

2007 Quick Look Report

Large-scale assessment of *Acropora* corals, coral species richness, urchins and *Coralliophila* snails in the Florida Keys National Marine Sanctuary and Biscayne National Park



December 2007

Steven L. Miller, Mark Chiappone and Leanne M. Rutten

Center for Marine Science, University of North Carolina-Wilmington, 515 Caribbean Drive, Key Largo, Florida 33037, USA

Citation: Miller SL, Chiappone M, Rutten LM (2007) 2007 Quick look report: Large-scale assessment of *Acropora* corals, coral species richness, urchins and *Coralliophila* snails in the Florida Keys National Marine Sanctuary and Biscayne National Park. Center for Marine Science, University of North Carolina-Wilmington, Key Largo, Florida. 147 pp

Cover Photo: Elkhorn coral (*Acropora palmata*) within the French Reef Sanctuary Preservation Area, Key Largo

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Principal Investigator

Steven L. Miller, Center for Marine Science, University of North Carolina at Wilmington (UNCW), 515 Caribbean Drive, Key Largo, FL 33037, Tel: 305 451 0233, Fax: 305 453 9719, Email: millers@uncw.edu

Program Team

Mark Chiappone, Center for Marine Science, University of North Carolina at Wilmington, 515 Caribbean Drive, Key Largo, FL 33037, Email: chiappone@uncw.edu

Leanne M. Rutten, Center for Marine Science, University of North Carolina at Wilmington, 515 Caribbean Drive, Key Largo, FL 33037, Email: ruttenl@uncw.edu

Acknowledgements

Funding for this 2007 effort was provided by the Florida Keys National Marine Sanctuary through NOAA's Coral Reef Conservation Program and Emerson Associates International. Logistics and field support were provided by NOAA's National Undersea Research Center-University of North Carolina at Wilmington, NOAA's National Marine Sanctuary Program (Brian Keller and Joanne Delaney), Biscayne National Park (Richard Curry), New World Expeditions (Key Largo), Quiescence Diving Services (Key Largo), A&B Marina (Key West), Lost Reef Adventures (Key West), Almond Tree Inn (Key West), Cudjoe Gardens Marina and Dive Center (Cudjoe Key), and Hall's Diving Center (Marathon). This effort would not have been possible without the dedication and expertise of Bernie Altmeier, captain of the R/V *Expedition II*. Research was conducted in the Florida Keys under National Marine Sanctuary Permit FKNMS-074-98 and in Biscayne National Park under National Park Service Permit BISC-2005-SCI-0039.

2007 Sampling Summary

The declines in abundance of two of the principal Caribbean reef-building corals, staghorn coral (*Acropora cervicornis*) and elkhorn coral (*A. palmata*) (Figure 1), are often-cited examples of the changes in western Atlantic reefs that have occurred during the past several decades. The causes of these declines, which began in the late 1970s, include large-scale factors such as coral bleaching and disease, especially white band disease, as well as smaller scale effects from storms and predation by corallivorous snails and damselfishes. Both coral species were under consideration for addition to the U.S. Endangered Species List since the early 1990s and were formally added to the list as threatened in 2005 based upon Caribbean-wide population declines and poor recovery. The reader is referred to the *Acropora* Biological Review Team summary at <http://sero.nmfs.noaa.gov/pr/pdf/050303%20status%20review.pdf> for further information.

To help support NOAA's efforts to ascertain the current status of both staghorn and elkhorn corals, scientists from the Center for Marine Science, University of North Carolina-Wilmington (UNCW) undertook an intensive assessment of the spatial distribution, colony abundance, size, and condition of both staghorn and elkhorn corals throughout the Florida Keys, including both the Florida Keys National Marine Sanctuary (FKNMS) and Biscayne National Park (BNP). During June-August 2007, a total of 235 sites were surveyed from the northern extent of Biscayne National Park (Fowey Rocks) to southwest of Key West near Satan Shoal, thus covering most of the Florida Reef Tract minus the Marquesas Keys and the Dry Tortugas further west. Previous surveys conducted by this program dating back to 1999 aided in optimizing a sampling plan for obtaining abundance and size distribution estimates for the two *Acropora* coral species. Similar surveys conducted in the upper Keys region during 2006 were especially useful for delineating the habitats to be sampled and the effort needed per site. Quick Look reports from previous years are available at http://people.uncw.edu/millers/CoralReef_QuickLooks.htm. A two-stage stratified random sampling design was employed that incorporated nine unique habitat types, as well as areas inside and outside of FKNMS no-take zones: Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), and Research Only Areas (RO). Twenty-two of the twenty-three no-take marine reserves between Carysfort Reef and the Marquesas Keys were sampled.

Hard-bottom and coral reef habitats were sampled from the inshore edge of Hawk Channel to the fore reef slope, essentially encompassing the spectrum of hard-bottom and coral reef habitat types that could presumably support colonies of either species over the depth range considered (< 1 m to 16 m depth). Habitat types sampled were mid-channel and offshore patch reefs, hard-bottom matrix, shallow (< 6 m) and deeper (> 6 m) low-relief hard-bottom, inner line reef tract spur and groove, high-relief spur and

groove, patchy hard-bottom in sand, and low-relief spur and groove. At each site, four transects 15-m in length were surveyed 0.5 m on each transect side to yield data on *Acropora* presence-absence, colony density, size, and condition. Data were also obtained on depth and maximum vertical relief, as well as the presence-absence and frequency of occurrence of all stony coral species encountered within the belt transects. Urchins were identified by species and counted and measured for test diameter. *Coralliophila* snails, important coral predators, as well as commonly encountered gastropod mollusks, namely *Thais deltoidea* and *Leucozonia nassa*, were also sampled for density, shell length, and substratum occupancy patterns. Thirty-one days of fieldwork were required to sample the 235 sites by a two-person team. Accompanying reef fish surveys were carried out by researchers from NOAA Fisheries and RSMAS-University of Miami at a subset of the sites surveyed for *Acropora* corals. All work was conducted using SCUBA, with boat and diving support provided by a chartered research vessel (R/V *Expedition II*), NURC-UNCW, and local area dive shops in Marathon and Key West, Florida.

This quick look report summarizes results concerning the habitat distribution, abundance, size, and condition of staghorn and elkhorn corals in the Florida Keys. Nineteen accompanying tables and 29 figures provide site-level information on coral, snail, and urchin variables. The information collected during 2007 will be used to derive habitat-based population abundance estimates for the two *Acropora* corals covering the northern extent of the Florida Reef Tract to the Marquesas Keys. The coral species richness data adds to a growing data set on the habitat distribution patterns of reef-building corals in the region, and provides useful spatial data relative to the location of current no-take marine reserves. The urchin density and size data add to a growing information base on the spatial and temporal patterns of these organisms, in particular the potential recovery of *Diadema antillarum* 25 years after the Caribbean-wide mass mortality. The spatial extent of the 2007 surveys should also provide helpful information for updating the existing benthic habitat maps for the study area.

2007 Sampling Goals and Objectives

The 2007 sampling of staghorn (*Acropora cervicornis*) and elkhorn (*A. palmata*) corals in the Florida Keys National Marine Sanctuary (FKNMS) and Biscayne National Park (BNP) was undertaken as a spatially intensive effort to determine the habitat-based spatial distribution, abundance, size, and condition of these two important Caribbean reef-building corals. The 2007 surveys conducted during June 23 to August 18 were an outgrowth of previous efforts conducted by UNCW dating back to 1999 to quantify the abundance and condition of coral reef benthos throughout the FKNMS, including the Tortugas region. Previous surveys from southwest of Key West to Biscayne National Park included 80 sites sampled in 1999, 45 sites in 2000, 108 sites in 2001, 195 sites in 2005, and 107 sites in the upper

Keys region in 2006. Data obtained from these earlier efforts, together with existing habitat mapping information for the FKNMS, were used to guide the sampling of *Acropora* corals during 2007. Five publications are in the final stages of preparation based on results from the previous sampling efforts. The objectives of the 2007 sampling design were to provide information on:

- Habitat-based presence-absence distribution patterns encompassing diverse hard-bottom and coral reef habitat types from 1 m to 16 m depth, including a photographic archival record of where both *Acropora* coral species were found;
- *Acropora* coral colony density by site, habitat type, and protection level that incorporated most of the existing FKNMS no-take marine reserves from northern Key Largo to southwest of Key West;
- *Acropora* coral colony size distribution in terms of tissue surface area;
- Prevalence of *Acropora* coral colony conditions (normal/healthy, bleaching, disease, predation);
- Population abundance estimates for both species that is habitat and size structured;
- Density, size, and substratum occupancy patterns of *Coralliophila* snails, potentially important predators of *Acropora* coral tissue;
- Density and size of urchins, representing a continuing effort to monitor recovery of the historically abundant *Diadema antillarum*; and
- Stony coral species richness and frequency of occurrence.

The information presented below represents a nearly system-wide effort to quantify these variables from the northern extent of the Florida Reef Tract southwest to the Marquesas Keys. Because of the timing of the surveys, we were also able to collect information on the extent and severity of scleractinian coral bleaching, the results of which will be presented elsewhere.

Logistics and Field Methodology

The 2007 surveys of *Acropora* corals in the FKNMS and BNP relied upon existing mapping information on the distribution of benthic habitat types in the region, as well as previous presence-absence and abundance surveys for corals conducted since 1999. Previous surveys conducted by UNCW have principally focused on: 1) the Florida Keys from southwest of Key West to Biscayne National Park and 2) the Tortugas Region, including Dry Tortugas National Park and the Tortugas Bank. In 1999, benthic coral reef organisms were sampled at 80 sites from southwest of Key West to north of Carysfort Reef. Coral abundance was determined in two 25-m x 0.4-m belt transects per site (20 m²), while the presence-

absence of coral species was determined in four 25-m x 0.4-m belt transects per site (80 m²). In 2000, a total of 45 sites were surveyed in the lower Keys region (SW of Key West to Bahia Honda) that encompassed habitats from the inshore edge of Hawk Channel to 15 m depth on the fore reef slope. Similar methods were used as in 1999, except 10-m transects were used on smaller size patch reefs. In 2001, a total of 86 sites were surveyed from southwest of Key West to upper Key Largo. These surveys were complemented by surveying larger belt transects 100 m² in area for the density of *Acropora* colonies. In 2005, a total of 195 sites were surveyed from south of the Marquesas Keys to the northern Biscayne National Park boundary. Coral abundance, size, and condition were sampled in two 10-m x 1-m belt transects per site, while the presence-absence of species was determined in four 15-m x 1-m belt transect areas. In 2006, a pilot study of *Acropora* coral density, size, and condition resulted in the sampling of 107 sites in the upper FKNMS.

The sampling design for assessing the population status of staghorn and elkhorn corals encompassed 235 sites visited during June–August 2007. Sites were distributed from northern Biscayne National Park (BNP) at Fowey Rocks to southwest of Key West at Satan Shoal (Figure 2). The original sampling design encompassed 180 sites in eight habitat types and included 17 of the 23 no-take marine reserves designated as Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), and Research Only Areas (RO) in the FKNMS, not including the Tortugas region (Table 1). Due to excellent weather conditions and logistics, we were able to sample an additional 55 sites, 28 of which were in BNP. All of the FKNMS zones except for Newfound Harbor SPA were visited and all eight habitat types were sampled, in addition to several sites that were hard-bottom matrix areas. Table 2 chronologically lists the sampling locations during June–August 2007. The largest discrepancy between the planned and the actual sampling program concerned areas indicated as low-relief hard-bottom in several of the SPAs, especially in the lower Florida Keys region, which instead tended to comprise patchy hard-bottom in sand (Table 1). We also added several high-relief spur and groove sites in both the upper and lower FKNMS regions. Some areas designated as low-relief hard-bottom were in fact matrix habitats consisting of a mosaic of hard-bottom, rubble, sand, and sometimes seagrass. The BNP sampling, due to time constraints, focused on mid-channel and offshore patch reefs, shallow hard-bottom, and high-relief spur and groove. Based upon the paucity of both *Acropora* coral species on deeper (> 10 m) hard-bottom and spur and groove in BNP during 2005, we chose to focus on shallower hard-bottom and reef habitats in that area.

The habitat strata selected for the 2007 sampling incorporated all of the hard-bottom and coral reef habitat types from the shoreward edge of Hawk Channel to 16 m depth along the reef tract that were known or suspected to potentially support *Acropora* corals. Based upon results from the 2006 surveys in the upper Florida Keys, the back reef rubble habitat type was not surveyed, as this habitat did not yield any *Acropora* corals in that year. In addition, we did not sample nearshore hard-bottom and seagrass

areas, although we suspect that *A. cervicornis* could be present in these habitats. Habitats sampled during 2007 were mid-channel and offshore patch reefs, shallow (< 6 m) and deeper (6-15 m) low-relief hard-bottom, patchy low-relief hard-bottom, high-relief spur and groove, and low-relief spur and groove (Figures 3 and 4). The sampling also incorporated a series of inner line spur and groove sites unique to the upper Keys region from Grecian Rocks SPA to Turtle Reef. The list of sites organized by benthic habitat type is provided in Table 3, together with site-level data on depth and maximum vertical relief. Site descriptions for each of the 235 sampling locations visited during 2007 are provided in Table 4 and should be useful for updating existing habitat mapping information for the region.

A two-stage stratified random sampling design was used to randomly select sites for assessing staghorn and elkhorn coral populations in the Florida Keys. A grid system constructed in a geographic information system (GIS) was used to overlay the existing habitat map of the Florida Keys. Cells or blocks 200 m x 200 m in dimension were used to randomly select sites from eight habitat strata. A second level of stratification was accomplished by delineating regional sectors as follows: Biscayne National Park (Fowey Rocks to southern BNP boundary), upper Florida Keys (BNP boundary south to Pickles Reef), middle Florida Keys (Conch Reef southwest to Moser Channel), and lower Florida Keys (Big Pine Shoal west to Satan Shoal). Regional sectors potentially reflect differences in oceanographic influences, geological history, and habitat distribution. A third stratification variable was protection level which included sites inside and outside of FKNMS no-take marine reserves (SPA, ER, and RO). Within each no-take zone, two replicate sites were sampled in a given habitat type. The power of the stratified random sampling approach is essentially two-fold. First, the habitats comprising the most area are allocated more sites than those with less area (i.e., a proportional design). Second, habitats with more variability (e.g. coral density) are allocated more sites than those with less variability. The ultimate power of this approach is derived from the number of sites sampled rather than the effort expended per site.

The underwater surveys consisted first of locating randomly selected, pre-determined coordinates with a differential global positioning system. The original sampling list included 180 sampling locations, with an additional 145 alternate sites for the upper, middle, and lower Florida Keys regions. As we originally did not intend to sample sites within BNP, we randomly selected a subset of sites allocated for NOAA Fisheries sampling in BNP using the same methodology as for the rest of the Florida Keys, but limited to patch reef, shallow hard-bottom, and high-relief spur and groove habitats. If the original waypoint was not the intended habitat type, the closest alternate site was sampled instead. Once on-site, a two-person benthic diver team oriented four transect tapes 15 m in length, marked in 1-m increments, along the bottom. A 60 m² area, therefore, was surveyed at each site for the variables described below. Each of divers surveyed two of the four transects for depth, maximum vertical relief, *Acropora* corals, stony coral species richness, *Coralliophila* and other selected other gastropod snails, and urchins. Transects were

placed in a haphazard fashion, but in a way that adequately represented the habitat at the randomly selected site coordinates. Once transects were deployed, divers determined the minimum and maximum depth along the transect using a digital depth gauge, as well as the maximum vertical relief along each transect using a 50-cm scale bar. Maximum vertical relief took into consideration hard substratum, corals, and sponges, but did not include gorgonian height. Depth was measured using a digital depth gauge and maximum vertical relief with a 50-cm PVC scale bar marked in 5-cm increments. Digital photographs of each site were taken to record general site features and *Acropora* corals, urchins, and *Coralliophila* snails encountered.

Any *Acropora* corals that were observed within the 15-m x 1-m belt transects were counted, measured, and assessed for colony condition. For this study, a colony was considered to be a patch of continuous live tissue (ramet). In cases where a skeletal unit, possibly representing a single genet, was divided into one or more patches of tissue with clearly defined boundaries, each patch was considered to be a separate colony. Dimensions of live tissue patches were measured to estimate the surface area of each colony using applicable surface area formulas. The condition measurements included an assessment of bleaching, other types of tissue disease, predation on live tissue, and overgrowth by algae, sponges, and other biota. NOAA's coral disease web site was consulted to assist with the identification of disease-like conditions in the field (www.coral.noaa.gov/coral_disease).

In addition to the *Acropora* coral variables, several other variables were measured during the 2007 sampling. Stony coral species richness for each transect and each site was determined by recording all of the stony coral species (Milleporina and Scleractinia) within each of the four belt transect boundaries. This yielded information on the number of species per station (transect), total species per site, and the frequency of occurrence (proportion of transects present) for each species. All identifications were made *in situ*; however, underwater photographs were also taken for archival purposes. The species, number, and test diameter of all urchins were also recorded. Based upon the 2006 surveys, we included an assessment of the density, size, and substratum occupancy patterns of *Coralliophila* snails. During the surveys, we also encountered relatively large numbers of other gastropod mollusks, namely the deltoid rock shell (*Thais deltoidea*) and the common lesser tulip shell (*Leucozonia nassa*). *Coralliophila* and the other two snail species were counted and measured for total shell length. In addition, we recorded the substratum that the snail was found upon when surveyed, whether it was live coral, turf algae, coralline algae, etc. A few specimens of each species were collected and identifications were confirmed by scientists at the Fish and Wildlife Conservation Commission in Marathon, Florida. Similar to observations in 2005, we noted the beginning of coral bleaching during July 2007. Information was collected on the stony corals exhibiting a bleaching response and notes were made on whether a given species was observed as normal, pale, partially bleached, or completely bleached along the belt transects at each site. Once we reached

BNP by August 15, detailed information on the severity of bleaching by species was collected, including colony numbers, colony sizes, the amount of live tissue, and the extent of bleaching. Data were also recorded on water temperature during the time of the surveys.

The 2007 sampling effort (235 sites) required 33 field days from June 23 through August 18 (Table 2). Fortunately, no days were lost to inclement weather or other logistical challenges. The June-August sampling was generally marked by outstanding underwater visibility and calm seas. This was particularly noticeable in the lower Florida Keys. A private research vessel (R/V *Expedition II*, New World Expeditions, Key Largo, captained by Bernie Altmeir) provided on-the-water diving support. The survey team consisted of personnel from the Center for Marine Science/UNCW (Mark Chiappone and Leanne Rutten) (Table 5). SCUBA tank fills and lodging were provided by the National Undersea Research Center-UNCW facility on Key Largo and local area dive shops and hotels/marinas in Marathon, Cudjoe Key, and Key West. The sampling effort depended upon 6 to 7 hours in the water daily by a two-person benthic team to complete an average of 6-8 sites per day. Typically 30-45 minutes per site was needed to sample all four transects for *Acropora* corals and the other variables; however, sites with abundant *Acropora* colonies took upwards of 1.5-2 hours to inventory. Table 5 summarizes the diving statistics for 2007. Benthic surveys for *Acropora* corals and the other specified variables at the 235 sites required 470 dives by a two-person comprising nearly 284 hours of underwater bottom time.

Summary of Results

Table 3 provides a list of the 235 sampling locations by habitat type and geographic location. This table also includes the average depth and maximum vertical relief for each site. Below is summary information on *Acropora* corals, *Coralliophila* and other gastropod snails, urchins, and stony coral species richness.

Density, size, and condition of staghorn coral (*Acropora cervicornis*)

Staghorn coral (*Acropora cervicornis*) was observed in the general survey area at 55 of the 235 sites (23%) and was recorded within belt transect boundaries at 45 sites (19%) (Table 6). The habitat distribution staghorn coral was much broader than elkhorn coral, with colonies found in all but one of the nine habitat types sampled: mid-channel patch reefs (30.6% of 36 sites within transects), offshore patch reefs (40.5% of 42 sites), shallow (< 6 m) low-relief hard-bottom (20% of 25 sites), inner line reef tract spur and groove (50% of 8 sites), high-relief spur and groove (7.8% of 51 sites), deeper (6-15 m) hard-bottom (6.7% of 15 sites), patchy hard-bottom (9.5% of 21 sites), and low-relief spur and groove (6.1% of

33 sites). Figure 5 illustrates some of the examples of colonies that were recorded from various habitat types in 2007. Regional variations in staghorn coral presence-absence by habitat type were evident. *A. cervicornis* was more commonly found within transects on mid-channel patch reefs in the lower Keys (67% of 12 sites) compared to all other regions. On offshore patch reefs, *A. cervicornis* was more commonly encountered in BNP and the middle Keys compared to the upper and lower Keys. Relative to other regions, the lower Keys was the only region where *A. cervicornis* was found within transects in high-relief spur and groove, deeper hard-bottom (> 6 m), patchy hard-bottom, and low-relief spur and groove sites. Figures 6-14 show the spatial distribution of presence-absence and site-level colony densities from northern BNP to Satan Shoal.

A total of 508 staghorn coral colonies were counted within the belt transect boundaries in eight of the nine habitat types (Table 7). Of these, 113 colonies (22.2%) were counted from among 36 mid-channel patch reefs (15.3% of the sampling effort), 246 colonies (48.4%) from 42 offshore patch reefs (17.9% of the sampling effort), 15 colonies (3.0%) from 25 shallow (< 6 m) low-relief hard-bottom (10.6% of the sampling effort), 29 colonies (5.7%) from eight inner line reef tract spur and groove sites (3.4% of the total sampling effort), 90 colonies (17.7%) from 51 high-relief spur and groove sites (21.7% of the total sampling effort), one colony (0.2%) from 15 deeper (> 6 m) hard-bottom sites (6.4% of the total sampling effort), six colonies (1.2%) from 21 patchy hard-bottom sites (8.9% of the total sampling effort), and eight colonies (1.6%) from 33 low-relief spur and groove sites (14.0% of the total sampling effort). These data illustrate that the distribution of staghorn coral was not proportional to the sampling effort, indicating preferential habitat distribution. Greater numbers of colonies than expected were recorded from the two patch reef habitat types, while fewer colonies than expected were recorded from the remaining seven habitat types, especially on the deeper fore reef slope below 6 m depth. Figures 6-14 illustrate the spatial variability in site-level colony density for staghorn coral throughout the study area. Three of the highest density sites recorded from mid-channel and offshore patch reefs. The greatest mean (± 1 SE) site level densities (no. colonies per m²) were 1.217 ± 1.780 on an offshore patch reef north of Looe Key SPA (site #131), 0.783 ± 0.683 colonies/m² on a mid-channel patch reef offshore of Broad Creek (site #406), and 0.683 ± 0.252 colonies/m² on an offshore patch reef northwest of Triumph Reef (site #471) (Table 7). Despite these relatively high site-level densities, *A. cervicornis* was extremely patchy in its distribution. Overall habitat-level densities were greatest on offshore patch reefs (0.098 ± 0.034 colonies/m²), inner line reef tract spur and groove (0.060 ± 0.037 colonies/m²), and mid-channel patch reefs (0.052 ± 0.024 colonies/m²).

Although most staghorn coral colonies were relatively small (< 0.5 m in max. diameter) and consisted of individual colonies, there were some locations with relatively larger thickets, but these were limited to mid-channel and offshore patch reefs (Figure 5). Table 7 provides site-level information on the total

surface area of live staghorn coral tissue measured, the mean percent cover (tissue surface area per m²) by site, and the mean area per colony. While larger colony sizes were evident on mid-channel patch reefs and offshore patch reefs, nearly 90% of the sampled colonies were less than 100 cm² in surface area. The percentage of live tissue surface area per m² of substratum was greatest on several mid-channel and offshore patch reefs, with site-level percent cover as high as 2%. Mean \pm 1 SE percent cover by habitat type was $< 0.2\%$ for all nine habitats, with offshore patch reefs ($0.16 \pm 0.06\%$), inner line reef tract ($0.11 \pm 0.06\%$), and mid-channel patch reefs ($0.10 \pm 0.05\%$) yielding the greatest habitat-level cover, albeit at obviously very low values. Average colony size by site was substantially greater in BNP on both mid-channel (331 ± 103 cm²/colony) and offshore patch reefs (393 ± 307 cm²/colony) compared to other regions. The greatest mean colony size (1312 ± 1486 cm²/colony) for a site was recorded from a mid-channel patch reef (#456) inshore of Pacific Reef, albeit with substantial variability in colony sizes.

Of the 481 staghorn colonies measured for condition, no obvious incidence of white band disease, white plague, tissue necrosis, or *Coralliophila* predation was observed (Table 8). However, nine colonies or 2.2% of the total had obvious signs of damselfish predation, with most cases involving one or more damselfish present per colony. Of these nine cases, six (5.3% of 113 colonies) were on mid-channel patch reefs and three cases (1.3% of 236 colonies) were on offshore patch reefs. Entanglement with lobster trap rope was common, especially on patch reefs where nearly 75% of all staghorn coral colonies were found. Of the 78 patch reefs sampled during 2007, more than 90% of sites, even those within the no-take zones, contained remnant lobster trap debris. There were several instances where staghorn coral colonies were entangled where obvious tissue damage and colony breakage occurred from rope abrasion.

Density, size, and condition of elkhorn coral (*Acropora palmata*)

Elkhorn coral (*Acropora palmata*) was observed in the general survey area at 24 of the 235 sites (10.2%) and was recorded within belt transect boundaries at 19 sites (8.1%) (Table 6). The habitat distribution of this coral was much narrower than its congener and was only found within belt transects in three of the nine habitat types: offshore patch reefs (4.8% of 42 sites), inner line reef tract spur and groove (37.5% of 8 sites), and high-relief spur and groove (27.5% of 51 sites). Figure 15 illustrates some of the examples of colonies that were recorded from the various habitat types. In addition to habitat variations in elkhorn presence-absence, regional variations were also evident (Table 6). *A. palmata* was more commonly found within transects on high-relief spur and groove reefs in the upper Keys (53% of 17 sites) compared to all other regions. Figures 16-24 show the spatial distribution of presence-absence and site-level colony densities from northern BNP to Satan Shoal.

A total of 403 elkhorn coral colonies were counted and measured for colony size within the belt transect boundaries in three of the nine habitat types sampled (Table 9). Of these, 15 colonies (3.7% of the total) were counted from among 42 offshore patch reefs (17.9% of the sampling effort), 10 colonies (2.5%) from eight inner line reef tract spur and groove sites (3.4 % of the sampling effort), and 378 colonies (93.8%) from 51 high-relief spur and groove sites (21.7% of the sampling effort). The distribution pattern of elkhorn coral with respect to habitat type was not proportional to the sampling effort, indicating preferential habitat distribution. Figures 16-24 clarify this pattern by illustrating the spatial variation in site-level density throughout the Florida Keys. Greater numbers of colonies than expected (if the habitat distribution is random) occurred in high-relief spur and groove sites. The greatest mean ± 1 SE site level densities (no. colonies per m^2) were recorded from high-relief spur and groove reefs at Elbow Reef SPA (site #28, 1.250 ± 0.959), Sombrero Key SPA (site #84, 1.133 ± 2.048), French Reef SPA (site #29, 0.900 ± 1.045), and South Carysfort Reef SPA (site #217, 0.833 ± 0.168) (Table 9). We were encouraged to find relatively extensive thickets of elkhorn coral at the following sites from northeast to southwest: South Carysfort Reef, Elbow Reef, Horseshoe Reef, French Reef, Molasses Reef, Sand Island, Sombrero Key, and Looe Key.

Elkhorn coral colony sizes showed a significantly greater range compared to its congener, and we were encouraged to find several sites with relatively large (> 0.5 cm diameter) colonies (Figure 15). Table 9 provides site-level information on the total surface area of live elkhorn coral tissue measured, the mean percent cover by site, and the mean area per colony. High-relief spur and groove reefs yielded the largest colonies and percent cover values. Although the mean percent cover on all 51 high-relief spur groove sites was $1.6 \pm 0.6\%$, mean cover was greater than 8% on several sites: South Carysfort Reef (24.6%), Elbow Reef (11.9%), Sombrero Reef (11.4%), and Sand Island (8.9%). These areas also yielded the largest colony sizes, with several sites yielding mean surface areas of $> 1,000$ cm^2 per colony.

Of the elkhorn colonies measured, the most obvious impacts to live tissue were predation by snails (*Coralliophila abbreviata*) and damselfishes (F. Pomacentridae) (Figure 25). We were discouraged to find lobster trap rope entangled in thickets of live colonies at South Carysfort Reef, but were encouraged by the absence of visible diseases such as white band and white pox. Of the colonies assessed for disease and predation, none were found with any visible symptoms of white band, white pox, or tissue necrosis (Table 10). For all sites and habitats combined, eight colonies (1.9% of the total measured), seven of which were from high-relief spur and groove, were impacted by *Coralliophila* snail predation. A total of 21 colonies (4.9%), all from high-relief spur and groove sites, were impacted by damselfish territories.

Density, size and substratum occupancy of *Coralliophila* and other gastropod snails

Before the 2007 sampling began, the decision was made to sample *Coralliophila* snails, well-known corallivores of *Acropora* corals and perhaps one of the factors inhibiting coral recovery. At all 235 sites, *Coralliophila* snails were counted and measured for total shell length (Figure 26). The type of substratum occupied by the snail was also recorded. We also encountered two species of gastropod mollusks, *Thais deltoidea* and *Leucozonia nassa*, that were included in the census, not only because they were extremely prevalent, but also because basic information on habitat-related patterns in density and size are poorly known (Figure 26).

A total of 48 *Coralliophila* sp. individuals were encountered in surveys of 235 sites encompassing 14,100 m² of hard-bottom and coral reef substratum. Table 11 summarizes site-level densities for *Coralliophila* sp. The 48 individuals were distributed among only three of the nine habitat types: offshore patch reefs (2 individuals, 4.2% of total), high-relief spur and groove (39 individuals, 81.3%), and low-relief spur and groove (7 individuals, 14.6%). The distribution of *Coralliophila* sp. was clearly non-random with respect to habitat type, as 81% of all individuals were recorded from high-relief spur and groove, despite this habitat only representing 22% of the total sampling effort. Mean densities in the upper Florida Keys in high-relief spur and groove were three to six times greater than in the middle and lower Keys (Table 11). The highest site-level mean \pm 1 SE densities were 0.250 ± 0.145 and 0.217 ± 0.217 at Molasses Reef SPA (site #31) and Looe Key SPA (site #148), respectively. The 48 *Coralliophila* sp. individuals had a mean \pm 1 SE total shell length of 2.1 ± 0.1 cm and ranged from 0.8 to 4.8 cm. Nearly 81% of all individuals were less than 2.9 cm in shell length (Figure 27). Of the 48 snails recorded, 41 individuals or 85% were found on live coral, while the remaining individuals were either found on algal turf, crustose coralline algae, or another *Coralliophila* shell (Table 12).

The most abundant gastropod mollusk included in our 2007 census was the deltoid rock shell (*Thais deltoidea*) (Figure 26). A total of 1,671 *T. deltoidea* individuals were encountered, with individuals distributed among five of the nine habitat types as follows: mid-channel patch reefs (3 individuals, 0.2% of total), offshore patch reefs (12 individuals, 0.7% of total), shallow (< 6 m) hard-bottom (84 individuals, 5% of total), and high-relief spur and groove (1,495 individuals, 89.5% of total). Similar to *Coralliophila* sp., the distribution of *T. deltoidea* was clearly non-random, with greater than expected individuals in the high-relief spur and groove habitat (Table 11). Mean site-level densities were as high 2.5 individuals per m², and the average density for the 23 high-relief spur and groove sites in the lower Keys was three to 24 times greater than for BNP, the upper Keys, or the middle Keys. The 1,671 *T. deltoidea* individuals had a mean total shell length of 2.7 cm, ranging from 1.0 to 4.9 cm. Nearly 88% of all individuals were between 2 cm and 4 cm in shell length (Figure 27). Of the 1,671 individuals recorded, 1,557 individuals or ~93% were found on either algal turf or crustose coralline algae (Table 12). This mollusk species appeared to

have a clear affinity for this substratum type, which was especially prevalent in the high-relief spur and groove sites, although we could not ascertain *in situ* what the snails were eating.

The third gastropod mollusk sampled during 2007 was the common lesser tulip shell (*Leucozonia nassa*) (Figure 26), a species that exhibited the widest habitat distribution of the three gastropod mollusks sampled. A total of 248 *L. nassa* individuals were encountered, with individuals distributed among seven of the nine habitat types as follows: mid-channel patch reefs (4 individuals, 1.6% of total), offshore patch reefs (1 individual, 0.4% of total), shallow (< 6 m) hard-bottom (5 individuals, 2% of total), inner line reef tract (13 individuals, 5.2% of total), high-relief spur and groove (222 individuals, 89.5% of total), deeper hard-bottom (2 individuals, 0.8% of total), and patchy hard-bottom (1 individual, 0.4% of total). Similar to the other two gastropod mollusks sampled, the distribution of *L. nassa* was clearly non-random, with greater than expected individuals in the high-relief spur and groove habitat. Mean site-level densities were as high 0.33 individuals per m² (Table 11), with average densities generally higher in spur and groove reefs, especially those in the lower Keys region. The 248 *L. nassa* individuals had a mean total shell length of 3.0 cm, ranging from 0.8 to 6.0 cm. Nearly 77% of all individuals were between 2 cm and 4 cm in shell length (Figure 27). Of the 248 individuals recorded, 232 individuals or ~94% were found on either algal turf or crustose coralline algae, similar to *T. deltoidea* (Table 12).

Density and size distribution of urchins

Since 1999, surveys of sea urchin density and test size have been carried out throughout the southeast Florida coast and continued in 2007 at all 235 sites. Six species were encountered within transects that encompassed 14,100 m² of hard-bottom and coral reef substratum: *Diadema antillarum*, *Echinometra lucunter*, *E. viridis*, *Eucidaris tribuloides*, *Lytechinus variegatus*, and *Tripneustes ventricosus* (Figure 28). Tables 13-15 summarize site-level densities for each species and Table 16 provides the mean and ranges in test diameters (TD) by habitat and for the entire sampling domain. Of the six urchin species and 3,170 individuals encountered, the most abundant species were *E. viridis* (1,901 individuals, 60% of all individuals) and *E. tribuloides* (853 individuals, 26.9%), followed by *D. antillarum* (297 individuals, 9.4%), *E. lucunter* (103 individuals, 3.3%), *T. ventricosus* (15 individuals, 0.5%), and *L. variegatus* (1 individual, 0.03%).

A total of 297 individuals of *Diadema antillarum* were recorded, with individuals distributed among all nine habitats sampled (Table 13). The maximum site-level density of 0.267 individuals/m² occurred at an offshore patch reef inshore of Molasses Reef (site #7). Relative to similar surveys dating back to 1999, we noticed an appreciable increase in the number of sites where *D. antillarum* was found and a general trend towards larger test sizes, especially on patch reefs. Habitat-level densities were greatest on offshore

patch reefs (Table 13). Test sizes ranged from 0.3 to 10.0 cm and averaged 3.6 ± 0.1 cm from all habitats combined (Table 16). The test sizes of the individuals recorded indicated a mixed distribution, with not only abundant recruits, but also over one-third of individuals greater than 5.0 cm TD (Figure 29).

Two species of *Echinometra* were encountered during the 2007 surveys. *E. lucunter* was the less abundant of the two species, with 103 individuals recorded among six of the nine habitats (Table 13). Nearly 74% of *E. lucunter* were recorded from high-relief spur and groove, with densities as high as 1.1 individuals per m² at one of three sites at Maryland Shoal (site #144) (Table 14). Similar to its congener, *E. viridis* was widely distributed among habitat types and was most abundant on mid-channel patch reefs, with 1,810 (95%) of the 1,901 individuals recorded from this habitat. Site-level densities of *E. viridis* were as high as 9.3 individuals per m² on mid-channel patch reefs and were relatively higher in BNP, the upper Keys, and the lower Keys (Table 14). The test diameter (TD) of individuals ranged from 0.5 cm to 5.0 cm and averaged 2.4 cm (Figure 29).

Eucidaris tribuloides was recorded from all nine habitats and exhibited a habitat distribution pattern similar to *Diadema antillarum*. A total of 853 individuals were found, with the highest site-level density estimate of 0.70 ± 0.08 individuals/m² recorded from a high-relief spur and groove site at Pelican Shoal (site #139) (Table 14). Densities tended to be greatest on offshore patch reefs and high-relief spur and groove habitats. Of the 853 individuals encountered, test diameters ranged from 0.5 cm to 4.6 cm, averaged 2.1 cm (Table 16), and showed a modal size class between 1.5 and 2.4 cm (Figure 29).

Stony coral species richness

The 2007 surveys also included an assessment of all stony coral species present along each of the four transects sampled at each site. A total of 47 taxa were observed among the 235 sites, represented by two milleporid hydrocorals and 45 scleractinian corals (Table 17). Table 18 provides habitat-level proportional transect frequency data for all 47 coral taxa, which further highlights habitat distribution patterns. These data allow for the discrimination of very common (e.g. *Agaricia agaricites*, *Porites astreoides*, *Siderastrea siderea*) to relatively rare corals (e.g. *A. lamarcki* and *Dendrogyra cylindrus*). Table 19 summarizes the average number of species per station (transect) by site, region, and habitat type, as well as the total numbers of coral species observed per site by region and by habitat type. The patterns observed by species and for total species richness are similar to previous surveys dating back to 1999. For example, greater site species richness is apparent for mid-channel and offshore patch reefs, followed by relatively lower numbers of species for shallower fore reef habitats, then increasing on the deeper fore reef slope habitats. Subsequent analyses will provide statistical comparisons of species frequency of

occurrence and site-level species richness among habitats, among regions, and between no-take marine reserves and corresponding reference areas.

Future Efforts

Results from the 2007 sampling effort provide a nearly system-wide assessment of *Acropora palmata* and *A. cervicornis* in the Florida Keys. Subsequent analyses will yield domain-wide abundance estimates, structured by colony size that will provide for estimates of population size by habitat, region, and for individual no-take marine reserves. While our Keys-wide sampling in previous years was not optimized for *Acropora* corals, the benthic data still provide important opportunities to compare populations across multiple habitat types, including managed areas in the FKNMS. What is apparent from the *Acropora* surveys is that the distribution and abundance patterns of these two species are clearly different, perhaps necessitating different management approaches. Although 34 different spur and groove reefs, including inner line reef tract, were sampled, our results indicate that significant *A. palmata* stands remain at only a handful of sites, namely South Carysfort Reef, Elbow Reef, Horseshoe Reef, French Reef, Molasses Reef, Sand Island, Sombrero Key, and Looe Key. While most of these sites are within existing FKNMS no-take zones, predation by snails and damselfishes, as well as physical impacts from lost fishing gear is still prevalent. In contrast, the distribution pattern of *A. cervicornis* reflects the importance of patch reefs to the possible recovery of this species. While there are over 5,000 patch reef sites on the south Florida shelf, staghorn is currently very patchily distributed, and the factors responsible for this pattern are not well known.

The sheer number of sites visited will allow us to update existing habitat maps for the study area, as well as assist in further optimizing future Keys-wide sampling. We also hope that this information will highlight the importance of the Florida Keys patch reef environment, little of which is located within no-take marine reserves, with most sites visited impacted by derelict fishing gear. Patch reefs include many of the best remaining reefs in the region, particularly in terms of coral cover and diversity. The sheer number of patch reefs inshore of the reef tract, their coral species composition that is dominated by mounding corals, and a highly variable natural physical environment (i.e., temperature, turbidity, sedimentation), are factors that contrast with habitats typically found along the outer reef tract. Why patch reefs appear to be in relatively good condition compared especially to the offshore spur-and-groove habitats is an important research and management question. Finally, as shown by results from these surveys, patch reefs support the most numerous stands of staghorn coral. However, patch reefs are also subjected to physical damage caused by lost fishing gear. This reflects both the higher coral cover remaining on patch reefs, significant habitat heterogeneity compared to surrounding areas (resulting in

accumulation or concentration of debris), their large number, proximity to trap placements, and generally favored status as fishing sites. Under current conditions of diminished population numbers, damage from lost fishing gear is one factor that potentially affects extant staghorn corals. While we did not observe disease, both disease and coral bleaching (and acidification) remain major threats to species recovery throughout the Florida Keys and wider Caribbean. Promising management options for the recovery of *Acropora* corals do not currently exist, yet there are obvious actions that can be taken at the local level to enhance survival of existing populations that include removing trap and fishing debris and minimizing potential for trap and fishing debris to affect select patch reefs.

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Figure 3. Patch reef and shallow low-relief habitats surveyed for *Acropora* spp., stony coral species richness, urchins, and *Coralliophila* snails in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007.

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Figure 8. Staghorn coral (*Acropora cervicornis*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Elbow Reef SPA to Molasses Reef SPA surveyed during June-August 2007.

Figure 9. Staghorn coral (*Acropora cervicornis*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Conch Reef SPA to Alligator Reef SPA surveyed during June-August 2007.

Figure 10. Staghorn coral (*Acropora cervicornis*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Tennessee Reef RO to Coffins Patch SPA surveyed during June-August 2007.

Figure 11. Staghorn coral (*Acropora cervicornis*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys within and near Sombrero Key SPA surveyed during June-August 2007.

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Figure 13. Staghorn coral (*Acropora cervicornis*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Maryland Shoal to Western Sambo Ecological Reserve surveyed during June-August 2007.

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Figure 15. *Acropora palmata* in hard-bottom and coral reef habitats in Biscayne National Park and the Florida Keys National Marine Sanctuary observed during June-August 2007.

Figure 16. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from the Fowey Rocks to Ajax Reef, Biscayne National Park, surveyed during June-August 2007.

Figure 17. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Pacific Reef, Biscayne National Park, to Carysfort/South Carysfort Reef SPA surveyed during June-August 2007.

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Figure 21. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys within and near Sombrero Key SPA surveyed during June-August 2007.

Figure 22. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Big Pine Shoal to Looe Key SPA surveyed during June-August 2007.

Figure 23. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Maryland Shoal to Western Sambo Ecological Reserve surveyed during June-August 2007.

Figure 24. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Eastern Dry Rocks SPA to Satan Shoal surveyed during June-August 2007.

Figure 25. Impacts to staghorn (*Acropora cervicornis*) and elkhorn (*A. palmata*) coral documented during June-August 2007 in Biscayne National Park and the Florida Keys National Marine Sanctuary.

Figure 26. *Coralliophila* and other gastropod mollusks surveyed for density, size, and substratum occupancy in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007.

Figure 27. Total shell length distribution of *Coralliophila* sp. and other gastropod mollusks in the Florida Keys National Marine Sanctuary and Biscayne National Park measuring during June-August 2007 at 235 hard-bottom and coral reef sites.

Figure 28. Urchin species surveyed for density and test diameter in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007. Not shown are *Echinometra lucunter* (rock boring urchin), *Lytechinus variegatus*, and *Tripneustes ventricosus*.

Figure 29. Size distribution of the urchins *Diadema antillarum*, *Echinometra viridis*, and *Eucidaris tribuloides* in the Florida Keys National Marine Sanctuary and Biscayne National Park measuring during June-August 2007 at 235 hard-bottom and coral reef sites.

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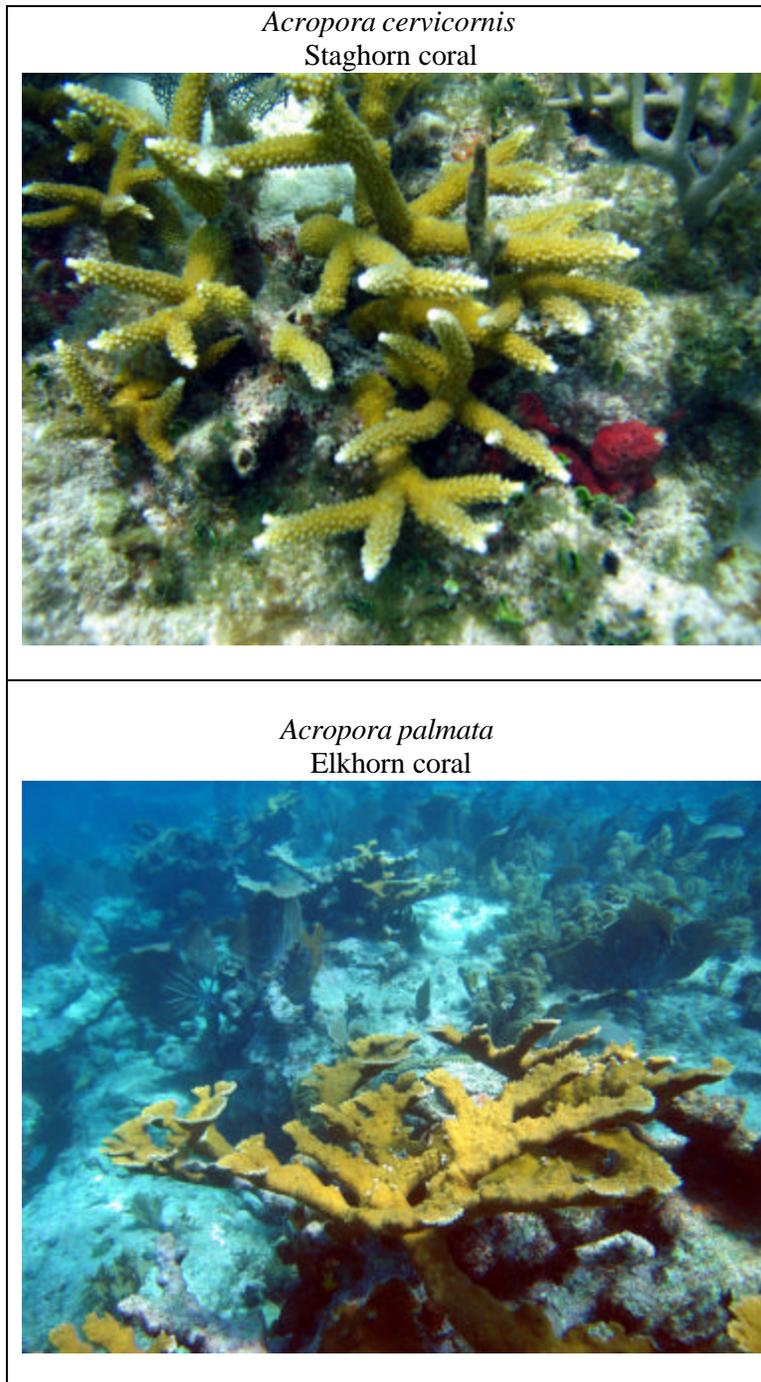


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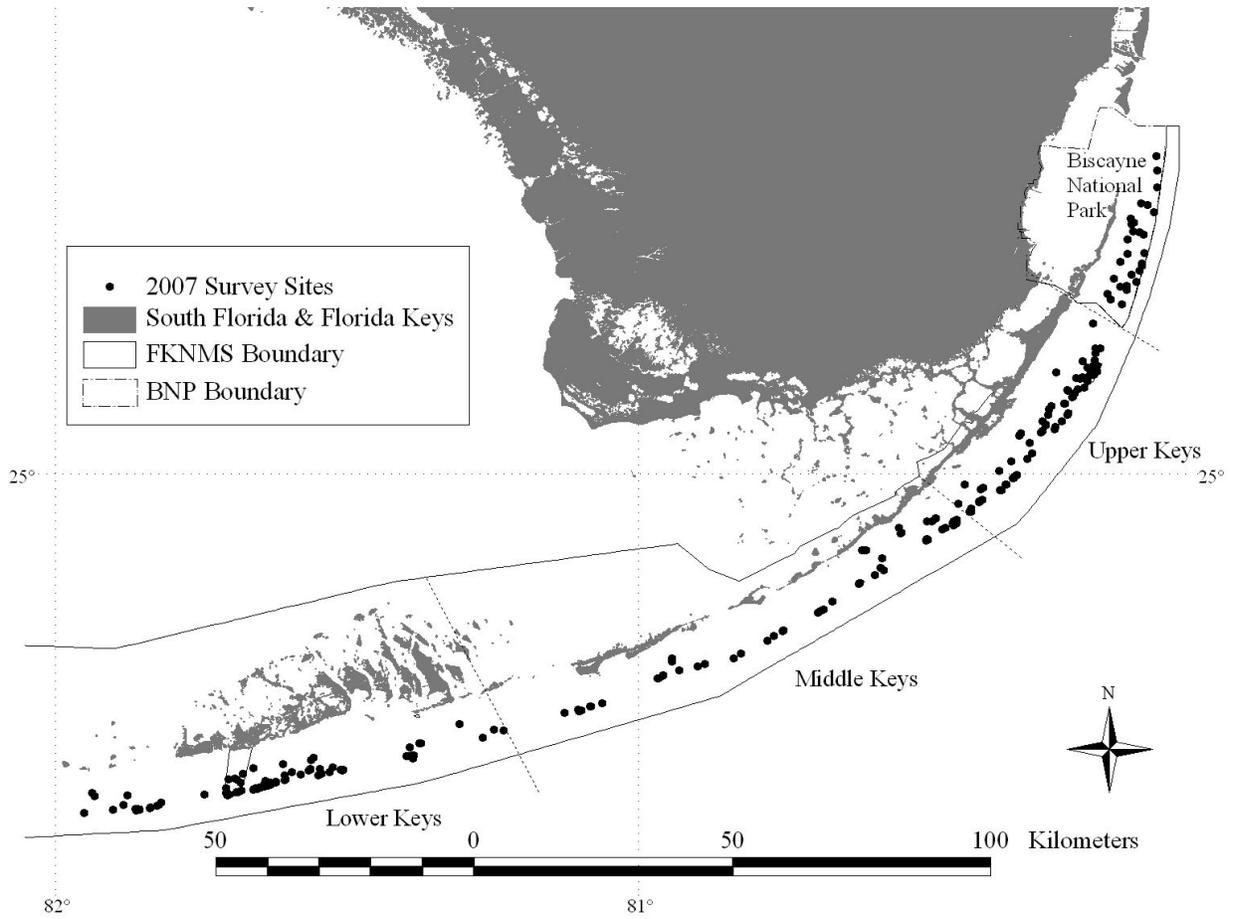
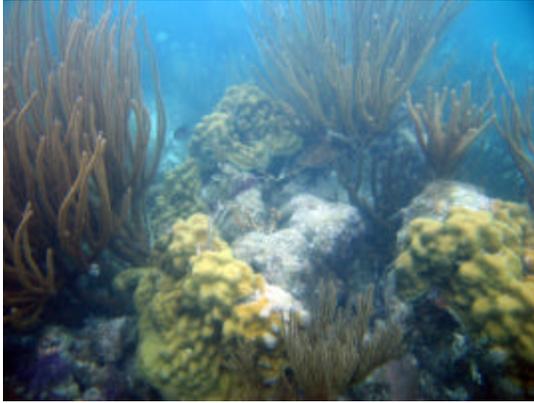


Figure 3. Patch reef and shallow low-relief habitats surveyed for *Acropora* spp., stony coral species richness, urchins, and *Coralliophila* snails in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007.

Mid-channel patch reef
Site #1, Inshore of Molasses Reef, 2.7-4.3 m
25° 01.109'N, 80° 26.336'W



Offshore patch reef
Site #132, Looe Key RO, 6.4-7.9 m
24° 34.051'N, 80° 23.251'W



Mid-channel patch reef
Site #119, North of Pelican Shoal, 4.9-7.0 m
24° 31.923'N, 81° 37.551'W



Hard-bottom/rubble/sand matrix
Site #36, West of Carysfort SPA, 4.6-5.8 m
25° 12.381'N, 80° 13.990'W



Offshore patch reef
Site #37, West of Carysfort SPA, 2.7-3.7 m
25° 13.355'N, 80° 13.474'W



Low-relief hard-bottom
Site #469, South of Ajax Reef, 3-4.3 m
25° 23.489'N, 80° 08.065'W



Figure 4. Offshore coral reef and hard-bottom habitats surveyed for *Acropora* spp., stony coral species richness, urchins, and *Coralliophila* snails in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007.

Inner line reef tract spur and groove
Site #62, Key Largo Dry Rocks, 1.5-3.4 m
25° 07.436'N, 80° 17.851'W



Inner line reef tract spur and groove
Site #58, Horseshoe Reef, 2.1-4.0 m
25° 08.405'N, 80° 17.662'W



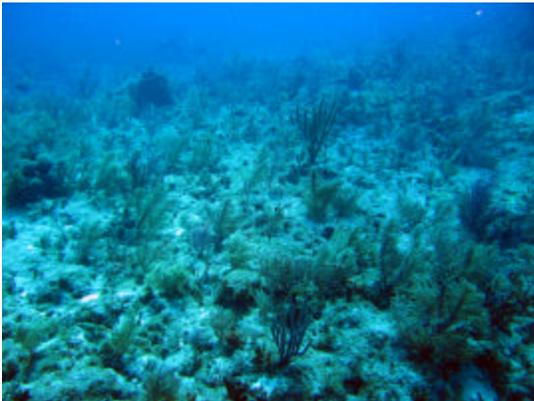
High-relief spur and groove
Site #155, Rock Key SPA, 1.5-3.7 m
24° 27.274'N, 81° 51.451'W



Patchy hard-bottom
Site #169, Sand Key SPA, 6.4-7.6 m
24° 27.229'N, 81° 52.895'W



Low-relief hard-bottom
Site #105, Conch Reef SPA, 10.1-11.3 m
24° 56.853'N, 80° 27.508'W



Low-relief spur and groove, 13.1-14.3 m
Site #106, Conch Reef RO,
24° 57.042'N, 80° 27.269'W



Figure 5. *Acropora cervicornis* in hard-bottom and coral reef habitats in the Florida Keys National Marine Sanctuary and Biscayne National Park observed during June-August 2007.

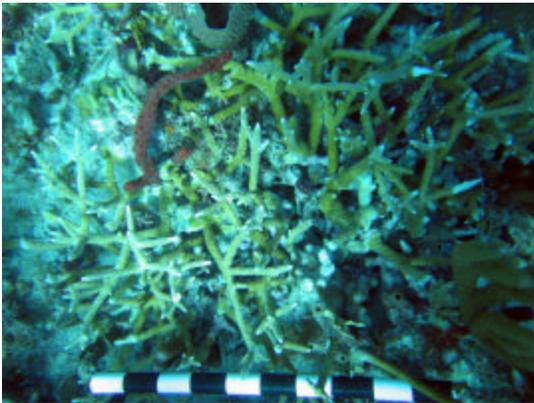
Mid-channel patch reef, 4.6-6.4 m
Site #406, Offshore of Broad Creek
25° 20.505'N, 80° 11.128'W



Mid-channel patch reef, 5.8-7.3 m
Site #124, Western Sambo ER
24° 30.350'N, 81° 42.380'W



Offshore patch reef, 6.4-7.0 m
Site #131, North of Looe Key SPA
24° 33.705'N, 81° 24.325'W



Offshore patch reef, 8.8-9.8 m
Site #130, Maryland Shoal
24° 31.396'N, 81° 33.686'W



Low-relief spur and groove, 8.2-10.1 m
Site #175, Eastern Sambo RO
24° 29.443'N, 81° 39.801'W



High-relief spur and groove, 3.0-5.5 m
Site #136, East of Eastern Dry Rocks
24° 27.849'N, 81° 50.291'W

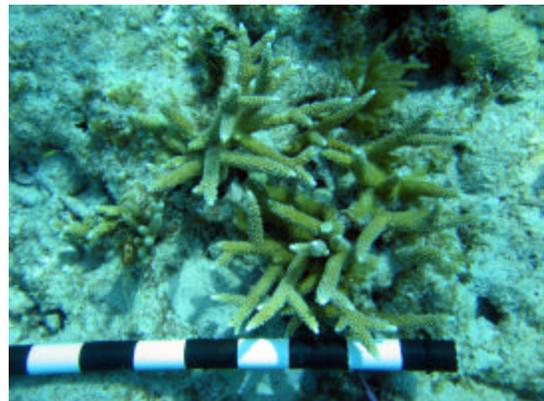


Figure 6. Staghorn coral (*Acropora cervicornis*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from the Fowey Rocks to Ajax Reef, Biscayne National Park, surveyed during June-August 2007.

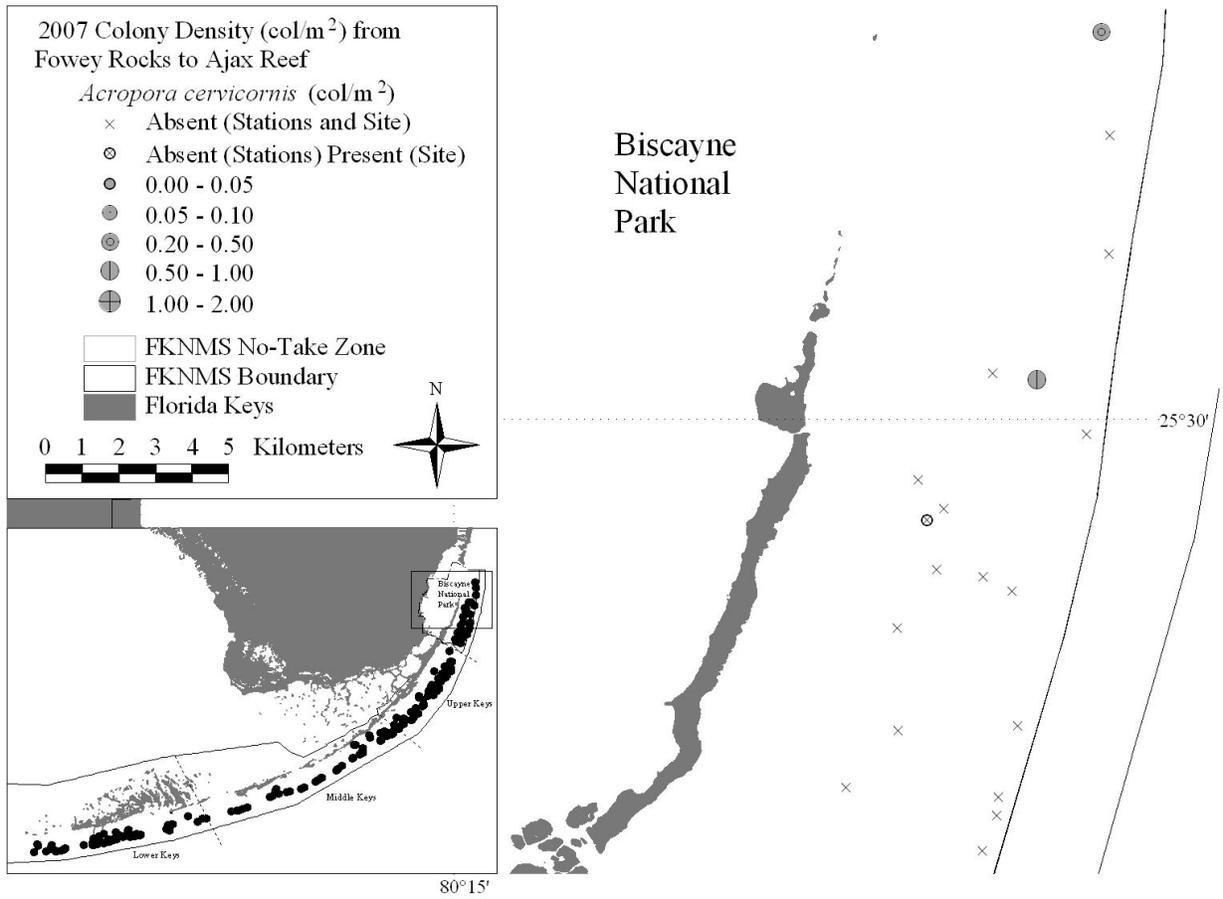


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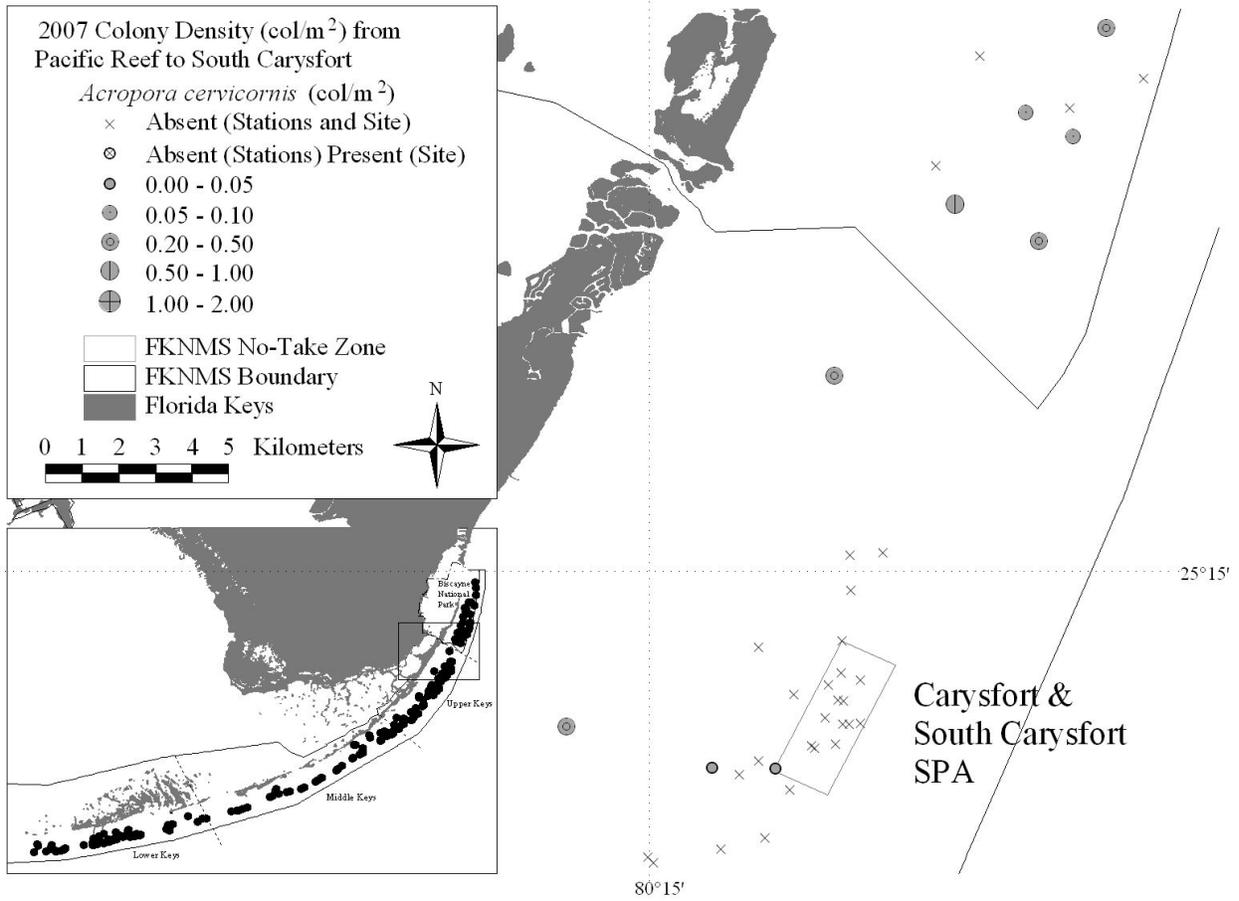


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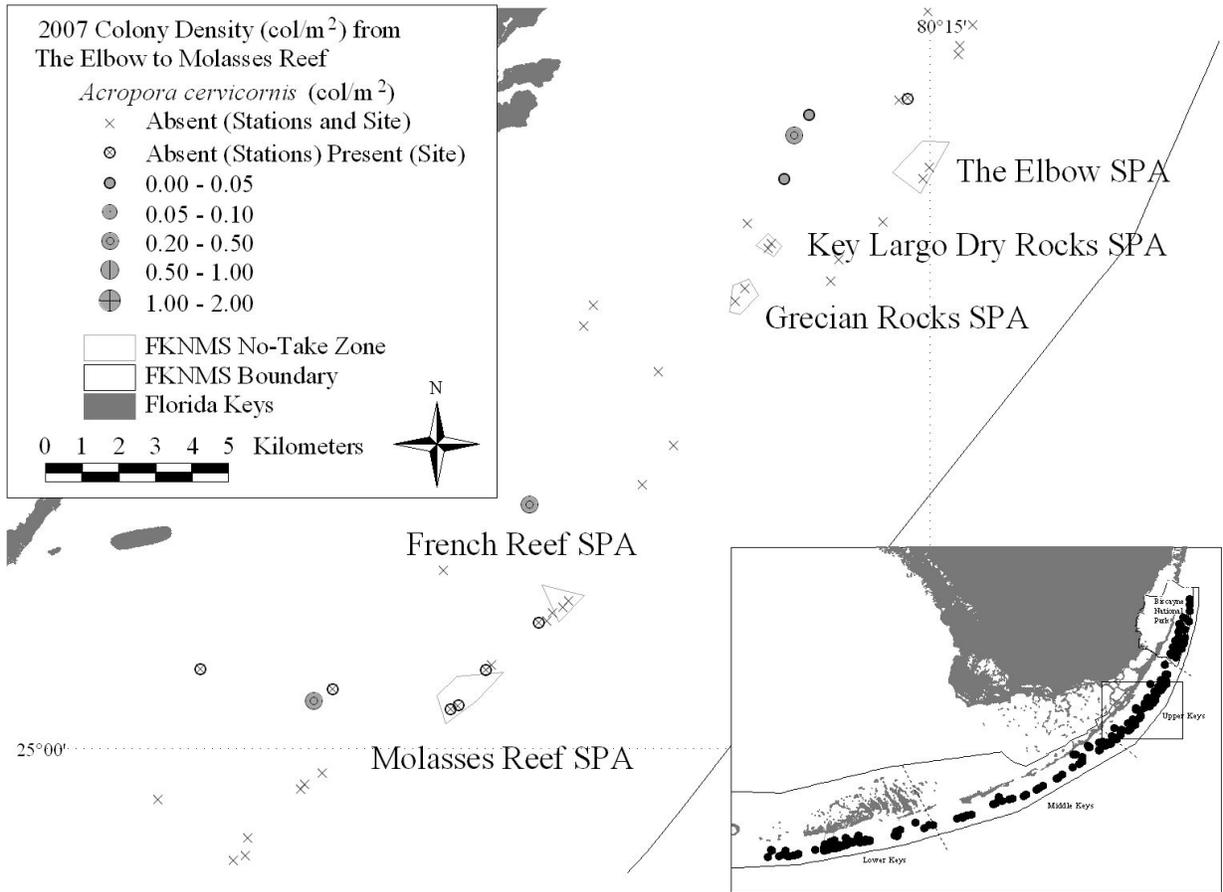


Figure 9. Staghorn coral (*Acropora cervicornis*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Conch Reef SPA to Alligator Reef SPA surveyed during June-August 2007.

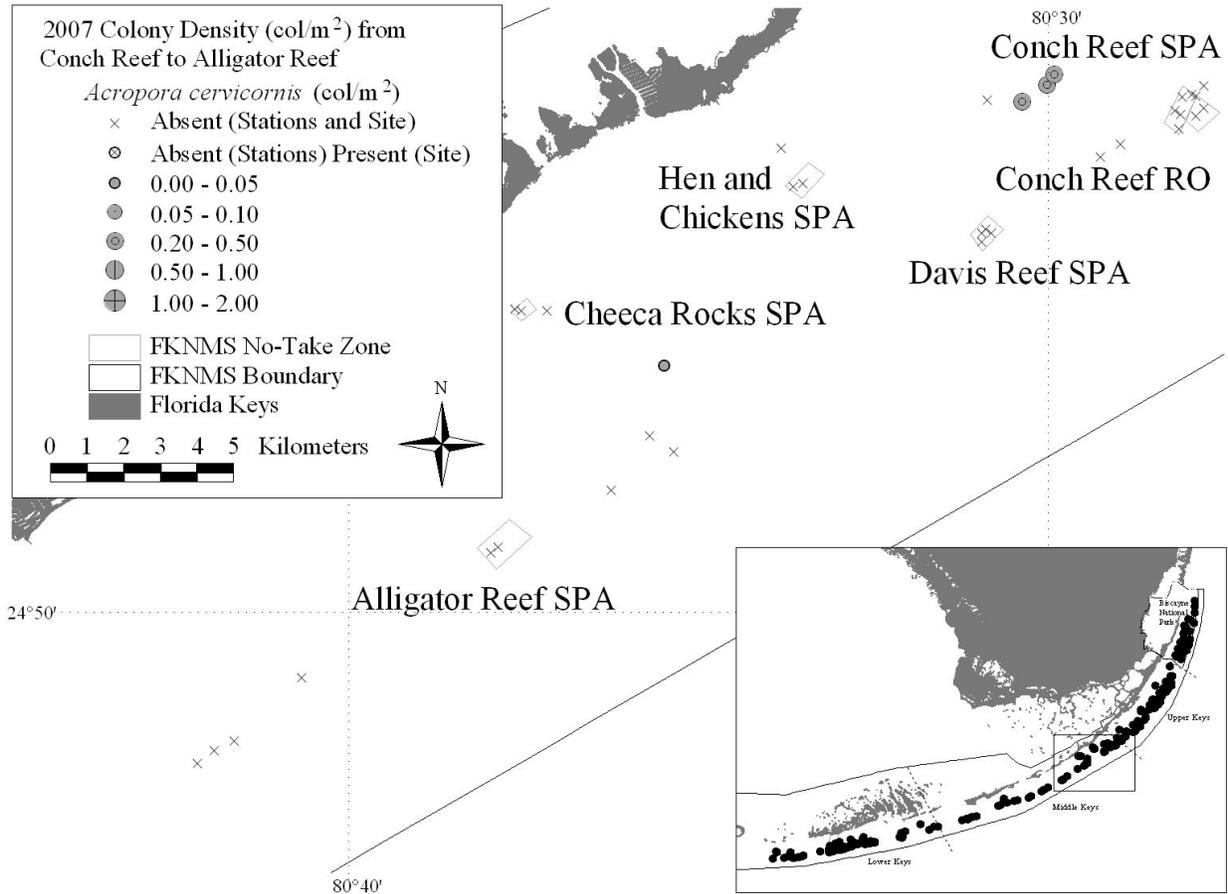


Figure 10. Staghorn coral (*Acropora cervicornis*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Tennessee Reef RO to Coffins Patch SPA surveyed during June-August 2007.

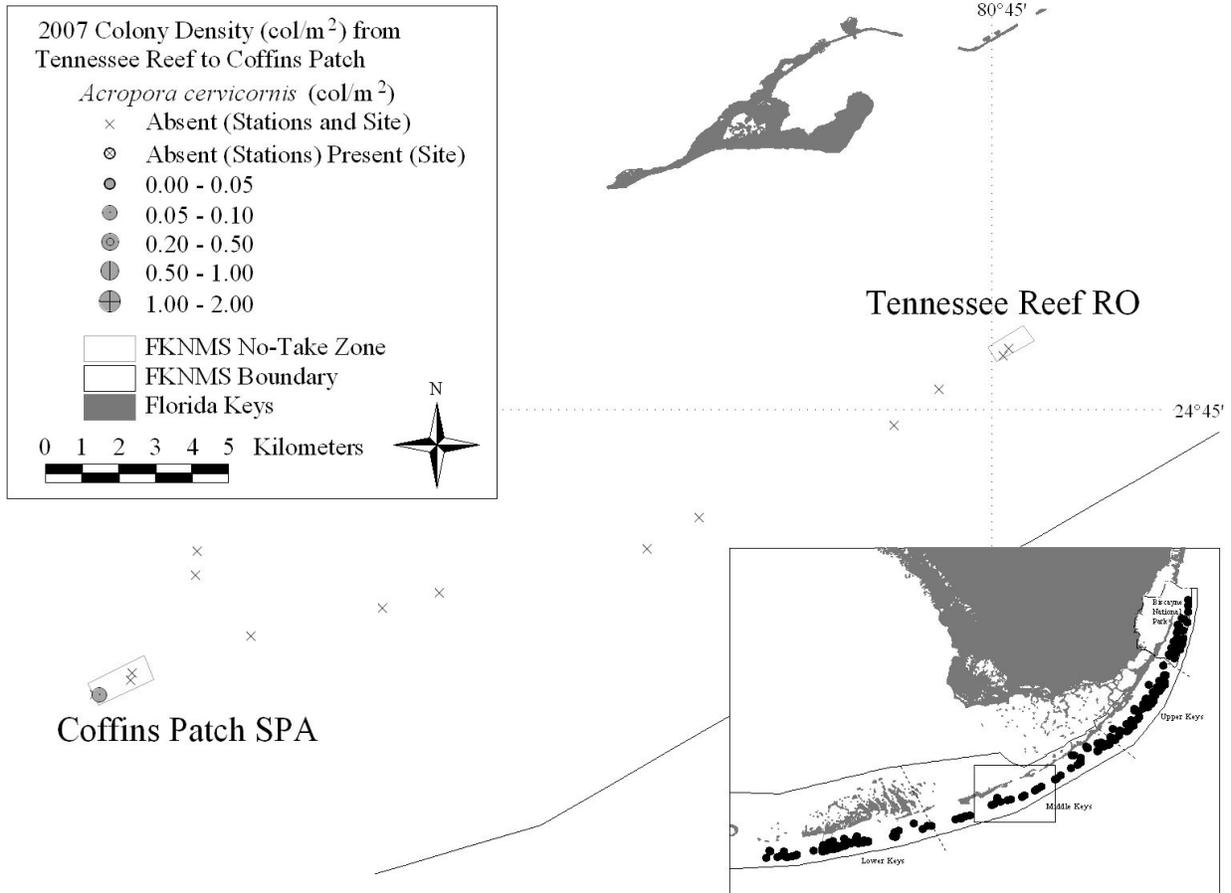


Figure 11. Staghorn coral (*Acropora cervicornis*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys within and near Sombrero Key SPA surveyed during June-August 2007.

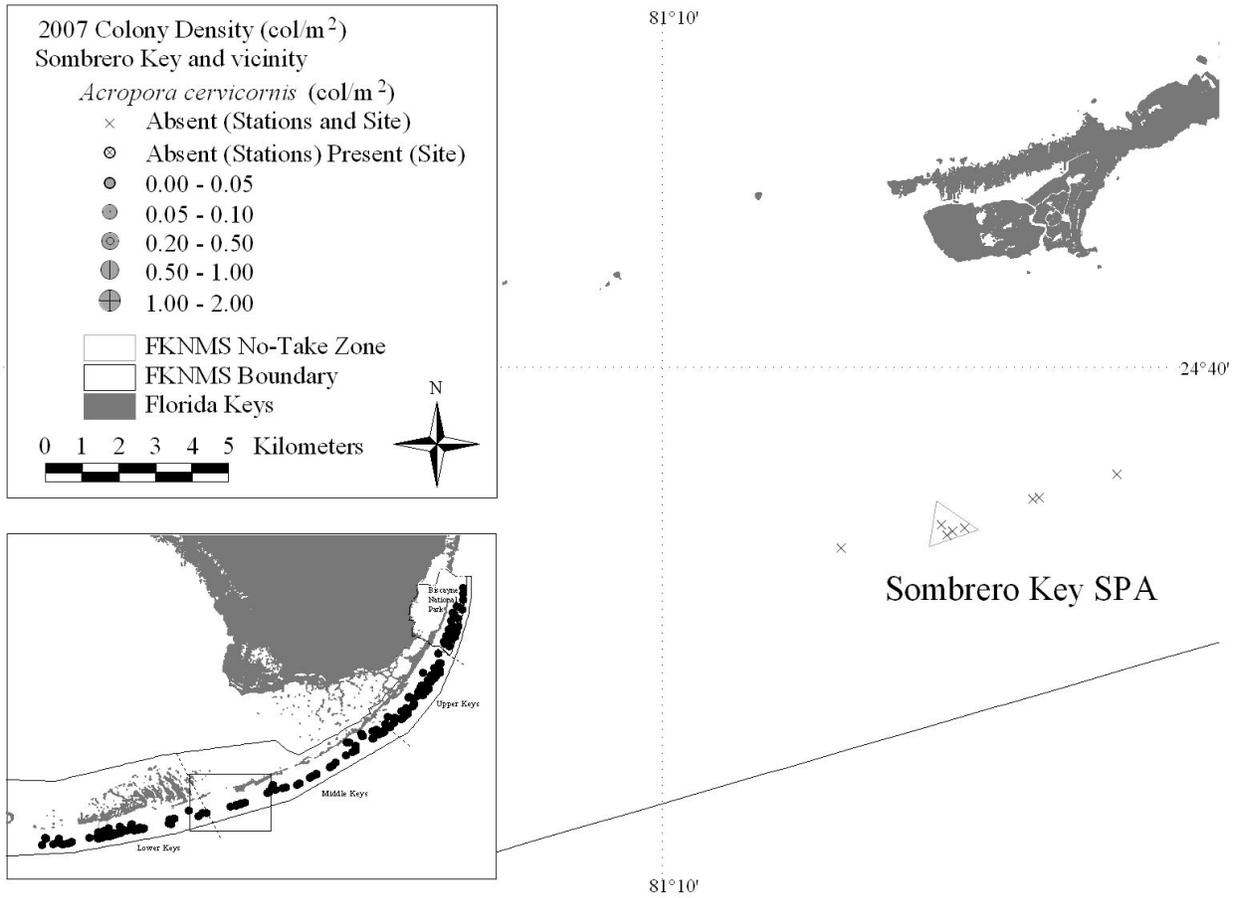


Figure 12. Staghorn coral (*Acropora cervicornis*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Big Pine Shoal to Looe Key SPA surveyed during June-August 2007.

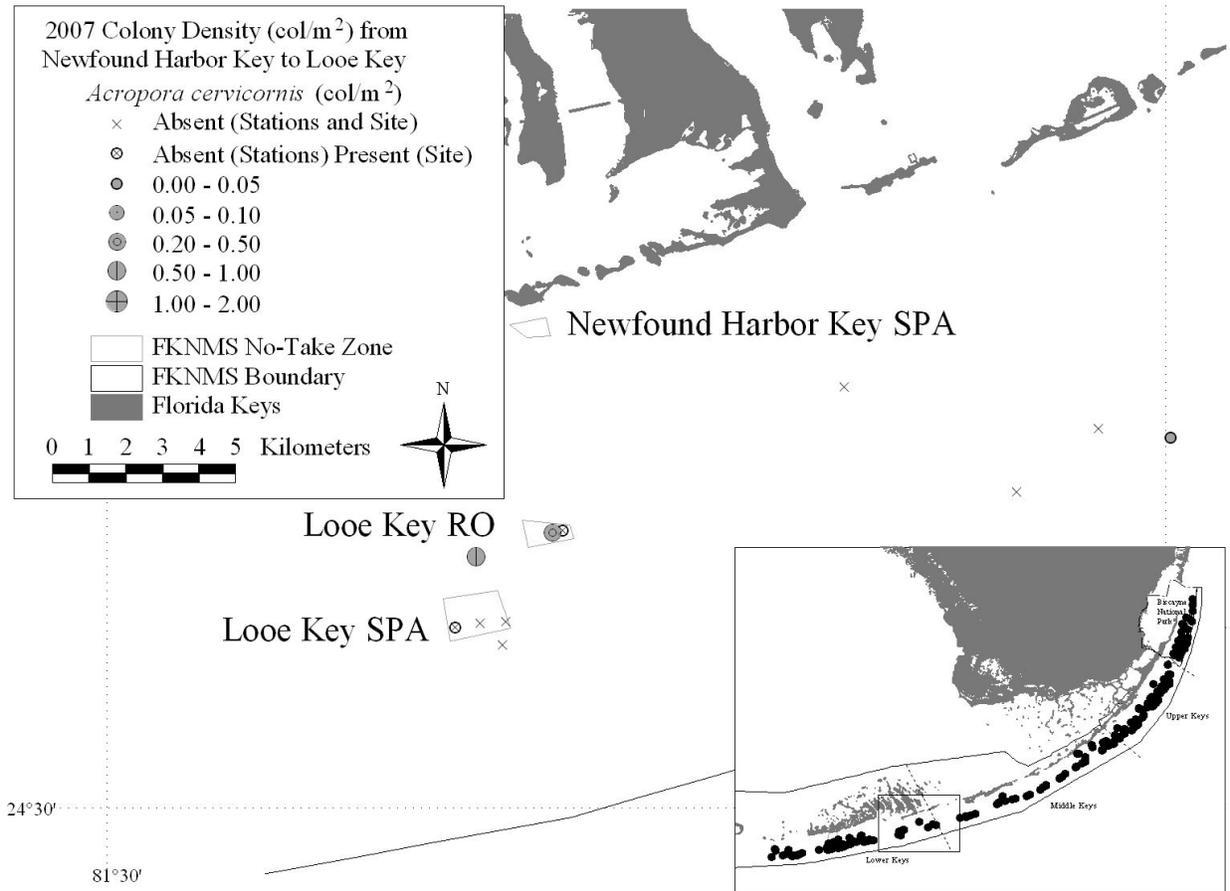


Figure 13. Staghorn coral (*Acropora cervicornis*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Maryland Shoal to Western Sambo Ecological Reserve surveyed during June-August 2007.

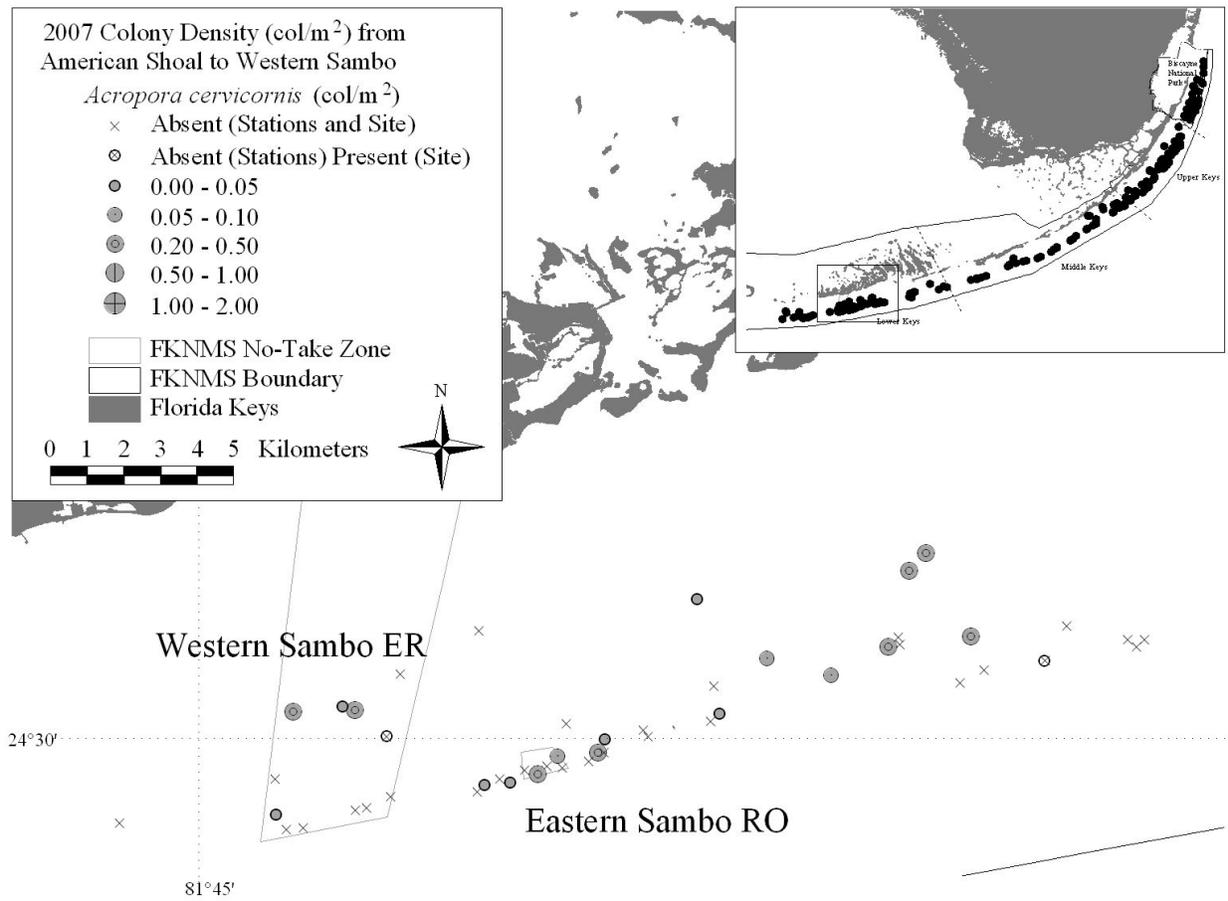


Figure 14. Staghorn coral (*Acropora cervicornis*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Eastern Dry Rocks SPA to Satan Shoal surveyed during June-August 2007.

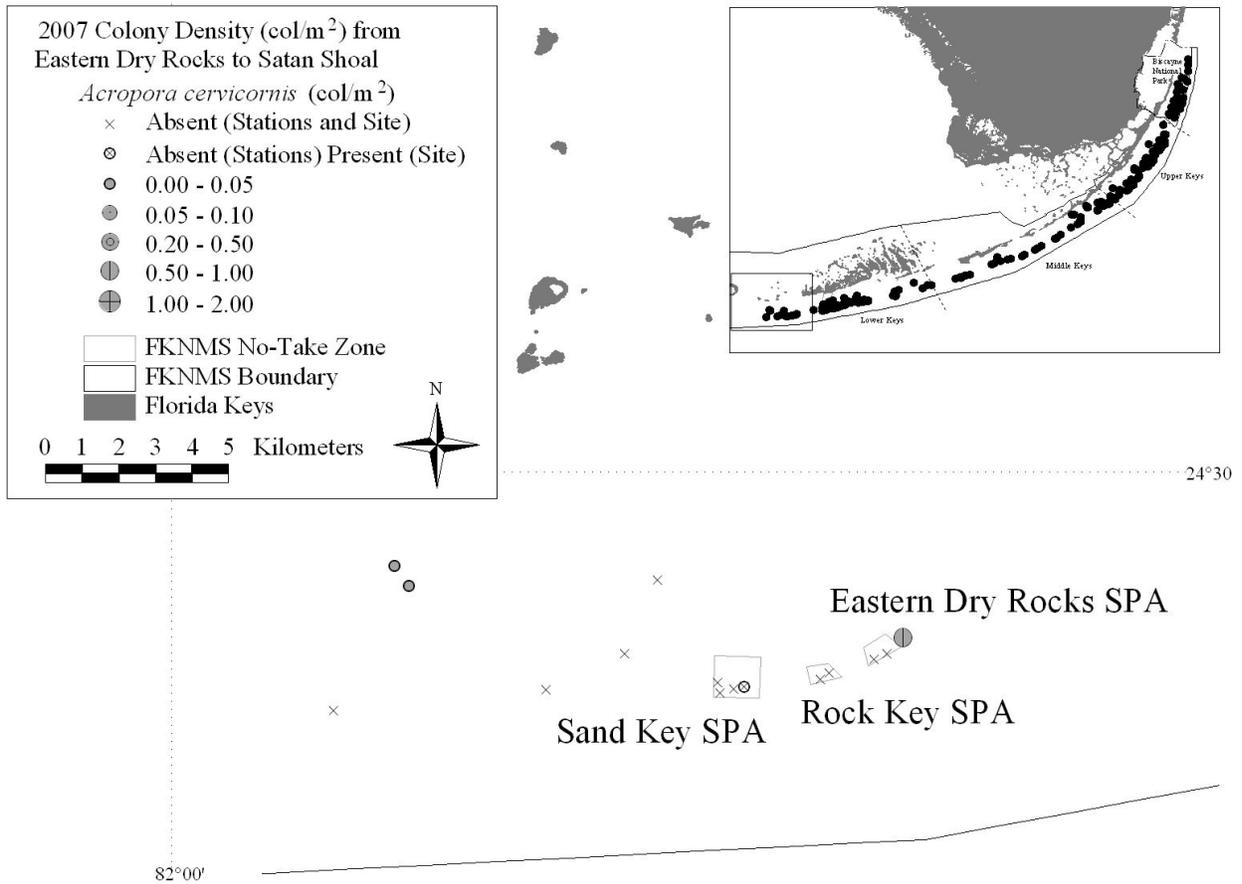


Figure 15. *Acropora palmata* in hard-bottom and coral reef habitats in Biscayne National Park and the Florida Keys National Marine Sanctuary observed during June-August 2007.

Inner line reef tract, 2.1-4.0 m
Site #28, Horseshoe Reef
25° 08.405'N, 80° 17.662'W



High-relief spur and groove, 1.2-2.7 m
Site #217, South Carysfort Reef
25° 12.569'N, 80° 13.172'W



High-relief spur and groove, 2.7-5.2 m
Site #28, Elbow Reef SPA
25° 08.562'N, 80° 15.499'W



High-relief spur and groove, 5.5-9.4 m
Site #29, French Reef SPA
25° 02.019'N, 80° 20.951'W



High-relief spur and groove, 3.4-6.1 m
Site #84, Sombrero Key SPA
24° 37.560'N, 81° 06.711'W



Inner line reef tract, 1.5-4.3 m
Site #148, Looe Key SPA
24° 32.770'N, 81° 24.276'W

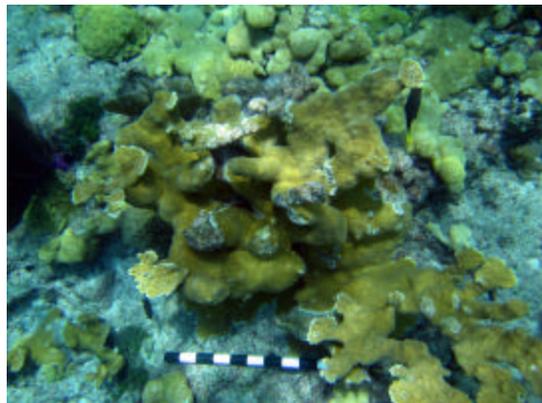


Figure 16. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from the Fowey Rocks to Ajax Reef, Biscayne National Park, surveyed during June-August 2007.

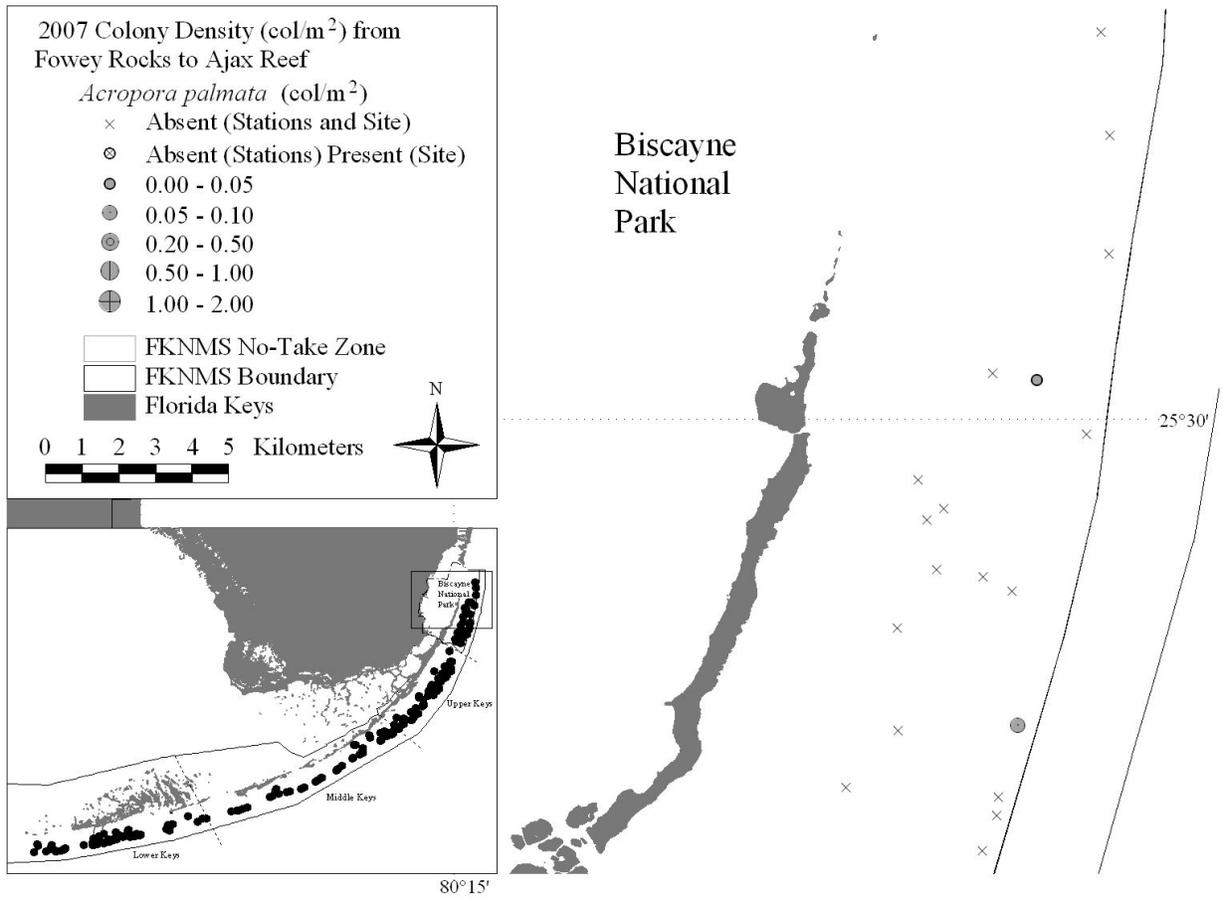


Figure 17. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Pacific Reef, Biscayne National Park, to Carysfort/South Carysfort Reef SPA surveyed during June-August 2007.

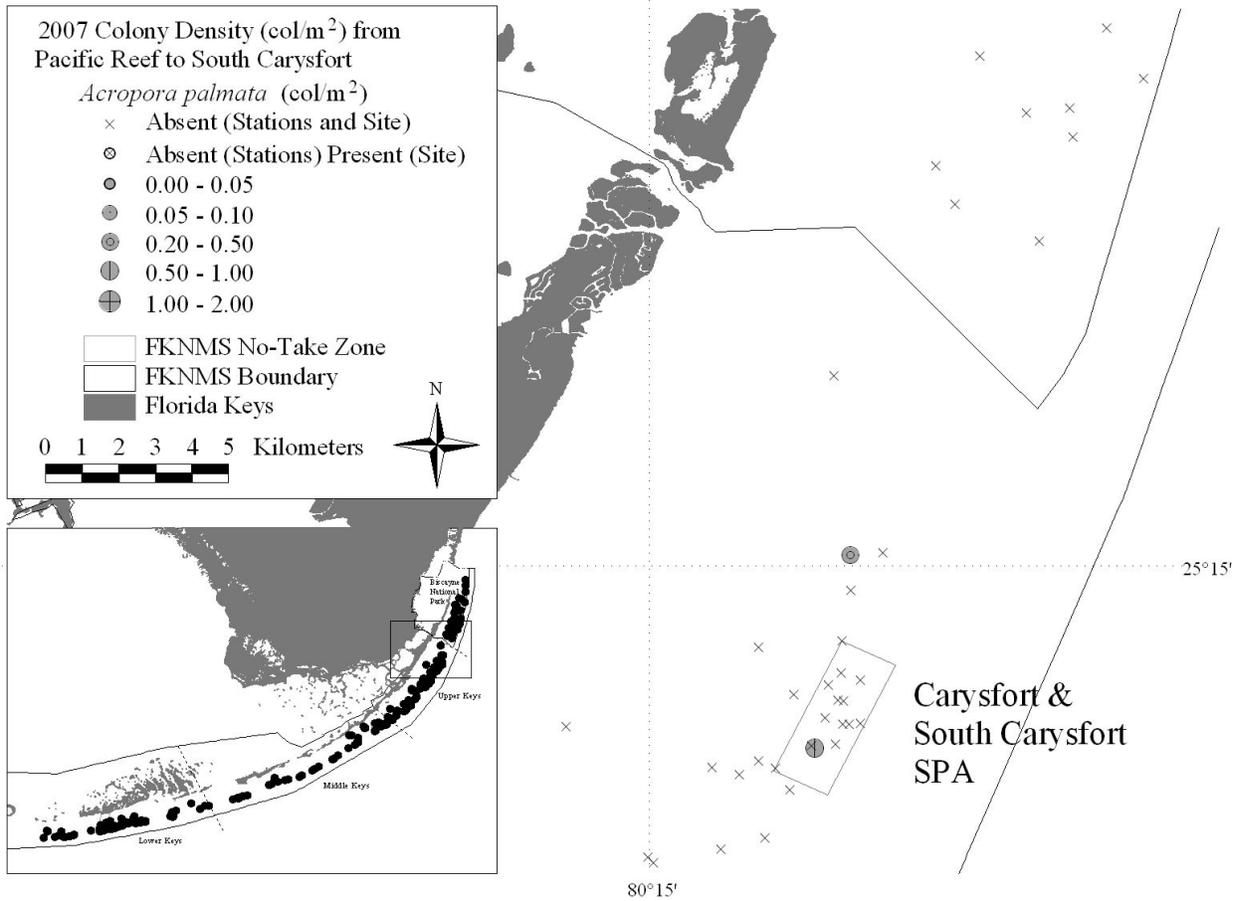


Figure 18. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Elbow Reef SPA to Molasses Reef SPA surveyed during June-August 2007.

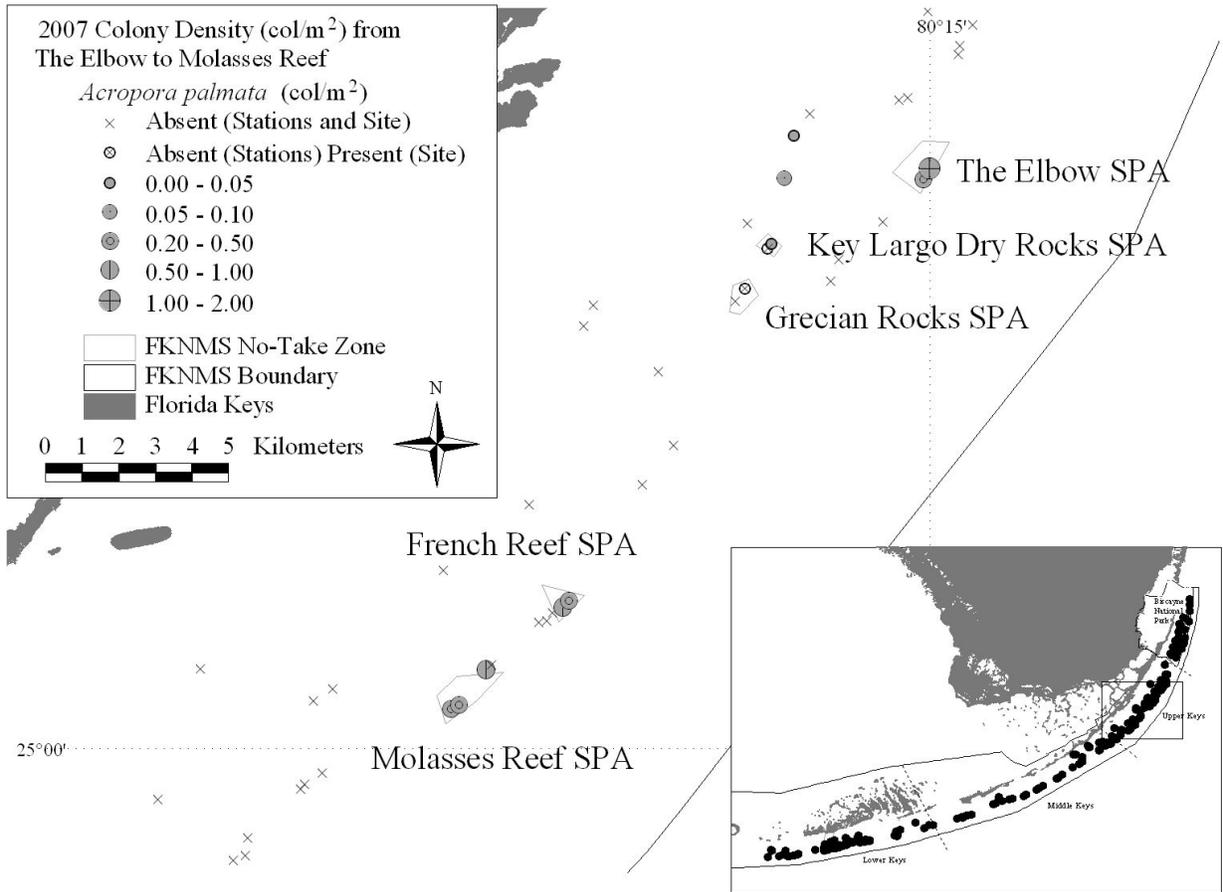


Figure 19. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Conch Reef SPA to Alligator Reef SPA surveyed during June-August 2007.

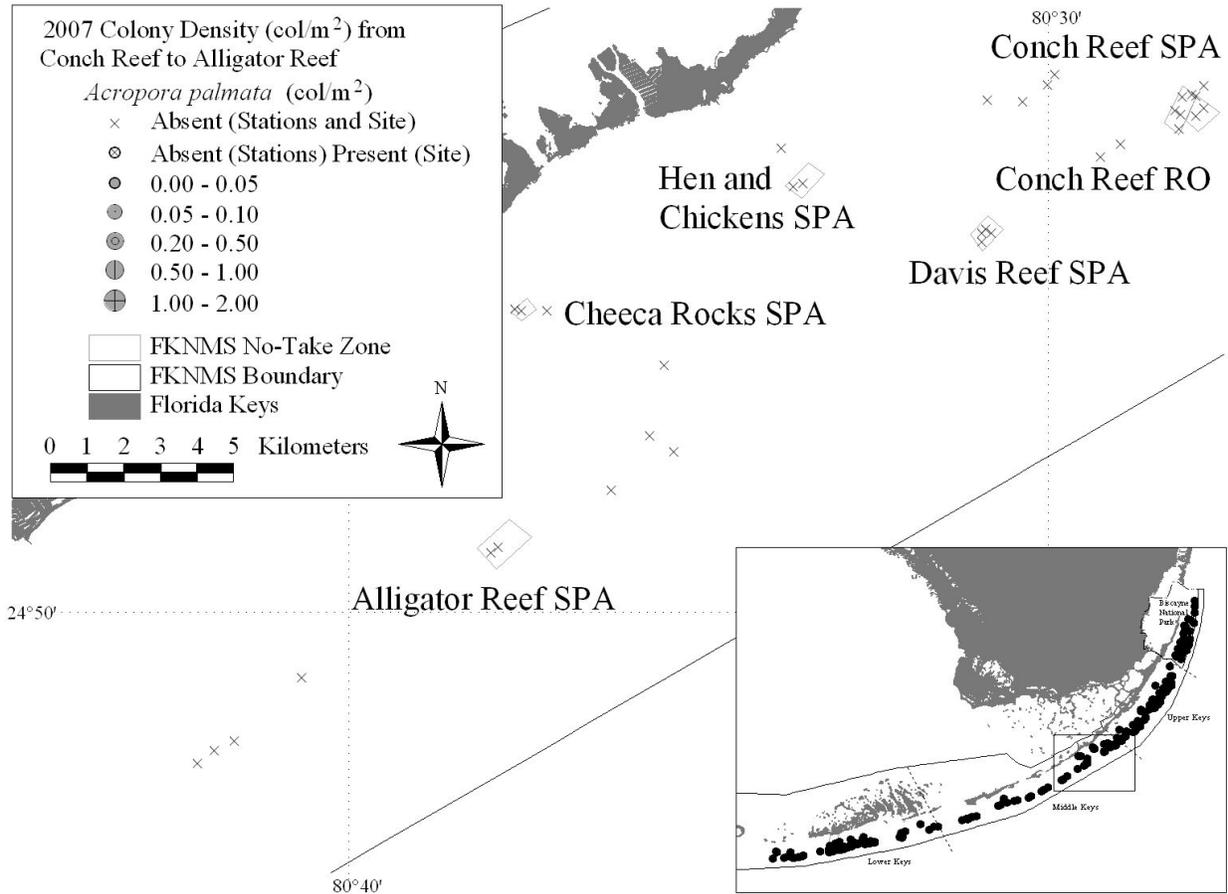


Figure 20. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Tennessee Reef RO to Coffins Patch SPA surveyed during June-August 2007.

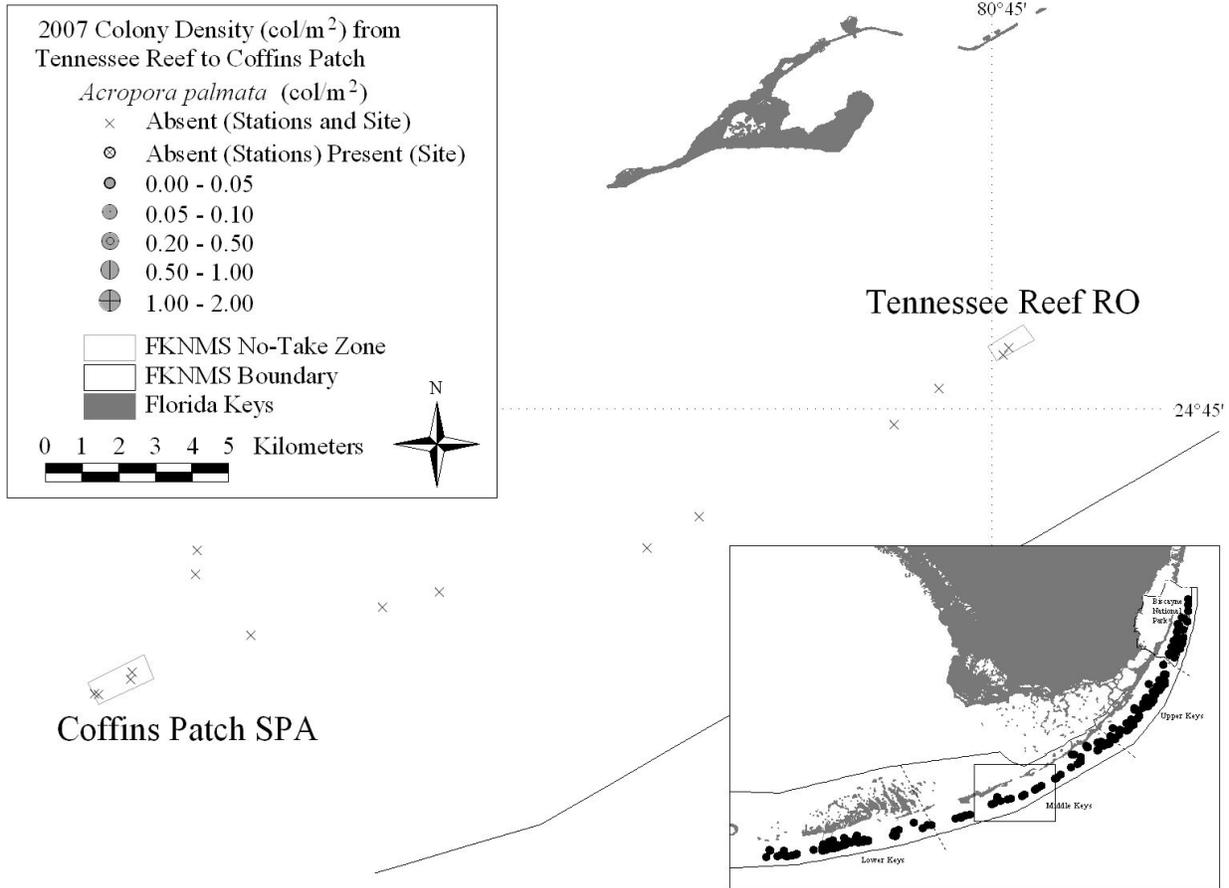


Figure 21. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys within and near Sombrero Key SPA surveyed during June-August 2007.

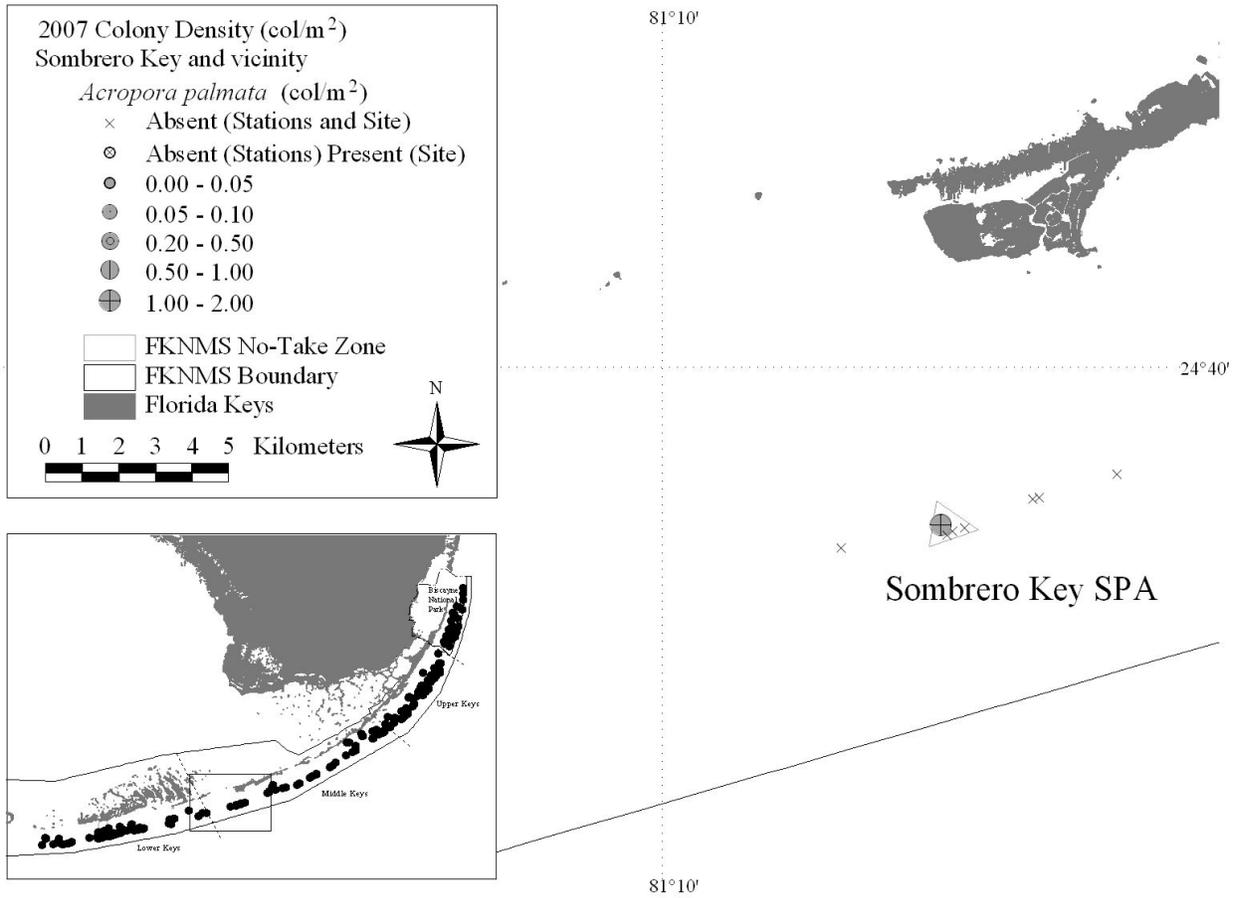


Figure 22. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Big Pine Shoal to Looe Key SPA surveyed during June-August 2007.

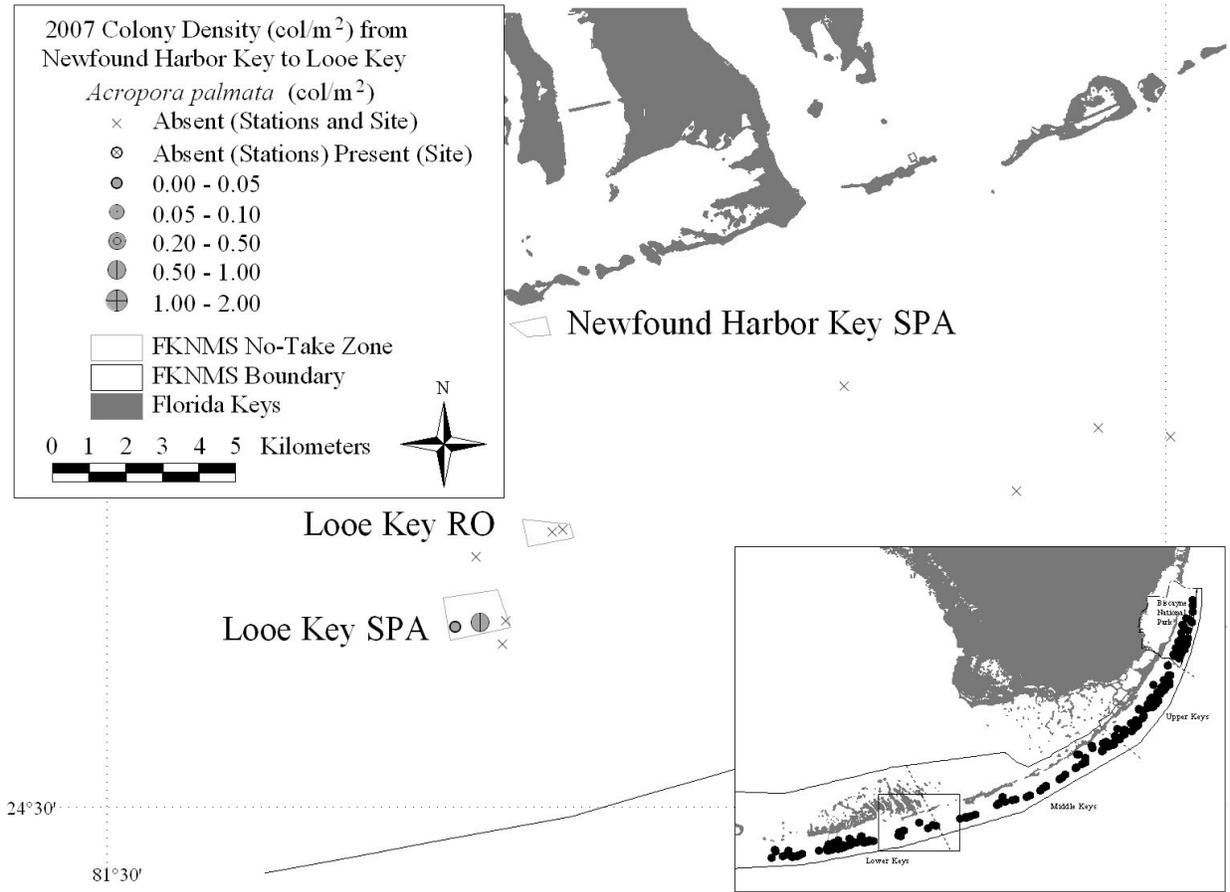


Figure 23. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Maryland Shoal to Western Sambo Ecological Reserve surveyed during June-August 2007.

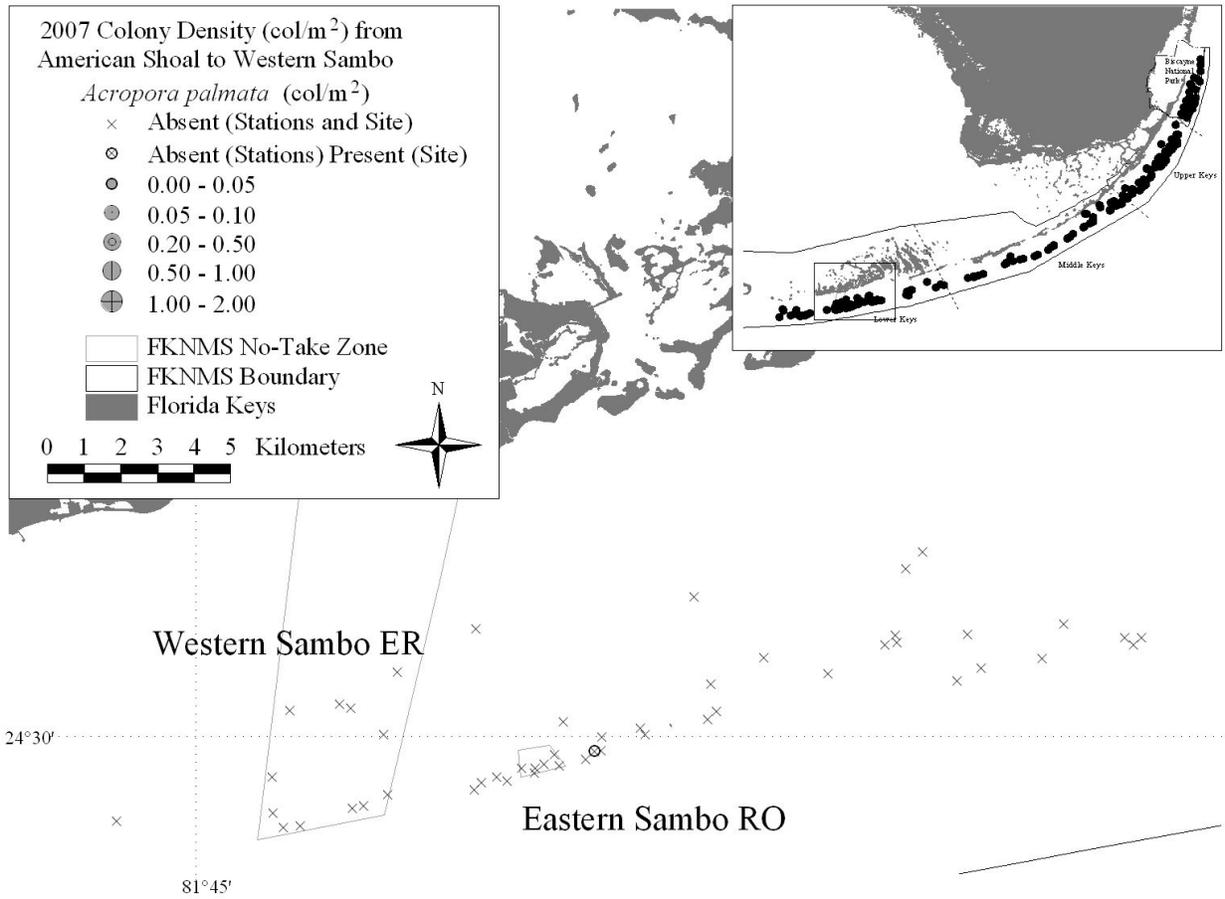


Figure 24. Elkhorn coral (*Acropora palmata*) presence-absence and colony density (no. of colonies/m²) in the Florida Keys from Eastern Dry Rocks SPA to Satan Shoal surveyed during June-August 2007.

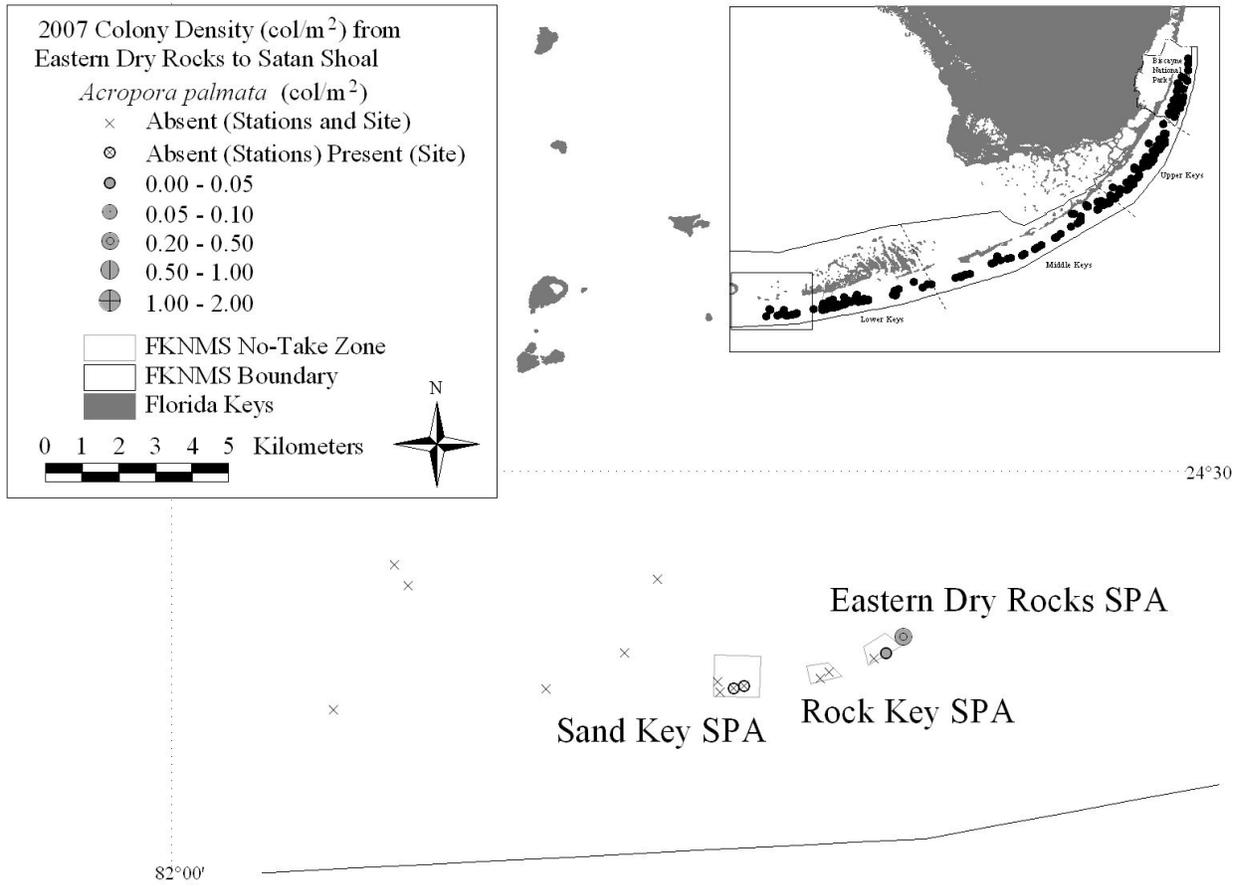


Figure 25. Impacts to staghorn (*Acropora cervicornis*) and elkhorn (*A. palmata*) coral documented during June-August 2007 in Biscayne National Park and the Florida Keys National Marine Sanctuary.

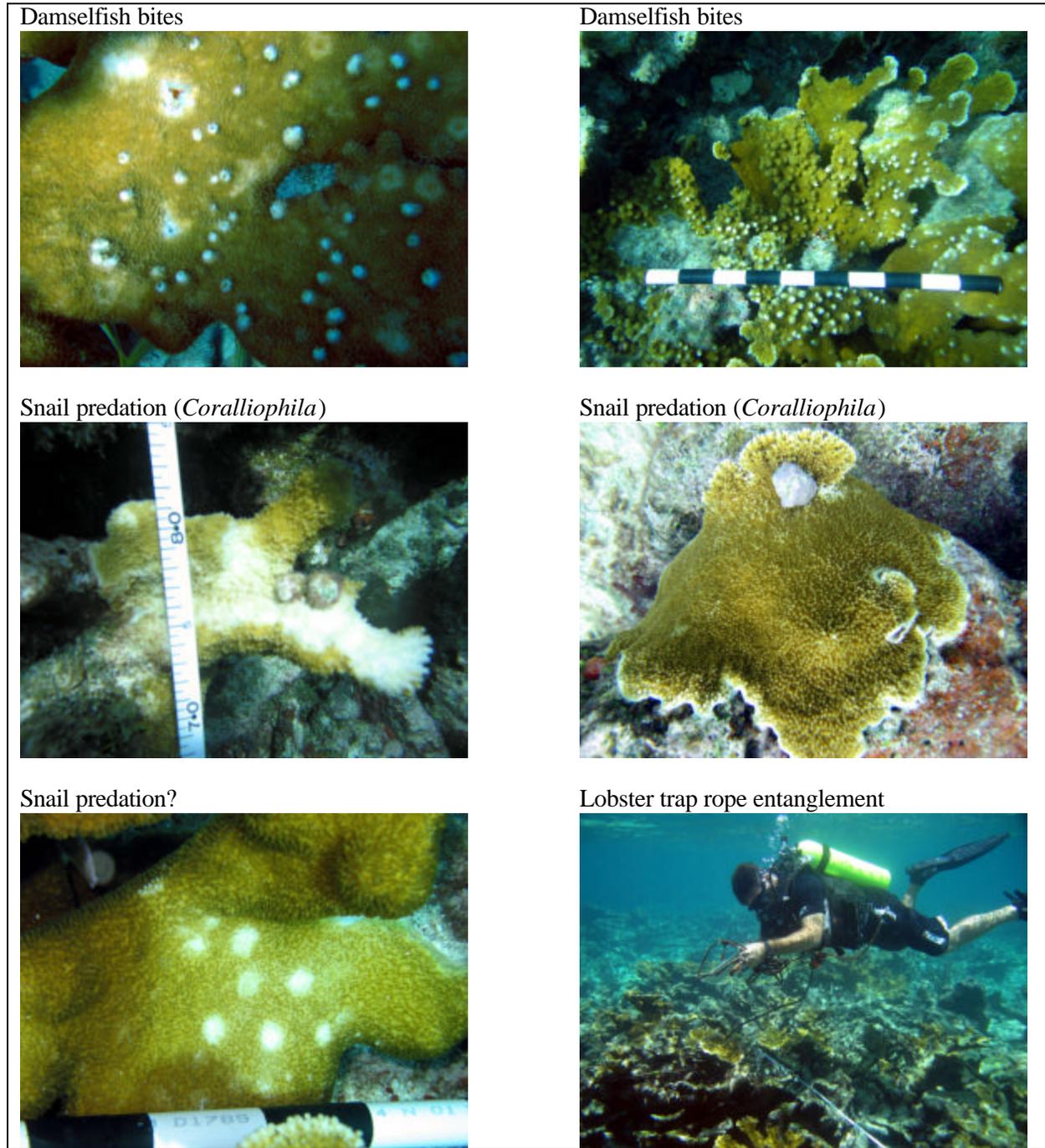


Figure 26. *Coralliophila* and other gastropod mollusks surveyed for density, size, and substratum occupancy in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007.

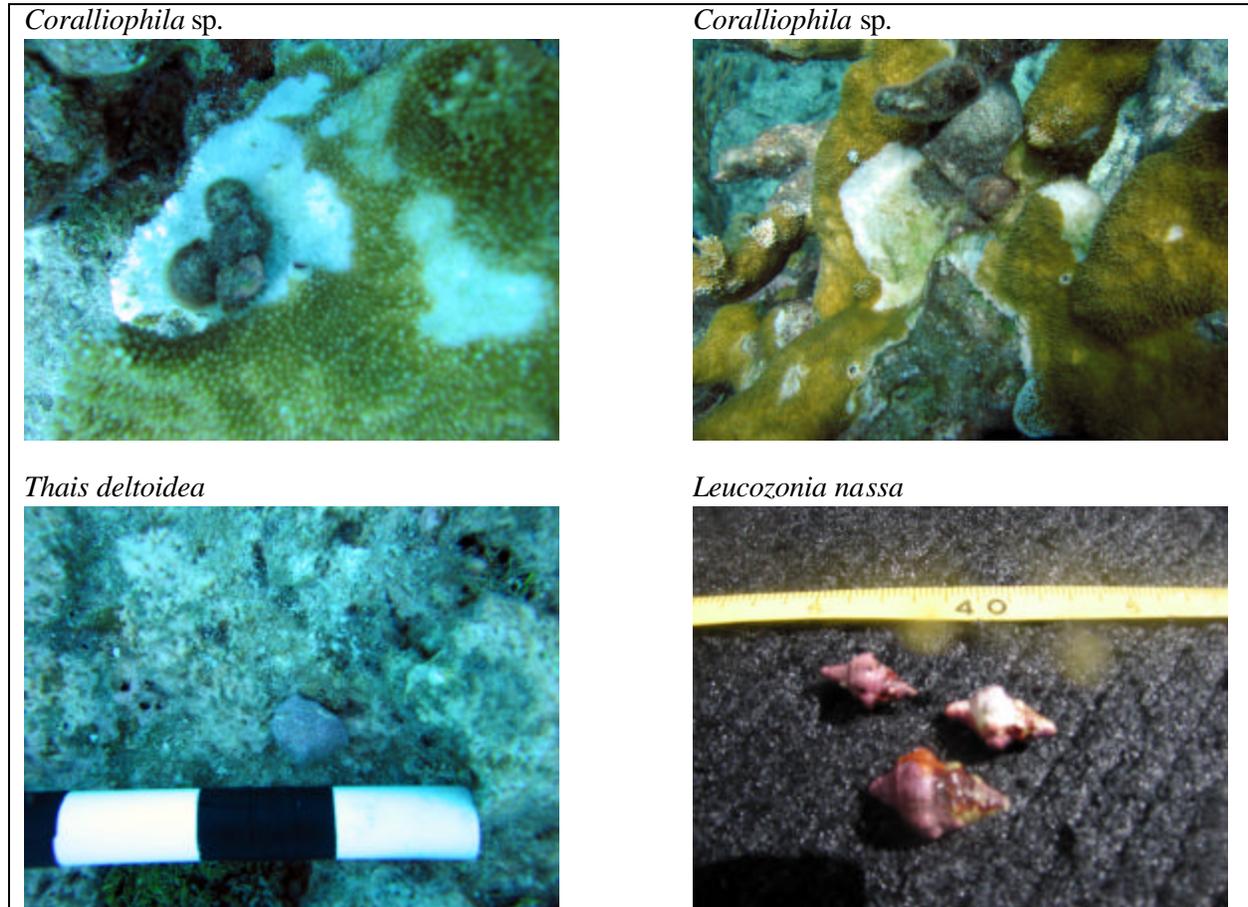


Figure 27. Total shell length distribution of *Coralliophila* sp. and other gastropod mollusks in the Florida Keys National Marine Sanctuary and Biscayne National Park measuring during June-August 2007 at 235 hard-bottom and coral reef sites.

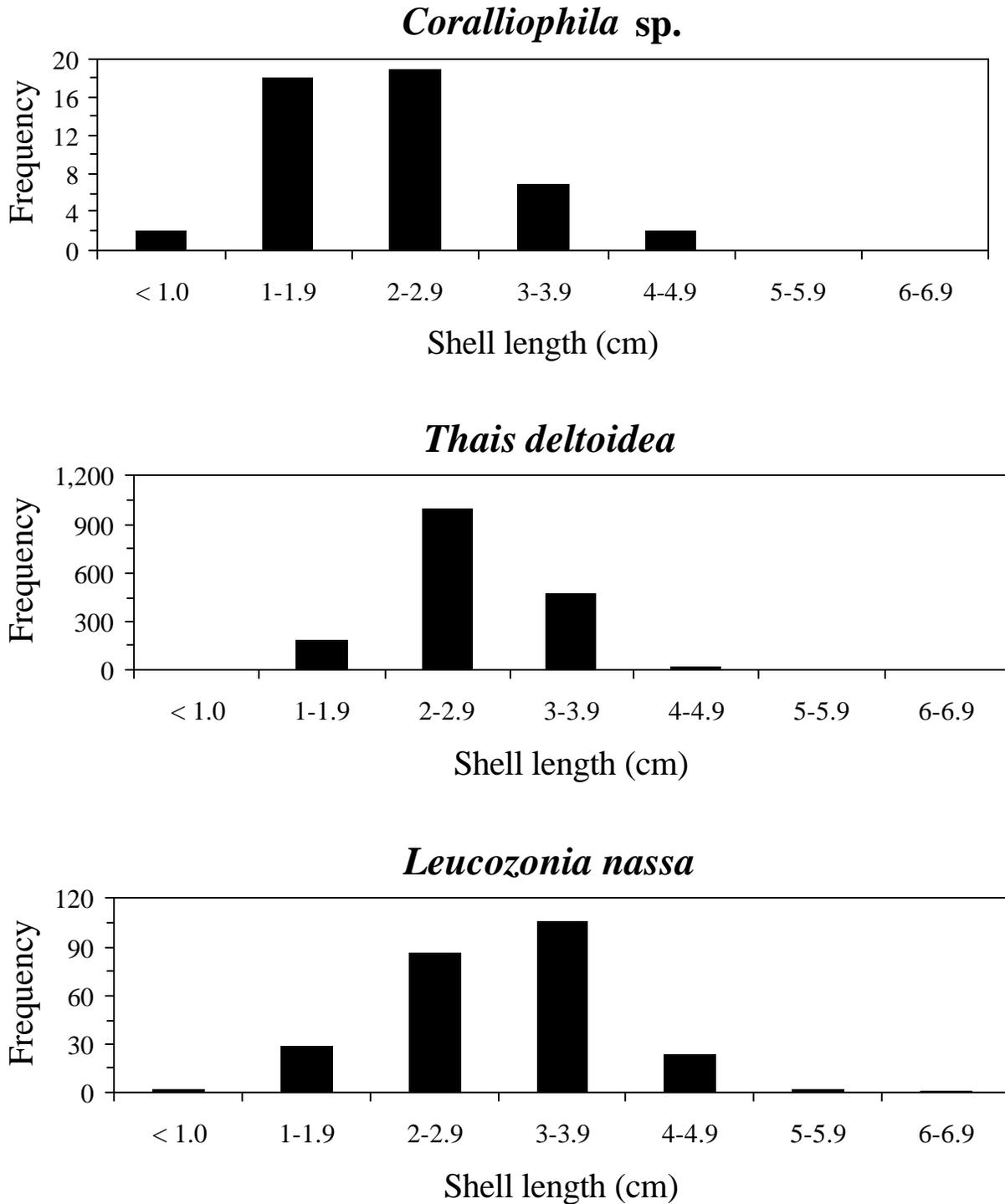


Figure 28. Urchin species surveyed for density and test diameter in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007. Not shown are *Echinometra lucunter* (rock boring urchin), *Lytechinus variegatus*, and *Tripneustes ventricosus*.

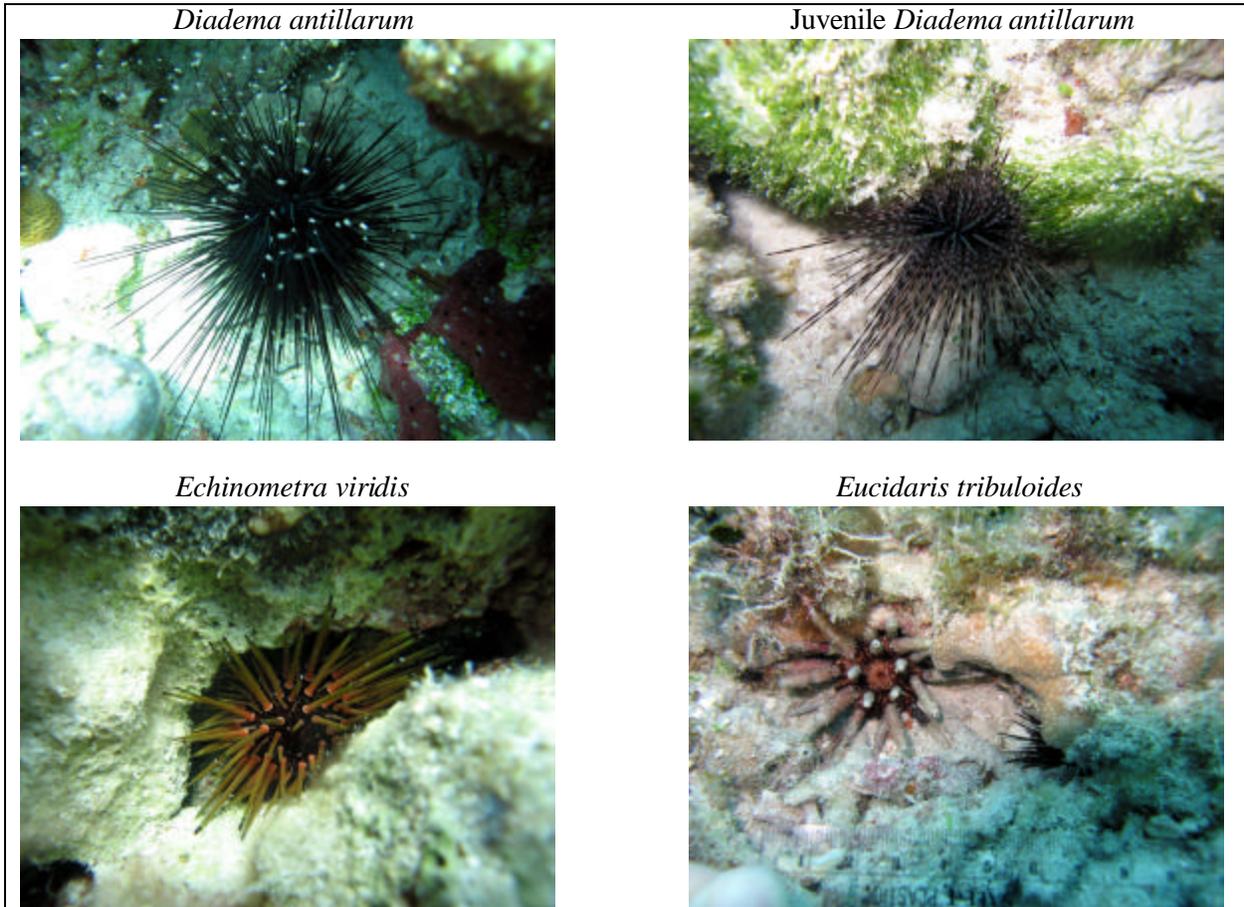
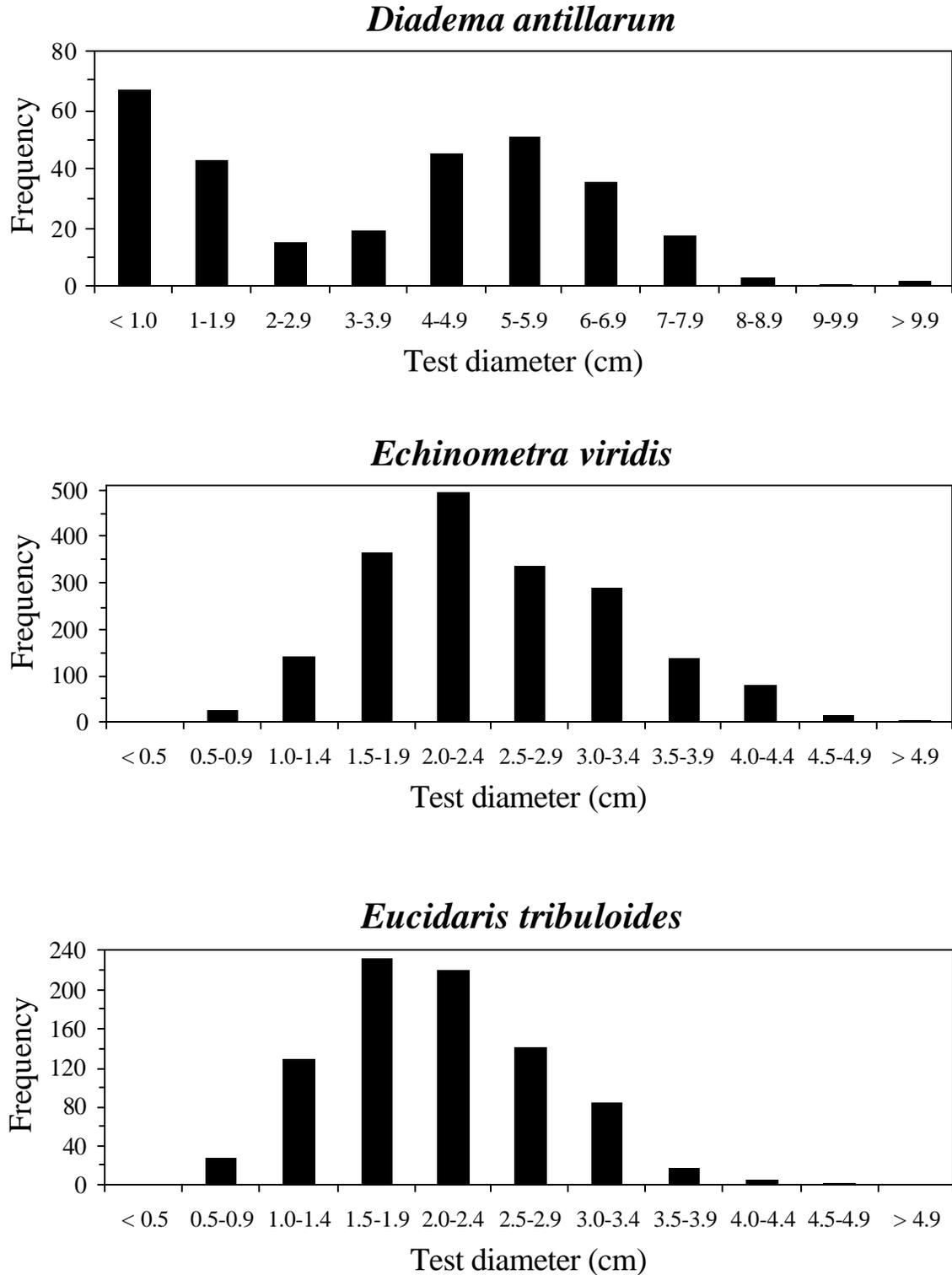


Figure 29. Size distribution of the urchins *Diadema antillarum*, *Echinometra viridis*, and *Eucidaris tribuloides* in the Florida Keys National Marine Sanctuary and Biscayne National Park measuring during June-August 2007 at 235 hard-bottom and coral reef sites.



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Table 2. Chronological list of survey locations for *Acropora* corals, stony coral species richness, *Coralliophila* snails, and urchins in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007. Asterisked sites (***) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

Table 3. Survey locations for *Acropora* corals, stony coral species richness, *Coralliophila* snails, and urchins in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007. Sites are arranged from northeast to southwest within each habitat type. Asterisked sites (***) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO). Mean \pm 1 SE depth and max. vertical relief are based upon surveys of four 15-m x 1-m transects surveyed per site.

Table 4. Site descriptions for survey locations in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007. Sites are arranged from northeast to southwest within each habitat type and asterisked locations (***) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

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Table 7. Mean (1 SD) density (no. colonies/m²) and live tissue surface area (cm²) of staghorn coral (*Acropora cervicornis*) in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from surveys of four 15-m x 1-m belt transects per site at 235 sites during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (***) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

Table 8. Numbers and relative frequencies (%) of staghorn coral (*Acropora cervicornis*) colonies exhibiting disease-like conditions and predation in the Florida Keys National Marine Sanctuary and Biscayne National Park, as quantified from four 15-m x 1-m transects per site at 235 locations during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (***) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

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Table 10. Numbers and relative frequencies (%) of elkhorn coral (*Acropora palmata*) colonies exhibiting disease-like conditions and predation in the Florida Keys National Marine Sanctuary and Biscayne National Park, as quantified from four 15-m x 1-m transects per site at 235 locations during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

Table 11. Mean \pm 1 SE densities (no. individuals per m²) and total shell lengths (SL, cm) of *Coralliophila* and other gastropod snails in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

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Table 13. Mean \pm 1 SE densities (no. individuals per m²), test diameter (TD, cm), and numbers of individuals (N) of the urchins *Diadema antillarum* and *Echinometra lucunter* in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (**) are no-take marine reserves.

Table 14. Mean \pm 1 SE densities (no. individuals per m²), test diameter (TD, cm), and numbers of individuals (N) of the urchins *Echinometra viridis* and *Eucidaris tribuloides* in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (**) are no-take marine reserves.

Table 15. Mean \pm 1 SE densities (no. individuals per m²), test diameter (TD, cm), and numbers of individuals (N) of the urchins *Lytechinus variegatus* and *Tripneustes ventricosus* in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (**) are no-take marine reserves.

Table 16. Number of individuals (N), mean, standard error (SE), and range in sea urchin test diameter by species and habitat type in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from surveys of four 15-m x 1-m belt transects per site at 235 sites during June-August 2007.

Table 17. Alphabetical list of stony coral species (Milleporina and Scleractinia) recorded within belt transect surveys at 235 sites in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007. Habitats are arranged from inshore to offshore and are designated as: MPR = mid-channel patch reef, OPR = offshore patch reef, HBM = hard-bottom matrix, LHBS = shallow (< 6 m) hard-bottom, IRT = inner line reef tract, HSG = high-relief spur and groove, LHBD = deeper (6-15 m) hard-bottom, PHB = patchy hard-bottom, and LSG = low-relief spur and groove.

Table 18. Mean \pm 1 SE proportional transect frequency of stony corals (Milleporina and Scleractinia) in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June-August 2007. A mean of value of 0.12, for example, indicates that a species was found on 12% of the sampled transects. Habitats are arranged from inshore to offshore and are designated as: MPR = mid-channel patch reef, OPR = offshore patch reef, HBM = hard-bottom matrix, LHBS = shallow (< 6 m) hard-bottom, IRT = inner line reef tract, HSG = high-relief spur and groove, LHBD = deeper (6-15 m) hard-bottom, PHB = patchy hard-bottom, and LSG = low-relief spur and groove.

Table 19. Stony coral (Milleporina and Scleractinia) site species richness (no. of species per site) in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects at 235 sites during June-August 2007. Values for regional and habitat totals are mean \pm 1 SE. Sites are arranged by habitat from northeast to southwest and asterisked locations (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

Table 1. Original 2007 sampling design and actual sites surveyed for *Acropora* corals, stony coral species richness, *Coralliophila* snails, and urchins in the Florida Keys National Marine Sanctuary and Biscayne National Park by habitat type, regional sector, and protection level. Available sites reflect the number of 200 m x 200 m sites as determined from FDEP (1998) habitat mapping data. Asterisked sites (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

Habitat type/region/protection	No. sites planned	No. sites sampled	% of Effort	No. sites available	% Available
Mid-channel patch reef (MPR)					
Biscayne National Park					
Reference sites		12	5.11		
Upper Florida Keys					
Reference sites	4	4	1.70	787	8.61
Middle Florida Keys					
Reference sites	4	4	1.70	326	3.57
Hen and Chickens SPA**	2	2	0.85	10	0.11
Cheeca Rocks SPA**	2	2	0.85	11	0.12
Lower Florida Keys					
Reference sites	8	8	3.40	1068	11.69
Western Sambo ER**	4	4	1.70	35	0.38
MPR Habitat Total	24	36	15.32	2,237	24.49
Offshore patch reef (OPR)					
Biscayne National Park					
Reference sites		7	2.98		
Upper Florida Keys					
Reference sites	12	15	6.38	723	7.91
Carysfort/S. Carysfort SPA**		4	1.70		
Middle Florida Keys					
Reference sites	4	4	1.70	55	0.60
Coffins Patch SPA**		2	0.85		
Lower Florida Keys					
Reference sites	5	6	2.55	152	1.66
Looe Key RO**	2	2	0.85	13	0.14
Western Sambo ER**	2	2	0.85	55	0.60
OPR Habitat Total	25	42	17.87	998	10.92
Hard-bottom/rubble/sand matrix					
Upper Florida Keys					
Reference sites		3	1.28		
Carysfort/S. Carysfort SPA**		1	0.43		
Hard-bottom Matrix Total		4	1.70		
Low-relief hard-bottom (< 6 m)					
Biscayne National Park					
Reference sites		2	0.85		
Upper Florida Keys					
Reference sites	6	4	1.70	497	5.44
Carysfort/S. Carysfort SPA**	2	1	0.43	22	0.24
Molasses Reef SPA**	1			4	0.04
Middle Florida Keys					
Reference sites	4	6	2.55	230	2.52
Conch Reef SPA**	1	2	0.85	5	0.05
Davis Reef SPA**	1	2	0.85	3	0.03
Alligator Reef SPA**		2	0.85		
Coffins Patch SPA**	2	2	0.85	17	0.19
Lower Florida Keys					
Reference sites	4	4		64	0.70
LRHB (< 6 m) Habitat Total	21	25	10.64	842	9.22

Habitat type/region/protection	No. sites planned	No. sites sampled	% of Effort	No. sites available	% Available
Inner line spur and groove (IRT)					
Upper Florida Keys					
Reference sites	4	4	1.70	68	0.74
Dry Rocks SPA**	2	2	0.85	5	0.05
Grecian Rocks SPA**	2	2	0.85	14	0.15
IRT Habitat Total	8	8	3.40	87	0.95
High-relief spur and groove (HSG)					
Biscayne National Park					
Reference sites		7	2.98		
Upper Florida Keys					
Reference sites	8	7	2.98	33	0.36
Carysfort/S. Carysfort SPA**	2	4	1.70	35	0.38
Elbow Reef SPA**	2	2	0.85	15	0.16
French Reef SPA**	2	2	0.85	13	0.14
Molasses Reef SPA**	2	2	0.85	18	0.20
Middle Florida Keys					
Reference sites	2	2	0.85	2	0.02
Davis Reef SPA**	1			1	0.01
Alligator Reef SPA**	2			11	0.12
Sombrero Reef SPA**	2	2	0.85	7	0.08
Lower Florida Keys					
Reference	11	11	4.68	44	0.48
Looe Key SPA**	2	2	0.85	15	0.16
Eastern Sambo RO**	2	2	0.85	6	0.07
Western Sambo ER**	2	2	0.85	14	0.15
Eastern Dry Rocks SPA**	2	2	0.85	8	0.09
Rock Key SPA**	2	2	0.85	6	0.07
Sand Key SPA**	1	2	0.85	7	0.08
HSG Habitat Total	45	51	21.70	235	2.57
Low-relief hard-bottom (> 6 m)					
Upper Florida Keys					
Reference sites	4	4	1.70	515	5.64
Carysfort/S. Carysfort SPA**	2	2	0.85	44	0.48
Middle Florida Keys					
Reference sites	4	4	1.70	704	7.71
Conch Reef SPA**		2	0.85		
Davis Reef SPA**	1			3	0.03
Coffins Patch SPA**	1			4	0.04
Lower Florida Keys					
Reference	4	3	1.28	667	7.30
Eastern Sambo RO**	1			4	0.04
Western Sambo ER**	2			14	0.15
Sand Key SPA**	1			5	0.05
LHB (> 6 m) Habitat Total	20	15	6.38	1,960	21.45
Patchy hard-bottom (> 6 m)					
Upper Florida Keys					
Reference sites	4	4	1.70	314	3.44
Middle Florida Keys					
Reference sites	4	4	1.70	486	5.32
Lower Florida Keys					
Reference	4	7	2.98	156	1.71
Eastern Sambo RO**		2	0.85		
Western Sambo ER**		2	0.85		
Sand Key SPA**		2	0.85		
PHB (> 6 m) Habitat Total	12	21	8.94	956	10.46
Low-relief spur and groove (> 6 m)					

Habitat type/region/protection	No. sites planned	No. sites sampled	% of Effort	No. sites available	% Available
Upper Florida Keys					
Reference sites	4	4	1.70	366	4.01
Carysfort/S. Carysfort SPA**	2	2	0.85	54	0.59
Middle Florida Keys					
Reference sites	6	6	2.55	726	7.95
Conch Reef SPA**	1	2	0.85	10	0.11
Conch Reef RO**	2	2	0.85	5	0.05
Davis Reef SPA**		2	0.85		
Tennessee Reef RO**	2	2	0.85	13	0.14
Sombrero Reef SPA**	1	2	0.85	14	0.15
Lower Florida Keys					
Reference sites	4	5	2.13	604	6.61
Eastern Sambo RO**	1	2	0.85	4	0.04
Western Sambo ER**	1	2	0.85	5	0.05
Sand Key SPA**	1	2	0.85	20	0.22
LSG (> 6 m) Habitat Total	25	33	14.04	1,821	19.93
Sampling Design Total	180	235	100.00	9,136	100.00

Table 2. Chronological list of survey locations for *Acropora* corals, stony coral species richness, *Coralliophila* snails, and urchins in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007. Asterisked sites (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

Site #	Date	Site location	Latitude (N)	Longitude (W)	Habitat type
61	6/23/2007	Turtle Reef	25°17.997'	80°12.894'	Inner line reef tract
15	6/23/2007	North of Carysfort Reef SPA	25°15.387'	80°12.651'	Offshore patch reef
16	6/23/2007	North of Carysfort Reef SPA	25°15.414'	80°12.172'	Offshore patch reef
14	6/23/2007	North of Carysfort Reef SPA	25°14.875'	80°12.645'	Offshore patch reef
38	6/23/2007	West of Carysfort Reef SPA	25°14.040'	80°13.995'	Hard-bottom/rubble/sand matrix
37	6/23/2007	West of Carysfort Reef SPA	25°13.355'	80°13.474'	Offshore patch reef
47	6/23/2007	Carysfort/S. Carysfort SPA**	25°13.496'	80°12.968'	Offshore patch reef
52	6/24/2007	Carysfort/S. Carysfort SPA**	25°12.927'	80°12.509'	Low-relief spur and groove
53	6/24/2007	Carysfort/S. Carysfort SPA**	25°12.918'	80°12.664'	Low-relief hard-bottom (> 6 m)
40	6/24/2007	Carysfort/S. Carysfort SPA**	25°13.670'	80°12.781'	Hard-bottom/rubble/sand matrix
26	6/24/2007	Carysfort/S. Carysfort SPA**	25°13.565'	80°12.503'	High-relief spur and groove
25	6/24/2007	Carysfort/S. Carysfort SPA**	25°13.258'	80°12.750'	High-relief spur and groove
345	6/24/2007	Carysfort/S. Carysfort SPA**	25°13.265'	80°12.835'	Offshore patch reef
46	6/24/2007	Carysfort/S. Carysfort SPA**	25°13.016'	80°13.014'	Offshore patch reef
39	6/24/2007	Carysfort/S. Carysfort SPA**	25°12.275'	80°13.738'	Offshore patch reef
240	6/25/2007	Carysfort/S. Carysfort SPA**	25°12.627'	80°12.865'	Low-relief hard-bottom (> 6 m)
241	6/25/2007	Carysfort/S. Carysfort SPA**	25°12.912'	80°12.759'	Low-relief spur and groove
218	6/25/2007	Carysfort/S. Carysfort SPA**	25°12.599'	80°13.223'	High-relief spur and groove
217	6/25/2007	Carysfort/S. Carysfort SPA**	25°12.569'	80°13.172'	High-relief spur and groove
24	6/25/2007	Near Maitland Grounding Site	25°11.953'	80°13.538'	High-relief spur and groove
36	6/25/2007	West of SW Carysfort SPA	25°12.381'	80°13.990'	Hard-bottom/rubble/sand matrix
50	6/26/2007	Offshore of Dry Rocks SPA	25°06.881'	80°16.966'	Low-relief spur and groove
51	6/26/2007	Offshore of Dry Rocks SPA	25°07.193'	80°16.843'	Low-relief spur and groove
45	6/26/2007	Offshore of Dry Rocks SPA	25°07.756'	80°16.190'	Low-relief hard-bottom (> 6 m)
27	6/26/2007	Elbow Reef SPA**	25°08.395'	80°15.595'	High-relief spur and groove
28	6/26/2007	Elbow Reef SPA**	25°08.562'	80°15.499'	High-relief spur and groove
54	6/26/2007	Inshore of Watson's Reef	25°10.247'	80°15.072'	Reef terrace
55	6/26/2007	Inshore of Watson's Reef	25°10.692'	80°14.858'	Offshore patch reef?
4	6/27/2007	Basin Hill Shoals	25°12.886'	80°16.790'	Mid-channel patch reef
346	6/27/2007	Carysfort/S. Carysfort SPA**	25°14.129'	80°12.778'	Low-relief hard-bottom (< 6 m)
35	6/27/2007	West of Carysfort Reef SPA	25°12.285'	80°14.663'	Low-relief hard-bottom (< 6 m)
34	6/27/2007	West of Carysfort Reef SPA	25°12.179'	80°14.269'	Low-relief hard-bottom (< 6 m)
13	6/27/2007	Inshore of Watson's Reef	25°10.983'	80°15.604'	Offshore patch reef
33	6/27/2007	Inshore of Watson's Reef	25°10.896'	80°15.522'	Low-relief hard-bottom (< 6 m)
62	6/28/2007	Dry Rocks SPA**	25°07.436'	80°17.851'	Inner line reef tract
63	6/28/2007	Dry Rocks SPA**	25°07.370'	80°17.904'	Inner line reef tract
57	6/28/2007	Inshore of Watson's Reef	25°11.260'	80°13.892'	Low-relief hard-bottom (> 6 m)
56	6/28/2007	Inshore of Watson's Reef	25°11.099'	80°14.538'	Patchy hard-bottom (> 6 m)
347	6/28/2007	Inshore of Watson's Reef	25°09.601'	80°15.824'	Offshore patch reef
12	6/28/2007	Inshore of Watson's Reef	25°09.572'	80°15.952'	Offshore patch reef
60	6/28/2007	Inshore of Elbow Reef SPA	25°09.361'	80°17.284'	Inner line reef tract
59	6/28/2007	Inshore of Elbow Reef SPA	25°09.046'	80°17.513'	Inner line reef tract
64	6/29/2007	Grecian Rocks SPA**	25°06.572'	80°18.385'	Inner line reef tract
65	6/29/2007	Grecian Rocks SPA**	25°06.770'	80°18.239'	Inner line reef tract
11	6/29/2007	NW of Dry Rocks SPA	25°07.730'	80°18.213'	Hard-bottom/rubble/sand matrix
58	6/29/2007	Horseshoe Reef	25°08.405'	80°17.662'	Inner line reef tract
2	6/29/2007	Near Cannon Patch Reef	25°06.518'	80°20.497'	Mid-channel patch reef
3	6/29/2007	Near Cannon Patch Reef	25°06.206'	80°20.638'	Mid-channel patch reef
9	6/29/2007	White Banks	25°03.546'	80°21.450'	Offshore patch reef
177	7/14/2007	NE of Satan Shoal	24°26.834'	81°58.272'	Low-relief hard-bottom (> 6 m)
115	7/14/2007	North of Satan Shoal	24°28.861'	81°57.420'	Mid-channel patch reef
116	7/14/2007	North of Satan Shoal	24°28.579'	81°57.223'	Mid-channel patch reef
162	7/14/2007	West of Western Dry Rocks	24°27.128'	81°55.290'	Patchy hard-bottom (> 6 m)

Site #	Date	Site location	Latitude (N)	Longitude (W)	Habitat type
127	7/14/2007	West of Sand Key SPA	24°27.626'	81°54.195'	Offshore patch reef
169	7/14/2007	Sand Key SPA**	24°27.229'	81°52.895'	Patchy hard-bottom (> 6 m)
335	7/14/2007	Sand Key SPA**	24°27.075'	81°52.852'	Patchy hard-bottom (> 6 m)
117	7/14/2007	NW of Sand Key SPA	24°28.659'	81°53.728'	Mid-channel patch reef
325	7/15/2007	Sand Key SPA**	24°27.171'	81°52.521'	High-relief spur and groove
157	7/15/2007	Sand Key SPA**	24°27.134'	81°52.665'	High-relief spur and groove
155	7/15/2007	Rock Key SPA**	24°27.274'	81°51.451'	High-relief spur and groove
156	7/15/2007	Rock Key SPA**	24°27.361'	81°51.327'	High-relief spur and groove
153	7/15/2007	Eastern Dry Rocks SPA**	24°27.557'	81°50.693'	High-relief spur and groove
154	7/15/2007	Eastern Dry Rocks SPA**	24°27.631'	81°50.522'	High-relief spur and groove
136	7/15/2007	East of Eastern Dry Rocks	24°27.849'	81°50.291'	High-relief spur and groove
163	7/16/2007	West of Western Sambo ER	24°28.760'	81°45.687'	Patchy hard-bottom (> 6 m)
168	7/16/2007	Western Sambo ER**	24°29.381'	81°43.495'	Offshore patch reef
167	7/16/2007	Western Sambo ER**	24°28.875'	81°43.484'	Patchy hard-bottom (> 6 m)
176	7/16/2007	Western Sambo ER**	24°28.672'	81°43.337'	Low-relief spur and groove
341	7/16/2007	Western Sambo ER**	24°28.694'	81°43.101'	Low-relief spur and groove
151	7/16/2007	Western Sambo ER**	24°28.935'	81°42.364'	High-relief spur and groove
152	7/16/2007	Western Sambo ER**	24°28.975'	81°42.203'	High-relief spur and groove
334	7/16/2007	Western Sambo ER**	24°29.132'	81°41.866'	Patchy hard-bottom (> 6 m)
123	7/17/2007	Western Sambo ER**	24°30.324'	81°43.247'	Mid-channel patch reef
125	7/17/2007	Western Sambo ER**	24°30.411'	81°42.539'	Mid-channel patch reef
124	7/17/2007	Western Sambo ER**	24°30.350'	81°42.380'	Mid-channel patch reef
135	7/17/2007	Western Sambo ER**	24°29.984'	81°41.926'	Offshore patch reef
126	7/17/2007	Western Sambo ER**	24°30.866'	81°41.723'	Mid-channel patch reef
118	7/17/2007	East of Western Sambo ER	24°31.467'	81°40.626'	Mid-channel patch reef
170	7/18/2007	Middle Sambo Reef	24°29.204'	81°40.642'	Low-relief spur and groove
309	7/18/2007	Middle Sambo Reef	24°29.302'	81°40.546'	High-relief spur and groove
348	7/18/2007	Middle Sambo Reef	24°29.377'	81°40.327'	High-relief spur and groove
171	7/18/2007	Middle Sambo Reef	24°29.329'	81°40.175'	Low-relief spur and groove
175	7/18/2007	Eastern Sambo RO**	24°29.443'	81°39.801'	Low-relief spur and groove
340	7/18/2007	Eastern Sambo RO**	24°29.543'	81°39.445'	Low-relief spur and groove
150	7/18/2007	Eastern Sambo RO**	24°29.560'	81°39.658'	High-relief spur and groove
149	7/18/2007	Eastern Sambo RO**	24°29.509'	81°39.787'	High-relief spur and groove
332	7/19/2007	Eastern Sambo RO**	24°29.509'	81°39.976'	Patchy hard-bottom (> 6 m)
166	7/19/2007	Eastern Sambo RO**	24°29.698'	81°39.516'	Patchy hard-bottom (> 6 m)
172	7/19/2007	East of Eastern Sambo Reef	24°29.624'	81°39.068'	Low-relief spur and groove
137	7/19/2007	East of Eastern Sambo Reef	24°29.746'	81°38.944'	High-relief spur and groove
138	7/19/2007	East of Eastern Sambo Reef	24°29.755'	81°38.858'	High-relief spur and groove
158	7/19/2007	East of No Name Reef	24°29.945'	81°38.848'	Low-relief hard-bottom (< 6 m)
164	7/19/2007	West of Pelican Shoal	24°30.069'	81°38.306'	Patchy hard-bottom (> 6 m)
128	7/19/2007	NE of Eastern Sambo	24°30.155'	81°39.389'	Offshore patch reef
178	7/20/2007	West of Pelican Shoal	24°29.981'	81°38.232'	Patchy hard-bottom (> 6 m)
139	7/20/2007	Pelican Shoal	24°30.192'	81°37.358'	High-relief spur and groove
159	7/20/2007	North of Pelican Shoal	24°30.308'	81°37.233'	Low-relief hard-bottom (< 6 m)
160	7/20/2007	North of Pelican Shoal	24°30.693'	81°37.312'	Patchy hard-bottom (> 6 m)
165	7/20/2007	North of Maryland Shoal	24°30.840'	81°35.658'	Offshore patch reef
129	7/20/2007	North of Maryland Shoal	24°31.070'	81°36.557'	Offshore patch reef
119	7/20/2007	North of Pelican Shoal	24°31.923'	81°37.551'	Mid-channel patch reef
140	7/21/2007	Maryland Shoal	24°30.738'	81°33.837'	Low-relief hard-bottom (< 6 m)
173	7/21/2007	Maryland Shoal	24°30.922'	81°33.493'	Low-relief hard-bottom (> 6 m)
130	7/21/2007	Maryland Shoal	24°31.396'	81°33.686'	Offshore patch reef
141	7/21/2007	Maryland Shoal	24°31.279'	81°34.690'	High-relief spur and groove
143	7/21/2007	Maryland Shoal	24°31.249'	81°34.856'	High-relief spur and groove
144	7/21/2007	Maryland Shoal	24°31.383'	81°34.704'	High-relief spur and groove
121	7/22/2007	North of Maryland Shoal	24°32.562'	81°34.326'	Mid-channel patch reef
120	7/22/2007	North of Maryland Shoal	24°32.317'	81°34.560'	Mid-channel patch reef
161	7/28/2007	West of American Shoal	24°31.052'	81°32.644'	Low-relief hard-bottom (< 6 m)
179	7/28/2007	West of American Shoal	24°31.539'	81°32.329'	Patchy hard-bottom (> 6 m)
145	7/28/2007	American Shoal	24°31.345'	81°31.476'	High-relief spur and groove
146	7/28/2007	American Shoal	24°31.344'	81°31.239'	High-relief spur and groove

Site #	Date	Site location	Latitude (N)	Longitude (W)	Habitat type
142	7/28/2007	American Shoal	24°31.243	81°31.354	Low-relief spur and groove
147	7/28/2007	Looe Key SPA**	24°32.711	81°24.622	High-relief spur and groove
148	7/28/2007	Looe Key SPA**	24°32.770	81°24.276	High-relief spur and groove
339	7/29/2007	Looe Key SPA**	24°32.468	81°23.950	Low-relief spur and groove
174	7/29/2007	Looe Key SPA**	24°32.788	81°23.903	Low-relief spur and groove
131	7/29/2007	North of Looe Key SPA	24°33.705	81°24.325'	Offshore patch reef
132	7/29/2007	Looe Key RO**	24°34.051	81°23.251'	Offshore patch reef
133	7/29/2007	Looe Key RO**	24°34.088	81°23.100'	Offshore patch reef
122	7/29/2007	North of Big Pine Shoal	24°36.119	81°19.120'	Mid-channel patch reef
337	7/29/2007	South of Bahia Honda Key	24°34.636	81°16.677'	Low-relief spur and groove
338	7/29/2007	South of Bahia Honda Key	24°35.524	81°15.524'	Patchy hard-bottom (> 6 m)
180	7/29/2007	South of Bahia Honda Key	24°35.406	81°14.499'	Low-relief hard-bottom (> 6 m)
111	7/30/2007	West of Sombrero Key	24°37.234	81°08.135'	Low-relief hard-bottom (> 6 m)
84	7/30/2007	Sombrero Key SPA**	24°37.560	81°06.711'	High-relief spur and groove
83	7/30/2007	Sombrero Key SPA**	24°37.470	81°06.542'	High-relief spur and groove
110	7/30/2007	Sombrero Key SPA**	24°37.520	81°06.373'	Low-relief spur and groove
287	7/30/2007	Sombrero Key SPA**	24°37.415	81°06.628'	Low-relief spur and groove
78	7/30/2007	Delta Shoal	24°37.928	81°05.408'	High-relief spur and groove
79	7/30/2007	Delta Shoal	24°37.943	81°05.317'	High-relief spur and groove
99	7/31/2007	East of Delta Shoal	24°38.274	81°04.211'	Low-relief spur and groove
98	7/31/2007	Coffins Patch SPA**	24°40.898	80°58.376'	Offshore patch reef
277	7/31/2007	Coffins Patch SPA**	24°40.892	80°58.316'	Offshore patch reef
91	7/31/2007	Coffins Patch SPA**	24°41.109	80°57.864'	Low-relief hard-bottom (< 6 m)
92	7/31/2007	Coffins Patch SPA**	24°41.212	80°57.834'	Low-relief hard-bottom (< 6 m)
85	7/31/2007	East of Coffins Patch SPA	24°41.743	80°56.131'	Low-relief hard-bottom (< 6 m)
66	7/31/2007	East Turtle Shoal	24°42.957	80°56.903'	Mid-channel patch reef
254	7/31/2007	East Turtle Shoal	24°42.613	80°56.933'	Mid-channel patch reef
93	8/1/2007	South of Duck Key	24°42.147	80°54.250'	Patchy hard-bottom (> 6 m)
94	8/1/2007	South of Duck Key	24°42.365	80°53.428'	Patchy hard-bottom (> 6 m)
100	8/1/2007	South of Conch Key	24°42.998	80°50.446'	Low-relief spur and groove
349	8/1/2007	South of Conch Key	24°43.449	80°49.700'	Low-relief spur and groove
350	8/1/2007	Tennessee Light	24°44.765	80°46.905'	Low-relief hard-bottom (< 6 m)
113	8/1/2007	NE of Tennessee Light	24°45.286	80°46.260'	Low-relief spur and groove
108	8/1/2007	Tennessee Reef RO**	24°45.770	80°45.339'	Low-relief spur and groove
109	8/1/2007	Tennessee Reef RO**	24°45.877	80°45.264'	Low-relief spur and groove
114	8/2/2007	South of Lower Matecumbe	24°47.703	80°41.647'	Patchy hard-bottom (> 6 m)
101	8/2/2007	South of Lower Matecumbe	24°47.891	80°41.411'	Low-relief hard-bottom (> 6 m)
102	8/2/2007	South of Lower Matecumbe	24°48.033	80°41.112'	Low-relief spur and groove
351	8/2/2007	South of Indian Key	24°48.942	80°40.146'	Low-relief hard-bottom (> 6 m)
81	8/2/2007	Alligator Reef SPA**	24°50.752	80°37.423'	Low-relief hard-bottom (< 6 m)
82	8/2/2007	Alligator Reef SPA**	24°50.829	80°37.313'	Low-relief hard-bottom (< 6 m)
103	8/2/2007	NE of Alligator Light	24°51.649	80°35.690'	Low-relief hard-bottom (< 6 m)
104	8/2/2007	NE of Alligator Light	24°52.197	80°34.786'	Low-relief hard-bottom (> 6 m)
96	8/2/2007	South of Windley Key	24°52.439	80°35.131'	Patchy hard-bottom (> 6 m)
86	8/2/2007	South of Windley Key	24°53.449	80°34.921'	Low-relief hard-bottom (< 6 m)
72	8/3/2007	Cheeca Rocks SPA**	24°54.239	80°36.986'	Mid-channel patch reef
73	8/3/2007	Cheeca Rocks SPA**	24°54.263	80°37.076'	Mid-channel patch reef
68	8/3/2007	East of Cheeca Rocks SPA	24°54.230	80°36.607'	Mid-channel patch reef
70	8/3/2007	Hen and Chickens SPA**	24°56.025	80°33.062'	Mid-channel patch reef
71	8/3/2007	Hen and Chickens SPA**	24°56.068	80°32.922'	Mid-channel patch reef
69	8/3/2007	Tavernier Rocks	24°56.580	80°33.235'	Mid-channel patch reef
75	8/3/2007	Inshore of Conch Reef SPA	24°57.268	80°30.274'	Offshore patch reef
74	8/3/2007	Inshore of Conch Reef SPA	24°57.252	80°29.768'	Offshore patch reef
80	8/4/2007	Davis Reef SPA**	24°55.232	80°30.356'	Low-relief spur and groove
276	8/4/2007	Davis Reef SPA**	24°55.360	80°30.217'	Low-relief spur and groove
97	8/4/2007	Davis Reef SPA**	24°55.418	80°30.294'	Low-relief hard-bottom (< 6 m)
90	8/4/2007	Davis Reef SPA**	24°55.351	80°30.350'	Low-relief hard-bottom (< 6 m)
352	8/4/2007	Little Conch Reef	24°56.448	80°28.643'	Low-relief hard-bottom (< 6 m)
76	8/4/2007	Inshore of Conch Reef SPA	24°57.497	80°29.410'	Offshore patch reef
77	8/4/2007	Inshore of Conch Reef SPA	24°57.647	80°29.304'	Offshore patch reef

Site #	Date	Site location	Latitude (N)	Longitude (W)	Habitat type
88	8/11/2007	Little Conch Reef	24°56.633	80°28.351'	Low-relief hard-bottom (< 6 m)
107	8/11/2007	Conch Reef RO**	24°57.162	80°27.152'	Low-relief spur and groove
106	8/11/2007	Conch Reef RO**	24°57.042	80°27.269'	Low-relief spur and groove
105	8/11/2007	Conch Reef SPA**	24°56.853	80°27.508'	Low-relief hard-bottom (> 6 m)
282	8/11/2007	Conch Reef SPA**	24°57.354	80°27.323'	Low-relief spur and groove
269	8/11/2007	Conch Reef SPA**	24°57.321	80°27.466'	Low-relief hard-bottom (< 6 m)
89	8/11/2007	Conch Reef SPA**	24°57.126	80°27.568'	Low-relief hard-bottom (< 6 m)
353	8/11/2007	Conch Reef SPA**	24°57.066	80°27.487'	Low-relief hard-bottom (> 6 m)
354	8/11/2007	Conch Reef SPA**	24°57.331	80°27.271'	Low-relief spur and groove
355	8/11/2007	NE of Conch Reef	24°57.484	80°27.146'	Low-relief spur and groove
17	8/12/2007	Little Pickles Reef	24°58.598	80°25.633'	Low-relief hard-bottom (< 6 m)
48	8/12/2007	Little Pickles Reef	24°58.257	80°25.845'	Low-relief spur and groove
49	8/12/2007	Little Pickles Reef	24°58.329	80°25.672'	Low-relief spur and groove
18	8/12/2007	Pickles Reef	24°59.314	80°24.844'	High-relief spur and groove
19	8/12/2007	Pickles Reef	24°59.553	80°24.527'	High-relief spur and groove
20	8/12/2007	Pickles Reef	24°59.390	80°24.781'	High-relief spur and groove
5	8/12/2007	Inshore of Pickles Reef	24°59.162	80°26.964'	Offshore patch reef
1	8/12/2007	Inshore of Molasses Reef	25°01.109	80°26.336'	Mid-channel patch reef
31	8/13/2007	Molasses Reef SPA**	25°00.511	80°22.618'	High-relief spur and groove
32	8/13/2007	Molasses Reef SPA	25°00.563	80°22.505	High-relief spur and groove
356	8/13/2007	Sand Island	25°01.095	80°22.092	High-relief spur and groove
357	8/13/2007	Sand Island	25°01.164	80°22.008	High-relief spur and groove
8	8/13/2007	Inshore of French Reef	25°02.568	80°22.721	Offshore patch reef
7	8/13/2007	Inshore of Molasses Reef	25°00.810	80°24.369	Offshore patch reef
6	8/13/2007	Inshore of Molasses Reef	25°00.627	80°24.656	Offshore patch reef
21	8/14/2007	SW of French Reef SPA	25°01.802	80°21.302	Low-relief hard-bottom (> 6 m)
22	8/14/2007	SW of French Reef SPA	25°01.825	80°21.187	Low-relief hard-bottom (> 6 m)
23	8/14/2007	SW of French Reef SPA	25°01.938	80°21.105	High-relief spur and groove
29	8/14/2007	French Reef SPA	25°02.019	80°20.951	High-relief spur and groove
30	8/14/2007	French Reef SPA	25°02.119	80°20.870	High-relief spur and groove
42	8/14/2007	Dixie Shoal	25°03.845	80°19.764	Patchy hard-bottom (> 6 m)
43	8/14/2007	Dixie Shoal	25°04.435	80°19.299	Patchy hard-bottom (> 6 m)
44	8/14/2007	Dixie Shoal	25°05.527	80°19.529	Patchy hard-bottom (< 6 m)
358	8/15/2007	Inshore of Watson's Reef	25°10.379	80°15.044	Reef terrace
454	8/15/2007	Northwest of Whistle Buoy	25°19.969	80°09.903	Offshore patch reef
406	8/15/2007	Offshore of Broad Creek	25°20.505	80°11.128	Mid-channel patch reef
408	8/15/2007	Offshore of Broad Creek	25°21.062	80°11.412	Mid-channel patch reef
456	8/15/2007	Inshore of Pacific Reef	25°21.487	80°09.403	Offshore patch reef
458	8/15/2007	Inshore of Pacific Reef	25°21.901	80°09.452	Offshore patch reef
410	8/16/2007	Inshore of Pacific Reef	25°21.833	80°10.090	Mid-channel patch reef
413	8/16/2007	Inshore of Pacific Reef	25°22.668	80°10.762	Mid-channel patch reef
464	8/16/2007	Pacific Reef	25°22.334	80°08.374	High-relief spur and groove
459	8/16/2007	NW of Pacific Reef	25°23.076	80°08.922	Offshore patch reef
469	8/16/2007	South of Ajax Reef	25°23.489	80°08.065	Low-relief hard-bottom (< 6 m)
465	8/16/2007	Ajax Reef	25°23.998	80°07.860	High-relief spur and groove
466	8/16/2007	Ajax Reef	25°24.267	80°07.835	High-relief spur and groove
419	8/16/2007	Inshore of Ajax Reef	25°24.414	80°10.063	Mid-channel patch reef
421	8/17/2007	Margot Fish Shoal	25°25.252	80°09.305	Mid-channel patch reef
467	8/17/2007	Long Reef	25°25.321	80°07.554	High-relief spur and groove
427	8/17/2007	Margot Fish Shoal	25°26.750	80°09.317	Mid-channel patch reef
460	8/17/2007	NW of Long Reef	25°27.299	80°07.630	Offshore patch reef
461	8/17/2007	NW of Long Reef	25°27.500	80°08.056	Offshore patch reef
437	8/17/2007	South of Legare Anchorage	25°27.607	80°08.742	Mid-channel patch reef
438	8/17/2007	South of Bache Shoal	25°28.344	80°08.880	Mid-channel patch reef
440	8/17/2007	South of Bache Shoal	25°28.502	80°08.634	Mid-channel patch reef
475	8/18/2007	Fowey Rocks	25°35.495	80°06.325	Low-relief hard-bottom (< 6 m)
474	8/18/2007	Brewster Reef	25°33.978	80°06.206	High-relief spur and groove
472	8/18/2007	Star Reef	25°32.247	80°06.217	High-relief spur and groove
471	8/18/2007	Northwest of Triumph Reef	25°30.393	80°07.262	Offshore patch reef
445	8/18/2007	Northern Legare Anchorage	25°30.490	80°07.915	Mid-channel patch reef

Site #	Date	Site location	Latitude (N)	Longitude (W)	Habitat type
470	8/18/2007	Triumph Reef	25°29.594	80°06.538	High-relief spur and groove
441	8/18/2007	Bache Shoal	25°28.931	80°09.014	Mid-channel patch reef

Table 3. Survey locations for *Acropora* corals, stony coral species richness, *Coralliophila* snails, and urchins in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007. Sites are arranged from northeast to southwest within each habitat type. Asterisked sites (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO). Mean \pm 1 SE depth and max. vertical relief are based upon surveys of four 15-m x 1-m transects surveyed per site.

Site number/site location	Latitude (N)	Longitude (W)	Mean depth (m)	Max. vertical relief (cm)
<i>Mid-channel patch reefs</i>				
Biscayne National Park				
445 - Northern Legare Anchorage	25°30.490'	80°07.915'	8.1 \pm 0.1	103 \pm 8
441 - Bache Shoal	25°28.931'	80°09.014'	3.7 \pm 0.0	79 \pm 6
440 - South of Bache Shoal	25°28.502'	80°08.634'	3.8 \pm 0.3	112 \pm 14
438 - South of Bache Shoal	25°28.344'	80°08.880'	4.9 \pm 0.2	113 \pm 3
437 - South of Legare Anchorage	25°27.607'	80°08.742'	5.4 \pm 0.2	118 \pm 18
427 - Margot Fish Shoal	25°26.750'	80°09.317'	4.8 \pm 0.2	110 \pm 19
421 - Margot Fish Shoal	25°25.252'	80°09.305'	2.9 \pm 0.2	47 \pm 5
419 - Inshore of Ajax Reef	25°24.414'	80°10.063'	4.4 \pm 0.1	84 \pm 13
413 - Inshore of Pacific Reef	25°22.668'	80°10.762'	3.9 \pm 0.1	46 \pm 14
410 - Inshore of Pacific Reef	25°21.833'	80°10.090'	4.7 \pm 0.2	72 \pm 19
408 - Offshore of Broad Creek	25°21.062'	80°11.412'	3.0 \pm 0.2	67 \pm 10
406 - Offshore of Broad Creek	25°20.505'	80°11.128'	5.5 \pm 0.0	79 \pm 15
Biscayne National Park Total (12)			4.6 \pm 0.4	86 \pm 7
Upper Florida Keys NMS				
4 - Basin Hill Shoals	25°12.886'	80°16.790'	1.8 \pm 0.1	90 \pm 11
2 - Near Cannon Patch Reef	25°06.518'	80°20.497'	2.5 \pm 0.1	38 \pm 5
3 - Near Cannon Patch Reef	25°06.206'	80°20.638'	1.8 \pm 0.0	45 \pm 8
1 - Inshore of Molasses Reef	25°01.109'	80°26.336'	3.0 \pm 0.2	65 \pm 10
Upper Florida Keys Total (4)			2.3 \pm 0.3	59 \pm 12
Middle Florida Keys NMS				
69 - Tavernier Rocks	24°56.580'	81°33.235'	3.9 \pm 0.1	206 \pm 19
71 - Hen and Chickens SPA**	24°56.068'	81°32.922'	4.5 \pm 0.3	183 \pm 27
70 - Hen and Chickens SPA**	24°56.025'	81°33.062'	4.3 \pm 0.0	208 \pm 23
68 - East of Cheeca Rocks SPA	24°54.230'	81°36.607'	4.0 \pm 0.1	171 \pm 9
72 - Cheeca Rocks SPA**	24°54.239'	81°36.986'	3.4 \pm 0.2	133 \pm 9
73 - Cheeca Rocks SPA**	24°54.263'	81°37.076'	4.0 \pm 0.1	84 \pm 4
66 - East Turtle Shoal	24°42.957'	81°56.903'	6.5 \pm 0.1	58 \pm 3
254 - East Turtle Shoal	24°42.613'	81°56.933'	5.5 \pm 0.3	106 \pm 10
Middle Florida Keys Total (8)			4.5 \pm 0.4	143 \pm 20
Lower Florida Keys NMS				
122 - North of Big Pine Shoal	24°36.119'	81°19.120'	8.5 \pm 0.0	29 \pm 5
121 - North of Maryland Shoal	24°32.562'	81°34.326'	6.6 \pm 0.3	62 \pm 12
120 - North of Maryland Shoal	24°32.317'	81°34.560'	6.1 \pm 0.1	61 \pm 10
119 - North of Pelican Shoal	24°31.923'	81°37.551'	5.4 \pm 0.3	72 \pm 18
118 - East of Western Sambo ER	24°31.467'	81°40.626'	5.3 \pm 0.1	57 \pm 11
126 - Western Sambo ER**	24°30.866'	81°41.723'	6.5 \pm 0.3	65 \pm 10
125 - Western Sambo ER**	24°30.411'	81°42.539'	6.4 \pm 0.0	49 \pm 12
124 - Western Sambo ER**	24°30.350'	81°42.380'	6.5 \pm 0.2	49 \pm 10
123 - Western Sambo ER**	24°30.324'	81°43.247'	5.3 \pm 0.1	32 \pm 5
117 - NW of Sand Key SPA	24°28.659'	81°53.728'	5.4 \pm 0.0	59 \pm 11
116 - North of Satan Shoal	24°28.579'	81°57.223'	6.0 \pm 0.2	40 \pm 7
115 - North of Satan Shoal	24°28.861'	81°57.420'	5.7 \pm 0.2	59 \pm 10
Lower Florida Keys Total (12)			6.1 \pm 0.3	53 \pm 4
Mid-channel Patch Reef Total (36)			4.8 \pm 0.3	85 \pm 8
<i>Offshore patch reefs</i>				
Biscayne National Park				
471 - Northwest of Triumph Reef	25°30.393'	80°07.262'	4.3 \pm 0.0	55 \pm 9
461 - NW of Long Reef	25°27.500'	80°08.056'	5.0 \pm 0.1	74 \pm 8

Site number/site location	Latitude (N)	Longitude (W)	Mean depth (m)	Max. vertical relief (cm)
460 - NW of Long Reef	25°27.299'	80°07.630'	11.3 ± 0.1	116 ± 11
459 - NW of Pacific Reef	25°23.076'	80°08.922'	7.3 ± 0.0	65 ± 6
458 - Inshore of Pacific Reef	25°21.901'	80°09.452'	3.8 ± 0.1	45 ± 12
456 - Inshore of Pacific Reef	25°21.487'	80°09.403'	10.0 ± 0.0	84 ± 7
454 - Northwest of Whistle Buoy	25°19.969'	80°09.903'	11.2 ± 0.1	63 ± 9
Biscayne National Park Total (7)			7.6 ± 1.2	71 ± 9
Upper Florida Keys NMS				
16 - North of Carysfort Reef SPA	25°15.414'	80°12.172'	10.6 ± 0.2	54 ± 8
15 - North of Carysfort Reef SPA	25°15.387'	80°12.651'	3.6 ± 0.1	161 ± 32
14 - North of Carysfort Reef SPA	25°14.875'	80°12.645'	7.1 ± 0.3	70 ± 7
47 - Carysfort Reef SPA**	25°13.496'	80°12.968'	5.7 ± 0.2	67 ± 13
345 - Carysfort Reef SPA**	25°13.265'	80°12.835'	5.4 ± 0.1	85 ± 17
46 - Carysfort Reef SPA**	25°13.016'	80°13.014'	6.7 ± 0.1	47 ± 8
39 - Carysfort Reef SPA**	25°12.275'	80°13.738'	5.0 ± 0.2	52 ± 3
37 - West of Carysfort Reef SPA	25°13.355'	80°13.474'	3.3 ± 0.1	45 ± 2
13 - Inshore of Watson's Reef	25°10.983'	80°15.604'	5.4 ± 0.8	108 ± 24
55 - Inshore of Watson's Reef	25°10.692'	80°14.858'	11.7 ± 0.1	59 ± 9
358 - Inshore of Watson's Reef	25°10.379'	80°15.044'	13.1 ± 0.4	74 ± 10
54 - Inshore of Watson's Reef	25°10.247'	80°15.072'	13.0 ± 0.1	67 ± 10
347 - Inshore of Watson's Reef	25°09.601'	80°15.824'	8.2 ± 0.4	34 ± 2
12 - Inshore of Watson's Reef	25°09.572'	80°15.952'	9.7 ± 0.1	54 ± 10
9 - White Banks	25°03.546'	80°21.450'	3.7 ± 0.1	62 ± 15
8 - Inshore of French Reef	25°02.568'	80°22.721'	2.5 ± 0.1	41 ± 5
7 - Inshore of Molasses Reef	25°00.810'	80°24.369'	4.2 ± 0.1	59 ± 9
6 - Inshore of Molasses Reef	25°00.627'	80°24.656'	5.5 ± 0.4	97 ± 8
5 - Inshore of Pickles Reef	24°59.162'	80°26.964'	5.7 ± 0.1	79 ± 17
Upper Florida Keys Total (19)			6.8 ± 0.8	69 ± 7
Middle Florida Keys NMS				
77 - Inshore of Conch Reef SPA	24°57.647'	80°29.304'	4.2 ± 0.0	62 ± 11
76 - Inshore of Conch Reef SPA	24°57.497'	80°29.410'	4.5 ± 0.2	76 ± 9
75 - Inshore of Conch Reef SPA	24°57.268'	80°30.274'	4.2 ± 0.1	52 ± 9
74 - Inshore of Conch Reef SPA	24°57.252'	80°29.768'	4.3 ± 0.1	33 ± 4
98 - Coffins Patch SPA**	24°40.898'	80°58.376'	5.9 ± 0.1	53 ± 8
277 - Coffins Patch SPA**	24°40.892'	80°58.316'	6.7 ± 0.0	44 ± 3
Middle Florida Keys Total (6)			5.0 ± 0.4	53 ± 6
Lower Florida Keys NMS				
133 - Looe Key Research Only**	24°34.051'	81°23.251'	6.2 ± 0.2	60 ± 4
132 - Looe Key Research Only**	24°33.705'	81°24.325'	7.1 ± 0.1	80 ± 12
131 - North of Looe Key SPA**	24°31.396'	81°33.686'	6.8 ± 0.0	54 ± 5
130 - Maryland Shoal	24°31.070'	81°36.557'	9.1 ± 0.1	47 ± 7
129 - North of Maryland Shoal	24°30.840'	81°35.658'	7.0 ± 0.4	93 ± 4
165 - North of Maryland Shoal	24°30.155'	81°39.389'	9.3 ± 0.2	55 ± 6
128 - NE of Eastern Sambo RO	24°29.984'	81°41.926'	8.8 ± 0.1	87 ± 12
135 - Western Sambo ER**	24°29.381'	81°43.495'	8.0 ± 0.2	61 ± 8
168 - Western Sambo ER**	24°27.626'	81°54.195'	9.4 ± 0.1	86 ± 7
127 - West of Sand Key SPA	24°34.088'	81°23.100'	11.5 ± 0.4	146 ± 34
Lower Florida Keys Total (10)			8.3 ± 0.5	77 ± 9
Offshore Patch Reef Total (42)			7.0 ± 0.4	69 ± 4
<i>Hard-bottom/rubble/sand matrix</i>				
Upper Florida Keys NMS				
40 - Carysfort Reef SPA**	25°13.670'	80°12.781'	5.4 ± 0.0	45 ± 4
38 - West of Carysfort Reef SPA	25°14.040'	80°13.995'	3.0 ± 0.0	58 ± 11
36 - West of Carysfort Reef SPA	25°12.381'	80°13.990'	5.2 ± 0.1	71 ± 2
11 - NW of Dry Rocks SPA	25°07.730'	80°18.213'	3.6 ± 0.1	27 ± 3
Upper Florida Keys Total (4)			4.3 ± 0.6	50 ± 9
Hard-bottom Matrix Total (4)			4.3 ± 0.6	50 ± 9

Site number/site location	Latitude (N)	Longitude (W)	Mean depth (m)	Max. vertical relief (cm)
<i>Low-relief hard-bottom (< 6 m)</i>				
Biscayne National Park				
475 - Fowey Rocks	25°35.495'	80°06.325'	4.4 ± 0.0	28 ± 4
469 - South of Ajax Reef	25°23.489'	80°08.065'	3.9 ± 0.1	37 ± 7
Biscayne National Park Total (2)			4.2 ± 0.2	33 ± 5
Upper Florida Keys NMS				
346 - Carysfort Reef SPA**	25°14.129'	80°12.778'	6.2 ± 0.1	68 ± 10
35 - West of Carysfort Reef SPA	25°12.285'	80°14.663'	2.8 ± 0.0	36 ± 2
34 - West of Carysfort Reef SPA	25°12.179'	80°14.269'	4.2 ± 0.1	76 ± 17
33 - Inshore of Watson's Reef	25°10.896'	80°15.522'	3.8 ± 0.1	92 ± 53
17 - Little Pickles Reef	24°58.598'	80°25.633'	5.3 ± 0.1	30 ± 4
Upper Florida Keys Total (5)			4.5 ± 0.6	60 ± 12
Middle Florida Keys NMS				
269 - Conch Reef SPA**	24°57.321'	80°27.466'	5.9 ± 0.1	47 ± 12
89 - Conch Reef SPA**	24°57.126'	80°27.568'	5.0 ± 0.1	37 ± 4
88 - Little Conch Reef	24°56.633'	80°28.351'	4.8 ± 0.1	29 ± 4
352 - Little Conch Reef	24°56.448'	80°28.643'	4.4 ± 0.0	20 ± 2
97 - Davis Reef SPA**	24°55.418'	80°30.294'	5.0 ± 0.0	31 ± 5
90 - Davis Reef SPA**	24°55.351'	80°30.350'	6.3 ± 0.1	47 ± 7
86 - South of Windley Key	24°53.449'	80°34.921'	3.9 ± 0.0	27 ± 4
103 - NE of Alligator Light	24°51.649'	80°35.690'	5.4 ± 0.1	22 ± 2
82 - Alligator Reef SPA**	24°50.829'	80°37.313'	4.7 ± 0.1	36 ± 5
81 - Alligator Reef SPA**	24°50.752'	80°37.423'	5.8 ± 0.1	37 ± 6
350 - Tennessee Light	24°44.765'	80°46.905'	5.7 ± 0.1	30 ± 3
85 - East of Coffins Patch SPA	24°41.743'	80°56.131'	5.3 ± 0.1	30 ± 5
92 - Coffins Patch SPA**	24°41.212'	80°57.834'	4.0 ± 0.1	33 ± 4
91 - Coffins Patch SPA**	24°41.109'	80°57.864'	5.6 ± 0.1	26 ± 3
Middle Florida Keys Total (14)			5.1 ± 0.2	32 ± 2
Lower Florida Keys NMS				
161 - West of American Shoal	24°31.052'	81°32.644'	5.3 ± 0.1	29 ± 5
140 - Maryland Shoal	24°30.738'	81°33.837'	5.4 ± 0.0	30 ± 9
159 - North of Pelican Shoal	24°30.308'	81°37.233'	4.8 ± 0.0	20 ± 3
158 - East of No Name Reef	24°29.945'	81°38.848'	4.9 ± 0.1	26 ± 5
Lower Florida Keys Total (4)			5.1 ± 0.1	26 ± 2
Hard-bottom (< 6 m) Total (25)			4.9 ± 0.2	37 ± 3
<i>Inner line reef tract spur & groove</i>				
Upper Florida Keys NMS				
61 - Turtle Reef	25°17.997'	80°12.894'	4.7 ± 0.4	110 ± 29
60 - Inshore of Elbow Reef SPA	25°09.361'	80°17.284'	3.5 ± 0.0	76 ± 13
59 - Inshore of Elbow Reef SPA	25°09.046'	80°17.513'	3.3 ± 0.2	105 ± 51
58 - Horseshoe Reef	25°08.405'	80°17.662'	3.2 ± 0.1	90 ± 9
62 - Dry Rocks SPA**	25°07.436'	80°17.851'	2.2 ± 0.1	71 ± 21
63 - Dry Rocks SPA**	25°07.370'	80°17.904'	2.2 ± 0.2	85 ± 14
65 - Grecian Rocks SPA**	25°06.770'	80°18.239'	2.3 ± 0.2	55 ± 10
64 - Grecian Rocks SPA**	25°06.572'	80°18.385'	1.9 ± 0.1	93 ± 17
Upper Florida Keys Total (8)			2.9 ± 0.3	86 ± 6
Inner Line Spur & Groove Total (8)			2.9 ± 0.3	86 ± 6
<i>High-relief spur & groove</i>				
Biscayne National Park				
474 - Brewster Reef	25°33.978'	80°06.206'	5.2 ± 0.2	103 ± 7
472 - Star Reef	25°32.247'	80°06.217'	4.3 ± 0.0	52 ± 3
470 - Triumph Reef	25°29.594'	80°06.538'	5.4 ± 0.1	54 ± 11
467 - Long Reef	25°25.321'	80°07.554'	3.8 ± 0.1	42 ± 1
466 - Ajax Reef	25°24.267'	80°07.835'	4.0 ± 0.1	57 ± 13
465 - Ajax Reef	25°23.998'	80°07.860'	4.7 ± 0.1	49 ± 2
464 - Pacific Reef	25°22.334'	80°08.374'	4.5 ± 0.1	58 ± 6
Biscayne National Park Total (7)			4.6 ± 0.2	59 ± 8

Site number/site location	Latitude (N)	Longitude (W)	Mean depth (m)	Max. vertical relief (cm)
Upper Florida Keys NMS				
26 - Carysfort Reef SPA**	25°13.565'	80°12.503'	4.3 ± 0.3	95 ± 16
25 - Carysfort Reef SPA**	25°13.258'	80°12.750'	1.8 ± 0.2	100 ± 19
218 - South Carysfort Reef SPA**	25°12.599'	80°13.223'	1.0 ± 0.2	93 ± 10
217 - South Carysfort Reef SPA**	25°12.569'	80°13.172'	1.8 ± 0.2	74 ± 23
24 - Maitland Grounding Site	25°11.953'	80°13.538'	3.8 ± 0.2	76 ± 13
28 - Elbow Reef SPA**	25°08.562'	80°15.499'	3.7 ± 0.3	72 ± 6
27 - Elbow Reef SPA**	25°08.395'	80°15.595'	4.6 ± 0.1	61 ± 7
30 - French Reef SPA**	25°02.119'	80°20.870'	7.3 ± 0.2	197 ± 33
29 - French Reef SPA**	25°02.019'	80°20.951'	7.5 ± 0.3	209 ± 39
23 - SW of French Reef SPA	25°01.938'	80°21.105'	6.1 ± 0.3	56 ± 14
357 - Sand Island	25°01.164'	80°22.008'	4.8 ± 0.3	93 ± 26
356 - Sand Island	25°01.095'	80°22.092'	4.8 ± 0.3	99 ± 9
32 - Molasses Reef SPA**	25°00.563'	80°22.505'	4.7 ± 0.2	91 ± 7
31 - Molasses Reef SPA**	25°00.511'	80°22.618'	5.3 ± 0.2	140 ± 33
19 - Pickles Reef	24°59.553'	80°24.527'	4.8 ± 0.1	32 ± 9
20 - Pickles Reef	24°59.390'	80°24.781'	3.7 ± 0.2	43 ± 9
18 - Pickles Reef	24°59.314'	80°24.844'	3.8 ± 0.2	43 ± 6
Upper Florida Keys Total (17)			4.3 ± 0.4	92 ± 12
Middle Florida Keys NMS				
79 - Delta Shoal	24°37.943'	81°05.317'	4.8 ± 0.1	75 ± 29
78 - Delta Shoal	24°37.928'	81°05.408'	4.3 ± 0.2	80 ± 20
84 - Sombrero Key SPA**	24°37.560'	81°06.711'	4.9 ± 0.2	167 ± 24
83 - Sombrero Key SPA**	24°37.470'	81°06.542'	5.2 ± 0.2	59 ± 5
Middle Florida Keys Total (4)			4.8 ± 0.2	95 ± 24
Lower Florida Keys NMS				
148 - Looe Key SPA**	24°32.770'	81°24.276'	3.1 ± 0.2	101 ± 20
147 - Looe Key SPA**	24°32.711'	81°24.622'	4.6 ± 0.3	236 ± 30
145 - American Shoal	24°31.345'	81°31.476'	6.3 ± 0.3	33 ± 6
146 - American Shoal	24°31.344'	81°31.239'	6.1 ± 0.1	35 ± 5
144 - Maryland Shoal	24°31.383'	81°34.704'	1.8 ± 0.0	66 ± 10
141 - Maryland Shoal	24°31.279'	81°34.690'	4.5 ± 0.3	75 ± 13
143 - Maryland Shoal	24°31.249'	81°34.856'	5.0 ± 0.1	43 ± 3
139 - Pelican Shoal	24°30.192'	81°37.358'	3.4 ± 0.3	65 ± 16
138 - No Name Reef	24°29.755'	81°38.858'	4.7 ± 0.3	185 ± 30
137 - No Name Reef	24°29.746'	81°38.944'	5.3 ± 0.0	159 ± 10
150 - Eastern Sambo RO**	24°29.560'	81°39.658'	2.8 ± 0.3	81 ± 24
149 - Eastern Sambo RO**	24°29.509'	81°39.787'	2.8 ± 0.1	105 ± 29
348 - Middle Sambo Reef	24°29.377'	81°40.327'	2.8 ± 0.3	55 ± 7
309 - Middle Sambo Reef	24°29.302'	81°40.546'	2.7 ± 0.2	44 ± 2
152 - Western Sambo ER**	24°28.975'	81°42.203'	3.9 ± 0.5	151 ± 29
151 - Western Sambo ER**	24°28.935'	81°42.364'	2.2 ± 0.1	62 ± 4
136 - East of Eastern Dry Rocks SPA	24°27.849'	81°50.291'	4.2 ± 0.2	70 ± 14
154 - Eastern Dry Rocks SPA**	24°27.631'	81°50.522'	3.5 ± 0.3	111 ± 42
153 - Eastern Dry Rocks SPA**	24°27.557'	81°50.693'	2.0 ± 0.2	69 ± 8
156 - Rock Key SPA**	24°27.361'	81°51.327'	4.2 ± 0.1	83 ± 11
155 - Rock Key SPA**	24°27.274'	81°51.451'	2.6 ± 0.1	120 ± 63
325 - Sand Key SPA**	24°27.171'	81°52.521'	2.7 ± 0.3	39 ± 9
157 - Sand Key SPA**	24°27.134'	81°52.665'	3.0 ± 0.3	86 ± 4
Lower Florida Keys Total (23)			3.7 ± 0.3	90 ± 11
High-relief Spur & Groove Total (51)			4.1 ± 0.2	87 ± 7
<i>Low-relief hard-bottom (6-15 m)</i>				
Upper Florida Keys NMS				
53 - Carysfort Reef SPA**	25°12.918'	80°12.664'	8.8 ± 0.3	30 ± 2
240 - Carysfort Reef SPA**	25°12.627'	80°12.865'	7.7 ± 0.3	28 ± 7
57 - Inshore of Watson's Reef	25°11.260'	80°13.892'	7.8 ± 0.2	40 ± 6
45 - Offshore of Dry Rocks SPA	25°07.756'	80°16.190'	11.4 ± 0.1	57 ± 5
22 - SW of French Reef SPA	25°01.825'	80°21.187'	8.5 ± 0.2	34 ± 10

Site number/site location	Latitude (N)	Longitude (W)	Mean depth (m)	Max. vertical relief (cm)
21 - SW of French Reef SPA	25°01.802'	80°21.302'	8.5 ± 0.1	62 ± 5
Upper Florida Keys Total (6)			8.8 ± 0.6	42 ± 6
<i>Middle Florida Keys NMS</i>				
353 - Conch Reef SPA**	24°57.066'	80°27.487'	10.8 ± 0.2	46 ± 6
105 - Conch Reef SPA**	24°56.853'	80°27.508'	10.5 ± 0.1	47 ± 9
104 - NE of Alligator Light	24°52.197'	80°34.786'	10.5 ± 0.2	10 ± 2
351 - South of Indian Key	24°48.942'	80°40.146'	8.5 ± 0.1	19 ± 6
101 - South of Lower Matecumbe	24°47.891'	80°41.411'	7.8 ± 0.1	40 ± 16
111 - West of Sombrero Key	24°37.234'	81°08.135'	8.3 ± 0.2	39 ± 4
Middle Florida Keys Total (6)			9.4 ± 0.5	33 ± 6
<i>Lower Florida Keys NMS</i>				
180 - South of Bahia Honda Key	24°35.406'	81°14.499'	8.6 ± 0.0	40 ± 9
173 - Maryland Shoal	24°30.922'	81°33.493'	7.4 ± 0.1	27 ± 2
177 - NE of Satan Shoal	24°26.834'	81°58.272'	12.9 ± 0.1	44 ± 4
Lower Florida Keys Total (3)			9.6 ± 1.7	37 ± 5
Hard-bottom (6-15 m) Total (15)			9.2 ± 0.4	37 ± 3
<i>Patchy hard-bottom (6-15 m)</i>				
<i>Upper Florida Keys NMS</i>				
56 - Inshore of Watson's Reef	25°11.099'	80°14.538'	8.0 ± 0.3	52 ± 7
44 - Dixie Shoal	25°05.527'	80°19.529'	4.8 ± 0.1	45 ± 13
43 - Dixie Shoal	25°04.435'	80°19.299'	7.2 ± 0.1	35 ± 6
42 - Dixie Shoal	25°03.845'	80°19.764'	7.1 ± 0.1	34 ± 6
Upper Florida Keys Total (4)			6.8 ± 0.7	41 ± 4
<i>Middle Florida Keys NMS</i>				
96 - South of Windley Key	24°52.439'	80°35.131'	7.6 ± 0.1	35 ± 10
114 - South of Lower Matecumbe	24°47.703'	80°41.647'	8.2 ± 0.0	21 ± 8
94 - South of Duck Key	24°42.365'	80°53.428'	7.1 ± 0.1	47 ± 13
93 - South of Duck Key	24°42.147'	80°54.250'	8.4 ± 0.1	33 ± 9
Middle Florida Keys Total (4)			7.8 ± 0.3	34 ± 5
<i>Lower Florida Keys NMS</i>				
338 - South of Bahia Honda Key	24°35.524'	81°15.524'	9.0 ± 0.1	48 ± 7
179 - West of American Shoal	24°31.539'	81°32.329'	9.8 ± 0.0	57 ± 5
160 - North of Pelican Shoal	24°30.693'	81°37.312'	5.8 ± 0.1	37 ± 4
164 - West of Pelican Shoal	24°30.069'	81°38.306'	7.7 ± 0.1	29 ± 5
178 - West of Pelican Shoal	24°29.981'	81°38.232'	7.5 ± 0.2	47 ± 8
166 - Eastern Sambo RO**	24°29.698'	81°39.516'	5.8 ± 0.3	21 ± 3
332 - Eastern Sambo RO**	24°29.509'	81°39.976'	6.8 ± 0.1	36 ± 4
334 - Western Sambo ER**	24°29.132'	81°41.866'	7.6 ± 0.1	33 ± 6
167 - Western Sambo ER**	24°28.875'	81°43.484'	7.8 ± 0.1	45 ± 7
163 - West of Western Sambo ER	24°28.760'	81°45.687'	10.2 ± 0.1	66 ± 2
335 - Sand Key SPA**	24°27.075'	81°52.852'	9.4 ± 0.3	48 ± 6
169 - Sand Key SPA**	24°27.229'	81°52.895'	7.2 ± 0.1	67 ± 11
162 - West of Western Dry Rocks	24°27.128'	81°55.290'	10.2 ± 0.3	57 ± 15
Lower Florida Keys Total (13)			8.1 ± 0.4	45 ± 4
Patchy Hard-bottom Total (21)			7.8 ± 0.3	43 ± 3
<i>Low-relief spur & groove (6-15 m)</i>				
<i>Upper Florida Keys NMS</i>				
52 - Carysfort Reef SPA**	25°12.927'	80°12.509'	9.4 ± 0.1	24 ± 5
241 - Carysfort Reef SPA**	25°12.912'	80°12.759'	10.8 ± 0.2	61 ± 7
51 - Offshore of Dry Rocks SPA	25°07.193'	80°16.843'	12.5 ± 0.3	47 ± 9
50 - Offshore of Dry Rocks SPA	25°06.881'	80°16.966'	11.1 ± 0.1	41 ± 11
49 - Little Pickles Reef	24°58.329'	80°25.672'	12.8 ± 0.2	50 ± 13
48 - Little Pickles Reef	24°58.257'	80°25.845'	14.0 ± 0.1	48 ± 8
Upper Florida Keys Total (6)			11.8 ± 0.7	45 ± 5
<i>Middle Florida Keys NMS</i>				
355 - NE of Conch Reef	24°57.484'	80°27.146'	15.4 ± 0.1	98 ± 20

Site number/site location	Latitude (N)	Longitude (W)	Mean depth (m)	Max. vertical relief (cm)
282 - Conch Reef SPA**	24°57.354'	80°27.323'	12.8 ± 0.1	36 ± 5
354 - Conch Reef SPA**	24°57.331'	80°27.271'	14.3 ± 0.1	56 ± 7
107 - Conch Reef RO**	24°57.162'	80°27.152'	14.6 ± 0.2	67 ± 12
106 - Conch Reef RO**	24°57.042'	80°27.269'	13.7 ± 0.1	46 ± 8
276 - Davis Reef SPA**	24°55.360'	80°30.217'	10.1 ± 0.1	31 ± 7
80 - Davis Reef SPA**	24°55.232'	80°30.356'	10.1 ± 0.0	20 ± 3
102 - South of Lower Matecumbe	24°48.033'	80°41.112'	11.5 ± 0.0	69 ± 2
109 - Tennessee Reef RO**	24°45.877'	80°45.264'	9.3 ± 0.1	60 ± 8
108 - Tennessee Reef RO**	24°45.770'	80°45.339'	9.8 ± 0.1	84 ± 20
113 - NE of Tennessee Light	24°45.286'	80°46.260'	8.1 ± 0.0	41 ± 8
349 - South of Conch Key	24°43.449'	80°49.700'	11.0 ± 0.0	26 ± 1
100 - South of Conch Key	24°42.998'	80°50.446'	13.4 ± 0.1	41 ± 4
99 - East of Delta Shoal	24°38.274'	81°04.211'	9.0 ± 0.1	19 ± 3
110 - Sombrero Key SPA**	24°37.520'	81°06.373'	11.5 ± 0.1	63 ± 10
287 - Sombrero Key SPA**	24°37.415'	81°06.628'	12.0 ± 0.1	39 ± 5
Middle Florida Keys Total (16)			11.7 ± 0.5	50 ± 6
Lower Florida Keys NMS				
337 - South of Bahia Honda Key	24°34.636'	81°16.677'	11.0 ± 0.1	14 ± 2
174 - Looe Key SPA**	24°32.788'	81°23.903'	10.2 ± 0.3	31 ± 4
339 - Looe Key SPA**	24°32.468'	81°23.950'	10.6 ± 0.2	35 ± 4
142 - American Shoal	24°31.243'	81°31.354'	10.7 ± 0.1	27 ± 4
172 - East of Eastern Sambo RO	24°29.624'	81°39.068'	11.2 ± 0.1	67 ± 8
340 - Eastern Sambo RO**	24°29.543'	81°39.445'	9.5 ± 0.2	45 ± 7
175 - Eastern Sambo RO**	24°29.443'	81°39.801'	9.1 ± 0.0	70 ± 10
171 - Middle Sambo Reef	24°29.329'	81°40.175'	10.5 ± 0.2	76 ± 10
170 - Middle Sambo Reef	24°29.204'	81°40.642'	9.5 ± 0.1	67 ± 23
341 - Western Sambo ER**	24°28.694'	81°43.101'	10.9 ± 0.1	80 ± 18
176 - Western Sambo ER**	24°28.672'	81°43.337'	10.5 ± 0.4	65 ± 8
Lower Florida Keys Total (11)			10.3 ± 0.2	52 ± 7
Low-relief Spur & Groove Total (33)			11.2 ± 0.3	50 ± 4

Table 4. Site descriptions for survey locations in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007. Sites are arranged from northeast to southwest within each habitat type and asterisked locations (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

Habitat type/site number and location	Site description
<i>Mid-channel patch reefs</i>	
Biscayne National Park	
445 - Northern Legare Anchorage	Offshore patch reef northwest of Triumph Reef, 12-16 feet, original waypoint was dense seagrass inshore of Star Reef, site was not hard-bottom, but an eroded elkhorn coral ridge, wave swept and dominated by gorgonians, small <i>Acropora palmata</i> observed along transects, numerous small colonies of <i>Acropora cervicornis</i>
441 - Bache Shoal	Mid-channel patch reef at Bache Shoal, 9-15 feet, large halo patch near marker, visibility poor, silty with large gorgonians and moderate relief, some large colonies of <i>M. cavernosa</i> , <i>S. siderea</i> and <i>Diploria</i> , no <i>Acropora</i> observed at site
440 - South of Bache Shoal	Mid-channel patch reef south of Bache Shoal, 8-19 feet, large linear mound, periphery with large head corals, interior of site with abundant <i>Porites astreoides</i> and sea fans, no <i>Acropora</i> observed at site
438 - South of Bache Shoal	Mid-channel patch reef south of Bache Shoal, 11-23 feet, large mound with high relief, large <i>Montastraea</i> colonies, very cavernous, abundant <i>Dictyota</i> , <i>Halimeda</i> and <i>Erythropodium</i> , numerous damselfish territories, small <i>Acropora cervicornis</i> observed at site, but not in transects
437 - South of Legare Anchorage	Mid-channel patch reef south of Legare Anchorage, 14-22 feet, large mound with high relief, 24 feet in sand, dominated by <i>Dictyota</i> algae, <i>Porites</i> , and mostly dead <i>Montastraea</i> heads, no <i>Acropora</i> observed at site
427 - Margot Fish Shoal	Mid-channel patch reef near Margot Fish Shoal, 13-21 feet, ~20 m in diameter, silty and surrounded by <i>Thalassia</i> seagrass, high relief and dominated by algal turf and gorgonians, no <i>Acropora</i> observed at site
421 - Margot Fish Shoal	Mid-channel patch reef south of Margot Fish Shoal marker, 7-14 feet, large mound, abundant <i>Porites</i> finger corals and <i>Echinometra</i> urchins, 15 feet in sand, dominated by <i>P. furcata</i> , <i>Erythropodium</i> , <i>S. siderea</i> and <i>P. astreoides</i> , water temperature 87°F, no <i>Acropora</i> observed at site
419 - Inshore of Ajax Reef	Mid-channel patch reef inshore of Ajax Reef, 11-20 feet, silty, 21 feet in sand halo, very high relief with abundant but mostly dead coral heads, water temperature 87°F, no <i>Acropora</i> observed at site
413 - Inshore of Pacific Reef	Mid-channel reef inshore of Pacific Reef, 10-16 feet, large mound, silty with abundant gorgonians, very few large corals, dominated by encrusting <i>Briareum</i> and <i>Erythropodium</i> , large gorgonians, no <i>Acropora</i> observed at site
410 - Inshore of Pacific Reef	Mid-channel reef inshore of Pacific Reef, 11-20 feet, large mound, ~40 m in diameter, abundant <i>Porites</i> finger corals, water temperature 85°C, <i>Acropora cervicornis</i> present on transects
408 - Offshore of Broad Creek	Mid-channel patch reef within Biscayne National Park, offshore of Broad Creek, 6-13 feet, bounded by dense <i>Thalassia</i> seagrass bed, relatively low profile, some <i>Montastraea</i> coral heads, abundant <i>Porites</i> finger corals and <i>Echinometra</i> urchins, no <i>Acropora</i> observed within site
406 - Offshore of Broad Creek	Mid-channel patch reef within Biscayne National Park, offshore of Broad Creek, 15-21 feet, high relief and dominated by gorgonians, corals and <i>Dictyota</i> algae, good visibility, abundant thickets of <i>Acropora cervicornis</i> throughout site
Upper Florida Keys NMS	
4 - Basin Hill Shoals	Reference mid-channel patch reef at Basin Hill Shoals, 3-9 feet, poor visibility, small patch reef, large colonies of <i>Montastraea</i> , thicket of staghorn coral on one transect, denuded substratum, very little macroalgae, abundant <i>Echinometra viridis</i>
2 - Near Cannon Patch Reef	Reference mid-channel patch reef near Cannon Patch Reef, 7-10 feet, similar to site 3, little macroalgae, large gorgonians, especially <i>Pseudoplexaura</i> , moderately large colonies of <i>Siderastrea</i> , <i>Stephanocoenia</i> , <i>Dichocoenia</i> , and <i>Diploria</i>
3 - Near Cannon Patch Reef	Reference mid-channel patch reef near Cannon Patch Reef, 5-7 feet, similar to site 2, little macroalgae, large gorgonians, especially <i>Pseudoplexaura</i> , moderately large colonies of <i>Siderastrea</i> , <i>Stephanocoenia</i> , <i>Dichocoenia</i> , and <i>Diploria</i>

Habitat type/site number and location	Site description
1 - Inshore of Molasses Reef	Reference mid-channel patch reef inshore of Molasses Reef, large site with abundant coral heads and large <i>Pseudoplexaura</i> gorgonians, very bad bleaching observed, water temperature 89°F, several large thickets of <i>Acropora cervicornis</i> observed at site, but not sampled within transects
Middle Florida Keys NMS	
69 - Tavernier Rocks	Reference mid-channel patch reef at Tavernier Rocks, northwest of Hen and Chickens SPA, 8-17 feet, decent visibility, patch reef ~20 m in diameter, high relief due to haystack <i>Montastraea</i> , several colonies fractured and overturned, site surrounded by sparse hard-bottom, abundant fishing gear on reef
71 - Hen and Chickens SPA**	Mid-channel patch reef at Hen and Chickens SPA, anchored near central eastern area of SPA, 9-22 feet, very high relief with haystack colonies of <i>Montastraea</i> , many with large patches of <i>Halimeda</i> , water temperature 87°F, bleaching prevalent, with most species and about 20% of all colonies
70 - Hen and Chickens SPA**	Mid-channel patch reef at Hen and Chickens SPA, mooring buoy HC10 near western corner, 9-19 feet, excellent visibility, haystack <i>Montastraea</i> colonies, many with large stands of <i>Halimeda</i> , bleaching prevalent
68 - East of Cheeca Rocks SPA	Reference mid-channel patch reef east of Cheeca Rocks SPA, mooring buoy CH8, 8-17 feet, slightly better visibility, large <i>M. annularis</i> and <i>C. natans</i> heads, <i>Halimeda</i> abundant, very high relief, bleaching prevalent, water temperature 88°F, no <i>Acropora</i> observed at site
72 - Cheeca Rocks SPA**	Mid-channel patch reef at Cheeca Rocks SPA, mooring buoy CH5, 8-15 feet, terrible visibility, very green water due to apparent phytoplankton bloom, large head corals and high relief, abundant <i>Halimeda</i> on many coral heads, bleaching prevalent, no <i>Acropora</i> observed at site
73 - Cheeca Rocks SPA**	Mid-channel patch reef at Cheeca Rocks SPA, mooring buoy CH6, 11-15 feet, terrible visibility, very green water due to apparent phytoplankton bloom, more scattered corals and sand, <i>Halimeda</i> common, bleaching prevalent, no <i>Acropora</i> observed at site
66 - East Turtle Shoal	Reference mid-channel patch reef north of Coffins Patch at East Turtle Shoal, 20-24 feet, sandy with moderate relief, dominated by gorgonians and corals, relatively clean substratum, but not many urchins observed, no <i>Acropora</i> observed at site, water temperature 89°F, bleaching of several corals, including <i>C. natans</i> , <i>Siderastrea</i> , <i>D. labyrinthiformis</i> , <i>A. agaricites</i> , <i>S. intersepta</i> and <i>M. alvicornis</i>
254 - East Turtle Shoal	Reference mid-channel patch reef north of Coffins Patch at East Turtle Shoal, 14-22 feet, original site (67) consisted of dense seagrass patches, secondary site south of site 66, very large corals, especially <i>C. natans</i> and <i>M. cavernosa</i> , high relief, bleaching of most coral species, particularly <i>C. natans</i> , <i>Siderastrea</i> , <i>Porites</i> , <i>Eusmilia</i> , <i>Meandrina</i> , and <i>Millepora</i>
Lower Florida Keys NMS	
122 - North of Big Pine Shoal	Reference mid-channel patch reef north of Big Pine Shoal, 27-29 feet, green water, broken up and very patchy, generally low profile, abundant coral recruits, debris prevalent, especially rope, water temperature 89°F, prevalent paling and bleaching of corals, especially <i>O. diffusa</i> , <i>Siderastrea</i> , and <i>S. intersepta</i>
121 - North of Maryland Shoal	Reference mid-channel patch reef north of Maryland Shoal, 20-27 feet, dominated by gorgonians and large corals, especially <i>M. faveolata</i> and <i>C. natans</i> , abundant <i>Echinometra</i> urchins, <i>A. cervicornis</i> present on transects, paling or bleaching of <i>S. siderea</i> and <i>C. natans</i> , trap rope observed on staghorn coral, water temperature 88°F
120 - North of Maryland Shoal	Reference mid-channel patch reef north of Maryland Shoal, 18-22 feet, north of Maryland Shoal marker, large linear patch, large gorgonians and coral heads, <i>A. cervicornis</i> present on transects, water temperature 88°F
119 - North of Pelican Shoal	Reference mid-channel patch reef north of Pelican Shoal, 16-23 feet, gorgonians and corals dominant, clean substratum and abundant <i>E. viridis</i> urchins, <i>A. cervicornis</i> present on transects, water temperature 88°F, several corals bleaching, especially <i>S. siderea</i> and <i>C. natans</i>
118 - East of Western Sambo ER	Reference mid-channel patch reef east of Western Sambo Ecological Reserve, 15-18 feet, east of reserve, very large site, generally low profile on top, abundant coral recruits, isolated but large colonies of <i>M. cavernosa</i> and <i>C. natans</i> , water temperature 87°F, very little bleaching, no <i>A. cervicornis</i> observed at site

Habitat type/site number and location	Site description
126 - Western Sambo ER**	Mid-channel patch reef within Western Sambo Ecological Reserve, 19-29 feet, northeastern area of reserve, large mound with high relief, silty, large corals, especially <i>M. cavernosa</i> and <i>S. siderea</i> , no <i>A. cervicornis</i> observed at site
125 - Western Sambo ER**	Mid-channel patch reef within Western Sambo Ecological Reserve, 19-23 feet, similar to site 123, but greater relief, larger corals, especially <i>M. cavernosa</i> , <i>S. siderea</i> and <i>S. intersepta</i> , water temperature 87°F, <i>A. cervicornis</i> present
124 - Western Sambo ER**	Mid-channel patch reef within Western Sambo Ecological Reserve, 19-24 feet, large mound, high relief, large gorgonians dominant, <i>A. cervicornis</i> present
123 - Western Sambo ER**	Mid-channel patch reef within Western Sambo Ecological Reserve, 16-19 feet, low profile, large gorgonians and <i>Palythoa</i> , dominant, small corals, <i>A. cervicornis</i> present on transects, water temperature 87°F, poor visibility
117 - NW of Sand Key SPA	Reference mid-channel patch reef northwest of Sand Key SPA, 16-20 feet, small mound, low profile, some coral heads, abundant and large <i>Dictyota</i> algae, water temperature 88°F
116 - North of Satan Shoal	Reference mid-channel patch reef, North of Satan Shoal, 18-22 feet, similar to site 115, low profile, some <i>M. cavernosa</i> heads, <i>Acropora cervicornis</i> present, water temperature 86°F, several coral species pale
115 - North of Satan Shoal	Reference mid-channel patch reef, North of Satan Shoal, 17-20 feet, relatively low profile, dominated by gorgonians, water temperature 87°F, <i>Acropora cervicornis</i> present at site
<i>Offshore patch reefs</i>	
Biscayne National Park	
471 - Northwest of Triumph Reef	Offshore patch reef northwest of Triumph Reef, 12-16 feet, original waypoint was dense seagrass inshore of Star Reef, site was not hard-bottom, but an eroded elkhorn coral ridge, wave swept and dominated by gorgonians, small <i>Acropora palmata</i> observed along transects, numerous small colonies of <i>Acropora cervicornis</i>
461 - NW of Long Reef	Offshore patch reef northwest of Long Reef, 14-18 feet, good visibility, large site with complex substratum, abundant <i>Agaricia</i> corals, sea plumes, sea fans and <i>Dictyota</i> algae, water temperature 87°F, no <i>Acropora</i> observed at site
460 - NW of Long Reef	Offshore patch reef northwest of Long Reef, 33-41 feet, deep linear mound, good visibility, 41 feet in sand, very high relief and abundant corals, <i>Dictyota</i> algae, <i>Erythropodium</i> and <i>Briareum</i> abundant, no <i>Acropora</i> observed at site
459 - NW of Pacific Reef	Offshore patch reef northwest of Pacific Reef, 22-26 feet, large mound with moderate relief, 27 feet in sand, dominated by <i>Dictyota</i> , gorgonians and <i>Porites</i> corals, <i>Acropora cervicornis</i> present on transects
458 - Inshore of Pacific Reef	Offshore patch reef within Biscayne National Park, inshore of Pacific Reef, 11-15 feet, large mound, relatively low profile on top with apparent elkhorn coral framework, dominated by sandy algal turf, <i>Dictyota</i> algae, sea plumes, and <i>Millepora</i> , relatively few scleractinian corals, no <i>Acropora</i> observed at site
456 - Inshore of Pacific Reef	Offshore patch reef within Biscayne National Park, inshore of Pacific Reef, 29-37 feet, dome-shaped mound, relatively deep with distinct halo, large corals and high relief, especially on periphery, large (~ 0.5 m) patch of <i>Acropora cervicornis</i> within transects
454 - Northwest of Whistle Buoy	Offshore patch reef within Biscayne National Park, northwest of Whistle Buoy at SE BNP boundary, 35-39 feet, very large linear mound, excellent visibility, very diverse assemblage of sponges, gorgonians and corals, moderate relief, several small thickets of <i>Acropora cervicornis</i> observed within transects
Upper Florida Keys NMS	
16 - North of Carysfort Reef SPA	Reference offshore patch reef north of Carysfort SPA, 32-37 feet, low-profile mound, large, sandy with some large corals
15 - North of Carysfort Reef SPA	Reference offshore patch reef north of Carysfort SPA, 8-15 feet, elkhorn coral base, sea fans and fire coral abundant, paling and bleaching of <i>Palythoa</i> , one elkhorn coral colony within transects
14 - North of Carysfort Reef SPA	Reference offshore patch reef north of Carysfort SPA, 18-28 feet, similar to site 16, but shallower, large mound, greater relief, abundant sponges
47 - Carysfort Reef SPA**	Offshore patch reef in central-western Carysfort Reef SPA, supposed to be deeper hard-bottom, but high relief, well-defined halo, abundant and large spiny lobster
345 - Carysfort Reef SPA**	Offshore patch reef in northwestern Carysfort Reef SPA, 16-20 feet, relatively small (20-30 m diameter) patch, dead <i>Montastraea annularis</i> colonies along periphery

Habitat type/site number and location	Site description
46 - Carysfort Reef SPA**	Offshore patch reef in central Carysfort SPA, 20-24 feet, supposed to be deeper hard-bottom, periphery lower profile, but interior of site very high relief with elkhorn coral base
39 - Carysfort Reef SPA**	Offshore patch reef in southwestern corner of Carysfort SPA, 14-20 feet, ~20 m diameter patch, bounded by dense seagrass, gorgonians dominant, one small colony of staghorn coral found
37 - West of Carysfort Reef SPA	Reference offshore patch reef west of Carysfort Reef SPA, 9-12 feet, supposed to be shallow hard-bottom, but moderate relief, mounding structure, elkhorn coral base on top, grades into lower profile area, abundant and large <i>Diadema</i> urchins
13 - Inshore of Watson's Reef	Reference offshore patch reef inshore of Watson's Reef, 10-25 feet, bottoms out in sand at 28 feet, large mound with complex and high-relief structure, comprised of mostly dead head corals, especially <i>Montastraea</i> and <i>Siderastrea</i> , one of several patch reefs in general area
55 - Inshore of Watson's Reef	Supposed to be reference patchy hard-bottom inshore of Watson's Reef, but offshore, linear patch reef mounds ~25 m in width and more than 50 m long, several in vicinity, 43 feet in sand, rising to 36-37 feet on top of mound, dominated by algae and gorgonians, but many species of corals
358 - Inshore of Watson's Reef	Replicate for site 54, inshore of Watson's Reef, reef terrace-like habitat, 40-48 feet, dominated by <i>Montastraea</i> heads, slopes down to 50 feet in sand, excellent visibility, corals very speciose, dominated by <i>Dictyota</i> and <i>Lobophora</i> algae and <i>Erythropodium</i> , abundant <i>Porites</i> and <i>Acropora</i> rubble, water temperature 87°F, no <i>Acropora</i> observed at site
54 - Inshore of Watson's Reef	Supposed to be reference patchy hard-bottom inshore of Watson's Reef, but reef terrace-like habitat, 41-44 feet, dominated by staghorn coral rubble and mostly dead <i>Montastraea</i> mounds, very similar to Carysfort Reef terrace, corals speciose, abundant juvenile corals
347 - Inshore of Watson's Reef	Reference offshore patch reef near Watson's Reef, 24-26 feet, close to site 12, mound with relatively low relief on top, gorgonians and smaller corals abundant, one small staghorn coral colony observed in general survey area
12 - Inshore of Watson's Reef	Reference offshore patch reef near Watson's Reef, 31-34 feet, close to site 402, mound with relatively moderate relief on top, rich diversity of stony corals, some larger colonies
9 - White Banks	Reference offshore patch reef in White Banks area, large mound ~25-30 m across, topographically complex, abundant sea plumes, sea fans, and finger corals, several small staghorn colonies present
8 - Inshore of French Reef	Reference offshore patch reef inshore of French Reef on White Banks, low profile and interspersed with <i>Thalassia</i> seagrass, dominated by gorgonians, algae and intermittent colonies of <i>S. siderea</i> and <i>S. bournoni</i> , water temperature 88°F, no <i>Acropora</i> observed at site
7 - Inshore of Molasses Reef	Reference offshore patch reef inshore of Molasses Reef, abundant <i>Porites</i> finger corals and coral rubble, dominated by <i>Dictyota</i> , low profile, isolated <i>S. siderea</i> heads, abundant urchins, water temperature 88°F, one colony of <i>Acropora cervicornis</i> observed at site, but not within transects
6 - Inshore of Molasses Reef	Reference offshore patch reef inshore of Molasses Reef, shoreward side 22 feet deep in sand, line of <i>Montastraea</i> colonies and <i>Dictyota</i> , seaward is lower profile area with <i>Porites</i> finger corals, some large colonies of <i>C. natans</i> and <i>M. annularis</i> , water temperature 88°F, several thickets of <i>Acropora cervicornis</i> observed along transects
5 - Inshore of Pickles Reef	Reference offshore patch reef inshore of Pickles Reef, small site, ~ 15 m in diameter, large halo with adjacent dense seagrass, dominated by <i>Dictyota</i> and <i>Sargassum</i> algae, gorgonians, and some coral heads, water temperature 88°F, no <i>Acropora</i> observed at site, TNC staghorn coral arrays near inshore edge of patch reef
Middle Florida Keys NMS	
77 - Inshore of Conch Reef SPA	Reference offshore patch reef inshore of Conch Reef SPA, 13-15 feet, scattered coral heads and generally low profile, dominated by <i>Dictyota</i> and gorgonians, seagrass interspersed throughout patch, <i>A. cervicornis</i> present on transects
76 - Inshore of Conch Reef SPA	Reference offshore patch reef inshore of Conch Reef SPA, 12-18 feet, dominated by gorgonians, <i>Dictyota</i> and small corals, some coral heads, but generally broken up, few urchins, abundant fishing line, several <i>A. cervicornis</i> colonies within transects
75 - Inshore of Conch Reef SPA	Reference offshore patch reef inshore of Conch Reef SPA, 13-15 feet, excellent visibility, small site with moderate relief, chunks of old reef with some <i>D. clivosa</i> , <i>S. siderea</i> and <i>S. bournoni</i> heads, site surrounded by dense <i>Thalassia</i> and <i>Syringodium</i> seagrasses, no <i>Acropora</i> observed at site

Habitat type/site number and location	Site description
74 - Inshore of Conch Reef SPA	Reference offshore patch reef inshore of Conch Reef SPA, 13-15 feet, excellent visibility, small site with moderate relief, dominated by <i>Dictyota</i> , <i>Sargassum</i> and <i>Porites</i> finger corals, site surrounded by dense <i>Thalassia</i> and <i>Syringodium</i> seagrasses, several small colonies of <i>Acropora cervicornis</i> observed at site
98 - Coffins Patch SPA**	Offshore patch reef within Coffins Patch SPA, 18-21 feet, supposed to be deeper hard-bottom, but moderate relief reef in sand, appears to be old elkhorn coral reef, abundant <i>A. cervicornis</i> rubble, dominated by gorgonians and small corals like <i>D. stokesi</i> and <i>S. siderea</i> , no <i>Acropora</i> observed at site, water temperature 86°F, bleaching by <i>D. stokesi</i> and <i>S. radians</i>
277 - Coffins Patch SPA**	Offshore patch reef within Coffins Patch SPA, 21-23 feet, supposed to be deeper hard-bottom, similar to site 98, more sand and less relief, three <i>A. cervicornis</i> colonies present on transects, paling to bleaching of <i>Agaricia</i> and <i>Siderastrea</i> corals
Lower Florida Keys NMS	
133 - Looe Key Research Only**	Offshore patch reef within Looe Key Research Only, 19-24 feet, near central area of RO, fewer large corals than site 132, dominated by <i>Palythoa</i> and gorgonians, <i>A. cervicornis</i> present at site but not in transects, paling to bleaching of <i>M. cavernosa</i> , <i>Siderastrea</i> , and <i>S. intersepta</i>
132 - Looe Key Research Only**	Offshore patch reef within Looe Key Research Only, 21-26 feet, good visibility, near western end of RO, <i>A. cervicornis</i> present on transects, water temperature 87°F, paling to bleaching of <i>Agaricia</i> and <i>Siderastrea</i>
131 - North of Looe Key SPA**	Reference offshore patch reef north of Looe Key SPA, 21-23 feet, good visibility, dominated by gorgonians, generally low profile, some <i>D. strigosa</i> heads, abundant <i>A. cervicornis</i> colonies
130 - Maryland Shoal	Reference offshore patch reef at Maryland Shoal, 29-32 feet, large linear patch reef, clean substratum and little macroalgae, <i>A. cervicornis</i> observed along transects
129 - North of Maryland Shoal	Reference offshore patch reef north of Maryland Shoal, 20-32 feet, large mound with many large coral heads, especially <i>M. cavernosa</i> , little macroalgae, <i>A. cervicornis</i> present on transects
165 - North of Maryland Shoal	Reference offshore patch reef north of Maryland Shoal, 28-32 feet, original waypoint was dense seagrass surrounded by large area of sand, large linear patch, high relief, abundant corals, <i>A. cervicornis</i> present on transects
128 - NE of Eastern Sambo RO	Reference offshore patch reef northeast of Eastern Sambo RO, 27-30 feet, broken up, patches of reef interspersed with sand, moderate relief, abundant coral heads and juvenile corals
135 - Western Sambo ER**	Offshore patch reef within Western Sambo Ecological Reserve, 24-30 feet, large mound, abundant corals, silty, little macroalgae, pale <i>S. siderea</i> colonies, water temperature 87°F, <i>A. cervicornis</i> present in general survey area
168 - Western Sambo ER**	Offshore patch reef within Western Sambo Ecological Reserve, 27-34 feet, original waypoint was seagrass, large mound 41 feet deep at base, 27 feet on top, abundant corals and recruits, especially <i>S. siderea</i> , <i>S. intersepta</i> and <i>C. natans</i> , silty, few macroalgae, water temperature 88°F
127 - West of Sand Key SPA	Reference offshore patch reef west of Sand Key SPA, 31-42 feet, large (> 10 m) boulders, very high relief, 43 feet in sand, abundant corals and sponges, as well as coral recruits, water temperature 86°F, no staghorn coral observed
Hard-bottom/rubble/sand matrix	
Upper Florida Keys NMS	
40 - Carysfort Reef SPA**	Low-relief hard-bottom/matrix community in northern Carysfort SPA, 11-18 feet, supposed to be continuous hard-bottom, but broken-up substratum, sea plumes dominant, some smaller coral heads
38 - West of Carysfort Reef SPA	Reference hard-bottom/rubble/sand matrix habitat north of Carysfort SPA, 9-10 feet, supposed to be shallow hard-bottom, loosely consolidated and patchy, gorgonians abundant, prevalent dark spot and pre-bleaching on <i>S. siderea</i> and <i>S. intersepta</i>
36 - West of Carysfort Reef SPA	Low-relief hard-bottom/matrix community west of the SW corner of Carysfort SPA, 15-19 feet, complex substratum with mix of sand, rubble and patches of high-relief but mostly dead coral structure, bounded by dense seagrass
11 - NW of Dry Rocks SPA	Low-relief hard-bottom/seagrass matrix habitat, 10-13 feet, northwest of Dry Rocks SPA, supposed to be offshore patch reef, but matrix of hard-bottom and seagrass, well scoured, little macroalgae, generally very low relief, gorgonians dominant, some small coral heads
Low-relief hard-bottom (< 6 m)	
Biscayne National Park	

Habitat type/site number and location	Site description
475 - Fowey Rocks	Shallow (< 6 m) low-relief hard-bottom at Fowey Rocks, 13-15 feet, scoured and wave swept, substratum broken up and dominated by turf algae, gorgonians and fire coral, scleractinian corals small and sparse, one small colony of <i>Acropora cervicornis</i> was observed on one of the transects
469 - South of Ajax Reef	Shallow, low-relief hard-bottom (< 6 m) south of Ajax Reef, 10-14 feet, elkhorn coral framework, but very eroded, scoured and dominated by sandy algal turf, abundant gorgonians and fire coral, no <i>Acropora</i> observed at site
Upper Florida Keys NMS	
346 - Carysfort Reef SPA**	Low-relief hard-bottom in northwestern corner of Carysfort Reef SPA, 18-23 feet, supposed to be replicate shallow hard-bottom, but matrix of moderate relief reef and some flat areas, <i>Dictyota</i> algae and sea plumes dominant, looks like old elkhorn coral reef
35 - West of Carysfort Reef SPA	Reference low-relief hard-bottom west of Carysfort Reef SPA, 9-10 feet, mixture of hard-bottom and dense <i>Thalassia</i> seagrass, small colonies of <i>S. siderea</i> and <i>D. stokesi</i> , a few small staghorn corals observed
34 - West of Carysfort Reef SPA	Reference low-relief hard-bottom west of Carysfort Reef SPA, 13-15 feet, mixture of hard-bottom, seagrass, and some reef structure, complex habitat, looks like eroded patch reef, gorgonians and <i>Styopodium</i> algae dominant, more relief than site #35
33 - Inshore of Watson's Reef	Reference low-relief hard-bottom inshore of Watson's Reef, 11-14 feet, part of site very low profile, other areas with moderate relief, looks like eroded patch reef, <i>Dictyota</i> algae and gorgonians dominant
17 - Little Pickles Reef	Reference shallow (< 6 m) hard-bottom at Little Pickles Reef, original waypoint was in deep water and shallower area was not spur and groove, site dominated by sandy algal turf, <i>H. tuna</i> , gorgonians and fire coral, very few corals and mostly small, water temperature 87°F, no <i>Acropora</i> observed at site
Middle Florida Keys NMS	
269 - Conch Reef SPA**	Shallow (< 6 m) low-relief hard-bottom within Conch Reef SPA, 18-22 feet, mooring buoy CO2, transects placed from inshore edge of ridge seaward, elkhorn coral base, some dead upright elkhorn skeletons, dominated by <i>Dictyota</i> and sea plumes, very few corals, no <i>Acropora</i> observed at site
89 - Conch Reef SPA**	Shallow (< 6 m) low-relief hard-bottom within Conch Reef SPA, 15-18 feet, mooring buoy CO1, similar to site 269, but slightly shallower, water temperature 88°F, no <i>Acropora</i> observed at site
88 - Little Conch Reef	Reference shallow (< 6 m) low-relief hard-bottom southwest of Conch Reef SPA at Little Conch Reef, 14-17 feet, wave-swept and low profile, elkhorn coral base, little macroalgae, dominated by gorgonians, fire coral, and small scleractinian corals, water temperature 85°F, no <i>Acropora</i> observed at site
352 - Little Conch Reef	Reference shallow low-relief hard-bottom at Little Conch Reef, site 87 inshore of Davis Reef was seagrass and sand, 14-15 feet, low profile and scoured, dominated by algal turf, gorgonians and fire coral, corals mostly small, water temperature 87°F, no <i>Acropora</i> observed at site
97 - Davis Reef SPA**	Shallow low-relief hard-bottom (< 6 m) within Davis Reef SPA, mooring buoy DL4, 16-17 feet, low profile and scoured with little macroalgae, dominated by turf, <i>H. tuna</i> , fire coral, <i>Palythoa</i> and gorgonians, water temperature 86°F, no <i>Acropora</i> observed at site
90 - Davis Reef SPA**	Shallow low-relief hard-bottom (< 6 m) within Davis Reef SPA, mooring buoy DL2, 19-23 feet, transects near shoreward ledge, dominated by algal turf, <i>Dictyota</i> , <i>H. tuna</i> , <i>Palythoa</i> and sea plumes, very few corals, no <i>Acropora</i> observed at site
86 - South of Windley Key	Reference shallow (< 6 m) hard-bottom south of Windley Key, 11-14 feet, bounded by seagrass and sand, looks like eroded down patch reef, low profile, dominated by <i>Cladophoropsis</i> and <i>Dictyota</i> algae, gorgonians and <i>D. clivosa</i> , several large <i>Diadema</i> urchins, <i>A. cervicornis</i> observed on transects
103 - NE of Alligator Light	Reference shallow (< 6 m) low-relief hard-bottom northeast of Alligator Light, 16-19 feet, supposed to be low-relief spur and groove, but shallower and similar in appearance to Alligator Reef, dominated by <i>Sargassum</i> , <i>Dictyota</i> , gorgonians and fire coral, elkhorn coral framework, but no <i>Acropora</i> observed at site, water temperature 88°F
82 - Alligator Reef SPA**	Shallow (< 6 m) low-relief hard-bottom within Alligator Reef SPA, 13-18 feet, transects near mooring buoy A4 on shoreward edge of relict reef flat, dominated by <i>Dictyota</i> algae and gorgonians, very few corals, no <i>Acropora</i> observed at site

Habitat type/site number and location	Site description
81 - Alligator Reef SPA**	Shallow (< 6 m) low-relief hard-bottom within Alligator Reef SPA, 18-21 feet, transects near mooring buoy A1 on relict reef flat, bloom of green cyanobacteria/diatoms, dominated by <i>Dictyota</i> , <i>H. tuna</i> and <i>Palythoa</i> , very few corals, water temperature 87°F, no <i>Acropora</i> observed at site
350 - Tennessee Light	Reference low-relief hard-bottom (> 6 m) at Tennessee Lighthouse, 18-20 feet, green water, transects just south of lighthouse, very old and eroded <i>A. palmata</i> reef, very few corals, dominated by <i>Dictyota</i> and <i>Palythoa</i> , water temperature 88°F, bleaching of <i>Palythoa</i>
85 - East of Coffins Patch SPA	Reference low-relief hard-bottom (< 6 m) east of Coffins Patch SPA, 16-19 feet, dominated by <i>Dictyota</i> , <i>H. tuna</i> and gorgonians, no <i>Acropora</i> observed at site
92 - Coffins Patch SPA**	Low-relief hard-bottom (< 6 m) within Coffins Patch SPA, 12-14 feet, second site of hard-bottom shoreward of mooring buoys, dominated by <i>H. tuna</i> and <i>Dasycladus</i> algae, small corals, no <i>Acropora</i> observed at site
91 - Coffins Patch SPA**	Low-relief hard-bottom (< 6 m) within Coffins Patch SPA, 16-20 feet, near westernmost mooring buoy (CP7), some seagrass interspersed with mound of hard-bottom, tapers down to 20 feet offshore, dominated by gorgonians and <i>H. tuna</i> , no <i>Acropora</i> observed at site
Lower Florida Keys NMS	
161 - West of American Shoal	Reference low-relief hard-bottom west of American Shoal, 16-19 feet, very low profile and old elkhorn coral reef, dominated by algal turf, fire coral, and gorgonians, <i>A. cervicornis</i> present at site, but not in transects, water temperature 86°F
140 - Maryland Shoal	Reference low-relief hard-bottom at Maryland Shoal, 17-18 feet, supposed to be high-relief spur and groove, but very eroded and low-profile <i>Acropora</i> reef, scoured and little macroalgae, dominated by <i>M. alcornis</i> and <i>H. tuna</i> , very few scleractinian corals, no <i>Acropora</i> observed at site, water temperature 87°F
159 - North of Pelican Shoal	Reference low-relief hard-bottom north of Pelican Shoal, 15-17 feet, on shoreward side of spur and groove system, little macroalgae, gorgonians and <i>S. vesparium</i> dominant, <i>A. cervicornis</i> present on transects
158 - East of No Name Reef	Reference low-relief hard-bottom east of No Name Reef, 16-17 feet, low profile, dominated by <i>Dictyota</i> and <i>Styopodium</i> algae and gorgonians, <i>A. cervicornis</i> rubble present, live <i>A. cervicornis</i> observed on transects
<i>Inner line reef tract spur and groove</i>	
Upper Florida Keys NMS	
61 - Turtle Reef	Reference inner line reef tract at Turtle Reef, 13-20 feet, elkhorn coral base, northern extension of inner line reef tract, intermittent staghorn coral colonies, lobster rope prevalent, moderate to high relief
60 - Inshore of Elbow Reef SPA	Reference inner line reef tract inshore of Elbow Reef SPA, northern extension of inner line reef tract, poor visibility, site well scoured, broken up in several places, staghorn coral present in transects
59 - Inshore of Elbow Reef SPA	Reference inner line reef tract inshore of Elbow Reef SPA, south of site 60, more scoured, less relief, some large coral heads, both staghorn and elkhorn coral observed within transects
58 - Horseshoe Reef	Reference inner line reef tract at Horseshoe Reef, 7-13 feet, one staghorn coral colony observed, small elkhorn corals in interior of site, huge stand of live elkhorn near mooring buoy
62 - Dry Rocks SPA**	Inner line reef tract at Dry Rocks SPA, 5-11 feet, mooring buoy 4, strong surge, abundant dead elkhorn coral, dominated by sea fans, fire coral, and <i>Porites astreoides</i> , small patch of elkhorn coral along transect 4
63 - Dry Rocks SPA**	Inner line reef tract at Dry Rocks SPA, 5-7 feet, southern side of SPA, lower profile, scoured bottom, elkhorn coral rubble abundant, one small elkhorn coral colony observed outside of transects
65 - Grecian Rocks SPA**	Inner line reef tract at Grecian Rocks SPA, 5-11 feet, mooring buoy G11, northern side of reef, strong surge, fewer corals than southern side, well scoured, elkhorn coral framework
64 - Grecian Rocks SPA**	Inner line reef tract at Grecian Rocks SPA, 5-9 feet, mooring buoy G3, strong surge, south side of SPA, large <i>Montastraea</i> coral heads, abundant but dead elkhorn coral rubble, small live elkhorn observed in general survey area
<i>High-relief spur & groove</i>	
Biscayne National Park	

Habitat type/site number and location	Site description
474 - Brewster Reef	High-relief spur and groove at Brewster Reef, 14-20 feet, supposed to be hard-bottom, but moderate-relief elkhorn coral framework, dominated by <i>Erythropodium</i> , fire coral and <i>Palythoa</i> , corals sparse, no <i>Acropora</i> observed at site
472 - Star Reef	High-relief spur and groove at Star Reef, 13-16 feet, similar in appearance to Long Reef, elkhorn coral framework, but eroded and scoured, dominated by algal turf, sea plumes, sea fans, and <i>Palythoa</i> , no <i>Acropora</i> observed at site
470 - Triumph Reef	High-relief spur and groove at Triumph Reef, 16-20 feet, supposed to be hard-bottom, but moderate-relief elkhorn coral framework, very scoured and rough seas, dominated by algal turf, sea fans, sea plumes and fire coral, few scleractinian corals and no <i>Acropora</i> observed at site
467 - Long Reef	High-relief spur and groove at Long Reef, 11-15 feet, very eroded and cross between low-relief hard-bottom and high-relief spur and groove, elkhorn coral framework parallel to shore, no definitive spur and groove structure, scoured and dominated by algal turf, crustose coralline algae and sea fans, corals very sparse, small <i>Acropora palmata</i> observed within transects
466 - Ajax Reef	High-relief spur and groove at Ajax Reef, 12-16 feet, north end of reef, dominated by algal turf, sea fans and <i>Palythoa</i> , very few corals, well scoured, no <i>Acropora</i> observed at site
465 - Ajax Reef	High-relief spur and groove at Ajax Reef, 13-17 feet, southern end of reef, elkhorn coral base, dominated by algal turf, crustose coralline algae, <i>Palythoa</i> and sea fans, very few corals, no <i>Acropora</i> observed at site
464 - Pacific Reef	High-relief spur and groove at Pacific Reef, 13-16 feet, good visibility, just northeast of marker, scoured substratum with little macroalgae, dominated by algal turf, sea fans, <i>Palythoa</i> and crustose coralline algae, very few corals, no <i>Acropora</i> observed at site
Upper Florida Keys NMS	
26 - Carysfort Reef SPA**	High-relief spur and groove near lighthouse at Carysfort Reef, 11-18 feet, near NE extent of spur and groove zone at stake, turf and CCA dominant, low live coral cover
25 - Carysfort Reef SPA**	<i>Acropora palmata</i> zone near lighthouse at Carysfort Reef SPA, 3-9 feet, no spur and groove, old reef flat habitat, shallow, dominated by algal turf and CCA, sea fans abundant, few coral species very low coral cover
218 - South Carysfort Reef SPA**	High-relief spur and groove at South Carysfort Reef within Carysfort SPA, 2-6 feet, transects placed in old elkhorn coral zone, bottom dominated by algal turf, crustose corallines, and sea fans, low live coral cover and no live elkhorn coral observed
217 - South Carysfort Reef SPA**	High-relief spur and groove at South Carysfort Reef within Carysfort SPA, 4-9 feet, transects placed near boundary of spur and groove and reef flat, similar area surveyed in 2006, abundant patches of live elkhorn coral, some with white necrotic patches, others damaged by damselfishes, otherwise in good condition
24 - Maitland Grounding Site	Reference high-relief spur and groove south of Carysfort Reef SPA, 10-14 feet, near Maitland grounding site, elkhorn coral base, but no live elkhorn coral observed, dominated by algal turf, sea fans, and <i>Porites astreoides</i>
28 - Elbow Reef SPA**	High-relief spur and groove at Elbow Reef SPA, 9-17 feet, E5 mooring, elkhorn corals abundant, damselfish territories abundant, elkhorn coral particularly abundant along edges of coralline spurs, abundant <i>Coralliophila</i> snails
27 - Elbow Reef SPA**	High-relief spur and groove at Elbow Reef SPA, 10-18 feet, E2 mooring, patchy elkhorn corals, damselfish territories common, very high profile spurs, also abundant <i>Coralliophila</i> snails, spur surfaces dominated by algal turf, crustose coralline algae, fire coral, and sea fans
30 - French Reef SPA**	High-relief spur and groove within French Reef SPA, mooring buoy F7, high relief and large colonies of <i>Montastraea faveolata</i> and <i>M. annularis</i> , isolated colonies of elkhorn coral, several <i>Acropora palmata</i> observed along transects, abundant <i>Dictyota</i> algae and sea plumes
29 - French Reef SPA**	High-relief spur and groove within French Reef SPA, mooring buoy F2, very high relief and large colonies of <i>Montastraea faveolata</i> , extensive thickets of elkhorn coral, several <i>Acropora palmata</i> observed along transects, damselfish territories especially prevalent on some of the elkhorn coral colonies
23 - SW of French Reef SPA	Reference high-relief spur and groove southwest of French Reef SPA, just south of SPA buoys, elkhorn coral framework, dominated by crustose coralline algae, sea fans, sea plumes, <i>Palythoa</i> and fire coral, very few scleractinians, water temperature 87°F, no <i>Acropora</i> observed at site

Habitat type/site number and location	Site description
357 - Sand Island	Reference high-relief spur and groove at Sand Island, northeast of Molasses Reef SPA, mooring buoy S3 at northern end of reef, excellent visibility, spurs shorter at northern extent of fore reef, fewer scleractinian corals, abundant <i>Millepora complanata</i> , no <i>Acropora</i> at site
356 - Sand Island	Reference high-relief spur and groove at Sand Island, northeast of Molasses Reef SPA, mooring buoy S1 at southern end of reef, excellent visibility, substratum dominated by algal turf, crustose coralline algae and sea plumes, several thickets of <i>Acropora palmata</i> on transects, water temperature 87°F
32 - Molasses Reef SPA**	High-relief spur and groove within Molasses Reef SPA, mooring buoy M6, excellent visibility, site dominated by algal turf, crustose coralline algae, <i>H. opuntia</i> , fire coral, sea plumes, sea fans and <i>Palythoa</i> , high-relief structure, <i>Acropora palmata</i> present on transects
31 - Molasses Reef SPA**	High-relief spur and groove within Molasses Reef SPA, mooring buoy M3, excellent visibility, site dominated by algal turf, crustose coralline algae, <i>H. opuntia</i> , fire coral, sea plumes, sea fans and <i>Palythoa</i> , high-relief structure, <i>Acropora palmata</i> present on transects
19 - Pickles Reef	Reference high-relief spur and groove at Pickles Reef, mooring buoy P5, elkhorn coral framework, dominated by algal turf, <i>H. tuna</i> , sea fans, fire coral and <i>Palythoa</i> , very few scleractinian corals, no <i>Acropora</i> observed at site
20 - Pickles Reef	Reference high-relief spur and groove at Pickles Reef, similar to site 18, elkhorn coral framework, dominated by algal turf, sea fans and fire coral, water temperature 88°F, no <i>Acropora</i> observed at site
18 - Pickles Reef	Reference high-relief spur and groove at Pickles Reef, elkhorn coral base, shoreward side lower profile, dominated by algal turf, <i>Millepora complanata</i> , sea fans and sea plumes, very abundant fire coral, water temperature 87°F, no <i>Acropora</i> observed at site
Middle Florida Keys NMS	
79 - Delta Shoal	Reference high-relief spur and groove at Delta Shoal, east of Sombrero Key SPA, 13-17 feet, near eastern end of reef, elkhorn coral framework, more <i>Dictyota</i> and less <i>Palythoa</i> than site 78, no <i>Acropora</i> observed at site
78 - Delta Shoal	Reference high-relief spur and groove at Delta Shoal, east of Sombrero Key SPA, 11-17 feet, near western end of reef, elkhorn coral framework, dominated by algal turf, <i>Dictyota</i> , <i>Palythoa</i> and sea fans, no <i>Acropora</i> observed at site
84 - Sombrero Key SPA**	High-relief spur and groove within Sombrero Key SPA, near western end of fore reef at mooring buoy 17, 11-20 feet, dominated by algal turf, coralline algae and <i>Palythoa</i> , large <i>A. palmata</i> colonies on transects, bleaching of <i>Millepora</i> and <i>Agaricia</i>
83 - Sombrero Key SPA**	High-relief spur and groove within Sombrero Key SPA, near eastern end of fore reef at mooring buoy 8, 14-22 feet, dominated by <i>Dictyota</i> and <i>Palythoa</i> , no <i>Acropora</i> observed at site, few urchins
Lower Florida Keys NMS	
148 - Looe Key SPA**	High-relief spur and groove at Looe Key SPA, 5-14 feet, near eastern end of reef, good visibility, abundant <i>A. palmata</i> confined to one coralline spur, shallower end of spur dominated by <i>Palythoa</i> and <i>P. astreoides</i> , deeper end with large <i>M. faveolata</i> heads, bleaching of <i>Millepora</i> and <i>Palythoa</i>
147 - Looe Key SPA**	High-relief spur and groove at Looe Key SPA, 11-20 feet, near western end of fore reef, good visibility, mooring buoy L27, dominated by algal turf and <i>Palythoa</i> , <i>A. palmata</i> in transects, <i>A. cervicornis</i> observed at site, pale to bleaching of <i>Palythoa</i> and <i>Agaricia</i>
145 - American Shoal	Reference high-relief spur and groove at American Shoal, 19-25 feet, western end of reef, low profile, dominated by <i>Dictyota</i> algae and <i>Palythoa</i> , no urchins or <i>Acropora</i> observed within transects, pale to bleaching of <i>Palythoa</i> , <i>Millepora</i> and <i>Agaricia</i> corals
146 - American Shoal	Reference high-relief spur and groove at American Shoal, 19-21 feet, near lighthouse, dominated by <i>Dictyota</i> algae, gorgonians, and <i>Palythoa</i> , pale to bleaching of <i>Palythoa</i> , <i>Agaricia</i> , <i>P. astreoides</i> , <i>M. cavernosa</i> , <i>Millepora</i> , and <i>S. siderea</i>
144 - Maryland Shoal	Reference high-relief spur and groove at Maryland Shoal, 4-8 feet, transects placed on back side of reef in old <i>A. palmata</i> zone, dominated by algal turf and crustose coralline algae, abundant <i>Echinometra</i> urchins and some large <i>Diadema</i> , no <i>Acropora</i> observed at site

Habitat type/site number and location	Site description
141 - Maryland Shoal	Reference high-relief spur and groove at Maryland Shoal, 10-19 feet, <i>M. annularis</i> heads at base of reef, <i>A. palmata</i> framework shallower, fuzzy substratum with abundant turf algae, no <i>Coralliophila</i> snails, no <i>Acropora</i> observed at site
143 - Maryland Shoal	Reference high-relief spur and groove at Maryland Shoal, 15-20 feet, towards western end of reef, lower profile with fewer upright but dead stands of <i>A. palmata</i> , dominated by <i>Dictyota</i> , abundant small colonies of <i>A. cervicornis</i> along transects
139 - Pelican Shoal	Reference high-relief spur and groove at Pelican Shoal, 8-15 feet, east end of reef, low profile spurs, grades shoreward into lower profile area near back reef, dominated by sea fans and <i>P. astreoides</i> , no <i>Acropora</i> observed at site
138 - No Name Reef	Reference high-relief spur and groove at No Name Reef, 10-20 feet, east of Eastern Sambo RO, east end of reef, relatively small spurs, fissures and cracks common in reef framework, water temperature 87°F, no <i>Acropora</i> observed at site
137 - No Name Reef	Reference high-relief spur and groove at No Name Reef, 11-23 feet, east of Eastern Sambo RO, west end of reef, relatively small spurs, both <i>A. palmata</i> and <i>A. cervicornis</i> present on transects, site dominated by algal turf and <i>Palythoa</i>
150 - Eastern Sambo RO**	High-relief spur and groove at Eastern Sambo Research Only, 5-16 feet, west end of reef, dominated by algal turf, <i>H. opuntia</i> , <i>Palythoa</i> , and <i>P. astreoides</i> , no <i>Acropora</i> observed within transects, water temperature 87-88°F
149 - Eastern Sambo RO**	High-relief spur and groove at Eastern Sambo Research Only, 6-12 feet, east end of reef near stake, transects near CRMP stake #4, no <i>Acropora</i> observed within transects, water temperature 88°F
348 - Middle Sambo Reef	Reference high-relief spur and groove at Middle Sambo Reef, 6-13 feet, east end of reef, no <i>Acropora</i> observed within transects
309 - Middle Sambo Reef	Reference high-relief spur and groove at Middle Sambo Reef, 6-12 feet, west end of reef near stake, bleaching of <i>A. agaricites</i> , water temperature 87°F, <i>A. cervicornis</i> present within transects
152 - Western Sambo ER**	High-relief spur and groove within Western Sambo Ecological Reserve, 9-20 feet, near eastern end of shallow fore reef at mooring buoy #1, dominated by algal turf, <i>Palythoa</i> , and sea fans, few corals and more algae than site 151, fewer snails, no <i>Acropora</i> in survey area
151 - Western Sambo ER**	High-relief spur and groove within Western Sambo Ecological Reserve, 5-9 feet, near eastern end of shallow fore reef at mooring buoy #4, dominated by algal turf, <i>Palythoa</i> , and sea fans, few corals but abundant <i>Coralliophila</i> , no <i>Acropora</i> in survey area
136 - East of Eastern Dry Rocks SPA	Reference high-relief spur and groove east of Eastern Dry Rocks, coralline spurs interspersed with pavement, abundant staghorn corals, elkhorn coral also observed in general survey area
154 - Eastern Dry Rocks SPA**	High-relief spur and groove at Eastern Dry Rocks SPA, near far eastern boundary of SPA, poor visibility, no <i>Acropora</i> observed in general survey area
153 - Eastern Dry Rocks SPA**	High-relief spur and groove at Eastern Dry Rocks SPA, near western end of SPA, poor visibility, no <i>Acropora</i> observed in general survey area
156 - Rock Key SPA**	High-relief spur and groove at Rock Key SPA, eastern end of SPA, good visibility, moderate relief coralline spurs, no <i>Acropora</i> observed in general survey area
155 - Rock Key SPA**	High-relief spur and groove at Rock Key SPA, central area of SPA, good visibility, very high-relief coralline spurs, no <i>Acropora</i> observed in general survey area
325 - Sand Key SPA**	High-relief spur and groove at Sand Key SPA, eastern end of SPA, incredible visibility, staghorn and elkhorn coral observed in general survey area, but not sampled in transects
157 - Sand Key SPA**	High-relief spur and groove at Sand Key SPA, western end of SPA, incredible visibility, elkhorn coral observed in general survey area, but not sampled in transects
<i>Low-relief hard-bottom (6-15 m)</i>	
Upper Florida Keys NMS	
53 - Carysfort Reef SPA**	Low-relief hard-bottom in central-eastern Carysfort Reef SPA, 26-33 feet deep, supposed to be low-relief spur and groove, but no defined sand grooves, broken-up substratum in many locations, algae and gorgonians dominant
240 - Carysfort Reef SPA**	Low-relief hard-bottom in southeastern Carysfort SPA, 22-28 feet, large mound that plateaus to hard-bottom and rubble, <i>Dictyota</i> and gorgonians dominant, small corals and low coverage, slopes down quickly to sand and rubble

Habitat type/site number and location	Site description
57 - Inshore of Watson's Reef	Reference low-relief hard-bottom site near Watson's Reef, 24-30 feet, strong surge, bottom heavily scoured, supposed to be reference patchy hard-bottom, but continuous hard-bottom with low to moderate relief, gorgonians abundant
45 - Offshore of Dry Rocks SPA	Reference low-relief hard-bottom offshore of Dry Rocks SPA, 36-39 feet, broken up bottom, no defined structure, dominated by brown algae, gorgonians and <i>Xestospongia</i> , sponges speciose and abundant
22 - SW of French Reef SPA	Reference deeper (> 6 m) low-relief hard-bottom southwest of French Reef SPA, supposed to be high-relief spur and groove, but relatively low profile drowned <i>Acropora</i> reef, some sand grooves, but very low profile, dominated by <i>Dictyota</i> algae and sea plumes, no <i>Acropora</i> observed at site
21 - SW of French Reef SPA	Reference deeper (> 6 m) low-relief hard-bottom southwest of French Reef SPA, supposed to be high-relief spur and groove, but relatively low profile drowned <i>Acropora</i> reef, dominated by <i>Dictyota</i> algae, sea plumes and <i>Aplysina</i> sponges, <i>Acropora cervicornis</i> observed at site, but not within transects
Middle Florida Keys NMS	
353 - Conch Reef SPA**	Low-relief hard-bottom (> 6 m) within Conch Reef SPA, 34-38 feet, added as second deeper hard-bottom site, offshore of mooring buoy CO1, dominated by <i>Dictyota</i> algae, gorgonians and fire coral, water temperature 88°F, no <i>Acropora</i> observed at site
105 - Conch Reef SPA**	Low-relief hard-bottom (> 6 m) within Conch Reef SPA, 33-37 feet, sandy algal turf substratum, dominated by <i>H. tuna</i> and gorgonians, few corals and mostly small <i>Porites</i> and <i>Siderastrea</i> , water temperature 87°F, no <i>Acropora</i> observed at site
104 - NE of Alligator Light	Reference deeper (> 6 m) low-relief hard-bottom northeast of Alligator Light, 33-36 feet, supposed to be low-relief spur and groove, but continuous and very low-relief hard-bottom, dominated by sandy algal turf and gorgonians, no <i>Acropora</i> observed at site
351 - South of Indian Key	Reference low-relief hard-bottom south of Indian Key, 27-29 feet, replaced site 95 that was dense seagrass patches, low profile and sandy, dominated by fire coral and gorgonians, water temperature 88°F, no <i>Acropora</i> observed at site
101 - South of Lower Matecumbe	Reference deep hard-bottom (> 6 m) south of Lower Matecumbe, 24-27 feet, near red marker R18, supposed to be low-relief spur and groove, but continuous hard-bottom with no sand grooves, low profile, no <i>Acropora</i> observed at site
111 - West of Sombrero Key	Reference low-relief hard-bottom west of Sombrero Key SPA, 25-30 feet, green water, supposed to be patchy hard-bottom, but generally continuous, low profile and eroded, little macroalgae and corals, water temperature 86°F, bleaching of <i>Millepora</i> , <i>Siderastrea</i> and <i>S. intersepta</i>
Lower Florida Keys NMS	
180 - South of Bahia Honda Key	Reference low-relief hard-bottom south of Bahia Honda Key, 28-29 feet, supposed to be patchy hard-bottom, but generally consolidated, low profile, dominated by sandy algal turf, gorgonians, fire coral, <i>I. campana</i> , <i>S. vesparium</i> and <i>X. muta</i> , corals generally small, <i>A. cervicornis</i> present on transects
173 - Maryland Shoal	Reference low-relief hard-bottom at Maryland Shoal, 23-25 feet, supposed to be low-relief spur and groove, but mostly consolidated with no sand grooves, dominated by gorgonians, <i>Dictyota</i> , <i>Sargassum</i> and <i>H. tuna</i> , small corals, no <i>Acropora</i> observed at site, water temperature 87°F
177 - NE of Satan Shoal	Reference low-relief hard-bottom NE of Satan Shoal, 40-45 feet, supposed to be patchy hard-bottom, but more continuous, some pockets of sand, outstanding visibility, dominated by <i>Dictyota</i> and gorgonians, water temperature 84°F, paling of several coral species, including <i>D. stokesi</i> , <i>S. bournoni</i> , <i>S. siderea</i> , <i>E. fastigiata</i> and <i>S. intersepta</i>
<i>Patchy hard-bottom (6-15 m)</i>	
Upper Florida Keys NMS	
56 - Inshore of Watson's Reef	Reference patchy hard-bottom site near Watson's Reef, 21-29 feet, inshore of site 57, some moderate relief inshore, scoured sandy substratum, corals relatively small, gorgonians abundant
44 - Dixie Shoal	Reference patchy low-relief hard-bottom (< 6 m) inshore of Dixie Shoal, supposed to be deeper hard-bottom, but shallower and consisting of rock patches interspersed with sand and <i>Thalassia</i> seagrass, dominated by <i>Dictyota</i> , <i>H. tuna</i> and sea plumes, isolated coral heads, water temperature 88°F, no <i>Acropora</i> observed at site

Habitat type/site number and location	Site description
43 - Dixie Shoal	Reference patchy low-relief hard-bottom (> 6 m) at Dixie Shoal, supposed to be deeper hard-bottom, but abundant rubble and sand interspersed with hard-bottom patches, some <i>Thalassia</i> seagrass interspersed, dominated by <i>Sargassum</i> , <i>H. tuna</i> , gorgonians, fire coral, and <i>X. muta</i> , water temperature 87°F, no <i>Acropora</i> observed at site
42 - Dixie Shoal	Reference patchy low-relief hard-bottom (> 6 m) at Dixie Shoal, supposed to be deeper hard-bottom, but abundant rubble and sand interspersed with hard-bottom patches, dominated by <i>Dictyota</i> algae, gorgonians, fire coral, and <i>X. muta</i> , water temperature 87°F, no <i>Acropora</i> observed at site
Middle Florida Keys NMS	
96 - South of Windley Key	Reference patchy hard-bottom south of Windley Key, 23-27 feet, very strange substratum, supposed to be continuous hard-bottom, but looks like eroded offshore patch reef with sand and rubble patches, dominated by large stands of <i>Sargassum</i> , very few corals, no <i>Acropora</i> observed at site
114 - South of Lower Matecumbe	Reference patchy hard-bottom south of Lower Matecumbe, near red marker R18, 26-28 feet, green water, small site with mostly sand, dominated by <i>Sargassum</i> and <i>S. vesparium</i> , small corals, water temperature 86°F, no <i>Acropora</i> observed at site
94 - South of Duck Key	Reference patchy hard-bottom south of Duck Key, 22-25 feet, patches of hard-bottom with seagrass and rubble, dominated by <i>Sargassum</i> , <i>H. tuna</i> , <i>Styopodium</i> and <i>Lobophora</i> , water temperature 85°F, paling or bleaching of <i>Siderastrea</i> , <i>M. meandrites</i> , and <i>P. astreoides</i> , no <i>Acropora</i> observed at site
93 - South of Duck Key	Reference patchy hard-bottom south of Duck Key, 26-29 feet, patches of sand hard-bottom, dominated by <i>Sargassum</i> , <i>Dictyota</i> , <i>H. tuna</i> , <i>Millepora</i> and gorgonians, very old and eroded <i>A. palmata</i> framework, isolated coral heads, no <i>Acropora</i> observed at site
Lower Florida Keys NMS	
338 - South of Bahia Honda Key	Reference patchy hard-bottom south of Bahia Honda Key, 28-30 feet, supposed to be low-relief spur and groove, but mostly rocky interspersed with sand, dominated by gorgonians, no defined structure, water temperature 89°F, paling to bleaching of <i>Agaricia</i>
179 - West of American Shoal	Reference patchy hard-bottom west of American Shoal, 31-33 feet, large mound, moderate relief, abundant <i>S. siderea</i> heads, chunks of low-profile reef interspersed with sand, no <i>Acropora</i> observed at site, pale to bleaching of <i>S. radians</i> and <i>S. intersepta</i>
160 - North of Pelican Shoal	Reference patchy hard-bottom, north of Pelican Shoal, 18-20 feet, supposed to be shallow hard-bottom, but deeper and patchy with large sand patches, dominated by <i>Dictyota</i> algae and gorgonians, water temperature 85°F, no <i>Acropora</i> observed at site
164 - West of Pelican Shoal	Reference patchy hard-bottom west of Pelican Shoal, 24-27 feet, supposed to be hard-bottom, but mixture of low-profile reef and sand, dominated by <i>Dictyota</i> , <i>Halimeda tuna</i> and gorgonians
178 - West of Pelican Shoal	Reference patchy hard-bottom, west of Pelican Shoal, 24-27 feet, dominated by <i>Dictyota</i> algae, gorgonians and <i>X. muta</i> , isolated coral heads, water temperature 85°F, no <i>Acropora</i> observed at site
166 - Eastern Sambo RO**	Patchy hard-bottom within Eastern Sambo Research Only, 17-22 feet, eastern side of no-take zone, more rubble and sand compared to site 332, abundant queen conch, very little coral, <i>A. cervicornis</i> observed on transects
332 - Eastern Sambo RO**	Patchy hard-bottom within Eastern Sambo Research Only, 21-24 feet, western side of no-take zone, supposed to be hard-bottom, but patches interspersed with sand and rubble, dominated by <i>Dictyota</i> algae, abundant queen conch, very little coral, no <i>Acropora</i> observed at site
334 - Western Sambo ER**	Patchy hard-bottom within Western Sambo Ecological Reserve, 24-26 feet, supposed to be hard-bottom, but mixture of hard-bottom, sand, and rubble, eastern edge of reserve, low profile, dominated by <i>Dictyota</i> algae and gorgonians, water temperature 85°F, no <i>Acropora</i> in general survey area
167 - Western Sambo ER**	Patchy hard-bottom within W. Sambo Ecological Reserve, 25-26 feet, supposed to be hard-bottom, but mix of hard-bottom, rubble and sand, dominated by <i>Dictyota</i> algae, gorgonians, <i>X. muta</i> , isolated <i>Acropora cervicornis</i> found within transects
163 - West of Western Sambo ER	Reference patchy hard-bottom west of Western Sambo Ecological Reserve, 32-35 feet, supposed to be hard-bottom, but broken-up reef with sand and rubble, moderate relief dominated by <i>Dictyota</i> algae and isolated heads of <i>C. natans</i> , <i>M. cavernosa</i> and <i>S. siderea</i> , water temperature 87°, no <i>Acropora</i> in survey area

Habitat type/site number and location	Site description
335 - Sand Key SPA**	Patchy hard-bottom inside of Sand Key SPA, 27-35 feet, SW corner of SPA, more consolidated than site 169, brown algae and gorgonians dominant, water temperature 87°F
169 - Sand Key SPA**	Patchy hard-bottom inside of Sand Key SPA, 21-25 feet, northwestern area of SPA, abundant staghorn coral rubble, isolated <i>Montastraea</i> heads, brown algae dominant
162 - West of Western Dry Rocks	Reference patchy hard-bottom site west of Western Dry Rocks, 30-37 feet, inshore of site 57, supposed to be hard-bottom, some moderate relief inshore, scoured sandy substratum, corals relatively small, <i>Dictyota</i> and gorgonians abundant, water temperature 84°F, several coral species pale
<i>Low-relief spur & groove (6-15 m)</i>	
Upper Florida Keys NMS	
52 - Carysfort Reef SPA**	Low-relief spur and groove in central-eastern Carysfort Reef SPA, 30-33 feet deep, very low profile, dominated by turf algae, <i>Dictyota</i> and gorgonians, sandy, some large <i>Xestospongia</i> , sand grooves obvious
241 - Carysfort Reef SPA**	Low-relief spur and groove in southeastern Carysfort SPA, 32-39 feet, some sand grooves, large but dead <i>Montastraea annularis</i> heads, moderate relief with complex substratum, brown algae and gorgonians dominant, some large <i>Xestospongia</i>
51 - Offshore of Dry Rocks SPA	Reference low-relief spur and groove offshore of Dry Rocks SPA, 38-43 feet, similar to site #51, decent visibility, sandy, some sand grooves evident, dominated by <i>Dictyota</i> algae, sea plumes and <i>Xestospongia</i> , moderate relief with small ledges
50 - Offshore of Dry Rocks SPA	Reference low-relief spur and groove offshore of Dry Rocks SPA, 33-38 feet, decent visibility, sandy, some sand grooves evident, dominated by <i>Dictyota</i> algae, sea plumes and <i>Xestospongia</i> , moderate relief with small ledges
49 - Little Pickles Reef	Reference low-relief spur and groove at Little Pickles Reef, poorly defined spur and groove, broken up substratum, dominated by <i>Dictyota</i> algae, gorgonians, and <i>X. muta</i> , water temperature 87°F, no <i>Acropora</i> observed at site
48 - Little Pickles Reef	Reference low-relief spur and groove at Little Pickles Reef, excellent visibility, moderate relief and dominated by <i>Dictyota</i> algae, sea plumes <i>X. muta</i> and <i>Aplysina</i> sponges, water temperature 87°F, no <i>Acropora</i> observed at site
Middle Florida Keys NMS	
355 - NE of Conch Reef	Reference low-relief spur and groove northeast of Conch Reef, 48-53 feet, just northeast of Conch SPA and RO, good visibility, relatively high relief consisting of <i>Montastraea</i> colonies along coralline spurs, dominated by <i>Lobophora</i> algae, <i>Briareum</i> gorgonians, and sea plumes, no <i>Acropora</i> observed at site
282 - Conch Reef SPA**	Low-relief spur and groove within Conch Reef SPA, 40-44 feet, near northeastern corner of SPA, good visibility, low profile spurs, dominated by sandy algal turf, <i>Dictyota</i> , gorgonians and <i>X. muta</i> , corals generally small, spurs 35-40 cm off of sand, no <i>Acropora</i> observed at site
354 - Conch Reef SPA**	Low-relief spur and groove within Conch Reef SPA, 45-49 feet, site added as replicate, similar to site 282, good visibility, water temperature 87°F, no <i>Acropora</i> observed at site
107 - Conch Reef RO**	Low-relief spur and groove within Conch Reef Research Only, 46-51 feet, good visibility, north of Aquarius habitat, dominated by <i>Dictyota</i> algae, gorgonians and <i>X. muta</i> , no <i>Acropora</i> observed at site
106 - Conch Reef RO**	Low-relief spur and groove within Conch Reef Research Only, 43-47 feet, inshore of Aquarius site, similar to site 107, good visibility, dominated by <i>Dictyota</i> algae, gorgonians and <i>X. muta</i> , water temperature 86°F, no <i>Acropora</i> observed at site
276 - Davis Reef SPA**	Low-relief spur and groove within Davis Reef SPA, 31-34 feet, closer to reef marker, good visibility, dominated by sandy algal turf, gorgonians, fire coral, <i>X. muta</i> and <i>S. vesparium</i> , spurs ~15 cm off of the sand, water temperature 85°F, no <i>Acropora</i> observed at site
80 - Davis Reef SPA**	Low-relief spur and groove within Davis Reef SPA, 32-34 feet, southern side of SPA, good visibility, low profile, dominated by sandy algal turf, fire coral, <i>S. vesparium</i> and gorgonians, corals mostly small, little macroalgae, water temperature 85°F, no <i>Acropora</i> observed at site
102 - South of Lower Matecumbe	Reference low-relief spur and groove south of Lower Matecumbe Key, 36-40 feet, moderate relief, green water, dominated by corals, especially <i>M. cavernosa</i> , <i>M. faveolata</i> and <i>S. siderea</i> , <i>Dictyota</i> and <i>H. goreau</i> , water temperature 86°F, colder water on bottom, no <i>Acropora</i> observed at site

Habitat type/site number and location	Site description
109 - Tennessee Reef RO**	Low-relief spur and groove within Tennessee Reef RO, 29-32 feet, near central area of RO, less large corals, cyanobacteria prevalent, no <i>Acropora</i> observed at site
108 - Tennessee Reef RO**	Low-relief spur and groove within Tennessee Reef RO, 31-34 feet, near SW boundary, moderate relief and dominated by brown algae and gorgonians, some large coral heads of <i>M. faveolata</i> , <i>D. strigosa</i> and <i>C. natans</i> , water temperature 89°F, no <i>Acropora</i> observed at site
113 - NE of Tennessee Light	Reference low-relief spur and groove northeast of Tennessee Lighthouse, 25-28 feet, supposed to be patchy hard-bottom, green water, generally good visibility, low-profile spurs with moderate relief, dominated by <i>H. tuna</i> , <i>Udotea</i> , <i>Sargassum</i> , <i>X. muta</i> , water temperature 88°F
349 - South of Conch Key	Reference low-relief spur and groove south of Conch Key, 35-37 feet, good visibility, more dense cover than site 100, dominated by sea plumes and <i>S. vesparium</i> , no <i>Acropora</i> observed at site
100 - South of Conch Key	Reference low-relief spur and groove south of Conch Key, 43-46 feet, good visibility, sandy and dominated by algal turf and gorgonians, corals small, no <i>Acropora</i> observed at site
99 - East of Delta Shoal	Reference low-relief spur and groove east of Delta Shoal, 28-31 feet, green water, low profile, silty, dominated by sandy algal turf and <i>S. vesparium</i> , no <i>Acropora</i> observed at site
110 - Sombrero Key SPA**	Low-relief spur and groove within Sombrero Key SPA, 36-40 feet, near eastern end of SPA, dominated by <i>Dictyota</i> algae and gorgonians, water temperature 88°F, no <i>Acropora</i> observed at site, very few urchins
287 - Sombrero Key SPA**	Low-relief spur and groove within Sombrero Key SPA, 38-41 feet, near western end of SPA, more sparse than site 110, silty and dominated by gorgonians, small corals, no <i>Acropora</i> observed at site, some queen conch observed
Lower Florida Keys NMS	
337 - South of Bahia Honda Key	Reference low-relief spur and groove south of Bahia Honda Key, 35-37 feet, low profile and silty substratum, dominated by gorgonians and fire coral, corals mostly small, abundant coral recruits, paling to bleaching of <i>Siderastrea</i> and <i>S. intersepta</i>
174 - Looe Key SPA**	Low-relief spur and groove within Looe Key SPA, 32-37 feet, similar to site 339, near eastern end of SPA, shallower end of spur more sparse, abundant sea plume recruits, no <i>Acropora</i> observed at site
339 - Looe Key SPA**	Low-relief spur and groove within Looe Key SPA, 32-37 feet, silty, low profile, dominated by algal turf, <i>S. vesparium</i> , fire coral and gorgonians, small corals, water temperature 88°F, paling to bleaching of <i>S. radians</i> , no <i>Acropora</i> observed at site
142 - American Shoal	Reference low-relief spur and groove at American Shoal, 34-37 feet, supposed to be high-relief spur and groove, but deeper and offshore of high-relief spurs, ~14 cm in height, dominated by <i>Dictyota</i> algae and gorgonians, silty appearance, abundant <i>S. vesparium</i> and <i>X. muta</i> sponges, no <i>Acropora</i> observed at site, water temperature 85°F
172 - East of Eastern Sambo RO	Reference low-relief spur and groove east of Eastern Sambo Research Only, 36-39 feet, moderate relief, dominated by <i>Dictyota</i> algae and gorgonians, isolated <i>M. cavernosa</i> heads, <i>A. cervicornis</i> rubble present, no live <i>Acropora</i> observed at site
340 - Eastern Sambo RO**	Low-relief spur and groove at Eastern Sambo Research Only, 27-33 feet, SE end of no-take zone, lower profile than site 175, no <i>Acropora</i> present at site
175 - Eastern Sambo RO**	Low-relief spur and groove at Eastern Sambo Research Only, 27-33 feet, SW end of no-take zone, old staghorn coral rubble present, <i>A. cervicornis</i> present on transects
171 - Middle Sambo Reef	Reference low-relief spur and groove at Middle Sambo Reef, 32-37 feet, old staghorn coral rubble present, dominated by <i>Dictyota</i> , isolated colonies of <i>C. natans</i> and <i>M. faveolata</i> , <i>A. cervicornis</i> present at site
170 - Middle Sambo Reef	Reference low-relief spur and groove at Middle Sambo Reef, 28-34 feet, spurs ~35 cm high, dominated by <i>Dictyota</i> , <i>H. goreauii</i> , and sea plumes, isolated heads of <i>M. faveolata</i> , pillar coral present, no <i>Acropora</i> observed at site
341 - Western Sambo ER**	Low-relief spur and groove within Western Sambo Ecological Reserve, 32-39 feet, second block added to reserve, east of site 176, similar structure, moderate relief, excellent visibility, abundant <i>X. muta</i> , abundant but old staghorn coral rubble, dominated by <i>Dictyota</i> , <i>Lobophora</i> , and gorgonians, no <i>Acropora</i> observed
176 - Western Sambo ER**	Low-relief spur and groove in SW corner of Western Sambo Ecological Reserve, 28-38 feet, moderate relief, excellent visibility, abundant <i>X. muta</i> and heads of <i>M. faveolata</i> , dominated by <i>Dictyota</i> algae and gorgonians, no <i>Acropora</i> observed

Table 5. SCUBA diving effort for *Acropora* corals, stony coral species richness, sea urchins, *Coralliophila* snails, and reef fishes in the Florida Keys National Marine Sanctuary during June-August 2007.

Diver	Affiliation	No. of dives	Depth range (m)	Bottom time
<i>Benthic surveys</i>				
Mark Chiappone	CMS/UNCW	235	0.5-15.9 m	141 hr 48 min
Leanne Rutten	CMS/UNCW	235	0.5-15.6 m	141 hr 48 min
Subtotal		470	0.5-15.9 m	283 hr 36 min
<i>Reef fish surveys</i>				
Doug Harper	NOAA Fisheries	14	2.1-10.5 m	3 hr 32 min
Dave McClellan	NOAA Fisheries	7	2.4-5.7 m	1 hr 47 min
Natalia Zurcher	NOAA Fisheries	7	4.5-9.0 m	1 hr 43 min
Subtotal		28	1.5-13.5 m	7 hr 02 min
Total all divers		498	0.5-15.9 m	291 hr 03 min

Table 6. Presence (P) of staghorn coral (*Acropora cervicornis*) and elkhorn coral (*A. palmata*) in the Florida Keys National Marine Sanctuary, as determined from surveys of 60 m² areas per site at 235 sites during June-August 2007. Values for regional sectors and habitat types are the percentage of sites where each species was observed. Sites are arranged by habitat from northeast to southwest. Asterisked locations (***) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

Site number/site location	<i>Acropora cervicornis</i>		<i>Acropora palmata</i>	
	Transects	Present at site	Transects	Present at site
<i>Mid-channel patch reefs</i>				
Biscayne National Park				
445 - Northern Legare Anchorage				
441 - Bache Shoal				
440 - South of Bache Shoal				
438 - South of Bache Shoal		P		
437 - South of Legare Anchorage				
427 - Margot Fish Shoal				
421 - Margot Fish Shoal				
419 - Inshore of Ajax Reef				
413 - Inshore of Pacific Reef				
410 - Inshore of Pacific Reef	P	P		
408 - Offshore of Broad Creek				
406 - Offshore of Broad Creek	P	P		
Biscayne National Park Total (12)	16.7%	25.0%	0%	0%
Upper Florida Keys NMS				
4 - Basin Hill Shoals	P	P		
2 - Near Cannon Patch Reef				
3 - Near Cannon Patch Reef				
1 - Inshore of Molasses Reef		P		
Upper Florida Keys Total (4)	25.0%	50.0%	0%	0%
Middle Florida Keys NMS				
69 - Tavernier Rocks				
71 - Hen and Chickens SPA**				
70 - Hen and Chickens SPA**				
68 - East of Cheeca Rocks SPA				
72 - Cheeca Rocks SPA**				
73 - Cheeca Rocks SPA**				
66 - East Turtle Shoal				
254 - East Turtle Shoal				
Middle Florida Keys Total (8)	0%	0%	0%	0%
Lower Florida Keys NMS				
122 - North of Big Pine Shoal				
121 - North of Maryland Shoal	P	P		
120 - North of Maryland Shoal	P	P		
119 - North of Pelican Shoal	P	P		
118 - East of Western Sambo ER				
126 - Western Sambo ER**				
125 - Western Sambo ER**	P	P		
124 - Western Sambo ER**	P	P		
123 - Western Sambo ER**	P	P		
117 - NW of Sand Key SPA				
116 - North of Satan Shoal	P	P		
115 - North of Satan Shoal	P	P		
Lower Florida Keys Total (12)	66.7%	75.0%	0%	0%
Mid-channel Patch Reef Total (36)	30.6%	36.1%	0%	0%
<i>Offshore patch reefs</i>				
Biscayne National Park				
471 - Northwest of Triumph Reef	P	P	P	P
461 - NW of Long Reef				

Site number/site location	<i>Acropora cervicornis</i>		<i>Acropora palmata</i>	
	Transects	Present at site	Transects	Present at site
460 - NW of Long Reef	P	P		
459 - NW of Pacific Reef				
458 - Inshore of Pacific Reef	P	P		
456 - Inshore of Pacific Reef	P	P		
454 - Northwest of Whistle Buoy	P	P		
Biscayne National Park Total (7)	71.4%	71.4%	28.6%	71.4%
Upper Florida Keys NMS				
16 - North of Carysfort Reef SPA				
15 - North of Carysfort Reef SPA			P	P
14 - North of Carysfort Reef SPA				
47 - Carysfort Reef SPA**				
345 - Carysfort Reef SPA**				
46 - Carysfort Reef SPA**				
39 - Carysfort Reef SPA**	P	P		
37 - West of Carysfort Reef SPA				
13 - Inshore of Watson's Reef				
55 - Inshore of Watson's Reef				
358 - Inshore of Watson's Reef				
54 - Inshore of Watson's Reef				
347 - Inshore of Watson's Reef		P		
12 - Inshore of Watson's Reef				
9 - White Banks	P	P		
8 - Inshore of French Reef				
7 - Inshore of Molasses Reef		P		
6 - Inshore of Molasses Reef	P	P		
5 - Inshore of Pickles Reef				
Upper Florida Keys Total (19)	15.8%	26.3%	5.3%	5.3%
Middle Florida Keys NMS				
77 - Inshore of Conch Reef SPA	P	P		
76 - Inshore of Conch Reef SPA	P	P		
75 - Inshore of Conch Reef SPA				
74 - Inshore of Conch Reef SPA	P	P		
98 - Coffins Patch SPA**				
277 - Coffins Patch SPA**	P	P		
Middle Florida Keys Total (6)	66.7%	66.7%	0%	0%
Lower Florida Keys NMS				
133 - Looe Key Research Only**		P		
132 - Looe Key Research Only**	P	P		
131 - North of Looe Key SPA**	P	P		
130 - Maryland Shoal	P	P		
129 - North of Maryland Shoal	P	P		
165 - North of Maryland Shoal	P	P		
128 - NE of Eastern Sambo RO				
135 - Western Sambo ER**		P		
168 - Western Sambo ER**				
127 - West of Sand Key SPA				
Lower Florida Keys Total (10)	50.0%	70.0%	0%	0%
Offshore Patch Reef Total (42)	40.5%	50.0%	4.8%	4.8%
<i>Hard-bottom/rubble/sand matrix</i>				
Upper Florida Keys NMS				
40 - Carysfort Reef SPA**				
38 - West of Carysfort Reef SPA				
36 - West of Carysfort Reef SPA				
11 - NW of Dry Rocks SPA				
Upper Florida Keys Total (4)	0%	0%	0%	0%
Hard-bottom Matrix Total (4)	0%	0%	0%	0%

Site number/site location	<i>Acropora cervicornis</i>		<i>Acropora palmata</i>	
	Transects	Present at site	Transects	Present at site
<i>Low-relief hard-bottom (< 6 m)</i>				
Biscayne National Park				
475 - Fowey Rocks	P	P		
469 - South of Ajax Reef				
Biscayne National Park Total (2)	50.0%	50.0%	0%	0%
Upper Florida Keys NMS				
346 - Carysfort Reef SPA**				
35 - West of Carysfort Reef SPA	P	P		
34 - West of Carysfort Reef SPA				
33 - Inshore of Watson's Reef				
17 - Little Pickles Reef				
Upper Florida Keys Total (5)	20.0%	20.0%	0%	0%
Middle Florida Keys NMS				
269 - Conch Reef SPA**				
89 - Conch Reef SPA**				
88 - Little Conch Reef				
352 - Little Conch Reef				
97 - Davis Reef SPA**				
90 - Davis Reef SPA**				
86 - South of Windley Key	P	P		
103 - NE of Alligator Light				
82 - Alligator Reef SPA**				
81 - Alligator Reef SPA**				
350 - Tennessee Light				
85 - East of Coffins Patch SPA				
92 - Coffins Patch SPA**				
91 - Coffins Patch SPA**				
Middle Florida Keys Total (14)	7.1%	7.1%	0%	0%
Lower Florida Keys NMS				
161 - West of American Shoal		P		
140 - Maryland Shoal				
159 - North of Pelican Shoal	P	P		
158 - East of No Name Reef	P	P		
Lower Florida Keys Total (4)	50.0%	75.0%		
Hard-bottom (< 6 m) Total (25)	20.0%	24.0%	0%	0%
<i>Inner line reef tract spur & groove</i>				
Upper Florida Keys NMS				
61 - Turtle Reef	P	P		
60 - Inshore of Elbow Reef SPA	P	P		
59 - Inshore of Elbow Reef SPA	P	P	P	P
58 - Horseshoe Reef	P	P	P	P
62 - Dry Rocks SPA**			P	P
63 - Dry Rocks SPA**				P
65 - Grecian Rocks SPA**				P
64 - Grecian Rocks SPA**				
Upper Florida Keys Total (8)	50.0%	50.0%	37.5%	62.5%
Inner Line Spur & Groove Total (8)	50.0%	50.0%	37.5%	62.5%
<i>High-relief spur & groove</i>				
Biscayne National Park				
474 - Brewster Reef				
472 - Star Reef				
470 - Triumph Reef				
467 - Long Reef			P	P
466 - Ajax Reef				
465 - Ajax Reef				
464 - Pacific Reef				
Biscayne National Park Total (7)	0%	0%	14.3%	14.3%

Site number/site location	<i>Acropora cervicornis</i>		<i>Acropora palmata</i>	
	Transects	Present at site	Transects	Present at site
Upper Florida Keys NMS				
26 - Carysfort Reef SPA**				
25 - Carysfort Reef SPA**				
218 - South Carysfort Reef SPA**				
217 - South Carysfort Reef SPA**			P	P
24 - Maitland Grounding Site				
28 - Elbow Reef SPA**			P	P
27 - Elbow Reef SPA**			P	P
30 - French Reef SPA**			P	P
29 - French Reef SPA**			P	P
23 - SW of French Reef SPA				
357 - Sand Island				
356 - Sand Island			P	P
32 - Molasses Reef SPA**			P	P
31 - Molasses Reef SPA**			P	P
19 - Pickles Reef				
20 - Pickles Reef				
18 - Pickles Reef				
Upper Florida Keys Total (17)	0%	0%	52.9%	52.9%
Middle Florida Keys NMS				
79 - Delta Shoal				
78 - Delta Shoal				
84 - Sombrero Key SPA**			P	P
83 - Sombrero Key SPA**				
Middle Florida Keys Total (4)	0%	0%	25.0%	25.0%
Lower Florida Keys NMS				
148 - Looe Key SPA**			P	P
147 - Looe Key SPA**		P	P	P
145 - American Shoal				
146 - American Shoal				
144 - Maryland Shoal				
141 - Maryland Shoal				
143 - Maryland Shoal	P	P		
139 - Pelican Shoal				
138 - No Name Reef				
137 - No Name Reef	P	P	P	P
150 - Eastern Sambo RO**				
149 - Eastern Sambo RO**				
348 - Middle Sambo Reef				
309 - Middle Sambo Reef	P	P		
152 - Western Sambo ER**				
151 - Western Sambo ER**				
136 - East of Eastern Dry Rocks SPA	P	P		P
154 - Eastern Dry Rocks SPA**			P	P
153 - Eastern Dry Rocks SPA**				
156 - Rock Key SPA**				
155 - Rock Key SPA**				
325 - Sand Key SPA**		P		P
157 - Sand Key SPA**				P
Lower Florida Keys Total (23)	17.4%	26.1%	17.4%	30.4%
High-relief Spur & Groove Total (51)	7.8%	11.8%	27.5%	33.3%
<i>Low-relief hard-bottom (6-15 m)</i>				
Upper Florida Keys NMS				
53 - Carysfort Reef SPA**				
240 - Carysfort Reef SPA**				
57 - Inshore of Watson's Reef				
45 - Offshore of Dry Rocks SPA				
22 - SW of French Reef SPA				

Site number/site location	<i>Acropora cervicornis</i>		<i>Acropora palmata</i>	
	Transects	Present at site	Transects	Present at site
21 - SW of French Reef SPA		P		
Upper Florida Keys Total (6)	0%	16.7%	0%	0%
Middle Florida Keys NMS				
353 - Conch Reef SPA**				
105 - Conch Reef SPA**				
104 - NE of Alligator Light				
351 - South of Indian Key				
101 - South of Lower Matecumbe				
111 - West of Sombrero Key				
Middle Florida Keys Total (6)	0%	0%	0%	0%
Lower Florida Keys NMS				
180 - South of Bahia Honda Key	P	P		
173 - Maryland Shoal				
177 - NE of Satan Shoal				
Lower Florida Keys Total (3)	33.3%	33.3%	0%	0%
Hard-bottom (6-15 m) Total (15)	6.7%	13.3%	0%	0%
<i>Patchy hard-bottom (6-15 m)</i>				
Upper Florida Keys NMS				
56 - Inshore of Watson's Reef				
44 - Dixie Shoal				
43 - Dixie Shoal				
42 - Dixie Shoal				
Upper Florida Keys Total (4)	0%	0%	0%	0%
Middle Florida Keys NMS				
96 - South of Windley Key				
114 - South of Lower Matecumbe				
94 - South of Duck Key				
93 - South of Duck Key				
Middle Florida Keys Total (4)	0%	0%	0%	0%
Lower Florida Keys NMS				
338 - South of Bahia Honda Key				
179 - West of American Shoal				
160 - North of Pelican Shoal				
164 - West of Pelican Shoal				
178 - West of Pelican Shoal				
166 - Eastern Sambo RO**	P	P		
332 - Eastern Sambo RO**				
334 - Western Sambo ER**				
167 - Western Sambo ER**	P	P		
163 - West of Western Sambo ER				
335 - Sand Key SPA**				
169 - Sand Key SPA**				
162 - West of Western Dry Rocks				
Lower Florida Keys Total (13)	15.4%	15.4%	0%	0%
Patchy Hard-bottom Total (21)	9.5%	9.5%	0%	0%
<i>Low-relief spur & groove (6-15 m)</i>				
Upper Florida Keys NMS				
52 - Carysfort Reef SPA**				
241 - Carysfort Reef SPA**				
51 - Offshore of Dry Rocks SPA				
50 - Offshore of Dry Rocks SPA				
49 - Little Pickles Reef				
48 - Little Pickles Reef				
Upper Florida Keys Total (6)	0%	0%	0%	0%
Middle Florida Keys NMS				
355 - NE of Conch Reef				

Site number/site location	<i>Acropora cervicornis</i>		<i>Acropora palmata</i>	
	Transects	Present at site	Transects	Present at site
282 - Conch Reef SPA**				
354 - Conch Reef SPA**				
107 - Conch Reef RO**				
106 - Conch Reef RO**				
276 - Davis Reef SPA**				
80 - Davis Reef SPA**				
102 - South of Lower Matecumbe				
109 - Tennessee Reef RO**				
108 - Tennessee Reef RO**				
113 - NE of Tennessee Light				
349 - South of Conch Key				
100 - South of Conch Key				
99 - East of Delta Shoal				
110 - Sombrero Key SPA**				
287 - Sombrero Key SPA**				
Middle Florida Keys Total (16)	0%	0%	0%	0%
Lower Florida Keys NMS				
337 - South of Bahia Honda Key				
174 - Looe Key SPA**				
339 - Looe Key SPA**				
142 - American Shoal				
172 - East of Eastern Sambo RO				
340 - Eastern Sambo RO**				
175 - Eastern Sambo RO**	P	P		
171 - Middle Sambo Reef	P	P		
170 - Middle Sambo Reef				
341 - Western Sambo ER**				
176 - Western Sambo ER**				
Lower Florida Keys Total (11)	18.2%	18/2%	0%	0%
Low-relief Spur & Groove Total (33)	6.1%	6.1%	0%	0%

Table 7. Mean density (no. colonies/m²), tissue surface area (cm² and % cover), and colony size of staghorn coral (*Acropora cervicornis*) in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June-August 2007. Sites are arranged by habitat from NE to SW and asterisked locations (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO). SE = standard error.

Site number/site location	Colony density			Colony size		
	Colonies	No./m ²	SE	Total area (cm ²) (%)	Area (cm ²) per colony	SE
<i>Mid-channel patch reefs</i>						
Biscayne National Park						
445 - Northern Legare Anchorage	0	0	0	0	0	0
441 - Bache Shoal	0	0	0	0	0	0
440 - South of Bache Shoal	0	0	0	0	0	0
438 - South of Bache Shoal	0	0	0	0	0	0
437 - South of Legare Anchorage	0	0	0	0	0	0
427 - Margot Fish Shoal	0	0	0	0	0	0
421 - Margot Fish Shoal	0	0	0	0	0	0
419 - Inshore of Ajax Reef	0	0	0	0	0	0
413 - Inshore of Pacific Reef	0	0	0	0	0	0
410 - Inshore of Pacific Reef	4	0.067	0.133	1,734 (0.3%)	434	335
408 - Offshore of Broad Creek	0	0	0	0	0	0
406 - Offshore of Broad Creek	47	0.783	0.683	10,690 (1.8%)	228	288
Biscayne National Park Total (12)	51	0.071	0.065	12,424 (0.2%)	331	103
Upper Florida Keys NMS						
4 - Basin Hill Shoals	10	0.167	0.333	2,163 (0.4%)	216	141
2 - Near Cannon Patch Reef	0	0	0	0	0	0
3 - Near Cannon Patch Reef	0	0	0	0	0	0
1 - Inshore of Molasses Reef	0	0	0	0	0	0
Upper Florida Keys Total (4)	10	0.042	0.042	2,163 (0.1%)	216	
Middle Florida Keys NMS						
69 - Tavernier Rocks	0	0	0	0	0	0
71 - Hen and Chickens SPA**	0	0	0	0	0	0
70 - Hen and Chickens SPA**	0	0	0	0	0	0
68 - East of Cheeca Rocks SPA	0	0	0	0	0	0
72 - Cheeca Rocks SPA**	0	0	0	0	0	0
73 - Cheeca Rocks SPA**	0	0	0	0	0	0
66 - East Turtle Shoal	0	0	0	0	0	0
254 - East Turtle Shoal	0	0	0	0	0	0
Middle Florida Keys Total (8)	0	0	0	0	0	0
Lower Florida Keys NMS						
122 - North of Big Pine Shoal	0	0	0	0	0	0
121 - North of Maryland Shoal	8	0.133	0.267	1,246 (0.2%)	156	111
120 - North of Maryland Shoal	9	0.150	0.300	1,608 (0.3%)	179	163
119 - North of Pelican Shoal	1	0.017	0.033	121 (< 0.1%)	121	
118 - East of Western Sambo ER	0	0	0	0	0	0
126 - Western Sambo ER**	0	0	0	0	0	0
125 - Western Sambo ER**	2	0.033	0.066	154 (< 0.1%)	77	77
124 - Western Sambo ER**	11	0.183	0.206	1,246 (0.2%)	113	80
123 - Western Sambo ER**	17	0.283	0.337	1,058 (0.2%)	62	111
117 - NW of Sand Key SPA	0	0	0	0	0	0
116 - North of Satan Shoal	3	0.050	0.064	575 (0.1%)	192	96
115 - North of Satan Shoal	1	0.017	0.033	831 (0.1%)	831	0
Lower Florida Keys Total (12)	52	0.072	0.027	6,839 (0.1%)	216	89
Mid-channel Patch Reef Total (36)	113	0.052	0.024	21,426 (0.1%)	216	89
<i>Offshore patch reefs</i>						
Biscayne National Park						
471 - Northwest of Triumph Reef	41	0.683	0.252	4,242 (0.7%)	104	166

Site number/site location	Colony density			Colony size		
	Colonies	No./m ²	SE	Total area (cm ²) (%)	Area (cm ²) per colony	SE
461 - NW of Long Reef	0	0	0.000	0	0	0
460 - NW of Long Reef	0	0	0.000	0	0	0
459 - NW of Pacific Reef	8	0.133	0.267	3535 (0.6%)	44	40
458 - Inshore of Pacific Reef	0	0	0.000	0	0	0
456 - Inshore of Pacific Reef	4	0.067	0.133	5,248 (0.9%)	1,312	1,486
454 - Northwest of Whistle Buoy	7	0.117	0.157	797 (0.1%)	1149	107
Biscayne National Park Total (7)	62	0.148	0.097	10,640 (0.3%)	393	307
Upper Florida Keys NMS						
16 - North of Carysfort Reef SPA	0	0	0	0	0	0
15 - North of Carysfort Reef SPA	0	0	0	0	0	0
14 - North of Carysfort Reef SPA	0	0	0	0	0	0
47 - Carysfort Reef SPA**	0	0	0	0	0	0
345 - Carysfort Reef SPA**	0	0	0	0	0	0
46 - Carysfort Reef SPA**	0	0	0	0	0	0
39 - Carysfort Reef SPA**	3	0.050	0.100	186 (< 0.1%)	62	59
37 - West of Carysfort Reef SPA	0	0	0	0	0	0
13 - Inshore of Watson's Reef	0	0	0	0	0	0
55 - Inshore of Watson's Reef	0	0	0	0	0	0
358 - Inshore of Watson's Reef	0	0	0	0	0	0
54 - Inshore of Watson's Reef	0	0	0	0	0	0
347 - Inshore of Watson's Reef	0	0	0	0	0	0
12 - Inshore of Watson's Reef	0	0	0	0	0	0
9 - White Banks	19	0.317	0.440	1,626 (0.3%)	86	106
8 - Inshore of French Reef	0	0	0	0	0	0
7 - Inshore of Molasses Reef	0	0	0	0	0	0
6 - Inshore of Molasses Reef	13	0.217	0.220	4,684 (0.8%)	360	547
5 - Inshore of Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (19)	35	0.031	0.020	6,496 (0.1%)	169	96
Middle Florida Keys NMS						
77 - Inshore of Conch Reef SPA	11	0.183	0.252	443 (0.1%)	44	40
76 - Inshore of Conch Reef SPA	16	0.267	0.349	2,149 (0.4%)	134	227
75 - Inshore of Conch Reef SPA	0	0	0	0	0	0
74 - Inshore of Conch Reef SPA	12	0.200	0.196	1,989 (0.3%)	166	122
98 - Coffins Patch SPA**	0	0	0	0	0	0
277 - Coffins Patch SPA**	4	0.067	0.094	1,713 (0.3%)	428	328
Middle Florida Keys Total (6)	43	0.119	0.046	6,294 (0.2%)	193	83
Lower Florida Keys NMS						
133 - Looe Key Research Only**	0	0	0	0	0	0
132 - Looe Key Research Only**	10	0.167	0.333	1,101 (0.2%)	110	175
131 - North of Looe Key SPA**	73	1.217	1.780	12,247 (2.0%)	168	228
130 - Maryland Shoal	15	0.250	0.319	2,988 (0.5%)	199	254
129 - North of Maryland Shoal	5	0.083	0.167	209 (< 0.1%)	42	26
165 - North of Maryland Shoal	5	0.083	0.167	411 (0.1%)	82	52
128 - NE of Eastern Sambo RO	0	0	0	0	0	0
135 - Western Sambo ER**	0	0	0	0	0	0
168 - Western Sambo ER**	0	0	0	0	0	0
127 - West of Sand Key SPA	0	0	0	0	0	0
Lower Florida Keys Total (10)	108	0.180	0.118	16,956 (0.3%)	120	28
Offshore Patch Reef Total (42)	246	0.098	0.034	40,386 (0.2%)	216	78
<i>Hard-bottom/rubble/sand matrix</i>						
Upper Florida Keys NMS						
40 - Carysfort Reef SPA**	0	0	0	0	0	0
38 - West of Carysfort Reef SPA	0	0	0	0	0	0
36 - West of Carysfort Reef SPA	0	0	0	0	0	0
11 - NW of Dry Rocks SPA	0	0	0	0	0	0
Upper Florida Keys Total (4)	0	0	0	0	0	0
Hard-bottom Matrix Total (4)	0	0	0	0	0	0

Site number/site location	Colony density			Colony size		
	Colonies	No./m ²	SE	Total area (cm ²) (%)	Area (cm ²) per colony	SE
<i>Low-relief hard-bottom (< 6 m)</i>						
Biscayne National Park						
475 - Fowey Rocks	7	0.117	0.233	399 (0.1%)	57	36
469 - South of Ajax Reef	0	0	0	0	0	0.0
Biscayne National Park Total (2)	7	0.058	0.058	399 (< 0.1%)	57	
Upper Florida Keys NMS						
346 - Carysfort Reef SPA**	0	0	0	0	0	0
35 - West of Carysfort Reef SPA	1	0.017	0.033	108 (< 0.1%)	108	
34 - West of Carysfort Reef SPA	0	0	0	0	0	0
33 - Inshore of Watson's Reef	0	0	0	0	0	0
17 - Little Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (5)	1	0.003	0.003	108 (< 0.1%)	108	
Middle Florida Keys NMS						
269 - Conch Reef SPA**	0	0	0	0	0	0
89 - Conch Reef SPA**	0	0	0	0	0	0
88 - Little Conch Reef	0	0	0	0	0	0
352 - Little Conch Reef	0	0	0	0	0	0
97 - Davis Reef SPA**	0	0	0	0	0	0
90 - Davis Reef SPA**	0	0	0	0	0	0
86 - South of Windley Key	3	0.050	0.100	163 (< 0.1%)	54	37
103 - NE of Alligator Light	0	0	0	0	0	0
82 - Alligator Reef SPA**	0	0	0	0	0	0
81 - Alligator Reef SPA**	0	0	0	0	0	0
350 - Tennessee Light	0	0	0	0	0	0
85 - East of Coffins Patch SPA	0	0	0	0	0	0
92 - Coffins Patch SPA**	0	0	0	0	0	0
91 - Coffins Patch SPA**	0	0	0	0	0	0
Middle Florida Keys Total (14)	3	0.004	0.004	163 (< 0.1%)	54	
Lower Florida Keys NMS						
161 - West of American Shoal	0	0	0	0	0	0
140 - Maryland Shoal	0	0	0	0	0	0
159 - North of Pelican Shoal	1	0.017	0.033	378 (0.1%)	378	
158 - East of No Name Reef	3	0.050	0.064	677 (0.1%)	226	109
Lower Florida Keys Total (4)	4	0.017	0.012	1055 (< 0.1%)	302	76
Hard-bottom (< 6 m) Total (25)	15	0.010	0.005	1726.0	164.7	61.7
<i>Inner line reef tract spur & groove</i>						
Upper Florida Keys NMS						
61 - Turtle Reef	18	0.300	0.338	2,743 (0.5%)	152	153
60 - Inshore of Elbow Reef SPA	3	0.050	0.100	159 (< 0.1%)	53	32
59 - Inshore of Elbow Reef SPA	7	0.117	0.233	312 (0.1%)	45	30
58 - Horseshoe Reef	1	0.017	0.033	1,973 (0.3%)	1,973	
62 - Dry Rocks SPA**	0	0	0	0	0	0
63 - Dry Rocks SPA**	0	0	0	0	0	0
65 - Grecian Rocks SPA**	0	0	0	0	0	0
64 - Grecian Rocks SPA**	0	0	0	0	0	0
Upper Florida Keys Total (8)	29	0.060	0.037	5,187 (0.1%)	556	473
Inner Line Spur & Groove Total (8)	29	0.060	0.037	5,187 (0.1%)	556	473
<i>High-relief spur & groove</i>						
Biscayne National Park						
474 - Brewster Reef	0	0	0	0	0	0
472 - Star Reef	0	0	0	0	0	0
470 - Triumph Reef	0	0	0	0	0	0
467 - Long Reef	0	0	0	0	0	0
466 - Ajax Reef	0	0	0	0	0	0
465 - Ajax Reef	0	0	0	0	0	0
464 - Pacific Reef	0	0	0	0	0	0

Site number/site location	Colony density			Colony size		
	Colonies	No./m ²	SE	Total area (cm ²) (%)	Area (cm ²) per colony	SE
Biscayne National Park Total (7)	0	0	0	0	0	0
Upper Florida Keys NMS						
26 - Carysfort Reef SPA**	0	0	0	0	0	0
25 - Carysfort Reef SPA**	0	0	0	0	0	0
218 - South Carysfort Reef SPA**	0	0	0	0	0	0
217 - South Carysfort Reef SPA**	0	0	0	0	0	0
24 - Maitland Grounding Site	0	0	0	0	0	0
28 - Elbow Reef SPA**	0	0	0	0	0	0
27 - Elbow Reef SPA**	0	0	0	0	0	0
30 - French Reef SPA**	0	0	0	0	0	0
29 - French Reef SPA**	0	0	0	0	0	0
23 - SW of French Reef SPA	0	0	0	0	0	0
357 - Sand Island	0	0	0	0	0	0
356 - Sand Island	0	0	0	0	0	0
32 - Molasses Reef SPA**	0	0	0	0	0	0
31 - Molasses Reef SPA**	0	0	0	0	0	0
19 - Pickles Reef	0	0	0	0	0	0
20 - Pickles Reef	0	0	0	0	0	0
18 - Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (17)	0	0	0	0	0	0
Middle Florida Keys NMS						
79 - Delta Shoal	0	0	0	0	0	0
78 - Delta Shoal	0	0	0	0	0	0
84 - Sombrero Key SPA**	0	0	0	0	0	0
83 - Sombrero Key SPA**	0	0	0	0	0	0
Middle Florida Keys Total (4)	0	0	0	0	0	0
Lower Florida Keys NMS						
148 - Looe Key SPA**	0	0	0	0	0	0
147 - Looe Key SPA**	0	0	0	0	0	0
145 - American Shoal	0	0	0	0	0	0
146 - American Shoal	0	0	0	0	0	0
144 - Maryland Shoal	0	0	0	0	0	0
141 - Maryland Shoal	0	0	0	0	0	0
143 - Maryland Shoal	21	0.350	0.305	3,588 (0.6%)	171	183
139 - Pelican Shoal	0	0	0	0	0	0
138 - No Name Reef	0	0	0	0	0	0
137 - No Name Reef	6	0.100	0.128	8,955 (1.5%)	1,492	2,808
150 - Eastern Sambo RO**	0	0	0	0	0	0
149 - Eastern Sambo RO**	0	0	0	0	0	0
348 - Middle Sambo Reef	0	0	0	0	0	0
309 - Middle Sambo Reef	1	0.017	0.033	1,027 (0.2%)	1,027	
152 - Western Sambo ER**	0	0	0	0	0	0
151 - Western Sambo ER**	0	0	0	0	0	0
136 - East of Eastern Dry Rocks SPA	62	1.033	0.725	7,469 (1.2%)	121	206
154 - Eastern Dry Rocks SPA**	0	0	0	0	0	0
153 - Eastern Dry Rocks SPA**	0	0	0	0	0	0
156 - Rock Key SPA**	0	0	0	0	0	0
155 - Rock Key SPA**	0	0	0	0	0	0
325 - Sand Key SPA**	0	0	0	0	0	0
157 - Sand Key SPA**	0	0	0	0	0	0
Lower Florida Keys Total (23)	90	0.065	0.047	21,039 (0.2%)	703	336
High-relief Spur & Groove Total (51)	90	0.029	0.021	21,039 (0.1%)	703	336
<i>Low-relief hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
53 - Carysfort Reef SPA**	0	0	0	0	0	0
240 - Carysfort Reef SPA**	0	0	0	0	0	0
57 - Inshore of Watson's Reef	0	0	0	0	0	0

Site number/site location	Colony density			Colony size		
	Colonies	No./m ²	SE	Total area (cm ²) (%)	Area (cm ²) per colony	SE
45 - Offshore of Dry Rocks SPA	0	0	0	0	0	0
22 - SW of French Reef SPA	0	0	0	0	0	0
21 - SW of French Reef SPA	0	0	0	0	0	0
Upper Florida Keys Total (6)	0	0	0	0	0	0
Middle Florida Keys NMS						
353 - Conch Reef SPA**	0	0	0	0	0	0
105 - Conch Reef SPA**	0	0	0	0	0	0
104 - NE of Alligator Light	0	0	0	0	0	0
351 - South of Indian Key	0	0	0	0	0	0
101 - South of Lower Matecumbe	0	0	0	0	0	0
111 - West of Sombrero Key	0	0	0	0	0	0
Middle Florida Keys Total (6)	0	0	0	0	0	0
Lower Florida Keys NMS						
180 - South of Bahia Honda Key	1	0.017	0.033	53 (< 0.1%)	53	
173 - Maryland Shoal	0	0	0	0	0	0
177 - NE of Satan Shoal	0	0	0	0	0	0
Lower Florida Keys Total (3)	1	0.006	0.006	53 (< 0.1%)	53	
Hard-bottom (6-15 m) Total (15)	1	0.001	0.001	53 (< 0.1%)	53	
<i>Patchy hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
56 - Inshore of Watson's Reef	0	0	0	0	0	0
44 - Dixie Shoal	0	0	0	0	0	0
43 - Dixie Shoal	0	0	0	0	0	0
42 - Dixie Shoal	0	0	0	0	0	0
Upper Florida Keys Total (4)	0	0	0	0	0	0
Middle Florida Keys NMS						
96 - South of Windley Key	0	0	0	0	0	0
114 - South of Lower Matecumbe	0	0	0	0	0	0
94 - South of Duck Key	0	0	0	0	0	0
93 - South of Duck Key	0	0	0	0	0	0
Middle Florida Keys Total (4)	0	0	0	0	0	0
Lower Florida Keys NMS						
338 - South of Bahia Honda Key	0	0	0	0	0	0
179 - West of American Shoal	0	0	0	0	0	0
160 - North of Pelican Shoal	0	0	0	0	0	0
164 - West of Pelican Shoal	0	0	0	0	0	0
178 - West of Pelican Shoal	0	0	0	0	0	0
166 - Eastern Sambo RO**	4	0.067	0.133	1,376 (0.2%)	344	331
332 - Eastern Sambo RO**	0	0	0	0	0	0
334 - Western Sambo ER**	0	0	0	0	0	0
167 - Western Sambo ER**	2	0.033	0.039	1,689 (0.3%)	845	637
163 - West of Western Sambo ER	0	0	0	0	0	0
335 - Sand Key SPA**	0	0	0	0	0	0
169 - Sand Key SPA**	0	0	0	0	0	0
162 - West of Western Dry Rocks	0	0	0	0	0	0
Lower Florida Keys Total (13)	6	0.008	0.006	3,065 (< 0.1%)	594	250
Patchy Hard-bottom Total (21)	6	0.005	0.003	3065 (< 0.1%)	594	250
<i>Low-relief spur & groove (6-15 m)</i>						
Upper Florida Keys NMS						
52 - Carysfort Reef SPA**	0	0	0	0	0	0
241 - Carysfort Reef SPA**	0	0	0	0	0	0
51 - Offshore of Dry Rocks SPA	0	0	0	0	0	0
50 - Offshore of Dry Rocks SPA	0	0	0	0	0	0
49 - Little Pickles Reef	0	0	0	0	0	0
48 - Little Pickles Reef	0	0	0	0	0	0

Site number/site location	Colony density			Colony size		
	Colonies	No./m ²	SE	Total area (cm ²) (%)	Area (cm ²) per colony	SE
Upper Florida Keys Total (6)	0	0	0	0	0	0
Middle Florida Keys NMS						
355 - NE of Conch Reef	0	0	0	0	0	0
282 - Conch Reef SPA**	0	0	0	0	0	0
354 - Conch Reef SPA**	0	0	0	0	0	0
107 - Conch Reef RO**	0	0	0	0	0	0
106 - Conch Reef RO**	0	0	0	0	0	0
276 - Davis Reef SPA**	0	0	0	0	0	0
80 - Davis Reef SPA**	0	0	0	0	0	0
102 - South of Lower Matecumbe	0	0	0	0	0	0
109 - Tennessee Reef RO**	0	0	0	0	0	0
108 - Tennessee Reef RO**	0	0	0	0	0	0
113 - NE of Tennessee Light	0	0	0	0	0	0
349 - South of Conch Key	0	0	0	0	0	0
100 - South of Conch Key	0	0	0	0	0	0
99 - East of Delta Shoal	0	0	0	0	0	0
110 - Sombrero Key SPA**	0	0	0	0	0	0
287 - Sombrero Key SPA**	0	0	0	0	0	0
Middle Florida Keys Total (16)	0	0	0	0	0	0
Lower Florida Keys NMS						
337 - South of Bahia Honda Key	0	0	0	0	0	0
174 - Looe Key SPA**	0	0	0	0	0	0
339 - Looe Key SPA**	0	0	0	0	0	0
142 - American Shoal	0	0	0	0	0	0
172 - East of Eastern Sambo RO	0	0	0	0	0	0
340 - Eastern Sambo RO**	0	0	0	0	0	0
175 - Eastern Sambo RO**	7	0.117	0.233	643 (0.1%)	92	93
171 - Middle Sambo Reef	1	0.017	0.033	454 (0.1%)	454	
170 - Middle Sambo Reef	0	0	0	0	0	0
341 - Western Sambo ER**	0	0	0	0	0	0
176 - Western Sambo ER**	0	0	0	0	0	0
Lower Florida Keys Total (11)	8	0.012	0.011	1,097 (< 0.1%)	273	181
Low-relief Spur & Groove Total (33)	8	0.004	0.004	1,097 (< 0.1%)	273	181

Table 8. Numbers and relative frequencies (%) of staghorn coral (*Acropora cervicornis*) colonies exhibiting disease-like conditions and predation in the Florida Keys National Marine Sanctuary and Biscayne National Park, as quantified from four 15-m x 1-m transects per site at 235 locations during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

Site number/site location	White band	White pox	Tissue necrosis	Snail predation	Damselfish bites	Total colonies
<i>Mid-channel patch reefs</i>						
Biscayne National Park						
445 - Northern Legare Anchorage	0	0	0	0	0	0
441 - Bache Shoal	0	0	0	0	0	0
440 - South of Bache Shoal	0	0	0	0	0	0
438 - South of Bache Shoal	0	0	0	0	0	0
437 - South of Legare Anchorage	0	0	0	0	0	0
427 - Margot Fish Shoal	0	0	0	0	0	0
421 - Margot Fish Shoal	0	0	0	0	0	0
419 - Inshore of Ajax Reef	0	0	0	0	0	0
413 - Inshore of Pacific Reef	0	0	0	0	0	0
410 - Inshore of Pacific Reef	0	0	0	0	0	4
408 - Offshore of Broad Creek	0	0	0	0	0	0
406 - Offshore of Broad Creek	0	0	0	0	6 (12.8)	47
Biscayne National Park Total (12)	0	0	0	0	6 (11.8)	51
Upper Florida Keys NMS						
4 - Basin Hill Shoals	0	0	0	0	0	10
2 - Near Cannon Patch Reef	0	0	0	0	0	0
3 - Near Cannon Patch Reef	0	0	0	0	0	0
1 - Inshore of Molasses Reef	0	0	0	0	0	0
Upper Florida Keys Total (4)	0	0	0	0	0	10
Middle Florida Keys NMS						
69 - Tavernier Rocks	0	0	0	0	0	0
71 - Hen and Chickens SPA**	0	0	0	0	0	0
70 - Hen and Chickens SPA**	0	0	0	0	0	0
68 - East of Cheeca Rocks SPA	0	0	0	0	0	0
72 - Cheeca Rocks SPA**	0	0	0	0	0	0
73 - Cheeca Rocks SPA**	0	0	0	0	0	0
66 - East Turtle Shoal	0	0	0	0	0	0
254 - East Turtle Shoal	0	0	0	0	0	0
Middle Florida Keys Total (8)	0	0	0	0	0	0
Lower Florida Keys NMS						
122 - North of Big Pine Shoal	0	0	0	0	0	0
121 - North of Maryland Shoal	0	0	0	0	0	8
120 - North of Maryland Shoal	0	0	0	0	0	9
119 - North of Pelican Shoal	0	0	0	0	0	1
118 - East of Western Sambo ER	0	0	0	0	0	0
126 - Western Sambo ER**	0	0	0	0	0	0
125 - Western Sambo ER**	0	0	0	0	0	2
124 - Western Sambo ER**	0	0	0	0	0	11
123 - Western Sambo ER**	0	0	0	0	0	17
117 - NW of Sand Key SPA	0	0	0	0	0	0
116 - North of Satan Shoal	0	0	0	0	0	3
115 - North of Satan Shoal	0	0	0	0	0	1
Lower Florida Keys Total (12)	0	0	0	0	0	52
Mid-channel Patch Reef Total (36)	0	0	0	0	6 (5.3)	113
<i>Offshore patch reefs</i>						
Biscayne National Park						
471 - Northwest of Triumph Reef	0	0	0	0	0	43
461 - NW of Long Reef	0	0	0	0	0	0

Site number/site location	White band	White pox	Tissue necrosis	Snail predation	Damselfish bites	Total colonies
460 - NW of Long Reef	0	0	0	0	0	0
459 - NW of Pacific Reef	0	0	0	0	1	8
458 - Inshore of Pacific Reef	0	0	0	0	0	0
456 - Inshore of Pacific Reef	0	0	0	0	1	4
454 - Northwest of Whistle Buoy	0	0	0	0	0	7
Biscayne National Park Total (7)	0	0	0	0	2	62
Upper Florida Keys NMS						
16 - North of Carysfort Reef SPA	0	0	0	0	0	0
15 - North of Carysfort Reef SPA	0	0	0	0	0	0
14 - North of Carysfort Reef SPA	0	0	0	0	0	0
47 - Carysfort Reef SPA**	0	0	0	0	0	0
345 - Carysfort Reef SPA**	0	0	0	0	0	0
46 - Carysfort Reef SPA**	0	0	0	0	0	0
39 - Carysfort Reef SPA**	0	0	0	0	0	3
37 - West of Carysfort Reef SPA	0	0	0	0	0	0
13 - Inshore of Watson's Reef	0	0	0	0	0	0
55 - Inshore of Watson's Reef	0	0	0	0	0	0
358 - Inshore of Watson's Reef	0	0	0	0	0	0
54 - Inshore of Watson's Reef	0	0	0	0	0	0
347 - Inshore of Watson's Reef	0	0	0	0	0	0
12 - Inshore of Watson's Reef	0	0	0	0	0	0
9 - White Banks	0	0	0	0	0	19
8 - Inshore of French Reef	0	0	0	0	0	0
7 - Inshore of Molasses Reef	0	0	0	0	0	0
6 - Inshore of Molasses Reef	0	0	0	0	0	13
5 - Inshore of Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (19)	0	0	0	0	0	35
Middle Florida Keys NMS						
77 - Inshore of Conch Reef SPA	0	0	0	0	0	11
76 - Inshore of Conch Reef SPA	0	0	0	0	0	16
75 - Inshore of Conch Reef SPA	0	0	0	0	0	0
74 - Inshore of Conch Reef SPA	0	0	0	0	0	13
98 - Coffins Patch SPA**	0	0	0	0	0	0
277 - Coffins Patch SPA**	0	0	0	0	0	4
Middle Florida Keys Total (6)	0	0	0	0	0	44
Lower Florida Keys NMS						
133 - Looe Key Research Only**	0	0	0	0	0	0
132 - Looe Key Research Only**	0	0	0	0	0	10
131 - North of Looe Key SPA**	0	0	0	0	1 (1.7)	60
130 - Maryland Shoal	0	0	0	0	0	15
129 - North of Maryland Shoal	0	0	0	0	0	5
165 - North of Maryland Shoal	0	0	0	0	0	5
128 - NE of Eastern Sambo RO	0	0	0	0	0	0
135 - Western Sambo ER**	0	0	0	0	0	0
168 - Western Sambo ER**	0	0	0	0	0	0
127 - West of Sand Key SPA	0	0	0	0	0	0
Lower Florida Keys Total (10)	0	0	0	0	1 (1.1)	95
Offshore Patch Reef Total (42)	0	0	0	0	3 (1.3)	236
<i>Hard-bottom/rubble/sand matrix</i>						
Upper Florida Keys NMS						
40 - Carysfort Reef SPA**	0	0	0	0	0	0
38 - West of Carysfort Reef SPA	0	0	0	0	0	0
36 - West of Carysfort Reef SPA	0	0	0	0	0	0
11 - NW of Dry Rocks SPA	0	0	0	0	0	0
Upper Florida Keys Total (4)	0	0	0	0	0	0
Hard-bottom Matrix Total (4)	0	0	0	0	0	0

Site number/site location	White band	White pox	Tissue necrosis	Snail predation	Damselfish bites	Total colonies
<i>Low-relief hard-bottom (< 6 m)</i>						
Biscayne National Park						
475 - Fowey Rocks	0	0	0	0	0	7
469 - South of Ajax Reef	0	0	0	0	0	0
Biscayne National Park Total (2)	0	0	0	0	0	7
Upper Florida Keys NMS						
346 - Carysfort Reef SPA**	0	0	0	0	0	0
35 - West of Carysfort Reef SPA	0	0	0	0	0	1
34 - West of Carysfort Reef SPA	0	0	0	0	0	0
33 - Inshore of Watson's Reef	0	0	0	0	0	0
17 - Little Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (5)	0	0	0	0	0	1
Middle Florida Keys NMS						
269 - Conch Reef SPA**	0	0	0	0	0	0
89 - Conch Reef SPA**	0	0	0	0	0	0
88 - Little Conch Reef	0	0	0	0	0	0
352 - Little Conch Reef	0	0	0	0	0	0
97 - Davis Reef SPA**	0	0	0	0	0	0
90 - Davis Reef SPA**	0	0	0	0	0	0
86 - South of Windley Key	0	0	0	0	0	3
103 - NE of Alligator Light	0	0	0	0	0	0
82 - Alligator Reef SPA**	0	0	0	0	0	0
81 - Alligator Reef SPA**	0	0	0	0	0	0
350 - Tennessee Light	0	0	0	0	0	0
85 - East of Coffins Patch SPA	0	0	0	0	0	0
92 - Coffins Patch SPA**	0	0	0	0	0	0
91 - Coffins Patch SPA**	0	0	0	0	0	0
Middle Florida Keys Total (14)	0	0	0	0	0	3
Lower Florida Keys NMS						
161 - West of American Shoal	0	0	0	0	0	0
140 - Maryland Shoal	0	0	0	0	0	0
159 - North of Pelican Shoal	0	0	0	0	0	1
158 - East of No Name Reef	0	0	0	0	0	3
Lower Florida Keys Total (4)	0	0	0	0	0	4
Hard-bottom (< 6 m) Total (25)	0	0	0	0	0	15
<i>Inner line reef tract spur & groove</i>						
Upper Florida Keys NMS						
61 - Turtle Reef	0	0	0	0	0	19
60 - Inshore of Elbow Reef SPA	0	0	0	0	0	3
59 - Inshore of Elbow Reef SPA	0	0	0	0	0	7
58 - Horseshoe Reef	0	0	0	0	0	1
62 - Dry Rocks SPA**	0	0	0	0	0	0
63 - Dry Rocks SPA**	0	0	0	0	0	0
65 - Grecian Rocks SPA**	0	0	0	0	0	0
64 - Grecian Rocks SPA**	0	0	0	0	0	0
Upper Florida Keys Total (8)	0	0	0	0	0	30
Inner Line Spur & Groove Total (8)	0	0	0	0	0	30
<i>High-relief spur & groove</i>						
Biscayne National Park						
474 - Brewster Reef	0	0	0	0	0	0
472 - Star Reef	0	0	0	0	0	0
470 - Triumph Reef	0	0	0	0	0	0
467 - Long Reef	0	0	0	0	0	0
466 - Ajax Reef	0	0	0	0	0	0
465 - Ajax Reef	0	0	0	0	0	0
464 - Pacific Reef	0	0	0	0	0	0
Biscayne National Park Total (7)	0	0	0	0	0	0

Site number/site location	White band	White pox	Tissue necrosis	Snail predation	Damselfish bites	Total colonies
Upper Florida Keys NMS						
26 - Carysfort Reef SPA**	0	0	0	0	0	0
25 - Carysfort Reef SPA**	0	0	0	0	0	0
218 - South Carysfort Reef SPA**	0	0	0	0	0	0
217 - South Carysfort Reef SPA**	0	0	0	0	0	0
24 - Maitland Grounding Site	0	0	0	0	0	0
28 - Elbow Reef SPA**	0	0	0	0	0	0
27 - Elbow Reef SPA**	0	0	0	0	0	0
30 - French Reef SPA**	0	0	0	0	0	0
29 - French Reef SPA**	0	0	0	0	0	0
23 - SW of French Reef SPA	0	0	0	0	0	0
357 - Sand Island	0	0	0	0	0	0
356 - Sand Island	0	0	0	0	0	0
32 - Molasses Reef SPA**	0	0	0	0	0	0
31 - Molasses Reef SPA**	0	0	0	0	0	0
19 - Pickles Reef	0	0	0	0	0	0
20 - Pickles Reef	0	0	0	0	0	0
18 - Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (17)	0	0	0	0	0	0
Middle Florida Keys NMS						
79 - Delta Shoal	0	0	0	0	0	0
78 - Delta Shoal	0	0	0	0	0	0
84 - Sombrero Key SPA**	0	0	0	0	0	0
83 - Sombrero Key SPA**	0	0	0	0	0	0
Middle Florida Keys Total (4)	0	0	0	0	0	0
Lower Florida Keys NMS						
148 - Looe Key SPA**	0	0	0	0	0	0
147 - Looe Key SPA**	0	0	0	0	0	0
145 - American Shoal	0	0	0	0	0	0
146 - American Shoal	0	0	0	0	0	0
144 - Maryland Shoal	0	0	0	0	0	0
141 - Maryland Shoal	0	0	0	0	0	0
143 - Maryland Shoal	0	0	0	0	0	21
139 - Pelican Shoal	0	0	0	0	0	0
138 - No Name Reef	0	0	0	0	0	0
137 - No Name Reef	0	0	0	0	0	7
150 - Eastern Sambo RO**	0	0	0	0	0	0
149 - Eastern Sambo RO**	0	0	0	0	0	0
348 - Middle Sambo Reef	0	0	0	0	0	0
309 - Middle Sambo Reef	0	0	0	0	0	1
152 - Western Sambo ER**	0	0	0	0	0	0
151 - Western Sambo ER**	0	0	0	0	0	0
136 - East of Eastern Dry Rocks SPA	0	0	0	0	0	43
154 - Eastern Dry Rocks SPA**	0	0	0	0	0	0
153 - Eastern Dry Rocks SPA**	0	0	0	0	0	0
156 - Rock Key SPA**	0	0	0	0	0	0
155 - Rock Key SPA**	0	0	0	0	0	0
325 - Sand Key SPA**	0	0	0	0	0	0
157 - Sand Key SPA**	0	0	0	0	0	0
Lower Florida Keys Total (23)	0	0	0	0	0	72
High-relief Spur & Groove Total (51)	0	0	0	0	0	72
<i>Low-relief hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
53 - Carysfort Reef SPA**	0	0	0	0	0	0
240 - Carysfort Reef SPA**	0	0	0	0	0	0
57 - Inshore of Watson's Reef	0	0	0	0	0	0
45 - Offshore of Dry Rocks SPA	0	0	0	0	0	0
22 - SW of French Reef SPA	0	0	0	0	0	0

Site number/site location	White band	White pox	Tissue necrosis	Snail predation	Damselfish bites	Total colonies
21 - SW of French Reef SPA	0	0	0	0	0	0
Upper Florida Keys Total (6)	0	0	0	0	0	0
Middle Florida Keys NMS						
353 - Conch Reef SPA**	0	0	0	0	0	0
105 - Conch Reef SPA**	0	0	0	0	0	0
104 - NE of Alligator Light	0	0	0	0	0	0
351 - South of Indian Key	0	0	0	0	0	0
101 - South of Lower Matecumbe	0	0	0	0	0	0
111 - West of Sombrero Key	0	0	0	0	0	0
Middle Florida Keys Total (6)	0	0	0	0	0	0
Lower Florida Keys NMS						
180 - South of Bahia Honda Key	0	0	0	0	0	1
173 - Maryland Shoal	0	0	0	0	0	0
177 - NE of Satan Shoal	0	0	0	0	0	0
Lower Florida Keys Total (3)	0	0	0	0	0	1
Hard-bottom (6-15 m) Total (15)	0	0	0	0	0	1
<i>Patchy hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
56 - Inshore of Watson's Reef	0	0	0	0	0	0
44 - Dixie Shoal	0	0	0	0	0	0
43 - Dixie Shoal	0	0	0	0	0	0
42 - Dixie Shoal	0	0	0	0	0	0
Upper Florida Keys Total (4)	0	0	0	0	0	0
Middle Florida Keys NMS						
96 - South of Windley Key	0	0	0	0	0	0
114 - South of Lower Matecumbe	0	0	0	0	0	0
94 - South of Duck Key	0	0	0	0	0	0
93 - South of Duck Key	0	0	0	0	0	0
Middle Florida Keys Total (4)	0	0	0	0	0	0
Lower Florida Keys NMS						
338 - South of Bahia Honda Key	0	0	0	0	0	0
179 - West of American Shoal	0	0	0	0	0	0
160 - North of Pelican Shoal	0	0	0	0	0	0
164 - West of Pelican Shoal	0	0	0	0	0	0
178 - West of Pelican Shoal	0	0	0	0	0	0
166 - Eastern Sambo RO**	0	0	0	0	0	4
332 - Eastern Sambo RO**	0	0	0	0	0	0
334 - Western Sambo ER**	0	0	0	0	0	0
167 - Western Sambo ER**	0	0	0	0	0	2
163 - West of Western Sambo ER	0	0	0	0	0	0
335 - Sand Key SPA**	0	0	0	0	0	0
169 - Sand Key SPA**	0	0	0	0	0	0
162 - West of Western Dry Rocks	0	0	0	0	0	0
Lower Florida Keys Total (13)	0	0	0	0	0	6
Patchy Hard-bottom Total (21)	0	0	0	0	0	6
<i>Low-relief spur & groove (6-15 m)</i>						
Upper Florida Keys NMS						
52 - Carysfort Reef SPA**	0	0	0	0	0	0
241 - Carysfort Reef SPA**	0	0	0	0	0	0
51 - Offshore of Dry Rocks SPA	0	0	0	0	0	0
50 - Offshore of Dry Rocks SPA	0	0	0	0	0	0
49 - Little Pickles Reef	0	0	0	0	0	0
48 - Little Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (6)	0	0	0	0	0	0
Middle Florida Keys NMS						
355 - NE of Conch Reef	0	0	0	0	0	0

Site number/site location	White band	White pox	Tissue necrosis	Snail predation	Damselfish bites	Total colonies
282 - Conch Reef SPA**	0	0	0	0	0	0
354 - Conch Reef SPA**	0	0	0	0	0	0
107 - Conch Reef RO**	0	0	0	0	0	0
106 - Conch Reef RO**	0	0	0	0	0	0
276 - Davis Reef SPA**	0	0	0	0	0	0
80 - Davis Reef SPA**	0	0	0	0	0	0
102 - South of Lower Matecumbe	0	0	0	0	0	0
109 - Tennessee Reef RO**	0	0	0	0	0	0
108 - Tennessee Reef RO**	0	0	0	0	0	0
113 - NE of Tennessee Light	0	0	0	0	0	0
349 - South of Conch Key	0	0	0	0	0	0
100 - South of Conch Key	0	0	0	0	0	0
99 - East of Delta Shoal	0	0	0	0	0	0
110 - Sombrero Key SPA**	0	0	0	0	0	0
287 - Sombrero Key SPA**	0	0	0	0	0	0
Middle Florida Keys T total (16)	0	0	0	0	0	0
Lower Florida Keys NMS						
337 - South of Bahia Honda Key	0	0	0	0	0	0
174 - Looe Key SPA**	0	0	0	0	0	0
339 - Looe Key SPA**	0	0	0	0	0	0
142 - American Shoal	0	0	0	0	0	0
172 - East of Eastern Sambo RO	0	0	0	0	0	0
340 - Eastern Sambo RO**	0	0	0	0	0	0
175 - Eastern Sambo RO**	0	0	0	0	0	7
171 - Middle Sambo Reef	0	0	0	0	0	1
170 - Middle Sambo Reef	0	0	0	0	0	0
341 - Western Sambo ER**	0	0	0	0	0	0
176 - Western Sambo ER**	0	0	0	0	0	0
Lower Florida Keys Total (11)	0	0	0	0	0	8
Low-relief Spur & Groove Total (33)	0	0	0	0	0	8
All sites/habitats combined	0 (0%)	0 (0%)	0 (0%)	0 (0%)	9 (2.2%)	481

Table 9. Mean density (no. colonies/m²), tissue surface area (cm² and % cover), and colony size of staghorn coral (*Acropora palmata*) in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June-August 2007. Sites are arranged by habitat from NE to SW and asterisked locations (***) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO). SE = standard error.

Site number/site location	Colony density			Colony size		
	Colonies	No./m ²	SE	Total area (cm ²) (%)	Area (cm ²) per colony	SE
<i>Mid-channel patch reefs</i>						
Biscayne National Park						
445 - Northern Legare Anchorage	0	0	0	0	0	0
441 - Bache Shoal	0	0	0	0	0	0
440 - South of Bache Shoal	0	0	0	0	0	0
438 - South of Bache Shoal	0	0	0	0	0	0
437 - South of Legare Anchorage	0	0	0	0	0	0
427 - Margot Fish Shoal	0	0	0	0	0	0
421 - Margot Fish Shoal	0	0	0	0	0	0
419 - Inshore of Ajax Reef	0	0	0	0	0	0
413 - Inshore of Pacific Reef	0	0	0	0	0	0
410 - Inshore of Pacific Reef	0	0	0	0	0	0
408 - Offshore of Broad Creek	0	0	0	0	0	0
406 - Offshore of Broad Creek	0	0	0	0	0	0
Biscayne National Park Total (12)	0	0	0	0	0	0
Upper Florida Keys NMS						
4 - Basin Hill Shoals	0	0	0	0	0	0
2 - Near Cannon Patch Reef	0	0	0	0	0	0
3 - Near Cannon Patch Reef	0	0	0	0	0	0
1 - Inshore of Molasses Reef	0	0	0	0	0	0
Upper Florida Keys Total (4)	0	0	0	0	0	0
Middle Florida Keys NMS						
69 - Tavernier Rocks	0	0	0	0	0	0
71 - Hen and Chickens SPA**	0	0	0	0	0	0
70 - Hen and Chickens SPA**	0	0	0	0	0	0
68 - East of Cheeca Rocks SPA	0	0	0	0	0	0
72 - Cheeca Rocks SPA**	0	0	0	0	0	0
73 - Cheeca Rocks SPA**	0	0	0	0	0	0
66 - East Turtle Shoal	0	0	0	0	0	0
254 - East Turtle Shoal	0	0	0	0	0	0
Middle Florida Keys Total (8)	0	0	0	0	0	0
Lower Florida Keys NMS						
122 - North of Big Pine Shoal	0	0	0	0	0	0
121 - North of Maryland Shoal	0	0	0	0	0	0
120 - North of Maryland Shoal	0	0	0	0	0	0
119 - North of Pelican Shoal	0	0	0	0	0	0
118 - East of Western Sambo ER	0	0	0	0	0	0
126 - Western Sambo ER**	0	0	0	0	0	0
125 - Western Sambo ER**	0	0	0	0	0	0
124 - Western Sambo ER**	0	0	0	0	0	0
123 - Western Sambo ER**	0	0	0	0	0	0
117 - NW of Sand Key SPA	0	0	0	0	0	0
116 - North of Satan Shoal	0	0	0	0	0	0
115 - North of Satan Shoal	0	0	0	0	0	0
Lower Florida Keys Total (12)	0	0	0	0	0	0
Mid-channel Patch Reef Total (36)	0	0	0	0	0	0
<i>Offshore patch reefs</i>						
Biscayne National Park						
471 - Northwest of Triumph Reef	1	0.017	0.033	326 (0.1%)	326	

Site number/site location	Colony density			Colony size		
	Colonies	No./m ²	SE	Total area (cm ²) (%)	Area (cm ²) per colony	SE
461 - NW of Long Reef	0	0	0	0	0	0
460 - NW of Long Reef	0	0	0	0	0	0
459 - NW of Pacific Reef	0	0	0	0	0	0
458 - Inshore of Pacific Reef	0	0	0	0	0	0
456 - Inshore of Pacific Reef	0	0	0	0	0	0
454 - Northwest of Whistle Buoy	0	0	0	0	0	0
Biscayne National Park Total (7)	1	0.002	0.002	326 (<0.1%)	326	
Upper Florida Keys NMS						
16 - North of Carysfort Reef SPA	0	0	0	0	0	0
15 - North of Carysfort Reef SPA	14	0.233	0.467	6,953 (1.2%)	497	592
14 - North of Carysfort Reef SPA	0	0	0	0	0	0
47 - Carysfort Reef SPA**	0	0	0	0	0	0
345 - Carysfort Reef SPA**	0	0	0	0	0	0
46 - Carysfort Reef SPA**	0	0	0	0	0	0
39 - Carysfort Reef SPA**	0	0	0	0	0	0
37 - West of Carysfort Reef SPA	0	0	0	0	0	0
13 - Inshore of Watson's Reef	0	0	0	0	0	0
55 - Inshore of Watson's Reef	0	0	0	0	0	0
358 - Inshore of Watson's Reef	0	0	0	0	0	0
54 - Inshore of Watson's Reef	0	0	0	0	0	0
347 - Inshore of Watson's Reef	0	0	0	0	0	0
12 - Inshore of Watson's Reef	0	0	0	0	0	0
9 - White Banks	0	0	0	0	0	0
8 - Inshore of French Reef	0	0	0	0	0	0
7 - Inshore of Molasses Reef	0	0	0	0	0	0
6 - Inshore of Molasses Reef	0	0	0	0	0	0
5 - Inshore of Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (19)	14	0.012	0.012	6,953 (0.1%)	497	
Middle Florida Keys NMS						
77 - Inshore of Conch Reef SPA	0	0	0	0	0	0
76 - Inshore of Conch Reef SPA	0	0	0	0	0	0
75 - Inshore of Conch Reef SPA	0	0	0	0	0	0
74 - Inshore of Conch Reef SPA	0	0	0	0	0	0
98 - Coffins Patch SPA**	0	0	0	0	0	0
277 - Coffins Patch SPA**	0	0	0	0	0	0
Middle Florida Keys Total (6)	0	0	0	0	0	0
Lower Florida Keys NMS						
133 - Looe Key Research Only**	0	0	0	0	0	0
132 - Looe Key Research Only**	0	0	0	0	0	0
131 - North of Looe Key SPA**	0	0	0	0	0	0
130 - Maryland Shoal	0	0	0	0	0	0
129 - North of Maryland Shoal	0	0	0	0	0	0
165 - North of Maryland Shoal	0	0	0	0	0	0
128 - NE of Eastern Sambo RO	0	0	0	0	0	0
135 - Western Sambo ER**	0	0	0	0	0	0
168 - Western Sambo ER**	0	0	0	0	0	0
127 - West of Sand Key SPA	0	0	0	0	0	0
Lower Florida Keys Total (10)	0	0	0	0	0	0
Offshore Patch Reef Total (42)	15	0.006	0.006	7,279 (<0.1%)	411	85
<i>Hard-bottom/rubble/sand matrix</i>						
Upper Florida Keys NMS						
40 - Carysfort Reef SPA**	0	0	0	0	0	0
38 - West of Carysfort Reef SPA	0	0	0	0	0	0
36 - West of Carysfort Reef SPA	0	0	0	0	0	0
11 - NW of Dry Rocks SPA	0	0	0	0	0	0
Upper Florida Keys Total (4)	0	0	0	0	0	0
Hard-bottom Matrix Total (4)	0	0	0	0	0	0

Site number/site location	Colony density			Colony size		
	Colonies	No./m ²	SE	Total area (cm ²) (%)	Area (cm ²) per colony	SE
<i>Low-relief hard-bottom (< 6 m)</i>						
Biscayne National Park						
475 - Fowey Rocks	0	0	0	0	0	0
469 - South of Ajax Reef	0	0	0	0	0	0
Biscayne National Park Total (2)	0	0	0	0	0	0
Upper Florida Keys NMS						
346 - Carysfort Reef SPA**	0	0	0	0	0	0
35 - West of Carysfort Reef SPA	0	0	0	0	0	0
34 - West of Carysfort Reef SPA	0	0	0	0	0	0
33 - Inshore of Watson's Reef	0	0	0	0	0	0
17 - Little Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (5)	0	0	0	0	0	0
Middle Florida Keys NMS						
269 - Conch Reef SPA**	0	0	0	0	0	0
89 - Conch Reef SPA**	0	0	0	0	0	0
88 - Little Conch Reef	0	0	0	0	0	0
352 - Little Conch Reef	0	0	0	0	0	0
97 - Davis Reef SPA**	0	0	0	0	0	0
90 - Davis Reef SPA**	0	0	0	0	0	0
86 - South of Windley Key	0	0	0	0	0	0
103 - NE of Alligator Light	0	0	0	0	0	0
82 - Alligator Reef SPA**	0	0	0	0	0	0
81 - Alligator Reef SPA**	0	0	0	0	0	0
350 - Tennessee Light	0	0	0	0	0	0
85 - East of Coffins Patch SPA	0	0	0	0	0	0
92 - Coffins Patch SPA**	0	0	0	0	0	0
91 - Coffins Patch SPA**	0	0	0	0	0	0
Middle Florida Keys Total (14)	0	0	0	0	0	0
Lower Florida Keys NMS						
161 - West of American Shoal	0	0	0	0	0	0
140 - Maryland Shoal	0	0	0	0	0	0
159 - North of Pelican Shoal	0	0	0	0	0	0
158 - East of No Name Reef	0	0	0	0	0	0
Lower Florida Keys Total (4)	0	0	0	0	0	0
Hard-bottom (< 6 m) Total (25)	0	0	0	0	0	0
<i>Inner line reef tract spur & groove</i>						
Upper Florida Keys NMS						
61 - Turtle Reef	0	0	0	0	0	0
60 - Inshore of Elbow Reef SPA	0	0	0	0	0	0
59 - Inshore of Elbow Reef SPA	3	0.050	0.100	583 (0.1%)	194	154
58 - Horseshoe Reef	5	0.083	0.167	2,520 (0.4%)	504	671
62 - Dry Rocks SPA**	2	0.033	0.066	1,075 (0.2%)	537	538
63 - Dry Rocks SPA**	0	0	0	0	0	0
65 - Grecian Rocks SPA**	0	0	0	0	0	0
64 - Grecian Rocks SPA**	0	0	0	0	0	0
Upper Florida Keys Total (8)	10	0.021	0.011	4,178 (0.1%)	412	109
Inner Line Spur & Groove Total (8)	10	0.021	0.011	4,178 (0.1%)	412	109
<i>High-relief spur & groove</i>						
Biscayne National Park						
474 - Brewster Reef	0	0	0	0	0	0
472 - Star Reef	0	0	0	0	0	0
470 - Triumph Reef	0	0	0	0	0	0
467 - Long Reef	5	0.083	0.126	922 (0.2%)	184	346
466 - Ajax Reef	0	0	0	0	0	0
465 - Ajax Reef	0	0	0	0	0	0
464 - Pacific Reef	0	0	0	0	0	0

Site number/site location	Colony density			Colony size		
	Colonies	No./m ²	SE	Total area (cm ²) (%)	Area (cm ²) per colony	SE
Biscayne National Park Total (7)	5	0.012	0.012	922 (< 0.1%)	184	
Upper Florida Keys NMS						
26 - Carysfort Reef SPA**	0	0	0	0	0	0
25 - Carysfort Reef SPA**	0	0	0	0	0	0
218 - South Carysfort Reef SPA**	0	0	0	0	0	0
217 - South Carysfort Reef SPA**	50	0.833	0.168	147,614 (24.6%)	2,952	4,900
24 - Maitland Grounding Site	0	0	0	0	0	0
28 - Elbow Reef SPA**	75	1.250	0.959	71,508 (11.9%)	966	2,272
27 - Elbow Reef SPA**	20	0.333	0.381	20,375 (3.4%)	1,072	2,668
30 - French Reef SPA**	12	0.200	0.357	4,365 (0.7%)	364	630
29 - French Reef SPA**	54	0.900	1.045	29,957 (5.0%)	555	803
23 - SW of French Reef SPA	0	0	0	0	0	0
357 - Sand Island	0	0	0	0	0	0
356 - Sand Island	28	0.467	0.283	53,138 (8.9%)	1,898	4,402
32 - Molasses Reef SPA**	18	0.300	0.515	14,926 (2.5%)	878	2,423
31 - Molasses Reef SPA**	13	0.217	0.433	11,952 (2.0%)	919	1,508
19 - Pickles Reef	0	0	0	0	0	0
20 - Pickles Reef	0	0	0	0	0	0
18 - Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (17)	270	0.265	0.094	353,835 (3.5%)	1201	297
Middle Florida Keys NMS						
79 - Delta Shoal	0	0	0	0	0	0
78 - Delta Shoal	0	0	0	0	0	0
84 - Sombrero Key SPA**	68	1.133	2.048	68,525 (11.4%)	1,008	4,013
83 - Sombrero Key SPA**	0	0	0	0	0	0
Middle Florida Keys Total (4)	68	0.283	0.283	68,525 (2.9%)	1008	
Lower Florida Keys NMS						
148 - Looe Key SPA**	32	0.533	0.422	28,645 (4.8%)	895	2,150
147 - Looe Key SPA**	1	0.017	0.033	8,533 (1.4%)	8,533	
145 - American Shoal	0	0	0	0	0	0
146 - American Shoal	0	0	0	0	0	0
144 - Maryland Shoal	0	0	0	0	0	0
141 - Maryland Shoal	0	0	0	0	0	0
143 - Maryland Shoal	0	0	0	0	0	0
139 - Pelican Shoal	0	0	0	0	0	0
138 - No Name Reef	0	0	0	0	0	0
137 - No Name Reef	1	0.017	0.033	4,662 (0.8%)	4,662	
150 - Eastern Sambo RO**	0	0	0	0	0	0
149 - Eastern Sambo RO**	0	0	0	0	0	0
348 - Middle Sambo Reef	0	0	0	0	0	0
309 - Middle Sambo Reef	0	0	0	0	0	0
152 - Western Sambo ER**	0	0	0	0	0	0
151 - Western Sambo ER**	0	0	0	0	0	0
136 - East of Eastern Dry Rocks SPA	0	0	0	0	0	0
154 - Eastern Dry Rocks SPA**	1	0.017	0.033	9,959 (1.7%)	9,959	
153 - Eastern Dry Rocks SPA**	0	0	0	0	0	0
156 - Rock Key SPA**	0	0	0	0	0	0
155 - Rock Key SPA**	0	0	0	0	0	0
325 - Sand Key SPA**	0	0	0	0	0	0
157 - Sand Key SPA**	0	0	0	0	0	0
Lower Florida Keys Total (23)	35	0.025	0.023	51,799 (0.4%)	6012	2040
High-relief Spur & Groove Total (51)	378	0.124	0.041	475,080 (1.6%)	2489	830
<i>Low-relief hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
53 - Carysfort Reef SPA**	0	0	0	0	0	0
240 - Carysfort Reef SPA**	0	0	0	0	0	0
57 - Inshore of Watson's Reef	0	0	0	0	0	0

Site number/site location	Colony density			Colony size		
	Colonies	No./m ²	SE	Total area (cm ²) (%)	Area (cm ²) per colony	SE
45 - Offshore of Dry Rocks SPA	0	0	0	0	0	0
22 - SW of French Reef SPA	0	0	0	0	0	0
21 - SW of French Reef SPA	0	0	0	0	0	0
Upper Florida Keys Total (6)	0	0	0	0	0	0
Middle Florida Keys NMS						
353 - Conch Reef SPA**	0	0	0	0	0	0
105 - Conch Reef SPA**	0	0	0	0	0	0
104 - NE of Alligator Light	0	0	0	0	0	0
351 - South of Indian Key	0	0	0	0	0	0
101 - South of Lower Matecumbe	0	0	0	0	0	0
111 - West of Sombrero Key	0	0	0	0	0	0
Middle Florida Keys Total (6)	0	0	0	0	0	0
Lower Florida Keys NMS						
180 - South of Bahia Honda Key	0	0	0	0	0	0
173 - Maryland Shoal	0	0	0	0	0	0
177 - NE of Satan Shoal	0	0	0	0	0	0
Lower Florida Keys Total (3)	0	0	0	0	0	0
Hard-bottom (6-15 m) Total (15)	0	0	0	0	0	0
<i>Patchy hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
56 - Inshore of Watson's Reef	0	0	0	0	0	0
44 - Dixie Shoal	0	0	0	0	0	0
43 - Dixie Shoal	0	0	0	0	0	0
42 - Dixie Shoal	0	0	0	0	0	0
Upper Florida Keys Total (4)	0	0	0	0	0	0
Middle Florida Keys NMS						
96 - South of Windley Key	0	0	0	0	0	0
114 - South of Lower Matecumbe	0	0	0	0	0	0
94 - South of Duck Key	0	0	0	0	0	0
93 - South of Duck Key	0	0	0	0	0	0
Middle Florida Keys Total (4)	0	0	0	0	0	0
Lower Florida Keys NMS						
338 - South of Bahia Honda Key	0	0	0	0	0	0
179 - West of American Shoal	0	0	0	0	0	0
160 - North of Pelican Shoal	0	0	0	0	0	0
164 - West of Pelican Shoal	0	0	0	0	0	0
178 - West of Pelican Shoal	0	0	0	0	0	0
166 - Eastern Sambo RO**	0	0	0	0	0	0
332 - Eastern Sambo RO**	0	0	0	0	0	0
334 - Western Sambo ER**	0	0	0	0	0	0
167 - Western Sambo ER**	0	0	0	0	0	0
163 - West of Western Sambo ER	0	0	0	0	0	0
335 - Sand Key SPA**	0	0	0	0	0	0
169 - Sand Key SPA**	0	0	0	0	0	0
162 - West of Western Dry Rocks	0	0	0	0	0	0
Lower Florida Keys Total (13)	0	0	0	0	0	0
Patchy Hard-bottom Total (21)	0	0	0	0	0	0
<i>Low-relief spur & groove (6-15 m)</i>						
Upper Florida Keys NMS						
52 - Carysfort Reef SPA**	0	0	0	0	0	0
241 - Carysfort Reef SPA**	0	0	0	0	0	0
51 - Offshore of Dry Rocks SPA	0	0	0	0	0	0
50 - Offshore of Dry Rocks SPA	0	0	0	0	0	0
49 - Little Pickles Reef	0	0	0	0	0	0
48 - Little Pickles Reef	0	0	0	0	0	0

Site number/site location	Colony density			Colony size		
	Colonies	No./m ²	SE	Total area (cm ²) (%)	Area (cm ²) per colony	SE
Upper Florida Keys Total (6)	0	0	0	0	0	0
Middle Florida Keys NMS						
355 - NE of Conch Reef	0	0	0	0	0	0
282 - Conch Reef SPA**	0	0	0	0	0	0
354 - Conch Reef SPA**	0	0	0	0	0	0
107 - Conch Reef RO**	0	0	0	0	0	0
106 - Conch Reef RO**	0	0	0	0	0	0
276 - Davis Reef SPA**	0	0	0	0	0	0
80 - Davis Reef SPA**	0	0	0	0	0	0
102 - South of Lower Matecumbe	0	0	0	0	0	0
109 - Tennessee Reef RO**	0	0	0	0	0	0
108 - Tennessee Reef RO**	0	0	0	0	0	0
113 - NE of Tennessee Light	0	0	0	0	0	0
349 - South of Conch Key	0	0	0	0	0	0
100 - South of Conch Key	0	0	0	0	0	0
99 - East of Delta Shoal	0	0	0	0	0	0
110 - Sombrero Key SPA**	0	0	0	0	0	0
287 - Sombrero Key SPA**	0	0	0	0	0	0
Middle Florida Keys Total (16)	0	0	0	0	0	0
Lower Florida Keys NMS						
337 - South of Bahia Honda Key	0	0	0	0	0	0
174 - Looe Key SPA**	0	0	0	0	0	0
339 - Looe Key SPA**	0	0	0	0	0	0
142 - American Shoal	0	0	0	0	0	0
172 - East of Eastern Sambo RO	0	0	0	0	0	0
340 - Eastern Sambo RO**	0	0	0	0	0	0
175 - Eastern Sambo RO**	0	0	0	0	0	0
171 - Middle Sambo Reef	0	0	0	0	0	0
170 - Middle Sambo Reef	0	0	0	0	0	0
341 - Western Sambo ER**	0	0	0	0	0	0
176 - Western Sambo ER**	0	0	0	0	0	0
Lower Florida Keys Total (11)	0	0	0	0	0	0
Low-relief Spur & Groove Total (33)	0	0	0	0	0	0

Table 10. Numbers and relative frequencies (%) of elkhorn coral (*Acropora palmata*) colonies exhibiting disease-like conditions and predation in the Florida Keys National Marine Sanctuary and Biscayne National Park, as quantified from four 15-m x 1-m transects per site at 235 locations during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

Site number/site location	White band	White pox	Tissue necrosis	Snail predation	Damselfish bites	Total colonies
<i>Mid-channel patch reefs</i>						
Biscayne National Park						
445 - Northern Legare Anchorage	0	0	0	0	0	0
441 - Bache Shoal	0	0	0	0	0	0
440 - South of Bache Shoal	0	0	0	0	0	0
438 - South of Bache Shoal	0	0	0	0	0	0
437 - South of Legare Anchorage	0	0	0	0	0	0
427 - Margot Fish Shoal	0	0	0	0	0	0
421 - Margot Fish Shoal	0	0	0	0	0	0
419 - Inshore of Ajax Reef	0	0	0	0	0	0
413 - Inshore of Pacific Reef	0	0	0	0	0	0
410 - Inshore of Pacific Reef	0	0	0	0	0	0
408 - Offshore of Broad Creek	0	0	0	0	0	0
406 - Offshore of Broad Creek	0	0	0	0	0	0
Biscayne National Park Total (12)	0	0	0	0	0	0
Upper Florida Keys NMS						
4 - Basin Hill Shoals	0	0	0	0	0	0
2 - Near Cannon Patch Reef	0	0	0	0	0	0
3 - Near Cannon Patch Reef	0	0	0	0	0	0
1 - Inshore of Molasses Reef	0	0	0	0	0	0
Upper Florida Keys Total (4)	0	0	0	0	0	0
Middle Florida Keys NMS						
69 - Tavernier Rocks	0	0	0	0	0	0
71 - Hen and Chickens SPA**	0	0	0	0	0	0
70 - Hen and Chickens SPA**	0	0	0	0	0	0
68 - East of Cheeca Rocks SPA	0	0	0	0	0	0
72 - Cheeca Rocks SPA**	0	0	0	0	0	0
73 - Cheeca Rocks SPA**	0	0	0	0	0	0
66 - East Turtle Shoal	0	0	0	0	0	0
254 - East Turtle Shoal	0	0	0	0	0	0
Middle Florida Keys Total (8)	0	0	0	0	0	0
Lower Florida Keys NMS						
122 - North of Big Pine Shoal	0	0	0	0	0	0
121 - North of Maryland Shoal	0	0	0	0	0	0
120 - North of Maryland Shoal	0	0	0	0	0	0
119 - North of Pelican Shoal	0	0	0	0	0	0
118 - East of Western Sambo ER	0	0	0	0	0	0
126 - Western Sambo ER**	0	0	0	0	0	0
125 - Western Sambo ER**	0	0	0	0	0	0
124 - Western Sambo ER**	0	0	0	0	0	0
123 - Western Sambo ER**	0	0	0	0	0	0
117 - NW of Sand Key SPA	0	0	0	0	0	0
116 - North of Satan Shoal	0	0	0	0	0	0
115 - North of Satan Shoal	0	0	0	0	0	0
Lower Florida Keys Total (12)	0	0	0	0	0	0
Mid-channel Patch Reef Total (36)	0	0	0	0	0	0
<i>Offshore patch reefs</i>						
Biscayne National Park						
471 - Northwest of Triumph Reef	0	0	0	0	0	1
461 - NW of Long Reef	0	0	0	0	0	0

Site number/site location	White band	White pox	Tissue necrosis	Snail predation	Damselfish bites	Total colonies
460 - NW of Long Reef	0	0	0	0	0	0
459 - NW of Pacific Reef	0	0	0	0	0	0
458 - Inshore of Pacific Reef	0	0	0	0	0	0
456 - Inshore of Pacific Reef	0	0	0	0	0	0
454 - Northwest of Whistle Buoy	0	0	0	0	0	0
Biscayne National Park Total (7)	0	0	0	0	0	0
Upper Florida Keys NMS	0	0	0	0	0	0
16 - North of Carysfort Reef SPA	0	0	0	0	0	0
15 - North of Carysfort Reef SPA	0	0	0	1 (7.1)	0	14
14 - North of Carysfort Reef SPA	0	0	0	0	0	0
47 - Carysfort Reef SPA**	0	0	0	0	0	0
345 - Carysfort Reef SPA**	0	0	0	0	0	0
46 - Carysfort Reef SPA**	0	0	0	0	0	0
39 - Carysfort Reef SPA**	0	0	0	0	0	0
37 - West of Carysfort Reef SPA	0	0	0	0	0	0
13 - Inshore of Watson's Reef	0	0	0	0	0	0
55 - Inshore of Watson's Reef	0	0	0	0	0	0
358 - Inshore of Watson's Reef	0	0	0	0	0	0
54 - Inshore of Watson's Reef	0	0	0	0	0	0
347 - Inshore of Watson's Reef	0	0	0	0	0	0
12 - Inshore of Watson's Reef	0	0	0	0	0	0
9 - White Banks	0	0	0	0	0	0
8 - Inshore of French Reef	0	0	0	0	0	0
7 - Inshore of Molasses Reef	0	0	0	0	0	0
6 - Inshore of Molasses Reef	0	0	0	0	0	0
5 - Inshore of Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (19)	0	0	0	1 (7.1)	0	14
Middle Florida Keys NMS						
77 - Inshore of Conch Reef SPA	0	0	0	0	0	0
76 - Inshore of Conch Reef SPA	0	0	0	0	0	0
75 - Inshore of Conch Reef SPA	0	0	0	0	0	0
74 - Inshore of Conch Reef SPA	0	0	0	0	0	0
98 - Coffins Patch SPA**	0	0	0	0	0	0
277 - Coffins Patch SPA**	0	0	0	0	0	0
Middle Florida Keys Total (6)	0	0	0	0	0	0
Lower Florida Keys NMS						
133 - Looe Key Research Only**	0	0	0	0	0	0
132 - Looe Key Research Only**	0	0	0	0	0	0
131 - North of Looe Key SPA**	0	0	0	0	0	0
130 - Maryland Shoal	0	0	0	0	0	0
129 - North of Maryland Shoal	0	0	0	0	0	0
165 - North of Maryland Shoal	0	0	0	0	0	0
128 - NE of Eastern Sambo RO	0	0	0	0	0	0
135 - Western Sambo ER**	0	0	0	0	0	0
168 - Western Sambo ER**	0	0	0	0	0	0
127 - West of Sand Key SPA	0	0	0	0	0	0
Lower Florida Keys Total (10)	0	0	0	0	0	0
Offshore Patch Reef Total (42)	0	0	0	1 (6.7)	0	15
<i>Hard-bottom/rubble/sand matrix</i>						
Upper Florida Keys NMS						
40 - Carysfort Reef SPA**	0	0	0	0	0	0
38 - West of Carysfort Reef SPA	0	0	0	0	0	0
36 - West of Carysfort Reef SPA	0	0	0	0	0	0
11 - NW of Dry Rocks SPA	0	0	0	0	0	0
Upper Florida Keys Total (4)	0	0	0	0	0	0
Hard-bottom Matrix Total (4)	0	0	0	0	0	0

Site number/site location	White band	White pox	Tissue necrosis	Snail predation	Damselfish bites	Total colonies
<i>Low-relief hard-bottom (< 6 m)</i>						
Biscayne National Park						
475 - Fowey Rocks	0	0	0	0	0	0
469 - South of Ajax Reef	0	0	0	0	0	0
Biscayne National Park Total (2)	0	0	0	0	0	0
Upper Florida Keys NMS						
346 - Carysfort Reef SPA**	0	0	0	0	0	0
35 - West of Carysfort Reef SPA	0	0	0	0	0	0
34 - West of Carysfort Reef SPA	0	0	0	0	0	0
33 - Inshore of Watson's Reef	0	0	0	0	0	0
17 - Little Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (5)	0	0	0	0	0	0
Middle Florida Keys NMS						
269 - Conch Reef SPA**	0	0	0	0	0	0
89 - Conch Reef SPA**	0	0	0	0	0	0
88 - Little Conch Reef	0	0	0	0	0	0
352 - Little Conch Reef	0	0	0	0	0	0
97 - Davis Reef SPA**	0	0	0	0	0	0
90 - Davis Reef SPA**	0	0	0	0	0	0
86 - South of Windley Key	0	0	0	0	0	0
103 - NE of Alligator Light	0	0	0	0	0	0
82 - Alligator Reef SPA**	0	0	0	0	0	0
81 - Alligator Reef SPA**	0	0	0	0	0	0
350 - Tennessee Light	0	0	0	0	0	0
85 - East of Coffins Patch SPA	0	0	0	0	0	0
92 - Coffins Patch SPA**	0	0	0	0	0	0
91 - Coffins Patch SPA**	0	0	0	0	0	0
Middle Florida Keys Total (14)	0	0	0	0	0	0
Lower Florida Keys NMS						
161 - West of American Shoal	0	0	0	0	0	0
140 - Maryland Shoal	0	0	0	0	0	0
159 - North of Pelican Shoal	0	0	0	0	0	0
158 - East of No Name Reef	0	0	0	0	0	0
Lower Florida Keys Total (4)	0	0	0	0	0	0
Hard-bottom (< 6 m) Total (25)	0	0	0	0	0	0
<i>Inner line reef tract spur & groove</i>						
Upper Florida Keys NMS						
61 - Turtle Reef	0	0	0	0	0	0
60 - Inshore of Elbow Reef SPA	0	0	0	0	0	0
59 - Inshore of Elbow Reef SPA	0	0	0	0	0	3
58 - Horseshoe Reef	0	0	0	0	0	5
62 - Dry Rocks SPA**	0	0	0	0	0	2
63 - Dry Rocks SPA**	0	0	0	0	0	0
65 - Grecian Rocks SPA**	0	0	0	0	0	0
64 - Grecian Rocks SPA**	0	0	0	0	0	0
Upper Florida Keys Total (8)	0	0	0	0	0	10
Inner Line Spur & Groove Total (8)	0	0	0	0	0	10
<i>High-relief spur & groove</i>						
Biscayne National Park						
474 - Brewster Reef	0	0	0	0	0	0
472 - Star Reef	0	0	0	0	0	0
470 - Triumph Reef	0	0	0	0	0	0
467 - Long Reef	0	0	0	0	0	5
466 - Ajax Reef	0	0	0	0	0	0
465 - Ajax Reef	0	0	0	0	0	0
464 - Pacific Reef	0	0	0	0	0	0
Biscayne National Park Total (7)	0	0	0	0	0	5

Site number/site location	White band	White pox	Tissue necrosis	Snail predation	Damselfish bites	Total colonies
Upper Florida Keys NMS						
26 - Carysfort Reef SPA**	0	0	0	0	0	0
25 - Carysfort Reef SPA**	0	0	0	0	0	0
218 - South Carysfort Reef SPA**	0	0	0	0	0	0
217 - South Carysfort Reef SPA**	0	0	0	1 (2.0)	3 (5.9)	51
24 - Maitland Grounding Site	0	0	0	0	0	0
28 - Elbow Reef SPA**	0	0	0	0	2 (26)	76
27 - Elbow Reef SPA**	0	0	0	0	0	21
30 - French Reef SPA**	0	0	0	0	1 (8.3)	12
29 - French Reef SPA**	0	0	0	1 (1.9)	5 (9.3)	54
23 - SW of French Reef SPA	0	0	0	0	0	0
357 - Sand Island	0	0	0	0	0	0
356 - Sand Island	0	0	0	1 (2.9)	2 (5.7)	35
32 - Molasses Reef SPA**	0	0	0	0	3 (17.7)	17
31 - Molasses Reef SPA**	0	0	0	1 (7.7)	0	13
19 - Pickles Reef	0	0	0	0	0	0
20 - Pickles Reef	0	0	0	0	0	0
18 - Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (17)	0	0	0	4 (1.4)	16 (5.7)	279
Middle Florida Keys NMS						
79 - Delta Shoal	0	0	0	0	0	0
78 - Delta Shoal	0	0	0	0	0	0
84 - Sombrero Key SPA**	0	0	0	2 (2.9)	3 (4.4)	68
83 - Sombrero Key SPA**	0	0	0	0	0	0
Middle Florida Keys Total (4)	0	0	0	2 (2.9)	3 (4.4)	68
Lower Florida Keys NMS						
148 - Looe Key SPA**	0	0	0	1 (3.0)	0	33
147 - Looe Key SPA**	0	0	0	0	1 (100)	1
145 - American Shoal	0	0	0	0	0	0
146 - American Shoal	0	0	0	0	0	0
144 - Maryland Shoal	0	0	0	0	0	0
141 - Maryland Shoal	0	0	0	0	0	0
143 - Maryland Shoal	0	0	0	0	0	0
139 - Pelican Shoal	0	0	0	0	0	0
138 - No Name Reef	0	0	0	0	0	0
137 - No Name Reef	0	0	0	0	0	1
150 - Eastern Sambo RO**	0	0	0	0	0	0
149 - Eastern Sambo RO**	0	0	0	0	0	0
348 - Middle Sambo Reef	0	0	0	0	0	0
309 - Middle Sambo Reef	0	0	0	0	0	0
152 - Western Sambo ER**	0	0	0	0	0	0
151 - Western Sambo ER**	0	0	0	0	0	0
136 - East of Eastern Dry Rocks SPA	0	0	0	0	0	20
154 - Eastern Dry Rocks SPA**	0	0	0	0	1 (100)	1
153 - Eastern Dry Rocks SPA**	0	0	0	0	0	0
156 - Rock Key SPA**	0	0	0	0	0	0
155 - Rock Key SPA**	0	0	0	0	0	0
325 - Sand Key SPA**	0	0	0	0	0	0
157 - Sand Key SPA**	0	0	0	0	0	0
Lower Florida Keys Total (23)	0	0	0	1 (1.8)	2 (3.6)	56
High-relief Spur & Groove Total (51)	0	0	0	7 (1.7)	21 (5.2)	408
<i>Low-relief hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
53 - Carysfort Reef SPA**	0	0	0	0	0	0
240 - Carysfort Reef SPA**	0	0	0	0	0	0
57 - Inshore of Watson's Reef	0	0	0	0	0	0
45 - Offshore of Dry Rocks SPA	0	0	0	0	0	0
22 - SW of French Reef SPA	0	0	0	0	0	0

Site number/site location	White band	White pox	Tissue necrosis	Snail predation	Damselfish bites	Total colonies
21 - SW of French Reef SPA	0	0	0	0	0	0
Upper Florida Keys Total (6)	0	0	0	0	0	0
Middle Florida Keys NMS						
353 - Conch Reef SPA**	0	0	0	0	0	0
105 - Conch Reef SPA**	0	0	0	0	0	0
104 - NE of Alligator Light	0	0	0	0	0	0
351 - South of Indian Key	0	0	0	0	0	0
101 - South of Lower Matecumbe	0	0	0	0	0	0
111 - West of Sombrero Key	0	0	0	0	0	0
Middle Florida Keys Total (6)	0	0	0	0	0	0
Lower Florida Keys NMS						
180 - South of Bahia Honda Key	0	0	0	0	0	0
173 - Maryland Shoal	0	0	0	0	0	0
177 - NE of Satan Shoal	0	0	0	0	0	0
Lower Florida Keys Total (3)	0	0	0	0	0	0
Hard-bottom (6-15 m) Total (15)	0	0	0	0	0	0
<i>Patchy hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
56 - Inshore of Watson's Reef	0	0	0	0	0	0
44 - Dixie Shoal	0	0	0	0	0	0
43 - Dixie Shoal	0	0	0	0	0	0
42 - Dixie Shoal	0	0	0	0	0	0
Upper Florida Keys Total (4)	0	0	0	0	0	0
Middle Florida Keys NMS						
96 - South of Windley Key	0	0	0	0	0	0
114 - South of Lower Matecumbe	0	0	0	0	0	0
94 - South of Duck Key	0	0	0	0	0	0
93 - South of Duck Key	0	0	0	0	0	0
Middle Florida Keys Total (4)	0	0	0	0	0	0
Lower Florida Keys NMS						
338 - South of Bahia Honda Key	0	0	0	0	0	0
179 - West of American Shoal	0	0	0	0	0	0
160 - North of Pelican Shoal	0	0	0	0	0	0
164 - West of Pelican Shoal	0	0	0	0	0	0
178 - West of Pelican Shoal	0	0	0	0	0	0
166 - Eastern Sambo RO**	0	0	0	0	0	0
332 - Eastern Sambo RO**	0	0	0	0	0	0
334 - Western Sambo ER**	0	0	0	0	0	0
167 - Western Sambo ER**	0	0	0	0	0	0
163 - West of Western Sambo ER	0	0	0	0	0	0
335 - Sand Key SPA**	0	0	0	0	0	0
169 - Sand Key SPA**	0	0	0	0	0	0
162 - West of Western Dry Rocks	0	0	0	0	0	0
Lower Florida Keys Total (13)	0	0	0	0	0	0
Patchy Hard-bottom Total (21)	0	0	0	0	0	0
<i>Low-relief spur & groove (6-15 m)</i>						
Upper Florida Keys NMS						
52 - Carysfort Reef SPA**	0	0	0	0	0	0
241 - Carysfort Reef SPA**	0	0	0	0	0	0
51 - Offshore of Dry Rocks SPA	0	0	0	0	0	0
50 - Offshore of Dry Rocks SPA	0	0	0	0	0	0
49 - Little Pickles Reef	0	0	0	0	0	0
48 - Little Pickles Reef	0	0	0	0	0	0
Upper Florida Keys Total (6)	0	0	0	0	0	0
Middle Florida Keys NMS						
355 - NE of Conch Reef	0	0	0	0	0	0

Site number/site location	White band	White pox	Tissue necrosis	Snail predation	Damselfish bites	Total colonies
282 - Conch Reef SPA**	0	0	0	0	0	0
354 - Conch Reef SPA**	0	0	0	0	0	0
107 - Conch Reef RO**	0	0	0	0	0	0
106 - Conch Reef RO**	0	0	0	0	0	0
276 - Davis Reef SPA**	0	0	0	0	0	0
80 - Davis Reef SPA**	0	0	0	0	0	0
102 - South of Lower Matecumbe	0	0	0	0	0	0
109 - Tennessee Reef RO**	0	0	0	0	0	0
108 - Tennessee Reef RO**	0	0	0	0	0	0
113 - NE of Tennessee Light	0	0	0	0	0	0
349 - South of Conch Key	0	0	0	0	0	0
100 - South of Conch Key	0	0	0	0	0	0
99 - East of Delta Shoal	0	0	0	0	0	0
110 - Sombrero Key SPA**	0	0	0	0	0	0
287 - Sombrero Key SPA**	0	0	0	0	0	0
Middle Florida Keys Total (16)	0	0	0	0	0	0
Lower Florida Keys NMS						
337 - South of Bahia Honda Key	0	0	0	0	0	0
174 - Looe Key SPA**	0	0	0	0	0	0
339 - Looe Key SPA**	0	0	0	0	0	0
142 - American Shoal	0	0	0	0	0	0
172 - East of Eastern Sambo RO	0	0	0	0	0	0
340 - Eastern Sambo RO**	0	0	0	0	0	0
175 - Eastern Sambo RO**	0	0	0	0	0	0
171 - Middle Sambo Reef	0	0	0	0	0	0
170 - Middle Sambo Reef	0	0	0	0	0	0
341 - Western Sambo ER**	0	0	0	0	0	0
176 - Western Sambo ER**	0	0	0	0	0	0
Lower Florida Keys Total (11)	0	0	0	0	0	0
Low-relief Spur & Groove Total (33)	0	0	0	0	0	0
All sites/habitats combined	0 (0%)	0 (0%)	0 (0%)	8 (1.9%)	21 (4.9%)	433

Table 11. Mean \pm 1 SE densities (no. individuals per m²) and total shell lengths (SL, cm) of *Coralliophila* snails and other gastropod mollusks in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

Site number/site location	<i>Coralliophila</i> sp.		<i>Thais deltoidea</i>		<i>Leucozonia nassa</i>	
	No./m ²	SL (cm)	No./m ²	SL (cm)	No./m ²	SL (cm)
<i>Mid-channel patch reefs</i>						
Biscayne National Park						
445 - Northern Legare Anchorage	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
441 - Bache Shoal	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0.017 \pm 0.017	2.3
440 - South of Bache Shoal	0 \pm 0	0 \pm 0	0.017 \pm 0.017	3.3	0 \pm 0	0 \pm 0
438 - South of Bache Shoal	0 \pm 0	0 \pm 0	0.017 \pm 0.017	4.4	0 \pm 0	0 \pm 0
437 - South of Legare Anchorage	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
427 - Margot Fish Shoal	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
421 - Margot Fish Shoal	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
419 - Inshore of Ajax Reef	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
413 - Inshore of Pacific Reef	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
410 - Inshore of Pacific Reef	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
408 - Offshore of Broad Creek	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
406 - Offshore of Broad Creek	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
Biscayne National Park Total (12)	0 \pm 0	0 \pm 0	0.003 \pm 0.002	3.9 \pm 0.5	0.001 \pm 0.001	2.3
Upper Florida Keys NMS						
4 - Basin Hill Shoals	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0.017 \pm 0.017	3.4
2 - Near Cannon Patch Reef	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
3 - Near Cannon Patch Reef	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
1 - Inshore of Molasses Reef	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
Upper Florida Keys Total (4)	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0.004 \pm 0.004	3.4
Middle Florida Keys NMS						
69 - Tavernier Rocks	0 \pm 0	0 \pm 0	0.017 \pm 0.017	4.8	0.017 \pm 0.017	2.7
71 - Hen and Chickens SPA**	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
70 - Hen and Chickens SPA**	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
68 - East of Cheeca Rocks SPA	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
72 - Cheeca Rocks SPA**	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
73 - Cheeca Rocks SPA**	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
66 - East Turtle Shoal	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
254 - East Turtle Shoal	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0.017 \pm 0.017	2.7
Middle Florida Keys Total (8)	0 \pm 0	0 \pm 0	0.002 \pm 0.002	4.8	0.004 \pm 0.003	2.7 \pm 0
Lower Florida Keys NMS						
122 - North of Big Pine Shoal	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
121 - North of Maryland Shoal	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
120 - North of Maryland Shoal	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
119 - North of Pelican Shoal	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
118 - East of Western Sambo ER	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
126 - Western Sambo ER**	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
125 - Western Sambo ER**	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
124 - Western Sambo ER**	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
123 - Western Sambo ER**	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
117 - NW of Sand Key SPA	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
116 - North of Satan Shoal	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
115 - North of Satan Shoal	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
Lower Florida Keys Total (12)	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
Mid-channel Patch Reef Total (36)	0 \pm 0	0 \pm 0	0.001 \pm 0.001	4.2 \pm 0.4	0.002 \pm 0.001	2.8 \pm 0.2
<i>Offshore patch reefs</i>						
Biscayne National Park						
471 - Northwest of Triumph Reef	0.017 \pm 0.017	2.0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
461 - NW of Long Reef	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0

Site number/site location	<i>Coralliophila</i> sp.		<i>Thais deltoidea</i>		<i>Leucozonia nassa</i>	
	No./m ²	SL (cm)	No./m ²	SL (cm)	No./m ²	SL (cm)
460 - NW of Long Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
459 - NW of Pacific Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
458 - Inshore of Pacific Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
456 - Inshore of Pacific Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
454 - Northwest of Whistle Buoy	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Biscayne National Park Total (7)	0.002 ± 0.002	2.0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Upper Florida Keys NMS						
16 - North of Carysfort Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
15 - North of Carysfort Reef SPA	0 ± 0	0 ± 0	0.133 ± 0.072	2.1 ± 0.2	0 ± 0	0 ± 0
14 - North of Carysfort Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
47 - Carysfort Reef SPA**	0 ± 0	0 ± 0	0.017 ± 0.017	1.3	0 ± 0	0 ± 0
345 - Carysfort Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
46 - Carysfort Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
39 - Carysfort Reef SPA**	0 ± 0	0 ± 0	0.017 ± 0.017	1.9	0 ± 0	0 ± 0
37 - West of Carysfort Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
13 - Inshore of Watson's Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
55 - Inshore of Watson's Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
358 - Inshore of Watson's Reef	0.017 ± 0.017	1.8	0 ± 0	0 ± 0	0 ± 0	0 ± 0
54 - Inshore of Watson's Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
347 - Inshore of Watson's Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
12 - Inshore of Watson's Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
9 - White Banks	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
8 - Inshore of French Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
7 - Inshore of Molasses Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
6 - Inshore of Molasses Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
5 - Inshore of Pickles Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Upper Florida Keys Total (19)	0.001 ± 0.001	1.8	0.009 ± 0.007	2.0 ± 0.2	0 ± 0	0 ± 0
Middle Florida Keys NMS						
77 - Inshore of Conch Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
76 - Inshore of Conch Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
75 - Inshore of Conch Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
74 - Inshore of Conch Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
98 - Coffins Patch SPA**	0 ± 0	0 ± 0	0.033 ± 0.019	2.6 ± 0.4	0 ± 0	0 ± 0
277 - Coffins Patch SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Middle Florida Keys Total (6)	0 ± 0	0 ± 0	0.006 ± 0.006	2.6 ± 0.4	0 ± 0	0 ± 0
Lower Florida Keys NMS						
133 - Looe Key Research Only**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
132 - Looe Key Research Only**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
131 - North of Looe Key SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
130 - Maryland Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
129 - North of Maryland Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
165 - North of Maryland Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
128 - NE of Eastern Sambo RO	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
135 - Western Sambo ER**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
168 - Western Sambo ER**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.017 ± 0.017	3.6
127 - West of Sand Key SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Lower Florida Keys Total (10)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.002 ± 0.002	3.6
Offshore Patch Reef Total (42)	0.001 ± 0.001	1.9 ± 0.1	0.005 ± 0.003	2.1 ± 0.1	0.001 ± 0.001	3.6
<i>Hard-bottom/rubble/sand matrix</i>						
Upper Florida Keys NMS						
40 - Carysfort Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
38 - West of Carysfort Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
36 - West of Carysfort Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
11 - NW of Dry Rocks Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Upper Florida Keys Total (4)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Hard-bottom Matrix Total (4)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0

Site number/site location	<i>Coralliophila</i> sp.		<i>Thais deltoidea</i>		<i>Leucozonia nassa</i>	
	No./m ²	SL (cm)	No./m ²	SL (cm)	No./m ²	SL (cm)
<i>Low-relief hard-bottom (< 6 m)</i>						
Biscayne National Park						
475 - Fowey Rocks	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
469 - South of Ajax Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.017 ± 0.017	3.1
Biscayne National Park Total (2)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.008 ± 0.008	3.1
Upper Florida Keys NMS						
346 - Carysfort Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
35 - West of Carysfort Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
34 - West of Carysfort Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
33 - Inshore of Watson's Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.017 ± 0.017	4.5
17 - Little Pickles Reef	0 ± 0	0 ± 0	0.133 ± 0.072	3.5 ± 0.1	0.017 ± 0.017	6.0
Upper Florida Keys Total (5)	0 ± 0	0 ± 0	0.027 ± 0.027	3.5 ± 0.1	0.007 ± 0.004	5.3 ± 0.8
Middle Florida Keys NMS						
269 - Conch Reef SPA**	0 ± 0	0 ± 0	0.200 ± 0.072	2.7 ± 0.1	0 ± 0	0 ± 0
89 - Conch Reef SPA**	0 ± 0	0 ± 0	0.333 ± 0.105	2.8 ± 0.1	0.017 ± 0.017	2.7
88 - Little Conch Reef	0 ± 0	0 ± 0	0.033 ± 0.033	3.0 ± 0.0	0 ± 0	0 ± 0
352 - Little Conch Reef	0 ± 0	0 ± 0	0.167 ± 0.088	3.2 ± 0.2	0 ± 0	0 ± 0
97 - Davis Reef SPA**	0 ± 0	0 ± 0	0.183 ± 0.057	2.9 ± 0.1	0 ± 0	0 ± 0
90 - Davis Reef SPA**	0 ± 0	0 ± 0	0.050 ± 0.032	3.3 ± 0.4	0 ± 0	0 ± 0
86 - South of Windley Key	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
103 - NE of Alligator Light	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
82 - Alligator Reef SPA**	0 ± 0	0 ± 0	0.133 ± 0.027	3.3 ± 0.3	0.017 ± 0.017	4.5
81 - Alligator Reef SPA**	0 ± 0	0 ± 0	0.133 ± 0.061	3.4 ± 0.2	0 ± 0	0 ± 0
350 - Tennessee Light	0 ± 0	0 ± 0	0.017 ± 0.017	3.1	0 ± 0	0 ± 0
85 - East of Coffins Patch SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
92 - Coffins Patch SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
91 - Coffins Patch SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Middle Florida Keys Total (14)	0 ± 0	0 ± 0	0.089 ± 0.028	3.0 ± 0.1	0.002 ± 0.002	3.6 ± 0.9
Lower Florida Keys NMS						
161 - West of American Shoal	0 ± 0	0 ± 0	0.017 ± 0.017	3.0	0 ± 0	0 ± 0
140 - Maryland Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
159 - North of Pelican Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
158 - East of No Name Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Lower Florida Keys Total (4)	0 ± 0	0 ± 0	0.004 ± 0.004	3.0	0 ± 0	0 ± 0
Hard-bottom (< 6 m) Total (25)	0 ± 0	0 ± 0	0.056 ± 0.018	3.0 ± 0.1	0.003 ± 0.001	4.2 ± 0.6
<i>Inner line reef tract spur & groove</i>						
Upper Florida Keys NMS						
61 - Turtle Reef	0 ± 0	0 ± 0	0.033 ± 0.033	1.8 ± 0.5	0 ± 0	0 ± 0
60 - Inshore of Elbow Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
59 - Inshore of Elbow Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
58 - Horseshoe Reef	0 ± 0	0 ± 0	0.267 ± 0.125	2.8 ± 0.2	0.017 ± 0.017	3.3
62 - Dry Rocks SPA**	0 ± 0	0 ± 0	0.300 ± 0.117	2.6 ± 0.1	0 ± 0	0 ± 0
63 - Dry Rocks SPA**	0 ± 0	0 ± 0	0.367 ± 0.104	2.8 ± 0.1	0.033 ± 0.033	3.4 ± 0.3
65 - Grecian Rocks SPA**	0 ± 0	0 ± 0	0.267 ± 0.122	2.7 ± 0.1	0.100 ± 0.043	3.2 ± 0.1
64 - Grecian Rocks SPA**	0 ± 0	0 ± 0	0.050 ± 0.032	2.3 ± 0.3	0.067 ± 0.038	2.6 ± 0.3
Upper Florida Keys Total (8)	0 ± 0	0 ± 0	0.160 ± 0.054	2.7 ± 0.1	0.027 ± 0.013	3.0 ± 0.1
Inner Line Reef Tract Total (8)	0 ± 0	0 ± 0	0.160 ± 0.054	2.7 ± 0.1	0.027 ± 0.013	3.0 ± 0.1
<i>High-relief spur & groove</i>						
Biscayne National Park						
474 - Brewster Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
472 - Star Reef	0 ± 0	0 ± 0	0.017 ± 0.017	3.1	0 ± 0	0 ± 0
470 - Triumph Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.067 ± 0.047	2.1 ± 0.2
467 - Long Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
466 - Ajax Reef	0 ± 0	0 ± 0	0.083 ± 0.050	3.2 ± 0.1	0 ± 0	0 ± 0
465 - Ajax Reef	0 ± 0	0 ± 0	0.017 ± 0.017	1.8	0.050 ± 0.050	1.6 ± 0.2

Site number/site location	<i>Coralliophila</i> sp.		<i>Thais deltoidea</i>		<i>Leucozonia nassa</i>	
	No./m ²	SL (cm)	No./m ²	SL (cm)	No./m ²	SL (cm)
464 - Pacific Reef	0 ± 0	0 ± 0	0.133 ± 0.027	2.7 ± 0.3	0.033 ± 0.033	2.3 ± 0.4
Biscayne National Park Total (7)	0 ± 0	0 ± 0	0.036 ± 0.020	2.8 ± 0.2	0.021 ± 0.011	2.0 ± 0.2
Upper Florida Keys NMS						
26 - Carysfort Reef SPA**	0 ± 0	0 ± 0	0.067 ± 0.038	3.0 ± 0.1	0 ± 0	0 ± 0
25 - Carysfort Reef SPA**	0 ± 0	0 ± 0	0.050 ± 0.032	2.2 ± 0.5	0 ± 0	0 ± 0
218 - South Carysfort Reef SPA**	0 ± 0	0 ± 0	0.017 ± 0.017	3.4	0.033 ± 0.033	4.1 ± 0.1
217 - South Carysfort Reef SPA**	0 ± 0	0 ± 0	0.333 ± 0.061	3.2 ± 0.1	0.067 ± 0.038	3.2 ± 0.3
24 - Maitland Grounding Site	0 ± 0	0 ± 0	0.083 ± 0.032	2.8 ± 0.1	0 ± 0	0 ± 0
28 - Elbow Reef SPA**	0 ± 0	0 ± 0	0.617 ± 0.250	2.7 ± 0.1	0.117 ± 0.079	3.2 ± 0.4
27 - Elbow Reef SPA**	0 ± 0	0 ± 0	0.217 ± 0.032	2.7 ± 0.2	0.033 ± 0.019	4.0 ± 0.3
30 - French Reef SPA**	0 ± 0	0 ± 0	0.117 ± 0.032	2.6 ± 0.2	0.017 ± 0.017	4.5
29 - French Reef SPA**	0.017 ± 0.017	4.1	0.067 ± 0.027	2.9 ± 0.1	0 ± 0	0 ± 0
23 - SW of French Reef SPA	0 ± 0	0 ± 0	0.017 ± 0.017	4.0	0 ± 0	0 ± 0
357 - Sand Island	0 ± 0	0 ± 0	0.500 ± 0.137	2.4 ± 0.1	0.050 ± 0.017	2.9 ± 0.1
356 - Sand Island	0.117 ± 0.057	2.2 ± 0.2	0.400 ± 0.133	2.4 ± 0.1	0.183 ± 0.032	2.8 ± 0.2
32 - Molasses Reef SPA**	0.017 ± 0.017	2.1	0.417 ± 0.100	2.7 ± 0.1	0.033 ± 0.019	3.8 ± 1.0
31 - Molasses Reef SPA**	0.250 ± 0.145	1.6 ± 0.1	0.100 ± 0.079	2.6 ± 0.3	0.033 ± 0.019	2.7 ± 0.1
19 - Pickles Reef	0 ± 0	0 ± 0	0.200 ± 0.082	3.1 ± 0.1	0 ± 0	0 ± 0
20 - Pickles Reef	0 ± 0	0 ± 0	0.250 ± 0.092	2.8 ± 0.1	0.033 ± 0.019	3.2 ± 0.2
18 - Pickles Reef	0.017 ± 0.017	3.4	0.267 ± 0.047	2.8 ± 0.1	0.150 ± 0.042	3.0 ± 0.2
Upper Florida Keys Total (17)	0.025 ± 0.016	2.0 ± 0.2	0.219 ± 0.044	2.7 ± 0.0	0.044 ± 0.013	3.1 ± 0.1
Middle Florida Keys NMS						
79 - Delta Shoal	0 ± 0	0 ± 0	0.150 ± 0.017	2.8 ± 0.3	0.033 ± 0.019	3.8 ± 0.7
78 - Delta Shoal	0 ± 0	0 ± 0	0.200 ± 0.027	2.9 ± 0.2	0.083 ± 0.063	1.6 ± 0.5
84 - Sombrero Key SPA**	0.017 ± 0.017	4.8	0.317 ± 0.050	2.9 ± 0.1	0.117 ± 0.074	3.3 ± 0.3
83 - Sombrero Key SPA**	0 ± 0	0 ± 0	0.433 ± 0.262	2.8 ± 0.1	0.017 ± 0.017	5.3
Middle Florida Keys Total (4)	0.004 ± 0.004	4.8	0.275 ± 0.063	2.9 ± 0.1	0.063 ± 0.023	2.9 ± 0.4
Lower Florida Keys NMS						
148 - Looe Key SPA**	0.217 ± 0.217	2.4 ± 0.2	0.933 ± 0.246	2.6 ± 0.1	0.233 ± 0.117	3.4 ± 0.2
147 - Looe Key SPA**	0 ± 0	0 ± 0	0.367 ± 0.111	2.8 ± 0.1	0 ± 0	0 ± 0
145 - American Shoal	0 ± 0	0 ± 0	0.017 ± 0.017	3.2	0 ± 0	0 ± 0
146 - American Shoal	0 ± 0	0 ± 0	0.150 ± 0.032	3.3 ± 0.2	0.033 ± 0.019	2.1 ± 0.4
144 - Maryland Shoal	0 ± 0	0 ± 0	0.283 ± 0.050	2.6 ± 0.2	0 ± 0	0 ± 0
141 - Maryland Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
143 - Maryland Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.017 ± 0.017	2.8
139 - Pelican Shoal	0 ± 0	0 ± 0	0.450 ± 0.21	2.7 ± 0.1	0.050 ± 0.050	1.6 ± 0.6
138 - No Name Reef	0 ± 0	0 ± 0	0.850 ± 0.254	2.7 ± 0.1	0.067 ± 0.038	1.8 ± 0.4
137 - No Name Reef	0 ± 0	0 ± 0	0.350 ± 0.113	2.6 ± 0.1	0.017 ± 0.017	2.7
150 - Eastern Sambo RO**	0 ± 0	0 ± 0	1.383 ± 0.208	2.5 ± 0.1	0.200 ± 0.082	2.8 ± 0.3
149 - Eastern Sambo RO**	0 ± 0	0 ± 0	1.717 ± 0.107	2.5 ± 0.0	0.117 ± 0.074	3.2 ± 0.3
348 - Middle Sambo Reef	0 ± 0	0 ± 0	1.300 ± 0.222	2.7 ± 0.1	0.100 ± 0.058	2.8 ± 0.1
309 - Middle Sambo Reef	0 ± 0	0 ± 0	1.267 ± 0.328	2.5 ± 0.1	0.167 ± 0.058	3.3 ± 0.1
152 - Western Sambo ER**	0 ± 0	0 ± 0	0.917 ± 0.247	2.7 ± 0.1	0.250 ± 0.032	2.9 ± 0.3
151 - Western Sambo ER**	0 ± 0	0 ± 0	2.483 ± 0.321	2.7 ± 0.0	0.133 ± 0.027	2.8 ± 0.4
136 - East of E. Dry Rocks SPA	0 ± 0	0 ± 0	0.267 ± 0.189	2.6 ± 0.1	0.050 ± 0.032	2.9 ± 0.5
154 - Eastern Dry Rocks SPA**	0 ± 0	0 ± 0	0.717 ± 0.069	2.8 ± 0.1	0.100 ± 0.043	4.0 ± 0.3
153 - Eastern Dry Rocks SPA**	0 ± 0	0 ± 0	1.850 ± 0.385	2.7 ± 0.0	0.167 ± 0.19	3.2 ± 0.2
156 - Rock Key SPA**	0 ± 0	0 ± 0	0.450 ± 0.145	2.9 ± 0.1	0.250 ± 0.129	2.8 ± 0.2
155 - Rock Key SPA**	0 ± 0	0 ± 0	1.267 ± 0.321	2.5 ± 0.1	0.033 ± 0.033	3.5 ± 0.5
325 - Sand Key SPA**	0 ± 0	0 ± 0	1.067 ± 0.268	2.8 ± 0.1	0.333 ± 0.112	2.8 ± 0.1
157 - Sand Key SPA**	0 ± 0	0 ± 0	1.767 ± 0.441	2.5 ± 0.0	0.233 ± 0.064	2.9 ± 0.2
Lower Florida Keys Total (23)	0.009 ± 0.009	2.4 ± 0.2	0.863 ± 0.142	3.6 ± 0.6	0.111 ± 0.021	3.3 ± 0.5
High-relief Spur & Groove (51)	0.013 ± 0.007	2.2 ± 0.1	0.489 ± 0.081	2.7 ± 0.0	0.073 ± 0.012	2.9 ± 0.1
<i>Low-relief hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
53 - Carysfort Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
240 - Carysfort Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0

Site number/site location	<i>Coralliophila</i> sp.		<i>Thais deltoidea</i>		<i>Leucozonia nassa</i>	
	No./m ²	SL (cm)	No./m ²	SL (cm)	No./m ²	SL (cm)
57 - Inshore of Watson's Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
45 - Offshore of Dry Rocks SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
22 - SW of French Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.017 ± 0.017	2.3
21 - SW of French Reef SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Upper Florida Keys Total (6)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.003 ± 0.003	2.3
Middle Florida Keys NMS						
353 - Conch Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
105 - Conch Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
104 - NE of Alligator Light	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
351 - South of Indian Key	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
101 - South of Lower Matecumbe	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.017 ± 0.017	4.6
111 - West of Sombrero Key	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Middle Florida Keys Total (6)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.003 ± 0.003	4.6
Lower Florida Keys NMS						
180 - South of Bahia Honda Key	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
173 - Maryland Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
177 - NE of Satan Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Lower Florida Keys Total (3)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Hard-bottom (6-15 m) Total (15)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.002 ± 0.002	3.5 ± 1.2
<i>Patchy hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
56 - Inshore of Watson's Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
44 - Dixie Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
43 - Dixie Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
42 - Dixie Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Upper Florida Keys Total (4)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Middle Florida Keys NMS						
96 - South of Windley Key	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
114 - South of Lower Matecumbe	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
94 - South of Duck Key	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
93 - South of Duck Key	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Middle Florida Keys Total (4)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Lower Florida Keys NMS						
338 - South of Bahia Honda Key	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
179 - West of American Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
160 - North of Pelican Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
164 - West of Pelican Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
178 - West of Pelican Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
166 - Eastern Sambo RO**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
332 - Eastern Sambo RO**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
334 - Western Sambo ER**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
167 - Western Sambo ER**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.017 ± 0.017	2.9
163 - West of Western Sambo ER	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
335 - Sand Key SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
169 - Sand Key SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
162 - West of Western Dry Rocks	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Lower Florida Keys Total (13)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Patchy Hard-bottom Total (21)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.001 ± 0.001	2.9
<i>Low-relief spur & groove (6-15 m)</i>						
Upper Florida Keys NMS						
52 - Carysfort Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
241 - Carysfort Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
51 - Offshore of Dry Rocks SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
50 - Offshore of Dry Rocks SPA	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
49 - Little Pickles Reef	0.033 ± 0.033	1.8 ± 0.3	0 ± 0	0 ± 0	0 ± 0	0 ± 0
48 - Little Pickles Reef	0.083 ± 0.083	2.0 ± 0.2	0 ± 0	0 ± 0	0 ± 0	0 ± 0

Site number/site location	<i>Coralliophila</i> sp.		<i>Thais deltoidea</i>		<i>Leucozonia nassa</i>	
	No./m ²	SL (cm)	No./m ²	SL (cm)	No./m ²	SL (cm)
Upper Florida Keys Total (6)	0.019 ± 0.014	2.0 ± 0.2	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Middle Florida Keys NMS						
355 - NE of Conch Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
282 - Conch Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
354 - Conch Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
107 - Conch Reef RO**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
106 - Conch Reef RO**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
276 - Davis Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
80 - Davis Reef SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
102 - South of Lower Matecumbe	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
109 - Tennessee Reef RO**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
108 - Tennessee Reef RO**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
113 - NE of Tennessee Light	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
349 - South of Conch Key	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
100 - South of Conch Key	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
99 - East of Delta Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
110 - Sombrero Key SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
287 - Sombrero Key SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Middle Florida Keys Total (16)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Lower Florida Keys NMS						
337 - South of Bahia Honda Key	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
174 - Looe Key SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
339 - Looe Key SPA**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
142 - American Shoal	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
172 - East of Eastern Sambo RO	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
340 - Eastern Sambo RO**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
175 - Eastern Sambo RO**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
171 - Middle Sambo Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
170 - Middle Sambo Reef	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
341 - Western Sambo ER**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
176 - Western Sambo ER**	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Lower Florida Keys Total (11)	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Low-relief Spur & Groove (33)	0.004 ± 0.003	2.0 ± 0.2	0 ± 0	0 ± 0	0 ± 0	0 ± 0

Table 12. Size frequency distributions (top) and substratum occupancy patterns (bottom) of *Coralliophila* and other gastropod mollusks in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June-August 2007.

Gastropod Shell Length Frequency

Total Shell Length (cm)	<i>Coralliophila</i> sp.		<i>Thais deltoidea</i>		<i>Leucozonia nassa</i>	
	Frequency	% Total	Frequency	% Total	Frequency	% Total
< 1.0	2	4.2	0	0.0	2	0.8
1-1.9	18	37.5	182	10.9	28	11.3
2-2.9	19	39.6	992	59.4	86	34.7
3-3.9	7	14.6	475	28.4	106	42.7
4-4.9	2	4.2	22	1.3	23	9.3
5-5.9	0	0.0	0	0.0	2	0.8
6-6.9	0	0.0	0	0.0	1	0.4
Total	48	100.0	1,671	100.0	248	100.0

Gastropod Substratum Occupancy

Substratum Type	<i>Coralliophila</i> sp.		<i>Thais deltoidea</i>		<i>Leucozonia nassa</i>	
	Frequency	% Total	Frequency	% Total	Frequency	% Total
Algal turf	4	8.3	1,129	67.6	141	56.9
Coralline algae	2	4.2	428	25.6	91	36.7
<i>Dictyota</i> algae	0	0.0	8	0.5	1	0.4
<i>Halimeda</i> algae	0	0.0	4	0.2	2	0.8
Sponge	0	0.0	0	0.0	1	0.4
<i>Millepora</i>	0	0.0	1	0.1	0	0.0
Scleractinian coral	41	85.4	14	0.8	1	0.4
<i>Palythoa</i>	0	0.0	1	0.1	0	0.0
<i>Coralliophila</i> sp.	1	2.1	0	0.0	0	0.0
<i>Thais deltoidea</i>	0	0.0	59	3.5	1	0.4
<i>Leucozonia nassa</i>	0	0.0	2	0.1	3	1.2
Sand	0	0.0	25	1.5	7	2.8
Total	48	100.0	1,671	100.0	248	100.0

Table 13. Mean \pm 1 SE densities (no. individuals per m²), test diameter (TD, cm), and numbers of individuals (N) of the urchins *Diadema antillarum* and *Echinometra lucunter* in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (***) are no-take marine reserves.

Site number/site location	<i>Diadema antillarum</i>			<i>Echinometra lucunter</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
<i>Mid-channel patch reefs</i>						
Biscayne National Park						
445 - Northern Legare Anchorage	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
441 - Bache Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
440 - South of Bache Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
438 - South of Bache Shoal	0.017 \pm 0.017	6.8	1	0 \pm 0	0 \pm 0	
437 - South of Legare Anchorage	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
427 - Margot Fish Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
421 - Margot Fish Shoal	0.050 \pm 0.050	0.7 \pm 0.0	3	0.017 \pm 0.017	2.2	1
419 - Inshore of Ajax Reef	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
413 - Inshore of Pacific Reef	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
410 - Inshore of Pacific Reef	0.050 \pm 0.032	2.0 \pm 1.2	3	0.033 \pm 0.033	1.9 \pm 0.3	2
408 - Offshore of Broad Creek	0 \pm 0	0 \pm 0		0.133 \pm 0.072	2.1 \pm 0.1	8
406 - Offshore of Broad Creek	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
Biscayne National Park Total (12)	0.010 \pm 0.006	2.2 \pm 0.9	7	0.015 \pm 0.011	2.0 \pm 0.1	11
Upper Florida Keys NMS						
4 - Basin Hill Shoals	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
2 - Near Cannon Patch Reef	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
3 - Near Cannon Patch Reef	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
1 - Inshore of Molasses Reef	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
Upper Florida Keys Total (4)	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
Middle Florida Keys NMS						
69 - Tavernier Rocks	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
71 - Hen and Chickens SPA**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
70 - Hen and Chickens SPA**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
68 - East of Cheeca Rocks SPA	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
72 - Cheeca Rocks SPA**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
73 - Cheeca Rocks SPA**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
66 - East Turtle Shoal	0.050 \pm 0.050	4.2 \pm 0.5	3	0 \pm 0	0 \pm 0	
254 - East Turtle Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
Middle Florida Keys Total (8)	0.006 \pm 0.006	4.2 \pm 0.5	3	0 \pm 0	0 \pm 0	
Lower Florida Keys NMS						
122 - North of Big Pine Shoal	0.050 \pm 0.032	5.2 \pm 2.3	3	0.017 \pm 0.017	1.0	1
121 - North of Maryland Shoal	0.017 \pm 0.017	5.6	1	0 \pm 0	0 \pm 0	
120 - North of Maryland Shoal	0.017 \pm 0.017	1.4	1	0 \pm 0	0 \pm 0	
119 - North of Pelican Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
118 - East of Western Sambo ER	0.050 \pm 0.132	3.7 \pm 1.5	3	0 \pm 0	0 \pm 0	
126 - Western Sambo ER**	0.017 \pm 0.017	6.0	1	0 \pm 0	0 \pm 0	
125 - Western Sambo ER**	0.050 \pm 0.032	2.5 \pm 1.5	3	0 \pm 0	0 \pm 0	
124 - Western Sambo ER**	0.017 \pm 0.017	4.2	1	0 \pm 0	0 \pm 0	
123 - Western Sambo ER**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
117 - NW of Sand Key SPA	0.033 \pm 0.019	4.6 \pm 0.6	2	0 \pm 0	0 \pm 0	
116 - North of Satan Shoal	0.033 \pm 0.019	1.8 \pm 0.2	2	0 \pm 0	0 \pm 0	
115 - North of Satan Shoal	0.033 \pm 0.019	1.4 \pm 0.2	2	0 \pm 0	0 \pm 0	
Lower Florida Keys Total (12)	0.026 \pm 0.005	3.5 \pm 0.6	19	0.001 \pm 0.001	1.0	1
Mid-channel Patch Reef Total (36)	0.013 \pm 0.003	3.3 \pm 0.4	29	0.006 \pm 0.004	1.9 \pm 0.1	12

Site number/site location	<i>Diadema antillarum</i>			<i>Echinometra lucunter</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
<i>Offshore patch reefs</i>						
Biscayne National Park						
471 - Northwest of Triumph Reef	0.067 ± 0.047	6.5 ± 0.5	4	0 ± 0	0 ± 0	
461 - NW of Long Reef	0.067 ± 0.027	4.4 ± 1.0	4	0 ± 0	0 ± 0	
460 - NW of Long Reef	0.033 ± 0.019	5.3 ± 0.8	2	0 ± 0	0 ± 0	
459 - NW of Pacific Reef	0.150 ± 0.050	5.4 ± 0.6	9	0 ± 0	0 ± 0	
458 - Inshore of Pacific Reef	0.200 ± 0.119	4.9 ± 0.4	12	0 ± 0	0 ± 0	
456 - Inshore of Pacific Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
454 - Northwest of Whistle Buoy	0.083 ± 0.032	1.9 ± 1.0	5	0 ± 0	0 ± 0	
Biscayne National Park Total (7)	0.086 ± 0.026	4.8 ± 0.3	36	0 ± 0	0 ± 0	
Upper Florida Keys NMS						
16 - North of Carysfort Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
15 - North of Carysfort Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
14 - North of Carysfort Reef SPA	0.083 ± 0.032	7.1 ± 0.9	5	0.017 ± 0.017	2.0	1
47 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
345 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
46 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
39 - Carysfort Reef SPA**	0.017 ± 0.017	6.6	1	0 ± 0	0 ± 0	
37 - West of Carysfort Reef SPA	0.133 ± 0.077	5.2 ± 0.3	8	0 ± 0	0 ± 0	
13 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
55 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
358 - Inshore of Watson's Reef	0.017 ± 0.017	1.0	1	0 ± 0	0 ± 0	
54 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
347 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
12 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
9 - White Banks	0.017 ± 0.017	0.7	1	0 ± 0	0 ± 0	
8 - Inshore of French Reef	0.033 ± 0.019	4.2 ± 0.2	2	0.117 ± 0.042	1.6 ± 0.2	7
7 - Inshore of Molasses Reef	0.267 ± 0.061	3.9 ± 0.6	16	0 ± 0	0 ± 0	
6 - Inshore of Molasses Reef	0.033 ± 0.033	9.5 ± 0.5	2	0 ± 0	0 ± 0	
5 - Inshore of Pickles Reef	0.100 ± 0.033	5.1 ± 0.6	6	0 ± 0	0 ± 0	
Upper Florida Keys Total (19)	0.037 ± 0.016	4.9 ± 0.4	42	0.007 ± 0.006	1.7 ± 0.2	8
Middle Florida Keys NMS						
77 - Inshore of Conch Reef SPA	0.033 ± 0.033	5.8 ± 0.3	2	0 ± 0	0 ± 0	
76 - Inshore of Conch Reef SPA	0.033 ± 0.019	3.7 ± 3.1	2	0 ± 0	0 ± 0	
75 - Inshore of Conch Reef SPA	0.017 ± 0.017	7.0	1	0.033 ± 0.033	1.2 ± 0.4	2
74 - Inshore of Conch Reef SPA	0.017 ± 0.017	5.5	1	0 ± 0	0 ± 0	
98 - Coffins Patch SPA**	0.033 ± 0.019	5.3 ± 1.8	2	0 ± 0	0 ± 0	
277 - Coffins Patch SPA**	0.050 ± 0.032	0.7 ± 0.1	3	0 ± 0	0 ± 0	
Middle Florida Keys Total (6)	0.031 ± 0.005	4.0 ± 0.8	11	0.006 ± 0.006	1.2 ± 0.4	2
Lower Florida Keys NMS						
133 - Looe Key Research Only**	0.050 ± 0.032	5.4 ± 1.4	3	0 ± 0	0 ± 0	
132 - Looe Key Research Only**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
131 - North of Looe Key SPA**	0.133 ± 0.027	4.5 ± 0.6	8	0 ± 0	0 ± 0	
130 - Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
129 - North of Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
165 - North of Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
128 - NE of Eastern Sambo RO	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
135 - Western Sambo ER**	0.033 ± 0.019	1.1 ± 0.3	2	0 ± 0	0 ± 0	
168 - Western Sambo ER**	0.067 ± 0.000	3.0 ± 1.5	4	0 ± 0	0 ± 0	
127 - West of Sand Key SPA	0.017 ± 0.017	1.0	1	0 ± 0	0 ± 0	
Lower Florida Keys Total (10)	0.030 ± 0.014	3.7 ± 0.6	18	0 ± 0	0 ± 0	
Offshore Patch Reef Total (42)	0.042 ± 0.009	4.6 ± 2.3	107	0.004 ± 0.003	1.6 ± 0.2	10
<i>Hard-bottom/rubble/sand matrix</i>						
Upper Florida Keys NMS						

Site number/site location	<i>Diadema antillarum</i>			<i>Echinometra lucunter</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
40 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
38 - West of Carysfort Reef SPA	0 ± 0	0 ± 0		0.050 ± 0.032	2.6 ± 0.8	3
36 - West of Carysfort Reef SPA	0.017 ± 0.017	2.3	1	0 ± 0	0 ± 0	
11 - NW of Dry Rocks SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (4)	0.004 ± 0.004	2.3	1	0.013 ± 0.013	2.6 ± 0.8	3
Hard-bottom Matrix Total (4)	0.004 ± 0.004	2.3	1	0.013 ± 0.013	2.6 ± 0.8	3
<i>Low-relief hard-bottom (< 6 m)</i>						
Biscayne National Park						
475 - Fowey Rocks	0.017 ± 0.017	4.5	1	0 ± 0	0 ± 0	
469 - South of Ajax Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Biscayne National Park Total (2)	0.008 ± 0.008	4.5	1	0 ± 0	0 ± 0	
Upper Florida Keys NMS						
346 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
35 - West of Carysfort Reef SPA	0.017 ± 0.017	5.2	1	0 ± 0	0 ± 0	
34 - West of Carysfort Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
33 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
17 - Little Pickles Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (5)	0.003 ± 0.003	5.2	1	0 ± 0	0 ± 0	
Middle Florida Keys NMS						
269 - Conch Reef SPA**	0.017 ± 0.017	4.1	1	0 ± 0	0 ± 0	
89 - Conch Reef SPA**	0.083 ± 0.050	1.5 ± 0.8	5	0 ± 0	0 ± 0	
88 - Little Conch Reef	0 ± 0	0 ± 0		0.017 ± 0.017	0.5	1
352 - Little Conch Reef	0.017 ± 0.017	0.8	1	0 ± 0	0 ± 0	
97 - Davis Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
90 - Davis Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
86 - South of Windley Key	0.133 ± 0.047	3.8 ± 0.7	8	0 ± 0	0 ± 0	
103 - NE of Alligator Light	0.050 ± 0.032	0.7 ± 0.1	3	0 ± 0	0 ± 0	
82 - Alligator Reef SPA**	0.017 ± 0.017	0.5	1	0 ± 0	0 ± 0	
81 - Alligator Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
350 - Tennessee Light	0.033 ± 0.033	3.2 ± 1.1	2	0 ± 0	0 ± 0	
85 - East of Coffins Patch SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
92 - Coffins Patch SPA**	0.033 ± 0.033	3.5 ± 1.3	2	0 ± 0	0 ± 0	
91 - Coffins Patch SPA**	0.033 ± 0.033	0.8 ± 0.1	2	0 ± 0	0 ± 0	
Middle Florida Keys Total (14)	0.030 ± 0.010	2.4 ± 0.4	25	0.001 ± 0.001	0.5	1
Lower Florida Keys NMS						
161 - West of American Shoal	0.017 ± 0.017	0.6	1	0 ± 0	0 ± 0	
140 - Maryland Shoal	0.017 ± 0.017	3.0	1	0 ± 0	0 ± 0	
159 - North of Pelican Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
158 - East of No Name Reef	0.017 ± 0.017	0.7	1	0 ± 0	0 ± 0	
Lower Florida Keys Total (4)	0.013 ± 0.004	1.4 ± 0.8	3	0 ± 0	0 ± 0	
Hard-bottom (< 6 m) Total (25)	0.020 ± 0.006	2.5 ± 0.4	30	0.001 ± 0.001	0.5	1
<i>Inner line reef tract spur & groove</i>						
Upper Florida Keys NMS						
61 - Turtle Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
60 - Inshore of Elbow Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
59 - Inshore of Elbow Reef SPA	0.033 ± 0.019	6.7 ± 0.6	2	0 ± 0	0 ± 0	
58 - Horseshoe Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
62 - Dry Rocks SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
63 - Dry Rocks SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
65 - Grecian Rocks SPA**	0.050 ± 0.050	4.8 ± 1.7	3	0 ± 0	0 ± 0	
64 - Grecian Rocks SPA**	0.017 ± 0.017	3.7	1	0.017 ± 0.017	1.2	1
Upper Florida Keys Total (8)	0.013 ± 0.007	5.3 ± 0.9	6	0.002 ± 0.002	1.2	1
Inner Line Spur & Groove Total (8)	0.013 ± 0.007	5.3 ± 0.9	6	0.002 ± 0.002	1.2	1
<i>High-relief spur & groove</i>						
Biscayne National Park						

Site number/site location	<i>Diadema antillarum</i>			<i>Echinometra lucunter</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
474 - Brewster Reef	0.017 ± 0.017	4.0	1	0 ± 0	0 ± 0	
472 - Star Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
470 - Triumph Reef	0.017 ± 0.017	0.7	1	0 ± 0	0 ± 0	
467 - Long Reef	0.017 ± 0.017	0.7	1	0 ± 0	0 ± 0	
466 - Ajax Reef	0.050 ± 0.032	2.4 ± 1.2	3	0 ± 0	0 ± 0	
465 - Ajax Reef	0.050 ± 0.032	0.9 ± 0.1	3	0.017 ± 0.017	1.9	1
464 - Pacific Reef	0.033 ± 0.019	1.0 ± 0.1	2	0 ± 0	0 ± 0	
Biscayne National Park Total (7)	0.026 ± 0.077	1.6 ± 0.4	11	0.002 ± 0.002	1.9	1
Upper Florida Keys NMS						
26 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
25 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
218 - South Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
217 - South Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
24 - Maitland Grounding Site	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
28 - Elbow Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
27 - Elbow Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
30 - French Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
29 - French Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
23 - SW of French Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
357 - Sand Island	0.033 ± 0.019	0.6 ± 0.0	2	0 ± 0	0 ± 0	
356 - Sand Island	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
32 - Molasses Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
31 - Molasses Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
19 - Pickles Reef	0.050 ± 0.017	2.4 ± 1.3	3	0 ± 0	0 ± 0	
20 - Pickles Reef	0.217 ± 0.083	2.3 ± 0.5	13	0 ± 0	0 ± 0	
18 - Pickles Reef	0.083 ± 0.042	1.7 ± 0.5	5	0.017 ± 0.017	0.5	1
Upper Florida Keys Total (17)	0.023 ± 0.013	2.1 ± 0.4	23	0 ± 0	0 ± 0	
Middle Florida Keys NMS						
79 - Delta Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
78 - Delta Shoal	0.033 ± 0.019	1.9 ± 1.0	2	0 ± 0	0 ± 0	
84 - Sombrero Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
83 - Sombrero Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys Total (4)	0.008 ± 0.008	1.9 ± 1.0	2	0 ± 0	0 ± 0	
Lower Florida Keys NMS						
148 - Looe Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
147 - Looe Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
145 - American Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
146 - American Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
144 - Maryland Shoal	0.183 ± 0.074	5.2 ± 1.3	11	1.100 ± 0.376	1.8 ± 0.1	66
141 - Maryland Shoal	0.100 ± 0.043	5.7 ± 0.5	6	0 ± 0	0 ± 0	
143 - Maryland Shoal	0.017 ± 0.017	5.8	1	0 ± 0	0 ± 0	
139 - Pelican Shoal	0.017 ± 0.017	0.4	1	0 ± 0	0 ± 0	
138 - No Name Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
137 - No Name Reef	0.017 ± 0.017	1.1	1	0 ± 0	0 ± 0	
150 - Eastern Sambo RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
149 - Eastern Sambo RO**	0.033 ± 0.033	2.0 ± 1.0	2	0 ± 0	0 ± 0	
348 - Middle Sambo Reef	0.050 ± 0.032	2.2 ± 1.4	3	0.017 ± 0.017	1.2	1
309 - Middle Sambo Reef	0.017 ± 0.017	1.2	1	0.017 ± 0.017	2.1	1
152 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
151 - Western Sambo ER**	0.033 ± 0.033	1.6 ± 1.0	2	0.017 ± 0.017	1.2	1
136 - East of Eastern Dry Rocks SPA	0.033 ± 0.019	1.7 ± 1.3	2	0 ± 0	0 ± 0	
154 - Eastern Dry Rocks SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
153 - Eastern Dry Rocks SPA**	0.050 ± 0.032	3.1 ± 2.5	3	0 ± 0	0 ± 0	
156 - Rock Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
155 - Rock Key SPA**	0 ± 0	0 ± 0		0.083 ± 0.063	2.8 ± 0.3	5
325 - Sand Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
157 - Sand Key SPA**	0.067 ± 0.067	3.3 ± 1.1	4	0 ± 0	0 ± 0	
Lower Florida Keys Total (23)	0.027 ± 0.009	3.8 ± 0.4	37	0.054 ± 0.048	1.8 ± 0.1	74
High-relief Spur & Groove Total (51)	0.024 ± 0.006	2.8 ± 0.3	73	0.025 ± 0.022	1.8 ± 0.1	76

Site number/site location	<i>Diadema antillarum</i>			<i>Echinometra lucunter</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
<i>Low-relief hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
53 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
240 - Carysfort Reef SPA**	0.017 ± 0.017	0.9	1	0 ± 0	0 ± 0	
57 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
45 - Offshore of Dry Rocks SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
22 - SW of French Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
21 - SW of French Reef SPA	0.017 ± 0.017	5.0	1	0 ± 0	0 ± 0	
Upper Florida Keys Total (6)	0.006 ± 0.004	3.0 ± 2.1	2	0 ± 0	0 ± 0	
Middle Florida Keys NMS						
353 - Conch Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
105 - Conch Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
104 - NE of Alligator Light	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
351 - South of Indian Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
101 - South of Lower Matecumbe	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
111 - West of Sombrero Key	0.017 ± 0.017	0.7	1	0 ± 0	0 ± 0	
Middle Florida Keys Total (6)	0.003 ± 0.003	0.7	1	0 ± 0	0 ± 0	
Lower Florida Keys NMS						
180 - South of Bahia Honda Key	0.017 ± 0.017	0.8	1	0 ± 0	0 ± 0	
173 - Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
177 - NE of Satan Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys Total (3)	0.006 ± 0.006	0.8	1	0 ± 0	0 ± 0	
Hard-bottom (6-15 m) Total (15)	0.004 ± 0.002	1.9 ± 1.1	4	0 ± 0	0 ± 0	
<i>Patchy hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
56 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
44 - Dixie Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
43 - Dixie Shoal	0.017 ± 0.017	1.4	1	0 ± 0	0 ± 0	
42 - Dixie Shoal	0.017 ± 0.017	1.3	1	0 ± 0	0 ± 0	
Upper Florida Keys Total (4)	0.008 ± 0.005	1.4 ± 0.0	2	0 ± 0	0 ± 0	
Middle Florida Keys NMS						
96 - South of Windley Key	0.033 ± 0.033	2.5 ± 1.8	2	0 ± 0	0 ± 0	
114 - South of Lower Matecumbe	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
94 - South of Duck Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
93 - South of Duck Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys Total (4)	0.008 ± 0.008	2.5 ± 1.8	2	0 ± 0	0 ± 0	
Lower Florida Keys NMS						
338 - South of Bahia Honda Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
179 - West of American Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
160 - North of Pelican Shoal	0.133 ± 0.047	4.1 ± 0.5	8	0 ± 0	0 ± 0	
164 - West of Pelican Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
178 - West of Pelican Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
166 - Eastern Sambo RO**	0.017 ± 0.017	1.1	1	0 ± 0	0 ± 0	
332 - Eastern Sambo RO**	0.033 ± 0.019	3.6 ± 0.4	2	0 ± 0	0 ± 0	
334 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
167 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
163 - West of Western Sambo ER	0.067 ± 0.000	4.7 ± 0.6	4	0 ± 0	0 ± 0	
335 - Sand Key SPA**	0.017 ± 0.017	0.5	1	0 ± 0	0 ± 0	
169 - Sand Key SPA**	0.033 ± 0.019	4.6 ± 0.6	2	0 ± 0	0 ± 0	
162 - West of Western Dry Rocks	0.100 ± 0.079	5.1 ± 0.5	6	0 ± 0	0 ± 0	
Lower Florida Keys Total (13)	0.031 ± 0.012	4.2 ± 0.3	24	0 ± 0	0 ± 0	
Patchy Hard-bottom Total (21)	0.022 ± 0.008	3.9 ± 0.3	28	0 ± 0	0 ± 0	
<i>Low-relief spur & groove (6-15 m)</i>						
Upper Florida Keys NMS						
52 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
241 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	

Site number/site location	<i>Diadema antillarum</i>			<i>Echinometra lucunter</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
51 - Offshore of Dry Rocks SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
50 - Offshore of Dry Rocks SPA	0.017 ± 0.017	3.7	1	0 ± 0	0 ± 0	
49 - Little Pickles Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
48 - Little Pickles Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (6)	0.003 ± 0.003	3.7	1	0 ± 0	0 ± 0	
Middle Florida Keys NMS						
355 - NE of Conch Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
282 - Conch Reef SPA**	0.083 ± 0.042	3.3 ± 1.3	5	0 ± 0	0 ± 0	
354 - Conch Reef SPA**	0.033 ± 0.019	0.6 ± 0.1	2	0 ± 0	0 ± 0	
107 - Conch Reef RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
106 - Conch Reef RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
276 - Davis Reef SPA**	0.017 ± 0.017	1.6	1	0 ± 0	0 ± 0	
80 - Davis Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
102 - South of Lower Matecumbe	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
109 - Tennessee Reef RO**	0.067 ± 0.047	4.9 ± 0.4	4	0 ± 0	0 ± 0	
108 - Tennessee Reef RO**	0.033 ± 0.033	1.8 ± 0.3	2	0 ± 0	0 ± 0	
113 - NE of Tennessee Light	0.050 ± 0.017	2.3 ± 1.4	3	0 ± 0	0 ± 0	
349 - South of Conch Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
100 - South of Conch Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
99 - East of Delta Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
110 - Sombrero Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
287 - Sombrero Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys Total (16)	0.018 ± 0.007	2.9 ± 0.6	17	0 ± 0	0 ± 0	
Lower Florida Keys NMS						
337 - South of Bahia Honda Key	0.017 ± 0.017	0.8	1	0 ± 0	0 ± 0	
174 - Looe Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
339 - Looe Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
142 - American Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
172 - East of Eastern Sambo RO	0.017 ± 0.017	2.7	1	0 ± 0	0 ± 0	
340 - Eastern Sambo RO**	0.017 ± 0.017	0.4	1	0 ± 0	0 ± 0	
175 - Eastern Sambo RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
171 - Middle Sambo Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
170 - Middle Sambo Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
341 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
176 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys Total (11)	0.005 ± 0.002	1.3 ± 0.7	3	0 ± 0	0 ± 0	
Low-relief Spur & Groove Total (33)	0.011 ± 0.004	2.7 ± 0.5	21	0 ± 0	0 ± 0	

Table 14. Mean \pm 1 SE densities (no. individuals per m²), test diameter (TD, cm), and numbers of individuals (N) of the urchins *Echinometra viridis* and *Eucidaris tribuloides* in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (**) are no-take marine reserves.

Site number/site location	<i>Echinometra viridis</i>			<i>Eucidaris tribuloides</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
<i>Mid-channel patch reefs</i>						
Biscayne National Park						
445 - Northern Legare Anchorage	0.033 \pm 0.019	2.2 \pm 0.2	2	0 \pm 0	0 \pm 0	
441 - Bache Shoal	0.050 \pm 0.017	1.8 \pm 0.1	3	0 \pm 0	0 \pm 0	
440 - South of Bache Shoal	0.033 \pm 0.019	2.4 \pm 0.1	2	0 \pm 0	0 \pm 0	
438 - South of Bache Shoal	0.117 \pm 0.079	2.9 \pm 0.1	7	0.017 \pm 0.017	2.0	1
437 - South of Legare Anchorage	0.267 \pm 0.027	2.1 \pm 0.1	16	0 \pm 0	0 \pm 0	
427 - Margot Fish Shoal	0.417 \pm 0.308	2.7 \pm 0.1	25	0.033 \pm 0.019	2.9 \pm 0.1	2
421 - Margot Fish Shoal	9.317 \pm 1.211	2.1 \pm 0.0	559	0.067 \pm 0.047	2.4 \pm 0.3	4
419 - Inshore of Ajax Reef	0.833 \pm 0.177	2.1 \pm 0.1	50	0 \pm 0	0 \pm 0	
413 - Inshore of Pacific Reef	1.417 \pm 0.341	2.4 \pm 0.1	85	0.050 \pm 0.017	2.6 \pm 0.5	3
410 - Inshore of Pacific Reef	1.600 \pm 0.314	1.8 \pm 0.1	96	0.083 \pm 0.017	2.0 \pm 0.1	5
408 - Offshore of Broad Creek	1.117 \pm 0.244	2.0 \pm 0.1	67	0.033 \pm 0.019	2.5 \pm 0.0	2
406 - Offshore of Broad Creek	0.233 \pm 0.079	1.9 \pm 0.1	14	0.033 \pm 0.033	1.8 \pm 0.0	2
Biscayne National Park Total (12)	1.286 \pm 0.748	2.1 \pm 0.0	926	0.026 \pm 0.008	2.3 \pm 0.1	19
Upper Florida Keys NMS						
4 - Basin Hill Shoals	5.183 \pm 1.693	4.0 \pm 0.0	311	0 \pm 0	0 \pm 0	
2 - Near Cannon Patch Reef	0.217 \pm 0.032	2.3 \pm 0.3	13	0.017 \pm 0.017	2.5	1
3 - Near Cannon Patch Reef	0.417 \pm 0.162	3.2 \pm 0.1	25	0.050 \pm 0.017	2.1 \pm 0.5	3
1 - Inshore of Molasses Reef	1.550 \pm 0.443	2.4 \pm 0.1	93	0.017 \pm 0.017	2.8	1
Upper Florida Keys Total (4)	1.842 \pm 1.152	2.8 \pm 0.0	442	0.021 \pm 0.010	2.3 \pm 0.3	5
Middle Florida Keys NMS						
69 - Tavernier Rocks	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
71 - Hen and Chickens SPA**	0.017 \pm 0.017	2.7	1	0 \pm 0	0 \pm 0	
70 - Hen and Chickens SPA**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
68 - East of Cheeca Rocks SPA	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
72 - Cheeca Rocks SPA**	0.017 \pm 0.017	1.6	1	0 \pm 0	0 \pm 0	
73 - Cheeca Rocks SPA**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
66 - East Turtle Shoal	0.133 \pm 0.047	2.3 \pm 0.3	8	0.050 \pm 0.017	2.3 \pm 0.5	3
254 - East Turtle Shoal	0.083 \pm 0.063	2.3 \pm 0.3		0.067 \pm 0.027	1.8 \pm 0.3	4
Middle Florida Keys Total (8)	0.031 \pm 0.018	2.3 \pm 0.2		0.015 \pm 0.010	2.0 \pm 0.3	7
Lower Florida Keys NMS						
122 - North of Big Pine Shoal	0 \pm 0	0 \pm 0		0.183 \pm 0.092	3.2 \pm 0.3	11
121 - North of Maryland Shoal	1.100 \pm 0.197	2.9 \pm 0.1	66	0.033 \pm 0.033	1.1 \pm 0.0	2
120 - North of Maryland Shoal	0.467 \pm 0.166	2.5 \pm 0.1	28	0.017 \pm 0.017	2.0	1
119 - North of Pelican Shoal	4.133 \pm 1.017	3.2 \pm 0.1	248	0.033 \pm 0.019	1.1 \pm 0.3	2
118 - East of Western Sambo ER	0.367 \pm 0.114	2.8 \pm 0.1	22	0 \pm 0	0 \pm 0	
126 - Western Sambo ER**	0.033 \pm 0.033	2.1 \pm 0.4	2	0.050 \pm 0.032	1.5 \pm 0.3	3
125 - Western Sambo ER**	0.150 \pm 0.057	2.6 \pm 0.2	9	0.033 \pm 0.019	1.8 \pm 0.6	2
124 - Western Sambo ER**	0.200 \pm 0.061	2.5 \pm 0.2	12	0.017 \pm 0.017	0.8	1
123 - Western Sambo ER**	0.417 \pm 0.096	2.6 \pm 0.2	25	0.150 \pm 0.609	2.4 \pm 0.2	9
117 - NW of Sand Key SPA	0.200 \pm 0.072	2.9 \pm 0.2	12	0.083 \pm 0.017	3.0 \pm 0.3	5
116 - North of Satan Shoal	0.033 \pm 0.033	1.6 \pm 0.4	2	0.200 \pm 0.072	2.3 \pm 0.2	12
115 - North of Satan Shoal	0.017 \pm 0.017	1.7	1	0.150 \pm 0.088	2.5 \pm 0.2	9
Lower Florida Keys Total (12)	0.593 \pm 0.334	3.0 \pm 0.0	427	0.079 \pm 0.021	2.4 \pm 0.1	57
Mid-channel Patch Reef Total (36)	0.838 \pm 0.304	2.5 \pm 0.0	1810	0.041 \pm 0.009	2.3 \pm 0.1	88

Site number/site location	<i>Echinometra viridis</i>			<i>Eucidaris tribuloides</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
<i>Offshore patch reefs</i>						
Biscayne National Park						
471 - Northwest of Triumph Reef	0 ± 0	0 ± 0		0.033 ± 0.033	2.3 ± 0.1	2
461 - NW of Long Reef	0.017 ± 0.017	0.9	1	0.067 ± 0.038	2.0 ± 0.0	4
460 - NW of Long Reef	0 ± 0	0 ± 0		0.083 ± 0.042	1.9 ± 0.3	5
459 - NW of Pacific Reef	0.017 ± 0.017	1.6	1	0.100 ± 0.019	1.8 ± 0.1	6
458 - Inshore of Pacific Reef	0.017 ± 0.017	0.7	1	0.467 ± 0.105	1.9 ± 0.1	28
456 - Inshore of Pacific Reef	0.017 ± 0.017	1.0	1	0 ± 0	0 ± 0	
454 - Northwest of Whistle Buoy	0 ± 0	0 ± 0		0.033 ± 0.033	1.5 ± 0.7	2
Biscayne National Park Total (7)	0.010 ± 0.003	1.1 ± 0.2	4	0.112 ± 0.060	1.9 ± 0.1	47
Upper Florida Keys NMS						
16 - North of Carysfort Reef SPA	0 ± 0	0 ± 0		0.017 ± 0.017	2.1	1
15 - North of Carysfort Reef SPA	0 ± 0	0 ± 0		0.033 ± 0.033	2.0 ± 0.2	2
14 - North of Carysfort Reef SPA	0.017 ± 0.017	1.5	1	0.100 ± 0.033	1.8 ± 0.2	6
47 - Carysfort Reef SPA**	0.017 ± 0.017	1.2	1	0.033 ± 0.019	2.5 ± 1.6	2
345 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0.533 ± 0.370	1.5 ± 0.1	32
46 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0.017 ± 0.017	1.2	1
39 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0.083 ± 0.042	1.8 ± 0.1	5
37 - West of Carysfort Reef SPA	0 ± 0	0 ± 0		0.117 ± 0.069	2.0 ± 0.1	7
13 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
55 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0.017 ± 0.017	2.1	1
358 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0.017 ± 0.017	1.9	1
54 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
347 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
12 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
9 - White Banks	0.100 ± 0.064	1.5 ± 0.3	6	0.133 ± 0.072	2.0 ± 0.3	8
8 - Inshore of French Reef	0.133 ± 0.061	2.3 ± 0.3	8	0.200 ± 0.047	2.5 ± 0.3	12
7 - Inshore of Molasses Reef	0.283 ± 0.074	1.3 ± 0.2	17	0.317 ± 0.074	2.0 ± 0.1	19
6 - Inshore of Molasses Reef	0 ± 0	0 ± 0		0.133 ± 0.027	1.7 ± 0.1	8
5 - Inshore of Pickles Reef	0.017 ± 0.017	3.0	1	0.050 ± 0.032	2.1 ± 0.6	3
Upper Florida Keys Total (19)	0.030 ± 0.016	1.6 ± 0.1	34	0.095 ± 0.031	1.9 ± 0.1	108
Middle Florida Keys NMS						
77 - Inshore of Conch Reef SPA	0.033 ± 0.019	2.7 ± 0.2	2	0.067 ± 0.067	2.5 ± 0.2	4
76 - Inshore of Conch Reef SPA	0.033 ± 0.019	2.0 ± 0.5	2	0.033 ± 0.019	2.3 ± 0.2	2
75 - Inshore of Conch Reef SPA	0.017 ± 0.017	2.0	1	0.050 ± 0.032	3.1 ± 0.5	3
74 - Inshore of Conch Reef SPA	0.050 ± 0.017	2.5 ± 0.6	3	0.267 ± 0.122	2.8 ± 0.1	16
98 - Coffins Patch SPA**	0 ± 0	0 ± 0		0.067 ± 0.027	1.7 ± 0.4	4
277 - Coffins Patch SPA**	0.017 ± 0.017	2.0	1	0.050 ± 0.032	2.2 ± 0.3	3
Middle Florida Keys Total (6)	0.025 ± 0.007	2.2 ± 0.3	9	0.089 ± 0.036	2.6 ± 0.1	32
Lower Florida Keys NMS						
133 - Looe Key Research Only**	0 ± 0	0 ± 0		0.033 ± 0.019	1.9 ± 0.0	2
132 - Looe Key Research Only**	0 ± 0	0 ± 0		0.083 ± 0.032	2.3 ± 0.4	5
131 - North of Looe Key SPA**	0 ± 0	0 ± 0		0.033 ± 0.019	1.7 ± 0.3	2
130 - Maryland Shoal	0 ± 0	0 ± 0		0.133 ± 0.047	2.7 ± 0.3	8
129 - North of Maryland Shoal	0 ± 0	0 ± 0		0.067 ± 0.027	1.7 ± 0.1	4
165 - North of Maryland Shoal	0 ± 0	0 ± 0		0.067 ± 0.027	1.8 ± 0.2	4
128 - NE of Eastern Sambo RO	0 ± 0	0 ± 0		0.167 ± 0.033	2.3 ± 0.3	10
135 - Western Sambo ER**	0 ± 0	0 ± 0		0.050 ± 0.032	2.8 ± 0.3	3
168 - Western Sambo ER**	0 ± 0	0 ± 0		0.117 ± 0.079	2.2 ± 0.2	7
127 - West of Sand Key SPA	0 ± 0	0 ± 0		0.083 ± 0.032	2.5 ± 0.3	5
Lower Florida Keys Total (10)	0 ± 0	0 ± 0		0.083 ± 0.014	2.3 ± 0.1	50
Offshore Patch Reef Total (42)	0.019 ± 0.008	1.7 ± 0.1	47	0.094 ± 0.018	2.1 ± 0.0	237

Hard-bottom/rubble/sand matrix

Upper Florida Keys NMS

Site number/site location	<i>Echinometra viridis</i>			<i>Eucladaria tribuloides</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
40 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0.033 ± 0.019	1.9 ± 0.7	2
38 - West of Carysfort Reef SPA	0.050 ± 0.017	1.7 ± 0.2	3	0 ± 0	0 ± 0	
36 - West of Carysfort Reef SPA	0.083 ± 0.032	2.0 ± 0.3	5	0.033 ± 0.019	2.7 ± 0.3	2
11 - NW of Dry Rocks SPA	0 ± 0	0 ± 0		0.183 ± 0.017	2.6 ± 0.2	11
Upper Florida Keys Total (4)	0.033 ± 0.020	1.9 ± 0.2	8	0.063 ± 0.041	2.5 ± 0.1	15
Hard-bottom Matrix Total (4)	0.033 ± 0.020	1.9 ± 0.2	8	0.063 ± 0.041	2.5 ± 0.1	15
<i>Low-relief hard-bottom (< 6 m)</i>						
Biscayne National Park						
475 - Fowey Rocks	0 ± 0	0 ± 0		0.067 ± 0.047	1.4 ± 0.3	4
469 - South of Ajax Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Biscayne National Park Total (2)	0 ± 0	0 ± 0		0.033 ± 0.033	1.4 ± 0.3	4
Upper Florida Keys NMS						
346 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0.017 ± 0.017	1.9	1
35 - West of Carysfort Reef SPA	0.050 ± 0.017	2.1 ± 0.8	3	0.067 ± 0.038	2.4 ± 0.3	4
34 - West of Carysfort Reef SPA	0.017 ± 0.017	2.0	1	0.083 ± 0.050	2.5 ± 0.2	5
33 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
17 - Little Pickles Reef	0 ± 0	0 ± 0		0.017 ± 0.017	1.5	1
Upper Florida Keys Total (5)	0.013 ± 0.010	2.1 ± 0.6		0.037 ± 0.016	2.3 ± 0.2	11
Middle Florida Keys NMS						
269 - Conch Reef SPA**	0.017 ± 0.017	1.4	1	0.017 ± 0.017	0.9	1
89 - Conch Reef SPA**	0 ± 0	0 ± 0		0.133 ± 0.072	1.5 ± 0.3	8
88 - Little Conch Reef	0 ± 0	0 ± 0		0.067 ± 0.047	1.9 ± 0.1	4
352 - Little Conch Reef	0 ± 0	0 ± 0		0.083 ± 0.042	1.8 ± 0.2	5
97 - Davis Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
90 - Davis Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
86 - South of Windley Key	0 ± 0	0 ± 0		0.333 ± 0.152	2.8 ± 0.1	20
103 - NE of Alligator Light	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
82 - Alligator Reef SPA**	0 ± 0	0 ± 0		0.033 ± 0.033	1.2 ± 0.4	2
81 - Alligator Reef SPA**	0 ± 0	0 ± 0		0.017 ± 0.017	2.3	1
350 - Tennessee Light	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
85 - East of Coffins Patch SPA	0 ± 0	0 ± 0		0.217 ± 0.017	2.2 ± 0.2	13
92 - Coffins Patch SPA**	0 ± 0	0 ± 0		0.167 ± 0.043	2.6 ± 0.2	10
91 - Coffins Patch SPA**	0 ± 0	0 ± 0		0.167 ± 0.079	2.3 ± 0.2	10
Middle Florida Keys Total (14)	0.001 ± 0.001	1.4	1	0.088 ± 0.027	2.3 ± 0.1	74
Lower Florida Keys NMS						
161 - West of American Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
140 - Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
159 - North of Pelican Shoal	0 ± 0	0 ± 0		0.017 ± 0.017	3.0	1
158 - East of No Name Reef	0 ± 0	0 ± 0		0.050 ± 0.017	2.2 ± 0.5	3
Lower Florida Keys Total (4)	0 ± 0	0 ± 0		0.017 ± 0.012	2.4 ± 0.4	4
Hard-bottom (< 6 m) Total (25)	0.003 ± 0.002	1.9 ± 0.5	5	0.062 ± 0.017	2.2 ± 0.1	93
<i>Inner line reef tract spur & groove</i>						
Upper Florida Keys NMS						
61 - Turtle Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
60 - Inshore of Elbow Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
59 - Inshore of Elbow Reef SPA	0 ± 0	0 ± 0		0.083 ± 0.017	2.8 ± 0.5	5
58 - Horseshoe Reef	0 ± 0	0 ± 0		0.117 ± 0.050	2.2 ± 0.2	7
62 - Dry Rocks SPA**	0 ± 0	0 ± 0		0.067 ± 0.047	2.4 ± 0.2	4
63 - Dry Rocks SPA**	0 ± 0	0 ± 0		0.233 ± 0.096	2.0 ± 0.1	14
65 - Grecian Rocks SPA**	0 ± 0	0 ± 0		0.183 ± 0.032	2.2 ± 0.1	11
64 - Grecian Rocks SPA**	0 ± 0	0 ± 0		0.167 ± 0.043	2.1 ± 0.2	10
Upper Florida Keys Total (8)	0 ± 0	0 ± 0		0.106 ± 0.030	2.2 ± 0.1	51
Inner Line Spur & Groove Total (8)	0 ± 0	0 ± 0		0.106 ± 0.030	2.2 ± 0.1	51
<i>High-relief spur & groove</i>						
Biscayne National Park						

Site number/site location	<i>Echinometra viridis</i>			<i>Euclidaris tribuloides</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
474 - Brewster Reef	0 ± 0	0 ± 0		0.017 ± 0.017	2.2	1
472 - Star Reef	0 ± 0	0 ± 0		0.050 ± 0.050	1.9 ± 0.2	3
470 - Triumph Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
467 - Long Reef	0 ± 0	0 ± 0		0.033 ± 0.019	1.9 ± 0.4	2
466 - Ajax Reef	0 ± 0	0 ± 0		0.117 ± 0.050	1.7 ± 0.1	7
465 - Ajax Reef	0 ± 0	0 ± 0		0.017 ± 0.017	2.0	1
464 - Pacific Reef	0 ± 0	0 ± 0		0.100 ± 0.058	1.6 ± 0.1	6
Biscayne National Park Total (7)	0 ± 0	0 ± 0		0.048 ± 0.017	1.8 ± 0.1	20
Upper Florida Keys NMS						
26 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0.033 ± 0.033	1.9 ± 0.4	2
25 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0.067 ± 0.027	1.7 ± 0.6	4
218 - South Carysfort Reef SPA**	0 ± 0	0 ± 0		0.017 ± 0.017	1.8	1
217 - South Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
24 - Maitland Grounding Site	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
28 - Elbow Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
27 - Elbow Reef SPA**	0.017 ± 0.017	1.4	1	0.033 ± 0.019	1.6 ± 0.2	2
30 - French Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
29 - French Reef SPA**	0 ± 0	0 ± 0		0.033 ± 0.033	1.4 ± 0.3	2
23 - SW of French Reef SPA	0 ± 0	0 ± 0		0.033 ± 0.033	2.2 ± 0.3	2
357 - Sand Island	0 ± 0	0 ± 0		0.167 ± 0.064	1.7 ± 0.1	10
356 - Sand Island	0.033 ± 0.033	1.4 ± 0.7	2	0.033 ± 0.019	1.8 ± 0.3	2
32 - Molasses Reef SPA**	0.017 ± 0.017	1.1	1	0.083 ± 0.083	2.3 ± 0.2	5
31 - Molasses Reef SPA**	0 ± 0	0 ± 0		0.050 ± 0.017	1.7 ± 0.3	3
19 - Pickles Reef	0 ± 0	0 ± 0		0.133 ± 0.112	2.3 ± 0.1	8
20 - Pickles Reef	0.033 ± 0.033	1.2 ± 0.1	2	0.250 ± 0.050	1.8 ± 0.1	15
18 - Pickles Reef	0 ± 0	0 ± 0		0.133 ± 0.077	1.5 ± 0.1	8
Upper Florida Keys Total (17)	0.006 ± 0.003	1.3 ± 0.2	6	0.063 ± 0.017	1.8 ± 0.1	63
Middle Florida Keys NMS						
79 - Delta Shoal	0.033 ± 0.033	1.3 ± 0.0	2	0.050 ± 0.017	1.6 ± 0.2	3
78 - Delta Shoal	0 ± 0	0 ± 0		0.067 ± 0.027	1.6 ± 0.1	4
84 - Sombrero Key SPA**	0 ± 0	0 ± 0		0.050 ± 0.017	1.7 ± 0.4	3
83 - Sombrero Key SPA**	0 ± 0	0 ± 0		0.083 ± 0.042	1.8 ± 0.2	5
Middle Florida Keys Total (4)	0.008 ± 0.008	1.3 ± 0.0	2	0.063 ± 0.008	1.7 ± 0.1	15
Lower Florida Keys NMS						
148 - Looe Key SPA**	0.017 ± 0.017	2.8	1	0.100 ± 0.064	1.9 ± 0.3	6
147 - Looe Key SPA**	0 ± 0	0 ± 0		0.033 ± 0.019	1.8 ± 0.5	2
145 - American Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
146 - American Shoal	0 ± 0	0 ± 0		0.017 ± 0.017	1.4	1
144 - Maryland Shoal	0.017 ± 0.017	1.5	1	0.467 ± 0.141	2.4 ± 0.1	28
141 - Maryland Shoal	0 ± 0	0 ± 0		0.600 ± 0.187	2.3 ± 0.1	36
143 - Maryland Shoal	0.033 ± 0.019	1.8 ± 0.3	2	0.300 ± 0.019	2.0 ± 0.1	18
139 - Pelican Shoal	0.050 ± 0.017	2.3 ± 0.6	3	0.700 ± 0.079	1.8 ± 0.1	42
138 - No Name Reef	0.033 ± 0.033	1.9 ± 0.4	2	0.033 ± 0.019	1.9 ± 0.0	2
137 - No Name Reef	0.017 ± 0.017	1.1	1	0.083 ± 0.042	1.5 ± 0.1	5
150 - Eastern Sambo RO**	0 ± 0	0 ± 0		0.150 ± 0.042	2.1 ± 0.2	9
149 - Eastern Sambo RO**	0 ± 0	0 ± 0		0.083 ± 0.032	1.4 ± 0.3	5
348 - Middle Sambo Reef	0.033 ± 0.019	2.0 ± 0.6	2	0.083 ± 0.050	1.5 ± 0.1	5
309 - Middle Sambo Reef	0.017 ± 0.017	2.8	1	0.233 ± 0.079	1.8 ± 0.2	14
152 - Western Sambo ER**	0.033 ± 0.019	1.4 ± 0.0	2	0.050 ± 0.032	1.4 ± 0.1	3
151 - Western Sambo ER**	0 ± 0	0 ± 0		0.133 ± 0.054	1.7 ± 0.4	8
136 - East of Eastern Dry Rocks SPA	0 ± 0	0 ± 0		0.033 ± 0.033	1.1 ± 0.1	2
154 - Eastern Dry Rocks SPA**	0 ± 0	0 ± 0		0.083 ± 0.032	1.7 ± 0.1	5
153 - Eastern Dry Rocks SPA**	0 ± 0	0 ± 0		0.067 ± 0.047	1.4 ± 0.3	4
156 - Rock Key SPA**	0 ± 0	0 ± 0		0.067 ± 0.027	1.5 ± 0.2	4
155 - Rock Key SPA**	0.050 ± 0.032	1.4 ± 0.3	3	0.117 ± 0.032	2.1 ± 0.2	7
325 - Sand Key SPA**	0 ± 0	0 ± 0		0.083 ± 0.042	1.9 ± 0.3	5
157 - Sand Key SPA**	0 ± 0	0 ± 0		0.117 ± 0.050	2.2 ± 0.3	7
Lower Florida Keys Total (23)	0.013 ± 0.004	1.8 ± 0.2	18	0.158 ± 0.039	2.0 ± 0.0	218
High-relief Spur & Groove (51)	0.008 ± 0.002	1.7 ± 0.7	26	0.104 ± 0.020	1.9 ± 0.0	317

Site number/site location	<i>Echinometra viridis</i>			<i>Eucidaris tribuloides</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
<i>Low-relief hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
53 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
240 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
57 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
45 - Offshore of Dry Rocks SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
22 - SW of French Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
21 - SW of French Reef SPA	0 ± 0	0 ± 0		0.050 ± 0.032	1.7 ± 0.2	3
Upper Florida Keys Total (6)	0 ± 0	0 ± 0		0.008 ± 0.008	1.7 ± 0.2	3
Middle Florida Keys NMS						
353 - Conch Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
105 - Conch Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
104 - NE of Alligator Light	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
351 - South of Indian Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
101 - South of Lower Matecumbe	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
111 - West of Sombrero Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys Total (6)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys NMS						
180 - South of Bahia Honda Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
173 - Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
177 - NE of Satan Shoal	0.017 ± 0.017	0.5	1	0.033 ± 0.033	1.5 ± 0.6	2
Lower Florida Keys Total (3)	0.006 ± 0.006	0.5	1	0.011 ± 0.011	1.5 ± 0.6	2
Hard-bottom (6-15 m) Total (15)	0.001 ± 0.001	0.5	1	0.006 ± 0.004	1.6 ± 0.2	5
<i>Patchy hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
56 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
44 - Dixie Shoal	0 ± 0	0 ± 0		0.067 ± 0.027	1.9 ± 0.3	4
43 - Dixie Shoal	0 ± 0	0 ± 0		0.017 ± 0.017	1.8	1
42 - Dixie Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (4)	0 ± 0	0 ± 0		0.021 ± 0.016	1.9 ± 0.2	5
Middle Florida Keys NMS						
96 - South of Windley Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
114 - South of Lower Matecumbe	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
94 - South of Duck Key	0 ± 0	0 ± 0		0.033 ± 0.019	3.3 ± 0.1	2
93 - South of Duck Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys Total (4)	0 ± 0	0 ± 0		0.008 ± 0.088	3.3 ± 0.1	2
Lower Florida Keys NMS						
338 - South of Bahia Honda Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
179 - West of American Shoal	0 ± 0	0 ± 0		0.017 ± 0.017	2.4	1
160 - North of Pelican Shoal	0 ± 0	0 ± 0		0.300 ± 0.064	2.8 ± 0.2	18
164 - West of Pelican Shoal	0 ± 0	0 ± 0		0.017 ± 0.017	3.0	1
178 - West of Pelican Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
166 - Eastern Sambo RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
332 - Eastern Sambo RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
334 - Western Sambo ER**	0 ± 0	0 ± 0		0.017 ± 0.017	0.6	1
167 - Western Sambo ER**	0 ± 0	0 ± 0		0.017 ± 0.017	1.5	1
163 - West of Western Sambo ER	0.033 ± 0.019	1.4 ± 0.1	2	0.100 ± 0.019	2.1 ± 0.1	6
335 - Sand Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
169 - Sand Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
162 - West of Western Dry Rocks	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys Total (13)	0.003 ± 0.003	1.4 ± 0.1	2	0.036 ± 0.023	2.5 ± 0.1	28
Patchy Hard-bottom Total (21)	0.002 ± 0.002	1.4 ± 0.1	2	0.028 ± 0.015	2.5 ± 0.1	35
<i>Low-relief spur & groove (6-15 m)</i>						
Upper Florida Keys NMS						
52 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
241 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0.017 ± 0.017	2.0	1

Site number/site location	<i>Echinometra viridis</i>			<i>Eucidaris tribuloides</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
51 - Offshore of Dry Rocks SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
50 - Offshore of Dry Rocks SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
49 - Little Pickles Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
48 - Little Pickles Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (6)	0 ± 0	0 ± 0		0.003 ± 0.003	2.0	1
Middle Florida Keys NMS						
355 - NE of Conch Reef	0.017 ± 0.017	1.7	1	0.050 ± 0.050	1.8 ± 0.1	3
282 - Conch Reef SPA**	0 ± 0	0 ± 0		0.067 ± 0.047	2.4 ± 0.3	4
354 - Conch Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
107 - Conch Reef RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
106 - Conch Reef RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
276 - Davis Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
80 - Davis Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
102 - South of Lower Matecumbe	0 ± 0	0 ± 0		0.067 ± 0.027	2.1 ± 0.1	4
109 - Tennessee Reef RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
108 - Tennessee Reef RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
113 - NE of Tennessee Light	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
349 - South of Conch Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
100 - South of Conch Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
99 - East of Delta Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
110 - Sombrero Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
287 - Sombrero Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys Total (16)	0.001 ± 0.001	1.7	1	0.011 ± 0.006	2.1 ± 0.1	11
Lower Florida Keys NMS						
337 - South of Bahia Honda Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
174 - Looe Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
339 - Looe Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
142 - American Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
172 - East of Eastern Sambo RO	0 ± 0	0 ± 0		0.017 ± 0.017	1.4	1
340 - Eastern Sambo RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
175 - Eastern Sambo RO**	0 ± 0	0 ± 0		0.017 ± 0.017	1.6	1
171 - Middle Sambo Reef	0 ± 0	0 ± 0		0.017 ± 0.017	1.3	1
170 - Middle Sambo Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
341 - Western Sambo ER**	0.017 ± 0.017	0.7	1	0 ± 0	0 ± 0	
176 - Western Sambo ER**	0 ± 0	0 ± 0		0.033 ± 0.019	1.9 ± 0.0	2
Lower Florida Keys Total (11)	0.002 ± 0.002	0.7	1	0.008 ± 0.003	1.6 ± 0.1	5
Low-relief Spur & Groove Total (33)	0.001 ± 0.001	1.2 ± 0.7	2	0.009 ± 0.003	2.0 ± 0.1	17

Table 15. Mean \pm 1 SE densities (no. individuals per m²), test diameter (TD, cm), and numbers of individuals (N) of the urchins *Lytechinus variegatus* and *Tripneustes ventricosus* in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June-August 2007. Sites are arranged by habitat from northeast to southwest and asterisked locations (**) are no-take marine reserves.

Site number/site location	<i>Lytechinus variegatus</i>			<i>Tripneustes ventricosus</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
<i>Mid-channel patch reefs</i>						
Biscayne National Park						
445 - Northern Legare Anchorage	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
441 - Bache Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
440 - South of Bache Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
438 - South of Bache Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
437 - South of Legare Anchorage	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
427 - Margot Fish Shoal	0 \pm 0	0 \pm 0		0.017 \pm 0.017	10.3	1
421 - Margot Fish Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
419 - Inshore of Ajax Reef	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
413 - Inshore of Pacific Reef	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
410 - Inshore of Pacific Reef	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
408 - Offshore of Broad Creek	0 \pm 0	0 \pm 0		0.017 \pm 0.017	5.1	1
406 - Offshore of Broad Creek	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
Biscayne National Park Total (12)	0 \pm 0	0 \pm 0		0.003 \pm 0.002	7.7 \pm 2.6	2
Upper Florida Keys NMS						
4 - Basin Hill Shoals	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
2 - Near Cannon Patch Reef	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
3 - Near Cannon Patch Reef	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
1 - Inshore of Molasses Reef	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
Upper Florida Keys Total (4)	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
Middle Florida Keys NMS						
69 - Tavernier Rocks	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
71 - Hen and Chickens SPA**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
70 - Hen and Chickens SPA**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
68 - East of Cheeca Rocks SPA	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
72 - Cheeca Rocks SPA**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
73 - Cheeca Rocks SPA**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
66 - East Turtle Shoal	0 \pm 0	0 \pm 0		0.017 \pm 0.017	6.4	1
254 - East Turtle Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
Middle Florida Keys Total (8)	0 \pm 0	0 \pm 0		0.002 \pm 0.001	6.4	1
Lower Florida Keys NMS						
122 - North of Big Pine Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
121 - North of Maryland Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
120 - North of Maryland Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
119 - North of Pelican Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
118 - East of Western Sambo ER	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
126 - Western Sambo ER**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
125 - Western Sambo ER**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
124 - Western Sambo ER**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
123 - Western Sambo ER**	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
117 - NW of Sand Key SPA	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
116 - North of Satan Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
115 - North of Satan Shoal	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
Lower Florida Keys Total (12)	0 \pm 0	0 \pm 0		0 \pm 0	0 \pm 0	
Mid-channel Patch Reef Total (36)	0 \pm 0	0 \pm 0		0.001 \pm 0.001	7.3 \pm 1.6	3

Site number/site location	<i>Lytechinus variegatus</i>			<i>Triptneustes ventricosus</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
<i>Offshore patch reefs</i>						
Biscayne National Park						
471 - Northwest of Triumph Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
461 - NW of Long Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
460 - NW of Long Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
459 - NW of Pacific Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
458 - Inshore of Pacific Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
456 - Inshore of Pacific Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
454 - Northwest of Whistle Buoy	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Biscayne National Park Total (7)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys NMS						
16 - North of Carysfort Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
15 - North of Carysfort Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
14 - North of Carysfort Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
47 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
345 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
46 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
39 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
37 - West of Carysfort Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
13 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
55 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
358 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
54 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
347 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
12 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
9 - White Banks	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
8 - Inshore of French Reef	0.017 ± 0.017	7.4	1	0.067 ± 0.047	5.7 ± 0.5	4
7 - Inshore of Molasses Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
6 - Inshore of Molasses Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
5 - Inshore of Pickles Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (19)	0.001 ± 0.001	7.4	1	0.004 ± 0.004	5.7 ± 0.5	4
Middle Florida Keys NMS						
77 - Inshore of Conch Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
76 - Inshore of Conch Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
75 - Inshore of Conch Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
74 - Inshore of Conch Reef SPA	0 ± 0	0 ± 0		0.033 ± 0.033	4.9 ± 0.5	2
98 - Coffins Patch SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
277 - Coffins Patch SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys Total (6)	0 ± 0	0 ± 0		0.006 ± 0.006	4.9 ± 0.5	2
Lower Florida Keys NMS						
133 - Looe Key Research Only**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
132 - Looe Key Research Only**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
131 - North of Looe Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
130 - Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
129 - North of Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
165 - North of Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
128 - NE of Eastern Sambo RO	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
135 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
168 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
127 - West of Sand Key SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys Total (10)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Offshore Patch Reef Total (42)	0.001 ± 0.001	7.4	1	0.002 ± 0.002	5.4 ± 0.4	6
<i>Hard-bottom/rubble/sand matrix</i>						
Upper Florida Keys NMS						

Site number/site location	<i>Lytechinus variegatus</i>			<i>Tripneustes ventricosus</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
40 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
38 - West of Carysfort Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
36 - West of Carysfort Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
11 - NW of Dry Rocks SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (4)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Hard-bottom Matrix Total (4)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
<i>Low-relief hard-bottom (< 6 m)</i>						
Biscayne National Park						
475 - Fowey Rocks	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
469 - South of Ajax Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Biscayne National Park Total (2)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys NMS						
346 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
35 - West of Carysfort Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
34 - West of Carysfort Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
33 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
17 - Little Pickles Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (5)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys NMS						
269 - Conch Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
89 - Conch Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
88 - Little Conch Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
352 - Little Conch Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
97 - Davis Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
90 - Davis Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
86 - South of Windley Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
103 - NE of Alligator Light	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
82 - Alligator Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
81 - Alligator Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
350 - Tennessee Light	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
85 - East of Coffins Patch SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
92 - Coffins Patch SPA**	0 ± 0	0 ± 0		0.017 ± 0.017	5.7	1
91 - Coffins Patch SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys Total (14)	0 ± 0	0 ± 0		0.001 ± 0.001	5.7	1
Lower Florida Keys NMS						
161 - West of American Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
140 - Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
159 - North of Pelican Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
158 - East of No Name Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys Total (4)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Hard-bottom (< 6 m) Total (25)	0 ± 0	0 ± 0		0.001 ± 0.001	5.7	1
<i>Inner line reef tract spur & groove</i>						
Upper Florida Keys NMS						
61 - Turtle Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
60 - Inshore of Elbow Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
59 - Inshore of Elbow Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
58 - Horseshoe Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
62 - Dry Rocks SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
63 - Dry Rocks SPA**	0 ± 0	0 ± 0		0.067 ± 0.067	9.1 ± 0.4	4
65 - Grecian Rocks SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
64 - Grecian Rocks SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (8)	0 ± 0	0 ± 0		0.008 ± 0.008	9.1 ± 0.4	4
Inner Line Spur & Groove Total (8)	0 ± 0	0 ± 0		0.008 ± 0.008	9.1 ± 0.4	4
<i>High-relief spur & groove</i>						
Biscayne National Park						

Site number/site location	<i>Lytechinus variegatus</i>			<i>Tripneustes ventricosus</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
474 - Brewster Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
472 - Star Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
470 - Triumph Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
467 - Long Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
466 - Ajax Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
465 - Ajax Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
464 - Pacific Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Biscayne National Park Total (7)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys NMS						
26 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
25 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
218 - South Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
217 - South Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
24 - Maitland Grounding Site	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
28 - Elbow Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
27 - Elbow Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
30 - French Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
29 - French Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
23 - SW of French Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
357 - Sand Island	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
356 - Sand Island	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
32 - Molasses Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
31 - Molasses Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
19 - Pickles Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
20 - Pickles Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
18 - Pickles Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (17)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys NMS						
79 - Delta Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
78 - Delta Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
84 - Sombrero Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
83 - Sombrero Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys Total (4)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys NMS						
148 - Looe Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
147 - Looe Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
145 - American Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
146 - American Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
144 - Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
141 - Maryland Shoal	0 ± 0	0 ± 0		0.017 ± 0.017	8.7	1
143 - Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
139 - Pelican Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
138 - No Name Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
137 - No Name Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
150 - Eastern Sambo RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
149 - Eastern Sambo RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
348 - Middle Sambo Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
309 - Middle Sambo Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
152 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
151 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
136 - East of Eastern Dry Rocks SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
154 - Eastern Dry Rocks SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
153 - Eastern Dry Rocks SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
156 - Rock Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
155 - Rock Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
325 - Sand Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
157 - Sand Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	

Site number/site location	<i>Lytechinus variegatus</i>			<i>Triploneustes ventricosus</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
Lower Florida Keys Total (23)	0 ± 0	0 ± 0		0.001 ± 0.001	8.7	1
High-relief Spur & Groove Total (51)	0 ± 0	0 ± 0		0.001 ± 0.001	8.7	1
<i>Low-relief hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
53 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
240 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
57 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
45 - Offshore of Dry Rocks SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
22 - SW of French Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
21 - SW of French Reef SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (6)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys NMS						
353 - Conch Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
105 - Conch Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
104 - NE of Alligator Light	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
351 - South of Indian Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
101 - South of Lower Matecumbe	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
111 - West of Sombrero Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys Total (6)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys NMS						
180 - South of Bahia Honda Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
173 - Maryland Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
177 - NE of Satan Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys Total (3)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Hard-bottom (6-15 m) Total (15)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
<i>Patchy hard-bottom (6-15 m)</i>						
Upper Florida Keys NMS						
56 - Inshore of Watson's Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
44 - Dixie Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
43 - Dixie Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
42 - Dixie Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (4)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys NMS						
96 - South of Windley Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
114 - South of Lower Matecumbe	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
94 - South of Duck Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
93 - South of Duck Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys Total (4)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys NMS						
338 - South of Bahia Honda Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
179 - West of American Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
160 - North of Pelican Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
164 - West of Pelican Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
178 - West of Pelican Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
166 - Eastern Sambo RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
332 - Eastern Sambo RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
334 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
167 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
163 - West of Western Sambo ER	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
335 - Sand Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
169 - Sand Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
162 - West of Western Dry Rocks	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys Total (13)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Patchy Hard-bottom Total (21)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	

Site number/site location	<i>Lytechinus variegatus</i>			<i>Tripneustes ventricosus</i>		
	No./m ²	TD (cm)	N	No./m ²	TD (cm)	N
<i>Low-relief spur & groove (6-15 m)</i>						
Upper Florida Keys NMS						
52 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
241 - Carysfort Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
51 - Offshore of Dry Rocks SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
50 - Offshore of Dry Rocks SPA	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
49 - Little Pickles Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
48 - Little Pickles Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Upper Florida Keys Total (6)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys NMS						
355 - NE of Conch Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
282 - Conch Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
354 - Conch Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
107 - Conch Reef RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
106 - Conch Reef RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
276 - Davis Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
80 - Davis Reef SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
102 - South of Lower Matecumbe	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
109 - Tennessee Reef RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
108 - Tennessee Reef RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
113 - NE of Tennessee Light	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
349 - South of Conch Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
100 - South of Conch Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
99 - East of Delta Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
110 - Sombrero Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
287 - Sombrero Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Middle Florida Keys Total (16)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys NMS						
337 - South of Bahia Honda Key	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
174 - Looe Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
339 - Looe Key SPA**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
142 - American Shoal	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
172 - East of Eastern Sambo RO	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
340 - Eastern Sambo RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
175 - Eastern Sambo RO**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
171 - Middle Sambo Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
170 - Middle Sambo Reef	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
341 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
176 - Western Sambo ER**	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Lower Florida Keys Total (11)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	
Low-relief Spur & Groove Total (33)	0 ± 0	0 ± 0		0 ± 0	0 ± 0	

Table 16. Number of individuals (N), mean, standard error (SE), and range in sea urchin test diameter by species and habitat type in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from surveys of four 15-m x 1-m belt transects per site at 235 sites during June-August 2007.

Habitat type (no. sites)	Transect depth (m)	N	Mean test size (cm)	SE	Min. test size (cm)	Max. test size (cm)
<i>Diadema antillarum</i>						
Mid-channel patch reef (36)	0.9-9.1 m	29	3.3	0.4	0.6	8.0
Offshore patch reef (42)	2.1-14.6 m	107	4.6	0.2	0.5	10.0
Hard-bottom-sand-rubble matrix (4)	2.7-5.8 m	1	2.3		2.3	2.3
Shallow (< 6 m) hard-bottom (25)	2.7-7.0 m	30	2.5	0.4	0.4	5.7
Inner line reef tract spur & groove (8)	1.5-6.1 m	6	5.3	0.9	1.5	7.3
High-relief spur and groove (51)	0.6-9.4 m	73	2.8	0.3	0.3	8.1
Deeper (> 6 m) hard-bottom (15)	6.7-13.7 m	4	1.9	1.1	0.7	5.0
Patchy hard-bottom, 6-15 m (21)	4.6-11.3 m	28	3.9	0.3	0.5	7.0
Low-relief spur and groove (33)	7.6-16.2 m	21	2.7	0.5	0.4	7.0
All habitats combined (235 sites)	0.9-16.2 m	299	3.6	0.1	0.3	10.0
<i>Echinometra lucunter</i>						
Mid-channel patch reef (36)	0.9-9.1 m	12	1.9	0.1	1.0	2.6
Offshore patch reef (42)	2.1-14.6 m	10	1.6	0.2	0.8	2.5
Hard-bottom-sand-rubble matrix (4)	2.7-5.8 m	3	2.6	0.8	1.2	4.0
Shallow (< 6 m) hard-bottom (25)	2.7-7.0 m	1	0.5		0.5	0.5
Inner line reef tract spur & groove (8)	1.5-6.1 m	1	1.2		1.2	1.2
High-relief spur and groove (51)	0.6-9.4 m	76	1.8	0.1	0.5	3.7
Deeper (> 6 m) hard-bottom (15)	6.7-13.7 m	0				
Patchy hard-bottom, 6-15 m (21)	4.6-11.3 m	0				
Low-relief spur and groove (33)	7.6-16.2 m	0				
All habitats combined (235 sites)	0.9-16.2 m	103	1.8	0.1	0.5	4.0
<i>Echinometra viridis</i>						
Mid-channel patch reef (36)	0.9-9.1 m	1,810	2.5	0.0	0.5	5.0
Offshore patch reef (42)	2.1-14.6 m	47	1.7	0.1	0.5	3.5
Hard-bottom-sand-rubble matrix (4)	2.7-5.8 m	8	1.9	0.2	0.9	3.0
Shallow (< 6 m) hard-bottom (25)	2.7-7.0 m	5	1.9	0.5	1.2	3.7
Inner line reef tract spur & groove (8)	1.5-6.1 m	0				
High-relief spur and groove (51)	0.6-9.4 m	26	1.7	0.1	0.7	3.4
Deeper (> 6 m) hard-bottom (15)	6.7-13.7 m	1	0.5		0.5	0.5
Patchy hard-bottom, 6-15 m (21)	4.6-11.3 m	2	1.4	0.1	1.2	1.5
Low-relief spur and groove (33)	7.6-16.2 m	2	1.2	0.5	0.7	1.7
All habitats combined (235 sites)	0.9-16.2 m	1,901	2.4	0.0	0.5	5.0
<i>Eucidaris tribuloides</i>						
Mid-channel patch reef (36)	0.9-9.1 m	88	2.3	0.1	0.7	4.2
Offshore patch reef (42)	2.1-14.6 m	237	2.1	0.0	0.7	4.6
Hard-bottom-sand-rubble matrix (4)	2.7-5.8 m	15	2.5	0.1	1.2	3.4
Shallow (< 6 m) hard-bottom (25)	2.7-7.0 m	93	2.2	0.1	0.8	3.8
Inner line reef tract spur & groove (8)	1.5-6.1 m	51	2.2	0.1	1.0	3.5
High-relief spur and groove (51)	0.6-9.4 m	317	1.9	0.0	0.5	3.4
Deeper (> 6 m) hard-bottom (15)	6.7-13.7 m	5	1.6	0.2	0.9	2.1
Patchy hard-bottom, 6-15 m (21)	4.6-11.3 m	35	2.5	0.1	0.6	3.5
Low-relief spur and groove (33)	7.6-16.2 m	17	2.0	0.1	1.3	3.0
All habitats combined (235 sites)	0.9-16.2 m	858	2.1	0.0	0.5	4.6
<i>Lytechinus variegatus</i>						
Mid-channel patch reef (36)	0.9-9.1 m	0				
Offshore patch reef (42)	2.1-14.6 m	1	7.4		7.4	7.4
Hard-bottom-sand-rubble matrix (4)	2.7-5.8 m	0				
Shallow (< 6 m) hard-bottom (25)	2.7-7.0 m	0				
Inner line reef tract spur & groove (8)	1.5-6.1 m	0				

Habitat type (no. sites)	Transect depth (m)	N	Mean test size (cm)	SE	Min. test size (cm)	Max. test size (cm)
<i>Lytechinus variegatus</i>						
High-relief spur and groove (51)	0.6-9.4 m	0				
Deeper (> 6 m) hard-bottom (15)	6.7-13.7 m	0				
Patchy hard-bottom, 6-15 m (21)	4.6-11.3 m	0				
Low-relief spur and groove (33)	7.6-16.2 m	0				
All habitats combined (235 sites)	0.9-16.2 m	1	7.4		7.4	7.4
<i>Tripneustes ventricosus</i>						
Mid-channel patch reef (36)	0.9-9.1 m	3	7.3	1.6	5.1	10.3
Offshore patch reef (42)	2.1-14.6 m	6	5.4	0.4	4.4	7.0
Hard-bottom-sand-rubble matrix (4)	2.7-5.8 m	0				
Shallow (< 6 m) hard-bottom (25)	2.7-7.0 m	1	5.7		5.7	5.7
Inner line reef tract spur & groove (8)	1.5-6.1 m	4	9.1	0.4	8.0	9.8
High-relief spur and groove (51)	0.6-9.4 m	1	8.7		8.7	8.7
Deeper (> 6 m) hard-bottom (15)	6.7-13.7 m	0				
Patchy hard-bottom, 6-15 m (21)	4.6-11.3 m	0				
Low-relief spur and groove (33)	7.6-16.2 m	0				
All habitats combined (235 sites)	0.9-16.2 m	15	7.0	0.5	4.4	10.3

Table 17. Alphabetical list of stony coral species (Milleporina and Scleractinia) recorded within belt transect surveys at 235 sites in the Florida Keys National Marine Sanctuary and Biscayne National Park during June-August 2007. Habitats are arranged from inshore to offshore and are designated as: MPR = mid-channel patch reef, OPR = offshore patch reef, HBM = hard-bottom matrix, LHBS = shallow (< 6 m) hard-bottom, IRT = inner line reef tract, HSG = high-relief spur and groove, LHBD = deeper (6-15 m) hard-bottom, PHB = patchy hard-bottom, and LSG = low-relief spur and groove. ? = present, ? = absent

Stony coral species	MPR (36)	OPR (42)	HBM (4)	LHBS (25)	IRT (8)	HSG (51)	LHBD (15)	PHB (21)	LSG (33)
<i>Acropora cervicornis</i>	?	?	?	?	?	?	?	?	?
<i>A. palmata</i>	?	?	?	?	?	?	?	?	?
<i>Agaricia agaricites</i>	?	?	?	?	?	?	?	?	?
<i>A. fragilis</i>	?	?	?	?	?	?	?	?	?
<i>A. humilis</i>	?	?	?	?	?	?	?	?	?
<i>A. lamarcki</i>	?	?	?	?	?	?	?	?	?
<i>Cladocora arbuscula</i>	?	?	?	?	?	?	?	?	?
<i>Colpophyllia natans</i>	?	?	?	?	?	?	?	?	?
<i>Dendrogyra cylindrus</i>	?	?	?	?	?	?	?	?	?
<i>Dichocoenia stokesi</i>	?	?	?	?	?	?	?	?	?
<i>Diploria clivosa</i>	?	?	?	?	?	?	?	?	?
<i>D. labyrinthiformis</i>	?	?	?	?	?	?	?	?	?
<i>D. strigosa</i>	?	?	?	?	?	?	?	?	?
<i>Eusmilia fastigiata</i>	?	?	?	?	?	?	?	?	?
<i>Favia fragum</i>	?	?	?	?	?	?	?	?	?
<i>Isophyllia sinuosa</i>	?	?	?	?	?	?	?	?	?
<i>Leptoseris cucullata</i>	?	?	?	?	?	?	?	?	?
<i>Madracis decactis</i>	?	?	?	?	?	?	?	?	?
<i>M. formosa</i>	?	?	?	?	?	?	?	?	?
<i>M. mirabilis</i>	?	?	?	?	?	?	?	?	?
<i>Manicina areolata</i>	?	?	?	?	?	?	?	?	?
<i>Meandrina meandrites</i>	?	?	?	?	?	?	?	?	?
<i>Millepora alcicornis</i>	?	?	?	?	?	?	?	?	?
<i>M. complanata</i>	?	?	?	?	?	?	?	?	?
<i>Montastraea annularis</i>	?	?	?	?	?	?	?	?	?
<i>M. faveolata</i>	?	?	?	?	?	?	?	?	?
<i>M. franksii</i>	?	?	?	?	?	?	?	?	?
<i>M. annularis</i> sp.	?	?	?	?	?	?	?	?	?
<i>M. cavernosa</i>	?	?	?	?	?	?	?	?	?
<i>Mussa angulosa</i>	?	?	?	?	?	?	?	?	?
<i>Mycetophyllia aliciae</i>	?	?	?	?	?	?	?	?	?
<i>M. danaana</i>	?	?	?	?	?	?	?	?	?
<i>M. ferox</i>	?	?	?	?	?	?	?	?	?
<i>M. lamarckiana</i>	?	?	?	?	?	?	?	?	?
<i>Mycetophyllia</i> sp.	?	?	?	?	?	?	?	?	?
<i>Oculina diffusa</i>	?	?	?	?	?	?	?	?	?
<i>Phyllangia americana</i>	?	?	?	?	?	?	?	?	?
<i>Porites astreoides</i>	?	?	?	?	?	?	?	?	?
<i>P. branteri</i>	?	?	?	?	?	?	?	?	?
<i>P. porites divaricata</i>	?	?	?	?	?	?	?	?	?
<i>P. porites furcata</i>	?	?	?	?	?	?	?	?	?
<i>P. porites porites</i>	?	?	?	?	?	?	?	?	?
<i>Scolymia</i> sp.	?	?	?	?	?	?	?	?	?
<i>Siderastrea radians</i>	?	?	?	?	?	?	?	?	?
<i>S. siderea</i>	?	?	?	?	?	?	?	?	?
<i>S. bournoni</i>	?	?	?	?	?	?	?	?	?
<i>Stephanocoenia intersepta</i>	?	?	?	?	?	?	?	?	?
Total taxa	37	42	21	28	26	35	30	35	40

Table 18. Mean \pm 1 SE proportional transect frequency of stony corals (Milleporina and Scleractinia) in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects per site at 235 sites during June–August 2007. A mean of value of 0.12, for example, indicates that a species was found on 12% of the sampled transects. Habitats are arranged from inshore to offshore and are designated as: MPR = mid-channel patch reef, OPR = offshore patch reef, HBM = hard-bottom matrix, LHBS = shallow (< 6 m) hard-bottom, IRT = inner line reef tract, HSG = high-relief spur and groove, LHBD = deeper (6–15 m) hard-bottom, PHB = patchy hard-bottom, and LSG = low-relief spur and groove.

Stony coral species	MPR (36)	OPR (42)	HBM (4)	LHBS (25)	IRT (8)	HSG (51)	LHBD (15)	PHB (21)	LSG (33)
<i>Acropora cervicornis</i>	0.12 \pm 0.04	0.19 \pm 0.04	0 \pm 0	0.04 \pm 0.02	0.19 \pm 0.09	0.04 \pm 0.02	0.02 \pm 0.02	0.04 \pm 0.03	0.02 \pm 0.01
<i>A. palmata</i>	0 \pm 0	0.01 \pm 0.01	0 \pm 0	0 \pm 0	0.13 \pm 0.07	0.16 \pm 0.04	0 \pm 0	0 \pm 0	0 \pm 0
<i>Agaricia agaricites</i>	0.75 \pm 0.05	0.89 \pm 0.03	0.75 \pm 0.18	0.54 \pm 0.09	0.69 \pm 0.11	0.90 \pm 0.03	0.63 \pm 0.11	0.62 \pm 0.07	0.80 \pm 0.06
<i>A. fragilis</i>	0.04 \pm 0.02	0.21 \pm 0.05	0.19 \pm 0.12	0.02 \pm 0.01	0 \pm 0	0.02 \pm 0.01	0.15 \pm 0.07	0.04 \pm 0.02	0.17 \pm 0.04
<i>A. humilis</i>	0.03 \pm 0.03	0.07 \pm 0.03	0 \pm 0	0 \pm 0	0 \pm 0	0.04 \pm 0.02	0.07 \pm 0.04	0.04 \pm 0.03	0.04 \pm 0.02
<i>A. lamarcki</i>	0 \pm 0	0.01 \pm 0.01	0.01 \pm 0.01						
<i>Cladocora arbuscula</i>	0.04 \pm 0.02	0.02 \pm 0.01	0 \pm 0						
<i>Colpophyllia natans</i>	0.53 \pm 0.07	0.36 \pm 0.06	0.06 \pm 0.06	0.02 \pm 0.01	0.06 \pm 0.04	0.06 \pm 0.02	0 \pm 0	0.07 \pm 0.03	0.16 \pm 0.04
<i>Dendrogyra cylindrus</i>	0 \pm 0	0.01 \pm 0.01	0.01 \pm 0.01						
<i>Dichocoenia stokesi</i>	0.81 \pm 0.05	0.83 \pm 0.04	0.88 \pm 0.13	0.75 \pm 0.06	0.34 \pm 0.15	0.19 \pm 0.04	0.70 \pm 0.08	0.69 \pm 0.07	0.58 \pm 0.06
<i>Diploria clivosa</i>	0.10 \pm 0.04	0.13 \pm 0.04	0.19 \pm 0.12	0.30 \pm 0.07	0.13 \pm 0.07	0.09 \pm 0.02	0.05 \pm 0.03	0.08 \pm 0.04	0.01 \pm 0.01
<i>D. labyrinthiformis</i>	0.43 \pm 0.05	0.23 \pm 0.04	0.06 \pm 0.06	0.05 \pm 0.02	0.09 \pm 0.07	0.06 \pm 0.02	0.18 \pm 0.06	0.13 \pm 0.05	0.14 \pm 0.03
<i>D. strigosa</i>	0.49 \pm 0.06	0.35 \pm 0.05	0.06 \pm 0.06	0.16 \pm 0.04	0.13 \pm 0.07	0.07 \pm 0.02	0.12 \pm 0.07	0.32 \pm 0.06	0.24 \pm 0.04
<i>Eusmilia fastigiata</i>	0.43 \pm 0.06	0.39 \pm 0.06	0.38 \pm 0.24	0.06 \pm 0.04	0.03 \pm 0.03	0.04 \pm 0.01	0.15 \pm 0.08	0.15 \pm 0.05	0.19 \pm 0.05
<i>Favia fragum</i>	0.13 \pm 0.04	0.02 \pm 0.01	0.13 \pm 0.13	0.05 \pm 0.03	0.03 \pm 0.03	0.31 \pm 0.04	0 \pm 0	0.04 \pm 0.02	0.02 \pm 0.01
<i>Isophyllia sinuosa</i>	0.03 \pm 0.02	0 \pm 0							
<i>Leptoseris cucullata</i>	0.07 \pm 0.03	0.24 \pm 0.05	0 \pm 0	0.03 \pm 0.02	0.06 \pm 0.04	0.03 \pm 0.01	0.10 \pm 0.06	0.01 \pm 0.01	0.11 \pm 0.04
<i>Madracis decactis</i>	0 \pm 0	0.18 \pm 0.05	0 \pm 0	0.06 \pm 0.03	0 \pm 0	0.02 \pm 0.01	0.10 \pm 0.06	0.04 \pm 0.02	0.20 \pm 0.05
<i>M. formosa</i>	0 \pm 0	0.02 \pm 0.01	0 \pm 0	0.02 \pm 0.02					
<i>M. mirabilis</i>	0 \pm 0	0.04 \pm 0.02	0 \pm 0	0 \pm 0	0.06 \pm 0.04				
<i>Manicina areolata</i>	0.01 \pm 0.01	0.01 \pm 0.01	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0.08 \pm 0.06	0.10 \pm 0.04	0.21 \pm 0.04
<i>Meandrina meandrites</i>	0.24 \pm 0.04	0.22 \pm 0.04	0 \pm 0	0.10 \pm 0.04	0.06 \pm 0.06	0.06 \pm 0.02	0.32 \pm 0.06	0.15 \pm 0.04	0.22 \pm 0.04
<i>Millepora alcicornis</i>	0.96 \pm 0.02	1.00 \pm 0.00	1.00 \pm 0.00	0.97 \pm 0.02	0.94 \pm 0.04	0.81 \pm 0.04	1.00 \pm 0.00	0.98 \pm 0.02	0.98 \pm 0.02
<i>M. complanata</i>	0 \pm 0	0.07 \pm 0.03	0 \pm 0	0.21 \pm 0.07	0.31 \pm 0.14	0.66 \pm 0.05	0.02 \pm 0.02	0 \pm 0	0 \pm 0
<i>Montastraea annularis</i>	0.29 \pm 0.05	0.18 \pm 0.04	0 \pm 0	0 \pm 0	0.09 \pm 0.07	0.09 \pm 0.02	0.03 \pm 0.03	0.07 \pm 0.03	0.03 \pm 0.02
<i>M. faveolata</i>	0.69 \pm 0.05	0.52 \pm 0.05	0.06 \pm 0.06	0.03 \pm 0.02	0.31 \pm 0.12	0.15 \pm 0.04	0.13 \pm 0.05	0.24 \pm 0.07	0.36 \pm 0.07
<i>M. franksii</i>	0.08 \pm 0.03	0.08 \pm 0.03	0.06 \pm 0.06	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0.02 \pm 0.02	0.08 \pm 0.03
<i>M. annularis</i> sp.	0 \pm 0	0.01 \pm 0.01	0 \pm 0						
<i>M. cavernosa</i>	0.78 \pm 0.05	0.71 \pm 0.05	0.31 \pm 0.19	0.53 \pm 0.07	0.25 \pm 0.13	0.40 \pm 0.04	0.63 \pm 0.07	0.58 \pm 0.08	0.80 \pm 0.05
<i>Mussa angulosa</i>	0.09 \pm 0.03	0.02 \pm 0.01	0 \pm 0	0.01 \pm 0.01					
<i>Mycetophyllia aliciae</i>	0.14 \pm 0.04	0.12 \pm 0.04	0 \pm 0	0.01 \pm 0.01	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0.02 \pm 0.01
<i>M. danaana</i>	0.11 \pm 0.03	0.06 \pm 0.02	0 \pm 0	0 \pm 0	0.03 \pm 0.03	0.01 \pm 0.01	0 \pm 0	0 \pm 0	0.02 \pm 0.01
<i>M. ferox</i>	0.03 \pm 0.02	0.01 \pm 0.01	0 \pm 0						

Stony coral species	MPR (36)	OPR (42)	HBM (4)	LHBS (25)	IRT (8)	HSG (51)	LHBD (15)	PHB (21)	LSG (33)
<i>M. lamarckiana</i>	0.10 ± 0.04	0.08 ± 0.02	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.01 ± 0.01
<i>Mycetophyllia</i> sp.	0.03 ± 0.01	0.05 ± 0.02	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.03 ± 0.02	0.02 ± 0.02	0.04 ± 0.02
<i>Oculina diffusa</i>	0.35 ± 0.06	0.17 ± 0.04	0 ± 0	0.01 ± 0.01	0 ± 0	0 ± 0	0 ± 0	0.06 ± 0.03	0.02 ± 0.01
<i>Phyllangia americana</i>	0.01 ± 0.01	0.01 ± 0.01	0 ± 0	0 ± 0	0 ± 0	0.01 ± 0.01	0.02 ± 0.02	0 ± 0	0 ± 0
<i>Porites astreoides</i>	0.94 ± 0.03	0.93 ± 0.02	0.88 ± 0.13	0.86 ± 0.04	0.97 ± 0.03	0.88 ± 0.03	0.88 ± 0.05	0.89 ± 0.05	0.89 ± 0.04
<i>P. branneri</i>	0 ± 0	0.02 ± 0.01	0 ± 0	0.07 ± 0.04	0 ± 0	0.01 ± 0.01	0.03 ± 0.02	0.11 ± 0.03	0.02 ± 0.02
<i>P. porites divaricata</i>	0.24 ± 0.05	0.31 ± 0.04	0.13 ± 0.07	0.11 ± 0.03	0.03 ± 0.03	0.03 ± 0.01	0.18 ± 0.05	0.11 ± 0.04	0.19 ± 0.05
<i>P. porites furcata</i>	0.65 ± 0.06	0.74 ± 0.04	0.56 ± 0.06	0.52 ± 0.05	0.50 ± 0.07	0.46 ± 0.04	0.70 ± 0.09	0.52 ± 0.05	0.52 ± 0.05
<i>P. porites porites</i>	0.37 ± 0.05	0.40 ± 0.04	0.44 ± 0.06	0.44 ± 0.05	0.41 ± 0.10	0.29 ± 0.03	0.42 ± 0.06	0.42 ± 0.07	0.45 ± 0.05
<i>Scolymia</i> sp.	0.16 ± 0.04	0.19 ± 0.04	0 ± 0	0 ± 0	0.03 ± 0.03	0 ± 0	0.02 ± 0.02	0.02 ± 0.02	0.08 ± 0.03
<i>Siderastrea radians</i>	0.65 ± 0.05	0.80 ± 0.04	1.00 ± 0.00	0.71 ± 0.06	0.47 ± 0.14	0.35 ± 0.05	0.62 ± 0.10	0.74 ± 0.06	0.74 ± 0.05
<i>S. siderea</i>	1.00 ± 0.00	0.96 ± 0.01	0.88 ± 0.13	0.90 ± 0.04	0.66 ± 0.12	0.71 ± 0.04	0.98 ± 0.02	0.92 ± 0.04	0.95 ± 0.02
<i>S. bournoni</i>	0.41 ± 0.06	0.32 ± 0.05	0.19 ± 0.12	0.11 ± 0.03	0 ± 0	0 ± 0	0.12 ± 0.05	0.42 ± 0.07	0.24 ± 0.05
<i>Stephanocoenia intersepta</i>	0.74 ± 0.06	0.71 ± 0.05	0.31 ± 0.24	0.44 ± 0.08	0.16 ± 0.09	0.15 ± 0.03	0.77 ± 0.08	0.73 ± 0.08	0.89 ± 0.03

Table 19. Stony coral (Milleporina and Scleractinia) species richness in the Florida Keys National Marine Sanctuary and Biscayne National Park, as determined from four 15-m x 1-m belt transects at 235 sites during June-August 2007. Values are the mean \pm 1 SE number of species per transect (15-m x 1-m) and total species per site (60 m²). Sites are arranged by habitat from northeast to southwest and asterisked locations (***) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO).

Site number/site location	No. species per transect		No. species per site		
	Mean	SE	Total	Mean	SE
<i>Mid-channel patch reefs</i>					
Biscayne National Park					
445 - Northern Legare Anchorage	16.3	0.6	23		
441 - Bache Shoal	12.3	0.5	18		
440 - South of Bache Shoal	9.3	1.3	17		
438 - South of Bache Shoal	10.5	0.3	17		
437 - South of Legare Anchorage	12.3	0.9	19		
427 - Margot Fish Shoal	11.8	1.0	19		
421 - Margot Fish Shoal	11.5	0.9	20		
419 - Inshore of Ajax Reef	15.0	0.0	21		
413 - Inshore of Pacific Reef	12.5	0.3	19		
410 - Inshore of Pacific Reef	11.8	1.3	18		
408 - Offshore of Broad Creek	14.0	0.7	21		
406 - Offshore of Broad Creek	17.5	1.2	28		
Biscayne National Park Total (12)	12.9	0.7	35	20.0	0.9
Upper Florida Keys NMS					
4 - Basin Hill Shoals	13.5	1.0	18		
2 - Near Cannon Patch Reef	13.3	0.6	19		
3 - Near Cannon Patch Reef	9.5	0.9	13		
1 - Inshore of Molasses Reef	16.8	0.9	26		
Upper Florida Keys Total (4)	13.3	1.5	30	19.0	2.7
Middle Florida Keys NMS					
69 - Tavernier Rocks	7.3	1.1	13		
71 - Hen and Chickens SPA**	9.8	0.3	15		
70 - Hen and Chickens SPA**	9.8	1.1	15		
68 - East of Cheeca Rocks SPA	10.3	1.3	17		
72 - Cheeca Rocks SPA**	8.8	0.8	14		
73 - Cheeca Rocks SPA**	14.8	0.5	21		
66 - East Turtle Shoal	15.3	0.8	23		
254 - East Turtle Shoal	15.3	0.5	23		
Middle Florida Keys Total (8)	11.4	1.1	27	17.6	1.5
Lower Florida Keys NMS					
122 - North of Big Pine Shoal	14.0	1.2	19		
121 - North of Maryland Shoal	17.5	1.3	25		
120 - North of Maryland Shoal	13.8	1.3	23		
119 - North of Pelican Shoal	17.8	0.9	26		
118 - East of Western Sambo ER	14.5	1.0	21		
126 - Western Sambo ER**	16.8	0.9	25		
125 - Western Sambo ER**	15.5	0.7	25		
124 - Western Sambo ER**	15.5	1.4	21		
123 - Western Sambo ER**	11.8	0.5	18		
117 - NW of Sand Key SPA	11.0	0.7	15		
116 - North of Satan Shoal	13.8	0.3	21		
115 - North of Satan Shoal	10.5	0.3	15		
Lower Florida Keys Total (12)	14.4	0.7	34	21.2	1.1
Mid-channel Patch Reef Total (36)	13.1	0.5	38	19.8	0.7
<i>Offshore patch reefs</i>					
Biscayne National Park					

Site number/site location	No. species per transect		No. species per site		
	Mean	SE	Total	Mean	SE
471 - Northwest of Triumph Reef	11.0	0.4	16		
461 - NW of Long Reef	10.5	0.3	15		
460 - NW of Long Reef	14.5	0.7	21		
459 - NW of Pacific Reef	12.5	0.3	19		
458 - Inshore of Pacific Reef	8.0	0.9	14		
456 - Inshore of Pacific Reef	17.5	1.0	25		
454 - Northwest of Whistle Buoy	16.3	1.4	23		
Biscayne National Park Total (7)	12.9	1.3	35	19.0	1.6
Upper Florida Keys NMS					
16 - North of Carysfort Reef SPA	13.3	0.5	22		
15 - North of Carysfort Reef SPA	8.3	0.6	12		
14 - North of Carysfort Reef SPA	12.3	0.5	18		
47 - Carysfort Reef SPA**	11.0	0.7	20		
345 - Carysfort Reef SPA**	10.8	0.8	16		
46 - Carysfort Reef SPA**	10.3	1.0	15		
39 - Carysfort Reef SPA**	11.0	0.4	17		
37 - West of Carysfort Reef SPA	6.5	0.7	11		
13 - Inshore of Watson's Reef	7.0	0.7	12		
55 - Inshore of Watson's Reef	13.8	1.0	19		
358 - Inshore of Watson's Reef	18.0	1.4	29		
54 - Inshore of Watson's Reef	14.3	0.9	22		
347 - Inshore of Watson's Reef	11.8	0.8	19		
12 - Inshore of Watson's Reef	14.8	1.0	21		
9 - White Banks	11.5	1.0	19		
8 - Inshore of French Reef	9.0	0.7	12		
7 - Inshore of Molasses Reef	12.3	0.5	18		
6 - Inshore of Molasses Reef	12.8	1.2	22		
5 - Inshore of Pickles Reef	14.8	1.5	22		
Upper Florida Keys Total (19)	11.7	0.7	38	18.2	1.0
Middle Florida Keys NMS					
77 - Inshore of Conch Reef SPA	13.3	0.8	19		
76 - Inshore of Conch Reef SPA	13.0	1.6	18		
75 - Inshore of Conch Reef SPA	11.3	1.3	17		
74 - Inshore of Conch Reef SPA	11.3	0.6	18		
98 - Coffins Patch SPA**	12.3	0.9	20		
277 - Coffins Patch SPA**	10.5	1.0	15		
Middle Florida Keys Total (6)	11.9	0.5	23	17.8	0.7
Lower Florida Keys NMS					
133 - Looe Key Research Only**	10.5	0.9	17		
132 - Looe Key Research Only**	15.8	1.5	25		
131 - North of Looe Key SPA**	15.3	0.8	21		
130 - Maryland Shoal	16.0	0.4	23		
129 - North of Maryland Shoal	13.5	1.7	21		
165 - North of Maryland Shoal	16.5	0.7	26		
128 - NE of Eastern Sambo RO	13.3	0.8	20		
135 - Western Sambo ER**	17.0	1.4	26		
168 - Western Sambo ER**	19.3	0.6	26		
127 - West of Sand Key SPA	17.5	1.6	26		
Lower Florida Keys Total (10)	15.5	0.8	32	23.1	1.0
Offshore Patch Reef Total (42)	12.8	0.5	42	19.5	0.7
<i>Hard-bottom/rubble/sand matrix</i>					
Upper Florida Keys NMS					
40 - Carysfort Reef SPA**	9.5	0.3	14		
38 - West of Carysfort Reef SPA	10.8	0.8	16		
36 - West of Carysfort Reef SPA	8.3	0.9	12		
11 - NW of Dry Rocks SPA	5.5	0.5	10		

Site number/site location	No. species per transect		No. species per site		
	Mean	SE	Total	Mean	SE
Upper Florida Keys Total (4)	8.5	1.1	21	13.0	1.3
Hard-bottom Matrix Total (4)	8.5	1.1	21	13.0	1.3
<i>Low-relief hard-bottom (< 6 m)</i>					
Biscayne National Park					
475 - Fowey Rocks	7.8	0.6	12		
469 - South of Ajax Reef	7.3	0.8	11		
Biscayne National Park Total (2)	7.5	0.3	14	11.5	0.5
Upper Florida Keys NMS					
346 - Carysfort Reef SPA**	12.0	1.0	18		
35 - West of Carysfort Reef SPA	7.5	0.5	11		
34 - West of Carysfort Reef SPA	7.3	0.5	11		
33 - Inshore of Watson's Reef	7.3	0.5	10		
17 - Little Pickles Reef	7.0	0.4	11		
Upper Florida Keys Total (5)	8.2	1.0	21	12.2	1.5
Middle Florida Keys NMS					
269 - Conch Reef SPA**	8.5	0.7	14		
89 - Conch Reef SPA**	7.0	1.1	12		
88 - Little Conch Reef	7.5	0.5	13		
352 - Little Conch Reef	8.5	0.9	13		
97 - Davis Reef SPA**	8.8	0.3	14		
90 - Davis Reef SPA**	10.3	0.8	14		
86 - South of Windley Key	9.0	0.4	14		
103 - NE of Alligator Light	11.3	1.0	18		
82 - Alligator Reef SPA**	9.5	0.9	13		
81 - Alligator Reef SPA**	7.8	1.1	15		
350 - Tennessee Light	5.3	0.8	9		
85 - East of Coffins Patch SPA	9.5	0.3	13		
92 - Coffins Patch SPA**	8.0	0.7	12		
91 - Coffins Patch SPA**	9.0	1.1	13		
Middle Florida Keys Total (14)	8.6	0.4	28	13.4	0.5
Lower Florida Keys NMS					
161 - West of American Shoal	3.0	1.8	8		
140 - Maryland Shoal	7.0	0.9	13		
159 - North of Pelican Shoal	8.5	0.9	13		
158 - East of No Name Reef	8.3	1.0	14		
Lower Florida Keys Total (4)	6.7	1.3	17	12.0	1.4
Hard-bottom (< 6 m) Total (25)	8.1	0.4	28	12.8	0.5
<i>Inner line reef tract spur & groove</i>					
Upper Florida Keys NMS					
61 - Turtle Reef	11.8	0.8	18		
60 - Inshore of Elbow Reef SPA	8.5	0.5	14		
59 - Inshore of Elbow Reef SPA	9.8	0.9	16		
58 - Horseshoe Reef	8.0	1.5	14		
62 - Dry Rocks SPA**	4.8	0.3	8		
63 - Dry Rocks SPA**	5.0	0.7	10		
65 - Grecian Rocks SPA**	4.0	0.7	7		
64 - Grecian Rocks SPA**	5.0	0.9	12		
Upper Florida Keys Total (8)	7.1	1.0	26	12.4	1.4
Inner Line Spur & Groove Total (8)	7.1	1.0	26	12.4	1.4
<i>High-relief spur & groove</i>					
Biscayne National Park					
474 - Brewster Reef	10.3	0.5	15		
472 - Star Reef	6.0	0.7	11		
470 - Triumph Reef	8.5	1.0	12		

Site number/site location	No. species per transect		No. species per site		
	Mean	SE	Total	Mean	SE
467 - Long Reef	7.3	0.5	12		
466 - Ajax Reef	6.3	0.8	10		
465 - Ajax Reef	7.5	1.9	13		
464 - Pacific Reef	7.5	0.7	10		
Biscayne National Park Total (7)	7.6	0.5	20	11.9	0.7
Upper Florida Keys NMS					
26 - Carysfort Reef SPA**	7.8	0.8	12		
25 - Carysfort Reef SPA**	5.3	0.9	9		
218 - South Carysfort Reef SPA**	4.3	0.3	8		
217 - South Carysfort Reef SPA**	5.0	0.7	8		
24 - Maitland Grounding Site	5.5	0.3	9		
28 - Elbow Reef SPA**	7.0	0.4	9		
27 - Elbow Reef SPA**	6.8	0.8	10		
30 - French Reef SPA**	10.3	1.0	20		
29 - French Reef SPA**	10.8	1.2	18		
23 - SW of French Reef SPA	8.3	0.9	14		
357 - Sand Island	6.8	0.6	12		
356 - Sand Island	8.5	1.3	15		
32 - Molasses Reef SPA**	6.8	0.8	11		
31 - Molasses Reef SPA**	7.8	0.5	14		
19 - Pickles Reef	8.0	0.7	15		
20 - Pickles Reef	6.8	0.3	11		
18 - Pickles Reef	8.0	0.4	13		
Upper Florida Keys Total (17)	7.3	0.4	31	12.2	0.8
Middle Florida Keys NMS					
79 - Delta Shoal	9.0	1.4	14		
78 - Delta Shoal	8.8	1.4	14		
84 - Sombrero Key SPA**	9.8	1.1	17		
83 - Sombrero Key SPA**	9.3	0.5	16		
Middle Florida Keys Total (4)	9.2	0.2	23	15.3	0.8
Lower Florida Keys NMS					
148 - Looe Key SPA**	3.0	1.9	8		
147 - Looe Key SPA**	4.8	2.8	12		
145 - American Shoal	3.3	1.9	9		
146 - American Shoal	4.8	2.8	10		
144 - Maryland Shoal	4.8	0.5	7		
141 - Maryland Shoal	11.3	1.6	16		
143 - Maryland Shoal	11.5	0.5	17		
139 - Pelican Shoal	8.5	0.7	14		
138 - No Name Reef	8.0	1.2	13		
137 - No Name Reef	11.0	0.8	21		
150 - Eastern Sambo RO**	6.0	1.1	10		
149 - Eastern Sambo RO**	6.5	0.9	11		
348 - Middle Sambo Reef	6.8	0.5	10		
309 - Middle Sambo Reef	7.8	0.5	12		
152 - Western Sambo ER**	6.5	1.2	13		
151 - Western Sambo ER**	4.8	1.0	9		
136 - East of Eastern Dry Rocks SPA	7.5	0.5	15		
154 - Eastern Dry Rocks SPA**	8.0	1.2	15		
153 - Eastern Dry Rocks SPA**	5.0	0.6	9		
156 - Rock Key SPA**	6.5	0.7	13		
155 - Rock Key SPA**	5.0	0.4	9		
325 - Sand Key SPA**	5.3	0.6	9		
157 - Sand Key SPA**	6.5	1.3	11		
Lower Florida Keys Total (23)	6.6	0.5	31	11.9	0.7
High-relief Spur & Groove Total (51)	7.2	0.3	34	12.3	0.4

Site number/site location	No. species per transect		No. species per site		
	Mean	SE	Total	Mean	SE
<i>Low-relief hard-bottom (6-15 m)</i>					
Upper Florida Keys NMS					
53 - Carysfort Reef SPA**	7.0	0.4	10		
240 - Carysfort Reef SPA**	9.5	0.3	14		
57 - Inshore of Watson's Reef	7.8	1.7	14		
45 - Offshore of Dry Rocks SPA	8.0	0.6	12		
22 - SW of French Reef SPA	10.8	0.3	16		
21 - SW of French Reef SPA	14.3	0.5	20		
Upper Florida Keys Total (6)	9.5	1.1	24	14.3	1.4
Middle Florida Keys NMS					
353 - Conch Reef SPA**	11.3	1.3	17		
105 - Conch Reef SPA**	9.3	0.3	16		
104 - NE of Alligator Light	4.0	0.7	7		
351 - South of Indian Key	9.3	0.3	14		
101 - South of Lower Matecumbe	11.0	0.4	17		
111 - West of Sombrero Key	12.3	0.6	17		
Middle Florida Keys Total (6)	9.5	1.2	26	14.7	1.6
Lower Florida Keys NMS					
180 - South of Bahia Honda Key	7.3	0.5	11		
173 - Maryland Shoal	9.0	0.4	14		
177 - NE of Satan Shoal	9.3	0.6	14		
Lower Florida Keys Total (3)	8.2	0.5	18	13.0	1.0
Hard-bottom (6-15 m) Total (15)	9.3	0.6	30	14.2	0.8
<i>Patchy hard-bottom (6-15 m)</i>					
Upper Florida Keys NMS					
56 - Inshore of Watson's Reef	8.0	1.0	13		
44 - Dixie Shoal	8.0	0.7	13		
43 - Dixie Shoal	9.8	1.0	15		
42 - Dixie Shoal	10.3	0.6	13		
Upper Florida Keys Total (4)	9.0	0.6	19	13.5	0.5
Middle Florida Keys NMS					
96 - South of Windley Key	9.8	0.6	14		
114 - South of Lower Matecumbe	4.5	0.7	8		
94 - South of Duck Key	8.5	0.3	14		
93 - South of Duck Key	13.8	1.2	22		
Middle Florida Keys Total (4)	9.1	1.9	23	14.5	2.9
Lower Florida Keys NMS					
338 - South of Bahia Honda Key	12.8	1.4	20		
179 - West of American Shoal	6.5	3.8	18		
160 - North of Pelican Shoal	8.5	0.3	14		
164 - West of Pelican Shoal	8.8	0.8	12		
178 - West of Pelican Shoal	10.3	0.6	17		
166 - Eastern Sambo RO**	7.3	0.8	13		
332 - Eastern Sambo RO**	3.5	1.0	7		
334 - Western Sambo ER**	9.8	1.0	17		
167 - Western Sambo ER**	9.5	0.5	14		
163 - West of Western Sambo ER	13.3	1.1	22		
335 - Sand Key SPA**	14.0	0.9	22		
169 - Sand Key SPA**	9.0	0.8	18		
162 - West of Western Dry Rocks	11.8	0.9	15		
Lower Florida Keys Total (13)	9.6	0.8	34	16.1	1.2
Patchy Hard-bottom Total (21)	9.4	0.6	35	15.3	0.9
<i>Low-relief spur & groove (6-15 m)</i>					
Upper Florida Keys NMS					
52 - Carysfort Reef SPA**	7.5	0.7	12		

Site number/site location	No. species per transect		No. species per site		
	Mean	SE	Total	Mean	SE
241 - Carysfort Reef SPA**	9.5	1.3	15		
51 - Offshore of Dry Rocks SPA	10.5	0.9	16		
50 - Offshore of Dry Rocks SPA	8.0	0.4	11		
49 - Little Pickles Reef	10.3	0.3	16		
48 - Little Pickles Reef	11.0	1.1	17		
Upper Florida Keys Total (6)	9.5	0.6	24	14.5	1.0
Middle Florida Keys NMS					
355 - NE of Conch Reef	17.0	1.5	26		
282 - Conch Reef SPA**	10.0	1.2	15		
354 - Conch Reef SPA**	16.8	0.3	25		
107 - Conch Reef RO**	12.3	0.3	20		
106 - Conch Reef RO**	13.3	0.8	20		
276 - Davis Reef SPA**	10.0	0.7	14		
80 - Davis Reef SPA**	8.8	0.3	14		
102 - South of Lower Matecumbe	13.8	0.3	23		
109 - Tennessee Reef RO**	13.3	1.6	23		
108 - Tennessee Reef RO**	13.8	0.9	21		
113 - NE of Tennessee Light	8.8	1.8	17		
349 - South of Conch Key	6.5	0.5	10		
100 - South of Conch Key	9.5	0.5	15		
99 - East of Delta Shoal	8.5	0.3	13		
110 - Sombrero Key SPA**	12.3	1.0	17		
287 - Sombrero Key SPA**	10.5	0.7	17		
Middle Florida Keys Total (16)	11.6	0.8	34	17.9	1.1
Lower Florida Keys NMS					
337 - South of Bahia Honda Key	12.3	0.8	18		
174 - Looe Key SPA**	5.0	0.8	8		
339 - Looe Key SPA**	6.8	0.6	10		
142 - American Shoal	5.8	3.3	14		
172 - East of Eastern Sambo RO	11.8	0.9	18		
340 - Eastern Sambo RO**	8.8	0.3	13		
175 - Eastern Sambo RO**	12.3	1.7	20		
171 - Middle Sambo Reef	12.5	0.9	19		
170 - Middle Sambo Reef	9.3	1.0	17		
341 - Western Sambo ER**	9.0	0.8	15		
176 - Western Sambo ER**	12.3	1.0	20		
Lower Florida Keys Total (11)	9.6	0.9	30	15.6	1.2
Low-relief Spur & Groove Total (33)	10.5	0.5	40	16.5	0.7