water Quality Segments in the Florida Keys National Marine Sanctuary (Figure 1). Over the five-year duration of the project, the randomly located reefs in this project may show no net decline. Alternatively, some or all the reefs may show a net decline. Data for each successive sampling year will be compared with prior years data to obtain a broader understanding of the dynamics of the FKNMS coral reef system. As the coral reef monitoring is integrated with the seagrass and water quality programs, the results can be used to focus research on determining causality and can be used to inform and evaluate management decisions. The Coral Reef/ Hardbottom Monitoring Project provides the first real opportunity in the Florida Keys to address these questions at the spatial scales required to detect large-scale patterns and discriminate between hypotheses.

Studies and anecdotal evidence suggest that coral diseases are increasing in some areas of FKNMS (Dustan, 1977; Dustan and Halas, 1987; Porter and Meier, 1992; Holden, 1996; Kuta and Richardson, 1996; Santavy and Peters, 1997). Most diseases are not caused by a single factor. Santavy and Peters (1997) report no coral diseases are known to be caused by viruses at present and they describe several bacterial diseases of Western Atlantic corals.

According to Richardson (in press) disease pathogens have only been identified for 3 coral diseases and the pathogen for only two of these has been shown to be the actual disease agent.
In some reports multiple disease names have been applied to symptoms that maybe caused by a single disease.

Because of limited baseline data, it is not clear whether the incidence of coral diseases is actually increasing, or, if there is an apparent increase due to increasing observational frequency and awareness. With randomly located and annually surveyed monitoring stations located throughout the Florida Keys, the EPA Coral Reef/Hardbottom Monitoring Project is in a unique position to document the incidence and distribution of certain disease categories. However, since different pathologies are associated with the same gross signs and many of the abnormalities are not adequately characterized (Santavy and Peters, 1997) studies devoted to research as well as monitoring are critical to evaluate loss of coral tissue.

The elkhorn coral (Acropora palmata) is of special concern. This species is a major framework builder of shallow Caribbean and South Florida reefs, capable of dispersing waves and protecting the backreef lagoon and coastal margin areas from wave damage, as well as providing shelter and food for other reef animals. Because of their structural and functional importance on reefs, the acroporids are useful in assessments to evaluate risks to coral reefs from physical, chemical and biological stressors (Peters et al., 1997). In October 1996, coral tissue mortality termed Awhite pox@ (Holden, 1996) was documented on A. palmata in a circumscribed area near Key West. White pox is not limited to the Key West area as similar phenomena have been observed in other locations.

It is critical to know if there is an actual increase in coral disease incidence and prevalence. If occurrence of coral disease is not due to changes in observational frequency, are the causative agents natural phenomenon or are anthropogenic activities contributing to coral demise in the Sanctuary?

PROGRESS TOWARD WORK OBJECTIVES

During the first year (94/95), sampling sites were selected according to EPA's EMAP protocol throughout the research area, including the upper, middle and lower Florida Keys. All video stations were selected and installed. Underwater video transect and species identification and enumeration methodologies were developed and tested.

During the second year (95/96), the videographic survey technique was instituted. A supplemental method to verify the video technique and provide additional data on species identification and species richness was refined. All 40 sites were sampled during 1996. Techniques for converting the video to CD-ROM were refined and a software program was customized for image analysis of the underwater video data.

During the third year (96/97), all 40 sites were sampled during the summer 1997 field season. All station species inventory data for 1997 was compiled, analyzed, and compared with 1996 data.

Video data for the 1996 field season (which extended into October 1996) was converted to digital format; however, because of extended sampling and development of framegrabbing techniques, the 6 volumes of CD-ROMs for 1996 pressed for image analysis were not received until September 1997. Only 1% of 1996 video image analysis was able to be completed by end of fiscal year 96/97.

For this Annual Report (96/97), 1997 video from sites *with highest probability for showing change* were selected from northern (Carysfort deep offshore), and southern Sanctuary (Atlantic and Florida Bay) sites (Rock Key shallow offshore and Content Keys, respectively). These analyses provide preliminary data for inter-annual comparisons of stony coral cover and will serve as a template for future comparisons of video data.

FIELD WORK

SITE DISTRIBUTION

The Implementation Plan for Coral Reef and Hardbottom Monitoring specifically documents site selection. The geographic layout of the Sanctuary survey sites constitutes the minimum coverage necessary to detect ecosystem change. Of the original 42 sites delimited, (23 among offshore reefs, 10 at patch reefs and 9 at hardbottom habitats) 41 were installed during 1995. However, one site was earmarked as a control for a Park Service study (John Pennekamp Coral Reef State Park) and was deleted from the monitoring project in 1996. The project=s 40 sites (23 among offshore reefs, 9 at patch reefs and 8 at hardbottom habitats) (Figure 1, Table 1) are located within 5 of the 9 EPA Water Quality Segments in the Florida Keys.

STATION MAP REFINEMENT

A complete description of station installation was provided in the CRMP First Annual Report (November 1995). All stations, permanently installed in 1995, consist of pairs of stainless steel stakes approximately 22 m apart. Each replicate station comprises a "video unit" (Figure 2). The video camera collects video imagery along transects bounding and bisecting the station. A total of 160 individual stations were installed.

Underwater maps were drafted in 1995, data were transcribed into digital format and site maps were constructed with Harvard Graphics software. These maps were transferred to underwater paper for use in station re-location. First drafts of station maps from 1995 were refined in 1996: stations were related to each other and to other structures underwater and compass headings, distances, and depth measurements were repeated. Sites, which were incompletely mapped in 1995, were mapped in detail in 1996.

Accuracy of all maps was further refined in 1997. Maps were corrected for distance and compass heading variability. These data comprise the database for 1997 revisions of maps of all sampling sites/stations presented in Appendix 1.

During the 1995/96 sampling season, Differential Global Positioning System (DGPS) fixes were taken at all forty sampling sites with a Trimble NT200D DGPS chart plotter to ensure accurate geographic coordinates were obtained for each site. The coordinates were compiled into a site/station list. An average of depths measured at the bottom of both stakes for each station (recorded by observers on station species inventory data sheets) was used to obtain exact station depths. Geographic coordinates were further refined in 1997. When depths were sufficient, the vessel was re-positioned adjacent to the sampling sites and DGPS numbers were re-recorded to the 4th decimal place. These data are presented in the revised site/station list (Table 1).

A Geographic Information System database was created in 1996 to assist in spatial analysis of site specific information as the data is collected and processed from the field. An Arc/Info geographic database was created using Arc/Info 7.04 (Environmental Systems Research Institute, ESRI) software and then exporting it for ArcView 3.0 (ESRI) format. Point coverage was generated with 1996 coordinates and depths. This was matched with other databases (FKNMS water quality segments, bathymetry, Aids to Navigation, major roads, **2** degree grid, and the State of Florida coastline). An additional database (connected to the GIS database) was created which integrated the date of site installation, sampling date, number of stony coral species observed in station species inventories in 1996, and water quality segment (as well as coordinates, site name, and depth). All of this information is being used to build a database to answer complex queries regarding different spatial relationships.

In 1997, Station Species Inventory data was reformatted from a multiple page Aworkbook@ format to a Aflat@ format. All data is now contained on a single database sheet, which facilitates multi-platform, multi-software conversion. GIS manipulation is enhanced and allows for comparison of SSI and Video data within a GIS application. Development of a Auniform@ format with the other WQPP components (seagrass and water quality) will allow for complex combinations of data to be analyzed. Data added to the existing database will show if sites and/or areas are changing with time. The data can be examined on the map which facilitates spatial analyses.

METHODS

During 1995, a variety of sampling methods were tested underwater to assess the feasibility of their use in the program. These were presented in the CRMP First Annual Report (November 1995). Approved methods, detailed in the June 1996 Standard Operating Procedures (Appendix 14 of the CRMP Quality Assurance Project Plan) were field tested and refined protocols developed for QA/QC of video analysis. Revision of the CRMP Standard Operating Procedures is in process.

Video Sampling

All sampling for 1997 was conducted with the Sony CCD-VX3 with full automatic settings and artificial lights (two 50 watt) at 40 cm above the benthos (Figure 3). A convergent laser light system indicates distance from the reef surface for filming. To improve the camera orientation and maintain the camera in a vertical position for filming, the buoyancy was slightly re-adjusted. The camera/housing system weights 50 pounds topside and is now about 1/2 pound negative when submerged. Camera batteries (SONY NP-98; 3,000 mah) used in 1996, were replaced with SONY NP-4500; 4,500 mah batteries. This change eliminated the need to return to the vessel for battery change out. In addition, 60-minute video tapes were replaced with HI-8 metal evaporite 120 minute tapes. Now, only the light battery has to be changed during filming of an individual site. This can be accomplished underwater if desired.

The video sampling protocol was presented in detail in the June 1996 Standard Operating Procedures. The videographer focuses on the clapperboard which is videoed on the film leader prior to beginning each transect and contains a complete record of date and location of each film segment. Sampling is conducted in a transect format. Images for all 480 transects (40 sites x 4 stations/site x 3 transects/station) are framegrabbed, processed, and written to CD-ROM.

Station Species Inventory (SSI)

Species Counts

Counts of stony coral species present in 1997 station species inventories (SSI) provide data on stony coral species richness (S). To summarize, two observers conduct simultaneous timed inventories within the roughly 22 x 2 m video stations and enter the data on pre-printed underwater data sheets (Figure 4). Each observer records all stony coral taxa and fire corals (Millepora spp.) and enumerates long-spined urchins (Diadema antillarum) within the station boundaries. After recording the data, observers compare counts underwater and make confirmations of species recorded by only one observer. Taxonomic differences are addressed. Data sheets are verified aboard the vessel and forwarded to FMRI for data entry and processing. This method facilitates data collection with broad spatial coverage at optimal expenditure of time and labor.

Principal investigators, qualified observers (O. Meier, K. Patterson) and those qualified in 1997 (M.Patterson) collected stony coral species presence data at all sites during 1997. J. Dotten and D. Marcinek qualified during 1997 and D. Eaken received species inventory training. In addition to "on site" training by principal investigators, the CRMP stony coral species identification guide (Appendix 2, refined in 1997) and photos from Reef Coral Identification (Humann, 1993) were used for reference. Field training during summer 1997 was mandatory to prepare staff for point counting of digital video images.

Diseases/Conditions Data Collection

If any species within the station exhibits specific signs of either bleaching or disease, the appropriate code letter is entered in the box under the species abbreviation on the data sheet (Figure 4) during the timed species count. Restricted bottom time at many sites precludes cross-checking disease notations between counters therefore cross-checking is not mandatory in the protocol. A proposed protocol for disease/condition data collection was drafted prior to the 1998 field season.

FIELD AND DIVING OPERATIONS

Table 2 summarizes actual field sampling days for FY 96/97 and "man-days" contributed by the three primary project institutions with assistance of EPA Region IV staff. A total of 278 man-days were expended in 1997 field sampling efforts (May through September 1997). Field sampling in October 1996 was summarized as part of the 1996 field season and was not included in 1997 calculations. FMRI contributed the most field time (54%) with assistance from UGA (20%), and UCSC (15%) (Table 3, Figure 5). Weather conditions were favorable during 1997 field season and did not impact scheduled sampling operations. In addition to the total "man days" of actual field sampling, all labs spent additional time for travel in support of field operations.

EPA again supported the project sampling efforts with a cruise aboard the OSV Peter Anderson (Figure 6) from 11-21 June. Thirteen outer reef sites were sampled with 12 CRMP team members assisted by 3 EPA Region IV divers (P. Murphy, G. Collins, M. Parsons) (Figure 7) for 10% of the man-days for the season.

Table 4 provides a summary of diving operations for the 1997 sampling season. Through September, a total of 642 dives were made for a cumulative bottom time of 515 hours. FMRI staff conducted 60% of the dives with assistance from UGA (20%), UCSC (11%), EPA Region IV (8%) and FKNMS (1%)(Table 5, Figure 8). The majority of diving was conducted in less than 30 ft depths (Table 6) and dives greater than 30 ft were reduced by 32% largely due to increased efficiency of multiple teams during the Anderson cruise.

As in 1995 and 1996, FMRI supported the majority of field sampling for 1997 aboard the R/V Tortugas. The expenditure of time and effort for CRMP monitoring personnel was exponential for the 1996 sampling season in comparison to 1995 installation work with FKNMS assistance. However, more accurate station data increased efficiency (battery and tape changes) and experienced personnel significantly reduced field effort during the 1997 field season. Although the total number of dives was only reduced by 17%, total bottom time was reduced by 25% and the total number of field days was reduced by 38% (442 days in 1996; 273 days in 1997).

Diving followed American Academy of Underwater Sciences (AAUS), FMRI scientific diving regulations and regulations of the Environmental Protection Agency. The majority of compressed air diving was conducted following the time at depth protocols of the Defense and Civil Institute of Environmental Medicine Sport (DCIEM) (Canadian Diving Tables). EPA dives were managed with NAVY tables. Staff lacking NITROX certification (M. Patterson, D. Eaken and D. Marcinek) completed training through NURC in May.

Diving reciprocity with FMRI was finalized with UCSC in 1997. UCSC=s diving program at the University of Charleston (UCSC) is under the auspices of the SCDNR whose reciprocity agreement qualifies the UCSC dive team for participation in OSV Anderson cruises. Dr. Dustan is the Diving Board member from UCSC and supervises the diving program at the University. The Diving Safety Officer for the University of Georgia (UGA) is Doug Marcinek. Their reciprocity agreement with FMRI was also finalized in 1997. They applied and were accepted for AAUS membership.

LABORATORY WORK

STATION SPECIES INVENTORY (SSI) DATA

Species Inventory Data Processing

Spreadsheets for raw data include site name and code, date of data collection, name of observers, presence of stony coral taxa recorded by each observer at each of four stations at each site and occurrence of selected diseases and bleaching (condition information). All 1996 SSI data were transferred from Quattro Pro spreadsheets into a concatenated EXCEL spreadsheet and double proofed. SSI and Acondition@ data for 1997 were entered into spreadsheets in EXCEL format and proofed.

Spreadsheets were reformatted for multivariate analyses (Lance and Williams 1967, Clifford and Stephenson 1975, Boesch 1977, Field et al. 1982, Lambshead et al. 1983, Warwick and Clarke 1991, Clarke 1993). This process was executed with the “confmt” and “fileform” program routines in the Primer[tm] multivariate data processing programs (Plymouth Marine Laboratory,

1995). **ALL MULTIVARIATE ANALYSES AND MAJORITY OF INTERPRETATIONS REGARDING SSI DATA WERE DRAFTED BY FMRI AND REVIEWED BY PRINCIPAL INVESTIGATORS. MINIMAL INTERPRETATION OF PRELIMINARY VIDEO DATA IS PRESENTED. SUBSEQUENT ANALYSES AND INTERPRETATION OF DATA WILL BE CONDUCTED BY PRINCIPAL INVESTIGATORS AT ALL 3 LABS FOR PEER REVIEW PUBLICATION.**

Species Inventory Analyses

SSI analyses for 1997 followed the same procedures as that for 1996 analyses. The total number of taxa recorded by each observer was calculated for each station and cumulative occurrence and frequency of occurrence were determined by site. Total number of taxa observed were also calculated for each site. Summaries of species presence by site were used to calculate species presence and frequency of occurrence and total number of taxa by site type (hardbottom, patch reef, shallow offshore reef, and deep offshore reef). Mean number of taxa and standard deviation were also computed for each site type. Data were pooled for all sites to calculate species presence and frequency of occurrence by site type to characterize the species composition of each type. Combined species presence data were also pooled to characterize the Sanctuary coral fauna.

The "cluster" routine in Primer[tm] was used for classification analyses. The data input was by site type and taxa frequency of occurrence. Data were not transformed or standardized. The Bray Curtis (Czekanowski=s) similarity coefficient (Bray and Curtis 1957, Bloom 1981) was used to classify the sites and the group average sorting strategy was utilized for dendrogram clustering (Lance and Williams 1967, UNESCO 1992, Clark 1993). The similarity matrix for each site type was used for the input data set for multi-dimensional scaling (MDS) ordination (Clark 1993). Primer[tm] routines "MDS" and "Conplot" were used to execute these analyses.

Species Inventory Results and Comparisons

Sanctuary-wide Results and Comparisons

Forty-four taxa (species and species complexes) are represented in the 1997 data set. A taxonomic list of these taxa is presented in Table 7. Three taxa (Agaricia agaricites, Porites porites, and Montastraea annularis) may include a complex of closely related forms. Presence/absence of stony coral taxa recorded at all sites for 1997 is presented in Table 8a.

Coral reefs are considered to be highly stable communities; however, species composition of our 160 stations (among 40 sites) exhibited changes from 1996 to 1997. Of the 160 stations counted, only 30 showed no change. At the remaining 130 stations, species counts at 67 stations recorded fewer species whereas counts at 63 stations recorded more species. Further analysis indicated that although no net change was observed at 30 stations, changes in overall species composition often occurred. The result of these repeated observations is that S (species richness) varies and is not a constant within sites sampled.

In 1997, Millepora alcicornis and Porites astreoides were observed at all sites (Table 8a). These taxa also occurred most frequently (Table 8b). Another 11 taxa were observed at 30 or more (75%) of the 40 sites. Ten of these were the same as those 11 taxa observed at 75% of the

sites in 1996. Favia fragum was not among that 75% in 1997. The brain coral, Colpophyllia natans, was observed at 28 sites in 1996; however, with the addition of records at stations 3 and 4 at Molasses Reef (shallow), station 2 at Conch Reef (shallow), and at station 3 at Moser Channel hardbottom, its presence was recorded at 75% of the sites in 1997.

At half (20) the sites, 8 additional taxa were recorded. Five of the 8 taxa (Eusmilia fastigiata, Favia fragum, Madracis decactis, Meandrina meandrities, and Mycetophyllia lamarckiana) were represented at 50% of the sites in both 1996 and 1997. Three taxa (Leptoseris cuculatta, Acropora cervicornis and Agaricia fragilis) recorded at 19 sites in 1996 were recorded at 20, 21 and 22 sites, respectively in 1997. Two species (Diploria clivosa and Solenastrea bournoni) which had been among those recorded for at least 50% of the sites in 1996 were less frequent in 1997 and were recorded at 17 and 18 sites.

Twelve species were recorded at 25% or more of the sites. Of the remaining taxa, Acropora palmata and Cladocora arbuscula were recorded at 8 sites. Isophyllastrea rigida and Isophyllia sinuosa were recorded at only 7 sites.

Seven taxa were reported at only 3 sites or less. In both 1996 and 1997, Dendrogyra cylindrus was observed at Conch, Sombrero, and Sand Key shallow offshore reef sites; interestingly one site each, off Key Largo, Marathon and Key West. Phyllangia americana, a small ahermatypic coral (common in the Eastern Gulf of Mexico) was only recorded at Western Head patch reef off Key West and at ABay@ patch reefs (Content Keys and Smith Shoal) as could be expected. All 3 sites have high turbidity and strong Gulf influences. Solenastrea hyades, another common Eastern Gulf species recorded only at hardbottom sites in 1996 was only recorded at El Radabob and Dove Key northern hardbottom sites in 1997. Porites branneri was recorded only at West Washerwoman patch reef.

As in 1996, Phyllangia americana, Solenastrea hyades, Dendrogyra cylindrus, Porites branneri, Astrangia poculata and Astrangia solitaria were among the least frequently occurring species in 1997 (Table 8b). Although the range of taxa recorded per site was 7 to a maximum of 35 for 1996 and 8 to a maximum of only 32 for 1997, for all sites combined, the mean number of taxa recorded for 1997 was only slightly less (21.73) than the reported mean for 1996 (21.9). Overall, Table 8a and Figure 9 show that the difference between 1996 and 1997 in number of taxa reported for a single site ranged from -8 at Western Head (5P2) to +6 at both West Washerwoman (5P1) and Conch Reef shallow (9S4).

Off Key West, in Water Quality Segment 5 (Figure 10), eight species recorded at Western Head in 1996 were absent from SSI 1997 records. Western Head is a small patch reef adjacent to the shipping channel into Key West (Figure 10). The turbidity is chronically high and the visibility low. The patch reef has high relief mounds arising from a sediment laden bottom. Sediments are easily resuspended. Also in Water Quality Segment 5, six species not recorded at West Washerwoman in 1996 were present in SSI 1997 records. Off Key Largo, in Water Quality Segment 9 (Figure 11), six species not recorded at Conch Shallow in 1996 were present in SSI 1997 records.

The data show that only 30 of the 160 stations showed no change in species presence, and although a majority of stations lost or gained two or fewer species almost one-third exhibited

greater change than this. The greatest documented changes were a loss of 8 species and a gain of 6 (Figure 9). However, similarity (Bray Curtis Similarity Coefficient) in species frequency of occurrence between 1996 and 1997 showed the majority of sites exhibited minor change and mean similarity of coral species frequency of occurrence of most sites (with exception of the inshore hardbottoms) was about 90% (Table 9, Figure 12).

The greatest change in coral species frequency of occurrence was at Dove Key hardbottom (Water Quality Segment 9) (Figure 11) whereas Admiral patch reef, offshore of Dove Key, had a similarity value of 93.827 for the between year comparison. Of the Ainshore sites@ Dove Key hardbottom and Admiral patch reef are geographically closer to each other than to any of the other sites (Figure 11). The low similarity in species frequency of occurrence for Dove Key hardbottom between 1996 and 1997 likely resulted from lack of a record of Favia fragum for 1997 and the addition of records for 4 species (Siderastrea siderea, Solenastrea bournoni, Porites astreoides and Astrangia solitaria) in 1997 out of a total of only 12 species. Differences in species records for individual stations also contributed. The hardbottom habitat at Dove Key is inshore and usually murky.

Molasses Keys hardbottom (Water Quality Segment 5) (Figure 10) similarity value (74.419) (Table 9) was also somewhat lower than values for the majority of the sites. A total of 9 stony coral taxa were recorded in 1997; an increase over 7 in 1996. Like Dove Key, this inshore hardbottom site is usually extremely murky and the corals in this habitat are small and inconspicuous.

The least change occurred at Tennessee Reef shallow (Water Quality Segment 7) (Figure 13; Table 9). Although 22 taxa were recorded at Tennessee shallow both years, Eusmilia fastigiata was recorded in 1996 but not in 1997; however, Isophyllastrea rigida which was not seen in 1996 was recorded in 1997.

Based on comparison of SSI records for 1996 and 1997 (Figure 9), no clear trend of species loss or gain is evident in Water Quality Segments. Within Water Quality Segments some sites had fewer species recorded in 1997 than in 1996, some had more. Similarity values also showed no clear trends in changes. Arranging the data by water quality segments may not be as informative as relationships between our benthic data and physical oceanographic data (such as proximity to oceanic connections between Florida Bay and the reef tract). Future analyses will incorporate GIS classifications to more clearly elucidate patterns.

Results of multi-dimensional scaling of the 1997 coral species frequency of occurrence data (Figure 14) for all sites were remarkably similar to results of 1996 work. As in 1996, six of the 8 hardbottom sites were outside the primary cluster as were the two Gulf sites. Nine of the twelve offshore shallow sites formed a separate cluster and four sites (Jaap hardbottom, Grecian Rocks, Tennessee and Looe Key shallow) showed some affinity to the offshore deep and patch reef grouping. The remaining patch reef and offshore deep sites formed the tightest cluster.

Site Type 1997 Results and Comparisons

Of the 44 total taxa observed in 1997, 16 were recorded at all four site types (Table 10a). Three species restricted to one type in 1996, still occurred at only those specific types (Acropora palmata and Dendrogyra cylindrus -offshore shallow reef and Solenastrea hyades -hardbotttom). Astrangia poculata which was observed at a hardbottom and patch reef site in 1996, was only observed at the hardbottom site in 1997. Astrangia solitaria (new for 1997) was reported only from a shallow offshore site. Porites branneri, Astrangia poculata, Astrangia solitaria and Dendrogyra cylindrus were least frequently observed (Table 10b). Patch reefs again had the greatest total number of taxa (37), shallow and deep offshore had intermediate numbers (35 and 33, respectively) and hardbottom sites had the least (25) taxa.

From 1996 to 1997, overall variability in number of coral taxa was greatest among patch reef sites. Mean taxonomic richness decreased slightly for patch reefs and offshore deep reefs and increased slightly for hardbottom and offshore shallow reefs (Figure 15).

Within site variability in number of stony coral taxa recorded by site within each habitat type is documented in Figures 16a and b. Patch reefs in water quality segment 5 (Key West area) exhibited the greatest change in number of coral taxa ranging from a loss of 8 to a gain of 6 (Figure 16a) between 1996 and 1997. Shallow offshore sites in Water Quality Segment 9 had a net change of 0 in number of coral taxa with both gains and losses of 6 taxa; however, the percent species change ranged from a 40% gain to a 20+% loss (Figure 16b).

Overall, more shallow offshore sites gained species than lost species. Offshore deep sites lost species at 8 of 11 sites.

Hardbottom Sites

A total of 24 coral taxa (with a range of 8-19 per site) were recorded among hardbottom sites in 1997 as opposed to 25 in 1996. Millepora alcicornis, Porites astreoides, Porites porites and Siderastrea radians occurred at all hardbottom sites at nearly all stations (Tables 11a and b). Similarity of coral taxa frequency of occurrence indicates similarity between Rattlesnake and El Radabob and between Rattlesnake and Molasses Keys. Long Key and Moser similarity was 80%; however remaining sites were less than 80% similar (Table 12, Figure 17). Ordination does not indicate close relationship among hardbottom sites with the lease similar sites being Jaap Reef and Content Keys (Figure 18).

Patch Reef Sites

A total of 37 coral taxa (with a range of 14-32 per site) were recorded among patch reefs in 1997 as opposed to 40 in 1996. Nine coral taxa (Agaricia agaricites, Dichocoenia stokesii, Diploria strigosa, Millepora alcicornis, Montastrea annularis, Montastrea cavernosa, Porites astreoides, Siderastrea siderea and Stephanocoenia michelinii) occurred at all sites. Three (Millepora alcicornis, Porites astreoides, and Siderastrea siderea) of the preceding nine coral taxa also occurred at all stations within sites. Another three (Agaricia agaricites, Montastrea annularis, and Montastrea cavernosa) of the nine occurred at nearly all stations (Tables 13a and b).

Coral taxa frequency of occurrence at Smith Shoal, on the Florida Bay side, was least similar to that of the other patch reefs (Table 14, Figure 19). Coral taxa frequency of occurrence for West Turtle Shoal was similar to that for Dustan Rocks, Cliff Green and Turtle. Cliff Green taxa also showed similarity to Western Head as did Dustan Rocks= to West Washerwoman=s. Ordination also showed Smith Shoal=s taxa to be separate from other patch reef groupings (Figure 20).

Offshore Shallow Reef Sites

A total of 35 coral taxa (with a range of 14-29 per site) were recorded among offshore shallow reef sites in 1997; the same number as in 1996. Eight (Agaricia agaricites, Favia fragum, Millepora alcicornis, Millepora complanata, Montastrea cavernosa, Porites astreoides, Porites porites, and Siderastrea siderea) coral taxa occurred at all sites. Only Porites astreoides occurred at all stations within sites; however, three of the preceding eight taxa (Agaricia agaricites, Millepora alcicornis, and Siderastrea siderea) occurred at nearly all stations (Tables 15a and b).

In Water Quality Segment 5 off Key West, Rock Key and Western Sambo shallow sites had the highest similarity (85%) in coral taxa frequency of occurrence (Table 16, Figure 21). In the middle Keys, Tennessee and Looe Key taxa were similar as were taxa of Conch and Alligator. Each of these reef pairs are in close geographic proximity within the Sanctuary (Figure 1). However, Molasses and Sand Key, Molasses and Western Sambo and Carysfort and Rock Key had similar coral taxa frequency of occurrence but are at opposite ends of the Sanctuary (Figure 1). Tennessee and Looe Key are on opposite sides of the major influx of Florida Bay waters onto the reef tract around Marathon (Figure 1). Coral taxa frequency of occurrence at Eastern Sambo was least similar to that of other offshore shallow reefs. O clusters of offshore shallow sites were apparent in ordination (Figure 22).

Offshore Deep Reef Sites

A total of 33 coral taxa (with a range of 22-30 per site) were recorded among offshore deep reefs in 1997 (as opposed to 36 in 1996). Over one third (13) of these (Agaricia agaricites, Dichocoenia stokesii, Diploria labyrinthiformis, Eusmilia fastigiata, Leptoseris cucullata, Meandrina meandrites, Millepora alcicornis, Montastrea annularis, Montastrea cavernosa, Porites astreoides, Porites porites, Siderastrea siderea and Stephanocoenia michelinii) coral taxa occurred at all sites. Four (Agaricia agaricites, Millepora alcicornis, Porites astreoides, and Siderastrea siderea) of these coral taxa occurred at all stations within sites; and four (Montastrea annularis, Montastrea cavernosa, Porites porites, and Stephanocoenia michelinii) more of these occurred at nearly all stations within sites (Tables 17a and b).

The highest similarity in coral taxa frequency of occurrence at deep sites was among Looe Key, Tennessee and Eastern Sambo (Table 18). However, greater than 80% similarity in coral taxa frequency of occurrence was exhibited among numerous deep reef sites (Sand Key, Rock Key, Tennessee, Eastern Sambo, Looe Key, Sombrero, Carysfort and Western Sambo (Figure 23). Frequency of occurrence of coral taxa was the least similar at Conch, Molasses and Alligator to that of other deep sites. Ordination indicates these reefs= coral taxa frequency of occurrence had little relationship to that of other deep sites.

1996-1997 Comparison of Reefs by Site Type

Between 1996 and 1997, mean number of coral taxa increased at four and decreased at four hardbottom sites (Figure 25) for a net change of 0. Temporal similarity in coral taxa frequency of occurrence was about 85% or greater for comparisons of successive years data at 6 of 8 hardbottom sites. Data for Molasses Keys was less similar; Dove Key (Table 19) had the least similarity between years. Classification documented the similarity of coral taxa frequency of occurrence within sites between years for most hardbottom sites with the exception of Dove Key and Molasses Keys (Figure 26). Ordination of successive year's data confirmed these relationships (Figure 27).

Mean taxonomic richness at eight of nine patch reef sites decreased between 1996 and 1997 (Figure 28) with only West Washerwoman (5P1) showing an increase. However, similarity values (85-94%) were high for between year comparison of coral taxa frequency of occurrence for all patch reefs (Table 20). Classification also documented the similarity of coral taxa frequency of occurrence within sites between years for patch reef sites (Figure 29). Ordination confirms the within site similarity of the patch reef sites over time (Figure 30).

In contrast to that of patch reefs, mean taxonomic richness increased at ten of twelve offshore shallow reef sites between 1996 and 1997. Mean taxonomic richness remained essentially the same at Eastern Sambo shallow and decreased at Grecian Rocks (9S2) (Figure 31). As for patch reefs, similarity values (82-97%) were high for all shallow reef coral taxa frequency of occurrence between year comparisons (Table 21). Classification also documented high within site similarity of coral taxa frequency of occurrence between years (Figure 32). Ordination supported the above findings with Conch showing the greatest change between years (Figure 33).

Between 1996 and 1997, six offshore deep sites had a decrease in mean taxonomic richness and five had increases (Figure 34). As for patch reef and offshore shallow sites, coral taxa frequency of occurrence within site similarity values (87-96%) were high between years at offshore deep sites (Table 22). Classification (Figure 35) and ordination (Figure 36) documented the within site similarity of offshore deep sites between 1996 and 1997.

Species Inventory Summary

Data for 1997 confirm that within the Sanctuary as a whole, a few species are restricted to particular site types and certain groups of species are more characteristic of certain habitat types but the majority of species occur throughout the Sanctuary. The results of multivariate analyses indicate overall coral species composition and distribution was relatively stable within the Sanctuary between 1996 and 1997 with some variability among habitat types.

DISEASE/CONDITION DATA

Disease Data Processing

Data for disease/condition entered from individual observers data sheets is tabulated as present if recorded by either of 2 observers. The data entry form (Figure 4)

provides codes for 4 categories: bleaching (BLCH), black band disease (BBD), white diseases (WH) and other diseases (which include a variety of conditions named and unnamed). There is no provision for confirmation of disease/condition records.

Disease Data Analyses

THE MAJORITY OF ANALYSES AND INTERPRETATION OF THE DISEASE DATA WAS CONDUCTED BY DR. J. PORTER (UGA).

In 1996, due to logistical constraints, 52 stations were scored for disease by one counter and the remaining 108 stations by two. Disease/condition for all 160 stations were counted by two counters in 1997. During the first half of the 1997 field season, attempts were made to diagnose more than seven different diseases/conditions. Due to lack of underwater sampling time for diagnoses at this level of accuracy, efforts were limited to noting bleached corals and distinguishing among 3 major phenotypic disease categories: white diseases, black band disease, and other diseases.

In black band disease, coral tissue is killed by a cyanophyte alga that forms a dark red, or black band which sweeps across the colony surface leaving a fresh white skeleton in its wake. The bared skeleton is subsequently colonized by an algal community which prevents regrowth of the coral tissue. White diseases also cause coral mortality by killing coral tissue but do not normally manifest a band at the interface. Other diseases such as ring Ableaching@ (yellow band, yellow blotch) affect corals. All types are illustrated in Figure 37. While it is desirable to determine the specific identification of the different diseases, such determinations underwater are not always practicable or possible.

Disease Results and Comparison

Frequency of Coral Disease Sanctuary-wide (160 stations) 1996-1997

In 1996, 91 (57%) among the 160 stations contained bleached or diseased individuals In 1997, the number of stations containing bleached or diseased individuals had risen to 117 (73%). Therefore, between 1996 and 1997, the recorded incidence of both coral bleaching and coral disease in the Florida Keys had increased 29% (Table 23). These station species inventory summaries of the presence or absence of disease do not reflect the fact that in 1996, most of the incidences of bleaching or disease were exhibited by only one individual of a species within a station. By contrast, almost all of the 1997 incidences of both bleaching and disease were manifested in many colonies (personal observation J. Porter) of each species within a station (Table 24).

Exclusive of bleaching, the incidence of disease [black band (Figure 38), white diseases (e.g. white pox, Figure 39), or other diseases] increased in frequency from 24 stations (15%) in 1996 to 94 stations (59%) in 1997. If analyzed by number of reef sites with diseased corals rather than number of stations, the number of sites (40 total) with disease increased from 15 (39%) in 1996 to 33 (83%) in 1997.

Frequency of Disease among Coral Species 1996 - 1997

In addition to an increase in the frequency of disease within stations, the number of species exhibiting disease increased. In 1996, nine (22%) of the forty species recorded during the station surveys showed signs of disease; in 1997, 28 (70%) of the 40 species showed signs of disease (Table 24).

Our data refute the null hypothesis that an increase in coral disease in the Florida Keys is only "an *apparent* increase due to increasing observational frequency and awareness," and instead prove that coral disease is becoming more frequent than in the recent past. Whether reported in terms of (1) the number of stations affected, (2) the number of species affected, or (3) the number of different diseases recorded, corals in the Florida Keys are being subjected to numerous potentially lethal infections. At this time, it is unknown whether these diseases are the expression of an episodic, naturally occurring, short-term event, or a human induced degradation with more serious long-term ramifications. Further research and monitoring is absolutely critical to discern which of these alternative ecosystem-wide processes is at work. A more detailed knowledge of disease distribution in the Keys may also provide clues to conditions conducive to disease incidence and prevalence, and to answer the fundamental question of whether anthropogenic influences are playing any role in the presence of so many diseases on coral reefs in the Florida Keys.

Other Coral Mortality Sources

Bleaching is not a disease but an indicator of stress. The coral tissue loses its symbiotic zooxanthellae from which the coral derives its yellow-brown color. The white skeleton then reflects ambient light through the semi-transparent coral tissue and appears Ableached@. Coral bleaching events were documented in both 1996 and 1997; however, in 1997 bleaching was much more extensive, particularly in early September. This is exemplified in the CRMP data for stations sampled on approximately the same date in successive years (Table 23). In both years, stations sampled in early June show less bleaching than stations sampled late in summer. This follows the premise that bleaching is induced by elevated temperature (Fitt et al., 1993) and is a function of seasonality. It is possible that bleaching throughout the Keys has a secondary geographic component to it but we are unable to discern a secondary pattern at this juncture.

Five outer reef locations spanning the geographic length of the Sanctuary were selected for supplemental video to document bleaching in late 1997 (Figure 40). Stations were selected at both shallow and deep sites. Table 25 summarizes video filmed along specific CRMP transects during late September and October. By November 1997, recovery appeared to be underway. When summer 1997 and summer 1998 video are analyzed, the fall 1997 bleaching video will be available for comparison of specific transects which had severe bleaching.

Microalgal filaments at the edge of corals form effective sediment dams which prevent corals from clearing sediment off their surface and slowly suffocate live tissue. This process, termed Aedge damage@ is a Afunctional disease@ and may be a significant source of coral tissue mortality (Figure 41). At minimum, this edge mortality may increase susceptibility to opportunistic pathogens which cause black band disease or white plague.

VIDEO DATA

Video Data Processing

Image Conversion (framegrabbing)

All video data conversion for the project is contracted to Dr. P. Dustan (UCSC). Dustan Lab revised the framegrabbing-assist software and devised ways of improving efficiency of frame capture for quickly-filmed transects (less than three minutes long) which require much more time to capture due to computer speed considerations. The frame capture processing was automated by creating software that actually controls the video tape player using the machine=s tape counter. Captured frames are stored in RAM, rather than being directly written to the hard drive. This process greatly reduces the minimum interval between frame capture. The process included installing 80 MB of RAM in the computer, obtaining and installing an RS422 communications board, deciphering the digital output signal from the controller port on the VCR, and generating a significant amount of computer programming code to control the actions of the videotape player.

Image Processing

Dustan Lab continued to refine the process of image acquisition and CD-ROM generation, 1997 was the first year of Aproduction@ rather than development. Data from the 1996 and 1997 field seasons were received and processed as detailed in Table 26.

Video Data Reduction (Image Analysis/Point Count)

IMAGE ANALYSIS OF THE DIGITIZED VIDEO FOR THE PROJECT IS DIVIDED AMONG THE LABS OF THE THREE PRINCIPAL INVESTIGATORS.

The software for the CRMP video image analysis was developed by the Dustan Lab and the first functional version was completed by fall of 1996. Dustan Lab is responsible for drafting a manuscript describing the CRMP software program to be entitled PointCount for Coral Reefs: A Random Point Method for Assessing Percent Cover from Digital Images. The manuscript will describe the functions, purposes, and output of the software, and present the results of sensitivity analyses performed on GIS-classified images of framegrabbed transects (*i.e.*, images with precisely known pixel-class populations). Dustan Lab also made revisions to PointCount for Coral Reefs software to accommodate several changes in identification categories and number of points per frame based on analysis of inter-investigator results for reefs. Additional changes were made to accommodate specific user requests for simplified application as well as more convenient implementation in the users= operating systems of choice (Windows95 and Windows 3.11). Additional revisions may include changing the opening page of the program, adding a comment category, and adding a disease category check box. Dustan lab provided station assignments for images on CD=s to the other labs.

Video Data Analyses

A cut-off date of December 1997 was selected for summaries of image analysis completed during FY 96/97. Image analysis (point count) of the first year's data (1996) was not begun until

November 1996. Preliminary results and analyses are included in this report as only 81% (130 files) of the 1996 video image analysis was completed between November 1996 and December 1997; only 12 selected files from 1997 video (7 1/2%) were completed (Table 27). Repeated image analysis was conducted on some files for quality assurance purposes. The remaining 19% of 1996 video image analysis were completed in May 1998. Compilation of a master data file and error checking on the 1996 data set is to be completed by 30 September 1998. Sanctuary-wide results of 1996 image analysis will be in the 1998 annual report.

Video for 1996 and 1997 from sites *with highest probability for showing change* were selected from northern (Carysfort deep offshore), and southern Sanctuary (Atlantic and Florida Bay) sites (Rock Key shallow offshore and Content Keys, respectively) for comparisons of results to be presented at the January 1998 Steering Committee meeting and for this report.

Several types of analyses were conducted on these data to provide *preliminary* inter-annual comparisons of stony corals and selected other major benthic categories. The majority of analyses for these comparisons were conducted by FMRI (multivariate) and UCSC (univariate). These will be reviewed with statisticians to determine the most appropriate analyses for comparisons of the project=s 5 years of video data. All 3 labs performed point counts (image analysis) on the 1997 data for the 3 sites that were used for 1996-97 comparisons.

DESCRIPTIVE ANALYSES

PointCount data was described at all three sites with measures of central tendency. Quattro Pro™ was used for descriptive analyses including range, mean, and standard deviation for sites and years.

UNIVARIATE ANALYSES

Percent cover of selected groups was calculated for each transect within a station to insure equal weighting of each of the transects. The mean of the three transects was used as the estimate of percent cover for the station. The estimates may be compared over time. The present analyses were conducted to test for significant changes in percent cover at selected stations over time using Wilcoxon=s Signed-Ranks Test for Two Groups (two-tailed), a non-parametric repeated measures test (Sokal and Rohlf, 1995). Non-parametric paired tests are more conservative than parametric procedures (paired t-test or ANOVA) and do not make assumptions about the normality of the data. The *a priori statistical* significance value of 0.15 was selected to detect change in the reef communities sampled.

In the univariate analyses, (data presented top and center in following tables), scleractinian corals were analyzed separately from the hydrocorals Millepora alcicornis and M. complanata. This was done to eliminate possibility of increases in fire corals off-setting declines in true stony corals (scleractinians) and perhaps masking changes in community composition if they were included in the analyses as Astony corals@A.

MULTIVARIATE

PointCount data were processed to provide a data interchange format (*.dif) data set with major benthic categories and stony coral taxa. Mean number of points for a station was calculated for

each category (stony corals, octocorals, sponges, zoanthids, macroalgae, and substrate) from the total number of points by category per each transect. Analyses presented for stony coral taxa include the hydrocorals (Millepora alcicornis and M. complanata) in total mean percent stony coral cover (data presented at bottom in following tables). For major benthic category analyses, mean number of points for each category were lumped.

Primer (Plymouth Laboratories, 1995) was used to document dynamics in the community structure. Classification based on Bray Curtis (Czekanowski=s) quantitative coefficient of similarity and group average sorting generated similarity matrices and dendrograms (Bloom 1981). Ordination was computed from the Bray Curtis similarity matrix. Twenty-five iterations of the data were used to compute the MDS vectors and generate a Multi-Dimensional-Scaling plot (Warwick and Clarke 1991, Clarke 1993). K dominance analysis (Lambshead et al., 1991) provided temporal dominance/diversity comparisons.

Results/Comparisons of Selected 1996-1997 Video Data

Carysfort Reef Deep

Figure 42 provides a panoramic view of Station 4 at the deep offshore Carysfort reef site from 1996 and 1997. Although visibility was somewhat reduced in 1997, the same features are clearly represented in both mosaics. The 1996 and 1997 video composites (station 3, transect 500) (Figure 43) from Carysfort Reef illustrate a repetitive paired comparison of the video imagery. The chain is draped over the same permanently marked station on the reef each year and the video frames are harvested to generate a set of overlapping images. The single frames on the right show a Montastrea cavernosa (top) with macroalgae (Dictyota spp) growing around it on the substrate. Note that the macroalgae appears to cover much more of the substrate in 1997. The lower set of frames shows a Mycetophyllia ferox infected with White Plague disease. The colony has lost about 20% of its living tissue to the disease.

Nineteen stony coral taxa were recorded in video imagery at the Carysfort Reef deep site in 1996 and 16 in 1997 (Table 28 bottom). Data for station species inventory counts show 27 stony coral species were recorded in 1996 (Table 29) and 26 in 1997 (Table 30). Figure 44 shows that although a decrease in the mean number of stony coral taxa at Carysfort Deep was documented by both point count and species inventory methods, the video under-represented the numbers of stony coral taxa by nearly 50%. However, relative estimates of percent cover of stony corals and other benthos can be determined from the video. Video also provides a permanent baseline record of each station at each site from which other information can be collected on an as needed basis (post bleaching events, hurricane damages, groundings etc). Other biological data can also be gathered.

Cover of Montastrea annularis complex, which comprised the majority of stony coral cover, decreased from 7.8% in 1996 to 7.2% in 1997. Mean percent cover for another nine taxa ranged from 0.12% to 0.92% in 1996 and 0.10% to 0.99% in 1997 (Table 28 bottom, Figure 45). By station, mean percent stony coral cover ranged from 12.5% to 14.8% in 1996 and 9.4% to 14.3% in 1997. The total mean percent cover of stony corals for the site was 13.5% in 1996 and ll.9% in 1997 a decrease of 1.6% mean stony coral cover at the site (Table 28 bottom, Figure 46). Considered separately, the encrusting fire coral Millepora alcicornis was not observed in video for stations 1 and 2 in 1996; however, it was recorded at all stations for 1997. Although it only comprised

0.25% of the mean percent cover at Carysfort in 1996, mean percent cover increased to 0.69% in 1997 (Table 28 center and bottom).

Mean percent cover increased for octocorals from 8.2% in 1996 to 9.3% in 1997 decreased for sponges from 4.4% to 1.9% and remained the same for zoanthids at 0.2% for the site (Table 28 center and bottom, Figure 46).

Mean percent cover of macroalgae increased from 17.4% to 29.5% between 1996 to 1997. The substrate category comprised about half the mean percent cover between years with a decrease from 56.3% in 1996 to 47.3 % in 1997 (Table 28 center and bottom, Figure 47).

Carysfort Deep 1996-1997 Similarity Analyses

Similarity analyses of mean number of stony coral points per station for 1996 and 1997 showed coral cover at Station 3 changed the least (88% similarity). Stations 1, 2, and 4 were less similar between years with values ranging from 70-74% (Table 31, Figure 48). Ordination (Figure 49) also indicates stony corals at station 3 were similar between years and the other 3 stations less so; however, the K Dominance curve (Figure 50) indicates the stony coral fauna of Carysfort deep sampled by point count was basically stable between 1996 and 1997.

When the mean number of points of all major categories were compared, those at station 1 changed the least; benthic categories at 2 and 3 changed little and station 4 was least similar when major categories were compared between years (Table 32, Figure 51, 52).

Rock Key Shallow

Thirteen stony coral taxa were recorded in video imagery at Rock Key Shallow in 1996. Two additional species were recorded in 1997; however two other species were not seen for a total of 13 species recorded the second year (Table 33 bottom). Data for station species inventory counts show 18 stony coral taxa were recorded in 1996 (Table 34) and 22 in 1997 (Table 35). Figure 53 shows that an increase in the mean number of stony coral taxa at Rock Key shallow was documented by the species inventory method; however, the increase was barely discernable by point count. Video under-represented number of stony coral taxa at Rock Key Shallow, but only by about 30%.

The bladed fire coral Millepora complanata comprised the majority of stony coral cover at Rock Key shallow both years (4.5% in 1996; 3.8% in 1997). Acropora palmata contributed the most cover of the Atrue stony corals@ which decreased from 4.1% in 1996 to 3.2% in 1997. Mean percent cover for another eight stony coral taxa ranged from 0.07% to 1.3% in 1996 and 0.15% to 1.2% in 1997 (Table 33 bottom, Figure 54). By station, mean percent stony coral cover ranged from 4.8% to 20.5% in 1996 and 4.7% to 20.2% in 1997. The total mean percent cover of stony corals for the site was 11.6% in 1996 and 10.5% in 1997, a decrease of 1.1% mean stony coral cover at the site (Table 33 bottom, Figure 55).

Mean percent cover increased for octocorals (3.1% in 1996 to 4.4% in 1997) and zoanthids (4.3% in 1996 to 4.7% in 1997) but decreased slightly for sponges from 0.85% to 0.61% (Table 33 bottom, Figure 55).

Overall, the macroalgae cover at Rock Key shallow was sparse (1.7% in 1996 and 2.5% in 1997) compared to mean percent cover of the substrate category which comprised 77-78% of the cover both years (Table 33, Figure 56).

Rock Key Shallow 1996-1997 Similarity Analyses

Similarity analyses of mean number of stony coral points per station for 1996 and 1997 showed coral cover at Station 3 changed the least (89% similarity). Stations 1 and 2 were less similar between years with values ranging from 71-73%. At station 4, mean number of stony coral points were also relatively similar between years (83%) (Table 36, Figure 57). Ordination (Figure 58) also indicates stony corals at all Rock Key Shallow stations were similar between years. The K Dominance curve (Figure 59) indicates the stony coral fauna of Rock Key Shallow sampled by point count was basically stable between 1996 and 1997.

When the mean number of points of all major categories were compared stations 1, 2, and 3 were more than 90% similar. Station 4 less similar between years (85%) (Table 37, Figure 60). Ordination of mean number of points of major benthic categories indicates station one changed the least (Figure 61).

Content Keys Hardbottom

At Content Keys, coral cover was extremely low. Eleven stony coral taxa were recorded in 1996 but 4 of those taxa were missing from point count in 1997 (Table 38) for a total of 7. Data for station species inventory shows 13 species were present in 1996 (Table 39) and 11 in 1997 (Table 40). Figure 62 shows that mean number of stony coral taxa at Content Keys decreased by both species inventory and point count methods. Video again under-represented number of stony coral taxa present.

No stony coral taxa at Content Keys contributed more than 0.5% cover either year. Mean percent cover for seven taxa which were represented both years, ranged from 0.01% to 0.38% in 1996 and 0.01% to 0.47% in 1997 (Table 38 bottom, Figure 63). By station, mean percent stony coral cover ranged from 0.96% to 1.78% in 1996 and 0.39% to 2.11% in 1997. The total mean percent cover of stony corals for the site was 1.29% in 1996 and 1.19% in 1997 (Table 38 bottom, Figure 63).

Sponges dominated cover of the major benthic fauna at Content Keys with nearly 2% cover in 1996 to over 4% cover in 1997. Cover of octocorals (0.03% in 1996 and 0.04% in 1997) and zoanthids (0.0l% or less both years) was negligible (Table 38, Figure 64).

Macroalgae contributed significant cover at Content Keys both years but decreased from 36% in 1996 to 23% in 1997. A majority of cover at Content Keys both years was recorded in the substrate category (60% in 1996 and 72% in 1997 (Table 38, Figure 65).

Content Keys 1996-1997 Similarity Analyses

All multivariate analyses for comparisons of mean number of stony coral taxa points by station indicated the coral fauna at all stations at Content Keys had undergone significant change between 1996 and 1997 (Table 41, Figures 66, 67 and 68).

Within station similarity was relatively high for all but station 2 when mean number of points for all categories combined were compared between years (Table 42, Figures 69, 70). This is primarily due to the dominance (mostly greater than 90%) of the macroalgae/substrate categories at all stations. Station 2 was least similar between years because the percent of macroalgae (63% decreasing to 15%) and substrate (34% increasing to 81%) reversed in dominance between years. Ordination of the mean number of points of major benthic categories indicated stations 1 and 4 were comparable; but stations 2 and 3 were not.

Summary/Selected 1996-1997 Video Data

For the preliminary analyses of the 3 selected sites, total mean stony coral cover was relatively high (10.5% to 13.5%) at the Carysfort and Rock Key outer reef sites and low at the Gulf site at Content Keys (about 1%) for both years (Tables 28, 33, and 38). The stony coral cover of the deep outer reef site at Carysfort was dominated by Montastrea annularis. Acropora palmata and Millepora complanata cover dominated at the shallow outer reef site at Rock Key. Porites astreoides dominated counts of stony coral taxa at Content Keys.

The biotic cover at all 3 sites was dominated by macroalgae. When combined with the substrate category, these two comprised 74% to 96% of the cover at all sites.

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FIGURES

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DATA MANAGEMENT

During 1997, many discussions, conference calls and meetings addressed the concerns associated with providing an effective data management system for the Water Quality Protection Program. As a consequence, the data management system was further refined to incorporate raw, results and synthesized data sets produced by Sanctuary investigators. FMRI coral staff have been and will continue to work with the data management staff (CAMRA) to define protocols that will help facilitate the transference of the CRMP data into the Sanctuary=s data management system. Discussions regarding a data manager for the CRMP project were initiated.

QUALITY ASSURANCE/QUALITY CONTROL

A Quality Assurance Project Plan for the Coral Reef/Hardbottom Monitoring Project was submitted to the Environmental Protection Agency July 17, 1996. Gary Bennett, USEPA Region 4 Quality Assurance Officer, reviewed and recommended approval. Formal approval was received 22 August 1996. Draft revisions and proposed new Standard Operating Procedures are being compiled for a revised SOP Manual.

Team members received additional training in field identification of stony corals this field season. Based on the agreement of records from their field training sheets, Matt Patterson, John Dotten and Doug Marcinek were qualified as species counters.

Stratified random selection and distribution of 10% of the stations was conducted by Dustan Lab for inter-observer analysis. The stations are distributed among labs, CD=s, sites, and habitats. With the exception of 2 stations for which every individual in every lab was required to submit point counts, labs are blind as to the location and assignment of the QA/QC stations. Team members are required to conduct point count on these selected csv files to qualify as counters for the video image analysis. Preliminary evaluations of inter-investigator agreement for point counts was also conducted by Dustan Lab.

Error-checking procedures with incoming data sets from all labs were conducted by Dustan Lab so that the resulting data sets for comparisons of 1996-1997 video data were of uniform and known quality.

ACKNOWLEDGMENTS

Our dedicated staff of research and field assistants are acknowledged for their perseverance. During 1996/7, we were fortunate to have a team of extremely capable and enthusiastic individuals: John Dotten, Matthew E. Patterson, and David Eaken, (FMRI); Mike Brill and James Leard (University of Charleston); Katie Patterson and Doug Marcinek (University of Georgia).

Sampling 100% of our stations was completed in record time in 1997. It remains a challenge to sample the 40 geographically separated CRMP sites. Numerous individuals assist with that effort in many ways. Most of those are represented in the field sampling and dive tables as FKNMS and EPA staff. Some only assisted one or two days; however, their assistance was often critical to meeting field schedule objectives at that particular time. We again want to thank Laurie MacLaughlin who has been willing to lend assistance onshore and on the water since the inception of this project.

The assistance of the EPA divers (Philip Murphy, Gary Collins, Mel Parsons, and Ken Potts) and the support of the captain (Capt. Mark Strout) and crew of the OSV Peter Anderson was instrumental in sampling our deep offshore sites.

For 1997, the Grand Mariner Award goes jointly to John Dotten and David Eaken each with 39 days "ship-time" during 1997 regular field sampling. They deserve special thanks for being there every day, every trip and then some. Their work Abehind the scenes@ kept the R/V Tortugas in top working condition with no Adown time@ for 1997. Honorable mention goes to Matt Patterson who was also present every day of every scheduled field trip for 1997. Dr. Porter=s team (Jim, Katie and Doug) along with FMRI=s field team made short work of the August 1997 trip to complete the regular sampling ahead of schedule.

The hardwork and perseverance of the Dustan Lab (particularly Mike Brill) is recognized for Apressing forward@ to complete pressing all 6 CD-ROMS for 1996 and the selected csv files for 1997 for this report.

Completing this report has been an arduous task that has been interrupted numerous times over the past year for other critical project needs. Matt Patterson deserves special recognition for keeping the digital files of all the datasets in some semblance of order. Kristina LeClercq, newcomer to the project for 1997/98 deserves special thanks for Ajumping in@ and assisting with final proofing. Fred McManus, our EPA project officer is also recognized for his support and understanding of the demands associated with such a huge geographically separated (both in sampling area and staffing) monitoring effort.

PROJECT OUTREACH

Team members attended an EPA meeting in Washington, DC, in February 1997. Dr. J. Porter made a presentation titled AAn Executive Summary@ which was prepared primarily by Dr. P. Dustan=s lab.

Dustan Lab World Wide Web site (http://www.cofc.edu/ ~ coral/coral.htm) created last year includes, among other projects, images and information about the CRMP in the Florida Keys National Marine Sanctuary. During 1997 additional information was provided.

Dustan Lab prepared a poster session on the Coral Reef Monitoring Project for the World Bank Global Conference, an associated event of ESD 5 and the International Coral Reef Initiative on Environmental Change 1997 of which the last 2 days are a special seminar on coral reefs. The poster is available to be used for future scientific meetings.

FMRI has made the CRMP an integral part of its ongoing outreach efforts at the Institute. Presentations have been made in-house and the project has been highlighted during MARINE QUEST, which is a local oceanographic interagency outreach event.

We are beginning to assist researchers outside of the CRMP who have repeatedly asked for information and guidance in their coral reef monitoring projects. It was always a goal of the CRMP to make its technology available for Aexport@ when appropriate.

1996-1997 ADMINISTRATIVE ACTIONS

FUNDING AND GRANT BUDGET

A revised Work plan was submitted along with the assistance request for funding for FY96/97. The receipt of $75,000 in increased funding for FY 96/97 was provided in October 1996. These funds were divided among the 3 investigating labs. Increased funding provided administrative support for project management at FMRI until May 1997. After May, the funding was used to hire an additional field research assistant at the Marathon Lab. Contracts to University of Charleston, S.C (Dustan) and University of Georgia (Porter) which had been initiated to start in early October at prior funding levels were amended to add the additional funds. Figure 72 depicts the disbursements made from project funds during FY 96/97. The breakdown of FMRI's supplies and equipment shows that nearly all the funds in those categories were expended for support of the project's field operations (vessel support, field navigation, field supplies, and travel for the primary field team).

PERSONNEL

The three principal investigators (Dustan, UCSC; Jaap, FMRI; Porter, UGA) and a project manager (Wheaton, FMRI) have primary responsibility for the project. The additional funds increased FMRIs staff with three full-time researchers (Patterson, Dotten and Eaken) and one part-time administrative clerk. The latter 2 researchers are stationed at the South Florida Regional Lab in Marathon. Dustan Lab included Brill and a research assistant (Meier then Kosmynin) full-time for 1997; UGA staff included Marcinek and Patterson full/part-time. Figure 73 depicts the Coral Monitoring Team staff and responsibilities.

Personnel Changes

Dr. Meier left the Dustan lab in August 1997 but remained as a member of the team through an Educational Related Professional Services agreement with the Dustan Lab. Dr. Vladimir N. Kosmynin joined the laboratory in Charleston. Dr. Kosmynin received his Ph.D. in 1980 from Moscow State University, where he holds an appointment as Senior Scientist, Paleontological Institute Russian Academy of Sciences. He has extensive research experience with coral reef ecology in the Indian Ocean and Red Sea. Most recently he has been working with Dr. Robert Ginsburg, RSMAS, University of Miami, developing methods for rapid assessment of coral reef health in the Florida Keys and Bahamas.

David Eaken joined the FMRI coral research group in the Marathon South Florida Regional Lab. David has worked at the Institute for several years and has extensive local knowledge of Keys reefs. In addition to training for video and SSI sampling and image analysis, he and John Dotten work year ›round as a field team in all facets of field preparation and sampling and vessel maintenance and operation.

PROBLEMS AND RESOLUTIONS

Field Work

The weather and field conditions were excellent for the majority of the 1997 field season which virtually eliminated any scheduling problems. The addition of Eaken in the Marathon location enabled the research vessel to be maintained in top condition with no Adown time@ this field season. The project was also accident free. The portable SCUBA air compressor carried on the vessel for all field sampling was replaced prior to field sampling for FY 96/97. Two video cameras are dedicated to project sampling effort. No major problems were encountered during field sampling this season.

Lab Work

Video data for the 1996 field season (which extended into October 1996) was converted to digital format; however, because of extended sampling and development of framegrabbing techniques, the 6 volumes of CD-ROMs for 1996 pressed for image analysis were not received from Dustan Lab until September 1997. Only 1% of 1996 video image analysis was able to be completed by 30 Sept 1997.

All labs dedicated time and effort to point counting the 1996 video data with 81% completed by December 1997. 1997 video must be framegrabbed before being distributed and counting can begin. Additional personnel becoming qualified to conduct point count should alleviate some of the back log. The learning curve for training on the point count software was addressed among the principal investigators and the trainees during the June 1977 Anderson cruise.

Funding

The project budget directly impacts man-power needs both in the field and in computer software development. During the first field season, FKNMS provided extensive field assistance for station installation including boats, captains, and divers. For the 1996 season, the project was primarily self-sufficient; however, staff and equipment showed the effects of such a rigorous schedule. With the intensive effort this comprehensive monitoring program requires, increased funding should provide the resources to adequately meet all objectives.

1996/97 PROJECT GOALS

(1) Complete point counting of all video imagery collected during 1996.
(2) Finalize statistical methodology.
(3) Conduct analyses of video data to estimate coral percent cover.
(4) Integrate analyses from species inventory data and video data.
(5) Refine data management protocols.
(6) Refine Quality Assurance Project Plan.
(7) Sample the project's 40 reef sites within calendar year 1997.

Much of the partitioning of effort has taken place as a natural result of the skills, expertise, and interests exhibited by groups and individual members within the CRMP.
Our accomplishments in reference to the above goals follow:
(1) 81% of 1996 video imagery was counted by December 1997.
(2) Statistical methods (multivariate and univariate) were tested in preliminary comparisons of 1996-1997 video selected from 3 sites. Standardized multivariate methods have been used for the majority of SSI data analyses.
(3) Analyses of the selected video data (3 sites) was completed for percent cover comparisons between 1996-1997.
(4) Image analysis of the first full years video data (1996) was not completed during FY 1997 and precluded comparisons of species recorded by SSI and in video except for the 3 selected sites.
(5) Data management protocol refinement was initiated.
(6) Revised SOP=s/draft new SOP=s are being incorporated into a Revised QA Plan.
(7) All 40 reef sites were sampled for the second consecutive year during 1997.

1997/98 PROJECT GOALS PROPOSED

For FY 1997/1998, we must optimize efforts among required laboratory tasks (point counts, data management, and statistical analysis) as we have field tasks, to accomplish the following objectives:

(1) Complete remainder of image analysis for 1996 field data.
(2) Conduct image analysis of 1997 field data.
(3) Create a master data set for SSI and point count data.
(4) Analyze 1996 point count data for percent coral cover.
(4) Integrate 1996 SSI and 1996 point count data.
(5) Finalize data management protocols.
(6) Initiate contract for analyses of intercalibration files and higher level statistics.
(7) Sample the project=s 40 reef sites within calendar year 1998.

Figure 1. Map of FKNMS and Coral reef/hardbottom Monitoring Sites

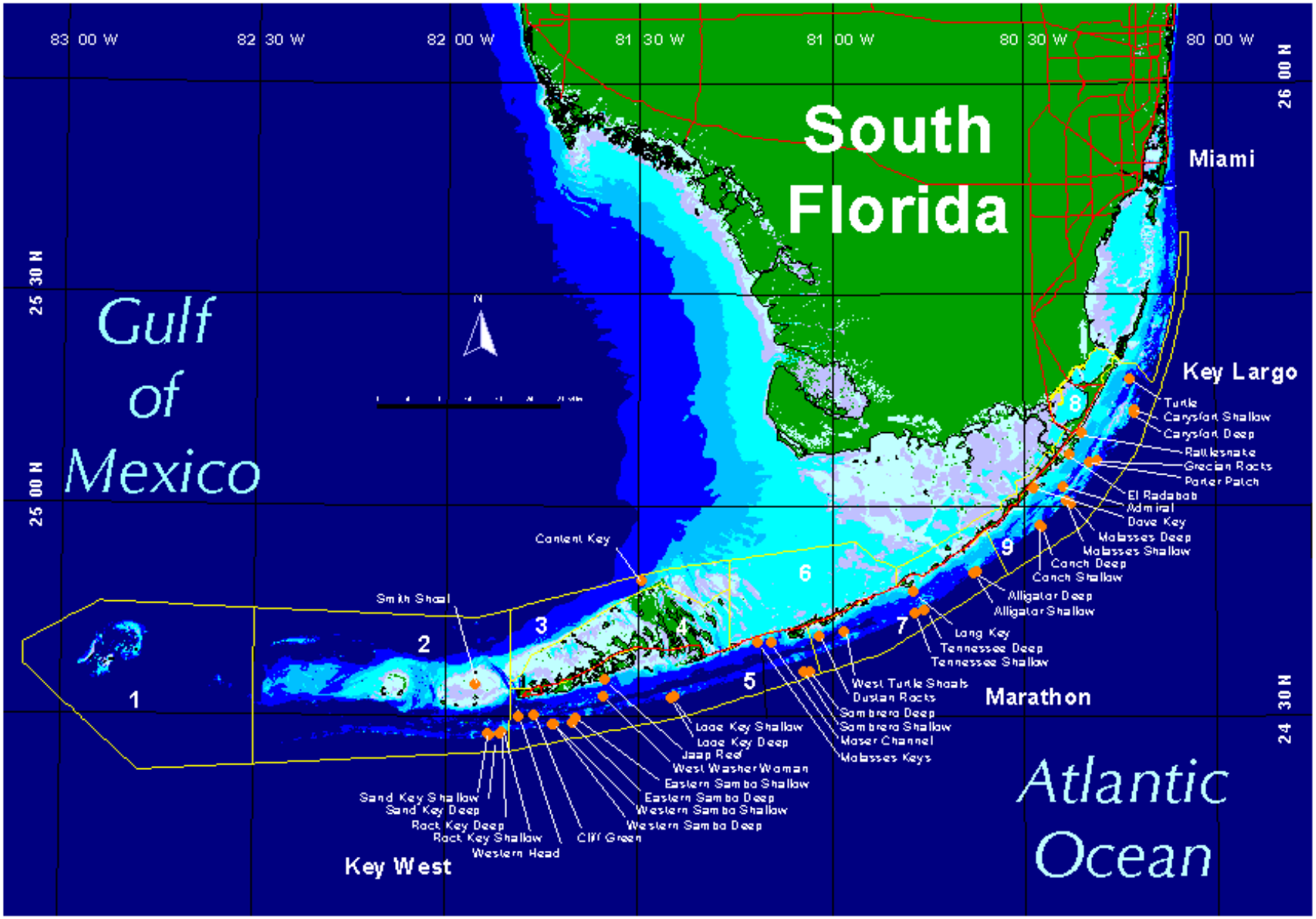


Figure 2. Sampling station for video and species inventory

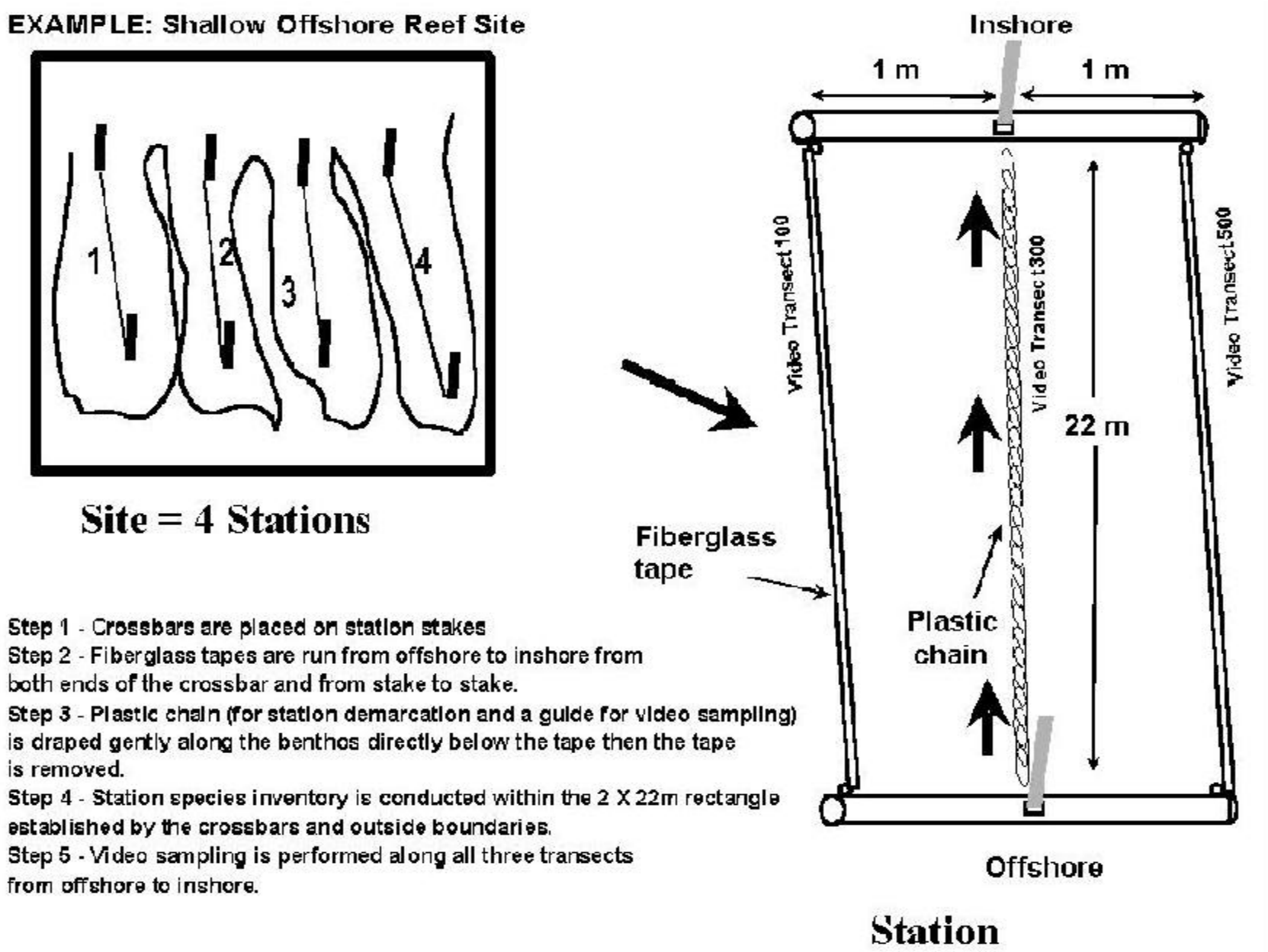
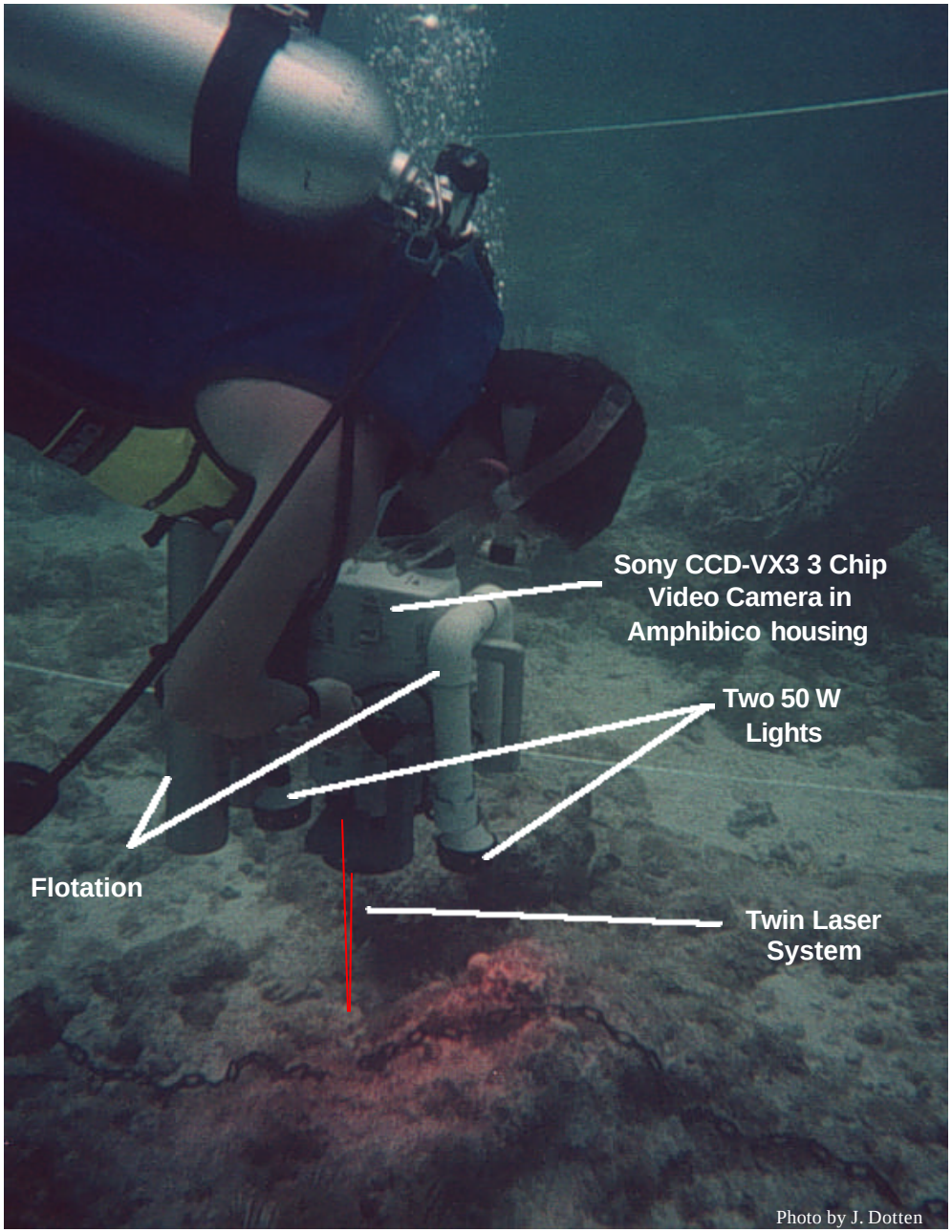


Figure 3. Coral reef / hardbottom monitoring project video data collection system



4. Station Species Inventory data form

Station Species Inventory Data Form
Coral Reef Monitoring Project

Mark an X in the small box right of species code to indicate presence.
Use codes to characterize conditions and diseases in species subbox.

H=Bleaching B=Black Band W=White Diseases O=Other Disease C=Confirmed Observation

A.cer	A.pal	A.agar	A.frag	A.lam	C.arb
C.nat	D.cyl	D. sto	D.cliv	D.lab	D.str
E.fas	F.frag	I.rig	I.sin	L.cuc	M.dec
M.mir	M.areo	M.mean	Mp.alc	Mp.com	M.ann
M.cav	My.ali	My.dan	My.fer	My.lam	M. ang
Mussid juv	O.dif	P.ame	P.ast	P.bran	P.por
S.cub	S.lac	S.bour	S.hyad	S.rad	S.sid
S.mich	Diadema (#)				

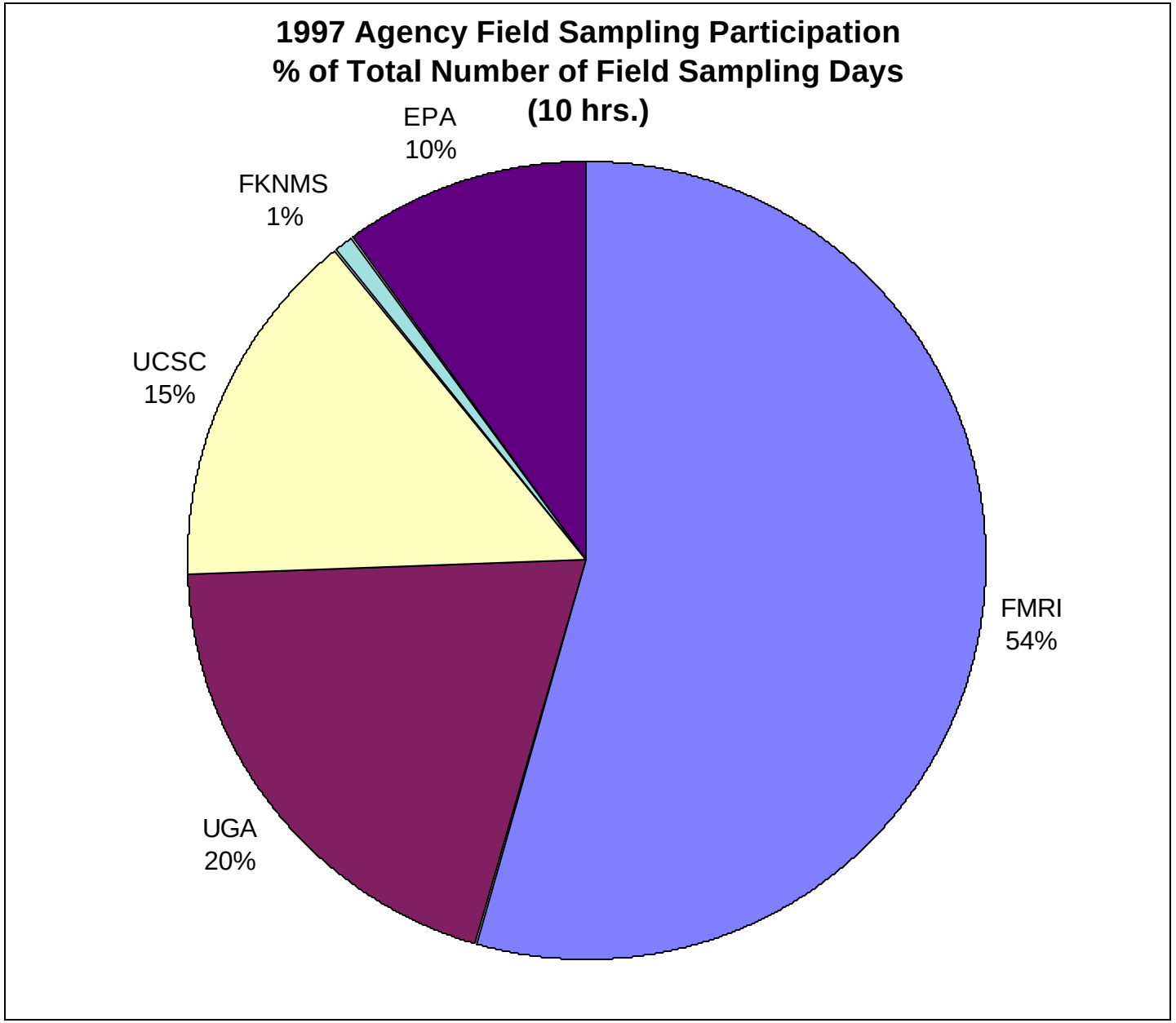
Site Code _____ Site Name _____ Station 1 2 3 4

Date_____ Collector _____ Start Time (hh:mm) ___:___ Stop___:___

Cross-Ref (name) _____ Data Entry (init.) _____ Date _____

Return Form to Project Manager for data entry and archive (REV7/99MEP).

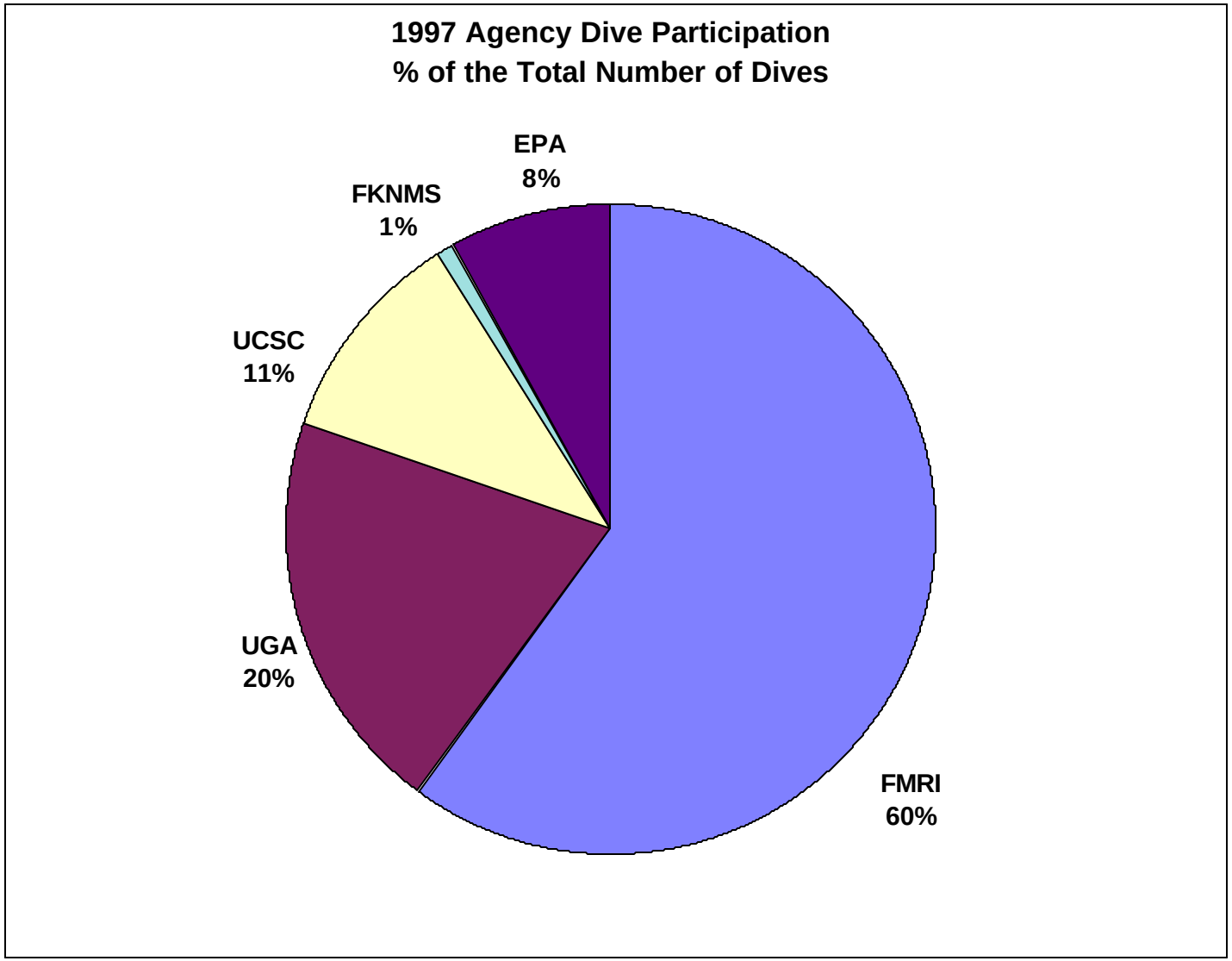
5. Agency field work distribution



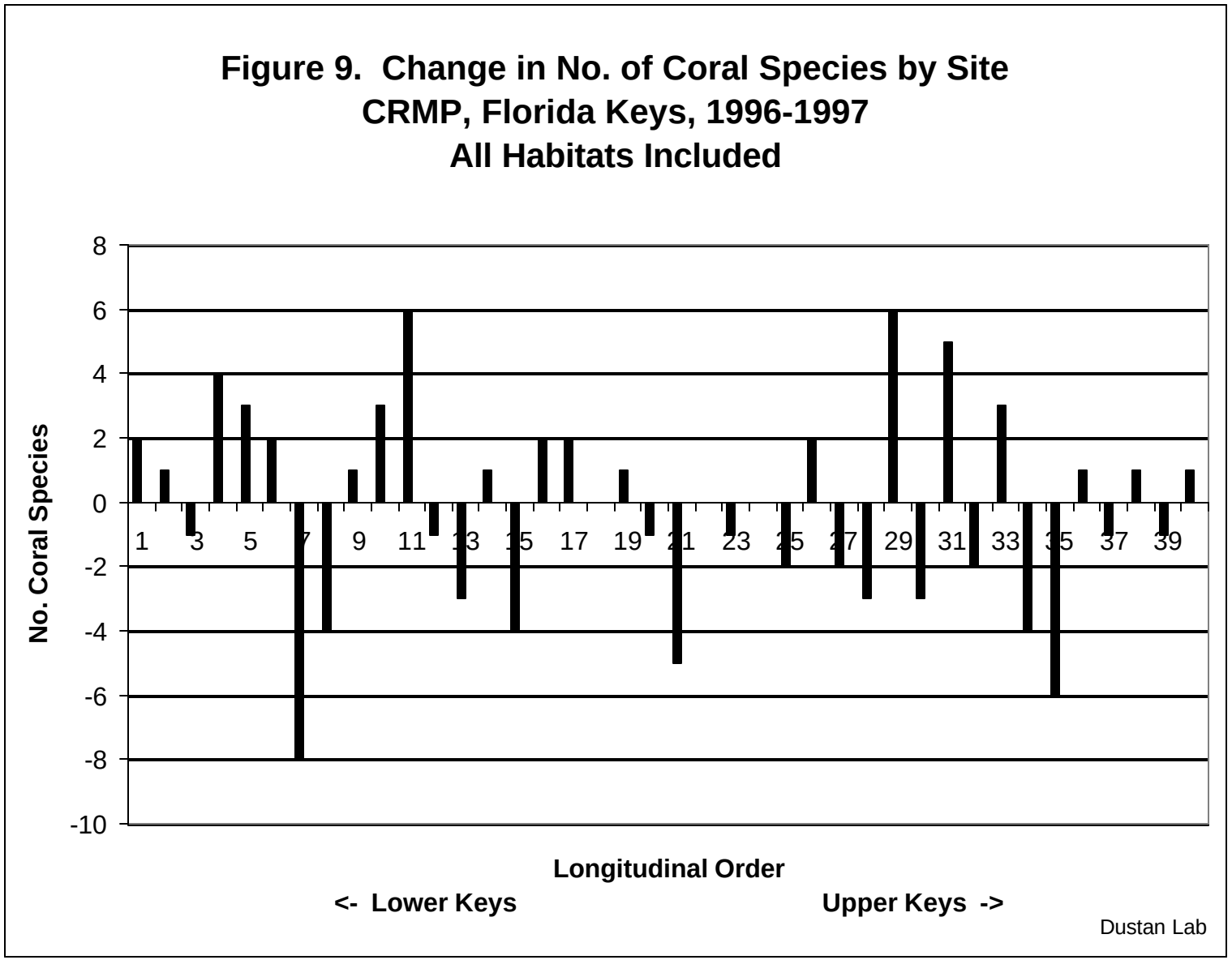
6. US/EPA OSV Anderson

7. Cruise participants

8. Agency dive effort distribution

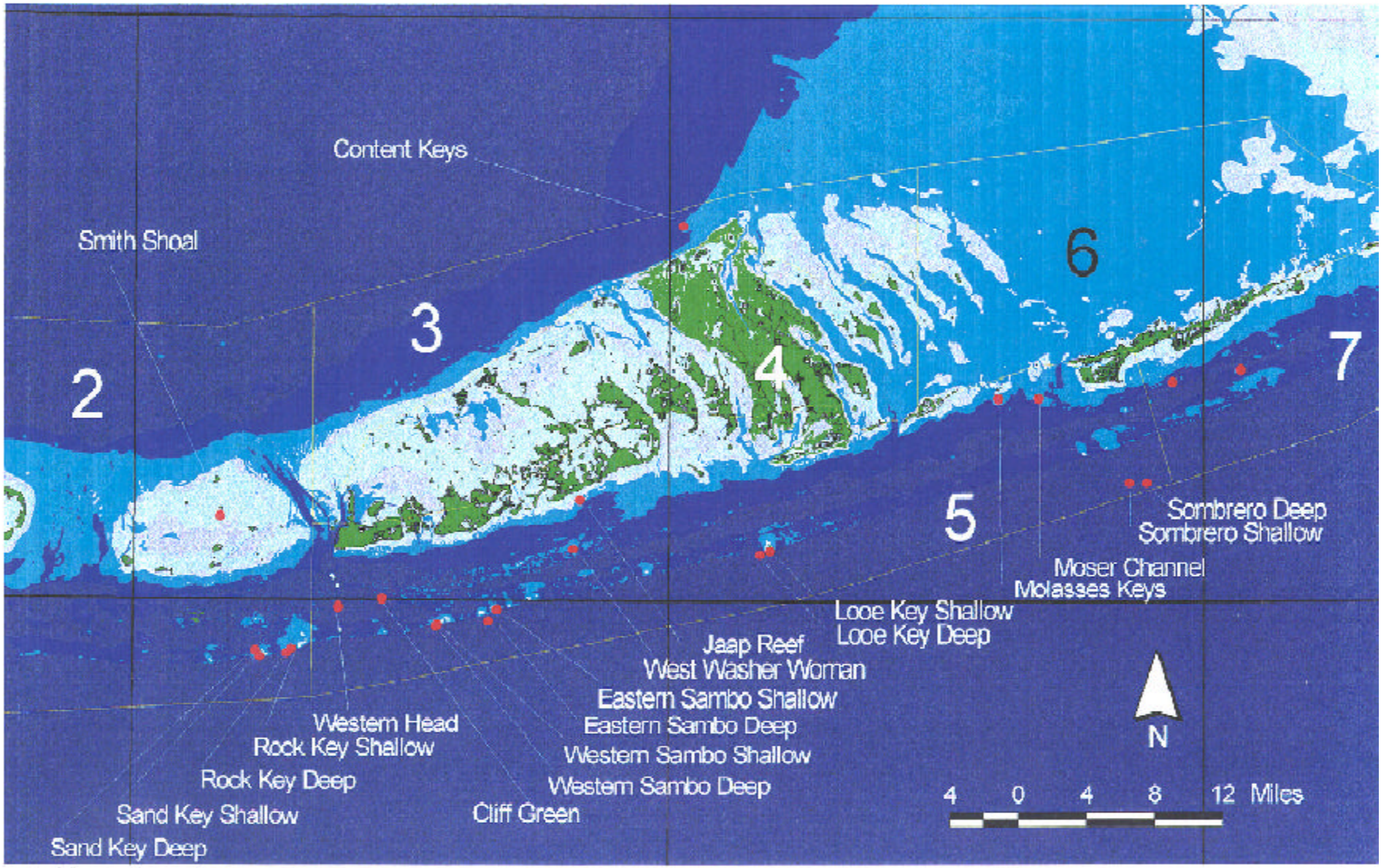


9. Change in number of species by site Sanctuary-wide, 1996-1997



10. Water Quality Segments 2, 3, and 5

Figure 10. Sampling Sites in Water Quality Segments 2, 3, & 5 (Key West).



Map by Matt Patterson - 8/98

11. Water Quality Segment 9

Figure 11. Sampling Sites in Water Quality Segment 9 (Key Largo).

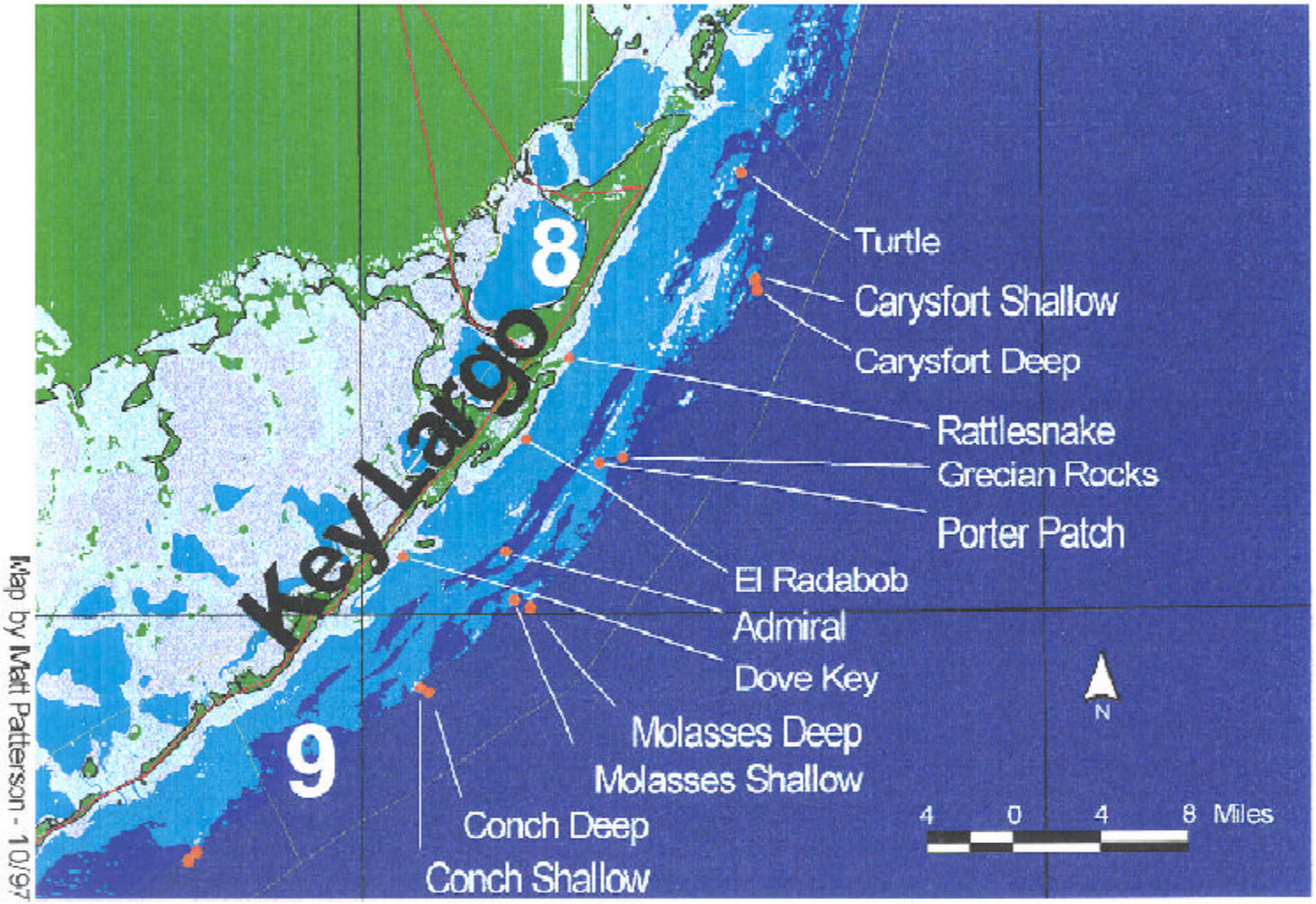
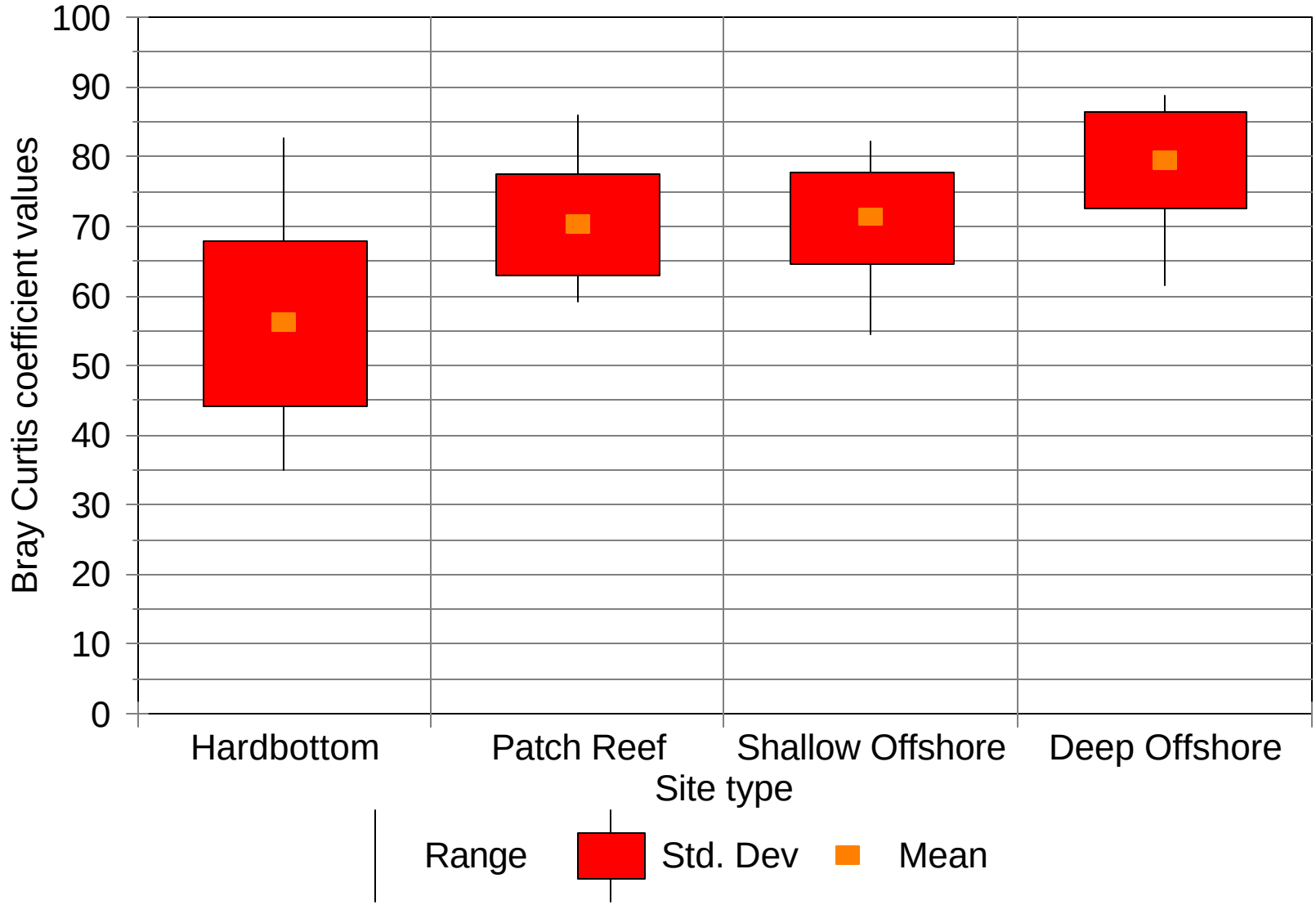
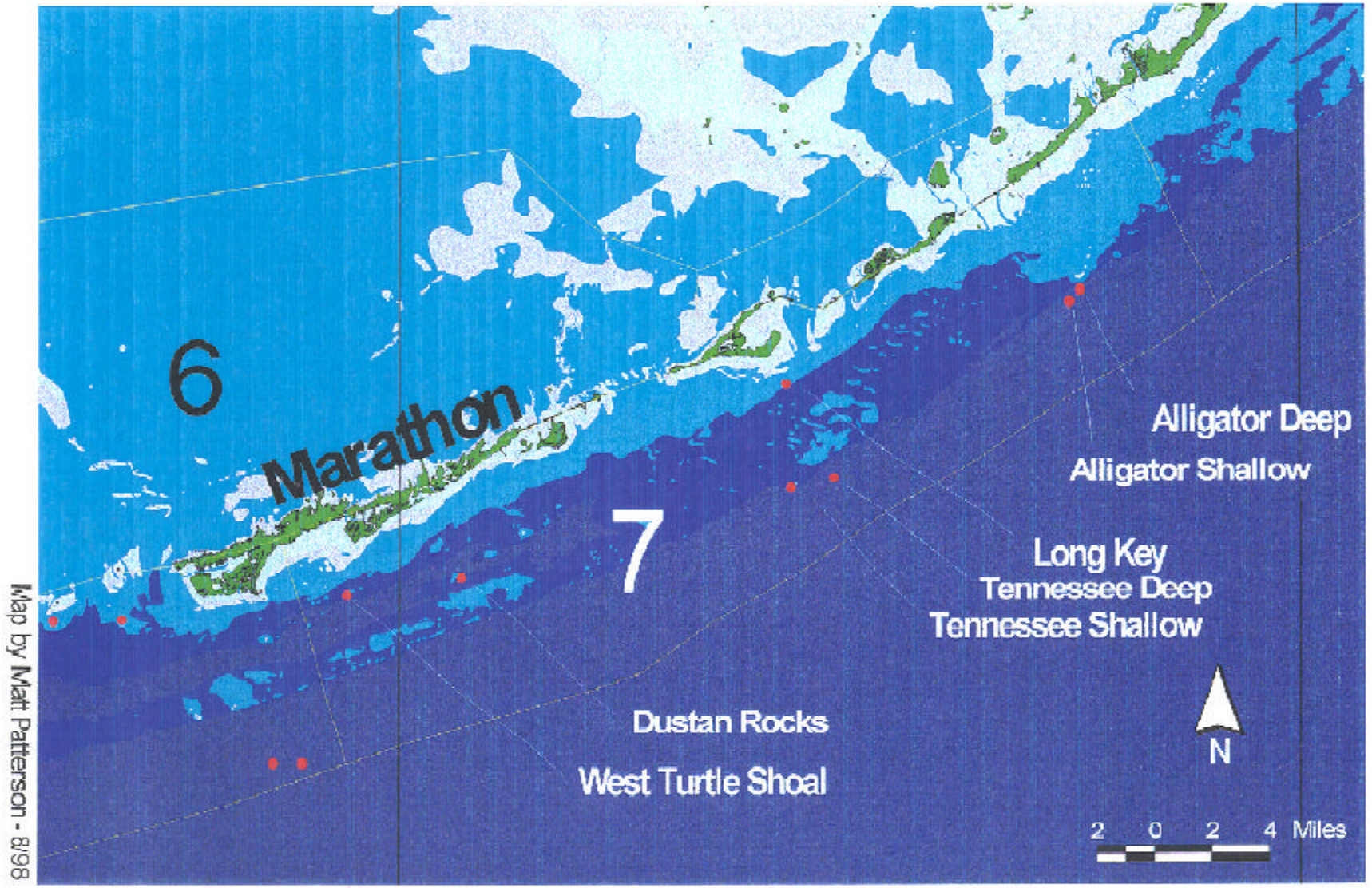


Figure 12. Similarity of Stony Coral taxa frequency of occurence, Station Species Inventory, Site type, 1996-1997.



13. Water Quality Segment 7

Figure 13. Sampling Sites in Water Quality Segment 7 (Marathon).

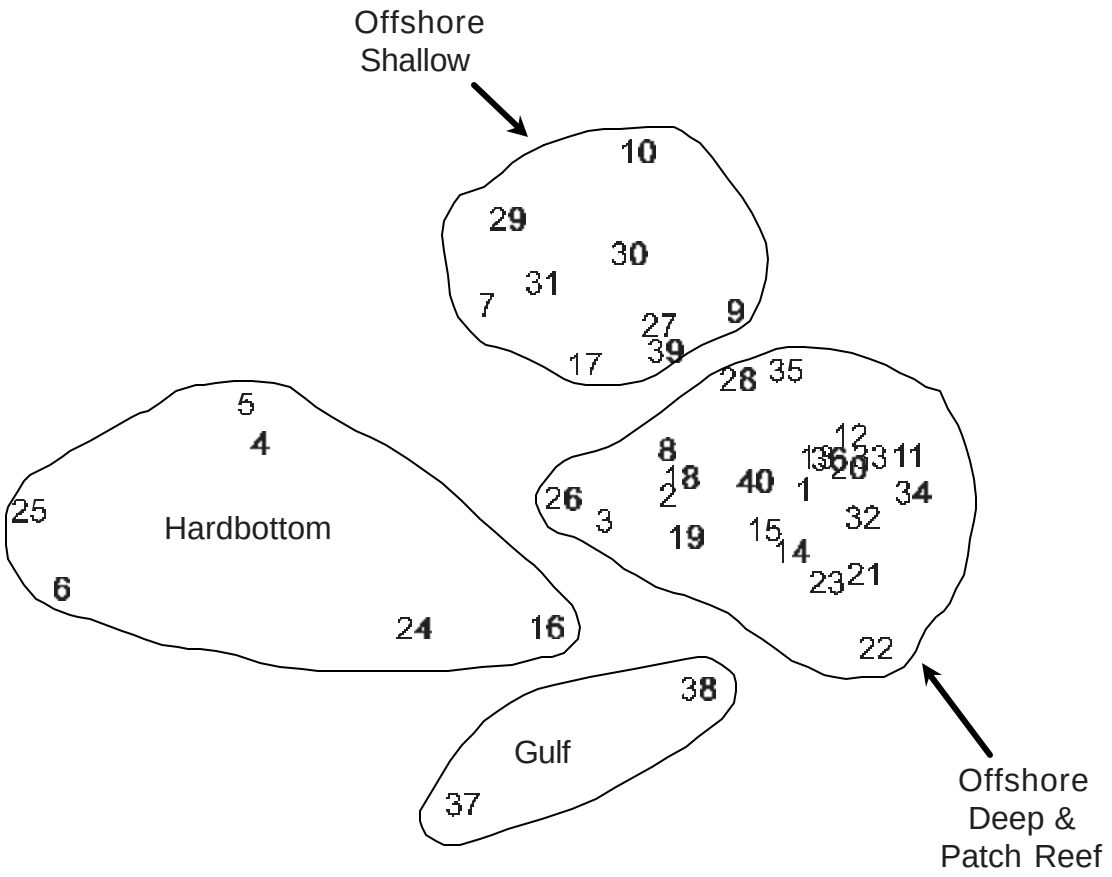


14. MDS ordination, coral species frequency of occurrence, all sites, 1997

Figure 14. MDS ordination, coral species frequency of occurence, all sites, 199

SITE LEGEND

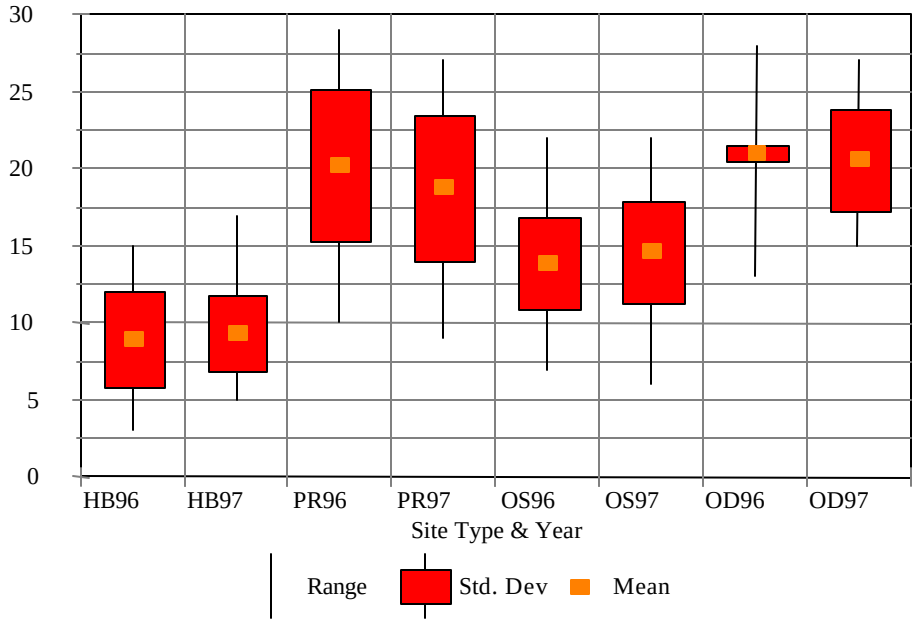
1 Turtle Patch Reef (9P1)
2 Porter Patch Reef (9P3)
3 Admiral Patch Reef (9P4)
4 Rattle Snake Hardbottom (9H1)
5 El Radabob Hardbottom (9H2)
6 Dove Key Hardbottom (9H3)
7 Carysfort Reef Offshore Shallow (9S1)
8 Grecian Rocks Reef Offshore Shallow (9S2)
9 Molasses Reef Offshore Shallow (9S3)
10 Conch Reef Offshore Shallow (9S4)
11 Carysfort Reef Offshore Deep (9D1)
12 Molasses Reef Offshore Deep (9D3)
13 Conch Reef Offshore Deep (9D4)
14 West Turtle Shoal Patch Reef (7P1)
15 Dustan Rocks Patch Reef (7P2)
16 Long Key Hardbottom (7H2)
17 Alligator Reef Offshore Shallow (7S1)
18 Tennessee Reef Offshore Shallow (7S2)
19 Alligator Reef Offshore Deep (7D1)
20 Tennessee Reef Offshore Deep (7D2)
21 West Washer Woman Patch Reef (5P1)
22 Western Head Patch Reef (5P2)
23 Cliff Green Patch Reef (5P3)
24 Moser Channel Hardbottom (5H1)
25 Molasses Keys Hardbottom (5H2)
26 Jaap Reef Hardbottom (5H3)
27 Sombrero Reef Offshore Shallow (5S1)
28 Looe Key Reef Offshore Shallow (5S2)
29 Eastern Sambo Reef Offshore Shallow (5S3)
30 Western Sambo Reef Offshore Shallow (5S4)
31 Rock Key Reef Offshore Shallow (5S5)
32 Sombrero Reef Offshore Deep (5D1)
33 Looe Key Reef Offshore Deep (5D2)
34 Eastern Sambo Reef Offshore Deep (5D3)
35 Western Sambo Reef Offshore Deep (5D4)
36 Rock Key Reef Offshore Deep (5D5)
37 Content Keys Hardbottom (3H1)
38 Smith Shoal Patch Reef (2P1)
39 Sand Key Reef Offshore Shallow (2S1)
40 Sand Key Reef Offshore Deep (2D1)



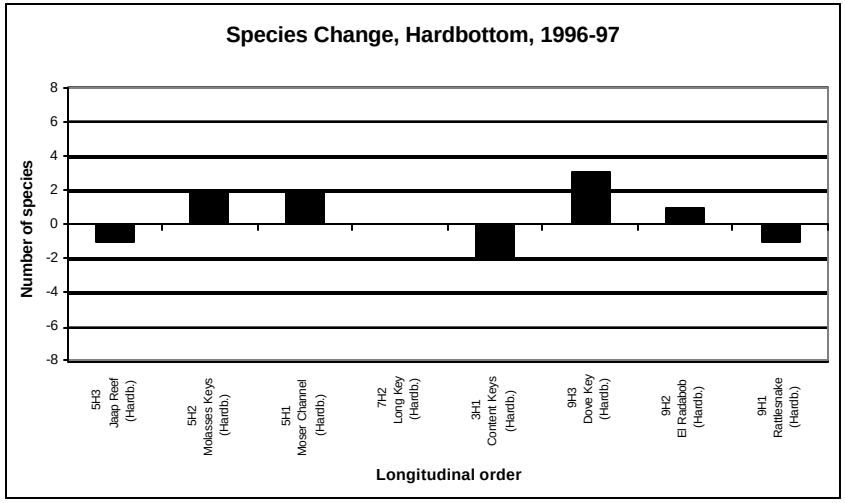
Stress = 0.11

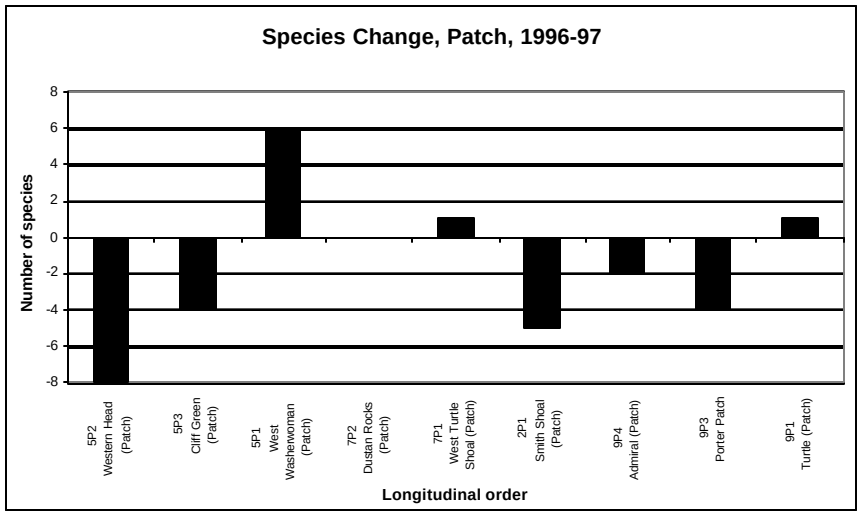
15. Comparison of coral taxonomic richness by types 1996-1997

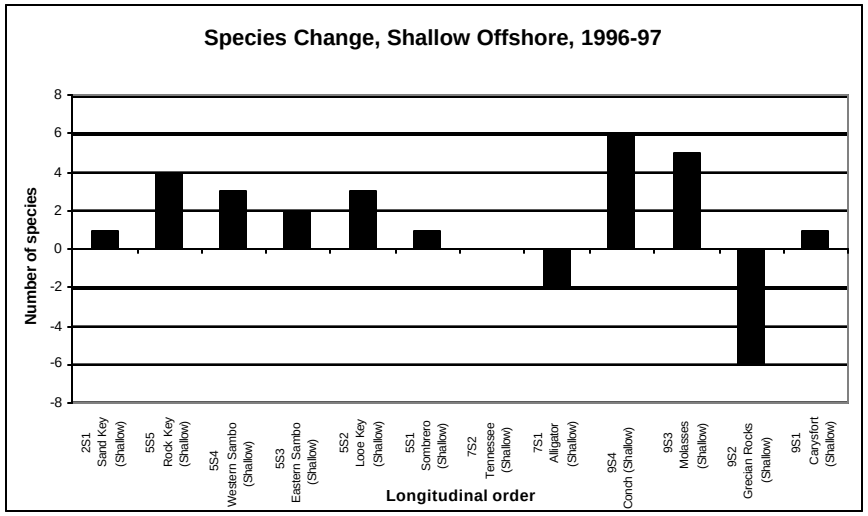
Figure 15. Comparison of Stony coral taxonomic richness by site type 1996-1997

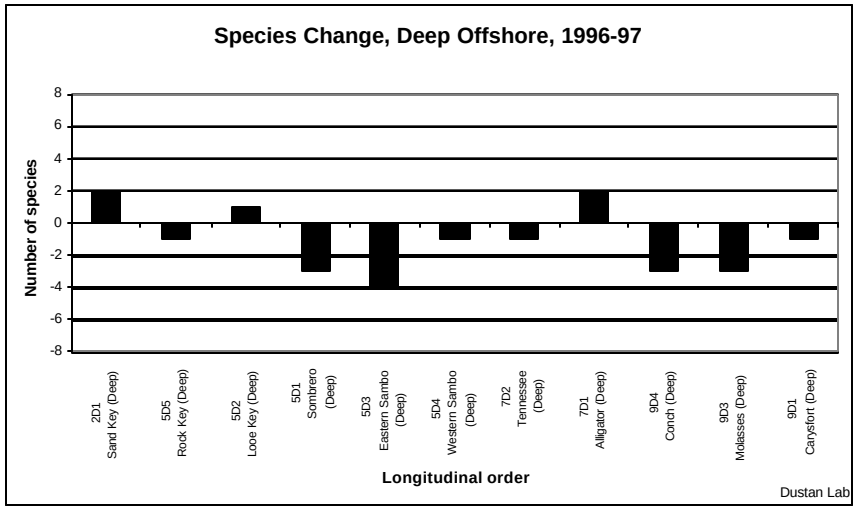


16 a. Change in number of species within site types, Sanctuary-wide, 1996-1997

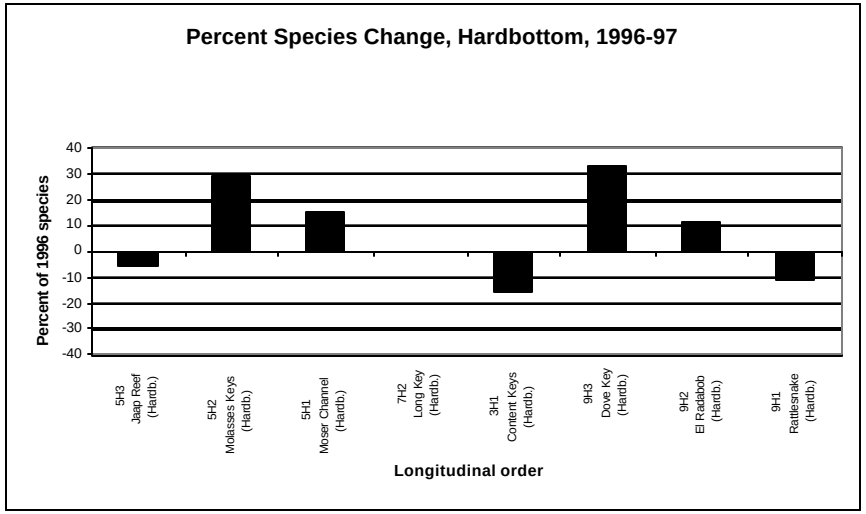


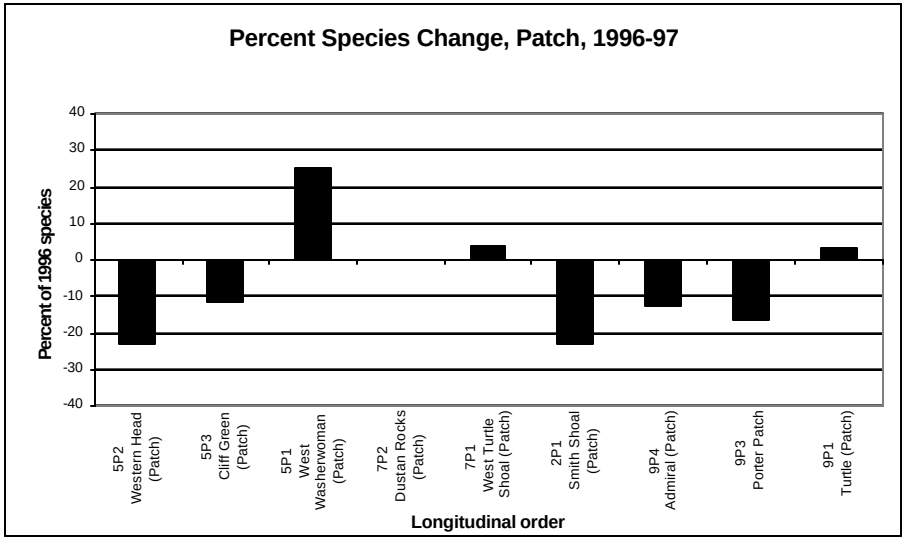


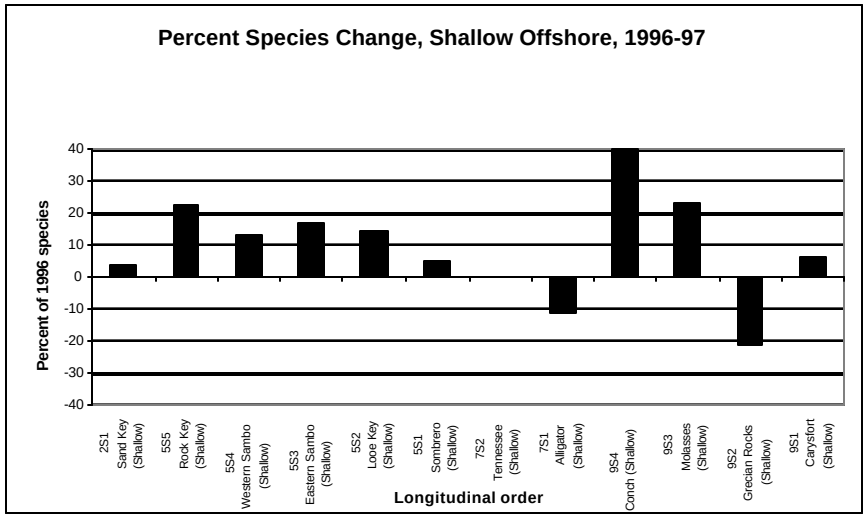


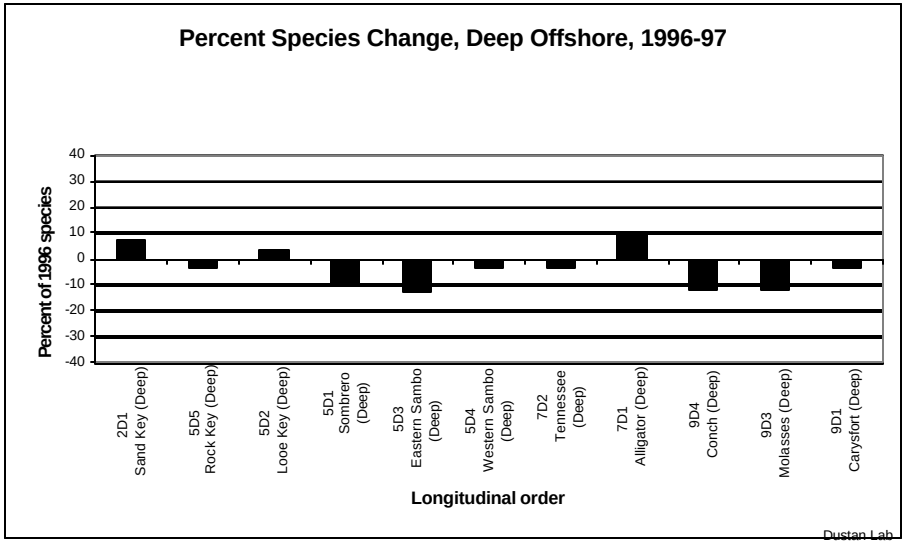


16 b. Percent change in species number within site types, Sanctuary-wide, 1996-1997



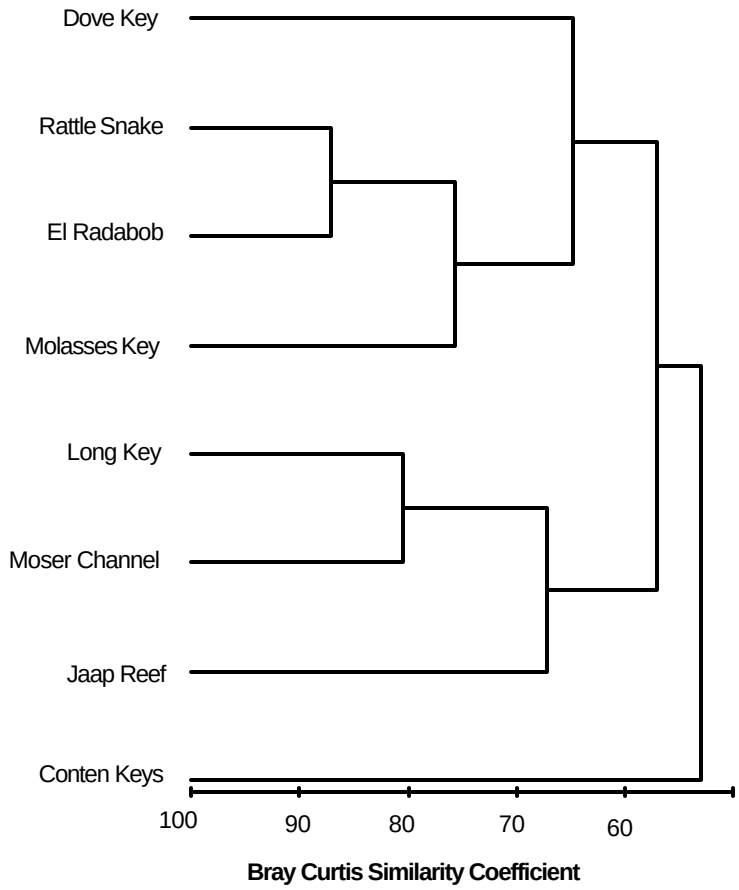






17. Classification of coral taxa frequency of occurrence, hardbottom sites, 1977

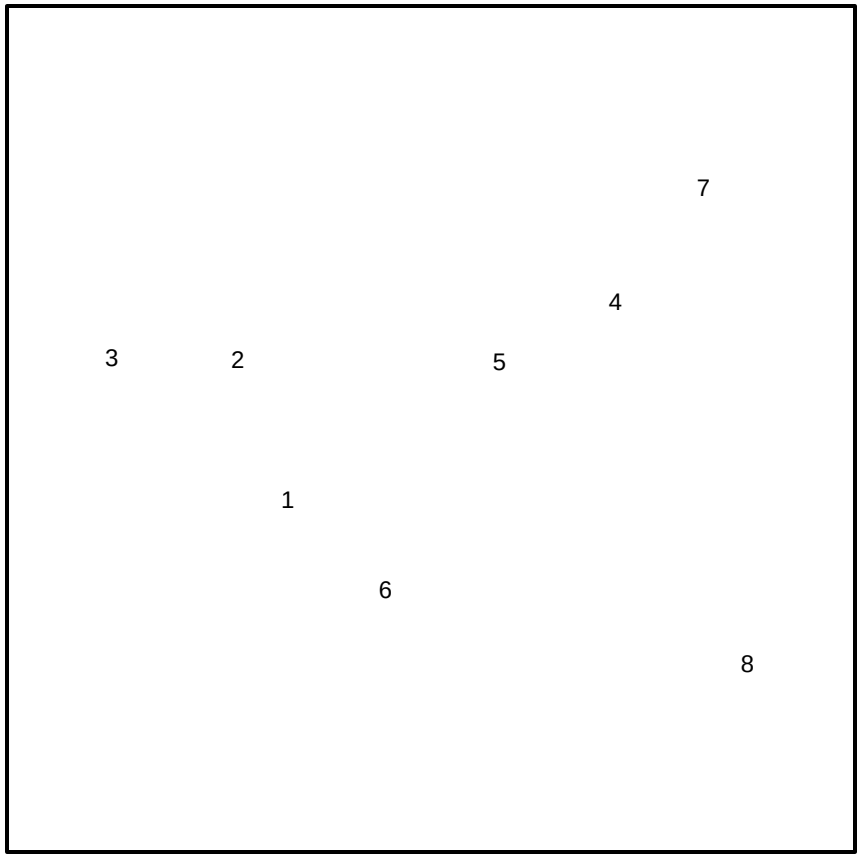
Figure 17. Similarity of Hardbottom Sites 1997, Species Inventory, Frequency of Occurrence



18. MDS ordination, hardbottom sites, 1977

Figure 18. Ordination (MDS) of Hardbottom Sites, Species Inventory, Frequency of Occurrence, 1997

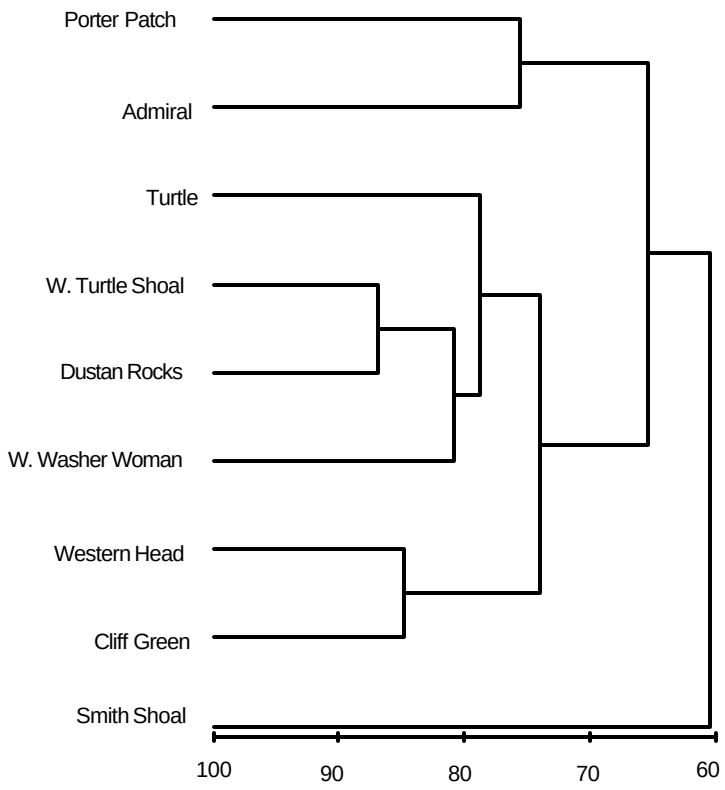
1= Rattle Snake
2= El Radabob
3= Dove Key
4= Long Key
5= Moser Channel
6= Molasses Keys
7= Jaap Reef
8= Content Keys



Stress= 0.05

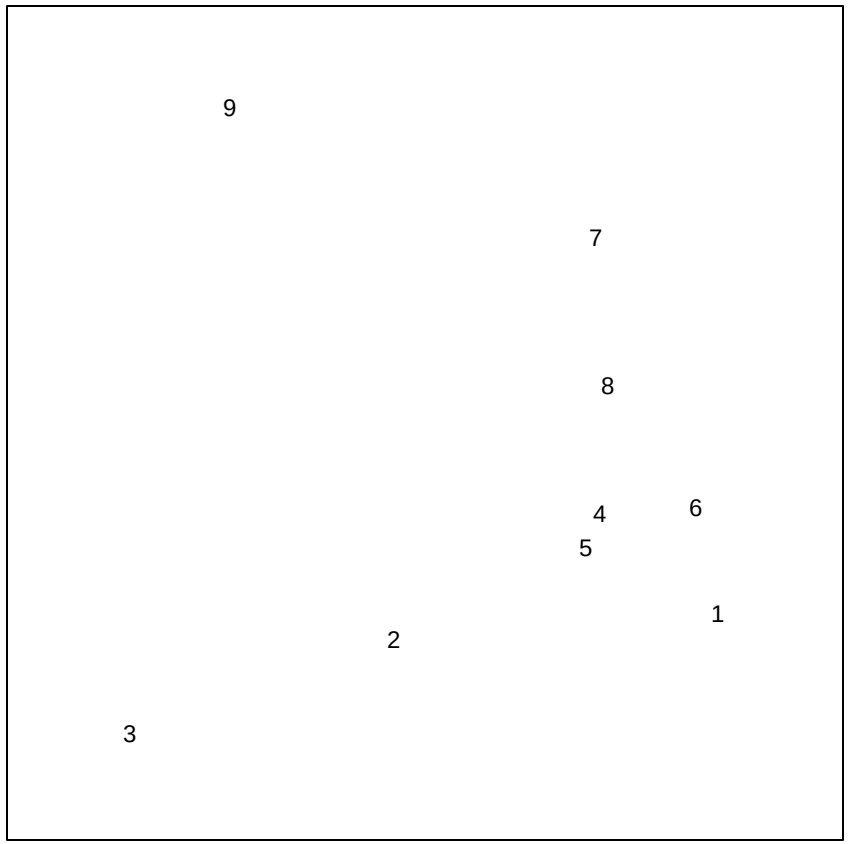
19. Classification of coral taxa frequency of occurrence, patch reef sites, 1997

Figure 19. Similarity of Patch reef Sites 1997, Species Inventory, Frequency of Occurrence



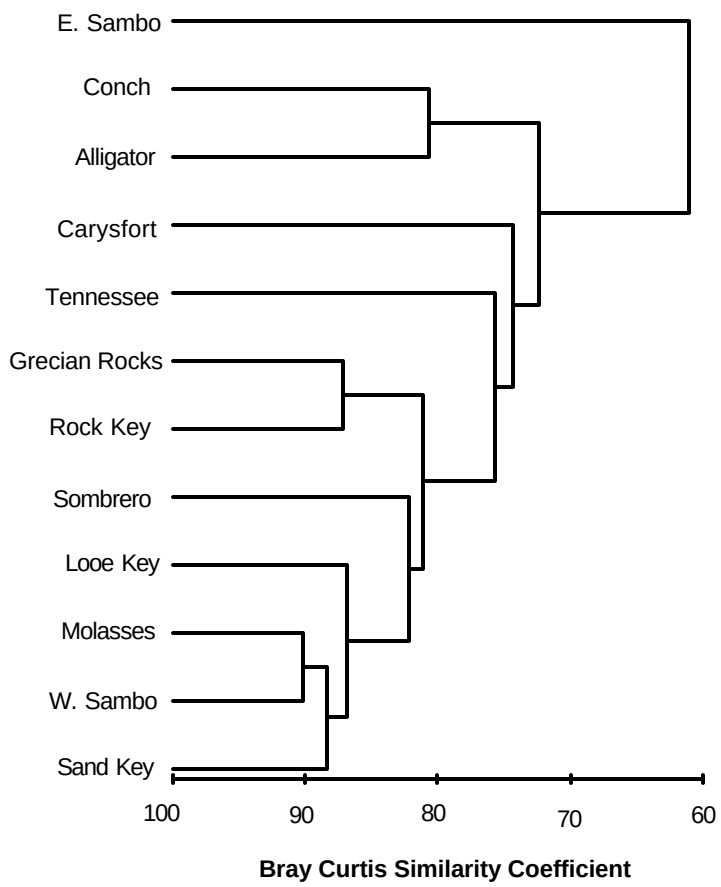
20. MDS ordination, patch reef sites, 1997

Figure 20. Ordination (MDS) of Patch Reef Sites, Species Inventory, Frequency of Occurrence, 1997



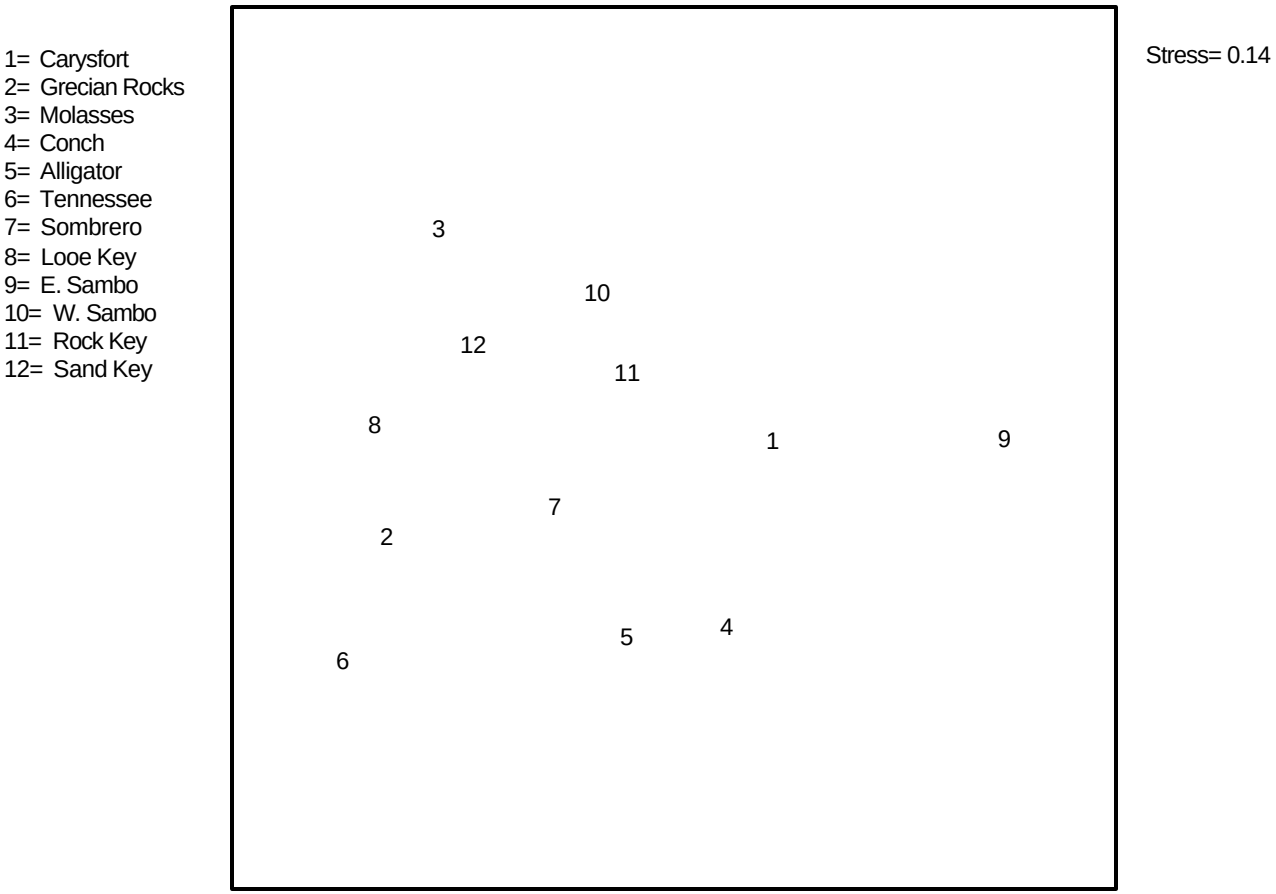
21. Classification of coral taxa frequency of occurrence, offshore shallow sites, 1997

Figure 21. Comparison of Coral Taxa Frequency of Occurrence, Shallow Reef Sites, 1997



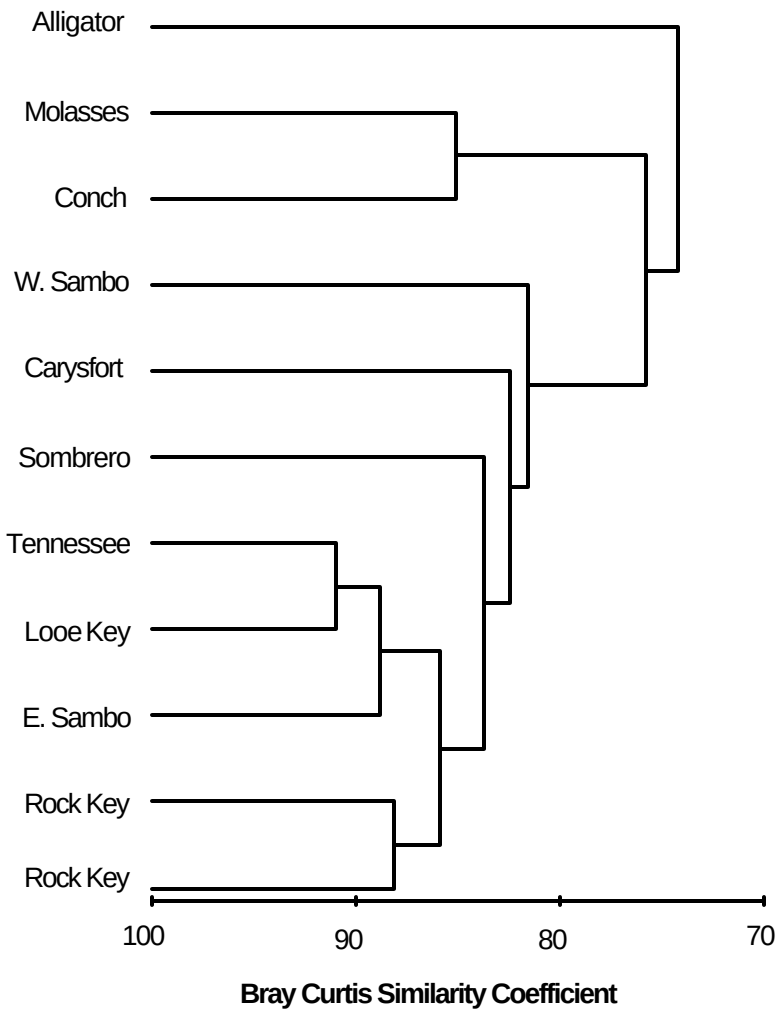
22. MDS ordination, offshore shallow sites, 1997

Figure 22. Ordination (MDS) of Offshore Shallow Sites, Species Inventory, Frequency of Occurrence, 1997



23. Classification of coral taxa frequency of occurrence, offshore deep sites, 1997

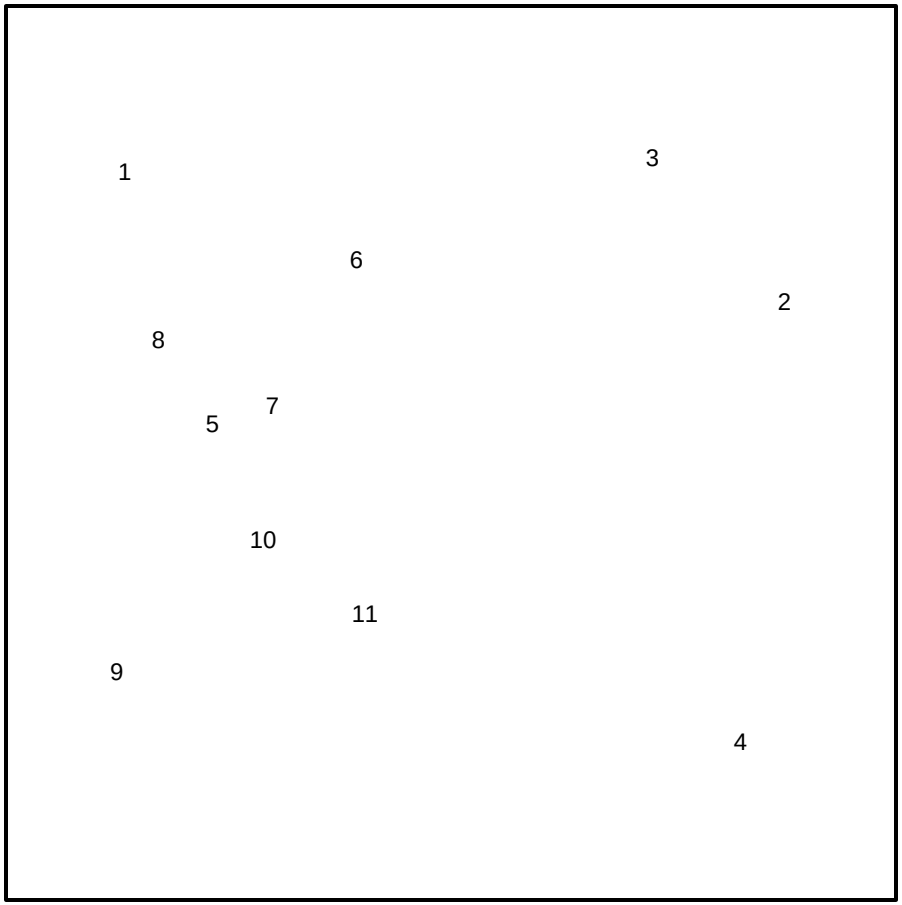
Figure 23. Comparison of Coral Taxa Frequency of Occurrence, Deep Reef sites, 1997



24. MDS ordination, offshore deep sites, 1997

Figure 24. Ordination (MDS) of Offshore Deep Sites, Species Inventory, Frequency of Occurrence, 1997.

1= Carysfort
2= Molasses
3= Conch
4= Alligator
5= Tennessee
6= Sombrero
7= Looe Key
8= E. Sambo
9= W. Sambo
10= Rock Key
11= Sand Key



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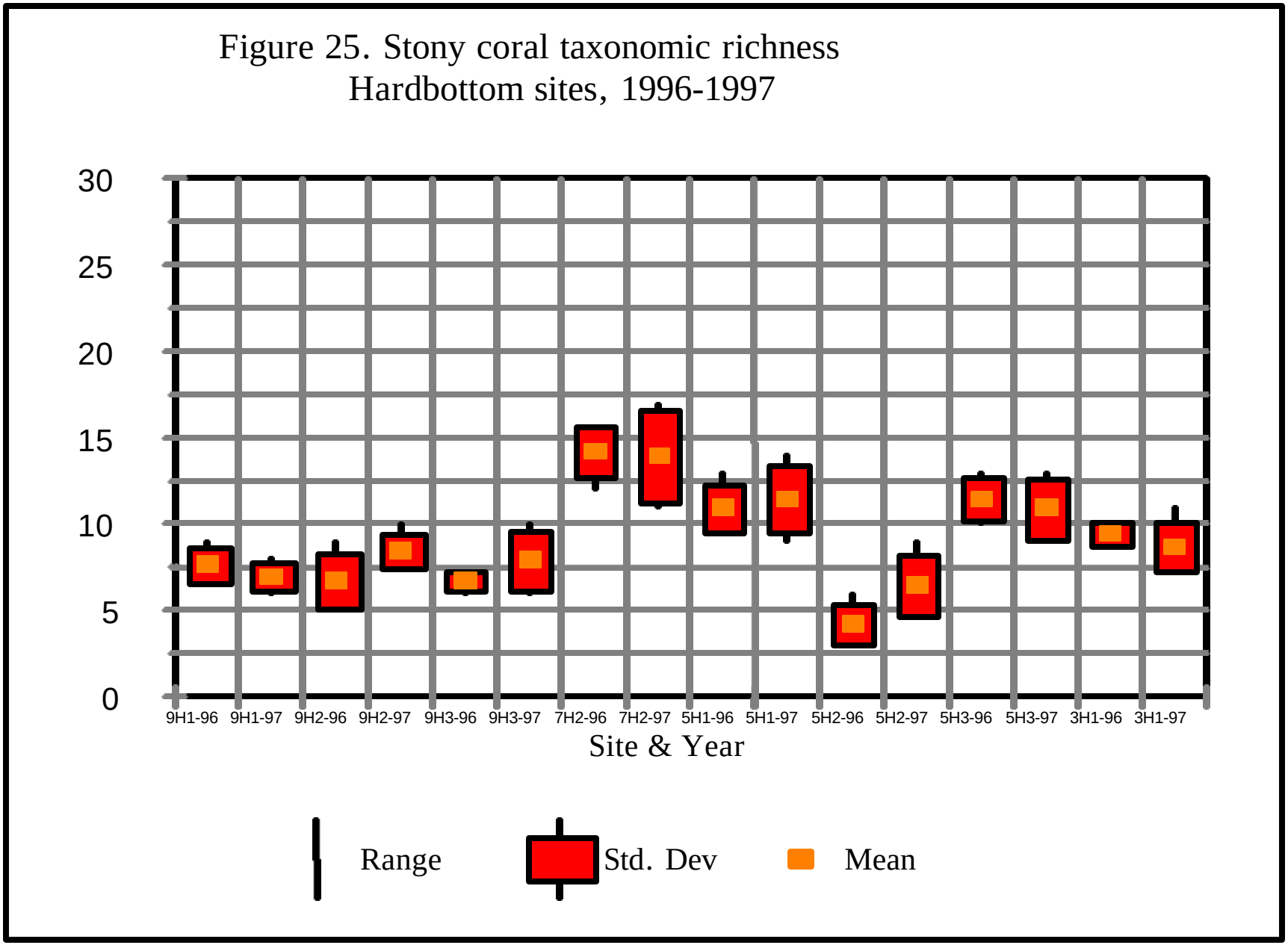
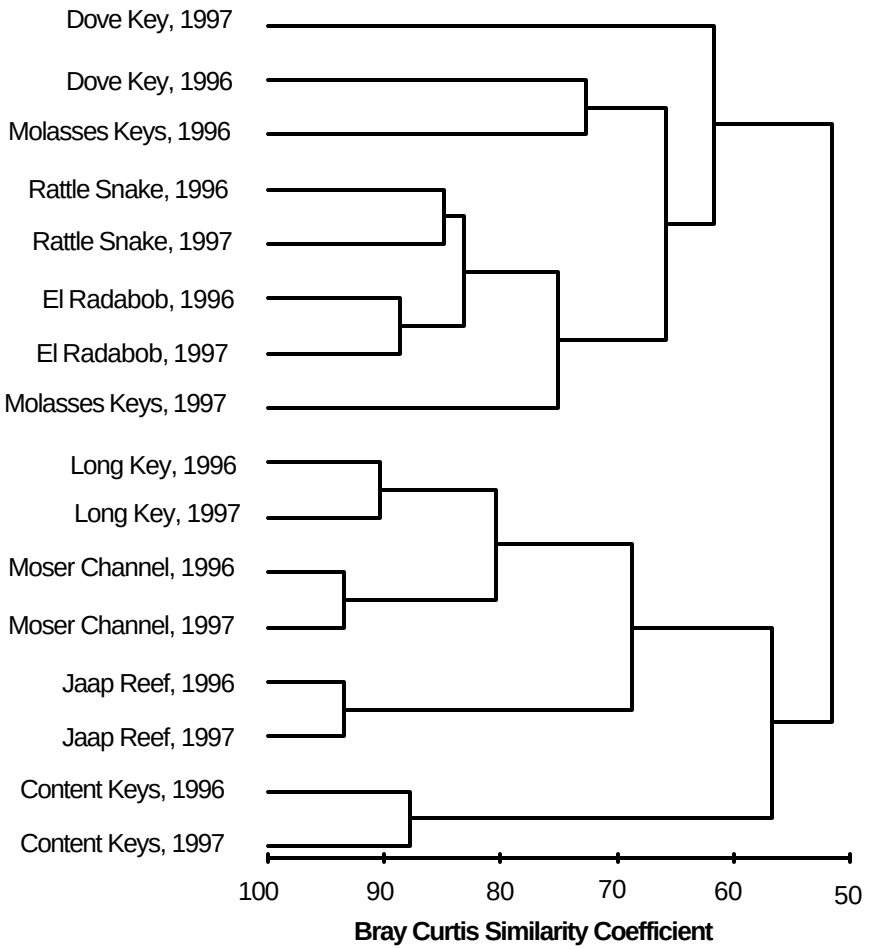


Figure 25. Stony coral taxonomic richness
Hardbottom sites, 1996-1997
30
25
20
15
10
5
0
9H1-96
9H1-97
9H2-96
9H2-97
9H3-96
9H3-97
7H2-96
7H2-97
5H1-96
5H1-97
5H2-96
5H2-97
5H3-96
5H3-97
3H1-96
3H1-97
Site & Year
Range
Std. Dev
Mean

26. Classification of coral taxa frequency of occurrence, hardbottom sites, 1996-1997

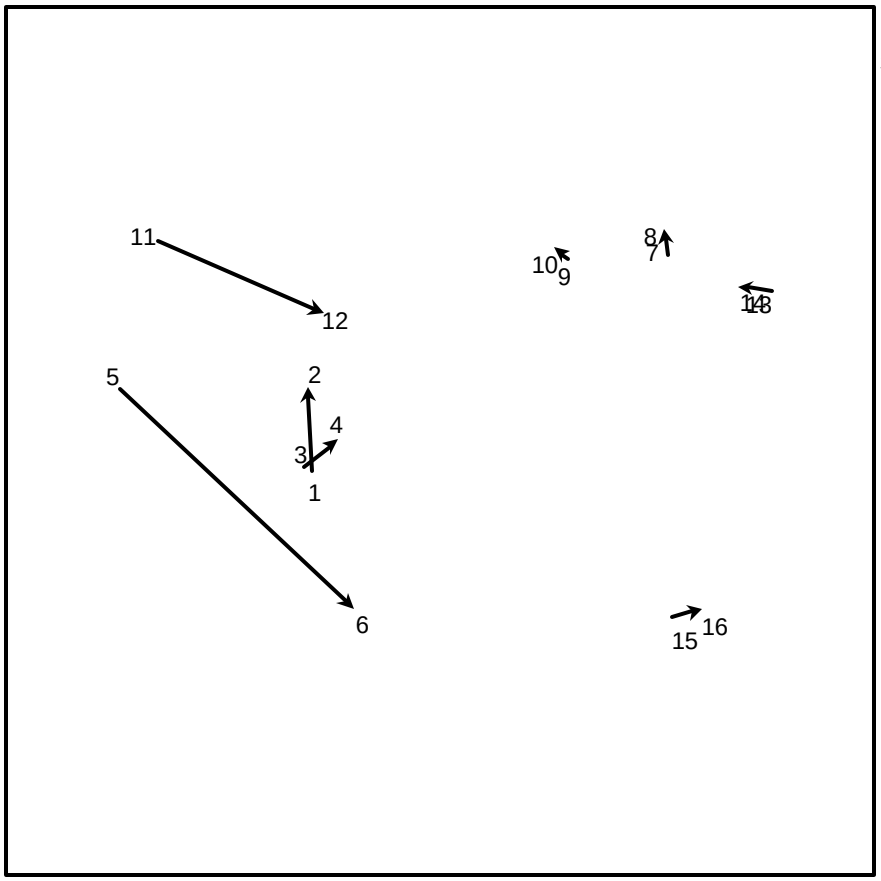
Figure 26. Similarity of Hard Bottom Sites, Species Inventory, Frequency of Occurrence, 1996 - 1997



27. MDS ordination, hardbottom sites 1996-1997

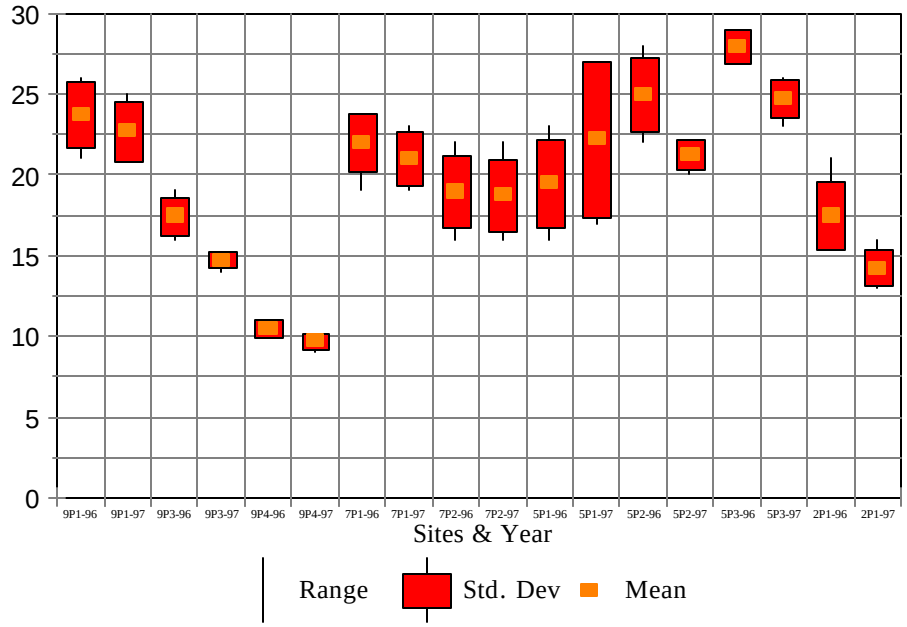
Figure 27. Ordination (MDS) of Hard Bottom Sites, Species Inventory, Frequency of Occurrence, 1996 - 1997

1= Rattle Snake Key, 1996
2= Rattle Snake Key, 1997
3= El Radabob Key, 1996
4= El Radabob Key, 1997
5= Dove Key, 1996
6= Dove Key, 1997
7= Long Key, 1996
8= Long Key, 1997
9= Moser Channel, 1996
10= Moser Channel, 1997
11= Molasses Key, 1996
12= Molasses Key, 1997
13= Jaap Reef, 1996
14= Jaap Reef, 1997
15= Content Keys, 1996
16= Content Keys, 1997



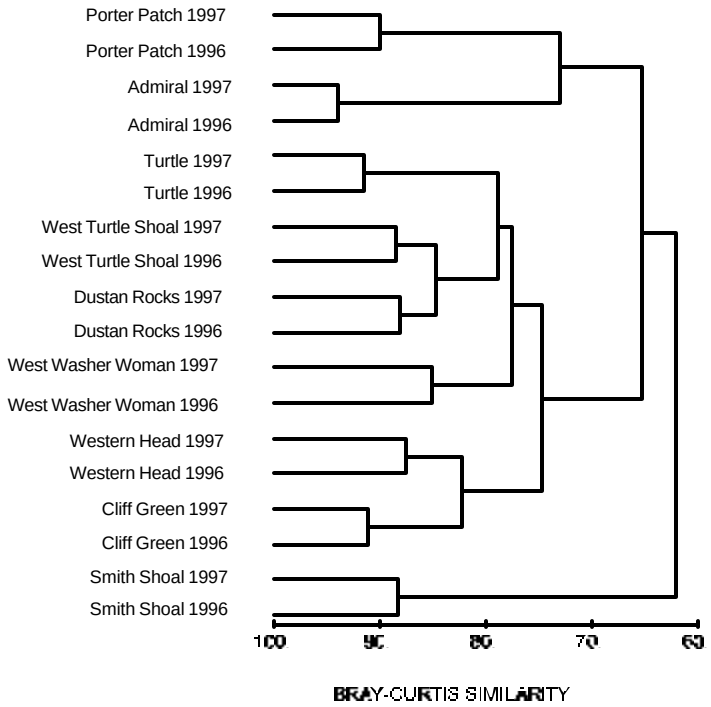
28. Coral taxonomic richness, patch reef sites, 1996-1997

Figure 28. Stony coral taxonomic richness
Patch reef sites, 1996-1997



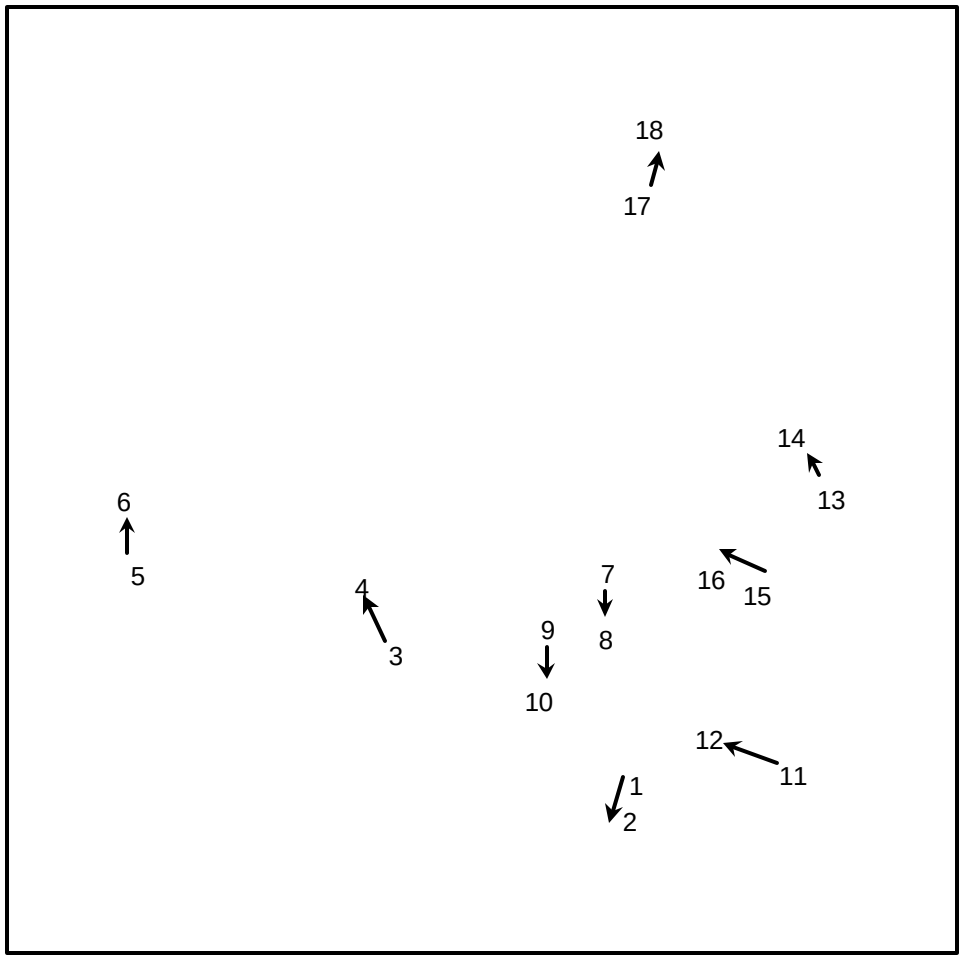
29. Classification of coral taxa frequency of occurrence, patch reef sites, 1996-1997

Figure 29. Comparison of Coral Taxa Frequency of Occurrence, Patch Reef Sites, 1996 - 1997.

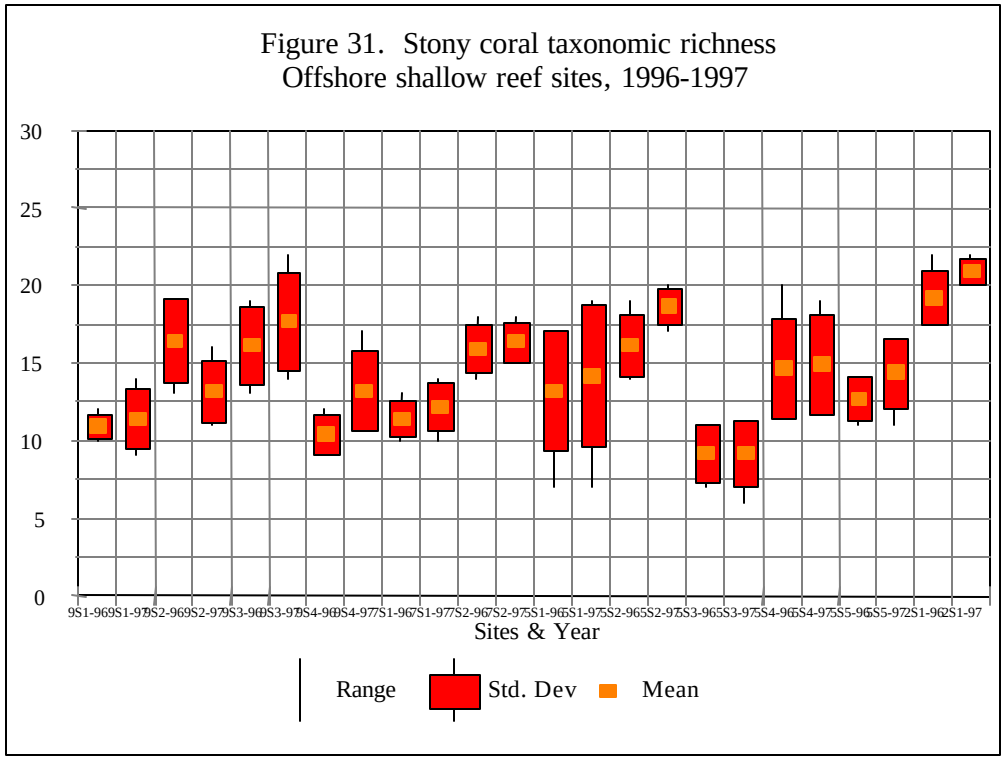


30. MDS ordination, patch reef sites, 1996-1997

Figure 30. Ordination (MDS) of Patch Reef Sites, Species Inventory, Frequency of Occurrence, 1996 - 1997

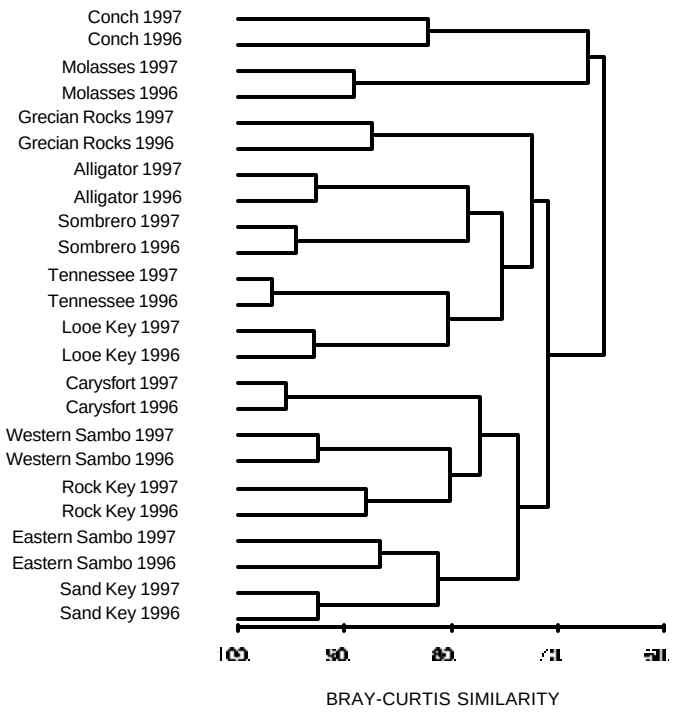


31. Coral taxonomic richness, offshore shallow sites, 1996-1997



32. Classification of coral taxa frequency of occurrence, offshore shallow sites, 1996-1997

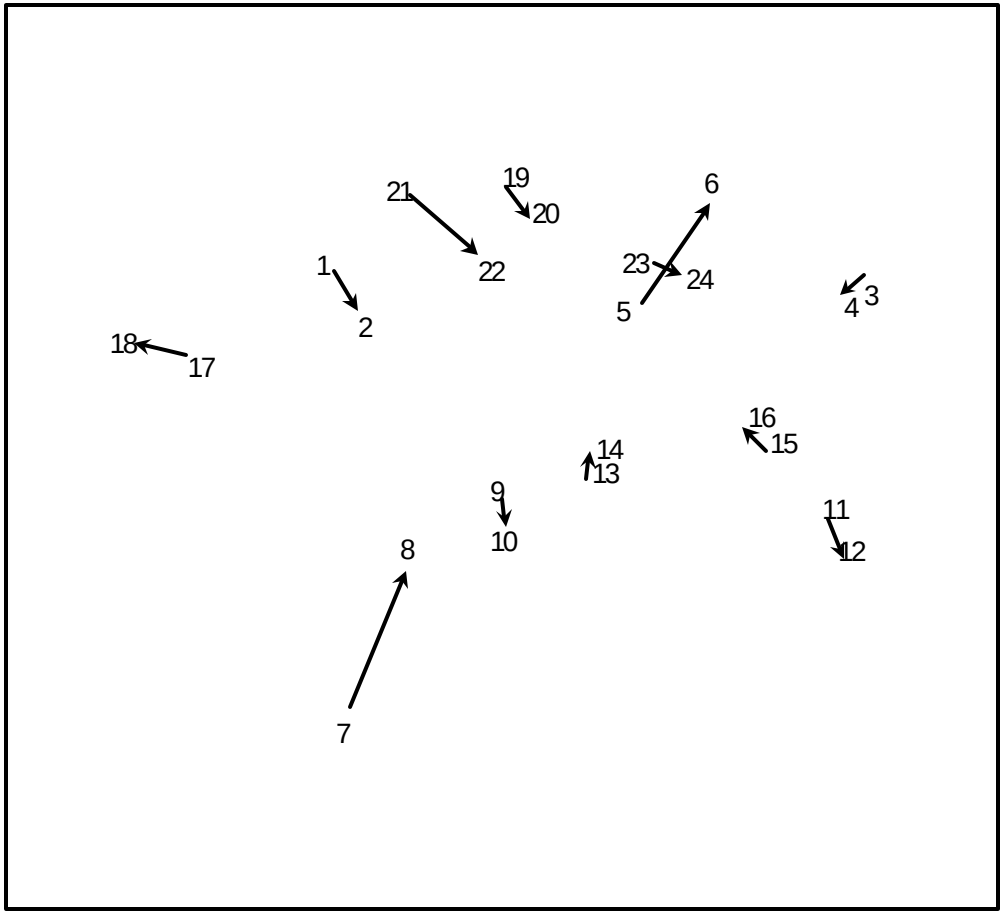
Figure 32. Comparison of Coral Taxa Frequency of Occurrence, Offshore Shallow Sites, 1996 - 1997



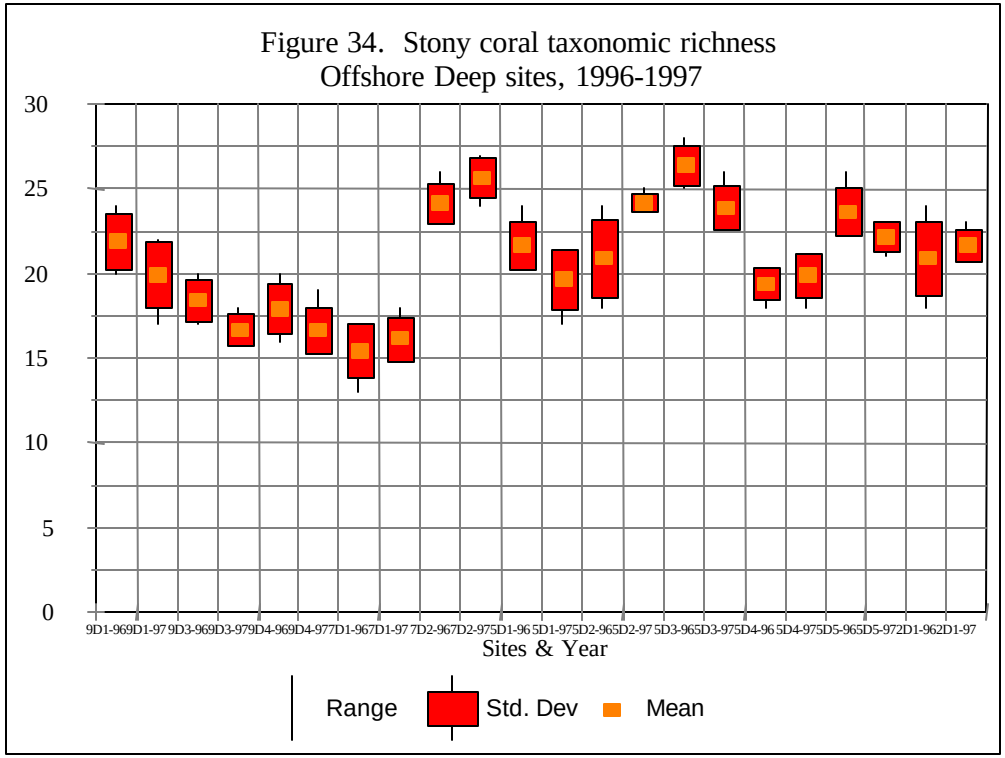
33. MDS ordination, offshore shallow sites, 1996-1997

Figure 33. Ordination (MDS) of Offshore Shallow Sites, Species Inventory, Frequency of Occurrence, 1996 - 1997

1= Carysfort, 1996
2= Carysfort, 1997
3= Grecian Rocks, 1996
4= Grecian Rocks, 1997
5= Molasses, 1996
6= Molasses, 1997
7= Conch, 1996
8= Conch, 1997
9= Alligator, 1996
10= Alligator, 1997
11= Tennessee, 1996
12= Tennessee, 1997
13= Sombrero, 1996
14= Sombrero, 1997
15= Looe Key, 1996
16= Looe Key, 1997
17= E. Sambo, 1996
18= E. Sambo, 1997
19= W. Sambo, 1996
20= W. Sambo, 1997
21= Rock Key, 1996
22= Rock Key, 1997
23= Sand Key, 1996
24= Sand Key, 1997

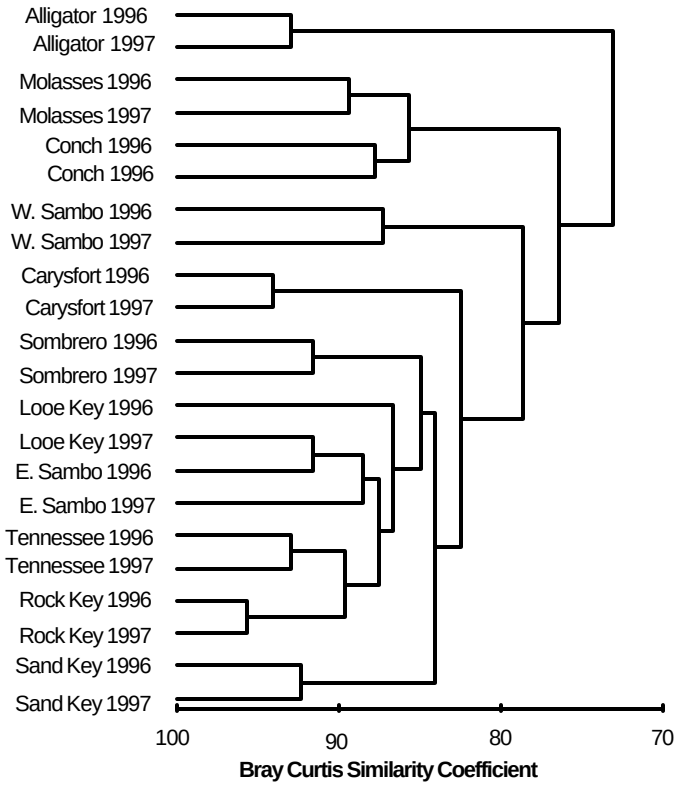


34. Coral taxonomic richness, offshore deep sites, 1996-1997



35. Classification of coral taxa frequency of occurrence, offshore deep sites, 1996-1997

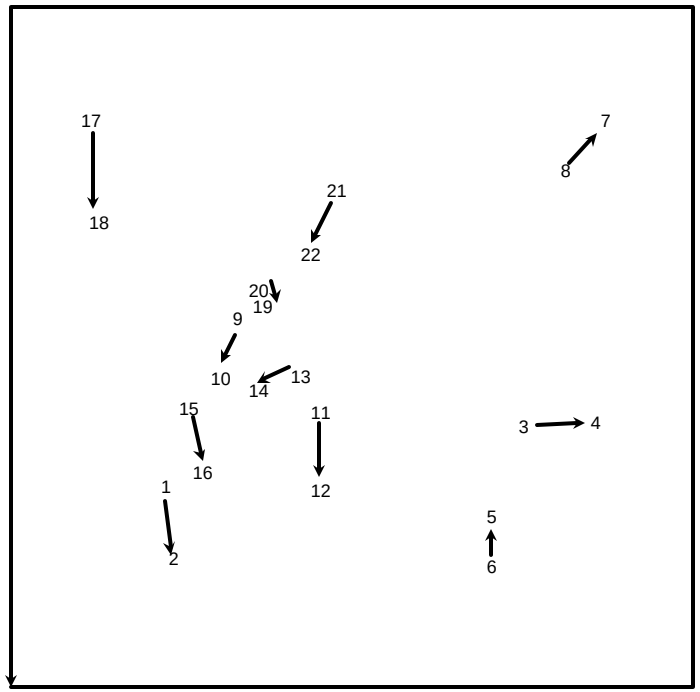
Figure 35. Similarity of Offshore Deep Sites, Species Inventory, Frequency of Occurrence, 1996 - 1997



36. MDS ordination, offshore deep sites, 1996-1997.

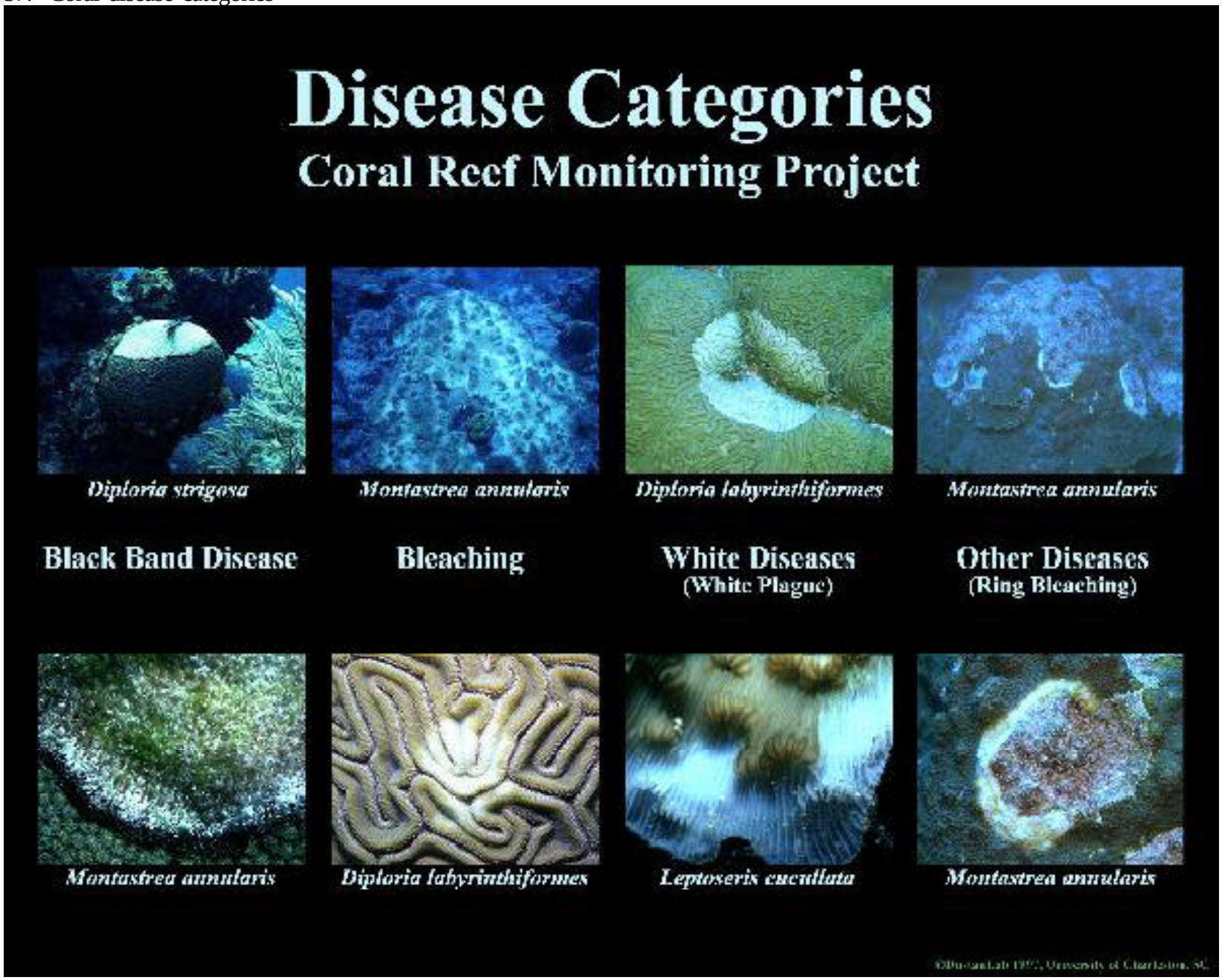
Figure 36. Ordination (MDS) 0f Offshore Deep Sites, Species Inventory, Frequency of Occurrence, 1996 - 1997

1= Carysfort, 1996
2= Carysfort, 1997
3= Molasses, 1996
4= Molasses, 1997
5= Conch, 1996
6= Conch, 1997
7= Alligator, 1996
8= Alligator, 1997
9= Tennessee, 1996
10= Tennessee, 1997
11= Sombrero, 1996
12= Sombrero, 1997
13= Looe Key, 1996
14= Looe Key, 1997
15= E. Sambo, 1996
16= E. Sambo, 1997
17= W. Sambo, 1996
18= W. Sambo, 1997
19= Rock Key, 1996
20= Rock Key, 1997
21= Sand Key, 1996
22= Sand Key, 1997

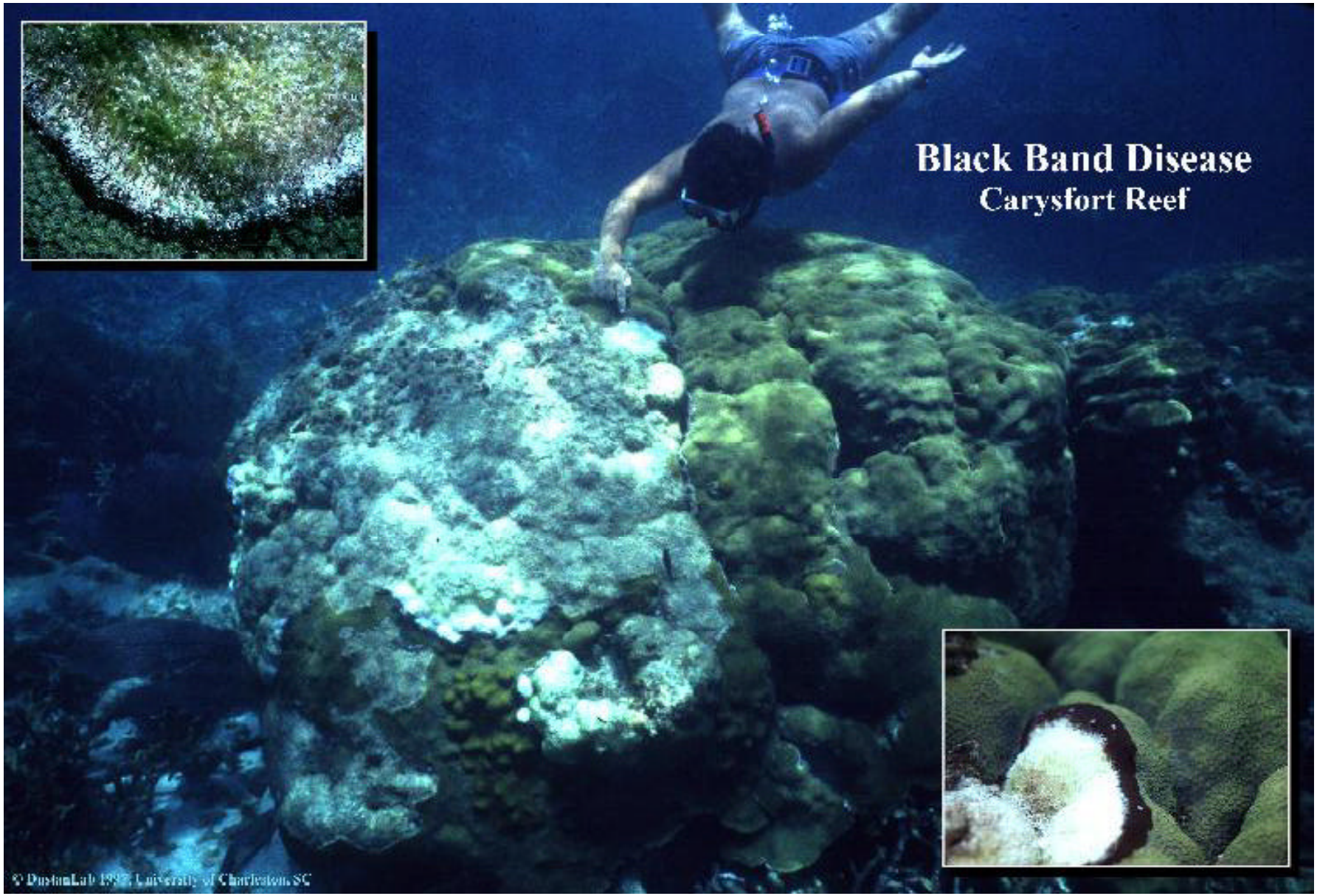


Stress= 0.12

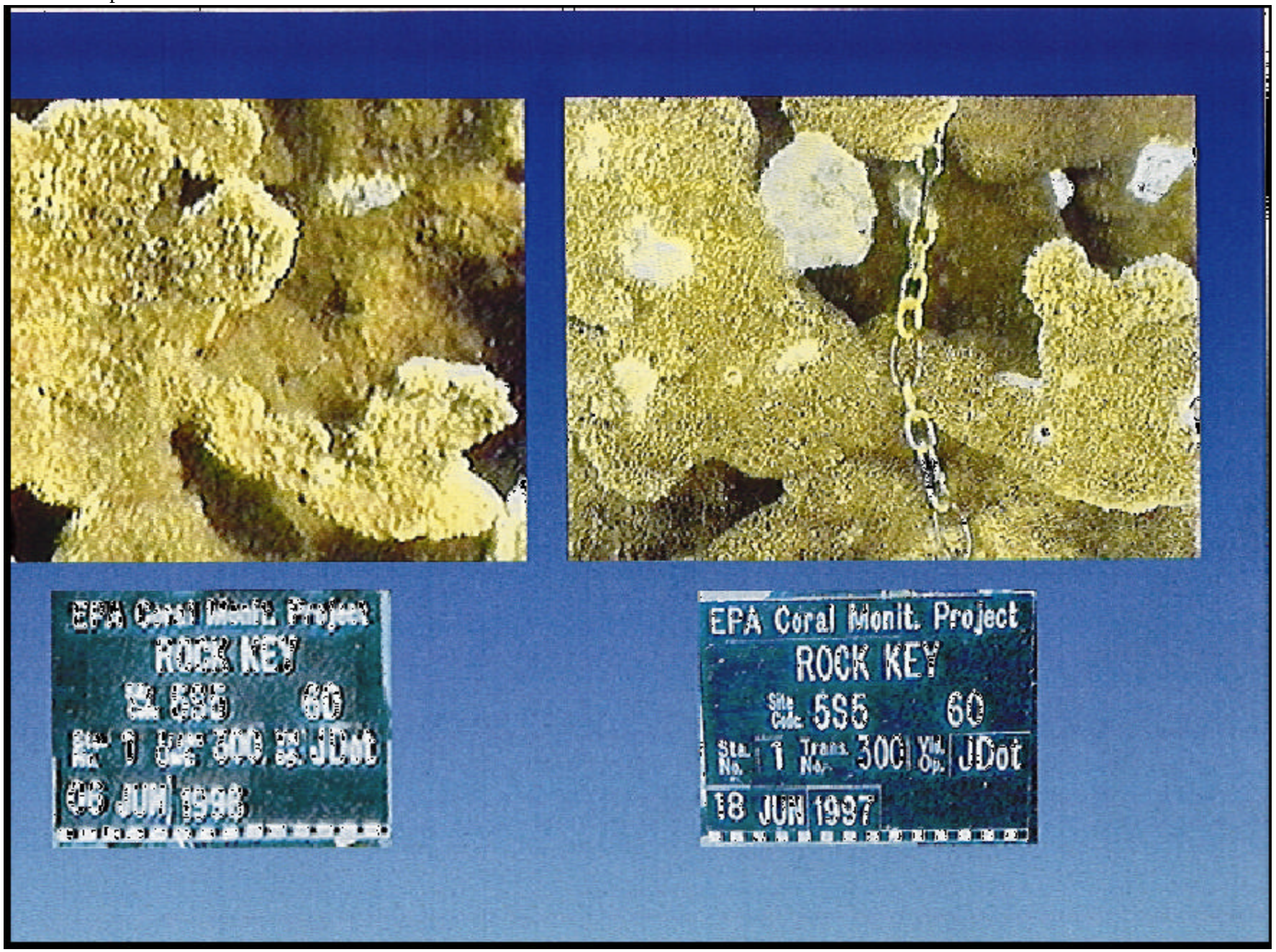
37. Coral disease categories



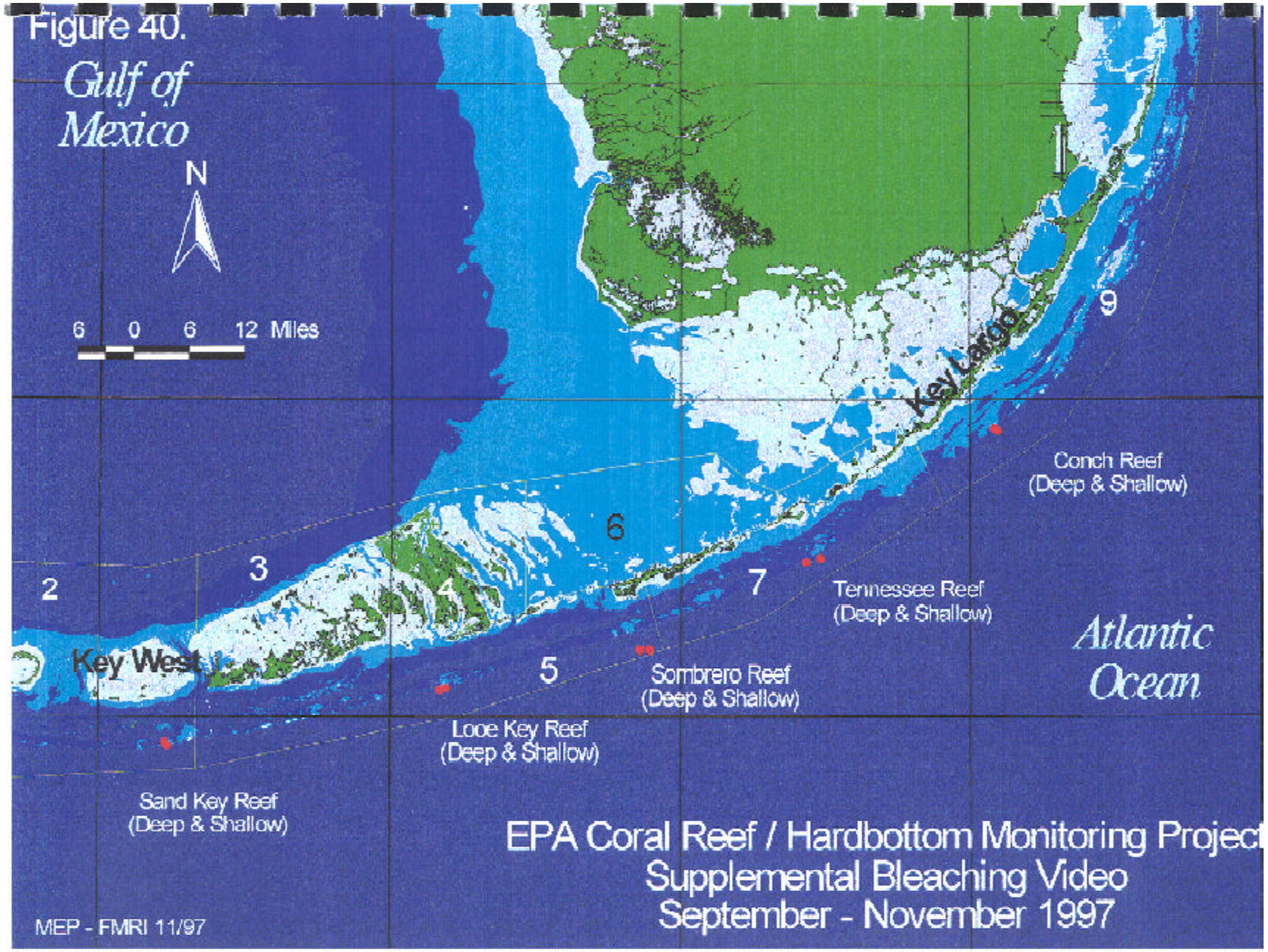
38. Black band disease



39. White pox disease



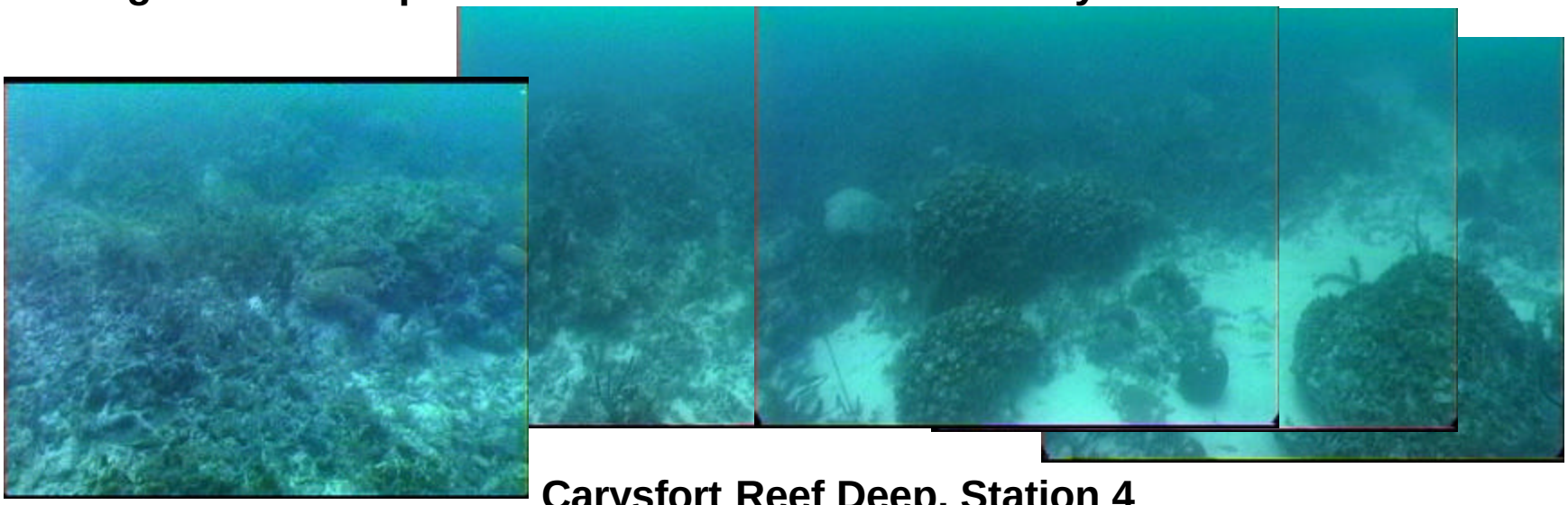
40. Bleaching video



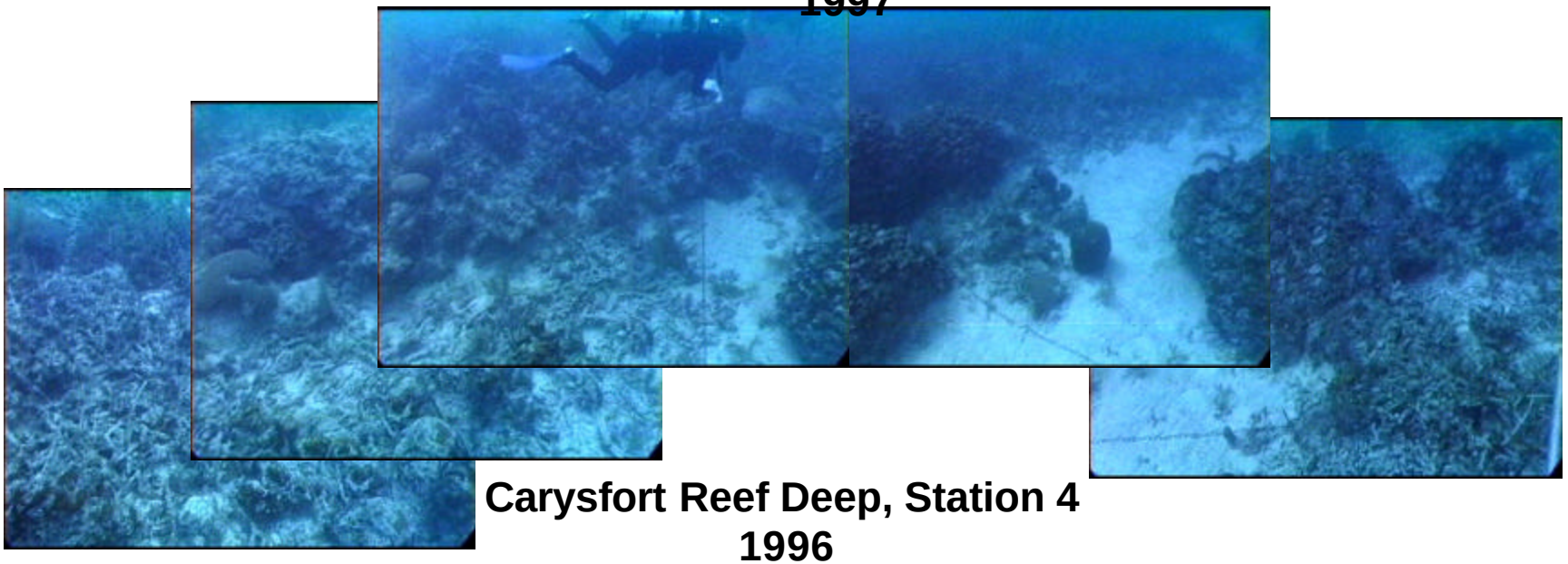
41. Algal-sediment coral mortality

42. Panoramic video Carysfort deep site 1996-1997

Figure 42. Comparison of Panoramic Video at Carysfort Offshore Reef.

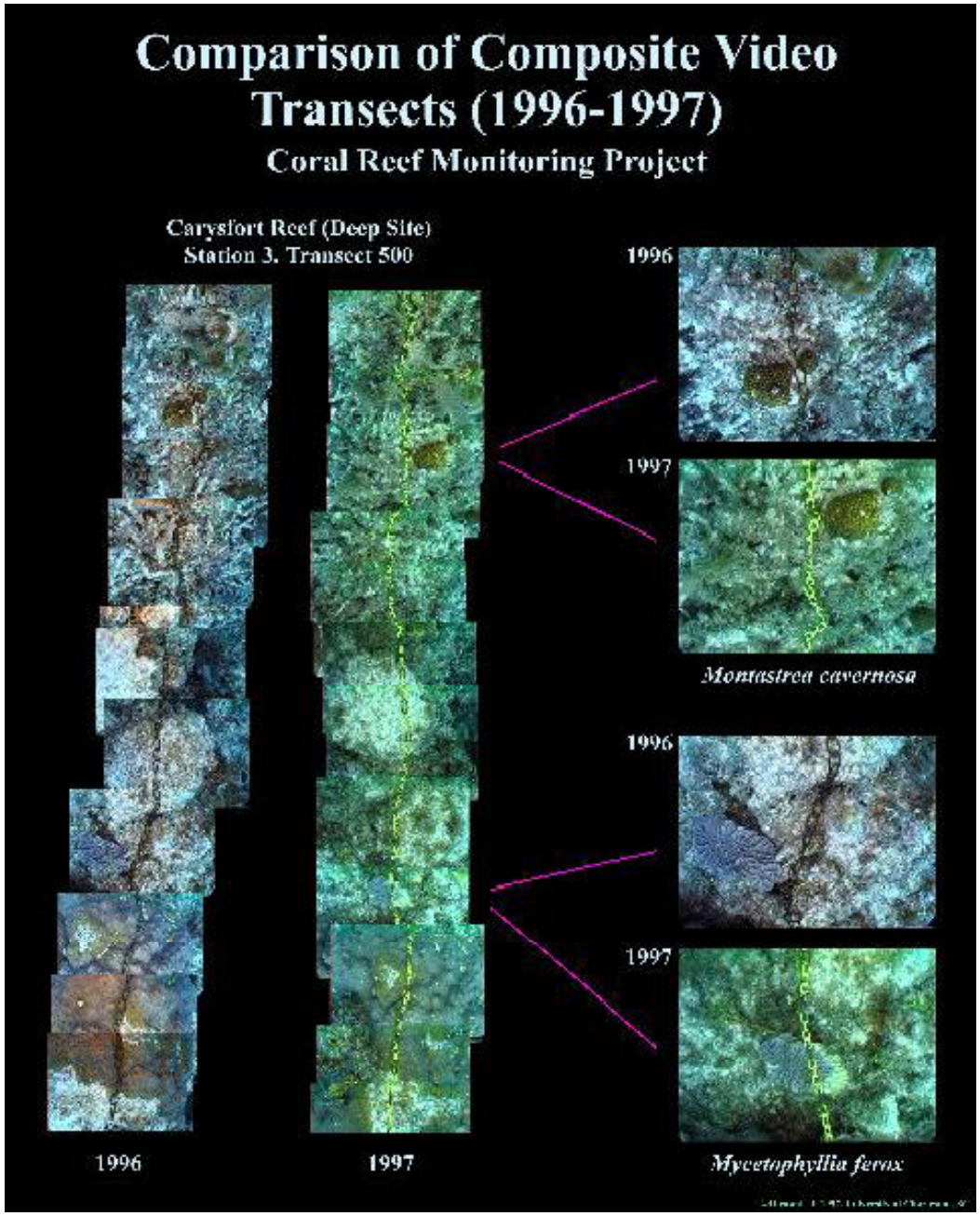


Carysfort Reef Deep, Station 4
1997

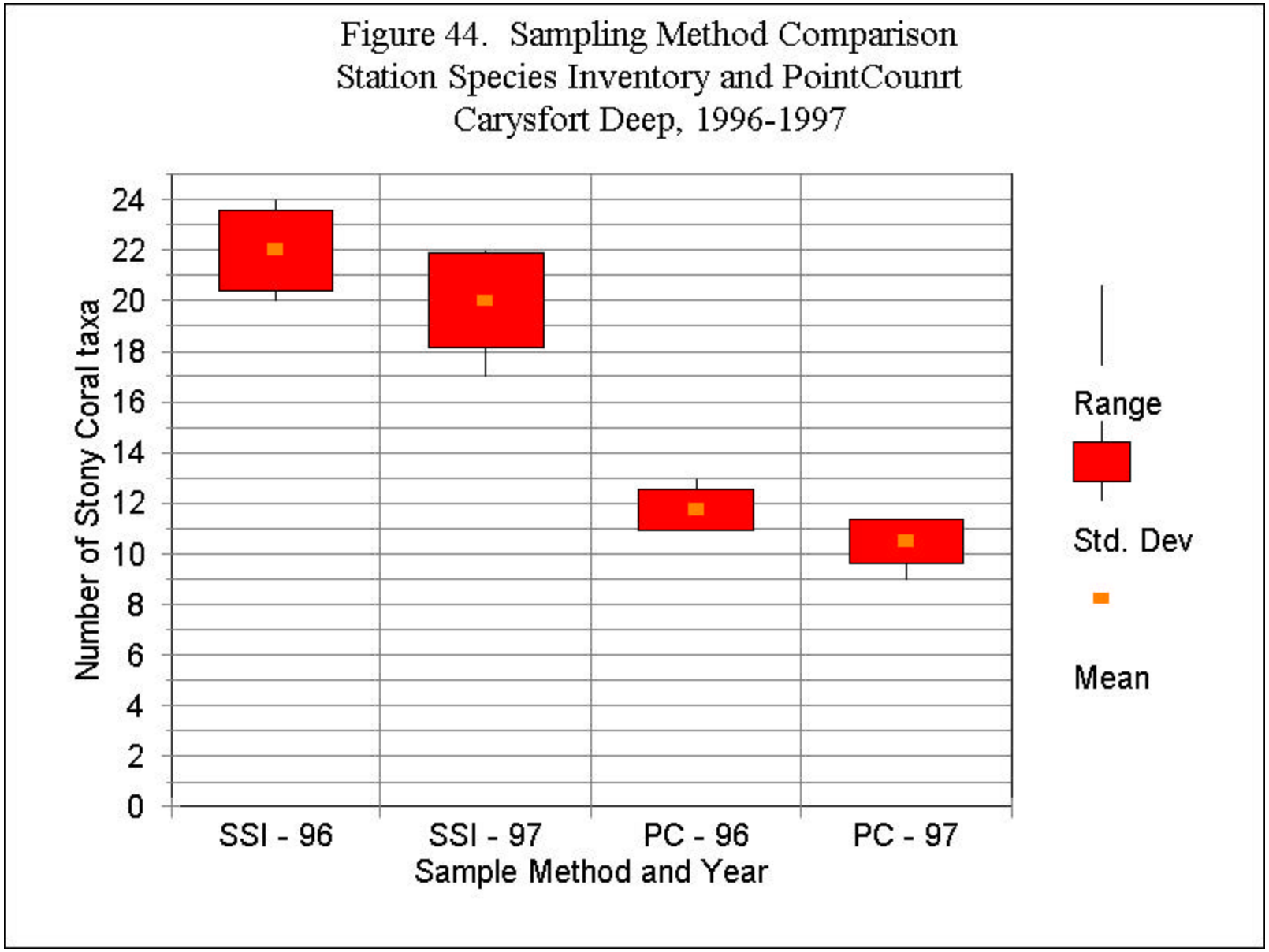


Carysfort Reef Deep, Station 4
1996

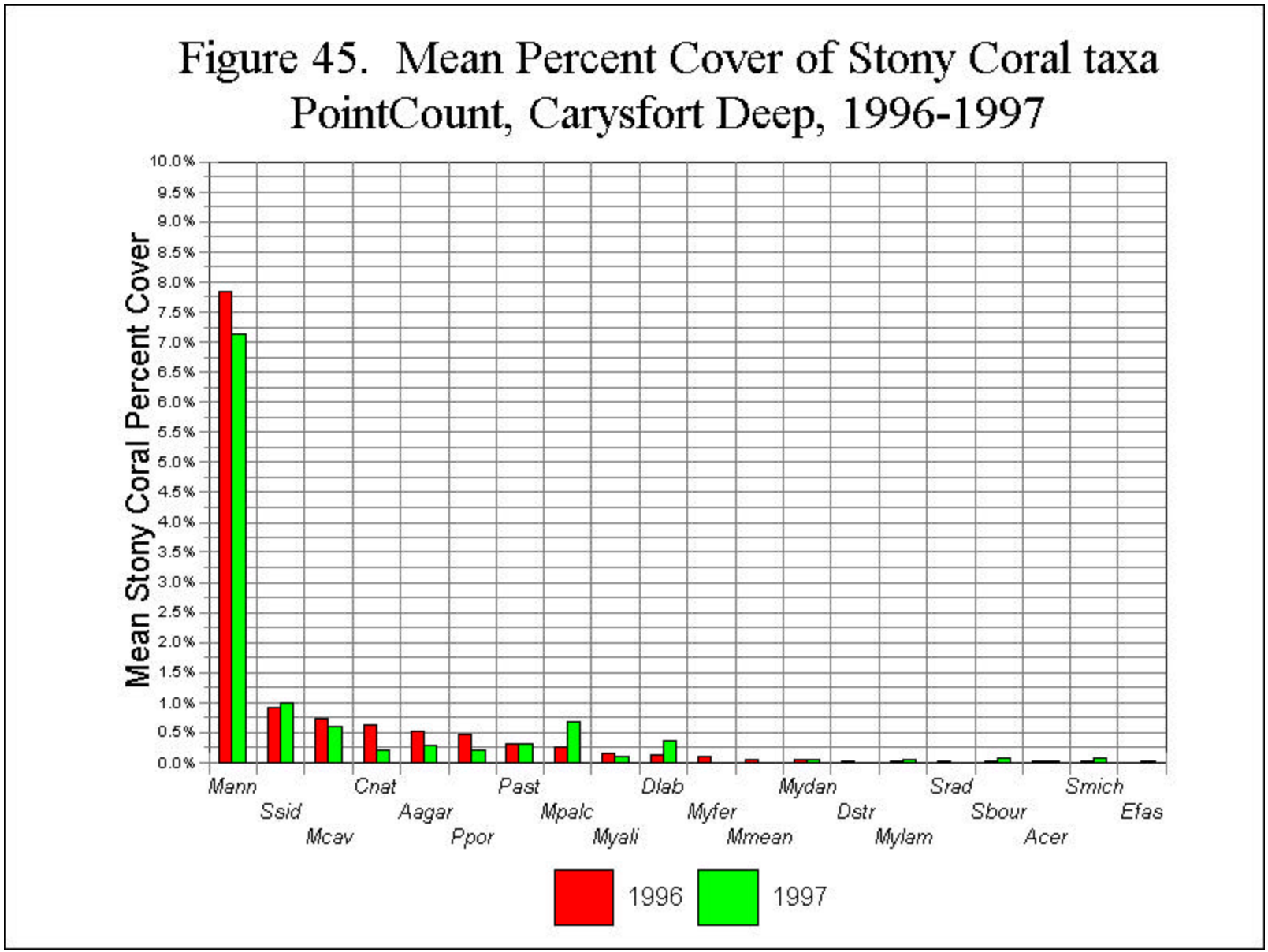
43. Composite video Carysfort deep site, station 3 transect 500



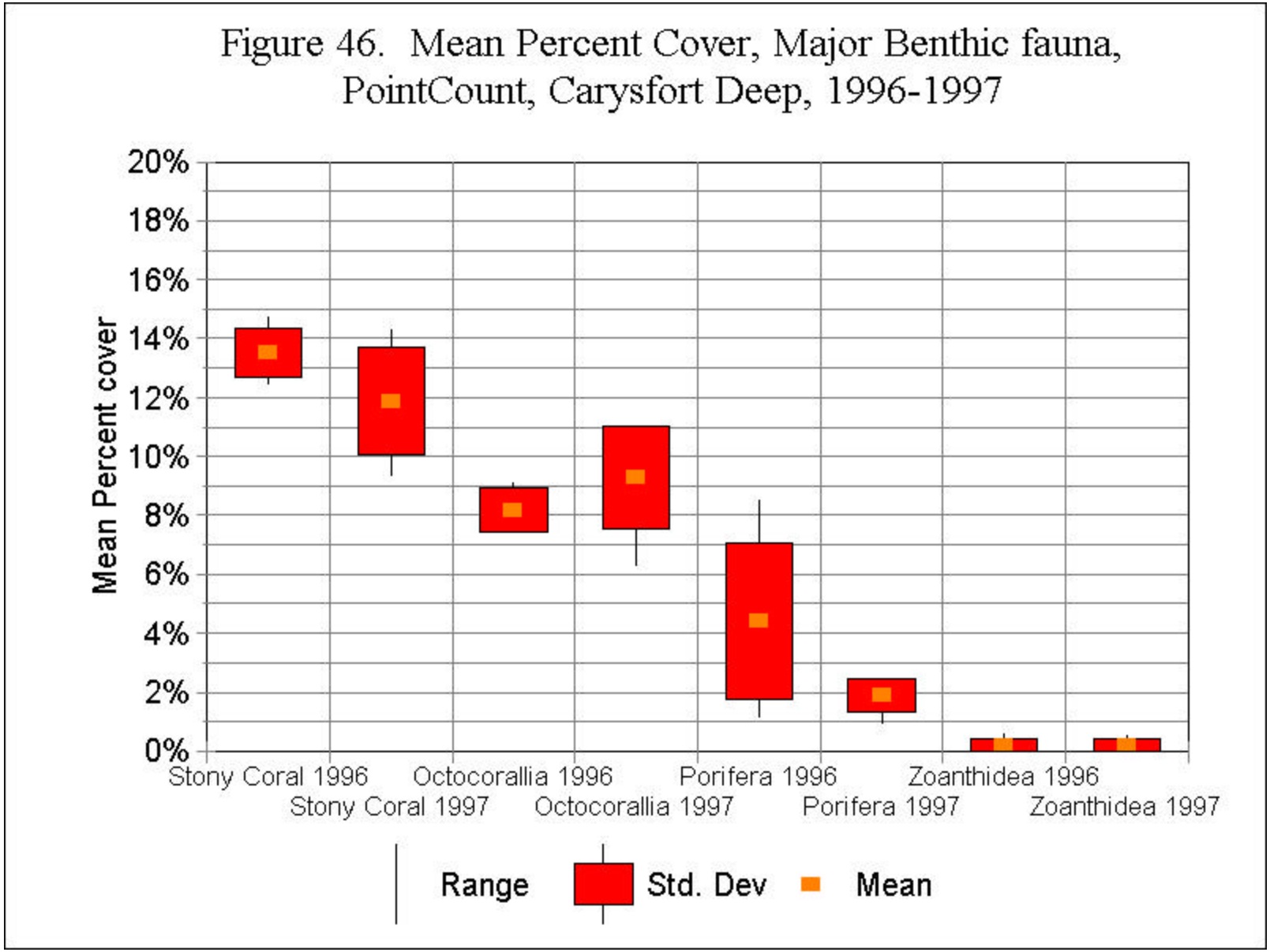
44. Sampling method comparison for stony corals, Carysfort deep



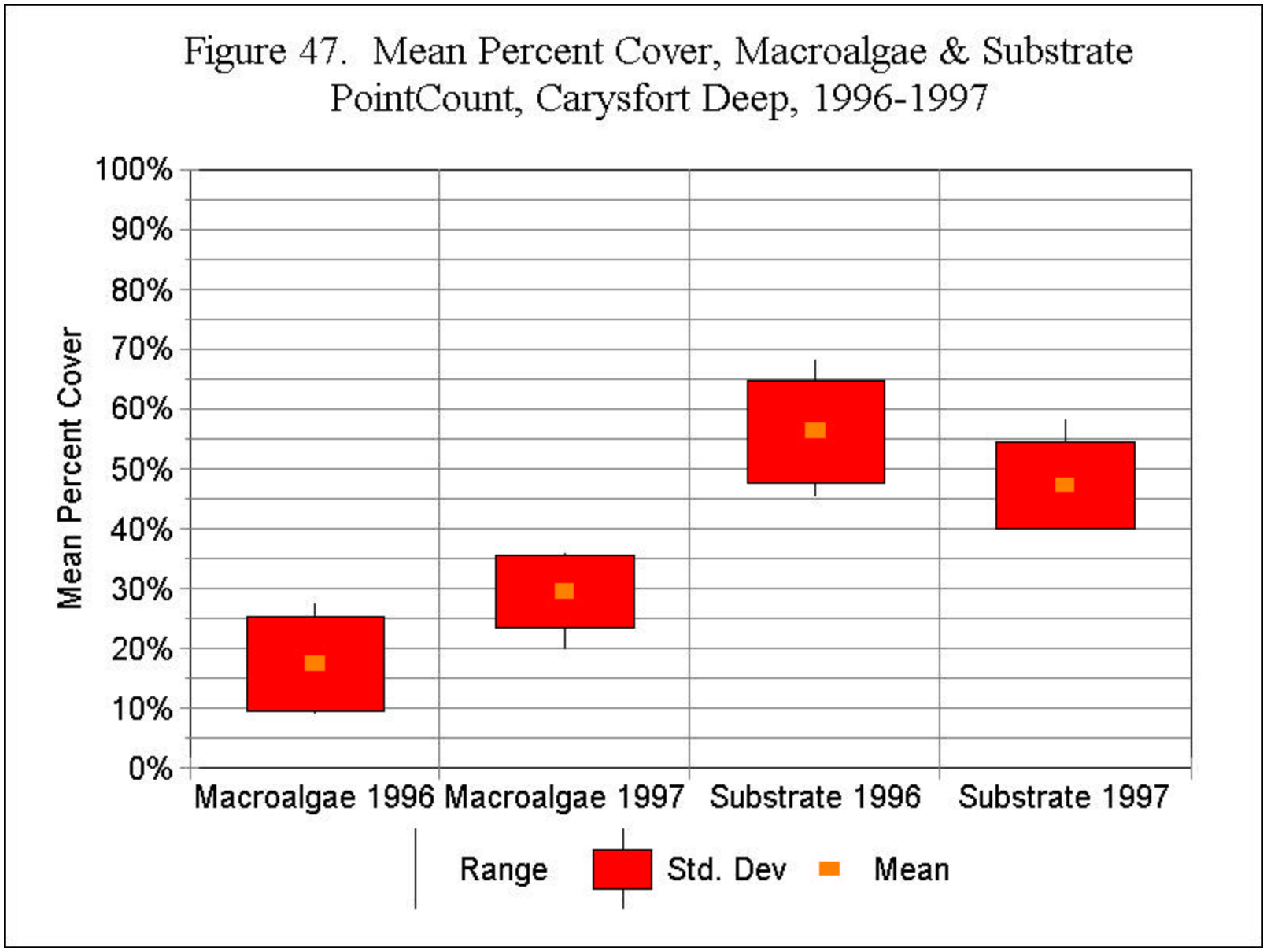
45. Mean percent cover, stony coral taxa, point count, Carysfort deep



46. Mean percent cover, major benthic fauna, point count, Carysfort deep

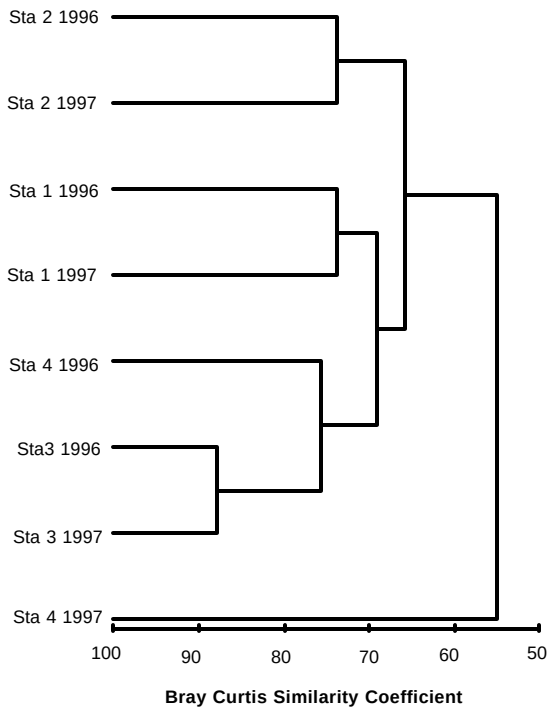


47. Mean percent cover, macroalgae and substrate, point count, Carysfort deep



48. Similarity dendrogram, stony coral taxa by station, Carysfort deep, 1996-1997

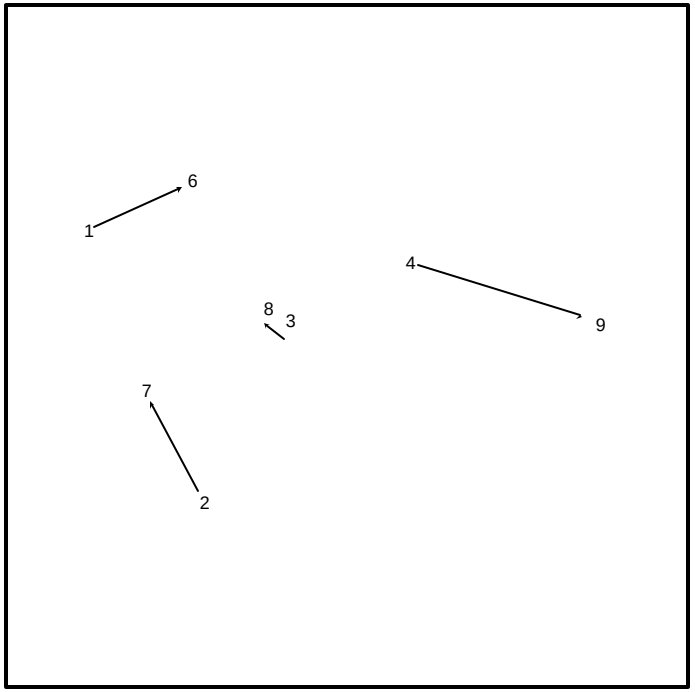
Figure 48. Similarity of Stony Coral taxa by station, PointCount, Carysfort Deep, 1996-1997.



49. MDS ordination, stony coral taxa by station, Carysfort deep, 1996-1997

Figure 49. Ordination (MDS) of Stony Coral taxa by station, PointCount, Carysfort Deep, 1996-1997.

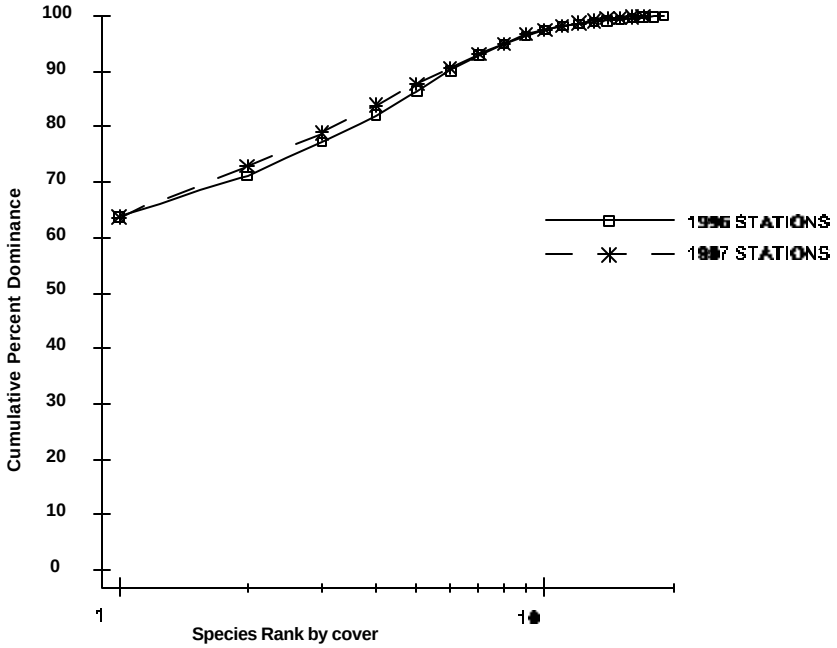
1= Sta 1 1996
2= Sta 2 1996
3= Sta 3 1996
4= Sta 4 1996
6= Sta 1 1997
7= Sta 2 1997
8= Sta 3 1997
9= Sta 4 1997



Stress=0.05

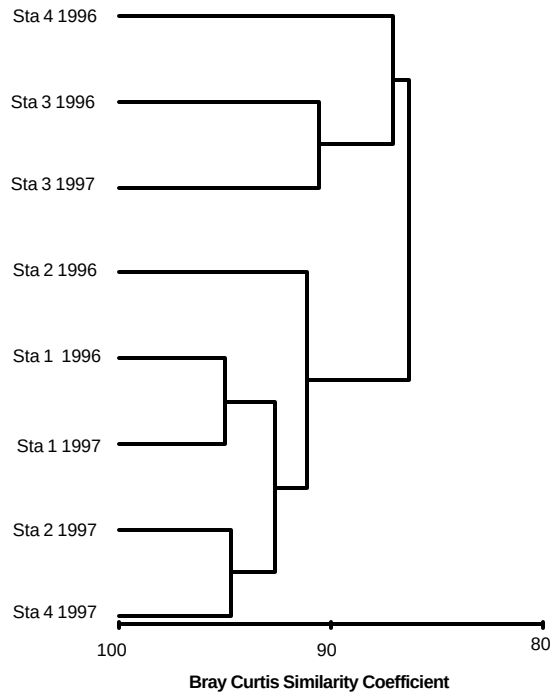
50. K-dominance curve, stony coral taxa by station, Carysfort deep, 1996-1997.

Figure 50. K Dominance Curve, Stony coral taxa, Carysfort Deep, PointCount, 1996-1997.



51. Similarity dendrogram, major benthic categories by station, Carysfort deep, 1996-1997.

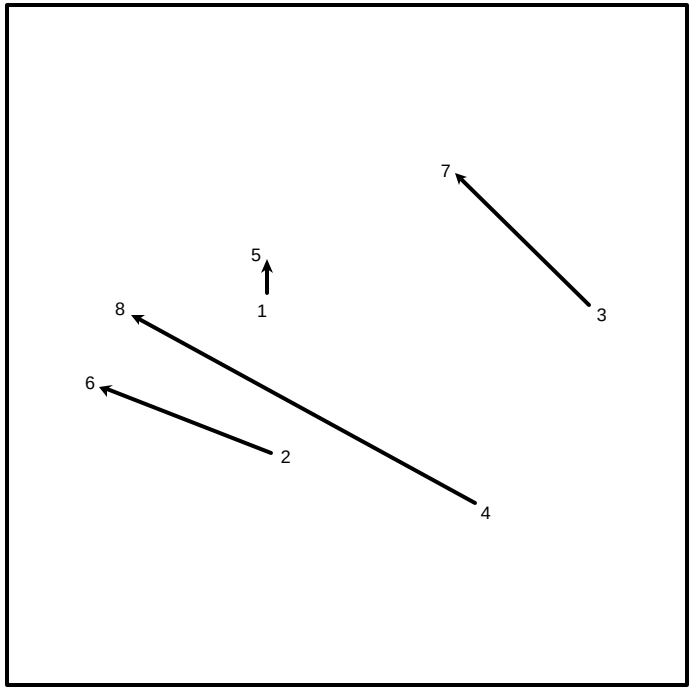
Figure 51. Similarity of major benthic categories by station, Carysfort Deep, PointCount, 1996-1997.



52. MDS ordination, major benthic categories by station, Carysfort deep, 1996-1997.

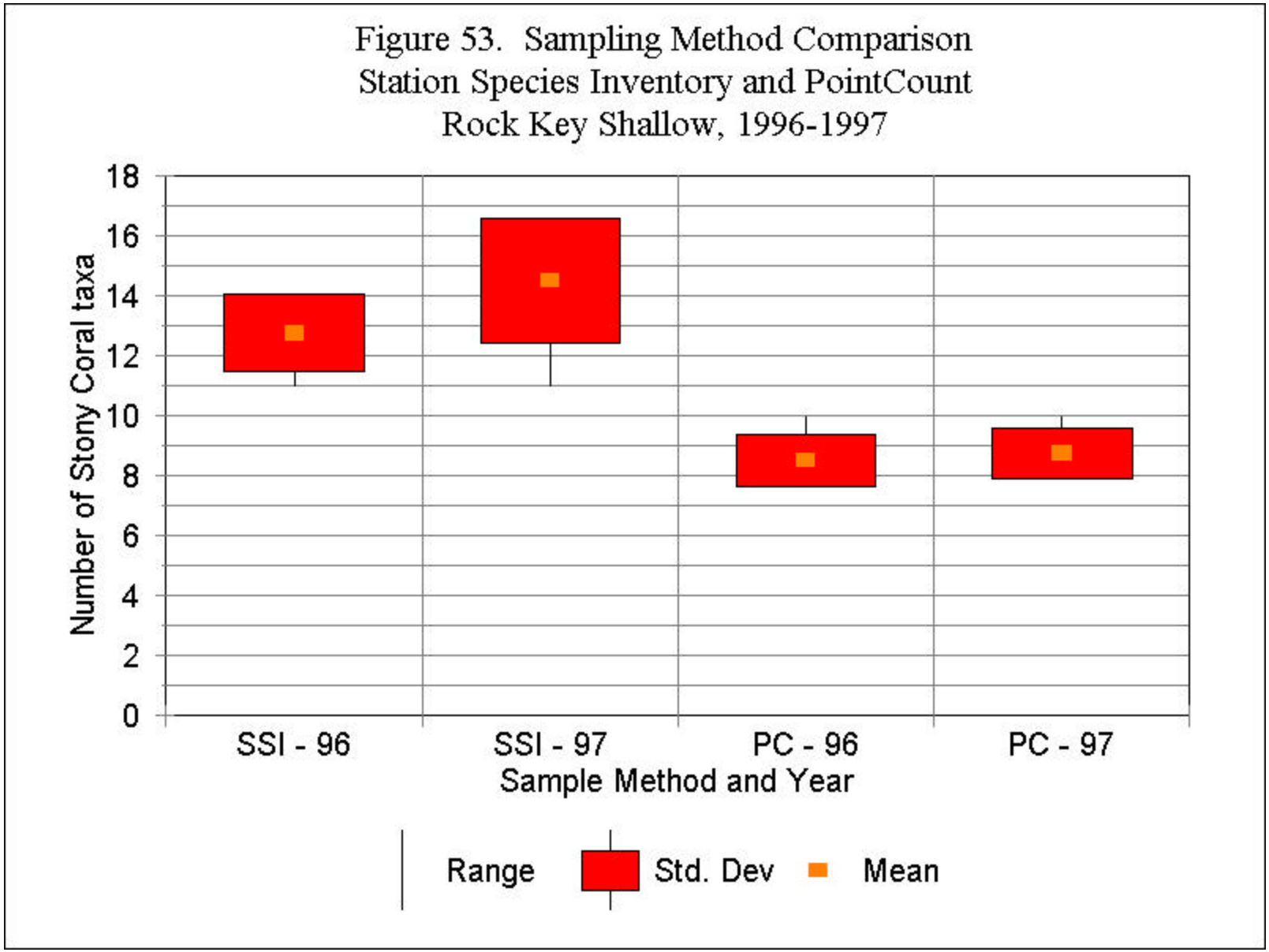
Figure 52. Ordination (MDS) of major benthic categories by station, PointCount, Carysfort Deep, 1996-1997

1=Sta 1 1996
2=Sta 2 1996
3=Sta 3 1996
4=Sta 4 1996
5=Sta 1 1997
6=Sta 2 1997
7=Sta 3 1997
8=Sta 4 1997

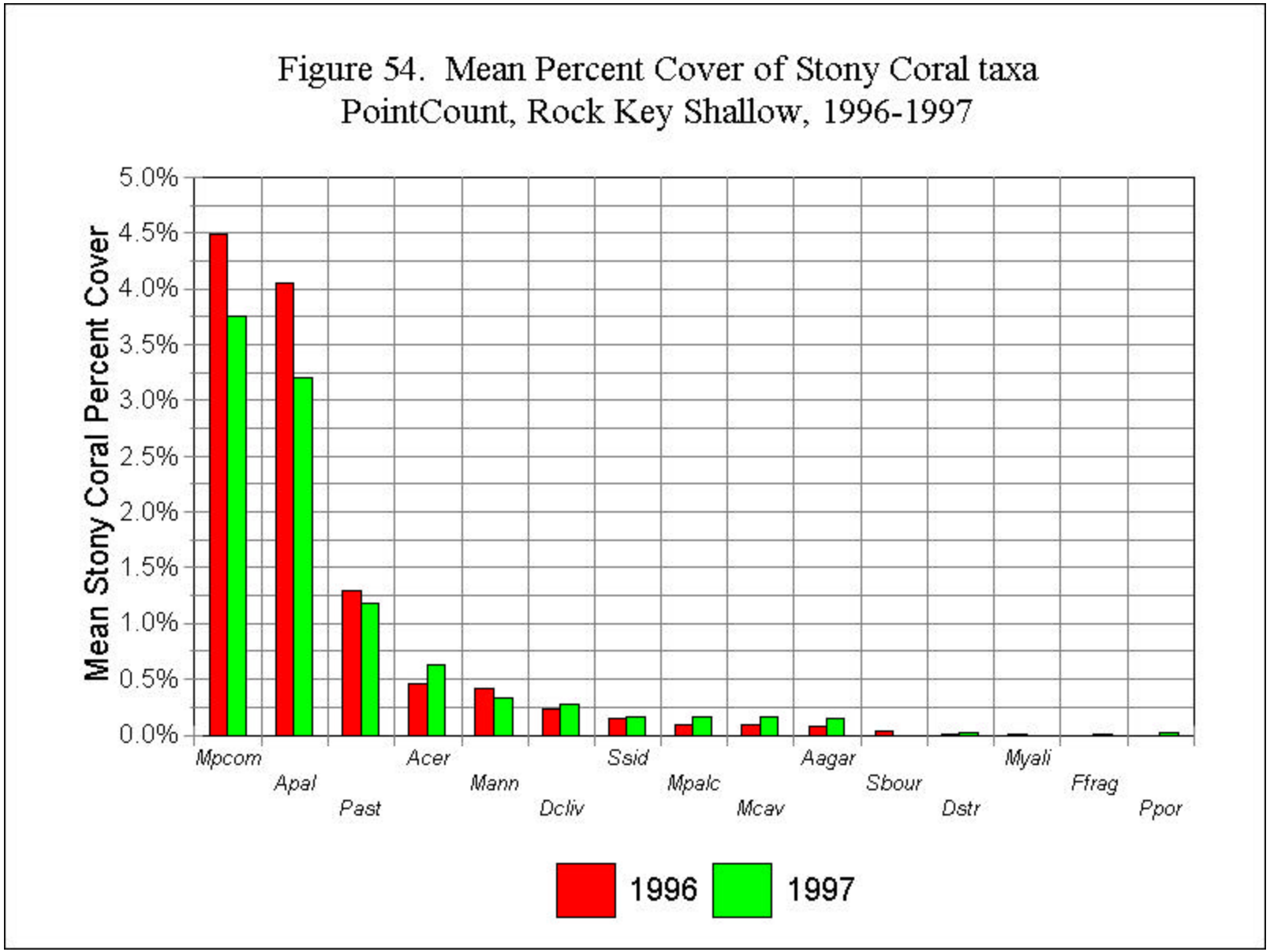


Stress= 0.01

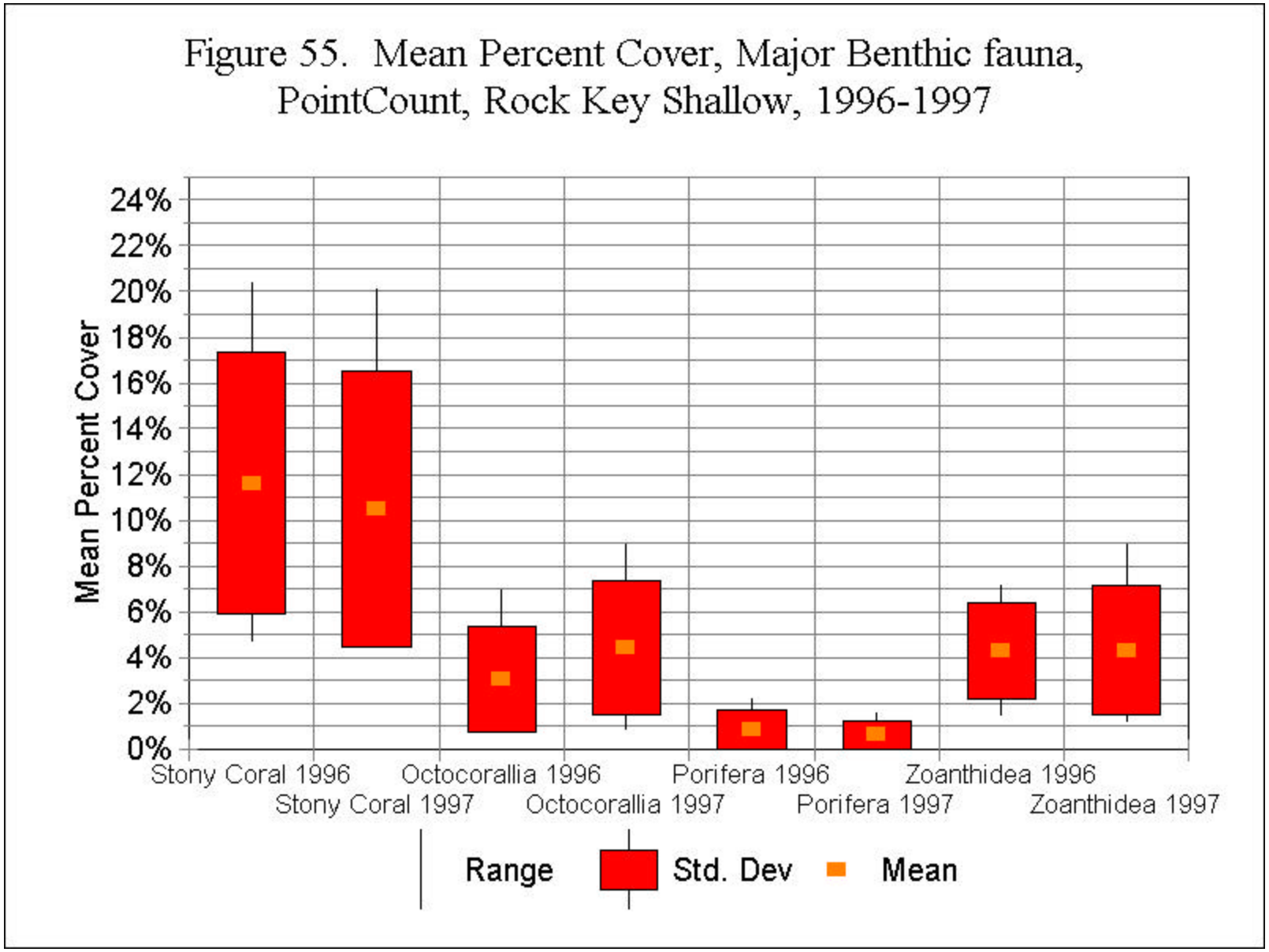
53. Sampling method comparison for stony corals, Rock Key shallow



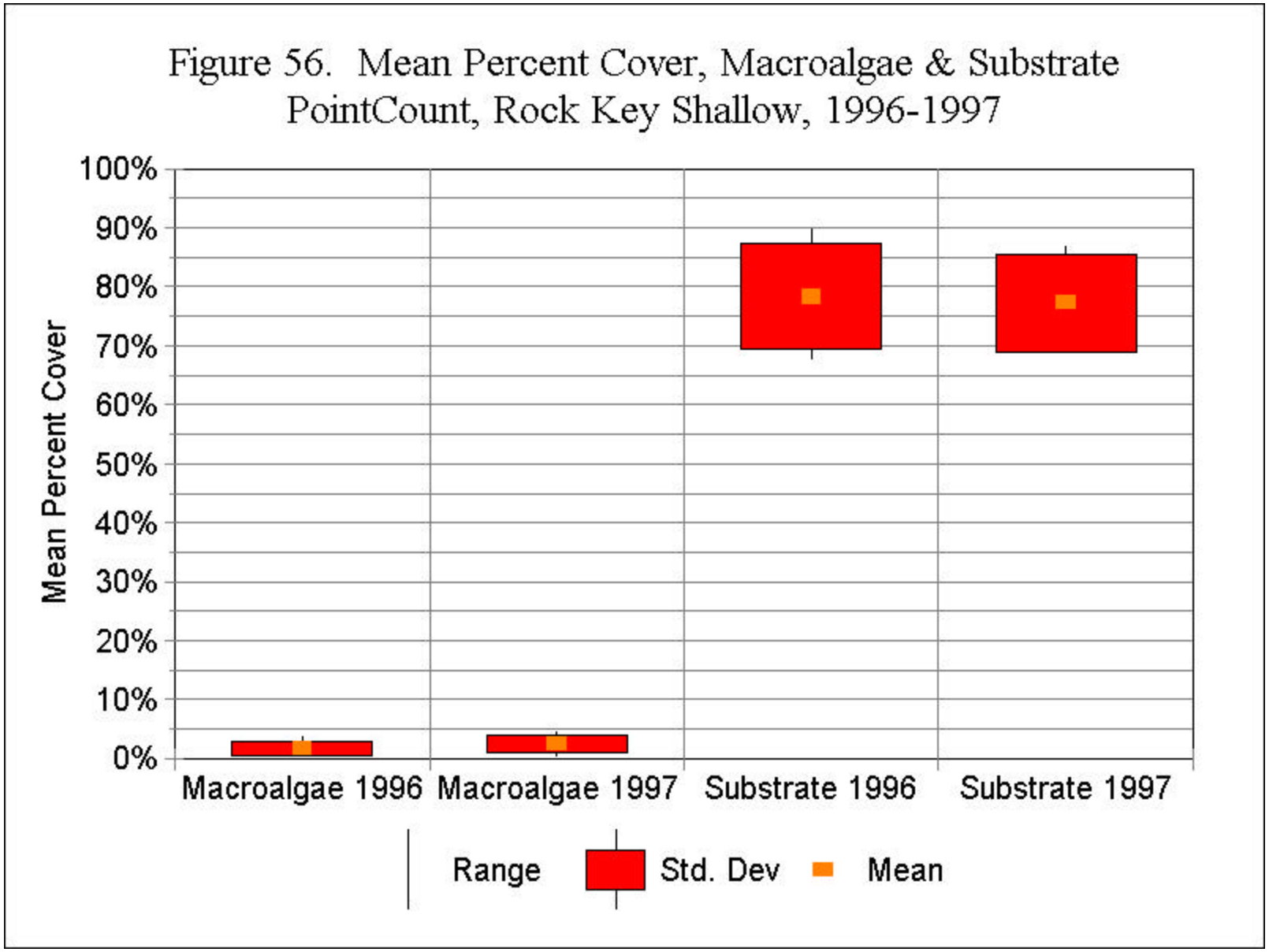
54. Mean percent cover, stony coral taxa, point count, Rock Key shallow



55. Mean percent cover, major benthic fauna, point count, Rock Key shallow

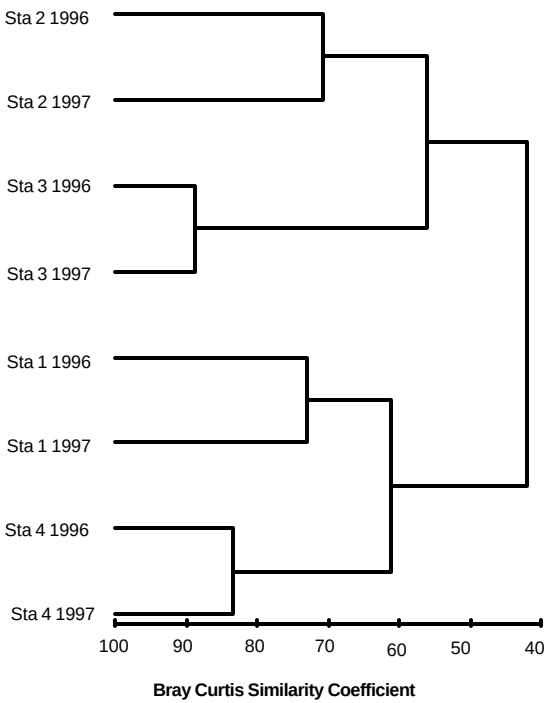


56. Mean percent cover, macroalgae and substrate, point count, Rock Key shallow



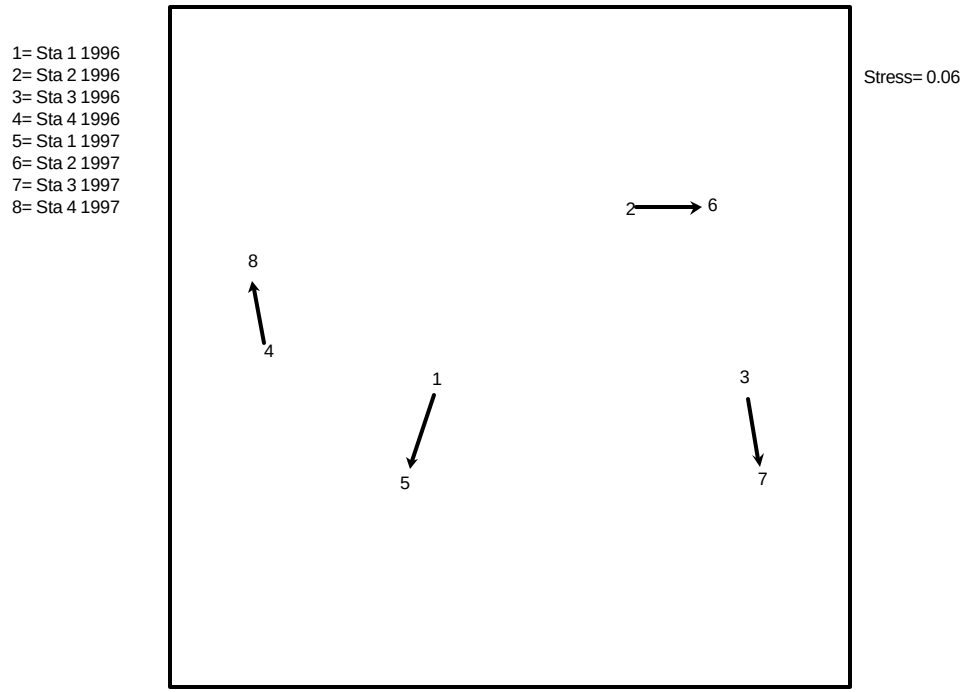
57. Similarity dendrogram, stony coral taxa by station, Rock Key shallow, 1996-1997

Figure 57. Similarity of Stony Coral taxa by station, PointCount, Rock Key Shallow, 1996-1997.



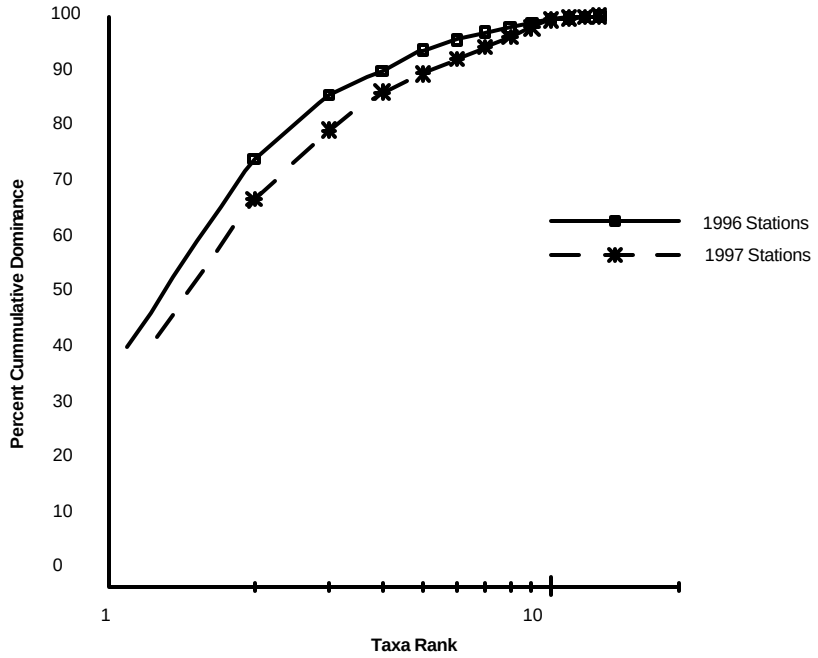
58. MDS ordination, stony coral taxa by station, Rock Key shallow, 1996-1997

Figure 58. Ordination (MDS) of Stony Coral taxa by station, PointCount, Rock Key Shallow, 1996-1997.



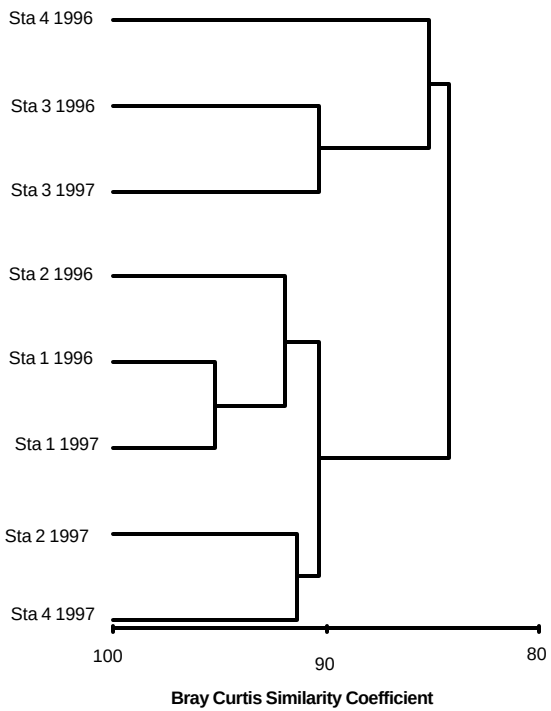
59. K-dominance curve, stony coral taxa by station, Rock Key shallow, 1996-1997.

Figure 59. K Dominance Curve, Stony Coral taxa by station, Rock Key Shallow, PointCount, 1996-1997.



60. Similarity dendrogram, major benthic categories by station, Rock Key shallow, 1996-1997.

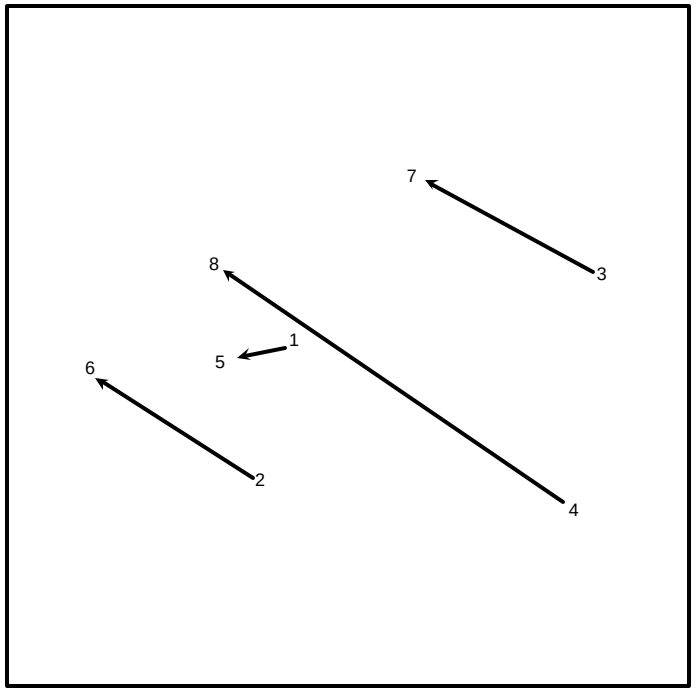
Figure 60. Similarity of major benthic categories by station, Rock Key Shallow, PointCount, 1996-1997.



61. MDS ordination, major benthic categories by station, Rock Key shallow, 1996-1997.

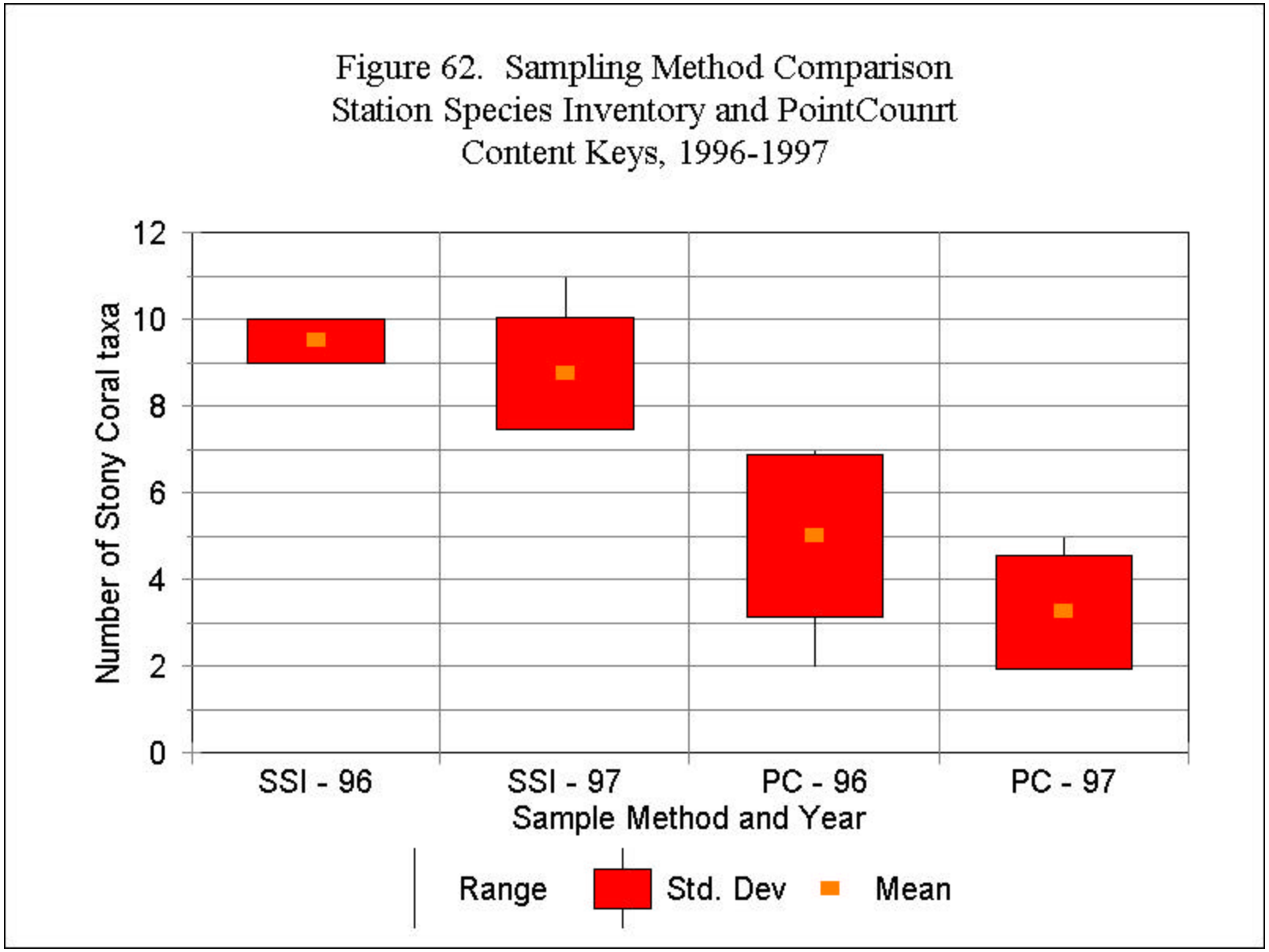
Figure 61. Ordination (MDS) of major benthic categories by station, PointCount, Rock Key Shallow, 1996-1997.

1= Sta 1 1996
2= Sta 2 1996
3= Sta 3 1996
4= Sta 4 1996
5= Sta 1 1997
6= Sta 2 1997
7= Sta 3 1997
8= Sta 4 1997

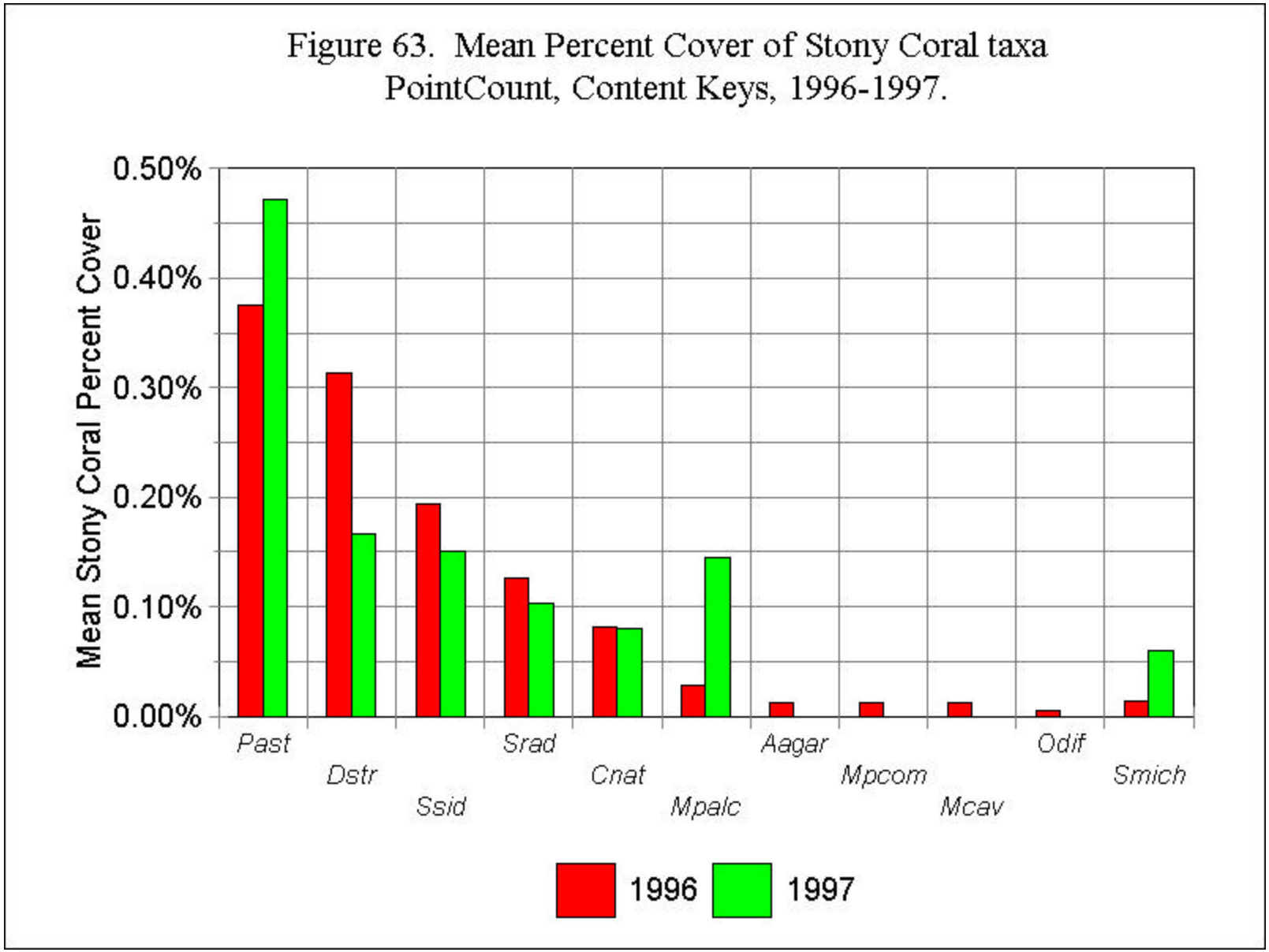


Stress= 0.05

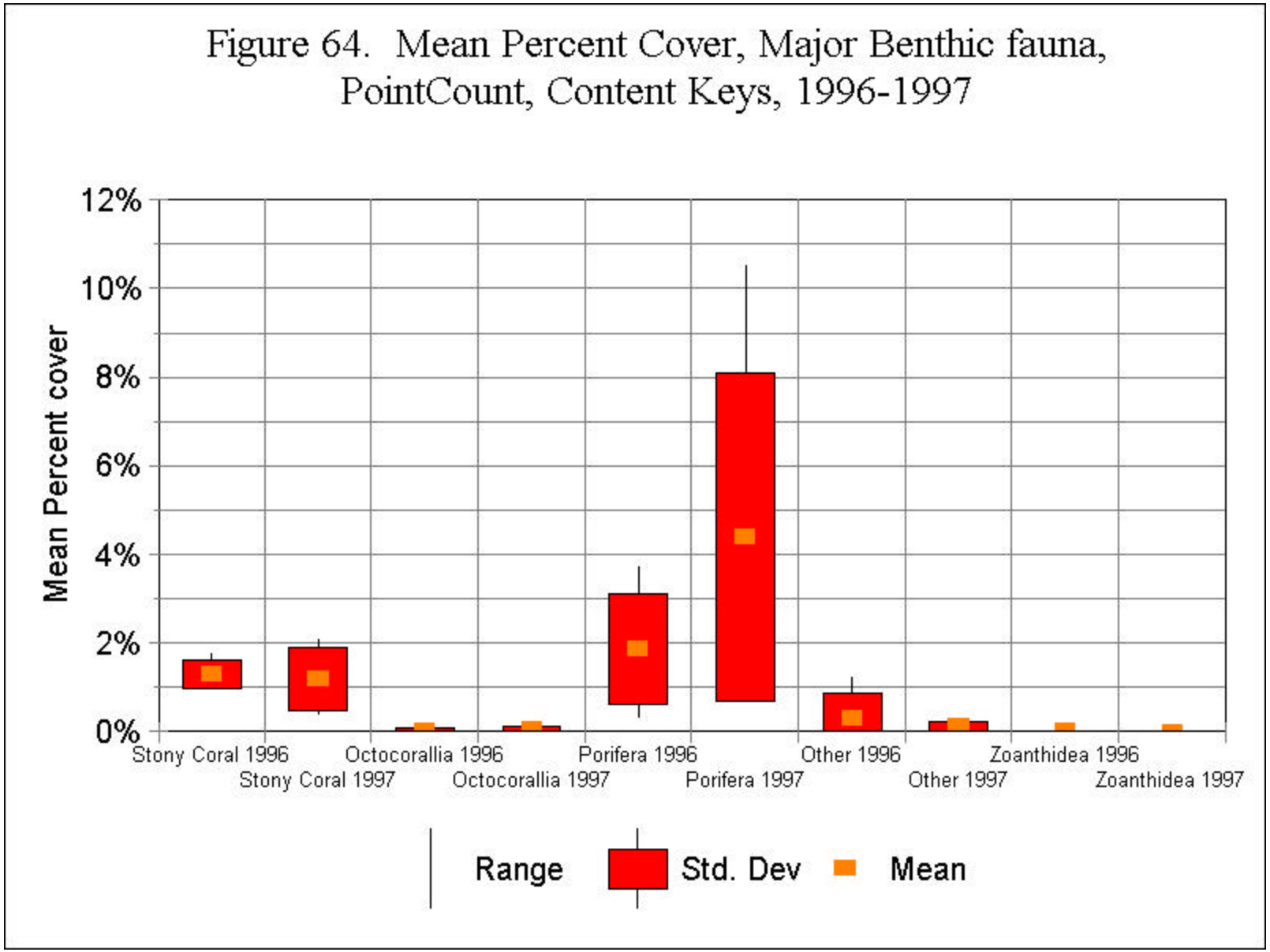
62. Sampling method comparison for stony corals, Content Keys



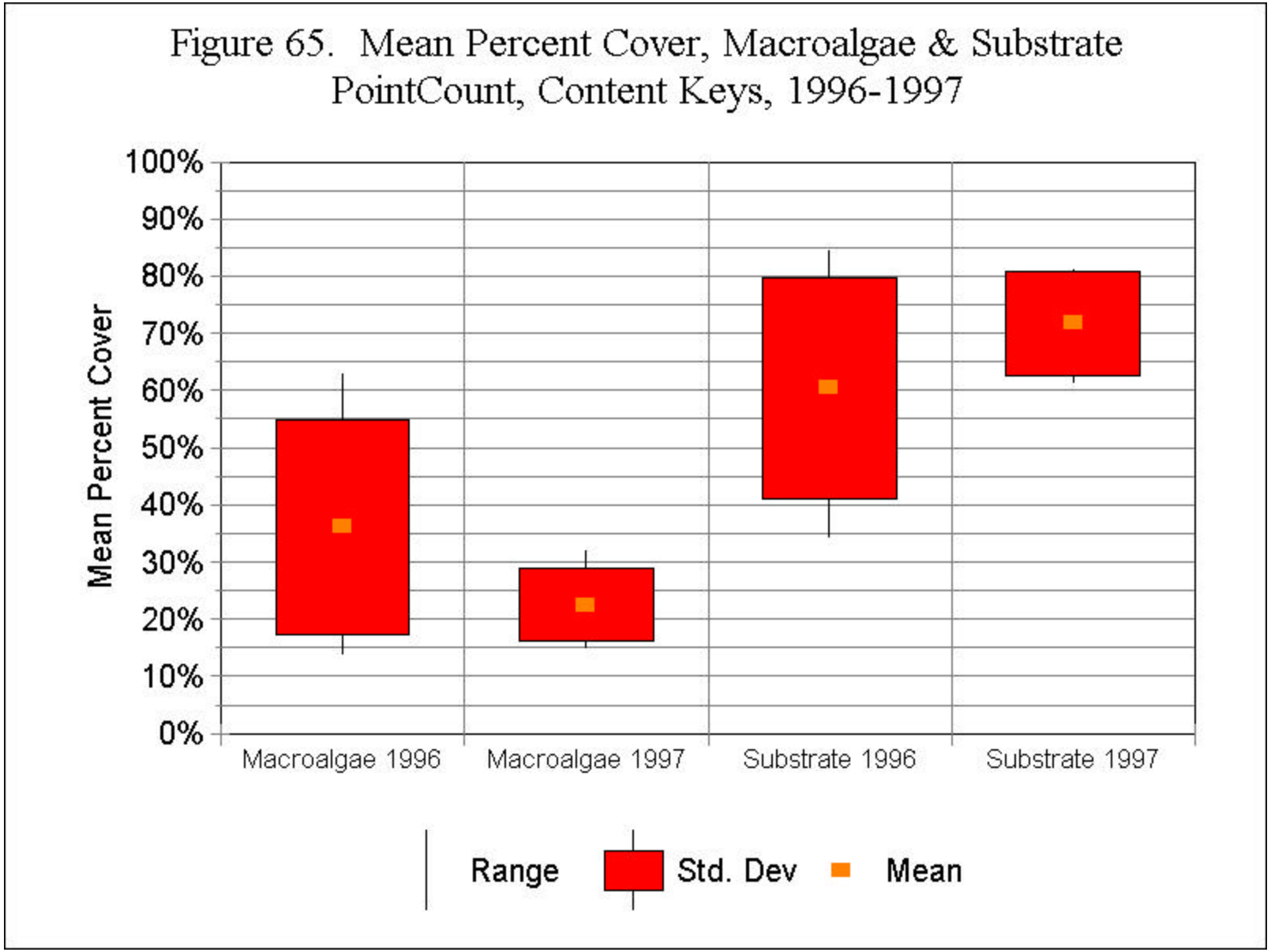
63. Mean percent cover, stony coral taxa, point count, Content Keys



64. Mean percent cover, major benthic fauna, point count, Content Keys

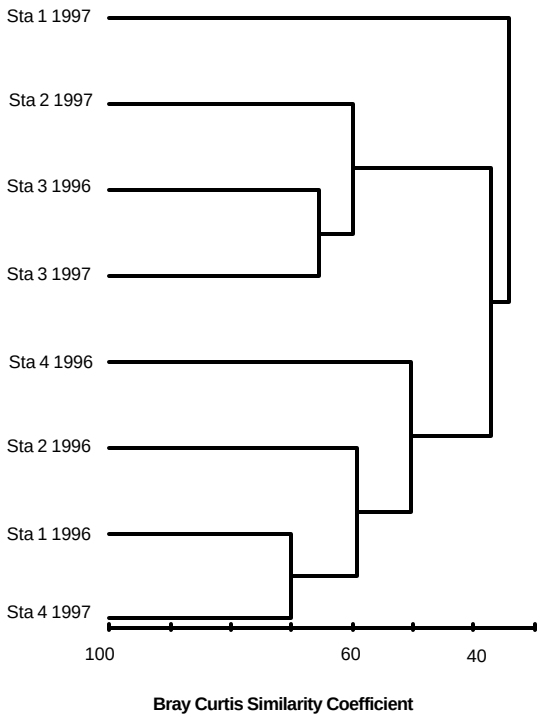


65. Mean percent cover, macroalgae and substrate, point count, Content Keys



66. Similarity dendrogram, stony coral taxa by station, Content Keys, 1996-1997

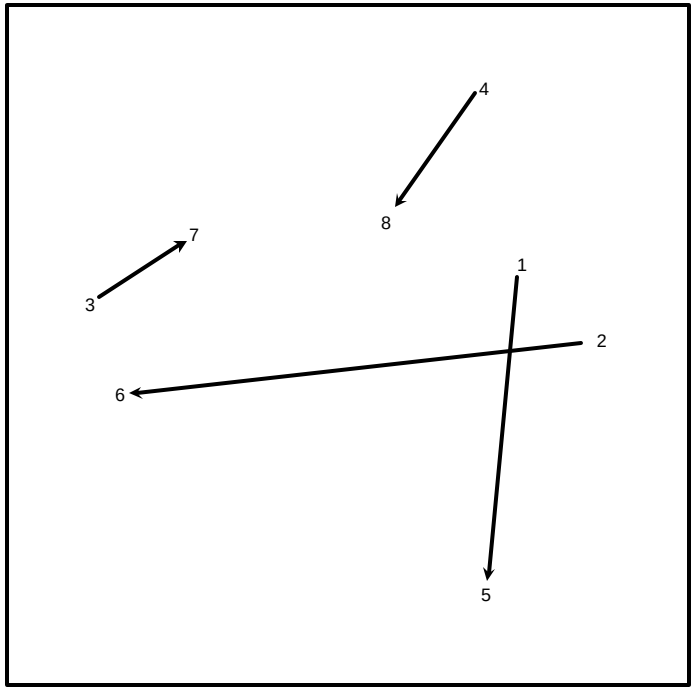
Figure 66. Similarity of Stony Coral taxa by station, PointCount, Content Keys, 1996-1997.



67. MDS ordination, stony coral taxa by station, Content Keys, 1996-1997

Figure 67. Ordination (MDS) of Stony Coral taxa by station, PointCount, Content Keys, 1996-1997.

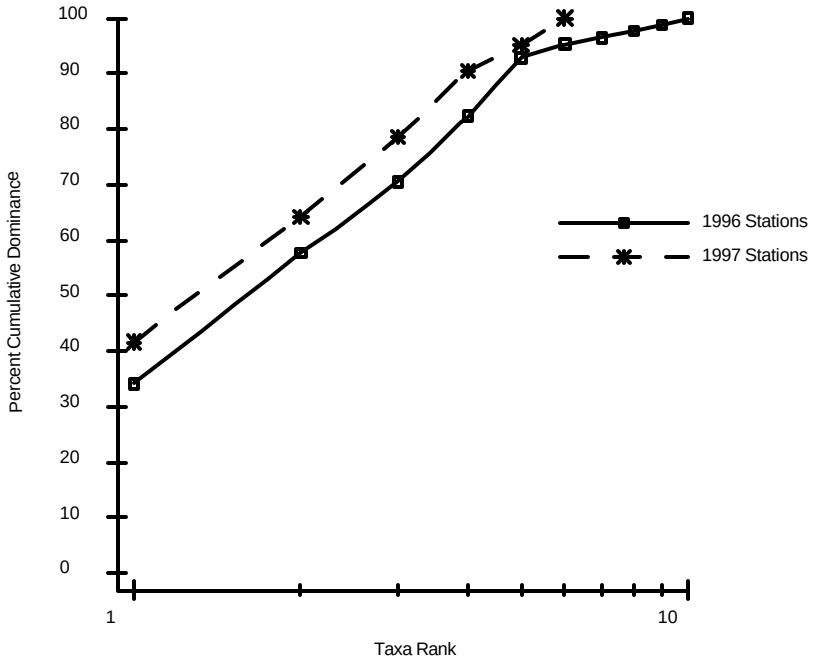
1= Sta 1 1996
2= Sta 2 1996
3= Sta 3 1996
4= Sta 4 1996
5= Sta 1 1997
6= Sta 2 1997
7= Sta 3 1997
8= Sta 4 1997



Stress= 0.08

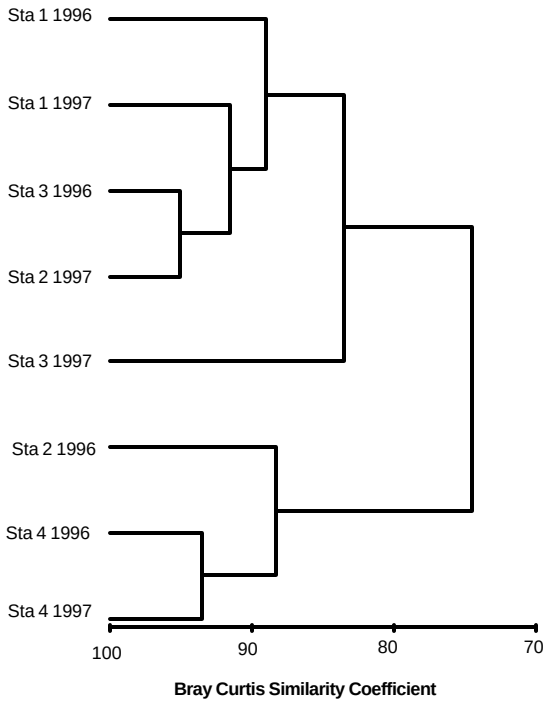
68. K-dominance curve, stony coral taxa by station, Content Keys, 1996-1997.

Figure 68. K Dominance Curve, Stony Coral taxa, PointCount, Content Keys, 1996-1997.



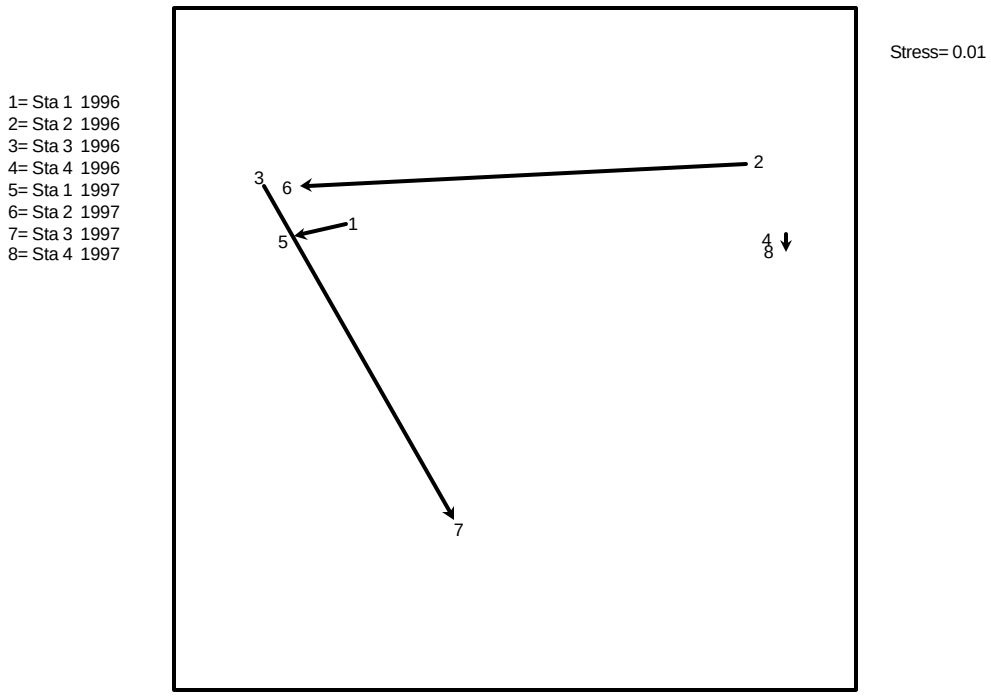
69. Similarity dendrogram, major benthic categories by station, Content Keys, 1996-1997.

Figure 69. Similarity of major benthic categories by station, PointCount, Content Keys, 1996-1997.

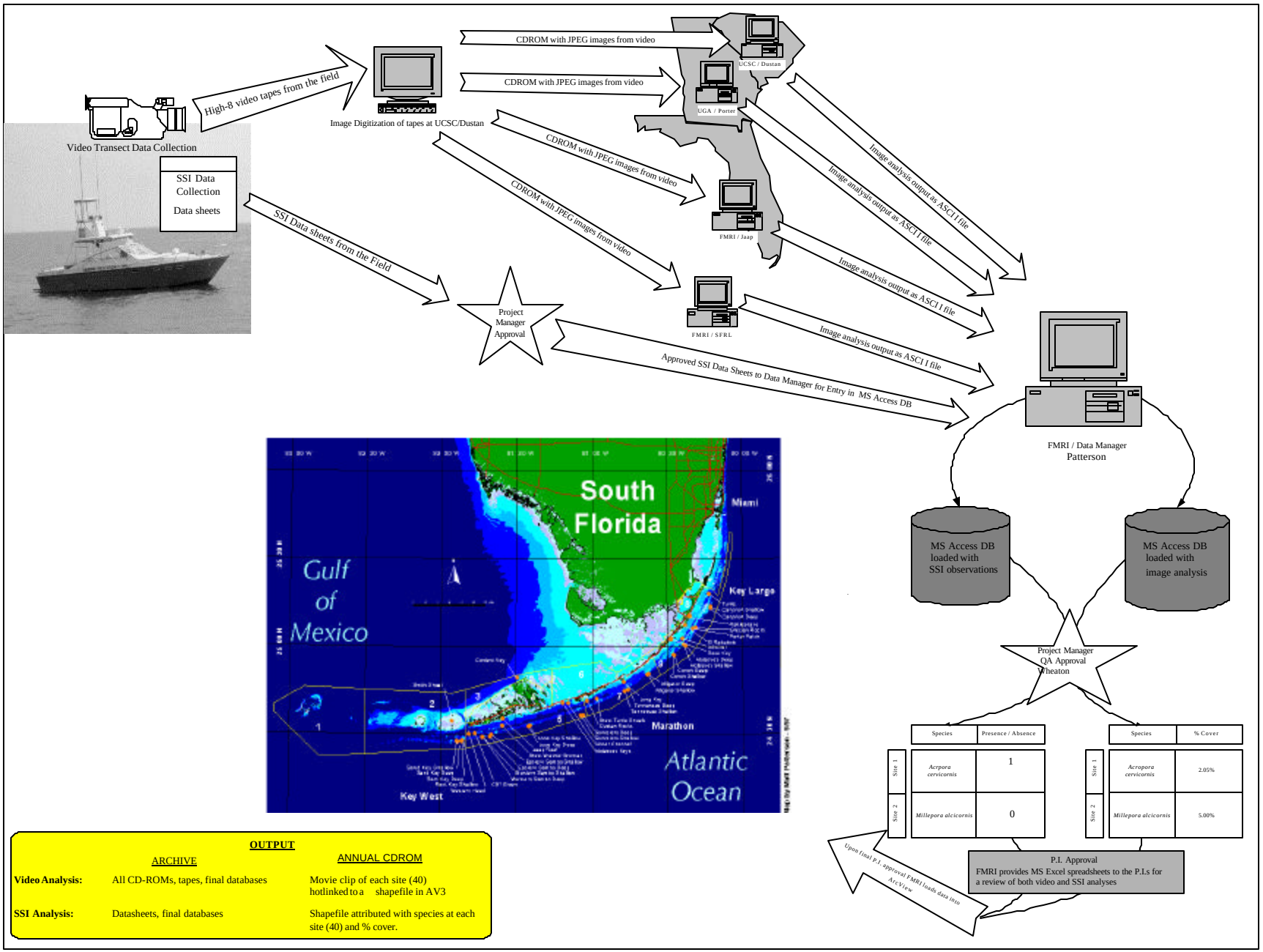


70. MDS ordination, major benthic categories by station, Content Keys, 1996-1997.

Figure 70. Ordination (MDS) of major benthic categories by station, PointCount, Content Keys, 1996-1997.



71. FKNMS WQPP data management system



OUTPUT

	ARCHIVE	ANNUAL CDROM
Video Analysis:	All CD-ROMs, tapes, final databases	Movie clip of each site (40) hotlinked to a shapefile in AV3
SSI Analysis:	Datasheets, final databases	Shapefile attributed with species at each site (40) and % cover.

72. EPA 1996-1997 funds disbursement

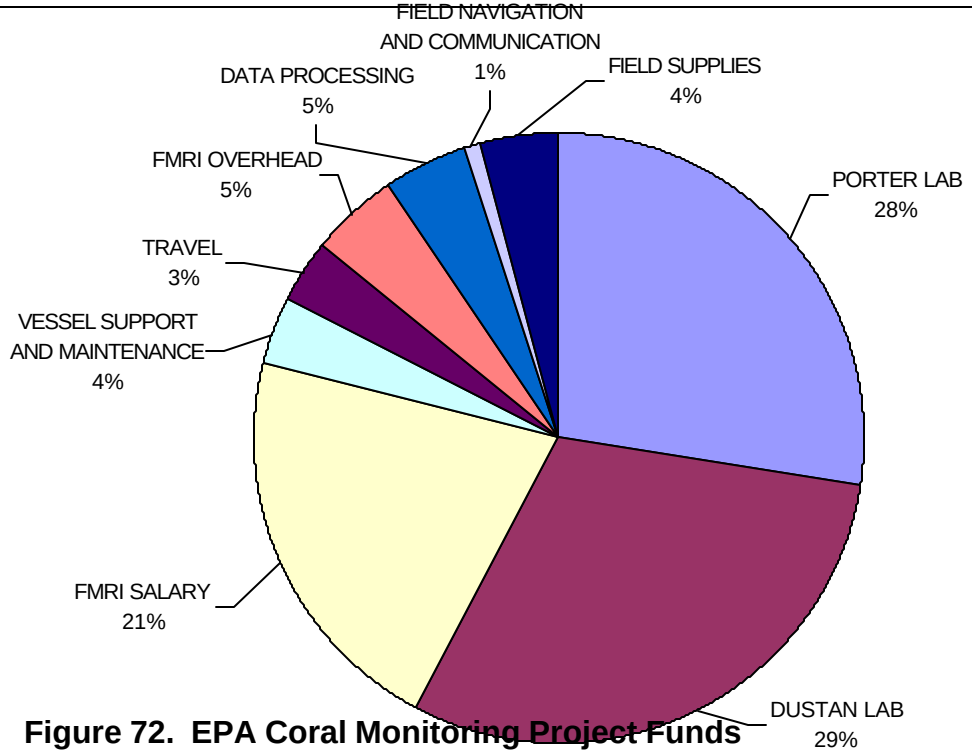


Figure 72. EPA Coral Monitoring Project Funds Disbursements FY 1996/1997

73. CRMP organizational chart

Figure 73. 1997 Coral Monitoring Project Team

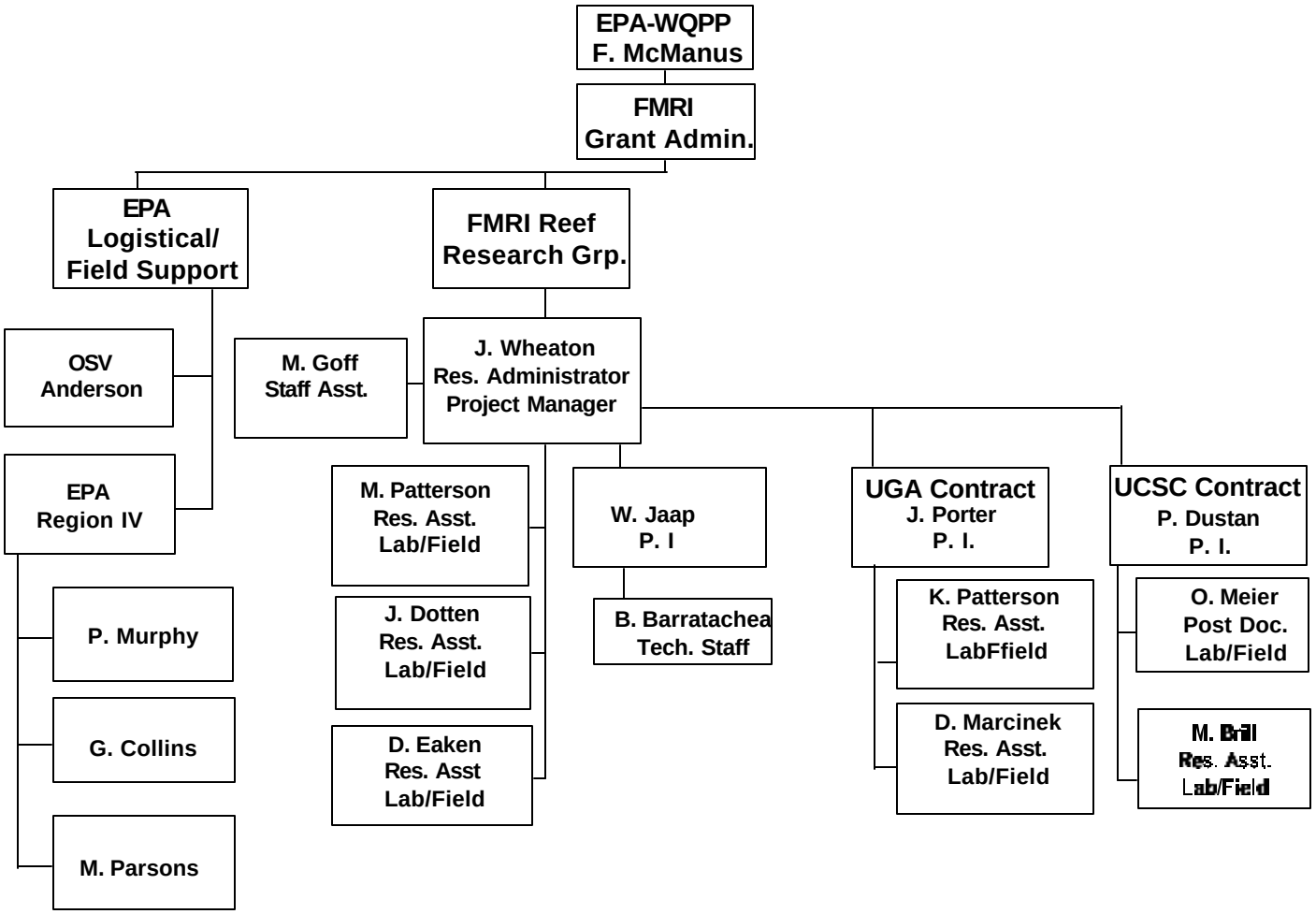


Table 1. Site/Station Data, Coral Reef and Hardbottom Monitoring

Site no.	Site Type	Site Name	Segment no.	Latitude (N)	Longitude (W)	Station no.	Depth (ft)	Date	Reference installed
9P1	P	Turtle	9	25°17.6647'	80°13.1481'	1&2	11-18	5/24/95	Buoy T6
				25°17.7448'	80°13.0505'	3&4	13-23	5/24/95	
9D1	OD	Carysfort	9	25°13.2481'	80°12.5915'	1&2	41-53	5/23/95	Bouy CF3
				25°13.3599'	80°12.5218'	3&4	40-47	5/23/95	Buoy CF6
9S1	OS	Carysfort	9	25°13.205'	80°12.628'	1	8-9	5/23/95	Bouy CF1
				25°13.245'	80°12.643'	2	5-8	5/23/95	Bouy CF2
				25°13.3339'	80°12.5851'	3&4	8-14	5/23/95	Bouy CF5
9H1	HB	Rattlesnake	9	25°10.415'	80°20.850'	1-4	5-6	5/17/95	
9S2	OS	Grecian Rocks	9	25°06.450'	80°18.410'	1&2	8-11	5/25/95	Bouy G1
				25°06.4528'	80°18.4155'	3&4	14-25	5/25/95	Bouy G12
9P3	P	Porter Patch	9	25°06.1899'	80°19.4586'	1-4	13-17	5/25/95	
9H2	HB	El Radabob	9	25°07.2068'	80°22.6937'	1-4	9	5/15/95	
9D3	OD	Molasses	9	25°00.4311'	80°22.5338'	1&2	40-44	5/16/95	Bouy M26
				25°00.4405'	80°22.4558'	3&4	45-49	5/15/95	Bouy M27
9S3	OS	Molasses	9	25°00.5 181'	80°22.589'	1	13-19	5/16/95	Bouy M4
				25°00.548'	80°22.502'	2	15-22	5/16/95	Bouy M6
				25°00.5521'	80°22.4371'	3	20-23	5/16/95	Bouy M9
				25°00.5795'	80°22.4365'	4	17-28	5/16/95	Bouy M11
9P4	P	Admiral	9	25°02.684'	80°23.685'	1-4	3-6	5/17/95	
9H3	HB	Dove Key	9	25°02.6793'	80°28.1025'	1-4	8	5/17/95	
9D4	OD	Conch	9	24°57.1114'	80°27.0807'	1-4	46-54	6/12/95	
9S4	OS	Conch	9	24°57.315'	80°27.481'	1&2	16-19	6/12/95	Bouy CO2
				24°57.371'	80°27.424'	3&4	16-21	6/12/95	Bouy CO3
7D1	OD	Alligator	7	24°50.7100'	80°37.2563'	1-4	34-38	6/14/95	
7S1	OS	Alligator	7	24°50.7723'	80°37.3812'	1&2	13-16	6/14/95	Bouy A2
				24°50.7792'	80°37.3393'	3&4	10-12	6/14/95	Bouy A3
7D2	OD	Tennessee	7	24°45.1621'	80°45.4696'	1-4	43-44	6/16/95	
7S2	OS	Tennessee	7	24°44.698'	80°46.873'	1-4	17-21	6/16/95	
7H2	HB	Long Key	7	24°47.834'	80°47.040'	1-4	12-13	9/29/95	ATON 44
7P1	P	W. Turtle Shoal	7	24°41.9572'	80°58.0127'	1-4	16-24	3/25/95	ATON 47
7P2	P	Dustan Rocks	7	24°41.3676'	81°01.8101'	1-4	12-21	3/27/95	W. Bouy
5D1	OD	Sombrero	5	24°37.3347'	81°06.7040'	1&2	45-52	12/6/94	Bouy #20
				24°37.3854'	81°06.6315'	3&4	47-48	12/7/94	Bouy #21
5S1	OS	Sombrero	5	24°37.5310'	81°06.6240'	1	17-18	12/8/94	Bouy #5
				24°37.5178'	81°06.6950'	2	16-20	12/8/94	Bouy #1
				24°37.5609'	81°06.5569'	3	13-20	12/8/94	Bouy #22
				24°37.6080'	81°06.5543'	4	8-9	12/8/94	Bouy #12
5H1	HB	Moser Channel	5	24°41.3450'	81°10.0502'	1-4	12-13	3/30/95	ATON 4
5H2	HB	Molasses Keys	5	24°40.5371'	81°11.4294'	1-4	12-14	3/30/95	
5D2	OD	Looe Key	5	24°32.5230'	81°24.9178'	1&2	41-44	6/20/95	Bouy L53
				24°32.5582'	81°24.7671'	3&4	38-42	6/20/95	Bouy L51
5S2	OS	Looe Key	5	24°32.7157'	81°24.4766'	1	12-24	6/20/95	Bouy L7
				24°32.714'	81°24.424'	2	21-24	6/20/95	Bouy L8
				24°32.720'	81°24.380'	3&4	15-25	6/24/95	Bouy L24
5P1	P	W. Wshrwoman	5	24°32.8480'	81°35.1934'	1-4	15-25	6/19/95	
5H3	HB	Jaap Reef	5	24°35.1421'	81°34.9568'	1-4	6-9	7/14/95	
5D3	OD	Eastern Sambo	5	24°29.3029'	81°39.9514'	1-4	43-48	7/13/95	
5S3	OS	Eastern Sambo	5	24°29.5013'	81°39.8139'	1-4	3-9	7/18/95	
5D4	OD	Western Sambo	5	24°28.6808'	81°43.0275'	1&2	38-40	7/18/95	
				24°28.776'	81°42.850'	3&4	24-29	7/18/95	Bouy #10
5S4	OS	Western Sambo	5	24°28.775'	81°43.054'	1&2	11-17	7/18/95	Bouy #13
				24°28.788'	81°42.945'	3&4	7-9	7/18/95	Bouy #11
5P2	P	Western Head	5	24°29.8625'	81°48.3343'	1-4	26-35	7/18/95	ATON 3A
5P3	P	Cliff Green	5	24°30.216'	81°46.059'	1-4	20-26	7/18/95	
5D5	OD	Rock Key	5	24°271929'	81°51.4076'	1-4	37-42	7/13/95	
5S5	OS	Rock Key	5	24°27.269'	81°51.532'	1	6-15	7/13/95	Bouy #9
				24°27.269'	81°51.532'	2	16-17	7/13/95	Bouy #8
				24°27.269'	81°51.532'	3	15-17	7/13/95	
				24°27.2853'	81°51.4213'	4	6-9	7/13/95	Bouy #3
3H1	HB	Content Keys	3	24°49.323'	81°29.335'	1-4	17-19	7/10/95	
2D1	OD	Sand Key	2	24°27.1005'	81°52.7909'	1-4	24-35	7/12/95	Bouy #17
2S1	OS	Sand Key	2	24°27.119'	81°52.650'	1-4	10-21	7/14/95	Bouy #12
2P1	P	Smith Shoal	2	24°43.184'	81°55.172'	1-4	19-26	7/10/95	

HB: Hardbottom OD: 0ffshore deep OS: Offshore shallow P: Patch reef Revised 7/98 DE

Table 2. 1997 Field Sampling Days

	May	June	July	August	September	Totals
B. Barrattachea	7	8	0	0	0	15
M. Brill	0	8	4	0	0	12
G. Collins	0	8	0	0	0	8
P. Dustan	0	8	4	0	0	12
J. Dotten	12	11	10	5	1	39
D. Eaken	12	11	10	5	1	39
W. Jaap	7	8	0	0	0	15
L. Mac Laughlin	1	0	0	1	0	2
O. Meier	0	8	4	0	0	17
P. Murphy	0	8	0	0	0	8
M. Parsons	0	8	0	0	0	8
M. Patterson	7	8	8	5	0	28
K. Patterson	0	8	3	5	0	16
J. Porter	0	8	4	5	0	17
D. Marcinek	7	8	3	5	0	23
E. McLean	0	2	0	0	0	2
T. Buckingham	0	2	0	0	0	2
J. Wheaton	7	8	0	0	0	15
Totals	**60**	**130**	**50**	**31**	**2**	**278**

* Travel Days not included

Table 3. Agency Field Sampling Participation

Agency	# of Days	% of Total
FMRI	151	54%
UGA	56	20%
UCSC	41	15%
FKNMS	2	1%
EPA	28	10%
Total	278	100%

Table 4. 1997 Dive Summary

		MAY		JUNE		JULY		AUGUST		SEPTEMBER		1997 Totals	
Divers	**Agency**	**# of Dives**	**B.T. in Minutes**	**# of Dives**	**B.T. in Minutes**	**# of Dives**	**B.T. in Minutes**	**# of Dives**	**B.T. in Minutes**	**# of Dives**	**B.T. in Minutes**	**# of Dives**	**B.T. in Minutes**
B. Barrattachea	**FMRI**	25	1220	15	423	0	0	0	0	0	0	40	1643
M. Brill	**UCSC**	0	0	14	716	8	700	0	0	0	0	22	1416
G. Collins	**EPA**	0	0	15	393	0	0	0	0	0	0	15	393
P. Dustan	**UCSC**	0	0	14	790	10	794	0	0	0	0	24	1584
J. Dotten	**FMRI**	40	1728	23	843	31	1382	14	818	0	0	108	4771
D. Eaken	**FMRI**	46	1828	24	643	31	1553	15	894	2	60	118	4978
W. Jaap	**FMRI**	18	942	14	692	0	0	0	0	2	60	34	1694
L. Mac Laughlin	**FKNMS**	2	101	0	0	0	0	3	104	0	0	5	205
O. Meier	**UCSC**	0	0	14	781	10	798	0	0	0	0	24	1579
P. Murphy	**EPA**	0	0	14	301	0	0	0	0	0	0	14	301
M. Parsons	**EPA**	0	0	15	488	0	0	0	0	0	0	15	488
M. Patterson	**FMRI**	20	993	14	687	19	1077	11	756	0	0	64	3513
K. Patterson	**UGA**	0	0	14	659	8	381	12	908	0	0	34	1948
J. Porter	**UGA**	0	0	14	698	10	531	12	887	0	0	36	2116
D. Marcinek	**UGA**	22	1300	16	555	10	444	12	906	0	0	60	3205
E. McLean	**EPA**	0	0	4	97	0	0	0	0	0	0	4	97
T. Buckingham	**EPA**	0	0	4	141	0	0	0	0	0	0	4	141
J. Wheaton	**FMRI**	11	521	10	325	0	0	0	0	0	0	21	846
Monthly Totals		**184**	**8,633**	**238**	**9,232**	**137**	**7,660**	**79**	**5,273**	**4**	**120**	**642**	**30,918**

	# of Dives	**B.T. in Minutes**	**B.T. in Hours**	
Annual Total	**642**	**30,918**	**515.30**	**B.T. = Bottom Time**

Table 5. 1997 Agency Dive Participation

Agency	# of Dives	% of Total
FMRI	385	60%
UGA	130	20%
UCSC	70	11%
FKNMS	5	1%
EPA	52	8%
Total	642	100%

Agency	B.T. in Hours	% of Total
FMRI	290.75	56%
UGA	121.15	24%
UCSC	76.32	15%
FKNMS	3.42	1%
EPA	23.67	5%
Total	515.30	100%

Table 6. Depth Distribution of Dives for Sampling Season 1996 and 1997

Depth	1996 Season Totals	1997 Season Totals
0-30'	496	452
31-60'	277	190

Table 7. Taxonomic List* of Hydrozoan and Scleractinian Corals from Species Inventories.
Revised 1997

PHYLUM CNIDARIA
CLASS HYDROZOA
ORDER ATHECATE
Family Milleporidae
Millepora alcicornis Linne, 1758
Millepora complanata Lamarck, 1816
CLASS ANTHOZOA
SUBCLASS ZOANTHARIA
ORDER SCLERACTINIA
SUBORDER ASTROCOENIINA
Family Astrocoeniidae
Stephanocoenia michelinii Milne Edwards and Haime, 1848
Family Pocilloporidae
Madracis decactis (Lyman, 1859)
Madracis mirabilis sensu Wells, 1973
Family Acroporidae
Acropora cervicornis (Lamarck, 1816)
Acropora palmata (Lamarck, 1816)
SUBORDER FUNGIINA
Family Agariciidae
Agaricia agaricites ((Linne, 1758) [COMPLEX]**
Agaricia fragilis (Dana, 1846)
Agaricia lamarcki Milne Edwards and Haime, 1851
Leptoseris cucullata (Ellis and Solander, 1786)
Family Siderastreidae
Siderastrea radians (Pallas, 1766)
Siderastrea siderea (Ellis and Solander, 1786)
Family Poritidae
Porites astreoides Lamarck, 1816
Porites branneri Rathbun, 1888
Porites porites (Pallas, 1766) [COMPLEX]**
SUBORDER FAVIINA
Family Faviidae
Cladocora arbuscula (Lesueur, 1821)
Colpophyllia natans (Houttuyn, 1772)
Diploria clivosa (Ellis and Solander, 1786)
Diploria labyrinthiformis (Linne, 1758)
Diploria strigosa (Dana, 1846)
Favia fragum (Esper, 1795)
Manicina areolata (Linne, 1758)
Montastraea cavernosa (Linne, 1767)
Montastraea annularis (Ellis and Solander, 1786) [COMPLEX]**

Solenastrea bournoni Milne Edwards and Haime, 1850
Solenastrea hyades (Dana, 1846)

Family Rhizangiidae
Astrangia poculata (Ellis and Solander, 1786)
Astrangia solitaria (Lesueur, 1817)
Phyllangia americana Milne Edwards and Haime, 1849
Family Oculinidae
Oculina diffusa Lamarck, 1816
Family Meandrinidae
Dendrogyra cylindrus Ehrenberg, 1834
Dichocoenia stokesi Milne Edwards and Haime, 1848
Meandrina meandrites (Linne, 1758)
Family Mussidae
Isophyllastraea rigida (Dana, 1846)
Isophyllia sinuosa (Ellis and Solander, 1786)
Mussa angulosa (Pallas, 1766)
Mycetophyllia lamarckiana Milne Edwards and Haime, 1848
Mycetophyllia danaana Milne Edwards and Haime, 1849
Mycetophyllia aliciae Wells, 1973
Mycetophyllia ferox Wells, 1973
Scolymia cubensis Milne Edwards and Haime, 1849
Scolymia lacera (Pallas, 1766)
SUBORDER CARYOPHYLLIINA
Family Caryophylliidae
Eusimilia fastigiata (Pallas, 1766)

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*Systematics follows Wells and Lang, 1973 and Cairns *et. al.* 1991.

***Agaricia agaricites* COMPLEX may include:
agaricites (Linne, 1758)
carinata Wells, 1973
danai Milne Edwards and Haime, 1860
purpurea (Lesueur, 1821)
***Porites porites* COMPLEX may include:
porites (Pallas, 1766)
clavaria Lamarck, 1816
furcata Lamarck, 1816
divaricata Lesueur, 1821
***Montastraea annularis* COMPLEX may include:
annularis (Ellis and Solander, 1786)
faveolata (Ellis and Solander, 1786)
franksi (Gregory, 1895)

Table 8a. Presence / Absence of Stony Coral Taxa - All Sites - 1997

	9P1	9P3	9P4	9H1	9H2	9H3	9S1	9S2	9S3	9S4	9D1	9D3	9D4	7P1	7P2	7H2	7S1	7S2	7D1	7D2	5P1	5P2	5P3	5H1	5H2	5H3	5S1	5S2	5S3	5S4	5S5	5D1	5D2	5D3	5D4	5D5	3H1	2P1	2S1	2D1	1997 Taxa Observed	Sum
Acropora cervicornis	1	1	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	1	0	1	1	1	1	0	0	0	1	1	0	1	1	0	1	1	1	1	0	0	1	1	1	21
Acropora palmata	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	0	1	8
Agaricia agaricites (complex)	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	34
Agaricia fragilis	1	1	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	0	0	1	1	0	1	0	0	0	0	1	0	1	1	1	1	1	1	1	0	0	1	1	1	22
Agaricia lamarcki	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	10
Astrangia poculata	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1
Astrangia solitaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0		1
Cladacora arbuscula	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0		7
Colpophyllia natans	1	1	1	0	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	31
Dendrogyra cylindrus	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3
Dichocoenia stokesii	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	38
Diploria clivosa	1	0	0	0	0	0	1	1	1	0	0	0	0	1	1	1	0	1	0	0	0	0	0	1	0	1	1	1	0	1	1	0	0	0	0	0	1	0	1	1	1	17
Diploria labyrinthiformis	1	1	1	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	30
Diploria strigosa	1	1	1	0	0	0	1	1	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	30
Eusmilia fastigiata	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	0	0	0	0	1	1	1	0	1	1	1	1	1	0	0	1	1	1	26
Favia fragum	1	1	0	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	0	0	1	1	0	0	1	1	1	29
Isophyllastrea rigida	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7
Isophyllia sinuosa	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	7
Leptoseris cucullata	1	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	1	1	1	20
Madracis decactis	1	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	1	1	0	1	0	1	1	0	0	0	0	1	0	1	0	1	1	1	1	1	0	1	1	1	1	22
Madracis mirabilis	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	1	1	13
Manicina areolata	0	0	0	1	1	1	0	0	0	1	1	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	1	1	15
Meadrina meandrites	1	1	1	0	0	0	0	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	0	1	1	0	1	0	1	1	1	1	1	0	0	1	1	1	27
Millepora alcicornis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	40
Millepora complanata	1	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0	1	0	0	0	1	0	1	16
Montastraea annularis (complex)	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	33
Montastraea cavernosa	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	35
Mussa angulosa	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	12
Mycetophyllia aliciae	1	0	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	0	1	1	1	0	1	0	0	0	0	1	15
Mycetophyllia danaana	1	0	0	0	0	0	0	0	1	0	1	0	0	1	1	0	0	0	1	1	1	0	1	0	0	0	1	1	0	1	0	0	1	0	1	1	0	0	1	1	1	17
Mycetophyllia ferox	1	0	0	0	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	1	1	0	0	1	1	1	17
Mycetophyllia lamarckiana	1	0	0	0	0	0	1	1	1	0	1	0	1	1	1	0	0	0	1	1	1	0	1	0	0	0	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	23
Oculina diffusa	1	1	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	13
Phyllangia americana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	3
Porites astreoides	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	40
Porites branneri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Porites porites (complex)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	39
Scolymia cubensis	1	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	0	1	1	17
Scolymia lacera	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	4
Solenastrea bournoni	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	0	0	1	0	0	1	1	18
Solenastrea hyades	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Siderastrea radians	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	0	1	1	1	1	33
Siderastrea siderea	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	36
Stephanocoenia michelinii	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	34
Total Number of Taxa - 1997	32	20	14	8	10	11	17	22	27	21	26	22	22	27	26	19	16	22	23	30	30	27	30	15	9	15	22	24	14	26	22	24	28	28	26	27	11	17	28	29	41	

Table 8b. Frequency of Stony Coral Taxa - All Sites - 1997

	9P1	9P3	9P4	9H1	9H2	9H3	9S1	9S2	9S3	9S4	9D1	9D3	9D4	7P1	7P2	7H2	7S1	7S2	7D1	7D2	5P1	5P2	5P3	5H1	5H2	5H3	5S1	5S2	5S3	5S4	5S5	5D1	5D2	5D3	5D4	5D5	3H1	2P1	2S1	2D1	SUM
Acropora cervicornis	1	0.25	0	0	0	0	0	0.5	0.25	0	0.25	0	0	0.5	0	0	0	1	0	0.75	0.25	0.25	0.25	0	0	0	0.25	0.75	0	0.5	0.5	0	0.25	0.75	1	0.5	0	0	0.25	0.5	10.5
Acropora palmata	0	0	0	0	0	0	0.5	0.25	1	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	1	1	0	0	0	0	0	0	1	0	5.25
Agaricia agaricites (complex)	1	1	1	0	0	0	1	0.75	1	1	1	1	1	1	1	0	1	1	1	1	1	0.5	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0.25	1	1	1	32.5
Agaricia fragilis	1	0.25	0	0	0	0	0	0.25	1	0.5	0.75	1	0.5	0	0	0	0.25	0	0	1	0.75	0	0.75	0	0	0	0	0.25	0	0.25	0.25	0.75	1	1	1	0.5	0	0	0.75	1	14.75
Agaricia lamarcki	0	0	0	0	0	0	0	0	0	0	0.25	0.5	0.75	0	0	0	0	0	0.25	0.5	0	0.5	0	0	0	0	0	0	0	0	0	0.25	0.5	0.25	0	0	0	0	0	0.25	4
Astrangia poculata	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25
Astrangia solitaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0.5
Cladacora arbuscula	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.75	0.25	0.75	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	5
Colpophyllia natans	0.5	0.25	0.5	0	0	0	0	0.25	0.5	0.25	1	0.25	0	1	1	1	0.75	0.75	0.25	1	1	1	1	0.25	0	0.75	0.5	1	0	0.25	0.25	0.75	0.75	1	1	1	0	0	0.5	1	21.25
Dendrogyra cylindrus	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0.75
Dichocoenia stokesii	1	1	0.75	0.75	1	1	0.75	1	0.5	0.75	0.75	0.75	0.75	1	1	1	1	1	1	1	1	1	1	1	0.5	0.25	0.75	1	0	0.25	0.5	1	1	1	0.75	1	0	0.25	0.75	1	31.75
Diploria clivosa	0.75	0	0	0	0	0	1	0.5	0.25	0	0	0	0	0.5	0.5	0.5	0	0.5	0	0	0	0	0	0.75	0	0.75	0.25	0.5	0	0.5	1	0	0	0	0	0	0.25	0	1	0.25	9.75
Diploria labyrinthiformis	0.75	1	0.5	0	0	0	0	0.5	0.75	0	0.5	1	0.5	1	0.75	0.75	0.25	1	0.5	1	0.5	0.25	1	0	0	0.25	0.75	1	0	0.25	0.25	0.5	0.75	0.75	1	0.75	0	0	0.25	1	20
Diploria strigosa	1	0.5	0.25	0	0	0	0.25	0.5	0.75	0	0	0.5	0.5	1	1	0.75	0	1	0.5	1	0.25	1	1	0	0	0.25	0	0.75	0	0.25	0.5	0.75	1	0.25	0.75	0.75	0.75	1	0.75	1	20.5
Eusmilia fastigiata	0.75	0.5	0	0	0	0	0.25	0.5	0.25	1	1	0.5	1	1	1	0	0	0	0.5	1	0.75	1	1	0	0	0	0	0.75	0.25	0.25	0	1	1	1	1	1	0	0	1	1	20.25
Favia fragum	0.75	0.25	0	1	1	0	1	0.25	1	1	0.25	0	0	0.25	0.25	1	1	0.25	0.25	0.75	0.25	0	0	1	1	0.5	1	0.75	1	1	1	0	0	0	0.5	0.5	0	0	1	0.25	20
Isophyllastrea rigida	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0.5	0.25	0	0.25	0	0	0.25	0	0	1	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.75
Isophyllia sinuosa	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0.25	0	0	0	0	0	0.25	0.25	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0.5	0	0	2
Leptoseris cucullata	1	0	0	0	0	0	0	0.5	0.75	0.5	1	0.75	0.75	0	0.25	0	0	0	0.5	1	0.75	0.5	0.25	0	0	0	0	0	0	0	0	1	1	1	0.75	0.5	0	0	0.25	0.5	13.5
Madracis decactis	0.25	0	0	0	0	0	0	0	0.25	0.5	1	1	1	0.25	0	0	0.5	0.25	0	1	0	0.25	0.75	0	0	0	0	0.25	0	0.25	0	1	1	1	0.5	0.75	0	0.5	0.5	0.75	13.5
Madracis mirabilis	0	0	0	0	0	0	0	0	0.25	0	0	0.75	0.5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.25	0.5	0.25	0.25	1	0.75	0.75	0.75	0	0	0	0.25	7.25
Manicina areolata	0	0	0	1	1	0.75	0	0	0	0.25	0.25	0	0	0	0	0.25	0	0	1	1	0	0	0	0.25	0	0	0	0	0	0	0	1	1	1	0.75	1	0	0	0	1	11.5
Meadrina meandrites	0.75	0.75	0.5	0	0	0	0	0	0.75	0.25	0.25	1	0.75	1	0.25	0	0.5	0.75	1	1	0.5	0.75	1	0	0	0	0.75	0.75	0	0.25	0	0.5	0.5	0.75	0.5	0.75	0	0	0.5	1	18
Millepora alcicornis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.75	0.75	0.75	1	1	1	1	1	1	1	1	1	39.25
Millepora complanata	0.25	0	0	0	0	0	1	0.25	1	1	0	0	0	0	0	0	1	0.5	0	0	0	0.75	0.5	0	0	0	1	1	1	1	1	0	0	0	0.25	0	0	0	1	0	12.5
Montastraea annularis (complex)	1	0.75	1	0	0	0	0.25	0.75	1	0.5	1	0.75	1	0.75	1	0.5	0	0.75	1	1	1	1	1	0	0	1	0.75	1	0.75	1	0.75	1	1	1	1	1	0	1	1	1	29.25
Montastraea cavernosa	1	0.75	0.75	0	0	0	0.5	0.75	1	0.25	1	1	1	1	1	1	1	1	1	1	1	1	1	0.75	0	0.75	0.75	1	0.5	0.75	0.75	1	1	1	0.75	1	0	1	1	1	31
Mussa angulosa	0.25	0	0	0	0	0	0	0	0	0	0.5	0.25	0.75	0.25	0.5	0	0	0	0	0	0.5	0.5	1	1	0	0	0	0	0	0	0	0	0	0	0.75	0	0	0	0.5	0	0	6.75
Mycetophyllia aliciae	0.25	0	0	0	0	0	0	0	0.25	0	0.75	0.25	0.25	0.25	0	0	0	0	0	0.75	0.5	1	0.75	0	0	0	0	0	0	0	0	0.25	0	0.5	0.5	1	0	0.25	0	0	0	7.5
Mycetophyllia danaana	0.75	0	0	0	0	0	0	0	0.5	0	0.75	0	0	1	1	0	0	0	0.25	0.25	1	0	0.5	0	0	0	0.25	0.5	0	0.5	0	0	0.5	0	0	0.25	0.75	0	0	0.75	0.5	10
Mycetophyllia ferox	0.75	0	0	0	0	0	0.25	0	0.25	0	0.75	0	0	0	0.5	0	0	0	0	0.75	1	0	0.25	0	0	0	0.25	0.75	0	0.25	0	0	1	1	0.75	1	0	0	0.25	0.25	10
Mycetophyllia lamarckiana	1	0	0	0	0	0	0.25	0.5	0.75	0	1	0	0.5	1	1	0	0	0	0.25	0.75	1	0	1	0	0	0	0.25	0.5	0	0.5	0.25	0.75	1	0.75	0.75	0.75	0	0	1	0.75	16.25
Oculina diffusa	0.75	0.75	0	0	0.25	0	0	0	0	0	0	0	0	0.75	0.25	0.75	0	0.25	0	0	0.25	1	1	0.5	0	0	0	0	0	0.25	0	0	0	0	0	0	1	0	0	7.75
Phyllangia americana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.75	0.75	0	0	1.75
Porites astreoides	1	1	1	1	1	0.75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.75	0.75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	39.25
Porites branneri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25
Porites porites (complex)	1	1	0.25	1	1	1	0.75	1	0.5	1	1	0.75	1	1	0.75	1	1	1	1	1	1	0	0.75	1	1	1	0.75	1	1	1	1	0.75	1	1	1	1	0.75	0.75	1	1	35.75
Scolymia cubensis	0.25	0	0	0	0	0	0	0	0	0	1	0	0.25	1	0.25	0	0	0	0.25	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	0.25	0.75	0	1	0	0.25	12.25
Scolymia lacera	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0.75	0	0	0	0.5	0	0	2.25
Solenastrea bournoni	0.5	1	0	0	0	0.75	0	0	0	0	0	0	0	0	0.25	0.75	0	0.25	0.75	0.25	0.75	1	1	0.75	0.25	0	0	0	0	0	0	1	0.5	0.5	0	0	1	0	0	0.5	11.75
Solenastrea hyades	0	0	0	0	0.25	0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Siderastrea radians	0.25	1	1	1	1	0.5	0.75	1	0	0.5	0	0.75	0	1	1	1	0.5	1	1	0.5	1	1	1	1	1	1	0.75	0.25	0.25	0.5	0.75	0	1	0	0	1	1	0	1	1	27.25
Siderastrea siderea	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0.25	1	1	1	1	1	1	1	1	0	0	0.75	1	1	0.75	1	1	1	1	1	1	1	0	1	1	1	34.75
Stephanocoenia michelinii	0.75	0.75	0.25	0	0	0.25	0	0.25	0.25	0.5	1	1	1	1	1	1	0.5	1	1	1	1	1	1	1	1	0	1	0.75	1	0	0	0.5	1	1	1	0.5	1	1	1	0.75	0.75	27.75
Mussid (juvenile)	1	0	0	0	0	0	0	0.25	0.25	0	0.75	0	0.25	0.5	0.75	0	0	0	0	1	1	1	1	0	0.5	0	0	0	0	0.25	0	0	0.75	0.5	0	0.75	0	0	0	0.25	10.75
URCHIN TAXA																																									
Diadema antillarum	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0.25	0	0	0	0	0	0	0	0	0	0.25	0	0	0.25	0.75	0.25	0	0	0	0	0	0	0	0	0	2.5

Table 9 . Bray Curtis Similarity Coefficient Comparing 1996 and 1997 Species Frequency of Occurrence.

Hardbottom	**Coefficient Value**	**Patch Reef**	**Coefficient Value**	**Offshore Shallow**	**Coefficient Value**	**Offshore Deep**	**Coefficient Value**
Rattle Snake	84.786	Turtle	91.398	Carysfort	95.556	Carysfort	94.048
El Radabob	88.525	Porter	89.922	Grecian Rocks	87.395	Molasses	89.362
Dove Key	57.627	Admiral	93.827	Molasses	86.765	Conch	87.770
Long Key	90.625	W. Turtle Shoal	88.327	Conch	82.105	Alligator	92.913
Moser Channel	93.333	Dustan Rocks	88.158	Alligator	92.632	Tennessee	93.000
Molasses Keys	74.419	W. Washer Woman	85.030	Tennessee	96.923	Sombrero	91.566
Jaap Reef	92.683	Western Head	87.568	Sombrero	94.545	Looe Key	88.398
Content Keys	87.324	Cliff Green	90.995	Looe Key	92.857	Eastern Sambo	90.640
		Smith Shoal	88.189	Eastern Sambo	89.189	Western Sambo	87.742
				Western Sambo	92.434	Rock Key	95.652
				Rock Key	88.073	Sand Key	91.860
				Sand Key	92.593		
Mean	83.620		89.273		90.923		90.962
Std. Dev.	11.292		2.422		4.242		2.159

Table 10a. Presence / Absence of Stony Coral Taxa - All Site Types - 1997

SITE TYPES:	HARDBOTTOM	PATCH REEF	SHALLOW OFFSHORE	DEEP OFFSHORE
STONY CORAL TAXA				
Acropora cervicornis	0	1	1	1
Acropora palmata	0	0	1	0
Agaricia agaricites (complex)	1	1	1	1
Agaricia fragilis	0	1	1	1
Agaricia lamarcki	0	1	0	1
Astrangia poculata	1	0	0	0
Astrangia solitaria	0	0	1	0
Cladocora arbuscula	1	1	0	0
Colpophyllia natans	1	1	1	1
Dendrogyra cylindrus	0	0	1	0
Dichocoenia stokesii	1	1	1	1
Diploria clivosa	1	1	1	1
Diploria labyrinthiformis	1	1	1	1
Diploria strigosa	1	1	1	1
Eusmilia fastigiata	0	1	1	1
Favia fragum	1	1	1	1
Isophyllastrea rigida	1	1	1	0
Isophyllia sinuosa	1	1	1	0
Leptoseris cucullata	0	1	1	1
Madracis decactis	0	1	1	1
Madracis mirabilis	0	0	1	1
Manicina areolata	1	0	1	1
Meadrina meandrites	0	1	1	1
Millepora alcicornis	1	1	1	1
Millepora complanata	0	1	1	1
Montastraea annularis (complex)	1	1	1	1
Montastraea cavernosa	1	1	1	1
Mussa angulosa	0	1	0	1
Mycetophyllia aliciae	0	1	1	1
Mycetophyllia danaana	0	1	1	1
Mycetophyllia ferox	0	1	1	1
Mycetophyllia lamarckiana	0	1	1	1
Oculina diffusa	1	1	1	0
Phyllangia americana	1	1	0	0
Porites astreoides	1	1	1	1
Porites branneri	0	1	0	0
Porites porites (complex)	1	1	1	1
Scolymia cubensis	0	1	0	1
Scolymia lacera	0	1	0	1
Solenastrea bournoni	1	1	1	1
Solenastrea hyades	1	0	0	0
Siderastrea radians	1	1	1	1
Siderastrea siderea	1	1	1	1
Stephanocoenia michelinii	1	1	1	1
Total Number of Taxa	**25**	**37**	**35**	**33**
Mussid (juvenile)	0	0	0	0
URCHIN TAXA				
Diadema antillarum	0	0	0	0

Table 10b. Frequency of Stony Coral Taxa - All Site Types - 1997

SITE TYPES:	HARDBOTTOM	PATCH REEF	SHALLOW OFFSHORE	DEEP OFFSHORE	SUM
STONY CORAL TAXA					
Acropora cervicornis	0.000	0.278	0.333	0.364	0.975
Acropora palmata	0.000	0.944	0.438	0.000	1.382
Agaricia agaricites (complex)	0.156	0.306	0.979	1.000	2.441
Agaricia fragilis	0.000	0.056	0.292	0.773	1.120
Agaricia lamarcki	0.000	0.306	0.000	0.318	0.624
Astrangia poculata	0.031	0.694	0.000	0.000	0.726
Astrangia solitaria	0.000	0.889	0.042	0.000	0.931
Cladacora arbuscula	0.281	0.194	0.000	0.000	0.476
Colpophyllia natans	0.250	0.639	0.417	0.727	2.033
Dendrogyra cylindrus	0.000	0.778	0.063	0.000	0.840
Dichocoenia stokesii	0.688	0.667	0.688	0.909	2.951
Diploria clivosa	0.281	0.194	0.458	0.023	0.957
Diploria labyrinthiformis	0.125	0.111	0.417	0.750	1.403
Diploria strigosa	0.219	0.111	0.396	0.636	1.362
Eusmilia fastigiata	0.000	0.306	0.354	0.909	1.569
Favia fragum	0.688	0.222	0.854	0.227	1.991
Isophyllastrea rigida	0.188	0.611	0.021	0.000	0.819
Isophyllia sinuosa	0.031	1.000	0.063	0.000	1.094
Leptoseris cucullata	0.000	0.167	0.167	0.795	1.129
Madracis decactis	0.000	0.944	0.208	0.818	1.971
Madracis mirabilis	0.000	0.944	0.104	0.545	1.594
Manicina areolata	0.406	0.444	0.021	0.727	1.599
Meadrina meandrites	0.000	0.611	0.375	0.727	1.713
Millepora alcicornis	1.000	0.306	0.938	1.000	3.243
Millepora complanata	0.000	0.472	0.896	0.023	1.391
Montastraea annularis (complex)	0.188	0.250	0.708	0.977	2.123
Montastraea cavernosa	0.313	0.556	0.771	0.977	2.616
Mussa angulosa	0.000	0.639	0.000	0.250	0.889
Mycetophyllia aliciae	0.000	0.111	0.042	0.386	0.539
Mycetophyllia danaana	0.000	1.000	0.208	0.295	1.504
Mycetophyllia ferox	0.000	0.028	0.167	0.500	0.694
Mycetophyllia lamarckiana	0.000	0.722	0.333	0.659	1.715
Oculina diffusa	0.188	0.611	0.042	0.000	0.840
Phyllangia americana	0.094	0.167	0.000	0.000	0.260
Porites astreoides	0.906	0.806	1.000	1.000	3.712
Porites branneri	0.000	1.000	0.000	0.000	1.000
Porites porites (complex)	0.969	0.500	0.917	0.955	3.340
Scolymia cubensis	0.000	0.861	0.000	0.614	1.475
Scolymia lacera	0.000	0.000	0.000	0.068	0.068
Solenastrea bournoni	0.438	0.000	0.021	0.318	0.777
Solenastrea hyades	0.125	0.000	0.000	0.000	0.125
Siderastrea radians	0.938	0.000	0.604	0.477	2.019
Siderastrea siderea	0.375	0.000	0.979	1.000	2.354
Stephanocoenia michelinii	0.531	0.000	0.458	0.932	1.921
Mussid (juvenile)	0.063	0.000	0.063	0.386	0.511
URCHIN TAXA					
Diadema antillarum	0.031	0.000	0.125	0.000	0.156

Table 11a. Presence / Absence of Stony Coral Taxa - Hardbottom Sites - 1997

SITE CODES:	9H1	9H2	9H3	7H2	5H1	5H2	5H3	3H1	SUM
STONY CORAL TAXA									
Acropora cervicornis	0	0	0	0	0	0	0	0	0
Acropora palmata	0	0	0	0	0	0	0	0	0
Agaricia agaricites (complex)	0	0	0	0	0	0	1	1	2
Agaricia fragilis	0	0	0	0	0	0	0	0	0
Agaricia lamarcki	0	0	0	0	0	0	0	0	0
Astrangia poculata	0	0	1	0	0	0	0	0	1
Astrangia solitaria	0	0	0	0	0	0	0	0	0
Cladacora arbuscula	1	0	0	0	1	1	0	1	4
Colpophyllia natans	0	0	0	1	1	0	1	0	3
Dendrogyra cylindrus	0	0	0	0	0	0	0	0	0
Dichocoenia stokesii	1	1	1	1	1	1	1	0	7
Diploria clivosa	0	0	0	1	1	0	1	1	4
Diploria labyrinthiformis	0	0	0	1	0	0	1	0	2
Diploria strigosa	0	0	0	1	0	0	1	1	3
Eusmilia fastigiata	0	0	0	0	0	0	0	0	0
Favia fragum	1	1	0	1	1	1	1	0	6
Isophyllastrea rigida	0	0	0	1	1	1	0	0	3
Isophyllia sinuosa	0	0	0	1	0	0	0	0	1
Leptoseris cucullata	0	0	0	0	0	0	0	0	0
Madracis decactis	0	0	0	0	0	0	0	0	0
Madracis mirabilis	0	0	0	0	0	0	0	0	0
Manicina areolata	1	1	1	1	1	0	0	0	5
Meadrina meandrites	0	0	0	0	0	0	0	0	0
Millepora alcicornis	1	1	1	1	1	1	1	1	8
Millepora complanata	0	0	0	0	0	0	0	0	0
Montastraea annularis (complex)	0	0	0	1	0	0	1	0	2
Montastraea cavernosa	0	0	0	1	1	0	1	0	3
Mussa angulosa	0	0	0	0	0	0	0	0	0
Mycetophyllia aliciae	0	0	0	0	0	0	0	0	0
Mycetophyllia danaana	0	0	0	0	0	0	0	0	0
Mycetophyllia ferox	0	0	0	0	0	0	0	0	0
Mycetophyllia lamarckiana	0	0	0	0	0	0	0	0	0
Oculina diffusa	0	1	0	1	1	0	0	0	3
Phyllangia americana	0	0	0	0	0	0	0	1	1
Porites astreoides	1	1	1	1	1	1	1	1	8
Porites branneri	0	0	0	0	0	0	0	0	0
Porites porites (complex)	1	1	1	1	1	1	1	1	8
Scolymia cubensis	0	0	0	0	0	0	0	0	0
Scolymia lacera	0	0	0	0	0	0	0	0	0
Solenastrea bournoni	0	0	1	1	1	1	0	1	5
Solenastrea hyades	0	1	1	0	0	0	0	0	2
Siderastrea radians	1	1	1	1	1	1	1	1	8
Siderastrea siderea	0	1	1	1	0	0	1	0	4
Stephanocoenia michelinii	0	0	1	1	1	0	1	1	5
Total Number of Stony Coral Taxa	**8**	**10**	**11**	**19**	**15**	**9**	**15**	**11**	
Mussid (juvenile)	0	0	0	0	0	0	0	0	0
URCHIN TAXA									
Diadema antillarum	0	0	0	0	0	0	0	0	0

Mean Hardbottom Taxa	12.25
Standard Deviation	3.73
Range	8 to 19

Table 11b. Frequency of Stony Coral Taxa - Hardbottom Sites - 1997

SITE CODES:	9H1	9H2	9H3	7H2	5H1	5H2	5H3	3H1	SUM
STONY CORAL TAXA									
Acropora cervicornis	0	0	0	0	0	0	0	0	0
Acropora palmata	0	0	0	0	0	0	0	0	0
Agaricia agaricites (complex)	0	0	0	0	0	0	1	0.25	1.25
Agaricia fragilis	0	0	0	0	0	0	0	0	0
Agaricia lamarcki	0	0	0	0	0	0	0	0	0
Astrangia poculata	0	0	0.25	0	0	0	0	0	0.25
Astrangia solitaria	0	0	0	0	0	0	0	0	0
Cladacora arbuscula	0.25	0	0	0	0.25	0.75	0	1	2.25
Colpophyllia natans	0	0	0	1	0.25	0	0.75	0	2
Dendrogyra cylindrus	0	0	0	0	0	0	0	0	0
Dichocoenia stokesii	0.75	1	1	1	1	0.5	0.25	0	5.5
Diploria clivosa	0	0	0	0.5	0.75	0	0.75	0.25	2.25
Diploria labyrinthiformis	0	0	0	0.75	0	0	0.25	0	1
Diploria strigosa	0	0	0	0.75	0	0	0.25	0.75	1.75
Eusmilia fastigiata	0	0	0	0	0	0	0	0	0
Favia fragum	1	1	0	1	1	1	0.5	0	5.5
Isophyllastrea rigida	0	0	0	0.25	1	0.25	0	0	1.5
Isophyllia sinuosa	0	0	0	0.25	0	0	0	0	0.25
Leptoseris cucullata	0	0	0	0	0	0	0	0	0
Madracis decactis	0	0	0	0	0	0	0	0	0
Madracis mirabilis	0	0	0	0	0	0	0	0	0
Manicina areolata	1	1	0.75	0.25	0.25	0	0	0	3.25
Meadrina meandrites	0	0	0	0	0	0	0	0	0
Millepora alcicornis	1	1	1	1	1	1	1	1	8
Millepora complanata	0	0	0	0	0	0	0	0	0
Montastraea annularis (complex)	0	0	0	0.5	0	0	1	0	1.5
Montastraea cavernosa	0	0	0	1	0.75	0	0.75	0	2.5
Mussa angulosa	0	0	0	0	0	0	0	0	0
Mycetophyllia aliciae	0	0	0	0	0	0	0	0	0
Mycetophyllia danaana	0	0	0	0	0	0	0	0	0
Mycetophyllia ferox	0	0	0	0	0	0	0	0	0
Mycetophyllia lamarckiana	0	0	0	0	0	0	0	0	0
Oculina diffusa	0	0.25	0	0.75	0.5	0	0	0	1.5
Phyllangia americana	0	0	0	0	0	0	0	0.75	0.75
Porites astreoides	1	1	0.75	1	1	0.75	0.75	1	7.25
Porites branneri	0	0	0	0	0	0	0	0	0
Porites porites (complex)	1	1	1	1	1	1	1	0.75	7.75
Scolymia cubensis	0	0	0	0	0	0	0	0	0
Scolymia lacera	0	0	0	0	0	0	0	0	0
Solenastrea bournoni	0	0	0.75	0.75	0.75	0.25	0	1	3.5
Solenastrea hyades	0	0.25	0.75	0	0	0	0	0	1
Siderastrea radians	1	1	0.5	1	1	1	1	1	7.5
Siderastrea siderea	0	1	1	0.25	0	0	0.75	0	3
Stephanocoenia michelinii	0	0	0.25	1	1	0	1	1	4.25
Mussid (juvenile)	0	0	0	0	0	0.5	0	0	0.5
URCHIN TAXA									
Diadema antillarum	0	0	0	0	0	0	0.25	0	0.25

Table 12. Similarity Coefficients of Coral Taxa Frequency of Occurrence, Hardbottom Sites, 1997.

SITES	9H197	9H297	9H397	7H297	5H197	5H297	5H397
9H297	87.097						
9H397	63.333	75.758					
7H297	57.143	60.000	52.273				
5H197	67.568	65.000	56.410	80.392			
5H297	81.481	70.000	55.172	56.098	66.667		
5H397	52.941	56.757	50.000	72.917	67.442	54.545	
3H197	51.613	44.118	48.485	57.778	60.000	60.000	54.054

Table 13a. Presence / Absence of Stony Coral Taxa - Patch Reef Sites - 1997

SITE CODES:	9P1	9P3	9P4	7P1	7P2	5P1	5P2	5P3	2P1	SUM
STONY CORAL TAXA										
Acropora cervicornis	1	1	0	1	0	1	1	1	0	6
Acropora palmata	0	0	0	0	0	0	0	0	0	0
Agaricia agaricites (complex)	1	1	1	1	1	1	1	1	1	9
Agaricia fragilis	1	1	0	0	0	1	0	1	0	4
Agaricia lamarcki	0	0	0	0	0	0	1	0	0	1
Astrangia poculata	0	0	0	0	0	0	0	0	0	0
Astrangia solitaria	0	0	0	0	0	0	0	0	0	0
Cladacora arbuscula	0	0	0	0	0	0	1	1	1	3
Colpophyllia natans	1	1	1	1	1	1	1	1	0	8
Dendrogyra cylindrus	0	0	0	0	0	0	0	0	0	0
Dichocoenia stokesii	1	1	1	1	1	1	1	1	1	9
Diploria clivosa	1	0	0	1	1	0	0	0	0	3
Diploria labyrinthiformis	1	1	1	1	1	1	1	1	0	8
Diploria strigosa	1	1	1	1	1	1	1	1	1	9
Eusmilia fastigiata	1	1	0	1	1	1	1	1	0	7
Favia fragum	1	1	0	1	1	1	0	0	0	5
Isophyllastrea rigida	0	0	0	1	1	1	0	0	0	3
Isophyllia sinuosa	1	0	0	1	0	0	1	1	0	4
Leptoseris cucullata	1	0	0	0	1	1	1	1	0	5
Madracis decactis	1	0	0	1	0	0	1	1	1	5
Madracis mirabilis	0	0	0	0	0	0	0	0	0	0
Manicina areolata	0	0	0	0	0	0	0	0	0	0
Meadrina meandrites	1	1	1	1	1	1	1	1	0	8
Millepora alcicornis	1	1	1	1	1	1	1	1	1	9
Millepora complanata	1	0	0	0	0	0	1	1	0	3
Montastraea annularis (complex)	1	1	1	1	1	1	1	1	1	9
Montastraea cavernosa	1	1	1	1	1	1	1	1	1	9
Mussa angulosa	1	0	0	1	1	1	1	1	1	7
Mycetophyllia aliciae	1	0	0	1	0	1	1	1	0	5
Mycetophyllia danaana	1	0	0	1	1	1	0	1	0	5
Mycetophyllia ferox	1	0	0	0	1	1	0	1	0	4
Mycetophyllia lamarckiana	1	0	0	1	1	1	0	1	0	5
Oculina diffusa	1	1	0	1	1	1	1	1	1	8
Phyllangia americana	0	0	0	0	0	0	1	0	1	2
Porites astreoides	1	1	1	1	1	1	1	1	1	9
Porites branneri	0	0	0	0	0	1	0	0	0	1
Porites porites (complex)	1	1	1	1	1	1	0	1	1	8
Scolymia cubensis	1	0	0	1	1	1	1	1	1	7
Scolymia lacera	1	0	0	0	0	1	0	0	1	3
Solenastrea bournoni	1	1	0	0	1	1	1	1	0	6
Solenastrea hyades	0	0	0	0	0	0	0	0	0	0
Siderastrea radians	1	1	1	1	1	1	1	1	0	8
Siderastrea siderea	1	1	1	1	1	1	1	1	1	9
Stephanocoenia michelinii	1	1	1	1	1	1	1	1	1	9
Total Number of Stony Coral Taxa	**32**	**20**	**14**	**27**	**26**	**30**	**27**	**30**	**17**	
Mussid (juvenile)	0	0	0	0	0	0	0	0	0	0
URCHIN TAXA										
Diadema antillarum	0	0	0	0	0	0	0	0	0	0

Mean Patch Reef Taxa	24.78
Standard Deviation	6.30
Range	14 to 32

Table 13b. Frequency of Stony Coral Taxa - Patch Reef Sites - 1997

SITE CODES:	9P1	9P3	9P4	7P1	7P2	5P1	5P2	5P3	2P1	SUM
STONY CORAL TAXA										
Acropora cervicornis	1	0.25	0	0.5	0	0.25	0.25	0.25	0	2.5
Acropora palmata	0	0	0	0	0	0	0	0	0	0
Agaricia agaricites (complex)	1	1	1	1	1	1	0.5	1	1	8.5
Agaricia fragilis	1	0.25	0	0	0	0.75	0	0.75	0	2.75
Agaricia lamarcki	0	0	0	0	0	0	0.5	0	0	0.5
Astrangia poculata	0	0	0	0	0	0	0	0	0	0
Astrangia solitaria	0	0	0	0	0	0	0	0	0	0
Cladacora arbuscula	0	0	0	0	0	0	1	0.75	1	2.75
Colpophyllia natans	0.5	0.25	0.5	1	1	1	1	1	0	6.25
Dendrogyra cylindrus	0	0	0	0	0	0	0	0	0	0
Dichocoenia stokesii	1	1	0.75	1	1	1	1	1	0.25	8
Diploria clivosa	0.75	0	0	0.5	0.5	0	0	0	0	1.75
Diploria labyrinthiformis	0.75	1	0.5	1	0.75	0.5	0.25	1	0	5.75
Diploria strigosa	1	0.5	0.25	1	1	0.25	1	1	1	7
Eusmilia fastigiata	0.75	0.5	0	1	1	0.75	1	1	0	6
Favia fragum	0.75	0.25	0	0.25	0.25	0.25	0	0	0	1.75
Isophyllastrea rigida	0	0	0	0.25	0.5	0.25	0	0	0	1
Isophyllia sinuosa	0.25	0	0	0.25	0	0	0.25	0.25	0	1
Leptoseris cucullata	1	0	0	0	0.25	0.75	0.5	0.25	0	2.75
Madracis decactis	0.25	0	0	0.25	0	0	0.25	0.75	0.5	2
Madracis mirabilis	0	0	0	0	0	0	0	0	0	0
Manicina areolata	0	0	0	0	0	0	0	0	0	0
Meadrina meandrites	0.75	0.75	0.5	1	0.25	0.5	0.75	1	0	5.5
Millepora alcicornis	1	1	1	1	1	1	1	1	1	9
Millepora complanata	0.25	0	0	0	0	0	0.75	0.5	0	1.5
Montastraea annularis (complex)	1	0.75	1	0.75	1	1	1	1	1	8.5
Montastraea cavernosa	1	0.75	0.75	1	1	1	1	1	1	8.5
Mussa angulosa	0.25	0	0	0.25	0.5	0.5	1	1	0.5	4
Mycetophyllia aliciae	0.25	0	0	0.25	0	0.5	1	0.75	0	2.75
Mycetophyllia danaana	0.75	0	0	1	1	1	0	0.5	0	4.25
Mycetophyllia ferox	0.75	0	0	0	0.5	1	0	0.25	0	2.5
Mycetophyllia lamarckiana	1	0	0	1	1	1	0	1	0	5
Oculina diffusa	0.75	0.75	0	0.75	0.25	0.25	1	1	1	5.75
Phyllangia americana	0	0	0	0	0	0	0.25	0	0.75	1
Porites astreoides	1	1	1	1	1	1	1	1	1	9
Porites branneri	0	0	0	0	0	0.25	0	0	0	0.25
Porites porites (complex)	1	1	0.25	1	0.75	1	0	0.75	0.75	6.5
Scolymia cubensis	0.25	0	0	1	0.25	1	1	1	1	5.5
Scolymia lacera	0.25	0	0	0	0	0.75	0	0	0.5	1.5
Solenastrea bournoni	0.5	1	0	0	0.25	0.75	1	1	0	4.5
Solenastrea hyades	0	0	0	0	0	0	0	0	0	0
Siderastrea radians	0.25	1	1	1	1	1	1	1	0	7.25
Siderastrea siderea	1	1	1	1	1	1	1	1	1	9
Stephanocoenia michelinii	0.75	0.75	0.25	1	1	1	1	1	1	7.75
Mussid (juvenile)	1	0	0	0.5	0.75	1	1	1	0	5.25
URCHIN TAXA										
Diadema antillarum	0.25	0	0	0.5	0	0	0	0	0	0.75

Table14. Similarity of Coral Taxa frequency of Occurrence, Patch Reef Sites, 1997

SITES	Turtle	Porter	Admiral	W. Turtle Shoal	Dustan	W. Washer Woman	W. Head	Cliff Green
Porter	70.667							
Admiral	55.385	75.510						
W. Turtle Shoal	80.000	75.524	61.789					
Dustan	77.844	71.111	66.087	86.250				
W. Washer Woman	78.889	70.270	60.938	79.769	82.424			
W. Head	64.773	66.667	56.452	72.189	67.081	68.966		
Cliff Green	76.842	72.152	56.522	83.060	77.714	79.787	84.783	
Smith Shoal	56.757	58.621	56.250	62.411	60.150	57.534	66.197	65.385

Table 15a. Presence / Absence of Stony Coral Taxa - Shallow Offshore Reef Sites - 1997

SITE CODES:	9S1	9S2	9S3	9S4	7S1	7S2	5S1	5S2	5S3	5S4	5S5	2S1	SUM
STONY CORAL TAXA													
Acropora cervicornis	0	1	1	0	0	1	1	1	0	1	1	1	8
Acropora palmata	1	1	1	1	0	0	1	0	0	1	1	1	8
Agaricia agaricites (complex)	1	1	1	1	1	1	1	1	1	1	1	1	12
Agaricia fragilis	0	1	1	1	1	0	0	1	0	1	1	1	8
Agaricia lamarcki	0	0	0	0	0	0	0	0	0	0	0	0	0
Astrangia poculata	0	0	0	0	0	0	0	0	0	0	0	0	0
Astrangia solitaria	0	0	0	0	0	0	0	0	1	0	0	0	1
Cladacora arbuscula	0	0	0	0	0	0	0	0	0	0	0	0	0
Colpophyllia natans	0	1	1	1	1	1	1	1	0	1	1	1	10
Dendrogyra cylindrus	0	0	0	1	0	0	1	0	0	0	0	1	3
Dichocoenia stokesii	1	1	1	1	1	1	1	1	0	1	1	1	11
Diploria clivosa	1	1	1	0	0	1	1	1	0	1	1	1	9
Diploria labyrinthiformis	0	1	1	0	1	1	1	1	0	1	1	1	9
Diploria strigosa	1	1	1	0	0	1	0	1	0	1	1	1	8
Eusmilia fastigiata	1	1	1	1	0	0	0	1	1	1	0	1	8
Favia fragum	1	1	1	1	1	1	1	1	1	1	1	1	12
Isophyllastrea rigida	0	0	0	0	0	1	0	0	0	0	0	0	1
Isophyllia sinuosa	0	0	0	0	0	0	0	0	0	0	1	1	2
Leptoseris cucullata	0	1	1	1	0	0	0	0	0	0	0	1	4
Madracis decactis	0	0	1	1	1	1	0	1	0	1	0	1	7
Madracis mirabilis	0	0	1	0	0	0	0	0	1	1	1	0	4
Manicina areolata	0	0	0	1	0	0	0	0	0	0	0	0	1
Meadrina meandrites	0	0	1	1	1	1	1	1	0	1	0	1	8
Millepora alcicornis	1	1	1	1	1	1	1	1	1	1	1	1	12
Millepora complanata	1	1	1	1	1	1	1	1	1	1	1	1	12
Montastraea annularis (complex)	1	1	1	1	0	1	1	1	1	1	1	1	11
Montastraea cavernosa	1	1	1	1	1	1	1	1	1	1	1	1	12
Mussa angulosa	0	0	0	0	0	0	0	0	0	0	0	0	0
Mycetophyllia aliciae	0	0	1	0	0	0	0	0	0	1	0	0	2
Mycetophyllia danaana	0	0	1	0	0	0	1	1	0	1	0	1	5
Mycetophyllia ferox	1	0	1	0	0	0	1	1	0	1	0	1	6
Mycetophyllia lamarckiana	1	1	1	0	0	0	1	1	0	1	1	1	8
Oculina diffusa	0	0	0	0	0	1	0	0	1	0	0	0	2
Phyllangia americana	0	0	0	0	0	0	0	0	0	0	0	0	0
Porites astreoides	1	1	1	1	1	1	1	1	1	1	1	1	12
Porites branneri	0	0	0	0	0	0	0	0	0	0	0	0	0
Porites porites (complex)	1	1	1	1	1	1	1	1	1	1	1	1	12
Scolymia cubensis	0	0	0	0	0	0	0	0	0	0	0	0	0
Scolymia lacera	0	0	0	0	0	0	0	0	0	0	0	0	0
Solenastrea bournoni	0	0	0	0	0	1	0	0	0	0	0	0	1
Solenastrea hyades	0	0	0	0	0	0	0	0	0	0	0	0	0
Siderastrea radians	1	1	0	1	1	1	1	1	1	1	1	1	11
Siderastrea siderea	1	1	1	1	1	1	1	1	1	1	1	1	12
Stephanocoenia michelinii	0	1	1	1	1	1	1	1	0	0	1	1	9
Total Number of Stony Coral Taxa	**17**	**22**	**27**	**21**	**16**	**22**	**22**	**24**	**14**	**26**	**22**	**28**	
Mussid (juvenile)	0	0	0	0	0	0	0	0	0	0	0	0	0
URCHIN TAXA													
Diadema antillarum	0	0	0	0	0	0	0	0	0	0	0	0	0

Mean Offshore Shallow Reef Taxa	21.75
Standard Deviation	4.33
Range	14 to 29

Table 15b. Frequency of Stony Coral Taxa - Shallow Offshore Reef Sites - 1997

SITE CODES:	9S1	9S2	9S3	9S4	7S1	7S2	5S1	5S2	5S3	5S4	5S5	2S1	SUM
STONY CORAL TAXA													
Acropora cervicornis	0	0.5	0.25	0	0	1	0.25	0.75	0	0.5	0.5	0.25	4
Acropora palmata	0.5	0.25	1	0.25	0	0	0.25	0	0	1	1	1	5.25
Agaricia agaricites (complex)	1	0.75	1	1	1	1	1	1	1	1	1	1	11.75
Agaricia fragilis	0	0.25	1	0.5	0.25	0	0	0.25	0	0.25	0.25	0.75	3.5
Agaricia lamarcki	0	0	0	0	0	0	0	0	0	0	0	0	0
Astrangia poculata	0	0	0	0	0	0	0	0	0	0	0	0	0
Astrangia solitaria	0	0	0	0	0	0	0	0	0.5	0	0	0	0.5
Cladacora arbuscula	0	0	0	0	0	0	0	0	0	0	0	0	0
Colpophyllia natans	0	0.25	0.5	0.25	0.75	0.75	0.5	1	0	0.25	0.25	0.5	5
Dendrogyra cylindrus	0	0	0	0.25	0	0	0.25	0	0	0	0	0.25	0.75
Dichocoenia stokesii	0.75	1	0.5	0.75	1	1	0.75	1	0	0.25	0.5	0.75	8.25
Diploria clivosa	1	0.5	0.25	0	0	0.5	0.25	0.5	0	0.5	1	1	5.5
Diploria labyrinthiformis	0	0.5	0.75	0	0.25	1	0.75	1	0	0.25	0.25	0.25	5
Diploria strigosa	0.25	0.5	0.75	0	0	1	0	0.75	0	0.25	0.5	0.75	4.75
Eusmilia fastigiata	0.25	0.5	0.25	1	0	0	0	0.75	0.25	0.25	0	1	4.25
Favia fragum	1	0.25	1	1	1	0.25	1	0.75	1	1	1	1	10.25
Isophyllastrea rigida	0	0	0	0	0	0.25	0	0	0	0	0	0	0.25
Isophyllia sinuosa	0	0	0	0	0	0	0	0	0	0	0.25	0.5	0.75
Leptoseris cucullata	0	0.5	0.75	0.5	0	0	0	0	0	0	0	0.25	2
Madracis decactis	0	0	0.25	0.5	0.5	0.25	0	0.25	0	0.25	0	0.5	2.5
Madracis mirabilis	0	0	0.25	0	0	0	0	0	0.25	0.5	0.25	0	1.25
Manicina areolata	0	0	0	0.25	0	0	0	0	0	0	0	0	0.25
Meadrina meandrites	0	0	0.75	0.25	0.5	0.75	0.75	0.75	0	0.25	0	0.5	4.5
Millepora alcicornis	1	1	1	1	1	1	1	1	0.75	0.75	0.75	1	11.25
Millepora complanata	1	0.25	1	1	1	0.5	1	1	1	1	1	1	10.75
Montastraea annularis (complex)	0.25	0.75	1	0.5	0	0.75	0.75	1	0.75	1	0.75	1	8.5
Montastraea cavernosa	0.5	0.75	1	0.25	1	1	0.75	1	0.5	0.75	0.75	1	9.25
Mussa angulosa	0	0	0	0	0	0	0	0	0	0	0	0	0
Mycetophyllia aliciae	0	0	0.25	0	0	0	0	0	0	0.25	0	0	0.5
Mycetophyllia danaana	0	0	0.5	0	0	0	0.25	0.5	0	0.5	0	0.75	2.5
Mycetophyllia ferox	0.25	0	0.25	0	0	0	0.25	0.75	0	0.25	0	0.25	2
Mycetophyllia lamarckiana	0.25	0.5	0.75	0	0	0	0.25	0.5	0	0.5	0.25	1	4
Oculina diffusa	0	0	0	0	0	0.25	0	0	0.25	0	0	0	0.5
Phyllangia americana	0	0	0	0	0	0	0	0	0	0	0	0	0
Porites astreoides	1	1	1	1	1	1	1	1	1	1	1	1	12
Porites branneri	0	0	0	0	0	0	0	0	0	0	0	0	0
Porites porites (complex)	0.75	1	0.5	1	1	1	0.75	1	1	1	1	1	11
Scolymia cubensis	0	0	0	0	0	0	0	0	0	0	0	0	0
Scolymia lacera	0	0	0	0	0	0	0	0	0	0	0	0	0
Solenastrea bournoni	0	0	0	0	0	0.25	0	0	0	0	0	0	0.25
Solenastrea hyades	0	0	0	0	0	0	0	0	0	0	0	0	0
Siderastrea radians	0.75	1	0	0.5	0.5	1	0.75	0.25	0.25	0.5	0.75	1	7.25
Siderastrea siderea	1	1	1	1	1	1	1	1	0.75	1	1	1	11.75
Stephanocoenia michelinii	0	0.25	0.25	0.5	0.5	1	0.75	1	0	0	0.5	0.75	5.5
Mussid (juvenile)	0	0.25	0.25	0	0	0	0	0	0	0.25	0	0	0.75
URCHIN TAXA													
Diadema antillarum	0	0	0	0	0.25	0	0	0	0.25	0.75	0.25	0	1.5

Table 16. Similarity Coefficients of Coral Taxa Frequency of Occurrence, Offshore Shallow Sites, 1997.

SITES	Carysfort	Grecian Rocks	Molasses	Conch	Alligator	Tennessee	Sombrero	Looe Key	Eastern Sambo	Western Sambo	Rock Key
Grecian Rocks	70.707										
Molasses	64.957	67.742									
Conch	72.727	69.811	66.129								
Alligator	71.579	66.667	66.667	80.392							
Tennessee	60.714	75.630	65.693	60.504	73.043						
Sombrero	77.670	72.727	76.563	74.545	79.245	76.423					
Looe Key	64.463	73.438	78.082	67.188	74.194	82.270	78.788				
Eastern Sambo	72.289	57.778	57.407	68.889	67.442	54.369	65.957	57.143			
Western Sambo	75.472	72.566	80.916	69.027	69.725	63.492	75.214	75.556	70.103		
Rock Key	80.769	77.477	72.868	70.270	72.897	69.355	78.261	70.677	69.474	84.746	
Sand Key	70.229	71.014	82.051	73.913	70.149	68.874	76.056	78.750	55.738	78.621	79.720

Table 17a. Presence / Absence of Stony Coral Taxa - Deep Offshore Reef Sites - 1997

SITE CODES:	9D1	9D3	9D4	7D1	7D2	5D1	5D2	5D3	5D4	5D5	2D1	SUM
STONY CORAL TAXA												
Acropora cervicornis	1	0	0	0	1	0	1	1	1	1	1	7
Acropora palmata	0	0	0	0	0	0	0	0	0	0	0	0
Agaricia agaricites (complex)	1	1	1	1	1	1	1	1	1	1	1	11
Agaricia fragilis	1	1	1	0	1	1	1	1	1	1	1	10
Agaricia lamarcki	1	1	1	1	1	1	1	1	0	0	1	9
Astrangia poculata	0	0	0	0	0	0	0	0	0	0	0	0
Astrangia solitaria	0	0	0	0	0	0	0	0	0	0	0	0
Cladacora arbuscula	0	0	0	0	0	0	0	0	0	0	0	0
Colpophyllia natans	1	1	0	1	1	1	1	1	1	1	1	10
Dendrogyra cylindrus	0	0	0	0	0	0	0	0	0	0	0	0
Dichocoenia stokesii	1	1	1	1	1	1	1	1	1	1	1	11
Diploria clivosa	0	0	0	0	0	0	0	0	0	0	1	1
Diploria labyrinthiformis	1	1	1	1	1	1	1	1	1	1	1	11
Diploria strigosa	0	1	1	1	1	1	1	1	1	1	1	10
Eusmilia fastigiata	1	1	1	1	1	1	1	1	1	1	1	11
Favia fragum	1	0	0	1	1	0	0	0	1	1	1	6
Isophyllastrea rigida	0	0	0	0	0	0	0	0	0	0	0	0
Isophyllia sinuosa	0	0	0	0	0	0	0	0	0	0	0	0
Leptoseris cucullata	1	1	1	1	1	1	1	1	1	1	1	11
Madracis decactis	1	1	1	0	1	1	1	1	1	1	1	10
Madracis mirabilis	0	1	1	0	1	1	1	1	1	1	1	9
Manicina areolata	1	0	0	1	1	1	1	1	1	1	1	9
Meadrina meandrites	1	1	1	1	1	1	1	1	1	1	1	11
Millepora alcicornis	1	1	1	1	1	1	1	1	1	1	1	11
Millepora complanata	0	0	0	0	0	0	0	0	1	0	0	1
Montastraea annularis (complex)	1	1	1	1	1	1	1	1	1	1	1	11
Montastraea cavernosa	1	1	1	1	1	1	1	1	1	1	1	11
Mussa angulosa	1	1	1	0	1	0	0	1	0	0	0	5
Mycetophyllia aliciae	1	1	1	0	1	1	1	1	0	1	0	8
Mycetophyllia danaana	1	0	0	1	1	0	1	0	1	1	1	7
Mycetophyllia ferox	1	0	0	0	1	0	1	1	1	1	1	7
Mycetophyllia lamarckiana	1	0	1	1	1	1	1	1	1	1	1	10
Oculina diffusa	0	0	0	0	0	0	0	0	0	0	0	0
Phyllangia americana	0	0	0	0	0	0	0	0	0	0	0	0
Porites astreoides	1	1	1	1	1	1	1	1	1	1	1	11
Porites branneri	0	0	0	0	0	0	0	0	0	0	0	0
Porites porites (complex)	1	1	1	1	1	1	1	1	1	1	1	11
Scolymia cubensis	1	0	1	1	1	1	1	1	1	1	1	10
Scolymia lacera	0	0	0	0	0	0	0	1	0	0	0	1
Solenastrea bournoni	0	0	0	1	1	1	1	1	0	0	1	6
Solenastrea hyades	0	0	0	0	0	0	0	0	0	0	0	0
Siderastrea radians	0	1	0	1	1	0	1	0	0	1	1	6
Siderastrea siderea	1	1	1	1	1	1	1	1	1	1	1	11
Stephanocoenia michelinii	1	1	1	1	1	1	1	1	1	1	1	11
Total Number of Stony Coral Taxa	**26**	**22**	**22**	**23**	**30**	**24**	**28**	**28**	**26**	**27**	**29**	
Mussid (juvenile)	0	0	0	0	0	0	0	0	0	0	0	0
URCHIN TAXA												
Diadema antillarum	0	0	0	0	0	0	0	0	0	0	0	0

Mean Offshore Deep Reef Taxa	25.91
Standard Deviation	2.81
Range	22 to 30

Table 17b. Frequency of Stony Coral Taxa - Deep Offshore Reef Sites - 1997

SITE CODES:	9D1	9D3	9D4	7D1	7D2	5D1	5D2	5D3	5D4	5D5	2D1	SUM
STONY CORAL TAXA												
Acropora cervicornis	0.25	0	0	0	0.75	0	0.25	0.75	1	0.5	0.5	4
Acropora palmata	0	0	0	0	0	0	0	0	0	0	0	0
Agaricia agaricites (complex)	1	1	1	1	1	1	1	1	1	1	1	11
Agaricia fragilis	0.75	1	0.5	0	1	0.75	1	1	1	0.5	1	8.5
Agaricia lamarcki	0.25	0.5	0.75	0.25	0.5	0.25	0.5	0.25	0	0	0.25	3.5
Astrangia poculata	0	0	0	0	0	0	0	0	0	0	0	0
Astrangia solitaria	0	0	0	0	0	0	0	0	0	0	0	0
Cladacora arbuscula	0	0	0	0	0	0	0	0	0	0	0	0
Colpophyllia natans	1	0.25	0	0.25	1	0.75	0.75	1	1	1	1	8
Dendrogyra cylindrus	0	0	0	0	0	0	0	0	0	0	0	0
Dichocoenia stokesii	0.75	0.75	0.75	1	1	1	1	1	0.75	1	1	10
Diploria clivosa	0	0	0	0	0	0	0	0	0	0	0.25	0.25
Diploria labyrinthiformis	0.5	1	0.5	0.5	1	0.5	0.75	0.75	1	0.75	1	8.25
Diploria strigosa	0	0.5	0.5	0.5	1	0.75	1	0.25	0.75	0.75	1	7
Eusmilia fastigiata	1	0.5	1	0.5	1	1	1	1	1	1	1	10
Favia fragum	0.25	0	0	0.25	0.75	0	0	0	0.5	0.5	0.25	2.5
Isophyllastrea rigida	0	0	0	0	0	0	0	0	0	0	0	0
Isophyllia sinuosa	0	0	0	0	0	0	0	0	0	0	0	0
Leptoseris cucullata	1	0.75	0.75	0.5	1	1	1	1	0.75	0.5	0.5	8.75
Madracis decactis	1	1	1	0	1	1	1	1	0.5	0.75	0.75	9
Madracis mirabilis	0	0.75	0.5	0	1	0.25	1	0.75	0.75	0.75	0.25	6
Manicina areolata	0.25	0	0	1	1	1	1	1	0.75	1	1	8
Meadrina meandrites	0.25	1	0.75	1	1	0.5	0.5	0.75	0.5	0.75	1	8
Millepora alcicornis	1	1	1	1	1	1	1	1	1	1	1	11
Millepora complanata	0	0	0	0	0	0	0	0	0.25	0	0	0.25
Montastraea annularis (complex)	1	0.75	1	1	1	1	1	1	1	1	1	10.75
Montastraea cavernosa	1	1	1	1	1	1	1	1	0.75	1	1	10.75
Mussa angulosa	0.5	0.25	0.75	0	0.5	0	0	0.75	0	0	0	2.75
Mycetophyllia aliciae	0.75	0.25	0.25	0	0.75	0.5	0.5	1	0	0.25	0	4.25
Mycetophyllia danaana	0.75	0	0	0.25	0.25	0	0.5	0	0.25	0.75	0.5	3.25
Mycetophyllia ferox	0.75	0	0	0	0.75	0	1	1	0.75	1	0.25	5.5
Mycetophyllia lamarckiana	1	0	0.5	0.25	0.75	0.75	1	0.75	0.75	0.75	0.75	7.25
Oculina diffusa	0	0	0	0	0	0	0	0	0	0	0	0
Phyllangia americana	0	0	0	0	0	0	0	0	0	0	0	0
Porites astreoides	1	1	1	1	1	1	1	1	1	1	1	11
Porites branneri	0	0	0	0	0	0	0	0	0	0	0	0
Porites porites (complex)	1	0.75	1	1	1	0.75	1	1	1	1	1	10.5
Scolymia cubensis	1	0	0.25	0.25	1	1	1	1	0.25	0.75	0.25	6.75
Scolymia lacera	0	0	0	0	0	0	0	0.75	0	0	0	0.75
Solenastrea bournoni	0	0	0	0.75	0.25	1	0.5	0.5	0	0	0.5	3.5
Solenastrea hyades	0	0	0	0	0	0	0	0	0	0	0	0
Siderastrea radians	0	0.75	0	1	0.5	0	1	0	0	1	1	5.25
Siderastrea siderea	1	1	1	1	1	1	1	1	1	1	1	11
Stephanocoenia michelinii	1	1	1	1	1	1	1	1	0.5	1	0.75	10.25
Mussid (juvenile)	0.75	0	0.25	0	1	0	0.75	0.5	0	0.75	0.25	4.25
URCHIN TAXA												
Diadema antillarum	0	0	0	0	0	0	0	0	0	0	0	0

Table 18. Similarity Coefficients of Coral Taxa Frequency of Occurrence, Offshore Deep Sites, 1997.

SITES	Carysfort	Molasses	Conch	Alligator	Tennessee	Sombrero	Looe Key	Eastern Sambo	Western Sambo	Rock Key
Molasses	70.748									
Conch	78.912	85.075								
Alligator	67.586	75.758	74.242							
Tennessee	84.153	77.647	76.471	72.619						
Sombrero	83.019	75.342	80.822	77.778	83.516					
Looe Key	83.616	76.829	75.610	75.309	91.000	87.500				
Eastern Sambo	84.746	73.171	78.049	69.136	90.000	85.227	87.629			
Western Sambo	77.987	72.603	73.973	69.444	84.615	77.215	80.682	80.862		
Rock Key	81.657	74.359	75.641	77.922	87.500	80.952	89.247	83.871	85.714	
Sand Key	77.381	77.419	74.839	82.353	86.911	81.437	86.486	81.081	83.832	88.136

Table 19. Temporal Similarity Comparison, Coral Taxa Frequency of Occurrence, Hardbottom Sites, 1996 – 1997.

SITES	**Coefficient Value**
Rattle Snake (9H1)	84.786
El Radabob (9H2)	88.525
Dove Key (9H3)	57.627
Long Key (7H2)	90.265
Moser Channel (5H1)	93.333
Molasses Key (5H2)	74.419
Jaap Reef (5H3)	92.683
Content Keys (3H1)	87.324

Table 20. Temporal Similarity Comparison, Coral Taxa Frequency of Occurrence, Patch Reef Sites, 1996 – 1997.

SITES	**Coefficient Value**
Turtle (9P1)	91.398
Porter (9P3)	89.922
Admiral (9P4)	93.827
West Turtle Shoal (7P1)	88.372
Dustan (7P2)	88.158
West Washer Woman (5P1)	85.030
Western Head (5P2)	87.568
Cliff Green (5P3)	90.995
Smith Shoal (2P1)	88.189

Table 21. Temporal Similarity Comparison, Coral Taxa Frequency of Occurrence, Offshore Shallow Sites, 1996 – 1997.

SITES	**Coefficient Value**
Carysfort (9S1)	95.556
Grecian Rocks (9S2)	87.395
Molasses (9S3)	86.765
Conch (9S4)	82.105
Alligator (7S1)	92.632
Tennessee (7S2)	96.923
Sombrero (5S1)	94.545
Looe Key (5S2)	92.857
Eastern Sambo (5S3)	89.189
Western Sambo (5S4)	92.437
Rock Key (5S5)	88.073
Sand Key (2S1)	92.593

Table 22. Temporal Similarity Comparison, Coral Taxa Frequency of Occurrence, Offshore Deep Sites, 1996 - 1997

SITES	**Coefficient Value**
Carysfort (9D1)	94.048
Molasses (9D3)	89.362
Conch (9D4)	87.770
Alligator (7D1)	92.913
Tennessee (7D2)	93.000
Sombrero (5D1)	91.566
Looe Key (5D2)	88.398
Eastern Sambo (5D3)	90.640
Western Sambo (5D4)	87.742
Rock Key (5D5)	95.652
Sand Key (2D1)	91.860

Table 23. Summary of incidence of coral bleaching and disease by station, 1996 - 1997.

Site Name	Latitude (N)	Longitude (W)	Survey Date		# of Species Exhibiting Bleaching and/or Coral Disease							
			1996	1997	1996				1997			
					BL	WH	BB	OD	BL	WH	BB	OD
Turtle												
Station 1	25° 17.683'	80° 13.145'	24-Jul	12-Jun	1				4			
Station 2	25° 17.683'	80° 13.145'	24-Jul	12-Jun					1	3		
Station 3	25° 17.718'	80° 13.043'	25-Jul	12-Jun								1
Station 4	25° 17.718'	80° 13.043'	25-Jul	12-Jun	1					1		2
Carysfort Deep												
Station 1	25° 13.2481'	80° 12.5915'	24-Jul	13-Jun	3				3	2		1
Station 2	25° 13.2481'	80° 12.5915'	24-Jul	13-Jun	3				3	2		1
Station 3	25° 13.3599'	80° 12.5218'	20-Jul	13-Jun	1				4			1
Station 4	25° 13.3599'	80° 12.5218'	20-Jul	13-Jun	1				1	1		
Carysfort Shallow												
Station 1	25° 13.205'	80° 12.628'	22-Jul	10-Jul					1	1		
Station 2	25° 13.245	80° 12.643	22-Jul	10-Jul		1			1	1		1
Station 3	25° 13.3339'	80° 12.5851'	20-Jul	10-Jul					3	1		1
Station 4	25° 13.3339'	80° 12.5851'	20-Jul	10-Jul					1			
Rattle Snake												
Station 1	25° 10.415'	80° 20.850'	25-Jul	14-Jul								
Station 2	25° 10.415'	80° 20.850'	25-Jul	14-Jul								
Station 3	25° 10.415'	80° 20.850'	25-Jul	14-Jul					1			
Station 4	25° 10.415'	80° 20.850'	25-Jul	14-Jul	1							
Grecian Rocks												
Station 1	25° 06.450'	80° 18.410'	22-Jul	9-Jul			1			1		
Station 2	25° 06.450'	80° 18.410'	22-Jul	9-Jul		1				1		
Station 3	25° 06.4528'	80° 18..4155'	19-Jul	9-Jul	1				2	3		1
Station 4	25° 06.4528'	80° 18..4155'	19-Jul	9-Jul	2				2			
Porter Patch												
Station 1	25° 06.1899'	80° 19.45586	19-Jul	11-Jul					1	2		1
Station 2	25° 06.1899'	80° 19.45586	19-Jul	11-Jul	3				2	1		1
Station 3	25° 06.1899'	80° 19.45586	19-Jul	11-Jul	1				1	3		1
Station 4	25° 06.1899'	80° 19.45586	19-Jul	11-Jul	1				3	1		1
El Radabob												
Station 1	25° 07.2068'	80° 22.6937'	22-Jul	9-Jul								
Station 2	25° 07.2068'	80° 22.6937'	22-Jul	9-Jul								
Station 3	25° 07.2068'	80° 22.6937'	22-Jul	9-Jul					1			
Station 4	25° 07.2068'	80° 22.6937'	22-Jul	9-Jul								
Molasses Deep												
Station 1	25° 00.4311'	80° 22.5338'	16-Jul	16-Jul	5						1	2
Station 2	25° 00.4311'	80° 22.5338'	16-Jul	16-Jul	6							3
Station 3	25° 00.4405'	80° 22.4558'	18-Jul	14-Jul	2							
Station 4	25° 00.4405'	80° 22.4558'	18-Jul	14-Jul	4						1	1
Molasses Shallow												
Station 1	25° 00.525'	80° 22.589'	18-Jul	15-Jul	3					2	1	
Station 2	25° 00.548'	80° 22.502'	18-Jul	15-Jul	2				1	1		1
Station 3	25° 00.525'	80° 22.461'	18-Jul	15-Jul	4				1	1		4
Station 4	25° 00.580'	80° 22.467'	23-Jul	15-Jul		1				1		3
Admiral												
Station 1	25° 02.684'	80° 23.685'	23-Jul	8-Jul					2			
Station 2	25° 02.684'	80° 23.685'	23-Jul	8-Jul	1		1		1			
Station 3	25° 02.684'	80° 23.685'	23-Jul	8-Jul	1				1			1
Station 4	25° 02.684'	80° 23.685'	23-Jul	8-Jul					1			1
Dove Key												
Station 1	25° 02.6793'	80° 28.1025'	14-Aug	8-Jul								
Station 2	25° 02.6793'	80° 28.1025'	14-Aug	8-Jul								
Station 3	25° 02.6793'	80° 28.1025'	14-Aug	8-Jul								
Station 4	25° 02.6793'	80° 28.1025'	14-Aug	8-Jul								
Conch Deep												

Station 1	24° 57.1114'	80° 27.0807'	10-Oct	14-Jun					1			
Station 2	24° 57.1114'	80° 27.0807'	10-Oct	14-Jun					1	2		
Station 3	24° 57.1114'	80° 27.0807'	10-Oct	14-Jun					2	5		
Station 4	24° 57.1114'	80° 27.0807'	10-Oct	14-Jun							1	1
Conch Shallow												
Station 1	24° 57.315'	80° 27.481'	14-Aug	13-Jun	1				1			
Station 2	24° 57.315'	80° 27.481'	14-Aug	13-Jun	1				3			
Station 3	24° 57.371'	80° 27.424'	14-Aug	13-Jun	2				2	1		
Station 4	24° 57.371'	80° 27.424'	14-Aug	13-Jun	2				1			
Alligator Deep												
Station 1	24° 50.7100'	80° 37.2563'	13-Aug	15-Jun	1							
Station 2	24° 50.7100'	80° 37.2563'	13-Aug	15-Jun					1			1
Station 3	24° 50.7100'	80° 37.2563'	15-Aug	15-Jun	1				1			1
Station 4	24° 50.7100'	80° 37.2563'	15-Aug	15-Jun	3			1				
Alligator Shallow												
Station 1	24° 50.743'	80° 37.440'	13-Aug	14-Jun				1	2			1
Station 2	24° 50.743'	80° 37.440'	13-Aug	14-Jun				1	3			
Station 3	24° 50.809'	80° 37.360'	13-Aug	14-Jun				2	1			
Station 4	24° 50.809'	80° 37.360'	13-Aug	14-Jun								
Tennessee Deep												
Station 1	24° 45.1621'	80° 45.4696'	25-Oct	16-Jun	2							1
Station 2	24° 45.1621'	80° 45.4696'	25-Oct	16-Jun	1				2			
Station 3	24° 45.1621'	80° 45.4696'	25-Oct	16-Jun					1			
Station 4	24° 45.1621'	80° 45.4696'	25-Oct	16-Jun	2				2			
Tennessee Shallow												
Station 1	24° 44.698'	80° 46.873'	16-Aug	15-Jun								
Station 2	24° 44.698'	80° 46.873'	16-Aug	15-Jun	1							
Station 3	24° 44.698'	80° 46.873'	16-Aug	15-Jun					1			
Station 4	24° 44.698'	80° 46.873'	16-Aug	15-Jun								1
Long key												
Station 1	24° 47.834'	80° 47.040'	5-Aug	8-May								
Station 2	24° 47.834'	80° 47.040'	5-Aug	8-May								
Station 3	24° 47.834'	80° 47.040'	5-Aug	8-May								
Station 4	24° 47.834'	80° 47.040'	5-Aug	8-May	1							
West Turtle Shoal												
Station 1	24° 41.9572'	80° 58.0127'	17-Aug	7-May	1			1				
Station 2	24° 41.9572'	80° 58.0127'	17-Aug	7-May								
Station 3	24° 41.9572'	80° 58.0127'	17-Aug	7-May				2				
Station 4	24° 41.9572'	80° 58.0127'	17-Aug	7-May								
Dustan Rocks												
Station 1	24° 41.3676'	81° 01.8101'	20-Aug	7-May	1			1	1			1
Station 2	24° 41.3676'	81° 01.8101'	20-Aug	7-May				2				
Station 3	24° 41.3676'	81° 01.8101'	20-Aug	7-May	1							
Station 4	24° 41.3676'	81° 01.8101'	20-Aug	7-May	2							
Sombrero Deep												
Station 1	24° 37.336'	81° 06.717'	26-Oct	10-May	4				1			
Station 2	24° 37.336'	81° 06.717'	26-Oct	10-May	3				1			
Station 3	24° 37.3854'	81° 06.6315'	26-Oct	9-May	2				1			1
Station 4	24° 37.3854'	81° 06.6315'	26-Oct	9-May	2						1	
Sombrero Shallow												
Station 1	24° 37.517'	81° 06.695'	9-Sep	9-May								1
Station 2	24° 37.615'	81° 06.549'	9-Sep	9-May	1							2
Station 3	24° 37.549'	81° 06.552'	9-Sep	9-May	2							1
Station 4	24° 37.531'	81° 06.624'	9-Sep	9-May	1	1						
Moser Channel												
Station 1	24° 41.3470'	81° 10.0546'	21-Aug	10-May								
Station 2	24° 41.3470'	81° 10.0546'	21-Aug	10-May								
Station 3	24° 41.3470'	81° 10.0546'	19-Aug	10-May								
Station 4	24° 41.3470'	81° 10.0546'	19-Aug	10-May								
Molasses Keys												

Station 1	24° 40.537'	81° 11.4294'	19-Aug	6-May								
Station 2	24° 40.537'	81° 11.4294'	19-Aug	6-May								
Station 3	24° 40.537'	81° 11.4294'	19-Aug	6-May								
Station 4	24° 40.537'	81° 11.4294'	19-Aug	6-May								
Looe Key Deep												
Station 1	24° 32.5230'	81° 24.9178'	21-Aug	20-Jun	1					1		
Station 2	24° 32.5230'	81° 24.9178'	21-Aug	20-Jun	2	1		1		1		2
Station 3	24° 32.5582'	81° 24.7671'	22-Aug	20-Jun	2				4	1		
Station 4	24° 32.5582'	81° 24.7671'	22-Aug	20-Jun					3	5	1	1
Looe Key Shallow												
Station 1	24° 32.7157'	81° 24.4766'	12-Sep	15-May				1				
Station 2	24° 32.714'	81° 24.424'	12-Sep	15-May	2		1		1			
Station 3	24° 32.720'	81° 24.380'	12-Sep	15-May		1	1		2			1
Station 4	24° 32.720'	81° 24.380'	12-Sep	15-May			1	2				1
West Washer Woman												
Station 1	24° 32.8480'	81° 35.1934'	11-Sep	14-May	2							
Station 2	24° 32.8480'	81° 35.1934'	11-Sep	14-May	1				1			
Station 3	24° 32.8480'	81° 35.1934'	11-Sep	14-May	5							1
Station 4	24° 32.8480'	81° 35.1934'	11-Sep	14-May	5							2
Jaap Reef												
Station 1	24° 35.1421'	81° 34.9568'	11-Sep	14-May	1							1
Station 2	24° 35.1421'	81° 34.9568'	11-Sep	14-May	2				1			
Station 3	24° 35.1421'	81° 34.9568'	11-Sep	14-May	1							1
Station 4	24° 35.1421'	81° 34.9568'	11-Sep	14-May	1							
Eastern Sambo Deep												
Station 1	24° 29.3029'	81° 39.9514'	11-Jun	19-Jun					1	4	1	
Station 2	24° 29.3029'	81° 39.9514'	11-Jun	19-Jun					2	2		
Station 3	24° 29.3029'	81° 39.9514'	12-Jun	19-Jun					2	1		
Station 4	24° 29.3029'	81° 39.9514'	12-Jun	19-Jun						3		
Eastern Sambo Shallow												
Station 1	24° 29.5013'	81° 39.8139'	12-Jun	19-Jun	1							
Station 2	24° 29.5013'	81° 39.8139'	12-Jun	19-Jun					2	1		
Station 3	24° 29.5013'	81° 39.8139'	12-Jun	19-Jun					4	1		
Station 4	24° 29.5013'	81° 39.8139'	12-Jun	19-Jun					1			1
Western Sambo Deep												
Station 1	24° 28.6808'	81° 43.0275'	10-Jun	5-Aug					3	6		4
Station 2	24° 28.6808'	81° 43.0275'	10-Jun	5-Aug					1	5		
Station 3	24° 28.776'	81° 42.850'	10-Jun	5-Aug	1				3	3	1	2
Station 4	24° 28.776'	81° 42.850'	10-Jun	5-Aug	2			1	4	4		2
Western Sambo Shallow												
Station 1	24° 28.775'	81° 43.054'	11-Jun	5-Aug					1	2		1
Station 2	24° 28.775'	81° 43.054'	11-Jun	5-Aug					3	5		
Station 3	24° 28.788'	81° 42.945'	11-Jun	5-Aug	1				1	2		1
Station 4	24° 28.788'	81° 42.945'	11-Jun	5-Aug					3	2		1
Western Head												
Station 1	24° 29.8625'	81° 48.3343'	7-Jun	8-Aug					7	2		
Station 2	24° 29.8625'	81° 48.3343'	7-Jun	8-Aug					8	2		2
Station 3	24° 29.8625'	81° 48.3343'	7-Jun	8-Aug	1				11	3		
Station 4	24° 29.8625'	81° 48.3343'	7-Jun	8-Aug	4				8	2		1
Cliff Green												
Station 1	24° 30.216'	81° 46.0059'	7-Jun	8-Aug	1	1			6			1
Station 2	24° 30.216'	81° 46.0059'	7-Jun	8-Aug	1				10	2		2
Station 3	24° 30.216'	81° 46.0059'	7-Jun	8-Aug	1				8			2
Station 4	24° 30.216'	81° 46.0059'	7-Jun	8-Aug					6			1
Rock Key Deep												
Station 1	24° 27.1929'	81° 51.4076'	14-Oct	18-Jun								1
Station 2	24° 27.1929'	81° 51.4076'	14-Oct	18-Jun								1
Station 3	24° 27.1929'	81° 51.4076'	14-Oct	18-Jun	3				3			
Station 4	24° 27.1929'	81° 51.4076'	14-Oct	18-Jun	1							
Rock Key Shallow												

Station 1	24° 27.269'	81° 51.532'	6-Jun	18-Jun	1					1		
Station 2	24° 27.269'	81° 51.532'	6-Jun	18-Jun	1					2		
Station 3	24° 27.269'	81° 51.532'	6-Jun	18-Jun						2		
Station 4	24° 27.2853'	81° 51.4213'	6-Jun	18-Jun	1			1	1	2		
Content Keys												
Station 1	24° 49.323'	81° 29.335'	10-Sep	12-May	2							1
Station 2	24° 49.323'	81° 29.335'	10-Sep	12-May								
Station 3	24° 49.323'	81° 29.335'	10-Sep	12-May	1				1			
Station 4	24° 49.323'	81° 29.335'	10-Sep	12-May	2							
Sand Key Deep												
Station 1	24° 27.1005'	81° 52.7909'	11-Oct	6-Aug					5	1		3
Station 2	24° 27.1005'	81° 52.7909'	11-Oct	6-Aug					3	2		2
Station 3	24° 27.1005'	81° 52.7909'	11-Oct	6-Aug					2	2		1
Station 4	24° 27.1005'	81° 52.7909'	11-Oct	6-Aug					2	1		
Sand Key Shallow												
Station 1	24° 27.119'	81° 52.650'	4-Jun	6-Aug					4	3		1
Station 2	24° 27.119'	81° 52.650'	4-Jun	6-Aug					2	1		1
Station 3	24° 27.119'	81° 52.650'	4-Jun	6-Aug				2	5	5		1
Station 4	24° 27.119'	81° 52.650'	4-Jun	6-Aug	4				4	4		1
Smith Shoal												
Station 1	24° 43.184'	81° 55.172'	13-Jun	7-Aug					12	1		
Station 2	24° 43.184'	81° 55.172'	13-Jun	7-Aug	2				11	1		1
Station 3	24° 43.184'	81° 55.172'	13-Jun	7-Aug			1		10	3		1
Station 4	24° 43.184'	81° 55.172'	13-Jun	7-Aug					8	1		
Total # of stations with each condition:					75	7	5	15	87	61	8	64
Total # of stations with bleaching and/or coral disease:								89				117
Total # of stations with coral disease:								24				93

Table 24. Summary of incidence of coral bleaching and disease by species, 1996 - 1997.

Species	# of Stations Exhibiting Bleaching and/or Coral Disease							
	1996				1997			
	BL	WH	BB	OD	BL	WH	BB	OD
Acropora cervicornis	1	1				13		
Acropora palmata		4		1		24		
Agaricia agaracites	15				20	9		2
Agaricia fragilis					2			
Agaricia lamarcki	1				2			
Colpophyllia natans	10	1		1	6	5		1
Dendrogyra cylindrus					1	1		1
Dichocoenia stokesii	5	3			5	16		4
Diploria clivosa	1							
Diploria labyrinthiformes	2				2	5		5
Diploria strigosa	1		1		2	1		10
Eusmilia fastigiata	3				12	1		
Favia fragum	15			1	12	1		
Isophyllastrea rigida					1			
Isophyllia sinuosa								
Leptoseris cucullata	1				3	6		1
Madracis decactis	2				2	1		
Madracis mirabilis						1		1
Manicina areolata	2				3			
Meandrina meandrites	3				4			3
Millepora alcicornis					16	1		
Millepora complanata					6			
Montastrea annularis	21		5	5	35	11	3	12
Montastrea cavernosa	9			2	16	2	1	2
Mycetophyllia aliciae								2
Mycetophyllia danaana					1			
Mycetophyllia ferox								3
Mycetophyllia lamarckiana					2	1		5
Mussa angulosa					1			
Oculina diffusa	2				9			
Porites astreoides	13			4	15	12		6
Porites branneri								
Porites porites	1				9	1		1
Scolymia cubensis					7			1
Scolymia lacera								
Solenastrea bournoni	1				3			1
Solenastrea hyades								
Siderastrea radians	5				3			1
Siderastrea siderea	24			1	35	13	8	37
Stephanocoenia michelinii	9			2	14	2	1	
Total # of Species with Bleaching and/or Coral Disease:								
	23	4	2	8	30	21	4	20

Table 25. 1997 Reefs sampled by Video for Bleaching Extent

Site Code	Site Name	Station Number	Transect Number	Date Sampled
5D1	Sombrero Deep	3	300	9/5/97
5S1	Sombrero Shallow	2	100	9/25/97
9D4	Conch Deep	1	300	9/25/97
9S4	Conch Shallow	4	300	9/25/97
5D2	Looe Key Deep	3	300	10/2/97
5S2	Looe Key Shallow	4	300	10/2/97
2D1	Sand Key Deep	2	300	10/3/97
2S1	Sand Key Shallow	1	300	10/3/97
7D2	Tennessee Deep	3	300	10/22/97
7S2	Tennessee Shallow	2	300	10/22/97

Table 26. Image processing

Data type	1996 Field data	1997 Field data	Total
Analog tapes received	58	52	110
Analog tapes processed	58	8	66
Sites completed (4 stations/site)	40	7	47
Data images framegrabbed	57,600	10,080	67,680
# CD-ROM's produced (TIF)	87	15	102
# CD-ROM's produced (JPG)	42	7	49
# Volumes	6	1	7
Data storage (TIF)	52.9 GB	9.1	62
Data storage (JPG)	3.2	.52	3.72

Table 27. Image Analysis Summary

1996 PointCount Files Site Name	# of Completed Stations
Admiral	3
Alligator (Deep)	2
Alligator (Shallow)	2
Carysfort (Deep)	4
Carysfort (Shallow)	4
Cliff Green	4
Conch (Deep)	4
Conch (Shallow)	4
Content Keys	4
Dove Key	2
Dustan Rocks	3
Eastern Sambo (Deep)	2
Eastern Sambo (Shallow)	3
El Radabob	4
Grecian Rocks	4
Jaap Reef	3
Long Key	3
Looe Key (Deep)	4
Looe Key (Shallow)	4
Molasses (Deep)	4
Molasses (Shallow)	4
Molasses Keys	4
Moser Channel	4
Porter Patch	3
Rattlesnake	2
Rock Key (Deep)	3
Rock Key (Shallow)	4
Sand Key (Deep)	1
Sand Key (Shallow)	4
Smith Shoal	4
Sombrero (Deep)	2
Sombrero (Shallow)	1
Tennessee (Deep)	2
Tennessee (Shallow)	3
Turtle	3
West Turtle Shoal	4
West Washerwoman	3
Western Head	4
Western Sambo (Deep)	4
Western Sambo (Shallow)	4

1997 PointCount Files Site Name	# of Completed Stations
Carysfort (Deep)	4
Content Keys	4
Rock Key (Shallow)	4

TOTALS:

1996: 130 Data Files
21 QA Files
12 Intercalibration Files

1997: 12 Data Files
2 QA Files

Table 28. Mean Percent Cover, Major Benthic Categories and Stony Coral taxa, PointCount, Carysfort Reef Deep 1996-97.

Consolidated ID: Carysfort Reef Deep (70 / 9D1), 1996-1997

		1996				1997				Change,
Station 1	Category	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	1997-96
	Scleractinia	17.4	7.1	16.0	13.5	9.2	7.6	10.5	9.1	-4.4
	Macroalgae	23.1	32.9	27.2	27.7	34.7	27.2	25.4	29.1	1.4
	Milleporidae	0.0	0.0	0.0	0.0	0.6	0.4	0	0.3	0.3
	Octocorallia	12.7	7.3	7.5	9.2	12.4	8.1	10.7	10.4	1.2
	Porifera	4.1	4.8	3.7	4.2	1	2.5	2.3	1.9	-2.3
	Substrate	42.7	48.0	45.6	45.4	42	54.3	51.1	49.1	3.7
	Zoanthidea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

		1996				1997				Change,
Station 2	Category	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	1997-96
	Scleractinia	18.7	11.5	14.2	14.8	15.2	5.5	16	12.2	-2.6
	Macroalgae	28.7	17.5	20.2	22.1	30	36.5	32.3	32.9	10.8
	Milleporidae	0.0	0.0	0.0	0.0	0.2	0	0.8	0.3	0.3
	Octocorallia	9.8	5.2	7.5	7.5	10.5	12.8	7	10.1	2.6
	Porifera	1.7	6.5	3.0	3.7	2	1.2	3.7	2.3	-1.4
	Substrate	41.1	59.3	55.1	51.8	42.2	44	38.5	41.6	-10.2
	Zoanthidea	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.6	0.6

		1996				1997				Change,
Station 3	Category	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	1997-96
	Scleractinia	11.7	13.2	14.7	13.2	11.6	17.1	12.8	13.8	0.6
	Macroalgae	14.4	8.5	4.6	9.2	22.7	15.7	21.5	20.0	10.8
	Milleporidae	0.0	0.2	0.0	0.1	1.2	0	0.2	0.5	0.4
	Octocorallia	7.2	7.9	7.3	7.5	8.7	6.4	3.7	6.3	-1.2
	Porifera	0.6	1.5	1.4	1.2	1.4	0.2	1.2	0.9	-0.3
	Substrate	66.1	67.1	71.8	68.3	54.4	60.6	60.5	58.5	-9.8
	Zoanthidea	0.0	1.7	0.2	0.6	0.0	0.0	0.0	0.0	-0.6

		1996				1997				Change,
Station 4	Category	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	1997-96
	Scleractinia	15.1	12.5	7.1	11.6	11.3	9	8.8	9.7	-1.9
	Macroalgae	12.5	10.4	9.1	10.7	40.3	35.8	31.5	35.9	25.2
	Milleporidae	0.9	0.5	1.4	0.9	0.9	1.1	2.9	1.6	0.7
	Octocorallia	7.3	9.8	8.8	8.6	9.7	9.7	11.5	10.3	1.7
	Porifera	12.7	2.3	10.7	8.6	2.4	2.6	2	2.3	-6.3
	Substrate	51.6	64.2	62.9	59.6	35.3	41.5	43.4	40.1	-19.5
	Zoanthidea	0.0	0.2	0.0	0.1	0.0	0.4	0.0	0.1	0.0

Consolidated ID: Carysfort Reef Deep (70 / 9D1), 1996-1997

	Percent Cover		Change in	Percent	
Category	1996	1997	pct. cover	change	P value
Scleractinia	**13.3**	**11.2**	**-2.1**	**-15.8**	**0.1441**
Macroalgae	**17.4**	**29.5**	**12.1**	**69.5**	**0.0656**
Milleporidae	**0.3**	**0.7**	**0.4**	**133.3**	**0.0656**
Octocorallia	8.2	9.3	1.1	13.4	0.1975
Porifera	**4.4**	**1.9**	**-2.5**	**-56.8**	**0.0679**
Substrate	**56.3**	**47.3**	**-9.0**	**-16.0**	**0.1441**
Zoanthidea	0.2	0.2	0.0	0.0	1.0000

Site Name-1996	Carysfort (Deep)	Carysfort (Deep)	Carysfort (Deep)	Carysfort (Deep)	Carysfort (Deep)		1997 Carysfort (Deep)	Carysfort (Deep)	Carysfort (Deep)	Carysfort (Deep)	Carysfort (Deep)
Station	1	2	3	4	Site Mean		1	2	3	4	Site Mean
Acropora cervicornis	0.00%	0.00%	0.00%	0.06%	0.01%	Acropora cervicornis	0.06%	0.00%	0.00%	0.00%	0.02%
Acropora palmata	0.00%	0.00%	0.00%	0.00%	0.00%	Acropora palmata	0.00%	0.00%	0.00%	0.00%	0.00%
Agaricia agaricites complex	1.25%	0.24%	0.14%	0.42%	0.51%	Agaricia agaricites complex	0.66%	0.11%	0.24%	0.19%	0.30%
Colpophyllia natans	0.00%	0.61%	1.40%	0.53%	0.64%	Colpophyllia natans	0.00%	0.22%	0.48%	0.12%	0.21%
Diploria clivosa	0.00%	0.00%	0.00%	0.00%	0.00%	Diploria clivosa	0.00%	0.00%	0.00%	0.00%	0.00%
Diploria labyrinthiformis	0.00%	0.48%	0.00%	0.00%	0.12%	Diploria labyrinthiformis	0.00%	1.50%	0.00%	0.00%	0.38%
Diploria strigosa	0.00%	0.13%	0.00%	0.00%	0.03%	Diploria strigosa	0.00%	0.00%	0.00%	0.00%	0.00%
Eusmilia fastigiata	0.00%	0.00%	0.00%	0.00%	0.00%	Eusmilia fastigiata	0.00%	0.00%	0.00%	0.06%	0.02%
Favia fragum	0.00%	0.00%	0.00%	0.00%	0.00%	Favia fragum	0.00%	0.00%	0.00%	0.00%	0.00%
Meandrina meandrites	0.19%	0.00%	0.00%	0.00%	0.05%	Meandrina meandrites	0.00%	0.00%	0.00%	0.00%	0.00%
Montastraea annularis complex	6.54%	8.04%	8.38%	8.40%	7.84%	Montastraea annularis complex	3.89%	6.83%	9.12%	8.75%	7.15%
Montastraea cavernosa	0.91%	1.17%	0.82%	0.06%	0.74%	Montastraea cavernosa	0.83%	0.33%	1.21%	0.00%	0.59%
Mycetophyllia aliciae	0.39%	0.17%	0.07%	0.00%	0.16%	Mycetophyllia aliciae	0.13%	0.11%	0.16%	0.00%	0.10%
Mycetophyllia danaana	0.06%	0.13%	0.00%	0.00%	0.05%	Mycetophyllia danaana	0.06%	0.11%	0.00%	0.00%	0.04%
Mycetophyllia ferox	0.11%	0.00%	0.21%	0.06%	0.09%	Mycetophyllia ferox	0.00%	0.00%	0.00%	0.00%	0.00%
Mycetophyllia lamarckiana	0.00%	0.00%	0.07%	0.06%	0.03%	Mycetophyllia lamarckiana	0.00%	0.00%	0.08%	0.12%	0.05%
Oculina diffusa	0.00%	0.00%	0.00%	0.00%	0.00%	Oculina diffusa	0.00%	0.00%	0.00%	0.00%	0.00%
Porites astreoides	0.33%	0.00%	0.20%	0.75%	0.32%	Porites astreoides	0.64%	0.22%	0.41%	0.00%	0.32%
Porites porites	0.40%	0.00%	0.55%	0.94%	0.48%	Porites porites	0.06%	0.00%	0.71%	0.12%	0.22%
Siderastrea radians	0.00%	0.11%	0.00%	0.00%	0.03%	Siderastrea radians	0.00%	0.00%	0.00%	0.00%	0.00%
Siderastrea siderea	1.90%	0.49%	0.98%	0.29%	0.92%	Siderastrea siderea	1.03%	1.83%	1.11%	0.00%	0.99%
Solenastrea bournoni	0.00%	0.00%	0.07%	0.00%	0.02%	Solenastrea bournoni	0.00%	0.00%	0.32%	0.00%	0.08%
Stephanocoenia michelinii	0.00%	0.06%	0.00%	0.00%	0.01%	Stephanocoenia michelinii	0.00%	0.00%	0.00%	0.27%	0.07%
Scleractinia spp.	1.40%	3.17%	0.28%	0.00%	1.21%	Scleractinia spp.	1.67%	0.94%	0.00%	0.06%	0.67%
Millepora alcicornis	0.00%	0.00%	0.07%	0.93%	0.25%	Millepora alcicornis	0.33%	0.33%	0.48%	1.61%	0.69%
Millepora complanata	0.00%	0.00%	0.00%	0.00%	0.00%	Millepora complanata	0.00%	0.00%	0.00%	0.00%	0.00%
Total Mean Stony Coral	13.50%	14.78%	13.25%	12.48%	13.51%	Total Mean Stony Coral	9.36%	12.56%	14.32%	11.29%	11.88%
Octocorallia	9.15%	7.51%	7.44%	8.64%	8.18%	Octocorallia	10.42%	10.11%	6.29%	10.29%	9.28%
Porifera	4.19%	3.73%	1.18%	8.56%	4.41%	Porifera	1.92%	2.28%	0.96%	2.34%	1.88%
Zoanthidea	0.00%	0.00%	0.63%	0.06%	0.17%	Zoanthidea	0.00%	0.56%	0.00%	0.12%	0.17%
Macroalgae	27.72%	22.13%	9.18%	10.66%	17.42%	Macroalgae	29.11%	32.94%	19.95%	35.93%	29.48%
Substrate	45.43%	51.85%	68.32%	59.60%	56.30%	Substrate	49.12%	41.56%	58.48%	40.03%	47.30%
Other	0.00%	0.00%	0.00%	0.00%	0.00%	Other	0.00%	0.00%	0.00%	0.00%	0.00%

Table 29. Frequency of Stony Coral taxa by Site - 1996 - Station Species Inventory (SSI)

Site Name	Species Name	1	2	3	4	All Stations
Carysfort Deep						
	Acropora cervicornis				0.25	0.25
	Agaricia agaricites complex	0.25	0.25	0.25	0.25	1
	Agaricia fragilis	0.25	0.25	0.25	0.25	1
	Agaricia lamarcki	0.25				0.25
	Colpophyllia natans	0.25	0.25	0.25	0.25	1
	Dichocoenia stokesii	0.25	0.25	0.25	0.25	1
	Diploria labyrinthiformis	0.25		0.25	0.25	0.75
	Eusmilia fastigiata	0.25	0.25	0.25	0.25	1
	Favia fragum				0.25	0.25
	Leptoseris cucullata	0.25	0.25	0.25	0.25	1
	Madracis decactis	0.25	0.25	0.25	0.25	1
	Manicina areolata				0.25	0.25
	Meandrina meandrites	0.25		0.125	0.125	0.5
	Millepora alcicornis	0.25	0.25	0.25	0.25	1
	Montastraea annularis complex	0.25	0.25	0.25	0.25	1
	Montastraea cavernosa	0.25	0.25	0.25	0.25	1
	Mussa angulosa		0.25		0.25	0.5
	Mycetophyllia aliciae	0.25	0.25	0.25	0.25	1
	Mycetophyllia danaana	0.25	0.25		0.25	0.75
	Mycetophyllia ferox	0.25	0.25	0.25	0.25	1
	Mycetophyllia lamarckiana	0.25	0.25	0.25	0.25	1
	Porites astreoides	0.25	0.25	0.25	0.25	1
	Porites porites	0.25	0.25	0.25	0.25	1
	Scolymia cubensis	0.25	0.25	0.125		0.625
	Siderastrea siderea	0.25	0.25	0.25	0.25	1
	Solenastrea bournoni	0.125	0.125			0.25
	Stephanocoenia michelinii	0.25	0.25	0.25	0.25	1
Species Total	27	23	21	20	24	

Table 30. Frequency of Stony Coral taxa by Site - 1997 - Station Species Inventory (SSI)

Site Name	Species Name	1	2	3	4	All Stations
Carysfort Deep						
	Acropora cervicornis				0.25	0.25
	Agaricia agaricites complex	0.25	0.25	0.25	0.25	1
	Agaricia fragilis	0.25	0.25	0.125		0.625
	Agaricia lamarcki	0.25				0.25
	Colpophyllia natans	0.25	0.25	0.25	0.25	1
	Dichocoenia stokesii	0.25	0.25	0.25		0.75
	Diploria labyrinthiformis	0.25		0.25		0.5
	Eusmilia fastigiata	0.25	0.25	0.25	0.25	1
	Favia fragum			0.25		0.25
	Leptoseris cucullata	0.25	0.25	0.25	0.25	1
	Madracis decactis	0.25	0.25	0.25	0.25	1
	Manicina areolata				0.25	0.25
	Meandrina meandrites	0.25				0.25
	Millepora alcicornis	0.25	0.25	0.25	0.25	1
	Montastraea annularis complex	0.25	0.25	0.25	0.25	1
	Montastraea cavernosa	0.25	0.25	0.25	0.25	1
	Mussa angulosa		0.25		0.25	0.5
	Mycetophyllia aliciae	0.25	0.25	0.25		0.75
	Mycetophyllia danaana	0.25	0.25	0.25		0.75
	Mycetophyllia ferox	0.25	0.25	0.25		0.75
	Mycetophyllia lamarckiana	0.25	0.25	0.25	0.25	1
	Porites astreoides	0.25	0.25	0.25	0.25	1
	Porites porites	0.25	0.25	0.25	0.25	1
	Scolymia cubensis	0.25	0.25	0.25	0.25	1
	Siderastrea siderea	0.25	0.25	0.25	0.25	1
	Stephanocoenia michelinii	0.25	0.25	0.25	0.25	1
Species Total	26	22	20	21	17	

Table 31. Similarity of Stony Coral Taxa by Station Point Count, Carysfort Deep Site, 1996-1997.

	Sta1, 1996						
Sta2, 1996	62.877	**Sta2, 1996**					
Sta3, 1996	72.959	67.124	**Sta3, 1996**				
Sta4, 1996	62.331	56.974	75.025	**Sta4, 1996**			
Sta1, 1997	**73.816**	58.953	66.230	64.882	**Sta1, 1997**		
Sta2, 1997	68.839	**73.815**	69.978	62.808	69.024	**Sta2, 1997**	
Sta3, 1997	73.282	67.247	**87.900**	76.449	74.215	74.975	**Sta3, 1997**
Sta4, 1997	44.304	52.427	57.213	**69.982**	46.051	53.611	61.812

Table 32. Similarity of major benthic categories by station, PointCount, Carysfort Deep, 1996 – 1997.

		Sta 1	**1996**					
Sta 2	**1996**	93.429	**Sta 2 1996**					
Sta 3	**1996**	85.086	85.402	**Sta 3 1996**				
Sta 4	**1996**	88.057	89.864	89.204	**Sta 4 1996**			
Sta 1	**1997**	**94.982**	91.207	85.375	85.981	**Sta 1 1997**		
Sta 2	**1997**	91.904	**91.298**	83.196	84.712	91.698	**Sta 2 1997**	
Sta 3	**1997**	89.445	87.548	**90.619**	85.045	90.499	84.136	**Sta 3 1997**
Sta 4	**1997**	92.667	88.745	83.662	**84.852**	94.610	94.761	87.458

Table 33. Mean Percent Cover, Major Benthic Categories and Stony Coral taxa, PointCount, Rock Key Shallow 1996-97.

Consolidated ID: Rock Key Shallow (60 / 5S5), 1996-1997

		1996				1997				Change,
Station 1	Category	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	1997-96
	Scleractinia	0.5	3.9	5.4	3.3	1.1	7.1	0.9	3.0	**-0.3**
	Macroalgae	0.5	0.9	2	1.1	1.9	2.8	2	2.2	**1.1**
	Milleporidae	7.5	5.3	4.8	5.9	4.8	1.2	3.7	3.2	**-2.7**
	Octocorallia	1.4	2.3	2.2	2.0	1.8	6.1	2.8	3.6	**1.6**
	Porifera	0.0	0.2	0.9	0.4	0.2	0.8	0.2	0.4	**0.0**
	Seagrass	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	**-0.1**
	Substrate	86.9	81	83.8	83.9	86.3	79.2	85.9	83.8	**-0.1**
	Zoanthidea	2.9	6.5	0.9	3.4	4	2.9	4.4	3.8	**0.4**

		1996				1997				Change,
Station 2	Category	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	1997-96
	Scleractinia	1.9	7.6	4.3	4.6	4.8	5.2	3.3	4.4	**-0.2**
	Macroalgae	1.2	1	1.1	1.1	3.2	1.5	2.3	2.3	**1.2**
	Milleporidae	0.3	0.0	0.2	0.2	0.5	0.2	0.2	0.3	**0.1**
	Octocorallia	1.2	1.5	3.8	2.2	4.8	3.7	4.4	4.3	**2.1**
	Porifera	0.3	0.6	0.2	0.4	0.2	0.2	0.5	0.3	**-0.1**
	Seagrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
	Substrate	93.9	88.1	88.2	90.1	85.4	87.5	88.6	87.2	**-2.9**
	Zoanthidea	1	1.1	2.3	1.5	1.2	1.7	0.7	1.2	**-0.3**

		1996				1997				Change,
Station 3	Category	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	1997-96
	Scleractinia	6.9	17.1	10.7	11.6	4	11.4	15	10.1	**-1.5**
	Macroalgae	3.1	3.9	4.5	3.8	4.5	6.5	3.7	4.9	**1.1**
	Milleporidae	0.4	0.6	0.4	0.5	0.2	0.0	1.8	0.7	**0.2**
	Octocorallia	8.4	6.3	6.4	7.0	10.6	7.2	9.4	9.1	**2.1**
	Porifera	0.0	0.6	0.4	0.3	1.4	2.2	1.3	1.6	**1.3**
	Seagrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
	Substrate	79.6	69	66.1	71.6	75.8	70.5	59.9	68.7	**-2.9**
	Zoanthidea	1.7	2.4	11.4	5.2	3.5	2.2	8.9	4.9	**-0.3**

		1996				1997				Change,
Station 4	Category	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	Tr. 100	Tr. 300	Tr. 500	Stn. Mean	1997-96
	Scleractinia	8.9	5.5	10.8	8.4	5.1	5.7	8	6.3	**-2.1**
	Macroalgae	1.1	1.2	0.5	0.9	1.4	2	1.2	1.5	**0.6**
	Milleporidae	14.4	9.7	10.5	11.5	12.5	4.7	7.5	8.2	**-3.3**
	Octocorallia	0.4	0.7	2.5	1.2	1.4	1.2	1.5	1.4	**0.2**
	Porifera	2.3	2.8	3.6	2.9	0.5	0.0	0.2	0.2	**-2.7**
	Seagrass	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.0	**-0.1**
	Substrate	69.6	72.9	61.2	67.9	73.4	75.5	74.1	74.3	**6.4**
	Zoanthidea	3.3	6.9	10.8	7.0	5.8	11	7.6	8.1	**1.1**

Consolidated ID: Rock Key Shallow (60 / 5S5), 1996-1997

	Percent Cover		Change in	Percent	
Category	1996	1997	pct. cover	change	P value
Scleractinia	**7.0**	**6.0**	**-1.0**	**-14.3**	**0.0679**
Macroalgae	**1.7**	**2.7**	**1.0**	**58.8**	**0.0656**
Milleporidae	4.5	3.1	-1.4	-31.1	0.4652
Octocorallia	**3.1**	**4.6**	**1.5**	**48.4**	**0.0656**
Porifera	1.0	0.6	-0.4	-40.0	0.5930
Seagrass	0.1	0.0	-0.1	-100.0	0.1573
Substrate	78.4	78.5	0.1	0.1	0.7127
Zoanthidea	4.3	4.5	0.2	4.7	0.4615

Site Name-1996	Rock Key (Shallow)	Rock Key (Shallow)	Rock Key (Shallow)	Rock Key (Shallow)	Rock Key (Shallow)		1997	Rock Key (Shallow)	Rock Key (Shallow)	Rock Key (Shallow)	Rock Key (Shallow)	Rock Key (Shallow)
Station	1	2	3	4	Site Mean			1	2	3	4	Site Mean
Acropora cervicornis	0.00%	1.23%	0.62%	0.00%	0.46%		Acropora cervicornis	0.00%	1.88%	0.64%	0.00%	0.63%
Acropora palmata	1.48%	2.36%	9.90%	2.49%	4.06%		Acropora palmata	2.02%	0.35%	8.19%	2.23%	3.20%
Agaricia agaricites complex	0.06%	0.11%	0.00%	0.12%	0.07%		Agaricia agaricites complex	0.18%	0.37%	0.00%	0.06%	0.15%
Colpophyllia natans	0.00%	0.00%	0.00%	0.00%	0.00%		Colpophyllia natans	0.00%	0.00%	0.00%	0.00%	0.00%
Diploria clivosa	0.24%	0.12%	0.58%	0.00%	0.23%		Diploria clivosa	0.12%	0.32%	0.67%	0.00%	0.28%
Diploria labyrinthiformis	0.00%	0.00%	0.00%	0.00%	0.00%		Diploria labyrinthiformis	0.00%	0.00%	0.00%	0.00%	0.00%
Diploria strigosa	0.00%	0.00%	0.00%	0.06%	0.01%		Diploria strigosa	0.00%	0.00%	0.11%	0.00%	0.03%
Eusmilia fastigiata	0.00%	0.00%	0.00%	0.00%	0.00%		Eusmilia fastigiata	0.00%	0.00%	0.00%	0.00%	0.00%
Favia fragum	0.00%	0.00%	0.00%	0.00%	0.00%		Favia fragum	0.00%	0.00%	0.00%	0.06%	0.01%
Meandrina meandrites	0.00%	0.00%	0.00%	0.00%	0.00%		Meandrina meandrites	0.00%	0.00%	0.00%	0.00%	0.00%
Montastraea annularis complex	1.07%	0.22%	0.00%	0.36%	0.41%		Montastraea annularis complex	0.39%	0.91%	0.00%	0.00%	0.33%
Montastraea cavernosa	0.18%	0.00%	0.21%	0.00%	0.10%		Montastraea cavernosa	0.23%	0.06%	0.39%	0.00%	0.17%
Mycetophyllia aliciae	0.00%	0.05%	0.00%	0.00%	0.01%		Mycetophyllia aliciae	0.00%	0.00%	0.00%	0.00%	0.00%
Mycetophyllia danaana	0.00%	0.00%	0.00%	0.00%	0.00%		Mycetophyllia danaana	0.00%	0.00%	0.00%	0.00%	0.00%
Mycetophyllia ferox	0.00%	0.00%	0.00%	0.00%	0.00%		Mycetophyllia ferox	0.00%	0.00%	0.00%	0.00%	0.00%
Mycetophyllia lamarckiana	0.00%	0.00%	0.00%	0.00%	0.00%		Mycetophyllia lamarckiana	0.00%	0.00%	0.00%	0.00%	0.00%
Oculina diffusa	0.00%	0.00%	0.00%	0.00%	0.00%		Oculina diffusa	0.00%	0.00%	0.00%	0.00%	0.00%
Porites astreoides	0.06%	0.29%	0.13%	4.72%	1.30%		Porites astreoides	0.00%	0.13%	0.11%	4.51%	1.19%
Porites porites	0.00%	0.00%	0.00%	0.00%	0.00%		Porites porites	0.07%	0.00%	0.00%	0.00%	0.02%
Siderastrea radians	0.00%	0.00%	0.00%	0.00%	0.00%		Siderastrea radians	0.00%	0.00%	0.00%	0.00%	0.00%
Siderastrea siderea	0.18%	0.23%	0.14%	0.06%	0.15%		Siderastrea siderea	0.00%	0.42%	0.00%	0.23%	0.16%
Solenastrea bournoni	0.00%	0.00%	0.00%	0.12%	0.03%		Solenastrea bournoni	0.00%	0.00%	0.00%	0.00%	0.00%
Stephanocoenia michelinii	0.00%	0.00%	0.00%	0.00%	0.00%		Stephanocoenia michelinii	0.00%	0.00%	0.00%	0.00%	0.00%
Scleractinia spp.	0.00%	0.00%	0.00%	0.73%	0.18%		Scleractinia spp.	0.00%	0.00%	0.06%	1.60%	0.42%
Millepora alcicornis	0.00%	0.12%	0.21%	0.06%	0.10%		Millepora alcicornis	0.06%	0.18%	0.27%	0.11%	0.16%
Millepora complanata	5.88%	0.06%	0.27%	11.75%	4.49%		Millepora complanata	3.15%	0.12%	0.37%	11.36%	3.75%
Total Mean Stony Coral	9.15%	4.78%	12.05%	20.48%	11.61%		Total Mean Stony Coral	6.23%	4.73%	10.80%	20.16%	10.48%
Octocorallia	1.96%	2.14%	7.03%	1.13%	3.06%		Octocorallia	3.54%	4.27%	9.03%	0.86%	4.43%
Porifera	0.36%	0.39%	0.35%	2.30%	0.85%		Porifera	0.38%	0.30%	1.66%	0.11%	0.61%
Zoanthidea	3.42%	1.50%	5.16%	7.18%	4.32%		Zoanthidea	3.81%	1.22%	4.79%	9.02%	4.71%
Macroalgae	1.13%	1.09%	3.83%	0.92%	1.74%		Macroalgae	2.24%	2.33%	4.86%	0.52%	2.49%
Substrate	83.92%	90.10%	71.57%	67.87%	78.37%		Substrate	83.79%	87.14%	68.86%	69.33%	77.28%
Other	0.00%	0.00%	0.00%	0.00%	0.00%		Other	0.00%	0.00%	0.00%	0.00%	0.00%

Table 34. Frequency of Stony Coral taxa by Site - 1996 - Station Species Inventory (SSI)

Site Name	Species Name	1	2	3	4	All Stations
Rock Key Shallow						
	Acropora cervicornis		0.25	0.25		0.5
	Acropora palmata	0.25	0.25	0.25	0.25	1
	Agaricia agaricites complex	0.25	0.25	0.25	0.25	1
	Diploria clivosa	0.25	0.25	0.25	0.25	1
	Diploria strigosa			0.25	0.25	0.5
	Favia fragum	0.25	0.25	0.25	0.25	1
	Isophyllia sinuosa		0.25			0.25
	Leptoseris cucullata	0.125				0.125
	Madracis decactis	0.25				0.25
	Millepora alcicornis	0.25	0.25	0.25		0.75
	Millepora complanata	0.25		0.25	0.25	0.75
	Montastraea annularis complex	0.25	0.25			0.5
	Montastraea cavernosa	0.25	0.25	0.25	0.25	1
	Porites astreoides	0.25	0.25	0.25	0.25	1
	Porites porites	0.25	0.25	0.25	0.25	1
	Siderastrea radians	0.25	0.125			0.375
	Siderastrea siderea	0.25	0.25	0.25	0.25	1
	Stephanocoenia michelinii		0.125		0.125	0.25
Species Total	**18**	14	14	12	11	

Table 35. Frequency of Stony Coral taxa by Site - 1997 - Station Species Inventory (SSI)

Site Name	Species Name	1	2	3	4	All Stations
Rock Key Shallow						
	Acropora cervicornis		0.25	0.25		0.5
	Acropora palmata	0.25	0.25	0.25	0.25	1
	Agaricia agaricites complex	0.25	0.25	0.25	0.25	1
	Agaricia fragilis	0.25				0.25
	Colpophyllia natans			0.25		0.25
	Dichocoenia stokesii	0.25	0.25			0.5
	Diploria clivosa	0.25	0.25	0.25	0.25	1
	Diploria labyrinthiformis			0.25		0.25
	Diploria strigosa			0.25	0.25	0.5
	Favia fragum	0.25	0.25	0.25	0.25	1
	Isophyllia sinuosa		0.25			0.25
	Madracis mirabilis	0.25				0.25
	Millepora alcicornis	0.25	0.25	0.25		0.75
	Millepora complanata	0.25	0.25	0.25	0.25	1
	Montastraea annularis complex	0.25	0.25		0.25	0.75
	Montastraea cavernosa	0.25	0.25	0.25		0.75
	Mycetophyllia lamarckiana	0.25				0.25
	Porites astreoides	0.25	0.25	0.25	0.25	1
	Porites porites	0.25	0.25	0.25	0.25	1
	Siderastrea radians	0.25	0.25	0.25		0.75
	Siderastrea siderea	0.25	0.25	0.25	0.25	1
	Stephanocoenia michelinii		0.25		0.125	0.375
Species Total	**22**	16	16	15	11	

Table 36. Similarity of stony coral taxa by station, PointCount, Rock Key Shallow, 1996-1997.

	Sta 1 1996						
Sta 2 1996	49.268	**Sta 2 1996**					
Sta 3 1996	49.857	62.130	**Sta 3 1996**				
Sta 4 1996	63.686	46.802	37.229	**Sta 4 1996**			
Sta 1 1997	73.052	45.778	43.792	60.455	**Sta 1 1997**		
Sta 2 1997	56.256	70.825	57.648	35.832	43.921	**Sta 2 1997**	
Sta 3 1997	44.090	54.420	88.771	37.261	44.453	50.523	**Sta 3 1997**
Sta 4 1997	65.133	40.008	35.641	83.363	55.099	32.474	31.068

Table 37. Similarity of major benthic categories by station, PointCount, Rock Key Shallow, 1996–1997.

	Sta 1 1996						
Sta 2 1996	91.298	**Sta 2 1996**					
Sta 3 1996	85.189	83.316	**Sta 3 1996**				
Sta 4 1996	85.158	84.840	86.826	**Sta 4 1996**			
Sta 1 1997	95.250	92.528	84.131	82.652	**Sta 1 1997**		
Sta 2 1997	89.537	90.789	80.540	79.277	92.424	**Sta 2 1997**	
Sta 3 1997	89.480	85.343	90.355	83.580	88.556	81.321	**Sta 3 1997**
Sta 4 1997	91.623	85.638	82.344	84.719	91.821	91.368	86.546

Table 38. Mean Percent Cover, Major Benthic Categories and Stony Coral taxa, PointCount, Content Keys 1996-97.

Consolidated ID: Content Keys Hardbottom (18 / 3H1), 1996-1997

Station 1	Category	1996 Tr. 100	1996 Tr. 300	1996 Tr. 500	1996 Stn. Mean	1997 Tr. 100	1997 Tr. 300	1997 Tr. 500	1997 Stn. Mean	Change, 1997-96
	Scleractinia	1.4	0.3	2.4	1.4	0.8	0.2	0.2	0.4	**-1.0**
	Macroalgae	29.4	18.7	25.5	24.5	25.4	20.9	8.8	18.4	**-6.1**
	Milleporidae	0	0	0	0.0	0.0	0.0	0.0	0.0	**0.0**
	Octocorallia	0	0	0	0.0	0.0	0.0	0.0	0.0	**0.0**
	Porifera	1.4	3.1	1.5	2.0	1.2	2.2	0.6	1.3	**-0.7**
	Substrate	67.8	77.9	70.6	72.1	72.6	76.7	90.4	79.9	**7.8**
	Zoanthidea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**

Station 2	Category	1996 Tr. 100	1996 Tr. 300	1996 Tr. 500	1996 Stn. Mean	1997 Tr. 100	1997 Tr. 300	1997 Tr. 500	1997 Stn. Mean	Change, 1997-96
	Scleractinia	1.3	0.4	1.1	0.9	2.2	0.4	0.7	1.1	**0.2**
	Macroalgae	75.8	66.5	47.3	63.2	17.3	18.8	9.5	15.2	**-48.0**
	Milleporidae	0	0.1	0.2	0.1	0.5	0.2	1	0.6	**0.5**
	Octocorallia	0	0	0	0.0	0.0	0.0	0.0	0.0	**0.0**
	Porifera	1	1	2.1	1.4	2.5	1.2	1.4	1.7	**0.3**
	Substrate	21.9	31.9	49.3	34.4	77.5	79.5	87.5	81.5	**47.1**
	Zoanthidea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**

Station 3	Category	1996 Tr. 100	1996 Tr. 300	1996 Tr. 500	1996 Stn. Mean	1997 Tr. 100	1997 Tr. 300	1997 Tr. 500	1997 Stn. Mean	Change, 1997-96
	Scleractinia	0.8	0.7	1.4	1.0	0.3	1.2	0.3	0.6	**-0.4**
	Macroalgae	24.3	4.4	13.2	14.0	17.5	14.4	41.4	24.4	**10.4**
	Milleporidae	0	0	0	0.0	0.0	0.0	0.0	0.0	**0.0**
	Octocorallia	0	0	0	0.0	0.0	0.0	0.5	0.2	**0.2**
	Porifera	0.7	0.2	0.2	0.4	3.3	24.2	4.1	10.5	**10.1**
	Substrate	74.2	94.7	85.3	84.7	78.8	60.3	53.7	64.3	**-20.4**
	Zoanthidea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**

Average Station 4	Category	1996 Tr. 100	1996 Tr. 300	1996 Tr. 500	1996 Stn. Mean	1997 Tr. 100	1997 Tr. 300	1997 Tr. 500	1997 Stn. Mean	Change, 1997-96
	Scleractinia	0.7	1.3	2.1	1.4	2.0	3.1	0.2	1.8	**0.4**
	Macroalgae	33.4	35.6	33.7	34.2	27.5	25.9	26.2	26.5	**-7.7**
	Milleporidae	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	**-0.1**
	Octocorallia	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	**-0.1**
	Porifera	2.1	2.1	4.5	2.9	2.2	2.9	4.4	3.2	**0.3**
	Substrate	63.5	60.6	59.4	61.2	68.4	68.1	69.2	68.6	**7.4**
	Zoanthidea	0.1	0.4	0.2	0.2	0.0	0.0	0.0	0.0	**-0.2**

Consolidated ID: Content Keys Hardbottom (18 / 3H1), 1996-1997

Category	Percent Cover 1996	1997	Change in pct. cover	Percent change	P value
Scleractinia	1.2	1.0	-0.2	-16.7	0.5807
Macroalgae	34.0	21.1	-12.9	-37.9	0.4652
Milleporidae	0.1	0.2	0.1	100.0	0.6547
Octocorallia	0.0	0.1	0.1	-	0.6547
Porifera	1.7	4.2	2.5	147.1	0.4652
Substrate	63.1	73.6	10.5	16.6	0.4652
Zoanthidea	0.1	0.0	-0.1	-100.0	0.3173

Site Name-1996 Station	Content Keys 1	Content Keys 2	Content Keys 3	Content Keys 4	Content Keys Site Mean	1997 Station	Content Keys 1	Content Keys 2	Content Keys 3	Content Keys 4	Content Keys Site Mean
Acropora cervicornis	0.00%	0.00%	0.00%	0.00%	0.00%	Acropora cervicornis	0.00%	0.00%	0.00%	0.00%	0.00%
Acropora palmata	0.00%	0.00%	0.00%	0.00%	0.00%	Acropora palmata	0.00%	0.00%	0.00%	0.00%	0.00%
Agaricia agaricites complex	0.00%	0.05%	0.00%	0.00%	0.01%	Agaricia agaricites complex	0.00%	0.00%	0.00%	0.00%	0.00%
Colpophyllia natans	0.00%	0.00%	0.00%	0.33%	0.08%	Colpophyllia natans	0.00%	0.00%	0.00%	0.32%	0.08%
Diploria clivosa	0.00%	0.00%	0.00%	0.00%	0.00%	Diploria clivosa	0.00%	0.00%	0.00%	0.00%	0.00%
Diploria labyrinthiformis	0.00%	0.00%	0.00%	0.00%	0.00%	Diploria labyrinthiformis	0.00%	0.00%	0.00%	0.00%	0.00%
Diploria strigosa	0.56%	0.27%	0.00%	0.42%	0.31%	Diploria strigosa	0.00%	0.00%	0.00%	0.67%	0.17%
Eusmilia fastigiata	0.00%	0.00%	0.00%	0.00%	0.00%	Eusmilia fastigiata	0.00%	0.00%	0.00%	0.00%	0.00%
Favia fragum	0.00%	0.00%	0.00%	0.00%	0.00%	Favia fragum	0.00%	0.00%	0.00%	0.00%	0.00%
Meandrina meandrites	0.00%	0.00%	0.00%	0.00%	0.00%	Meandrina meandrites	0.00%	0.00%	0.00%	0.00%	0.00%
Montastraea annularis complex	0.00%	0.00%	0.00%	0.00%	0.00%	Montastraea annularis complex	0.00%	0.00%	0.00%	0.00%	0.00%
Montastraea cavernosa	0.05%	0.00%	0.00%	0.00%	0.01%	Montastraea cavernosa	0.00%	0.00%	0.00%	0.00%	0.00%
Mycetophyllia aliciae	0.00%	0.00%	0.00%	0.00%	0.00%	Mycetophyllia aliciae	0.00%	0.00%	0.00%	0.00%	0.00%
Mycetophyllia danaana	0.00%	0.00%	0.00%	0.00%	0.00%	Mycetophyllia danaana	0.00%	0.00%	0.00%	0.00%	0.00%
Mycetophyllia ferox	0.00%	0.00%	0.00%	0.00%	0.00%	Mycetophyllia ferox	0.00%	0.00%	0.00%	0.00%	0.00%
Mycetophyllia lamarckiana	0.00%	0.00%	0.00%	0.00%	0.00%	Mycetophyllia lamarckiana	0.00%	0.00%	0.00%	0.00%	0.00%
Oculina diffusa	0.00%	0.00%	0.00%	0.02%	0.01%	Oculina diffusa	0.00%	0.00%	0.00%	0.00%	0.00%
Porites astreoides	0.26%	0.05%	0.79%	0.40%	0.38%	Porites astreoides	0.13%	0.77%	0.50%	0.48%	0.47%
Porites porites	0.00%	0.00%	0.00%	0.00%	0.00%	Porites porites	0.00%	0.00%	0.00%	0.00%	0.00%
Siderastrea radians	0.20%	0.25%	0.00%	0.05%	0.13%	Siderastrea radians	0.00%	0.06%	0.11%	0.24%	0.10%
Siderastrea siderea	0.23%	0.32%	0.00%	0.23%	0.19%	Siderastrea siderea	0.26%	0.00%	0.00%	0.35%	0.15%
Solenastrea bournoni	0.00%	0.00%	0.00%	0.00%	0.00%	Solenastrea bournoni	0.00%	0.00%	0.00%	0.00%	0.00%
Stephanocoenia michelinii	0.00%	0.00%	0.06%	0.00%	0.01%	Stephanocoenia michelinii	0.00%	0.24%	0.00%	0.00%	0.06%
Scleractinia spp.	0.06%	0.00%	0.11%	0.27%	0.11%	Scleractinia spp.	0.00%	0.00%	0.00%	0.05%	0.01%
Millepora alcicornis	0.00%	0.05%	0.00%	0.06%	0.03%	Millepora alcicornis	0.00%	0.58%	0.00%	0.00%	0.14%
Millepora complanata	0.00%	0.05%	0.00%	0.00%	0.01%	Millepora complanata	0.00%	0.00%	0.00%	0.00%	0.00%
Total Mean Stony Coral	1.36%	1.05%	0.96%	1.78%	1.29%	Total Mean Stony Coral	0.39%	1.65%	0.61%	2.11%	1.19%
Octocorallia	0.00%	0.00%	0.00%	0.12%	0.03%	Octocorallia	0.00%	0.00%	0.17%	0.00%	0.04%
Porifera	1.99%	1.36%	0.34%	3.74%	1.86%	Porifera	1.33%	1.71%	10.54%	4.00%	4.39%
Zoanthidea	0.00%	0.00%	0.00%	0.04%	0.01%	Zoanthidea	0.00%	0.00%	0.00%	0.00%	0.00%
Macroalgae	24.55%	63.23%	13.99%	42.57%	36.08%	Macroalgae	18.38%	15.18%	24.40%	32.19%	22.54%
Substrate	72.10%	34.36%	84.72%	50.50%	60.42%	Substrate	79.90%	81.46%	64.00%	61.49%	71.71%
Other	0.00%	0.00%	0.00%	1.25%	0.31%	Other	0.00%	0.00%	0.28%	0.21%	0.12%

Table 39. Frequency of Stony Coral taxa by Site - 1996 - Station Species Inventory (SSI)

Site Name	Species Name	1	2	3	4	All Stations
Content Keys						
	Agaricia agaricites complex				0.25	0.25
	Cladacora arbuscula	0.25	0.125		0.25	0.625
	Dichocoenia stokesii			0.25		0.25
	Diploria strigosa	0.25	0.25		0.25	0.75
	Millepora alcicornis	0.25	0.25	0.25	0.25	1
	Phyllangia americana	0.25	0.125	0.25	0.25	0.875
	Porites astreoides	0.25	0.25	0.25	0.25	1
	Porites porites	0.25		0.25		0.5
	Scolymia lacera			0.25		0.25
	Siderastrea radians	0.25	0.25	0.25	0.25	1
	Siderastrea siderea	0.25	0.25		0.25	0.75
	Solenastrea bournoni	0.25	0.25	0.25	0.125	0.875
	Stephanocoenia michelinii	0.25	0.25	0.25	0.25	1
Species Total	13	10	9	9	10	

Table 40. Frequency of Stony Coral taxa by Site - 1997 - Station Species Inventory (SSI)

Site Name	Species Name	1	2	3	4	All Stations
Content Keys						
	Agaricia agaricites complex				0.25	0.25
	Cladacora arbuscula	0.25	0.25	0.25	0.25	1
	Diploria clivosa				0.25	0.25
	Diploria strigosa		0.25	0.25	0.25	0.75
	Millepora alcicornis	0.25	0.25	0.25	0.25	1
	Phyllangia americana	0.25		0.25	0.25	0.75
	Porites astreoides	0.25	0.25	0.25	0.25	1
	Porites porites	0.125	0.125		0.25	0.5
	Siderastrea radians	0.25	0.25	0.25	0.25	1
	Solenastrea bournoni	0.25	0.25	0.25	0.25	1
	Stephanocoenia michelinii	0.25	0.25	0.25	0.25	1
Species Total	11	8	8	8	11	

Table 41. Similarity of stony coral taxa by station, PointCount, Content Keys, 1996-1997.

	Sta 1 1996						
Sta 2. 1996	67.881	**Sta 2 1996**					
Sta 3 1996	29.539	12.769	**Sta 3 1996**				
Sta 4 1996	52.625	49.119	39.630	**Sta 4 1996**			
Sta 1 1997	49.436	41.853	34.680	34.957	**Sta 1 1997**		
Sta 2 1997	32.094	29.000	63.483	39.670	21.457	**Sta 2 1997**	
Sta 3 1997	49.286	31.485	65.532	40.506	36.130	56.409	**Sta 3 1997**
Sta 4 1997	70.213	50.675	43.025	49.693	20.074	42.230	58.506

Table 42. Similarity of major benthic categories by station, PointCount, Content Keys, 1996 – 1997.

	Sta 1 1996						
Sta 2 1996	82.609	**Sta 2 1996**					
Sta 3 1996	86.126	69.904	**Sta 3 1996**				
Sta 4 1996	77.309	87.725	69.078	**Sta 4 1996**			
Sta 1 1997	90.813	76.313	90.792	72.538	**Sta 1 1997**		
Sta 2 1997	90.251	73.339	95.141	73.758	92.314	**Sta 2 1997**	
Sta 3 1997	85.865	73.337	80.511	78.677	84.711	83.244	**Sta 3 1997**
Sta 4 1997	77.319	89.005	67.982	93.514	72.521	72.985	80.443