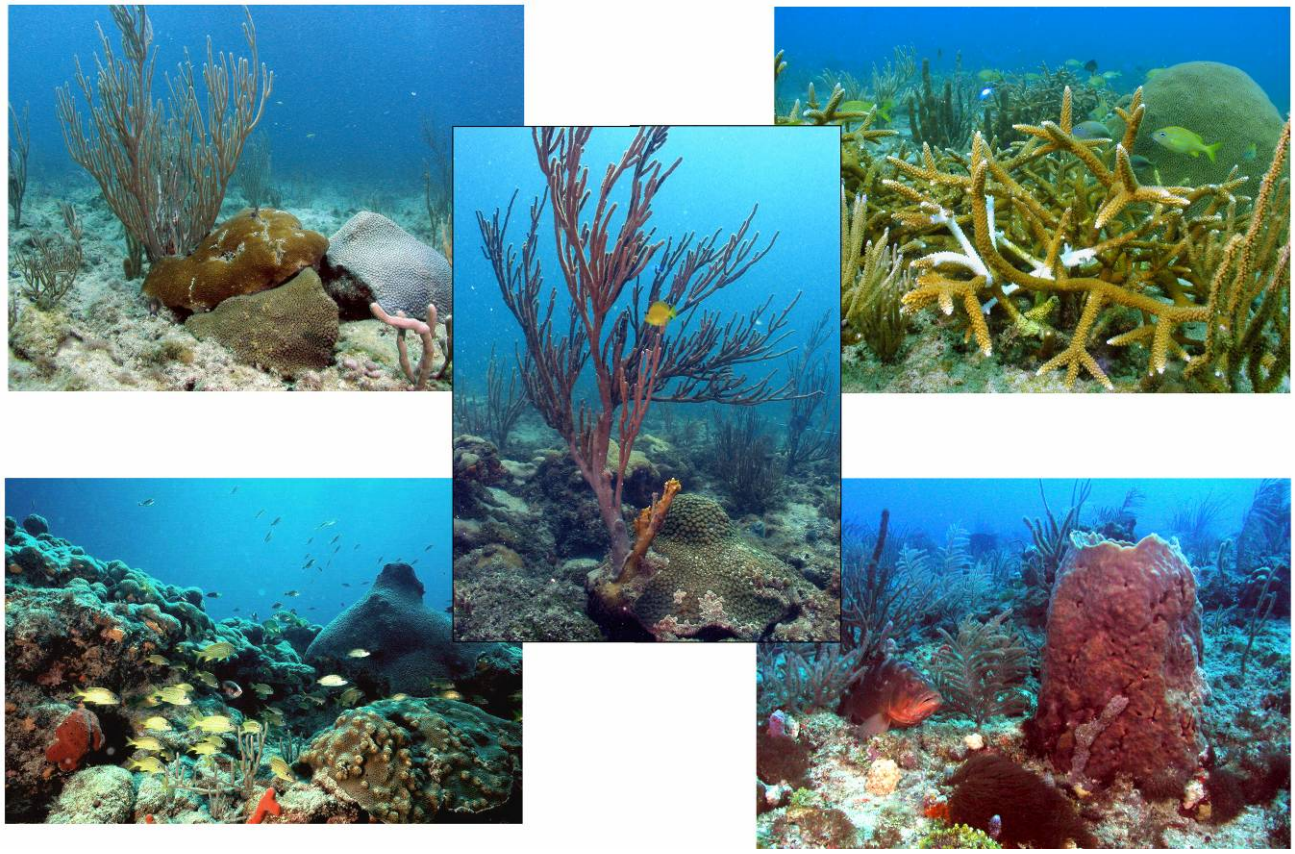
Southeast Florida Coral Reef Evaluation and Monitoring Project
2003 Year 1 Final Report
30 June 2004



A report of the

Florida Fish and Wildlife Conservation Commission, Fish & Wildlife Research Institute and the National Coral Reef Institute, Nova Southeastern University Oceanographic Center pursuant to FDEP grant award number # FG0059

for

Florida Department of Environmental Protection
Office of Coastal & Aquatic Managed Areas
Biscayne Bay Environmental Center
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INTRODUCTION

The coral reef ecosystem in Florida extends beyond the Florida Keys northward through Miami-Dade, Broward, and Palm Beach Counties; however, the primary focus for coral reef research and long-term monitoring has long been in the Florida Keys and Dry Tortugas. Coral reef monitoring efforts in the Keys grew exponentially with the establishment of the Florida Keys National Marine Sanctuary (FKNMS). Since 1996, the Coral Reef Evaluation and Monitoring Project (CREMP) has documented changes in reef resources throughout the Florida reef tract from Key West to Carysfort. In 1999 the project was expanded to include 3 sites in the Dry Tortugas.

In 2003 the CREMP was further expanded to include 10 sites in Miami-Dade, Broward and Palm Beach counties. This expansion, named the Southeast Coral Reef Evaluation and Monitoring Project (SECREMP), will assist in filling gaps in coverage of knowledge and monitoring of coral reef ecosystems nationwide and complement the goals of the National Monitoring Network to monitor a minimum suite of parameters at sites in the network. In addition, these efforts will assist the National Monitoring Network in building its capacity to archive biotic attributes of coral reef ecosystems nationwide.

The reef system from northern Monroe County to Palm Beach County can be characterized as a series of discontinuous reef lines that parallel the shoreline. Generally three lines of reef (terraces) are present and crest in 3 to 5 m (First Reef), 7 to 9 m (Second Reef), and 16 to 23 m (Third Reef) water depths (Figure 1).

Most previous monitoring efforts (Dodge et al., 1995; Gilliam et al., 2001, 2002) along the southeast coast originated as impact and mitigation studies from adverse environmental impacts to specific sites (dredge insults, ship groundings, pipeline and cable deployments, and beach renourishment). Studies were of limited duration (1–3 years) with focus on restoration with some baseline data collection at specific reference areas.

Beginning in 1997, in response to beach renourishment efforts in Broward County, annual collection of environmental data (sedimentation quantities and rates, water quality and temperature measurements), and coral, sponge, and fish abundance/cover data was conducted at 18 sites. In 2000 Nova Southeastern University (NSU) assumed the monitoring responsibility from the County. During that year, five new sites were added. In 2003 two additional sites were added. Monitoring of these 25 sites is ongoing and is scheduled to continue through 2007.

Monitoring of reef habitats off Miami-Dade and Palm Beach counties is short term and localized, and of little use in evaluating the overall health and condition of the northern extension of the Florida reef tract. Estimates of cover are available from some local areas such as those in Broward County but, to a large extent, stony coral cover throughout the southeast Florida reefs is poorly defined. Because the area has few long-term data sets on abundance and/or cover for

benthic components, it is difficult to provide scientifically valid information on status and trends for these reefs.

In 2003, the Florida Department of Environmental Protection (FDEP) proposed and was awarded funding for inception of coral reef monitoring along the southeast Florida coast. To ensure that this monitoring is of the highest scientific quality, and consistent with National Monitoring Network protocols, the Florida Department of Environmental Protection contracted this work *en toto* to the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute (FWC-FWRI). The Coral Reef Research Group at FWC-FWRI has a long history of monitoring reefs in the FKNMS. Their on-going FKNMS Coral Reef Evaluation & Monitoring Project (CREMP) dates back to 1996 and has included parameters (e.g. depth, habitat delineation, and/or percent live/dead cover of corals, submerged aquatic vegetation, macroalgae, sponges) for benthic habitat characterization since its inception.

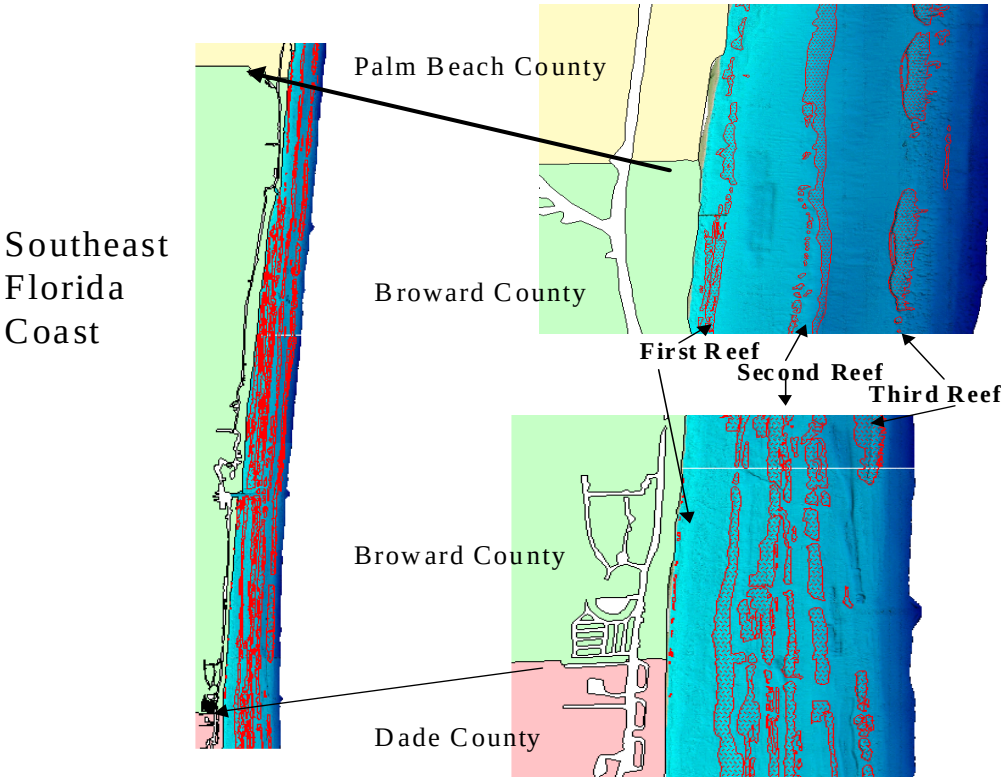

Figure 1. View of reef tracts along the southeast Florida coast

Project Planning

Planning for the Year 1 fieldwork began in early 2003. Year 1 fieldwork included locating, installing, and monitoring sites in Miami-Dade, Broward, and Palm Beach Counties. Principal investigators from FWRI supplied to and discussed with researchers from the National Coral Reef Institute (NCRI) the Standard Operating Procedures for site selection and installation. Dates for selecting, installing, and then monitoring the sites were defined. Representatives from

Miami-Dade County Department of Environmental Resource Management (DERM), Broward County Department of Planning and Environmental Planning (DPEP), and Palm Beach County Environmental Resource Management (ERM) were kept informed on the progress of the project and invited to participate in the site selection and sampling. On 16 June 2003 a workshop was held at Nova Southeast University to discuss the purpose, background, and methods of the CREMP and the SECREMP. Participants included personnel from NCRI, FWRI (St. Petersburg and Tequesta), DPEP, DERM, and ERM.

Monitoring Site Selection

The project initially required three sites be installed and sampled in each of three southeast Florida counties (Miami-Dade, Broward, and Palm Beach). For Miami-Dade and Broward Counties one site was to be selected and installed on each off the three reef tracts from nearshore to offshore. Because Palm Beach does not have three separate reef tracts, one site was selected on a patch of nearshore hardbottom and two sites were selected on the offshore reef tract. Additionally, because of the unique *Acropora cervicornis* patches located off Broward County, a fourth site was added to the project in Broward to monitor one of these patches. All 10 sites include four standard CREMP stations.

Personnel from NCRI, FWRI, and each of the Counties were present during site selection. Each county assisted by providing vessel support. The Miami-Dade, Broward, and Palm Beach County sites were selected between 30 April and 16 May 2003. Industrial Divers Corp. (IDC), was subcontracted to install the reference stakes. Site installation was completed between 28 May and 11 June 2003. Sampling was conducted between 17 June and 20 August 2003. Table 1 provides work dates, depths, and locations of each of the SECREMP sites.

Table 1. Location and Year 1 selection, installation, and sample dates for the 10 SECREMP monitoring sites (DC = Miami-Dade County; BC = Broward County; PB = Palm Beach County).

Site Code	Depth (ft)	Latitude (N)	Longitude (W)	Date Selected	Date Installed	Date Sampled
DC1	25	25° 50.530’	80° 06.242’	5-16-2003	6-2- 2003	6-24-2003
DC2	45	25° 50.520’	80° 05.704’	5-16-2003	6-4-2003	6-24-2003
DC3	55	25° 50.526’	80° 05.286’	4-30-2003	6-6- 2003	6-23-2003
BCA	25	26° 08.985’	80° 05.810’	5-6-2003	5-30-2003	6-19-2003
BC1	25	26° 08.872’	80° 05.758’	5-6-2003	5-30-2003	6-17-2003
BC2	40	26° 09.597’	80° 04.950’	5-12-2003	5-29-2003	6-18-2003
BC3	55	26° 09.518’	80° 04.641’	5-6-2003	5-28-2003	6-18-2003
PB1	25	26° 42.583’	80° 01.714’	5–5-2003	6-12-2003	8-20-2003
PB2	55	26° 40.710’	80° 01.095’	5-5-2003	6-11-2003	8-18-2003
PB3	55	26° 42.626’	80° 00.949’	5-5-2003	6-11-2003	8-19- 2003

METHODS

Each of the 10 SECREMP monitoring sites consists of four monitoring stations delineated by permanent stainless steel markers. Stations are approximately 2 x 22 meters. The SECREMP stations have a north-south orientation, which is generally parallel to the reef terraces of southeast Florida. Within each station, field sampling consists of a station species inventory (SSI), three video transects (100, 300 & 500) and a bio-eroding sponge survey (Figure 2). The SECREMP sampling protocols generally follow standard CREMP sampling protocols.

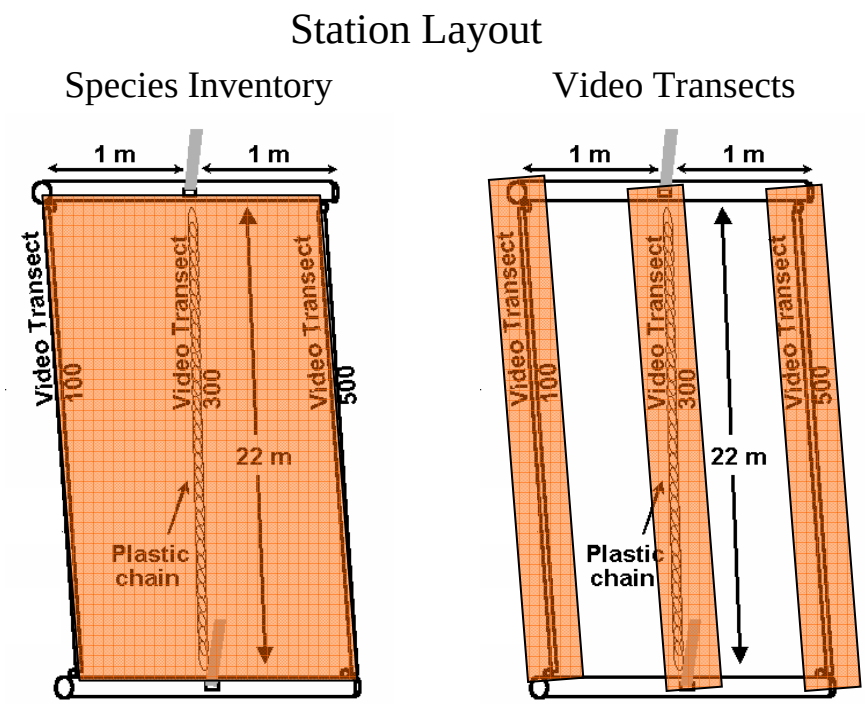

Figure 2. Typical layout of SECREMP station.

Video Transects

Video was selected as the method for cover evaluation because it is a rapid and efficient means of field data collection that provides a permanent data record. Traditional transect and quadrat methods used in terrestrial environments are too time consuming for underwater use in addition to being less accurate and precise.

Percent cover of live coral, sessile benthic biota, and selected substrates is determined annually from video transects filmed at each station. The videographer films a clapperboard prior to filming each transect. This provides a complete record of date and location of each segment recorded. Three video transects are filmed at a constant distance above the substrate at each station.

Two lasers converge 40 cm from the camera lens and guide the videographer in maintaining the camera at a uniform distance above the reef surface. Filming is conducted perpendicular to the

substrate at a constant swim speed of about 4 meters per minute. Artificial lights are used when necessary to ensure image quality. All transects are filmed with a SONY TRV 900 digital video camcorder. The minimum number of digital images necessary to represent each station are framegrabbed and then written to and archived on CD-ROM.

Analysis of benthic cover images is predicated on selecting video frames that abut, with minimal overlap between images. At a filming distance of 40 cm above the reef surface, the field of view is approximately 40 cm wide. A set of abutting images that best covers the station is grabbed directly from the video tape.

Image analysis is conducted using a custom software application PointCount for coral reefs. The software places ten random points on each image. Under each point, selected benthic taxa (stony coral species, octocoral, zoanthid, sponge, seagrass, and macroalgae) and substrate are identified. The software has a "point and click" feature that feeds the identification data into a backend spreadsheet. After all images are analyzed, the data are converted to an ASCII file for Quality Assurance and entry into the master ACCESS data set.

Standard video protocol is modified slightly for site BCA (Broward County nearshore *Acropora cervicornis* patch), and the Palm Beach County sites. Standard protocol calls for a plastic chain to be laid across the substrate to delineate the transect, and act as a guide for the videographer. At site BCA, extensions are added to the transect end stakes in order to raise transect lines above the coral. Fiberglass tapes are used to delineate the transects and guide the videographer instead of chains. All transect videos are taken on the east side of the transect tapes. These modifications reduced the potential for damage to the *A. cervicornis* colonies during sampling.

Off Palm Beach County, there is generally a strong north-flowing current present at offshore sites (PB2 and PB3). This current adds safety risk and greatly increases the effort required to complete the sampling. In order to reduce risk, the use of fiberglass tapes was used in lieu of chains to mark transects and guide the videographer. Transect videos at all Palm Beach County sites are taken on the east side of the transect tapes. Additionally, all transects are videotaped with the diver swimming into the current to slow the divers speed (all stations in Miami-Dade and Broward Counties are sampled north-south).

Station Species Inventory (SSI)

Stony coral species (Milleporina and Scleractinia) presence is recorded at each station. Two observers conduct simultaneous, timed (15 minute) inventories within SSI area and enter the data on underwater data sheets. Each observer records all stony coral taxa and enumerates long-spined urchins (*Diadema antillarum*) within the station boundaries. During the species inventory, any species within a station that exhibits specific signs of either bleaching or disease is documented on the data sheet. Diseases are sorted into three categories: black band, white complex (including white plague, white band, white pox), and other (dark spot, yellow band, and idiopathic diseases). After conducting the survey, the observers compare data (5 minutes) underwater and each confirms the species recorded by each observer. Data sheets are verified aboard the vessel and entered into the database. All data and data sheets are then forwarded to Fish & Wildlife Research Institute for quality assurance checks. This method facilitates robust data collection with broad spatial coverage at optimal expenditure of time and labor.

Bio-eroding Sponge Survey

Three clionid sponge species (*Cliona delitrix*, *C. lampa*, and *C. caribbaea*) recorded by SECREMP are known to be aggressive coral bio-eroders and over-growers. Three 1-meter-wide belt transects provide the maximum spatial coverage within each station. A 22-meter survey tape marks the center of reference for each transect. A diver delineates the survey area by swimming directly above the tape holding a meter stick perpendicular to the tape and parallel to the reef surface. The location, species, and size of each clionid sponge colony and species of stony coral affected by the clionid colony is recorded. Area is measured by means of a 40-cm^2 quadrat frame subdivided into 5 cm squares. The area occupied by the clionid colony is recorded to the nearest half square.

RESULTS

Stony Coral Species Richness

Stony coral species richness were summarized from SSI data. Within the 10 SECREMP sites, a total of 30 stony coral species were identified with a mean of 9.97 species per site (Table 2). Two species, *Montastraea cavernosa* and *Porites astreoides*, were identified at all 10 sites. Thirteen stony coral species were identified at all three counties. Miami-Dade County had the greatest total number of stony coral species (24 species) followed by Broward County (22 species), and Palm Beach County (21) (Figure 3).

Miami-Dade County had a mean 11.17 stony coral species per station while Palm Beach had 10.00 species per station and Broward County had 9.06 species per station. Stony coral species counts at Broward County sites were slightly skewed by site BCA, which is dominated by *Acropora cervicornis*. Without site BCA, Broward County had a slightly greater mean number (10.5) of species per station. The offshore sites (third reef sites DC3, BC3, and PB3) had lower species richness than the first and second reef sites.

Stony Coral Condition

In addition to recording stony coral species presence, the SSI protocol also includes an assessment of stony coral condition, the presence or absence of bleaching and diseases. Disease categories included black band, white complex (white plague, white band, white pox), and "other" (dark spot, yellow band, and idiopathic diseases).

Bleached or partially bleached colonies were observed more frequently than diseased colonies. Bleaching was recorded at five of the 10 sites (nine stations) with PB1 having the greatest incidence of bleaching. Diseased colonies were identified at six sites (six stations). "Other" diseases were seen at four sites (four stations) while "white complex" diseases were identified at two sites (two stations), BC2 and PB1. Black band disease was not seen within any of the 10 sites. Table 3 lists all stony coral species that displaying symptoms of bleaching and/or disease.

Table 2. Presence/absence and disease/condition for all stony coral species for all SECREMP sites in Broward, Dade and Palm Beach counties for 2003. Key: A, 1, 2, 3 = station, X= Present, O= Absent, H= bleached, W= White disease.

Species List	**Broward**	**Dade**	**Palm Beach**
	Present/Absent	**Present/ Absent**	**Present/ Absent**
Acropora cervicornis	A	1	O
Agaricia agaricites	A, 1	1, 2	2, 3
Agaricia fragilis	1, 2	2	O
Agaricia lamarki	2, 3	2	O
Cladocora arbuscula	O	3	O
Colpophyllia natans	A, 1	1, 2	1, 2
Dichocoenia stokesii	1, 2, 3	1, 2, 3	1, 2, 3
Diploria clivosa	A	O	1
Diploria labyrinthiformis	O	1	1
Diploria strigosa	O	1, 2, 3	1, 2
Eusimilia fastigiata	2	2	2
Madracis decactis	1, 2, 3	2, 3	2, 3
Madracis mirabilis	O	O	2
Meandrina meandrites	2, 3	1, 2, 3	1, 2, 3
Millepora alcicornis	A, 1, 2, 3	1, 2, 3	1, 2, 3
Millepora complanata	O	O	O
Montastrea annularis	1, 2	1, 2	2
Montastrea cavernosa	A, 1, 2, 3	1, 2, 3	1, 2, 3
Mycetophyllia aliciae	O	O	3
Mycetophyllia lamarckiana	O	2	O
Oculina diffusa	1	O	1
Phyllangia americana	1	O	1, 2
Porites astreoides	A, 1, 2, 3	1, 2, 3	1, 2, 3
Porites porites	A, 1, 2, 3	1, 2	O
Scolymia cubensis	1, 2	2	O
Scolymia lacera	O	2	O
Siderastrea radians	A, 1, 2, 3	1	1, 2
Siderastrea siderea	1, 2, 3	1, 2, 3	1, 2, 3
Solenastrea bournoni	A, 1, 2, 3	1, 2, 3	1
Stephanocoenia michelini	1, 2, 3	1, 2, 3	2, 3

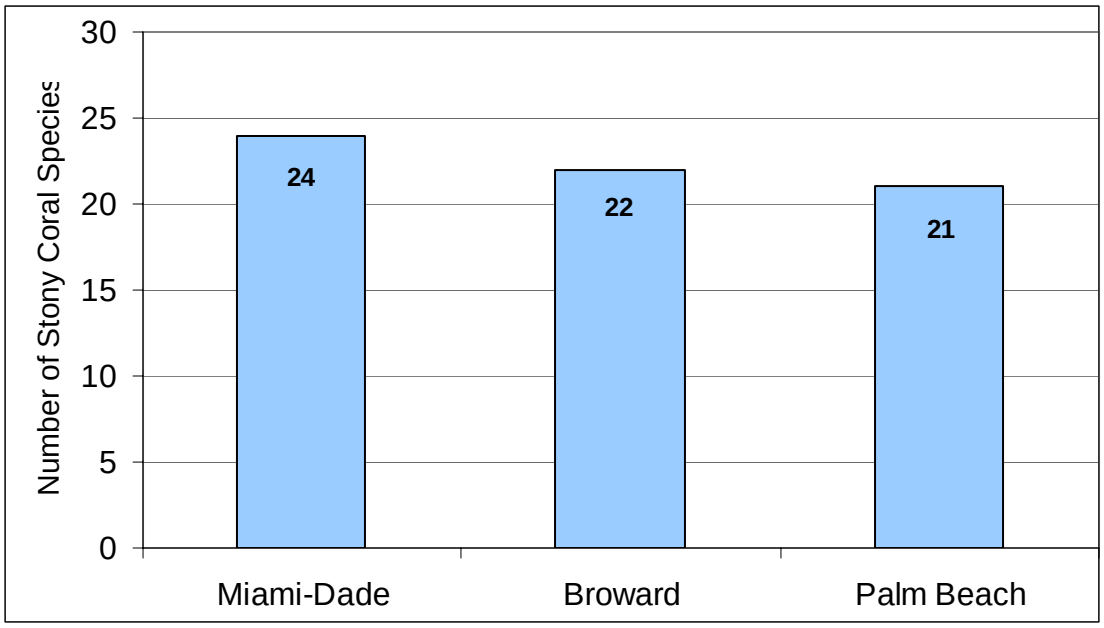

Figure 3. Stony coral species richness at SECREMP sites for Miami-Dade, Broward and Palm Beach counties for 2003. (n=12 stations for Miami-Dade and Palm Beach, n=16 for Broward).

Table 3. List of all sites and stations with bleached or diseased stony corals and stony coral species affected (H = bleaching, O = other disease, W = white type disease).

County	Site	Station	Habitat	Species Affected	Condition
Miami-Dade	DC2	3	Second Reef	*Montastraea annularis*	O
	DC1	2	First Reef	*Porites astreoides*	H
	DC1	4	First Reef	*Siderastrea siderea*	O
Broward	BC3	1	Third Reef	*Dichocoenia stokesii*	H
	BC3	2	Third Reef	*Siderastrea siderea*	H
	BC2	1	Second Reef	*Siderastrea radians*	H
	BC2	4	Second Reef	*Solenastrea bournoni*	W
	BC1	3	First Reef	*Montastraea cavernosa*	O
	BC1	3	First Reef	*Porites astreoides*	H
Palm Beach	PB1	1	First Reef	*Solenastrea bournoni*	H,O
	PB1	1	First Reef	*Siderastrea radians*	H
	PB1	2	First Reef	*Meandrina meandrites*	H
	PB1	2	First Reef	*Solenastrea bournoni*	H
	PB1	2	First Reef	*Siderastrea radians*	H
	PB1	3	First Reef	*Siderastrea radians*	H
	PB1	3	First Reef	*Oculina diffusa*	H
	PB1	4	First Reef	*Solenastrea bournoni*	H, W
	PB1	4	First Reef	*Siderastrea radians*	H

Stony Coral Cover

Mean stony coral cover for the 10 SECREMP sites was 5%. Broward County (11.2%) had the greatest mean stony coral cover followed by Palm Beach (1.3%) and Miami-Dade (1.1%)

(Figure 4). The disparity between the Broward sites and both the Miami-Dade and Palm Beach sites was due to the significantly greater coral cover at site BCA which had 31.7% stony coral cover, and site BC1 which had 12.1% stony coral cover. The remaining Broward sites BC3 and BC2 had stony coral cover similar to that at Miami-Dade and Palm Beach sites. Mean stony coral coverage for all stations is presented in Table 4.

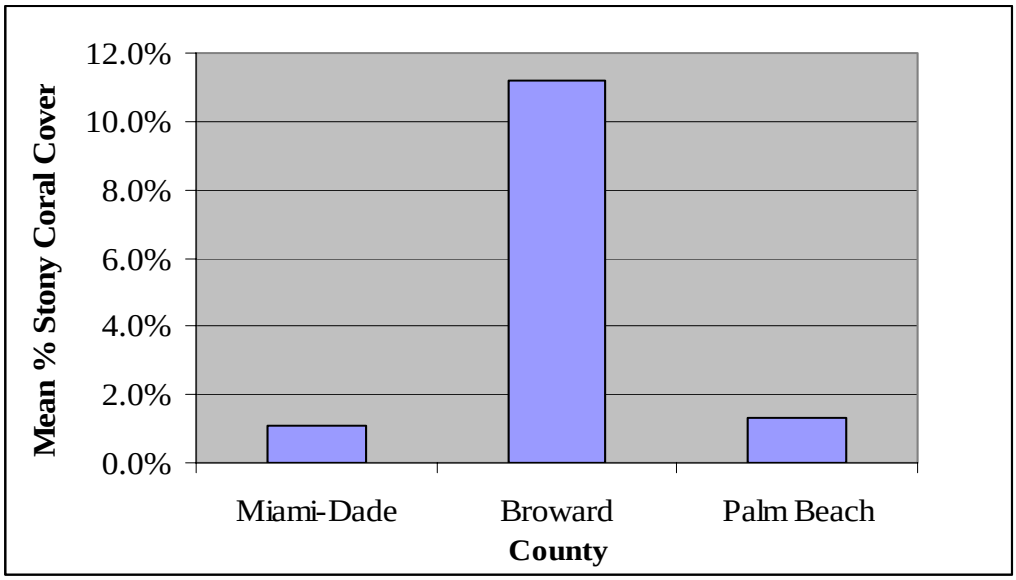

Figure 4. Mean percent stony coral cover at SECREMP sites in Miami-Dade, Broward and Palm Beach counties for 2003.

Table 4. Mean stony coral cover for SECREMP sites by county and habitat for 2003.

County	Site Code	Habitat	Mean % Coral Cover
Miami-Dade	All	All	1.07
	DC3	Third Reef	0.2
	DC2	Second Reef	0.61
	DC1	First Reef	2.4
Broward	All	All	11.15
	BC3	Third Reef	0.28
	BC2	Second Reef	0.4
	BC1	First Reef	12.21
	BCA	Nearshore	31.72
Palm Beach	All	All	1.26
	PB3	Third Reef	1.02
	PB2	Third Reef	1.79
	PB1	First Reef	0.97

The offshore Miami-Dade (DC3) and Broward (BC3) sites had reduced coral cover compared to both second (DC2 and BC2) and first reef (DC1 and BC1) sites. Table 5 lists the mean cover for stony coral species at each site.

Table 5. Mean percent cover of stony coral species at SECREMP sites for 2003. Percent cover was derived from video transects using PointCount for Coral Reefs 1999 software.
Dade = Miami-Dade County, BWD = Broward County, and PB = Palm Beach County.

Stony Coral	**Percent cover**												
Species	**Dade**	**DC1**	**DC2**	**DC3**	**Bwd**	**BCA**	**BC1**	**BC2**	**BC3**	**PB**	**PB1**	**PB2**	**PB3**
Acropora cervicornis	0.03	0.10	0.00	0.00	7.77	31.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agaricia agaricites	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00
Colpophyllia natans	0.04	0.03	0.08	0.00	0.08	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00
Dichocoenia stokesii	0.01	0.03	0.00	0.00	0.01	0.00	0.04	0.00	0.00	0.02	0.01	0.04	0.00
Diploria clivosa	0.00	0.00	0.00	0.00	0.06	0.23	0.00	0.00	0.00	0.11	0.34	0.00	0.00
Diploria strigosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.11	0.00	0.00
Eusmilia fastigiata	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Madracis decactis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Meandrina meandrites	0.06	0.08	0.09	0.02	0.02	0.00	0.00	0.04	0.04	0.20	0.05	0.16	0.39
Millepora alcicornis	0.07	0.03	0.11	0.08	0.01	0.00	0.01	0.00	0.01	0.10	0.04	0.10	0.15
Montastraea annularis	0.01	0.00	0.04	0.00	0.14	0.00	0.51	0.04	0.00	0.02	0.00	0.04	0.01
Montastraea cavernosa	0.58	1.52	0.12	0.09	2.80	0.31	10.70	0.05	0.15	0.66	0.27	1.36	0.34
Oculina diffusa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.00
Porites astreoides	0.13	0.32	0.07	0.00	0.06	0.09	0.05	0.06	0.04	0.06	0.05	0.01	0.12
Porites Porites	0.00	0.01	0.00	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Scleractinia	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.02	0.00
Siderastrea radians	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Siderastrea siderea	0.09	0.24	0.02	0.00	0.12	0.00	0.28	0.17	0.01	0.02	0.00	0.05	0.00
Solenastrea bournoni	0.03	0.04	0.05	0.00	0.09	0.00	0.30	0.03	0.01	0.02	0.06	0.00	0.00
Stephanocoenia michelinii	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00

Functional Group Benthic Cover

Table 6 lists the mean functional group cover for each site. Functional groups included substrate (rock, rubble, and sediments), stony corals, octocorals, zoanthids, sponges, and macroalgae. Substrate dominated benthic cover at all sites, ranging from 83.54% at PB1 to 64.96% at BCA (Figure 6). Octocoral was generally the second most common functional group. Offshore (third reef sites) tended to have greater octocoral cover than inshore sites. Macroalgae cover was greatest at the Miami-Dade sites while sponge cover was greatest at Palm Beach sites.

Bio-eroding Sponge

Cliona delitrix was the only bio-eroding sponge species identified at any SECREMP site. *C. delitrix* was seen in all three Counties (Table 7). Only site BCA did not have bio-eroding sponge present. Broward County had the greatest coverage of *C. delitrix*, while Palm Beach County had the greatest number of *C. delitrix* colonies. The first reef sites tended to have greater cover and more colonies than offshore, third reef, sites.

Table 6. Mean percent cover of functional groups for SECREMP sites for 2003. Mean values are based n=12 stations for Miami-Dade and Palm Beach and n=16 for Broward.

Functional Group	**Percent Cover**												
	Miami Dade	**DC3**	**DC2**	**DC1**	**Broward**	**BC3**	**BC2**	**BC1**	**BCA**	**Palm Beach**	**PB3**	**PB2**	**PB1**
Substrate	73.42	78.48	69.56	72.21	77.17	79.76	86.58	77.37	64.96	68.71	55.37	67.23	83.54
Stony coral	1.07	0.20	0.61	2.40	11.15	0.28	0.40	12.21	31.72	1.26	1.02	1.79	0.97
Octocoral	12.00	15.48	14.67	5.86	7.24	13.54	6.63	6.46	2.34	20.12	30.34	27.32	2.70
Macroalgae	8.51	2.25	9.97	13.32	1.94	3.62	3.70	0.43	0.03	0.12	0.27	0.00	0.10
Porifera	3.16	3.50	5.14	0.85	1.89	2.79	2.67	1.84	0.27	8.10	10.46	3.53	10.29
Zoanthidea	1.80	0.00	0.03	5.36	0.59	0.00	0.00	1.68	0.68	0.67	1.36	0.09	0.55
Others	0.04	0.09	0.03	0.00	0.01	0.01	0.01	0.00	0.00	1.02	1.17	0.05	1.84

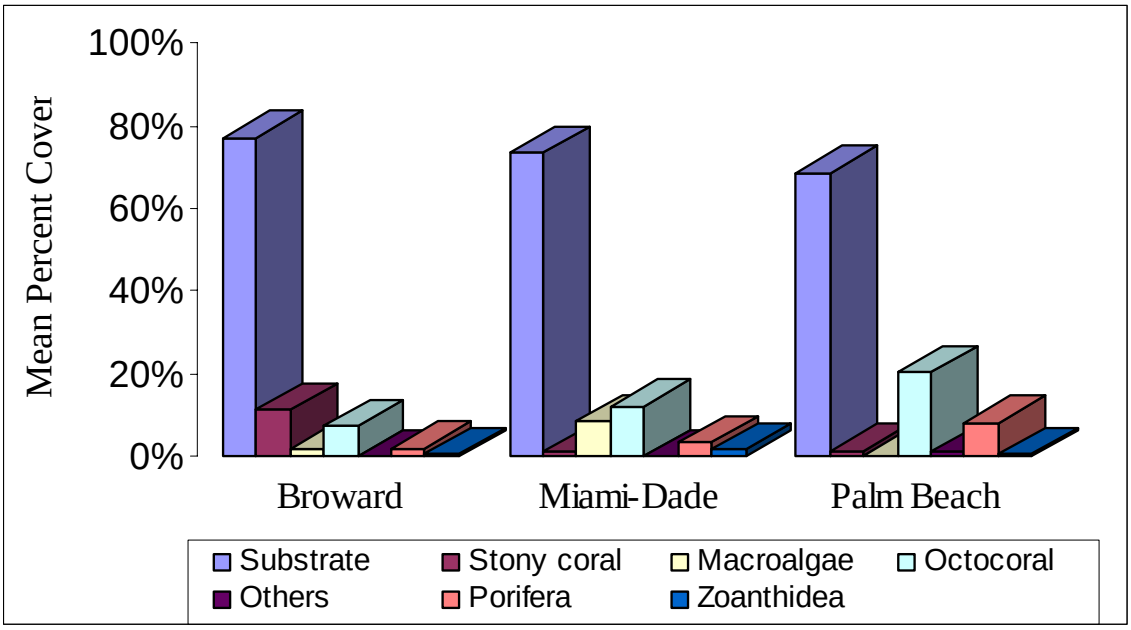

Figure 6. Mean percent cover of functional groups by county at SECREMP sites for 2003.

Table 7. Clionid sponge, *Cliona delitrix*, total colony area (cm^2), habitat type and number of colonies at SECREMP sites by county for 2003.

County	Site code	Habitat type	Total colony area (cm^2)	No. of colonies
Miami-Dade	All	All	1,362.5	7
	DC1	First Reef	287.5	4
	DC2	Second Reef	1,000	2
	DC3	Third Reef	75	1
Broward	All	All	7,062.5	14
	BC1	First Reef	6,525	9
	BC2	Second Reef	125	1
	BC3	Third Reef	412.5	3
Palm Beach	All	All	3,212.5	16
	PB1	First Reef	1,787.5	4
	PB2	Third Reef	1,175	9
	PB3	Third Reef	250	3

DISCUSSION

The coral reef ecosystem off southeast Florida is a marginal system near the environmental threshold for significant reef growth. Southeast Florida reefs generally have reduced stony coral species richness and stony coral cover than the Dry Tortugas or Florida Keys coral reefs. Benthic cover by octocorals is interestingly very similar throughout the Florida reef system. Southeast Florida reefs appear to have reduced macroalgae cover and increased substrate cover compared to reefs in the Dry Tortugas and the Florida Keys. The presence of stony corals with incidence of bleaching and/or disease appears to be reduced in the southeast Florida region compared to the Florida Keys.

Despite their reduced diversity and coral cover compared to reefs in the Florida Keys, the coral reefs of southeast Florida represent a significant economic resource to the region. Between June 2000 and May 2001 visitors spent 28 million person-days enjoying artificial and natural reefs in southeast Florida. During the same period, reef related expenditures amounted to some 1.81 billion dollars and generated 61,300 jobs in Miami-Dade, Broward and Palm Beach counties (Johns et al., 2003).

These important economic and recreational benefits are threatened as the coral reef environments of Southeast Florida are under varied and chronic stressors. This area is highly urbanized along the coast. Dredging for beach renourishment, channel deepening, and channel maintenance can have significant impacts on water quality. Chronic turbidity and deposition of silt can smother sessile invertebrates and result in barren areas. Nearshore reef areas are at risk from diverting of millions of gallons of fresh water into the ocean and the resultant reduction in salinity and introduction of agricultural and industrial chemical contamination, and excess nutrients.

Impacts from boating and fishing activities are a significant threat to reef areas as damage from fishing gear and anchoring can be severe. Adverse impacts from SCUBA divers can also occur. Traffic from large ports (Miami, Port Everglades, and Palm Beach) including cruise and container ships, military vessels, and oil tankers can conflict with reef resources. Ships occasionally run aground and anchor on reefs causing extensive, and often long-lasting damage. Other recent impacts include those of the installation of fiber optic cables deployed across the reefs, which may cause abrasion and detachment of corals and sponges (Jaap, 2000).

The chronic nature of disturbances to, and the significant economic value of the southeast Florida reefs requires comprehensive, long-term monitoring be conducted to define change and help identify threats to the ecosystem. Scientifically valid monitoring of reefs will help local resource managers understand the implications of actions occurring in terrestrial and adjacent marine habitats. This knowledge is necessary if resource managers are to development sound management plans for coral reefs that permit continued use, and realization of the economic value of these fragile marine ecosystems.

The expansion of the Coral Reef Monitoring Project to include sites in Broward, Miami-Dade, and Palm Beach counties has insured that this minimum suite of parameters is being monitored for the full extent of the Florida coral reef ecosystem. One of the goals of the NOAA Coral Ecosystem Monitoring Program is monitoring with an explicit link to assessing the efficacy of "coastal" management strategies. While a true effects study is not possible with our limited sample size, sample design has incorporated insofar as possible, monitoring "control" or references sites so as to gauge potential effects from past or future impacts (e.g., beach renourishment, pipelines, etc.).

The partnership with Nova Southeastern University and its constituent National Coral Reef Institute has worked to expand local capacity for maintaining long-term monitoring sites, complementing those being sampled as part of the National Coral Reef Monitoring Network. As a monitoring project under the Coral Reef Conservation Grant Program for the Florida east coast, the SECREMP will continue characterization of baseline ecosystem condition, inventory/mapping of biotic resources, and data base development, providing resource managers with the critical information required to manage this valuable natural resource.

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LITERATURE CITED

Dodge, R.E., W. Goldberg, G.G. Messing and S. Hess. 1995. Final report Biological monitoring of the Hollywood-Hollandale beach renourishment. Prepared for the Broward County Board of County Commissioners, Broward County Department of Natural Resources, Biological Resources Division. 103 pp.

Gilliam, D.S., R.E. Dodge, R.E. Spieler, S.T.Thornton and L.K.B. Jordan. 2001 Marine Biological monitoring in Broward County, Florida: Year 1 Annual Report. Technical Report 01-08. Prepared for the Broward County Board of County Commissioners, Broward County Department of Natural Resources, Biological Resources Division. 62 pp.

Gilliam, D.S., R.E. Dodge, R.E. Spieler, S.T.Thornton and L.K.B. Jordan. 2002 Marine Biological monitoring in Broward County, Florida: Year 2 Annual Report. Technical Report 02-01. Prepared for the Broward County Board of County Commissioners, Broward County Department of Natural Resources, Biological Resources Division. 67 pp.

Jaap, W.C. 2000. Coral reef restoration. *Ecological Engineering.* Vol.15:345-364.

Johns, G.M., V.R. Leeworthy, F.W. Bell, and M.A. Bonn. 2003. Socioeconomic study of reefs in southeast Florida October 19, 2001 as revised April 18, 2003. Silver Spring MD: Special Projects NOS 255 pp.