

Large-scale Assessment of the Abundance, Distribution and Condition of Benthic Coral Reef Organisms in the Florida Keys National Marine Sanctuary

2009 Quick Look Report and Data Summary



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Cover photo. Examples of benthic coral reef organisms sampled during 2009 in the Florida Keys. Species richness, density, size, and condition of benthic organisms were quantified at 160 sites during May to September. Upper left: Acropora palmata, Upper right: Cribrochalina vasculum, Lower left: Eucidaris tribuloides, Lower right: Discosoma sanctithomae

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2009 Executive Summary

During 44 days of fieldwork from May 30th through September 6th, 2009, research scientists from the Center for Marine Science, University of North Carolina at Wilmington, surveyed the density, size, and condition of benthic coral reef organisms in the Florida Keys National Marine Sanctuary (FKNMS) from northern Key Largo to SW of Key West. This work is part of a larger program that started in 1999 that documents the status and condition of benthic coral reef resources in the Florida Keys in relation to cross-shelf position, regional location, and the location of spatial management zones (no-take areas). We also collaborated this year with Ms. Nancy Sheridan from the Florida Fish & Wildlife Research Institute (FWRI/FWCC), who is pursuing research funding to sample nearshore habitats for species targeted by the marine life trade.

Benthic survey methods are built around a two-stage stratified random sampling design that partitions the Florida Keys sampling domain by benthic habitat type, regional sector, and management zone. Five main hard-bottom and coral reef habitat types were sampled from inshore of Hawk Channel to the deeper fore-reef from 0.9 m to 13.1 m depth: inshore patch reefs, mid-channel patch reefs, offshore patch reefs, shallow hard-bottom, platform margin high-relief spur and groove (< 6 m depth), and the deeper fore-reef (6-13 m depth) encompassing continuous hard-bottom, patchy hard-bottom, and low-relief spur and groove. Sites were further partitioned by regional sector (upper, middle, and lower Keys) and management zone within the FKNMS. The 2009 sampling included all 23 no-take zones from northern Key Largo to SW of Key West, designated as Sanctuary Preservation Areas, Ecological Reserves, and Special-use Areas/Research Only Areas. For the 160 sites sampled, latitude/longitude points were randomly generated in a geographic information system (GIS) incorporating available benthic habitat and bathymetry data for the sampling domain. At each site, four 15-m transects were deployed to inventory: depth and topographic complexity; species richness of stony corals, gorgonians, and sponges; percent cover of abiotic (e.g. sand and rubble) and biotic (e.g. algae, sponges, stony corals, gorgonians) components; stony coral density, colony size, and condition; juvenile coral density and size; gorgonian density and gorgonian host occupation patterns by flamingo-tongue (*Cyphoma*) snails; density and size (test diameter) of urchins; density of anemones and corallimorpharians; and density of selected mollusks (sea slugs, nudibranchs, and certain gastropods). These variables have been assessed periodically by our program over the past ten years and add to a growing spatial and temporal data set to document their status and trends, specifically in relation to no-take management strategies in the Sanctuary.

This report summarizes the major findings and provides descriptive data for the benthic variables measured during 2009. The report is divided by chapter for each of the major categories of variables

measured, and includes data tables, underwater photographs, maps, and data charts. The data were collected by a four-member survey team that conducted 505 SCUBA dives and approximately 700 hours of underwater bottom time.

Species richness surveys for stony corals, gorgonians, and sponges encompassed 9,600 m² of benthic habitats among the 160 sites. A total of 43 stony coral taxa were encountered, with a range in site-level species richness of 5 to 26 species per 60 m². Similar to previous years, mid-channel and offshore patch reefs tended to yield the greatest numbers of species, especially in the lower Florida Keys region. A total of 31 gorgonian taxa were encountered, with a range of two to 25 species per 60 m² among sites. A total of 82 sponge taxa were encountered and site species richness ranged from one to 46 species. Surveys of percent cover of major bottom components using the point-intercept technique indicated patterns of coverage that were generally consistent with similar surveys in 1999-2001 and 2005. Total coral cover showed a considerable range among habitats (0.3-58.3%), but was generally greater on patch reefs in both reference areas and no-take zones. Greater coral cover on patch reefs reflected the dominance of massive framework corals. On the platform margin, algae were dominant (> 75% cover) at the majority of sites sampled and consisted primarily of turf algae, crustose coralline algae, but also certain macroalgal genera such as *Dictyota*, *Halimeda*, and *Styopodium*.

A total of 14,685 stony corals were counted, measured, and assessed for condition, including disease, bleaching, and predation. In contrast to 2005, coral bleaching was mild during 2009 and the prevalence of disease-like conditions was less than one percent. Patch reefs continue to harbor the greatest densities of corals, especially massive framework builders such as *Diploria*, *Colpophyllia*, *Montastraea*, and *Siderastrea*. A total of 5,544 juvenile (< 4 cm max. diameter) scleractinian corals were identified, enumerated, and measured for maximum length representing at least 32 different coral taxa. Juvenile coral densities were relatively high (> 8 per m²) on mid-channel and offshore patch reefs, especially in the lower Florida Keys. Overall, the dominant corals comprising the juvenile coral assemblage paralleled the patterns of relative abundance in the adult coral community. A total of 34,965 gorgonians were identified and counted, along with assessments of the density, shell length, and host occupation patterns of flamingo-tongue snails (*Cyphoma* spp.) among 160 sites (2,560 m²). With the exception of some patch reef and shallow spur and groove sites, gorgonians are a dominant component of the sessile invertebrate assemblage, with densities as high as 38 colonies per m². A total of 111 *C. gibbosum* snails were encountered and all but one was found on gorgonian hosts. Similar to surveys in 2001 and 2008, *Cyphoma* snails appeared to preferentially occupy certain gorgonian genera in relation to their abundance,

but not others. In contrast to previous surveys in 2001 and 2008, *Cyphoma* densities were more similar between reference areas and no-take zones for several habitat types.

Five urchin species were encountered and 1,768 individuals were counted and measured for test diameter (TD). Of these, 90% were either *Echinometra viridis*, which was particularly abundant on mid-channel and offshore patch reefs, or *Eucidaris tribuloides*, which was most abundant on high-relief spur and groove and deeper fore-reef habitats. Densities of the long-spined sea urchin (*Diadema antillarum*) are still relatively low (< 0.3 individuals per m^2) by historical (pre-1983) standards; however, two temporal trends are noteworthy. First, densities of *D. antillarum* have slowly increased since 1999, and the highest densities presently occur on mid-channel and offshore patch reefs. Second, there has been a shift in the average and maximum sizes of individuals encountered over the past 10 years to larger individuals. In 2009, individuals as large as 9.3 cm TD were recorded, which we never encountered from 1999-2005. The average size of *Diadema* encountered up until 2005 was < 3.0 cm TD, while 2009 yielded an average size of 5.0 cm TD. Where aggregations of urchins were found, there were clear and obvious impacts to the substratum. Assuming these trends continue, and as more space becomes cleared of algae, it will be important to monitor for recruitment of invertebrates, including perhaps corals.

Five anemone species and three corallimorpharian species were encountered and frequency of occurrence and densities were determined among habitat types, regions, and between no-take zones and reference areas. A total of 461 anemones were counted, of which ~91% were either *Bartholomea annulata* or *Lebrunia danae*. Anemones and corallimorpharians exhibited similar spatial patterns in abundance among habitats in 2009 compared to previous surveys in 2000, 2005, and 2008. A total of 5,418 corallimorpharians were counted, of which ~79% were *Ricordea florida*, followed by two *Discosoma* species. *R. florida* was most abundant on mid-channel and offshore patch reefs, especially in the lower Keys, and was particularly abundant in no-take zones in the Western Sambo and Looe Key areas compared to patch reefs outside of FKNMS no-take zones.

I. Introduction

Like many coral reef ecosystems, the Florida Keys have experienced significant decline in recent decades, including loss of urchins and corals due to disease and for corals loss from bleaching during warm-water events that have also occurred throughout the wider Caribbean (Jaap 1984; Dustan and Halas 1987; Aronson and Precht 2001; Chiappone et al. 2002). In addition, impacts to reefs are also evident from over-use such as from finfish fishing and harvesting ornamentals, coastal development, and a considerable array of natural phenomena affecting Florida Keys reefs including atmospheric cold fronts

because of high latitude, continental influence (including Florida Bay exchange), and destructive tropical storms (Precht and Miller 2007). This multitude of stressors has made it difficult to discern the degree to which human activities have affected ecological integrity relative to natural system variability (Somerfield et al. 2008).

While understanding the causes of coral reef decline is a fundamental pursuit among coral reef ecologists, our sampling program was designed specifically to document the status and trends of no-take management zones throughout the FKNMS. To evaluate potential changes in no-take management zones, it is necessary to also document changes caused by natural system variability or stressors, such as mortality events caused by disease or bleaching, coral recruitment events (especially related to *Acropora* corals), or recovery of the previously abundant sea urchin, *Diadema antillarum*. By broadly sampling populations across multiple habitat types, from nearshore to offshore, inside and outside of the no-take management zones, and throughout the Florida Keys from south of Miami to the Dry Tortugas, over a ten-year period, we have documented the distribution, abundance, and changes over time, of coral reef communities in the region. Our data and results are unprecedented in spatial coverage and establish a baseline from which future comparisons can be made, related to further decline, recovery, or stasis. It is important to note that our program began in the late 1990s, long after major declines had already occurred in the region, specifically the loss of *D. antillarum* and *Acropora* corals. One way we are addressing the absence of earlier information (from the 1970s before the major die-offs) is through a data-rescue project that will begin in 2010. In partnership with the FKNMS, we have identified a previously-funded NSF project that sampled reefs in the lower Florida Keys, but was never published. We are working with the Principal Investigator of that project to incorporate the historical data set with ours and to resample these same sites originally surveyed over 30 years ago.

In 2009, during just over six weeks of fieldwork in the Florida Keys, we sampled 160 different sites stratified by habitat, regional sector, and management zone from northern Key Largo to Key West within the FKNMS. These measurements add to a growing temporal base of observations made by our program since 1999 (Chiappone et al. 2002a, b; Miller et al. 2002). Previous surveys aided in optimizing a sampling plan for obtaining estimates of abundance and size of benthic coral reef organisms (see previous Quick Look reports at <http://people.uncw.edu/millers>). Our sampling program is specifically designed to help resource managers evaluate the performance of smaller protected areas (no-take zones) relative to other factors that influence the larger ecosystem.

II. Study Area and Survey Methods

Study area and sampling objectives

The Florida Keys comprise an archipelago of limestone islands spanning more than 360 km from south of Miami to the Dry Tortugas and, with the exception of isolated banks in the Flower Gardens area in the Gulf of Mexico, represent the only region of extensive coral reef development in the continental United States (Jaap 1984). The islands are part of the larger south Florida shelf, a submerged Pleistocene platform 6 km to 35 km wide and generally < 12 m deep (Lidz et al. 2003). The primary influences on the distribution and development of Florida Keys reefs are paleotopography and fluctuating sea level (Shinn et al. 1989; Lidz et al. 2003). Bedrock throughout south Florida is Pleistocene limestone, either exposed on the seafloor or lying underneath Holocene reefs and sands (Shinn et al. 1989). As one proceeds seaward from the shoreline of the Pleistocene islands, a nearshore rock ledge extends ~2.5 km from the shoreline, with the seabed consisting of hard-bottom, seagrass, and isolated inshore patch reefs (FMRI 1998). Offshore of the island platform is Hawk Channel, a broad trough-like depression dominated by non-coralline, non-oolitic grainstone, dotted with several thousand patch reefs whose distribution is affected by the number and width of tidal passes connecting Florida Bay and the Atlantic Ocean (Marszalek et al. 1977). Bands of rock ridges exist further offshore along the outer shelf and on the upper slope from 30-40 m depth before tapering off into the Straits of Florida. The semi-continuous offshore reef tract is emergent in places, in which Holocene reefs sit atop a ridge of Pleistocene corals (~86-78 ka), forming a shelf-margin ledge (Lidz et al. 2003), with a series of outlier reefs seaward of this main reef tract at 30-40 m depth (Lidz 2006). Similar to the inner shelf margin patch reefs, offshore platform margin reef distribution reflects exchange processes between Florida Bay and the Atlantic Ocean (Marszalek et al. 1977; Shinn et al. 1989), which is related to the size and orientation of the Pleistocene islands, the locations of major tidal passes, and the proximity of the Florida Current to the platform margin (Pitts 1994; Smith 1994).

The 2009 sampling of coral reef benthic invertebrates and marine debris in the Florida Keys National Marine Sanctuary (FKNMS) was undertaken as a spatially intensive effort to quantify the distribution, abundance, size, and condition of benthic coral reef organisms. The 2009 surveys conducted during May 30th through September 6th were an outgrowth of previous efforts conducted by our program dating back to 1999 to quantify the abundance and condition of coral reef benthos throughout the FKNMS, including the Tortugas region (Miller et al. 2002). Previous surveys in the FKNMS, excluding the Tortugas region, included 80 sites sampled Keyswide in 1999, 45 sites in the lower Keys region in 2000, 108 sites Keyswide in 2001, 195 sites Keyswide in 2005, 107 sites in the upper Keys region in 2006, 235 sites Keyswide in 2007, and 145 sites Keyswide in 2008. Data obtained from these earlier efforts, together

with existing habitat mapping information for the FKNMS, were used to guide the sampling of benthic coral reef organisms in 2009. The objectives of the 2009 sampling effort were to provide information on:

- Depth and physical structure (maximum vertical relief) of survey sites;
- Habitat-based presence-absence distribution patterns of stony corals, gorgonians, and sponges within diverse hard-bottom and coral reef habitat types from ~1 m to 13 m depth;
- Percent cover of abiotic and biotic components;
- Density, size, and condition (percent live tissue, disease, bleaching, predation) of stony corals;
- Density and maximum diameter of juvenile (< 4 cm) scleractinian corals;
- Density of gorgonians, as well as gorgonian host occupation patterns of flamingo-tongue snails;
- Density and size (test diameter) of sea urchins, representing a continuing effort to monitor recovery of the historically abundant long-spined sea urchin *Diadema antillarum*;
- Density of sea anemones and corallimorpharians; and
- Density of selected mollusks such as sea slugs, nudibranchs, and certain other gastropods (*Thais*, *Leucozonia*, *Coralliophila*).

Sampling design and field methodology

The sampling design for assessing benthic coral reef organisms encompassed 160 sites visited during May-September 2009. Sites were distributed from northern Key Largo near the boundary between the FKNMS and Biscayne National Park to southwest of Key West at Western Dry Rocks (Figure 2-1). The sampling design included six major habitat types in three regions, as well as all 23 of the 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 2-1). Table 2-2 chronologically lists the sampling locations during May-September 2009.

The habitat strata selected for the 2009 sampling incorporated most of the hard-bottom and coral reef habitat types from inshore of Hawk Channel to ~13 m depth along the reef tract. The sampling in 2009 did not include back reef rubble, nearshore hard-bottom, hard-bottom/seagrass matrix habitats, or deeper (> 15 m) fore reef areas. Habitats sampled during 2009 were inshore and mid-channel patch reefs, offshore patch reefs, shallow (< 6 m) hard-bottom, inner line reef tract spur and groove from Grecian Rocks northward to Turtle Reef, shallow (< 6 m) high-relief spur and groove along the platform margin, and deeper fore-reef habitats from 7-13 m depth. Deeper fore-reef habitats encompassed continuous, low-relief hard-bottom, patchy hard-bottom, and low-relief spur and groove. The list of sites organized by benthic habitat type is provided in Table 2-3, together with site-level data on depth and maximum vertical

relief. Besides habitat type, sites were further categorized by regional sector (along-shelf position) and management zone (inside and outside of FKNMS no-take zones). Figures 2-2 to 2-4 show the spatial distribution of sampling locations by habitat type for the upper, middle, and lower Florida Keys regional sectors, along with the boundaries of existing no-take marine reserves in the FKNMS. Figures 2-5 to 2-7 provide examples of each of the hard-bottom and coral reef habitat types sampled during 2009.

A geographic information system (GIS) containing digital layers for benthic habitat (FMRI 1998), bathymetry, and no-take marine reserve boundaries was used to facilitate delineation of the sampling survey domain, strata, and sample units. Map resolution was such that the survey domain was divided into a grid with individual cells of size 200 m by 200 m (40,000 m²) that defined unique habitat classes (Table 2-1). A two-stage sampling scheme following Cochran (1977) was employed to control for spatial variation in population metrics at scales smaller than the grid cell minimum mapping unit. Grid cells containing targeted reef and hard-bottom habitats were designated as primary sample units. A second-stage sample unit was defined as a belt transect of fixed area (15-m x 1-m in dimension) within a primary sample unit. The size of an individual primary sampling unit allowed divers to swim to the location of any given second-stage sampling unit from a moored or anchored vessel.

To control for spatial variation in species richness, cover, and population abundance metrics, we divided the Florida Keys survey domain into strata based upon: 1) habitat class; 2) geographic region; and 3) management zones of the Florida Keys National Marine Sanctuary (FKNMS). 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 the combination of habitat type, regional sector, and management zone. Habitats were designated using regional benthic habitat maps (FMRI 1998). The habitat classification scheme accounted for features that correlate with benthic fauna distributions, including cross-shelf position, topographic complexity, and the proportion of sand interspersed among hard-bottom structures. A geographic regional stratification variable was used to account for oceanographic and geological features in the Florida Keys that may influence the distribution and community composition of hard-bottom and reef habitats (Marszalek *et al.* 1977; Shinn *et al.* 1989). Regional sectors were defined as follows: 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). FKNMS management zones (*i.e.* no-take marine reserves) were incorporated as a third stratification variable that delineated areas open and closed to consumptive activities. Within each no-take zone, a minimum of 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 in a particular metric are allocated more sites than those with less variability. The ultimate power of this approach is derived more 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. A Garmin® global positioning system receiver (model GPS76) was used to determine the position at each site. The original sampling list included 158 sampling locations, with an additional 107 alternate sites for the upper, middle, and lower Florida Keys regions. If the original waypoint was not the intended habitat type, the closest alternate site was sampled instead. Once on-site, a two- or three-person benthic diver team oriented four transect tapes 15 m in length, marked in 1-m increments, along the bottom. A 60 m² area (a 1-m wide belt centered on each 15-m long transect tape) was surveyed at each site for most variables. Benthic cover was assessed by sampling 100 points spaced 15 cm apart along each transect. The diver team surveyed the array of transects for: depth, maximum vertical relief, and estimates of the percent of the belt transect area represented by different relief categories on all four transects; stony coral, gorgonian, and sponge species presence-absence; stony coral numbers, colony sizes, and colony condition; juvenile scleractinian coral numbers and maximum diameter on two of four transects in ten randomly placed 0.65-cm x 0.48-cm quadrats; gorgonian numbers and *Cyphoma* snail numbers, sizes, and gorgonian hosts; urchin numbers and sizes (test diameter); anemone and corallimorpharian numbers; and the numbers of other selected mollusks. Transects were placed in a haphazard fashion, but in a way that best 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 marked in 5-cm increments. Maximum vertical relief took into consideration hard substratum, corals, and sponges, but did not include gorgonian height. Belt transect areas were also scored for the percentage transect area with different relief categories (< 0.2 m, 0.2-0.5 m, 0.5-1.0 m, 1.0-1.5 m, > 1.5 m) for both hard and soft (gorgonians) complexity features. Digital photographs of each site were taken to record general site features and organisms encountered.

The 2009 sampling effort (160 sites) required 44 field days from May 30 through September 6 (Table 2-3). Only a few field days were lost due to personnel injuries or inclement weather in July and August. The May-September sampling was generally marked by calm conditions, but curiously odd patterns of

underwater visibility, with better than average visibility in the lower and middle Keys for most of the summer. A private research vessel (R/V *Magic II*, Key Largo, captained by David Ward) and NURC/UNCW in Key Largo provided on-the-water diving support. The survey team consisted of personnel from the Center for Marine Science/UNCW (Mark Chiappone, Leanne Rutten and Thor Dunmire) and the Florida Wildlife Research Institute (Nancy Sheridan) (Table 4). SCUBA tank fills and lodging were partially provided by the National Undersea Research Center-UNCW facility on Key Largo. The sampling effort depended upon 6 to 7 hours in the water daily by a two- or three-person benthic team to complete an average of 3-4 sites per day. Typically 70-80 minutes per site were needed to sample the targeted benthic variables. Table 2-4 summarizes the diving statistics for 2009. The benthic surveys at the 160 sites required 505 dives comprising just over 700 hours of underwater bottom time.

Figure 2-1. Sampling locations for benthic coral reef organisms from southwest of Key West to northern Key Largo during May-September 2009.

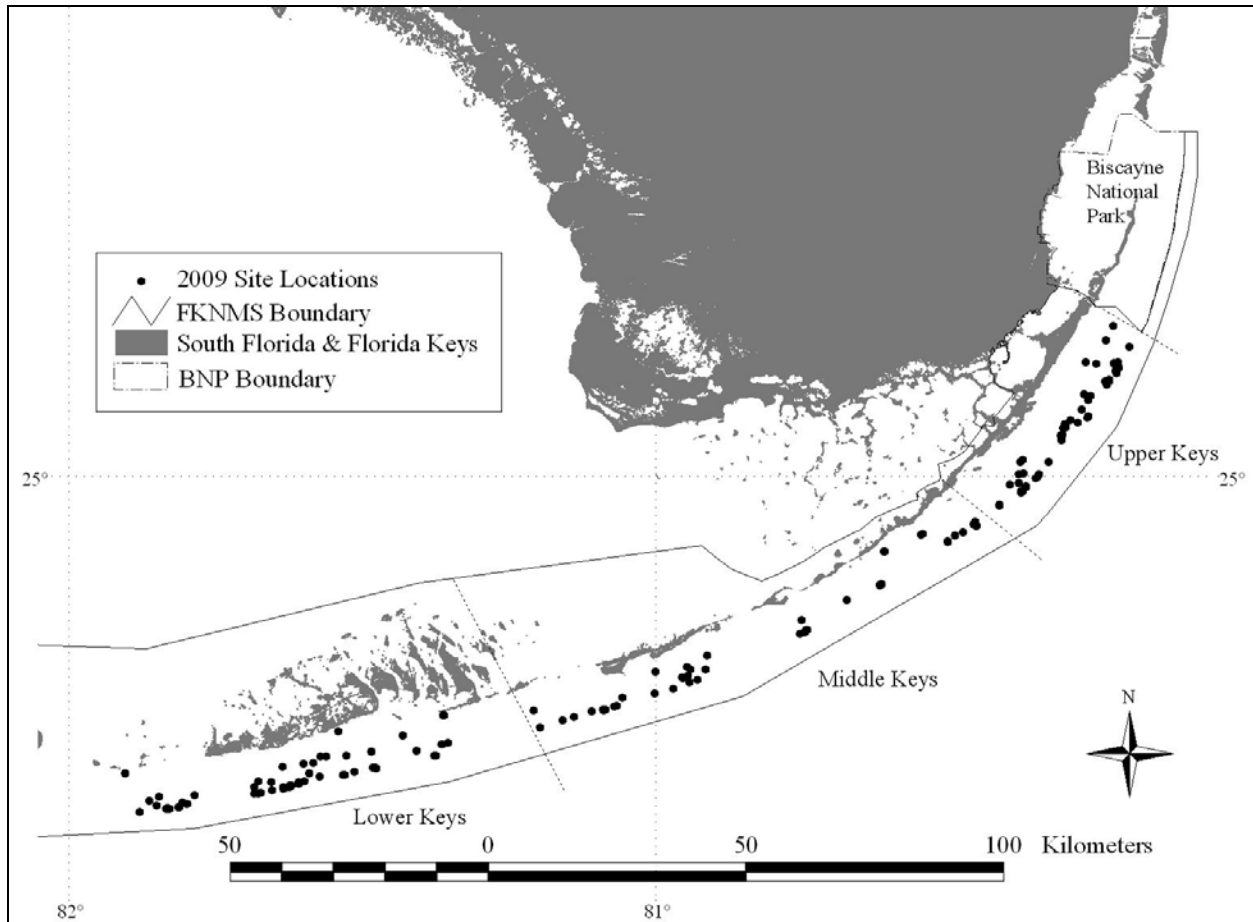


Figure 2-2. Florida Keys sampling locations by benthic habitat type from the southern Biscayne National Park boundary to Tavernier during 2009.

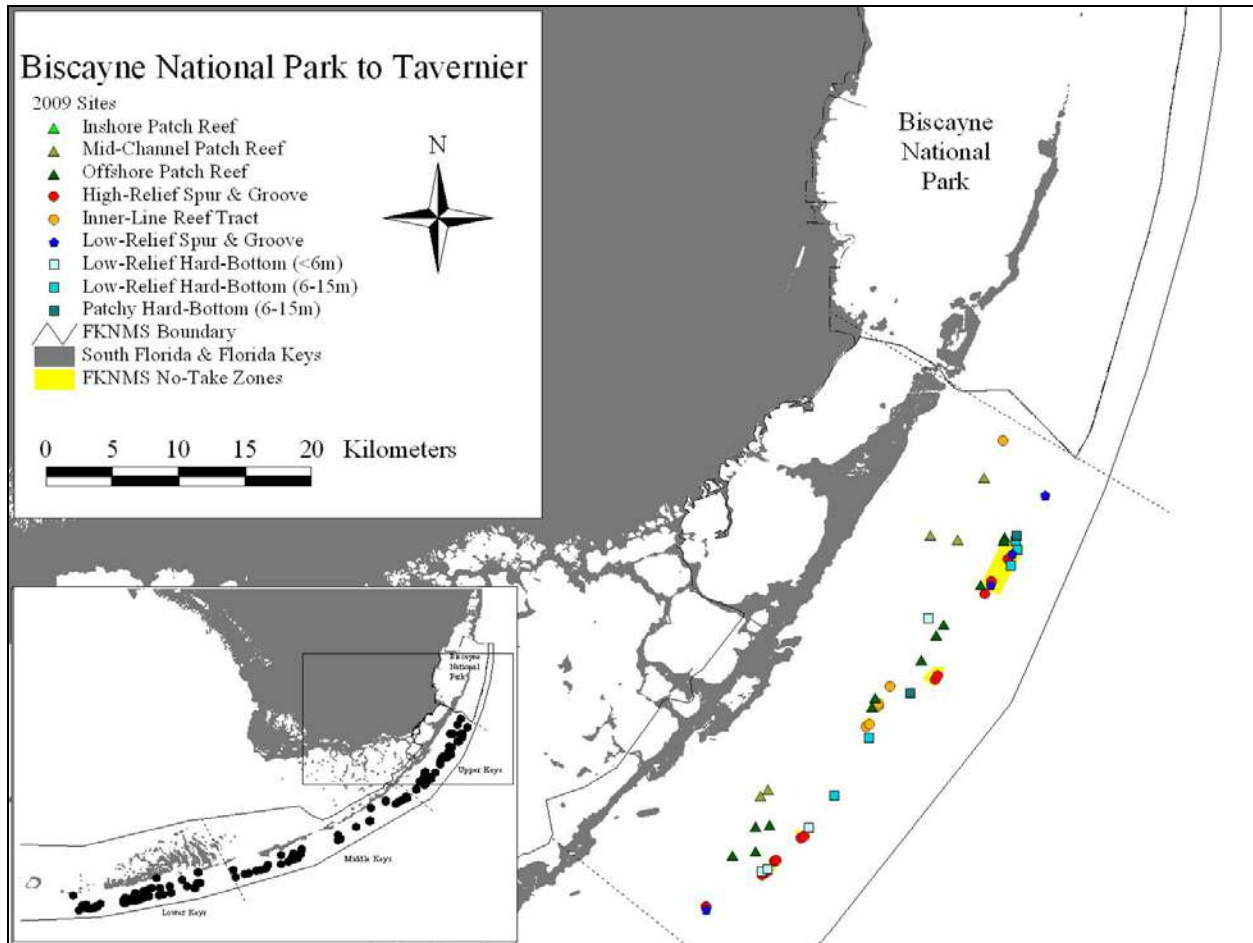


Figure 2-3. Florida Keys sampling locations by benthic habitat type from Tavernier to Bahia Honda during 2009.

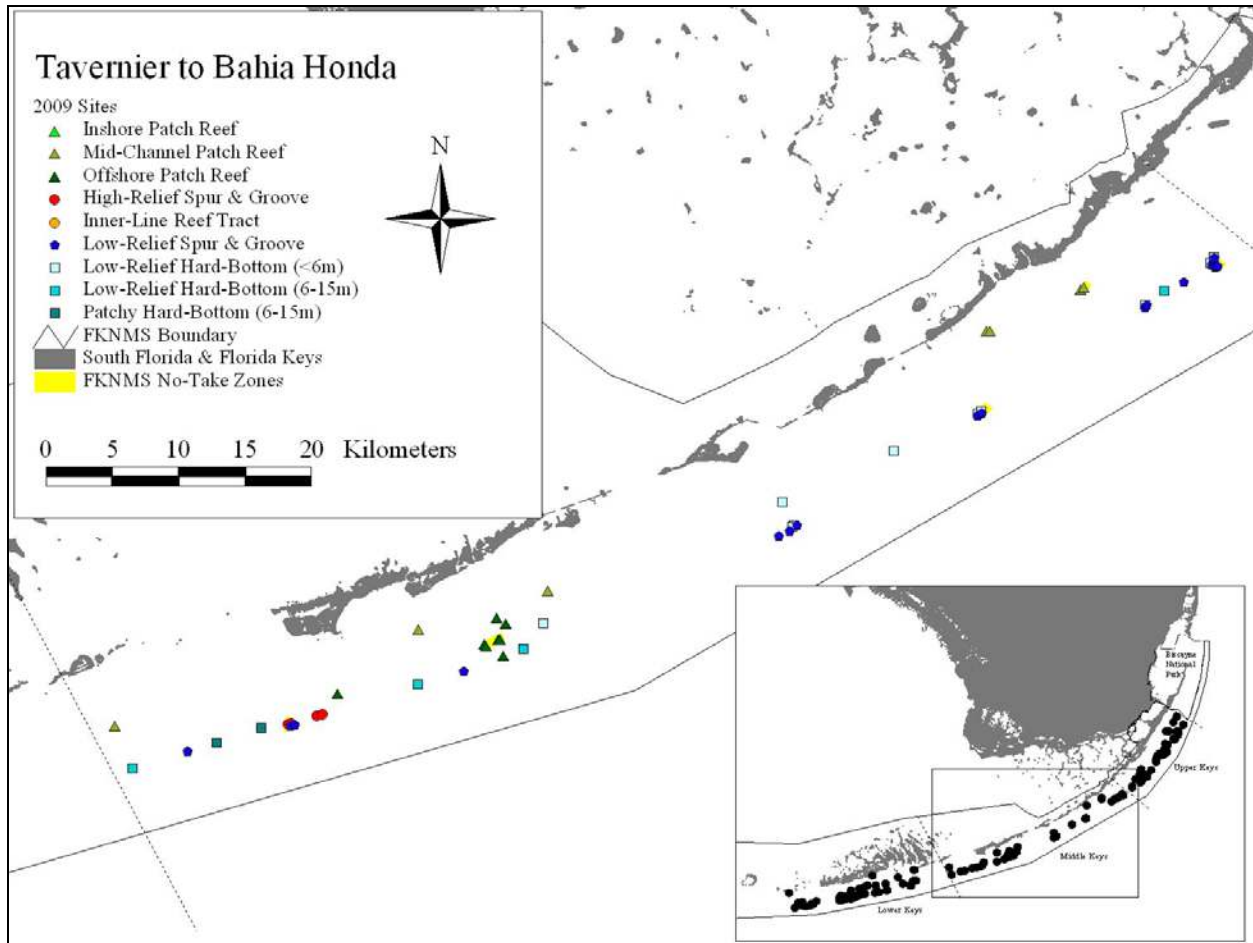


Figure 2-4. Florida Keys sampling locations by benthic habitat type from Bahia Honda to Western Dry Rocks during 2009.

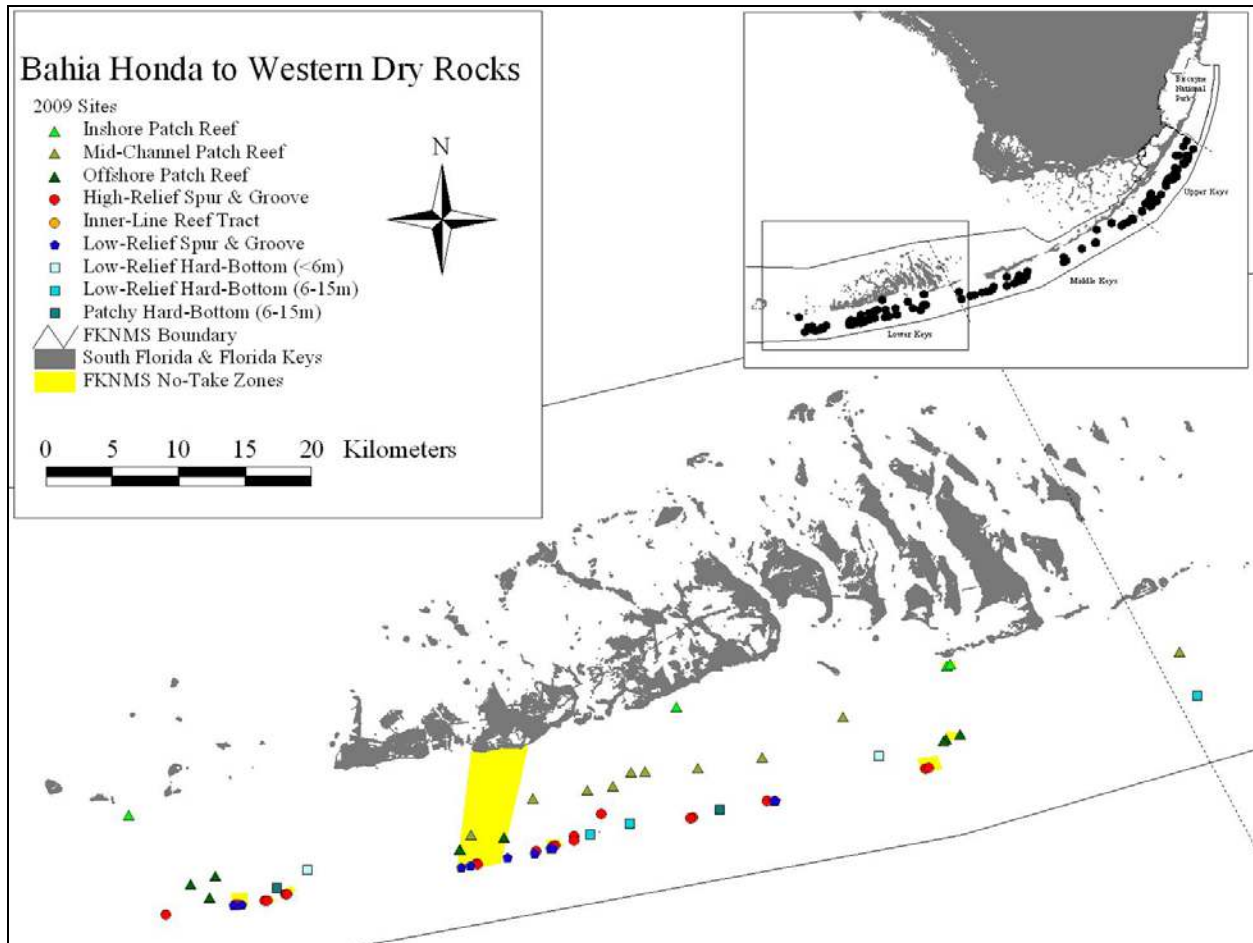


Figure 2-5. Examples of mid-channel and offshore patch reefs sampled in the Florida Keys during 2009.

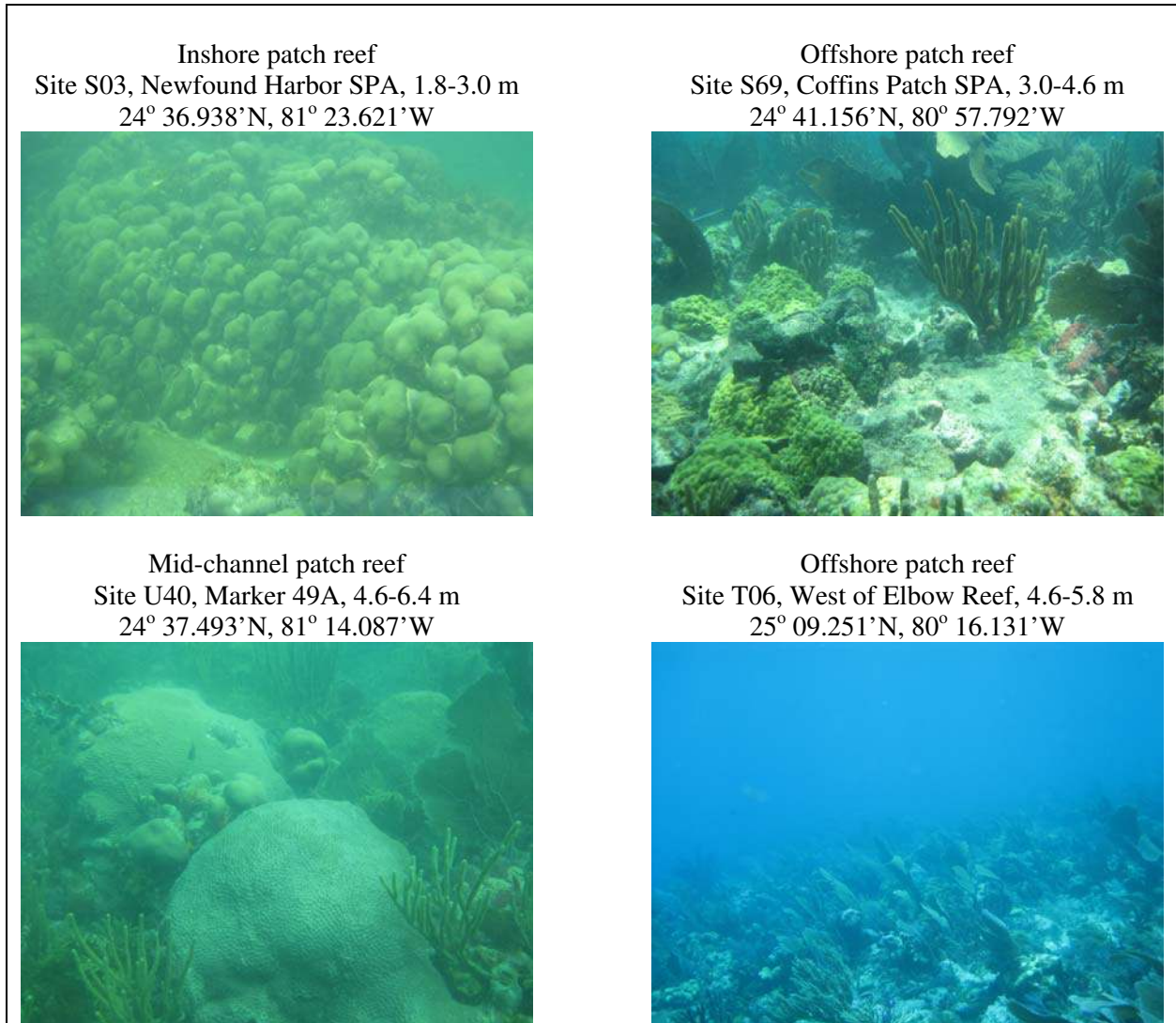


Figure 2-6. Examples of low-relief hard-bottom and high-relief spur and groove reefs sampled in the Florida Keys during 2009.

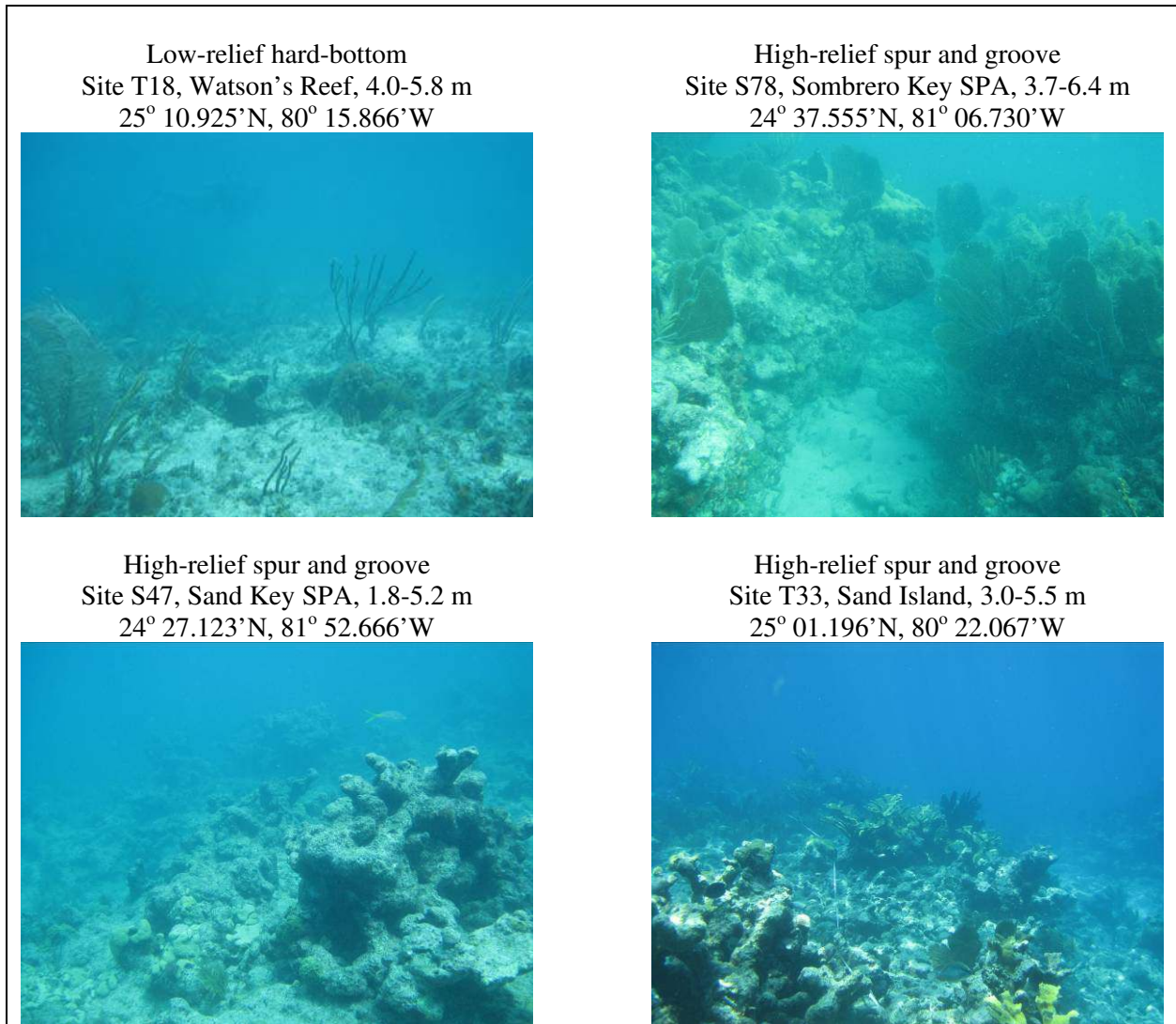


Figure 2-7. Examples of deeper (6-15 m) fore-reef habitats sampled in the Florida Keys during 2009.

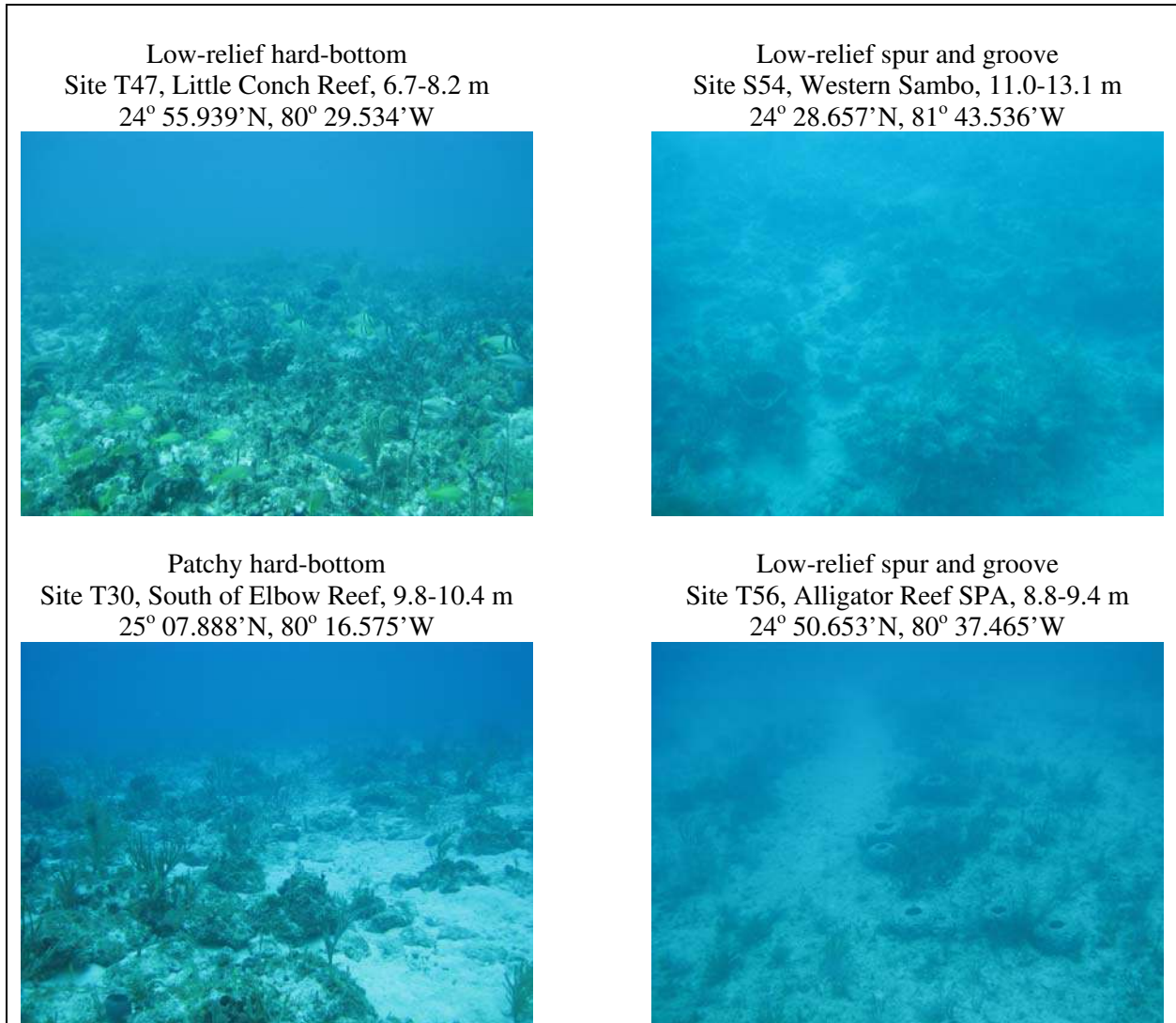


Table 2-1. Survey effort for benthic coral reef organisms in the Florida Keys National Marine Sanctuary during May-September 2009. Sites are arranged by habitat type, regional sector, and management zone. Available sites (n_{tot}) reflect the number of 200 m x 200 m sites based upon FMRI (1998) habitat mapping data. Asterisked sites (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO). $n_{\text{tot}} (\%)$ = proportion of sites available in a particular stratum relative to the total number of sites in the sampling domain.

Habitat type/region/protection	Sites sampled (n)	% of Effort	Sites available (n_{tot})	$n_{\text{tot}} (\%)$	$n/n_{\text{tot}} (\%)$
Inshore patch reef (IPR)					
Lower Florida Keys					
Reference sites	2	1.25	114	1.09	1.75
Hen and Chickens SPA**	2	1.25	6	0.06	33.33
IPR Habitat Total	26	16.25	120	1.18	1.38
Mid-channel patch reef (MPR)					
Upper Florida Keys					
Reference sites	5	3.13	706	6.76	0.71
Middle Florida Keys					
Reference sites	3	1.88	165	1.58	1.82
Hen and Chickens SPA**	2	1.25	9	0.09	22.22
Cheeca Rocks SPA**	2	1.25	12	0.11	16.67
Lower Florida Keys					
Reference sites	8	5.00	840	8.05	0.95
Western Sambo ER**	2	1.25	38	0.36	5.26
MPR Habitat Total	22	13.75	1,770	17.47	1.24
Offshore patch reef (OPR)					
Upper Florida Keys					
Reference sites	9	5.63	719	9.82	0.88
Carysfort/S. Carysfort SPA**	2	1.25	28	0.27	7.14
Middle Florida Keys					
Reference sites	4	2.50	94	0.90	4.26
Coffins Patch SPA**	4	2.50	4	0.04	100.00
Lower Florida Keys					
Reference sites	4	2.50	458	4.39	0.87
Looe Key RO**	2	1.25	13	0.12	15.38
Western Sambo ER**	2	1.25	61	0.58	3.28
OPR Habitat Total	27	16.88	1,377	13.59	1.96
Shallow (< 6 m) hard-bottom (LHB)					
Upper Florida Keys					
Reference sites	2	1.25	775	7.42	0.26
Molasses Reef SPA**	2	1.25	5	0.05	40.00
Middle Florida Keys					
Reference sites	3	1.88	176	1.69	1.70
Conch Reef SPA**	2	1.25	5	0.05	40.00
Davis Reef SPA**	2	1.25	2	0.02	100.00
Alligator Reef SPA**	2	1.25	10	0.10	20.00
Tennessee Reef RO**	2	1.25	5	0.05	40.00
Lower Florida Keys					
Reference sites	2	1.25	71	0.68	2.82
LHBS Habitat Total	17	10.63	978	9.65	1.74
Inner line spur and groove (IRT)					
Upper Florida Keys					
Reference sites	2	1.25	78	0.90	4.41
Dry Rocks SPA**	2	1.25	4	0.07	40.00
Grecian Rocks SPA**	2	1.25	13	0.19	14.29
IRT Habitat Total	6	3.75	95	0.94	6.32

Habitat type/region/protection	Sites sampled (n)	% of Effort	Sites available (n _{tot})	n _{tot} (%)	n/n _{tot} (%)
High-relief spur and groove (HSG)					
Upper Florida Keys					
Reference sites	4	2.50	34	0.34	21.88
Carysfort/S. Carysfort SPA**	2	1.25	39	0.38	5.88
Elbow Reef SPA**	2	1.25	16	0.16	13.33
French Reef SPA**	2	1.25	12	0.12	16.67
Molasses Reef SPA**	2	1.25	14	0.14	11.11
Middle Florida Keys					
Reference sites	2	1.25	3	0.03	100.00
Sombrero Reef SPA**	2	1.25	7	0.07	28.57
Lower Florida Keys					
Reference	8	5.00	49	0.48	21.43
Looe Key SPA**	2	1.25	14	0.14	13.33
Eastern Sambo RO**	2	1.25	7	0.07	33.33
Western Sambo ER**	2	1.25	16	0.16	14.29
Eastern Dry Rocks SPA**	2	1.25	9	0.09	50.00
Rock Key SPA**	2	1.25	4	0.04	33.33
Sand Key SPA**	2	1.25	7	0.07	66.67
HSG Habitat Total	36	22.50	210	2.08	17.14
Deeper (6-15 m) hard-bottom (LHB)					
Upper Florida Keys					
Reference sites	3	1.88	662	6.53	0.45
Carysfort/S. Carysfort SPA**	2	1.25	39	0.38	5.13
Middle Florida Keys					
Reference sites	4	2.50	311	3.07	1.29
Lower Florida Keys					
Reference sites	2	1.25	576	5.68	0.35
LHBD Habitat Total	11	6.88	1,588	15.70	0.69
Patchy (6-15 m) hard-bottom (PHB)					
Upper Florida Keys					
Reference sites	2	1.25	217	2.14	0.92
Middle Florida Keys					
Reference sites	2	1.25	128	1.26	1.56
Lower Florida Keys					
Reference sites	2	1.25	26	0.26	7.69
LHBD Habitat Total	11	6.88	1,588	12.09	0.69
Low-relief spur and groove (LSG)					
Upper Florida Keys					
Reference sites	3	1.25	709	7.00	0.92
Carysfort/S. Carysfort SPA**	2	1.25	54	0.53	5.13
Middle Florida Keys					
Reference sites	4	2.50	807	7.96	0.92
Conch Reef SPA**	2	1.25	14	0.14	5.13
Conch Reef RO**	2	1.25	6	0.06	5.13
Davis Reef SPA**	2	1.25	9	0.09	5.13
Alligator Reef SPA**	2	1.25	7	0.07	5.13
Tennessee Reef RO**	2	1.25	10	0.10	5.13
Sombrero Key SPA**	2	1.25	15	0.15	5.13
Lower Florida Keys					
Reference sites	3	1.88	684	6.75	0.92
Eastern Sambo RO**	2	1.25	5	0.05	5.13
Western Sambo ER**	2	1.25	17	0.17	5.13
Sand Key SPA**	2	1.25	16	0.16	5.13
LSG Habitat Total	30	18.75	2,353	23.22	1.27
Sampling Design Total	160	100.00	10,133	100.00	1.58

Table 2-2. Chronological list of survey site locations for benthic coral reef organisms in the Florida Keys National Marine Sanctuary during May-September 2009. 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
S46	5/30/2009	Sand Key SPA	24° 27.119	81° 52.778	High-relief spur and groove
S47	5/30/2009	Sand Key SPA	24° 27.123	81° 52.666	High-relief spur and groove
S27	5/30/2009	Sand Key SPA	24° 27.113	81° 52.537	Low-relief spur and groove (6-15 m)
S01	5/31/2009	SE of Ballast Key	24° 30.796	81° 57.150	Inshore patch reef
S32	5/31/2009	Western Dry Rocks	24° 26.706	81° 55.632	High-relief spur and groove
S14	5/31/2009	North of Sand Key	24° 27.955	81° 54.612	Offshore patch reef
U19	6/01/2009	Sand Key SPA	24° 27.070	81° 52.862	Low-relief spur and groove (6-15 m)
S15	6/01/2009	North of Sand Key	24° 27.416	81° 53.833	Offshore patch reef
S16	6/01/2009	North of Sand Key	24° 28.314	81° 53.614	Offshore patch reef
S44	6/02/2009	Rock Key SPA	24° 27.284	81° 51.562	High-relief spur and groove
S45	6/02/2009	Rock Key SPA	24° 27.278	81° 51.457	High-relief spur and groove
S23	6/02/2009	East of Rock Key SPA	24° 27.783	81° 51.098	Patchy hard-bottom (6-15 m)
S42	6/03/2009	Eastern Dry Rocks SPA	24° 27.548	81° 50.732	High-relief spur and groove
S43	6/03/2009	Eastern Dry Rocks SPA	24° 27.560	81° 50.655	High-relief spur and groove
S21	6/03/2009	East of E. Dry Rocks SPA	24° 28.531	81° 49.855	Low-relief hard-bottom (< 6 m)
S40	6/03/2009	Western Sambo ER	24° 28.800	81° 42.885	High-relief spur and groove
S54	6/04/2009	Western Sambo ER	24° 28.657	81° 43.536	Low-relief spur and groove (6-15 m)
S19	6/04/2009	Western Sambo ER	24° 29.394	81° 43.582	Offshore patch reef
S12	6/04/2009	Western Sambo ER	24° 29.382	81° 43.572	Mid-channel patch reef
S55	6/05/2009	Western Sambo ER	24° 28.720	81° 43.138	Low-relief spur and groove (6-15 m)
S41	6/05/2009	Western Sambo ER	24° 28.795	81° 42.858	High-relief spur and groove
S13	6/05/2009	Western Sambo ER	24° 30.012	81° 43.131	Mid-channel patch reef
S48	6/06/2009	East of Western Sambo ER	24° 29.065	81° 41.636	Low-relief spur and groove (6-15 m)
S20	6/06/2009	Western Sambo ER	24° 29.911	81° 41.785	Offshore patch reef
S05	6/06/2009	North of Middle Sambo Reef	24° 31.471	81° 40.594	Mid-channel patch reef
S49	6/07/2009	Middle Sambo Reef	24° 29.228	81° 40.509	Low-relief spur and groove (6-15 m)
S52	6/07/2009	Eastern Sambo RO	24° 29.419	81° 39.885	Low-relief spur and groove (6-15 m)
S38	6/07/2009	Eastern Sambo RO	24° 29.509	81° 39.789	High-relief spur and groove
S33	6/07/2009	Middle Sambo Reef	24° 29.336	81° 40.442	High-relief spur and groove
S53	6/08/2009	Eastern Sambo RO	24° 29.410	81° 39.779	Low-relief spur and groove (6-15 m)
S39	6/08/2009	Eastern Sambo RO	24° 29.561	81° 39.657	High-relief spur and groove
S24	6/08/2009	East of Eastern Sambo RO	24° 29.930	81° 38.878	High-relief spur and groove
S06	6/08/2009	North of Pelican Shoal	24° 31.826	81° 38.342	Mid-channel patch reef
S22	6/09/2009	West of Looe Key SPA	24° 33.216	81° 26.431	Low-relief hard-bottom (6-15 m)
S11	6/09/2009	North of American Shoal	24° 34.823	81° 27.895	Mid-channel patch reef
S51	6/09/2009	American Shoal	24° 31.382	81° 30.724	Low-relief spur and groove (6-15 m)
S50	6/10/2009	American Shoal	24° 31.376	81° 30.656	Low-relief spur and groove (6-15 m)
S35	6/10/2009	American Shoal	24° 31.399	81° 30.988	High-relief spur and groove
S10	6/10/2009	North of American Shoal	24° 33.166	81° 31.200	Mid-channel patch reef
S31	6/11/2009	East of Maryland Shoal	24° 31.028	81° 32.962	Patchy hard-bottom (6-15 m)
S34	6/11/2009	Maryland Shoal	24° 30.688	81° 34.033	High-relief spur and groove
S09	6/11/2009	North of Maryland Shoal	24° 32.725	81° 33.831	Mid-channel patch reef
U22	6/12/2009	West of Pelican Shoal	24° 30.008	81° 38.237	Low-relief hard-bottom (6-15 m)
S30	6/12/2009	East of Pelican Shoal	24° 30.442	81° 36.624	Low-relief hard-bottom (6-15 m)
S08	6/12/2009	West Washerwoman Shoal	24° 32.584	81° 35.990	Mid-channel patch reef
U15	6/13/2009	No Name Reef	24° 29.752	81° 38.889	High-relief spur and groove
U24	6/13/2009	Pelican Shoal	24° 30.828	81° 37.789	High-relief spur and groove
U04	6/13/2009	North of Pelican Shoal	24° 31.975	81° 37.317	Mid-channel patch reef
S93	6/22/2009	Turtle Rocks	25° 16.630	80° 13.593	Mid-channel patch reef
T11	6/22/2009	North of Turtle Reef	25° 18.149	80° 12.821	Inner line reef tract
T49	6/22/2009	SE of Turtle Rocks	25° 15.911	80° 11.094	Low-relief spur and groove (6-15 m)
S91	6/23/2009	Basin Hill Shoals	25° 14.298	80° 15.756	Mid-channel patch reef
S92	6/23/2009	Basin Hill Shoals	25° 14.140	80° 14.659	Mid-channel patch reef
S99	6/24/2009	Wolf Reef	25° 01.311	80° 23.774	Offshore patch reef

Site #	Date	Site location	Latitude (N)	Longitude (W)	Habitat type
U23	7/11/2009	Maryland Shoal	24° 30.668	81° 34.129	High-relief spur and groove
S07	7/11/2009	West Washerwoman Shoal	24° 32.579	81° 36.553	Mid-channel patch reef
S02	7/11/2009	South of Sugarloaf Creek	24° 35.250	81° 34.705	Inshore patch reef
S03	7/12/2009	Newfound Harbor SPA	24° 36.938	81° 23.621	Inshore patch reef
S04	7/12/2009	Newfound Harbor SPA	24° 36.985	81° 23.480	Inshore patch reef
S17	7/12/2009	Looe Key RO	24° 33.923	81° 23.646	Offshore patch reef
S18	7/12/2009	Looe Key RO	24° 34.103	81° 23.070	Offshore patch reef
S36	7/13/2009	Looe Key SPA	24° 32.699	81° 24.507	High-relief spur and groove
S37	7/13/2009	Looe Key SPA	24° 32.734	81° 24.354	High-relief spur and groove
U12	7/13/2009	West of Looe Key RO	24° 33.866	81° 23.768	Offshore patch reef
S71	7/13/2009	South of Bahia Honda	24° 35.656	81° 13.359	Low-relief hard-bottom (6-15 m)
U40	7/14/2009	Marker 49A	24° 37.493	81° 14.087	Mid-channel patch reef
S80	7/14/2009	West of Sombrero Key	24° 36.415	81° 10.995	Low-relief spur and groove (6-15 m)
S74	7/14/2009	West of Sombrero Key	24° 36.769	81° 09.775	Patchy hard-bottom (6-15 m)
S72	7/14/2009	West of Sombrero Key	24° 37.389	81° 07.881	Patchy hard-bottom (6-15 m)
S78	7/15/2009	Sombrero Key SPA	24° 37.555	81° 06.730	High-relief spur and groove
S79	7/15/2009	Sombrero Key SPA	24° 37.587	81° 06.581	High-relief spur and groove
S85	7/15/2009	Sombrero Key SPA	24° 37.534	81° 06.449	Low-relief spur and groove (6-15 m)
S86	7/15/2009	Sombrero Key SPA	24° 37.495	81° 06.620	Low-relief spur and groove (6-15 m)
S60	7/15/2009	NE of Delta Shoal	24° 38.873	81° 04.645	Offshore patch reef
S62	7/16/2009	Coffins Patch SPA	24° 40.879	80° 58.314	Offshore patch reef
S63	7/16/2009	Coffins Patch SPA	24° 40.948	80° 58.391	Offshore patch reef
S69	7/16/2009	Coffins Patch SPA	24° 41.156	80° 57.792	Offshore patch reef
S70	7/16/2009	Coffins Patch SPA	24° 41.175	80° 57.726	Offshore patch reef
S81	7/17/2009	SW of Coffins Patch	24° 39.797	80° 59.278	Low-relief spur and groove (6-15 m)
S64	7/17/2009	South of Coffins Patch	24° 40.469	80° 57.579	Offshore patch reef
S61	7/17/2009	West Turtle Shoal	24° 42.096	80° 57.862	Offshore patch reef
S58	7/17/2009	Marker 48	24° 41.590	81° 01.212	Mid-channel patch reef
S73	7/18/2009	East of Delta Shoal	24° 39.244	81° 01.221	Low-relief hard-bottom (6-15 m)
S77	7/18/2009	Delta Shoal	24° 37.975	81° 05.257	High-relief spur and groove
S76	7/18/2009	Delta Shoal	24° 37.909	81° 05.524	High-relief spur and groove
T24	7/25/2009	North of Carysfort Reef	25° 14.218	80° 12.740	Offshore patch reef
T48	7/25/2009	North of Carysfort Reef	25° 14.272	80° 12.288	Patchy hard-bottom (6-15 m)
T37	7/25/2009	South Carysfort Reef	25° 12.412	80° 13.269	High-relief spur and groove
T38	7/25/2009	Carysfort Reef	25° 13.333	80° 12.617	High-relief spur and groove
T25	7/26/2009	North of Carysfort Reef	25° 14.060	80° 12.320	Low-relief hard-bottom (6-15 m)
T27	7/26/2009	Carysfort Reef	25° 13.707	80° 12.226	Low-relief hard-bottom (6-15 m)
T26	7/26/2009	Carysfort Reef	25° 13.069	80° 12.524	Low-relief hard-bottom (6-15 m)
T35	7/26/2009	South of South Carysfort	25° 11.940	80° 13.539	High-relief spur and groove
T50	7/27/2009	Carysfort Reef	25° 12.263	80° 13.302	Low-relief spur and groove (6-15 m)
T51	7/27/2009	Carysfort Reef	25° 13.541	80° 12.435	Low-relief spur and groove (6-15 m)
T19	7/27/2009	Carysfort Reef	25° 14.104	80° 12.794	Offshore patch reef
T20	7/28/2009	Carysfort Reef	25° 12.283	80° 13.720	Offshore patch reef
T18	7/28/2009	Watson's Reef	25° 10.925	80° 15.866	Low-relief hard-bottom (< 6 m)
T07	7/28/2009	SW of Watson's Reef	25° 10.263	80° 15.516	Offshore patch reef
T31	7/29/2009	South of Watson's Reef	25° 10.694	80° 15.218	Offshore patch reef
T06	7/29/2009	West of Elbow Reef	25° 09.251	80° 16.131	Offshore patch reef
T10	7/29/2009	North-North Dry Rocks	25° 08.195	80° 17.385	Inner line reef tract
T13	7/30/2009	Key Largo Dry Rocks	25° 07.462	80° 17.849	Inner line reef tract
T12	7/30/2009	Key Largo Dry Rocks	25° 07.362	80° 17.854	Inner line reef tract
T15	7/30/2009	Grecian Rocks	25° 06.630	80° 18.231	Inner line reef tract
T14	7/30/2009	Grecian Rocks	25° 06.551	80° 18.364	Inner line reef tract
T08	7/31/2009	West of Dry Rocks SPA	25° 07.697	80° 17.983	Offshore patch reef
T09	7/31/2009	South of Dry Rocks SPA	25° 07.340	80° 18.120	Offshore patch reef
S90	7/31/2009	Mosquito Bank	25° 03.989	80° 22.357	Mid-channel patch reef
U42	8/09/2009	East of Coffins Patch	24° 41.847	80° 57.479	Offshore patch reef
S65	8/09/2009	SE of Coffins Patch	24° 41.839	80° 55.920	Low-relief hard-bottom (< 6 m)
S75	8/09/2009	Marker 20	24° 40.732	80° 56.746	Low-relief hard-bottom (6-15 m)
S59	8/09/2009	East Turtle Shoal	24° 43.228	80° 55.711	Mid-channel patch reef
S82	8/10/2009	Tennessee Reef	24° 45.532	80° 45.903	Low-relief spur and groove (6-15 m)

Site #	Date	Site location	Latitude (N)	Longitude (W)	Habitat type
S83	8/10/2009	Tennessee Reef RO	24° 45.741	80° 45.436	Low-relief spur and groove (6-15 m)
S84	8/10/2009	Tennessee Reef RO	24° 45.992	80° 45.106	Low-relief spur and groove (6-15 m)
S67	8/10/2009	Tennessee Reef RO	24° 45.992	80° 45.252	Low-relief hard-bottom (< 6 m)
S68	8/11/2009	Tennessee Reef RO	24° 45.924	80° 45.335	Low-relief hard-bottom (< 6 m)
S66	8/11/2009	Tennessee Reef	24° 46.993	80° 45.770	Low-relief hard-bottom (< 6 m)
T16	8/11/2009	West of Alligator Reef	24° 49.138	80° 41.007	Low-relief hard-bottom (< 6 m)
T56	8/11/2009	Alligator Reef	24° 50.653	80° 37.465	Low-relief spur and groove (6-15 m)
T57	8/12/2009	Alligator Reef	24° 50.763	80° 37.270	Low-relief spur and groove (6-15 m)
T45	8/12/2009	Alligator Reef	24° 50.734	80° 37.439	Low-relief hard-bottom (< 6 m)
T46	8/12/2009	Alligator Reef	24° 50.826	80° 37.307	Low-relief hard-bottom (< 6 m)
S97	8/13/2009	Cheeca Rocks	24° 54.282	80° 36.933	Mid-channel patch reef
S96	8/13/2009	Cheeca Rocks	24° 54.261	80° 37.085	Mid-channel patch reef
T54	8/13/2009	Davis Reef	24° 55.259	80° 30.341	Low-relief spur and groove (6-15 m)
T55	8/13/2009	Davis Reef	24° 55.343	80° 30.270	Low-relief spur and groove (6-15 m)
T36	8/13/2009	Davis Reef	24° 55.356	80° 30.341	Low-relief hard-bottom (< 6 m)
V03	8/14/2009	Davis Reef	24° 55.352	80° 30.348	Low-relief hard-bottom (< 6 m)
T47	8/14/2009	Little Conch Reef	24° 55.939	80° 29.534	Low-relief hard-bottom (6-15 m)
S94	8/14/2009	Hen and Chickens Reef	24° 56.026	80° 33.087	Mid-channel patch reef
S95	8/14/2009	Hen and Chickens Reef	24° 56.143	80° 32.924	Mid-channel patch reef
S89	8/15/2009	Mosquito Bank	25° 03.741	80° 22.637	Mid-channel patch reef
T03	8/15/2009	White Bank	25° 02.490	80° 22.832	Offshore patch reef
T05	8/15/2009	White Bank	25° 02.555	80° 22.286	Offshore patch reef
T21	8/22/2009	Conch Reef	24° 57.135	80° 27.572	Low-relief hard-bottom (< 6 m)
T22	8/22/2009	Conch Reef	24° 57.385	80° 27.442	Low-relief hard-bottom (< 6 m)
T32	8/22/2009	Pickles Reef	24° 59.251	80° 24.866	High-relief spur and groove
T33	8/22/2009	Sand Island	25° 01.096	80° 22.067	High-relief spur and groove
T43	8/23/2009	Molasses Reef	25° 00.536	80° 22.568	High-relief spur and groove
T44	8/23/2009	Molasses Reef	25° 00.671	80° 22.384	High-relief spur and groove
T28	8/23/2009	Molasses Reef	25° 00.654	80° 22.597	Low-relief hard-bottom (< 6 m)
T29	8/23/2009	Molasses Reef	25° 00.768	80° 22.388	Low-relief hard-bottom (< 6 m))
T23	8/29/2009	Little Conch Reef	24° 56.344	80° 28.708	Low-relief spur and groove (6-15 m)
T52	8/29/2009	Conch Reef	24° 57.068	80° 27.513	Low-relief spur and groove (6-15 m)
T53	8/29/2009	Conch Reef	24° 57.338	80° 27.389	Low-relief spur and groove (6-15 m)
T04	8/29/2009	Inshore of Sand Island	25° 01.488	80° 22.848	Offshore patch reef
V09	8/30/2009	Conch Reef	24° 56.979	80° 27.351	Low-relief spur and groove (6-15 m)
V10	8/30/2009	Conch Reef	24° 57.006	80° 27.265	Low-relief spur and groove (6-15 m)
U98	8/30/2009	Pickles Reef	24° 59.117	80° 24.844	Low-relief spur and groove (6-15 m)
T41	8/30/2009	French Reef	25° 02.029	80° 20.999	High-relief spur and groove
T40	9/05/2009	Elbow Reef	25° 08.627	80° 15.439	High-relief spur and groove
T39	9/05/2009	Elbow Reef	25° 08.458	80° 15.553	High-relief spur and groove)
T30	9/05/2009	South of Elbow Reef	25° 07.888	80° 16.575	Patchy hard-bottom (6-15 m)
T42	9/05/2009	French Reef	25° 02.103	80° 20.861	High-relief spur and groove
U84	9/06/2009	North of Dixie Shoal	25° 06.060	80° 18.262	Low-relief hard-bottom (6-15 m)
U87	9/06/2009	Dixie Shoal	25° 03.739	80° 19.682	Low-relief hard-bottom (6-15 m)
T17	9/06/2009	North of French Reef	25° 02.416	80° 20.699	Low-relief hard-bottom (< 6 m))
T34	9/06/2009	Sand Island	25° 01.141	80° 22.019	High-relief spur and groove

Table 2-3. Site locations and physical data for benthic coral reef organism surveys in the Florida Keys National Marine Sanctuary during May-September 2009. Sites are arranged from southwest to northeast by habitat type. Asterisked sites (**) are Sanctuary Preservation Areas (SPA), Ecological Reserves (ER), or Research Only Areas (RO). Mean $\pm$ 1 SE transect depth and maximum vertical relief are based upon surveys of four 15-m x 1-m transects per site.

Site number/site location	Latitude (N)	Longitude (W)	Mean depth (m)	Max. vertical relief (cm)
<i>Inshore patch reefs</i>				
Lower Florida Keys				
S01 – SE of Ballast Key	24° 30.796	81° 57.150	4.0 $\pm$ 0.1	79 $\pm$ 23
S02 – South of Sugarloaf Creek	24° 35.250	81° 34.705	3.2 $\pm$ 0.1	118 $\pm$ 12
S03 – Newfound Harbor SPA**	24° 36.938	81° 23.621	2.5 $\pm$ 0.0	107 $\pm$ 13
S04 – Newfound Harbor SPA**	24° 36.985	81° 23.480	2.6 $\pm$ 0.0	112 $\pm$ 8
Lower Florida Keys Total (4)			3.1 $\pm$ 0.4	104 $\pm$ 9
Inshore Patch Reef Total (4)			3.1 $\pm$ 0.4	104 $\pm$ 9
<i>Mid-channel patch reefs</i>				
Lower Florida Keys				
S12 - Western Sambo ER**	24° 29.382	81° 43.572	5.3 $\pm$ 0.0	44 $\pm$ 3
S13 - Western Sambo ER**	24° 30.012	81° 43.131	6.0 $\pm$ 0.3	88 $\pm$ 19
S05 - North of Middle Sambo Reef	24° 31.471	81° 40.594	5.0 $\pm$ 0.2	75 $\pm$ 20
S06 - North of Pelican Shoal	24° 31.826	81° 38.342	4.5 $\pm$ 0.0	41 $\pm$ 5
U04 - North of Pelican Shoal	24° 31.975	81° 37.317	6.0 $\pm$ 0.1	57 $\pm$ 2
S07 - West Washerwoman Shoal	24° 32.579	81° 36.553	6.6 $\pm$ 0.1	69 $\pm$ 13
S08 - West Washerwoman Shoal	24° 32.584	81° 35.990	5.6 $\pm$ 0.1	77 $\pm$ 15
S09 - North of Maryland Shoal	24° 32.725	81° 33.831	5.9 $\pm$ 0.0	43 $\pm$ 7
S10 - North of American Shoal	24° 33.166	81° 31.200	8.4 $\pm$ 0.1	35 $\pm$ 5
S11 - North of American Shoal	24° 34.823	81° 27.895	6.4 $\pm$ 0.1	80 $\pm$ 10
Lower Florida Keys Total (10)			6.0 $\pm$ 0.3	61 $\pm$ 6
Middle Florida Keys				
U40 - Marker 49A	24° 37.493	81° 14.087	5.4 $\pm$ 0.2	89 $\pm$ 12
S58 - Marker 48	24° 41.590	81° 01.212	5.6 $\pm$ 0.2	149 $\pm$ 20
S59 - East Turtle Shoal	24° 43.228	80° 55.711	4.1 $\pm$ 0.2	41 $\pm$ 4
S96 - Cheeca Rocks SPA**	24° 54.261	80° 37.085	4.1 $\pm$ 0.1	95 $\pm$ 6
S97 - Cheeca Rocks SPA**	24° 54.282	80° 36.933	3.4 $\pm$ 0.1	175 $\pm$ 14
S94 - Hen and Chickens Reef SPA**	24° 56.026	80° 33.087	4.8 $\pm$ 0.2	263 $\pm$ 24
S95 - Hen and Chickens Reef SPA**	24° 56.143	80° 32.924	5.8 $\pm$ 0.1	159 $\pm$ 23
Middle Florida Keys Total (7)			4.8 $\pm$ 0.3	138 $\pm$ 27
Upper Florida Keys				
S89 - Mosquito Bank	25° 03.741	80° 22.637	3.0 $\pm$ 0.1	70 $\pm$ 7
S90 - Mosquito Bank	25° 03.989	80° 22.357	2.6 $\pm$ 0.0	70 $\pm$ 8
S91 - Basin Hill Shoals	25° 14.298	80° 15.756	3.6 $\pm$ 0.1	51 $\pm$ 5
S92 - Basin Hill Shoals	25° 14.140	80° 14.659	1.6 $\pm$ 0.1	48 $\pm$ 11
S93 - Turtle Rocks	25° 16.630	80° 13.593	2.9 $\pm$ 0.0	35 $\pm$ 4
Upper Florida Keys Total (5)			2.7 $\pm$ 0.3	55 $\pm$ 7
Mid-channel Patch Reef Total (22)			4.9 $\pm$ 0.3	84 $\pm$ 12
<i>Offshore patch reefs</i>				
Lower Florida Keys				
S14 - North of Sand Key	24° 27.955	81° 54.612	11.2 $\pm$ 0.3	80 $\pm$ 7
S15 - North of Sand Key	24° 27.416	81° 53.833	6.7 $\pm$ 0.2	125 $\pm$ 5
S16 - North of Sand Key	24° 28.314	81° 53.614	8.5 $\pm$ 0.1	192 $\pm$ 35
S19 - Western Sambo ER**	24° 29.394	81° 43.582	9.6 $\pm$ 0.1	58 $\pm$ 8
S20 - Western Sambo ER**	24° 29.911	81° 41.785	8.0 $\pm$ 0.1	61 $\pm$ 15
U12 - West of Looe Key RO	24° 33.866	81° 23.768	8.1 $\pm$ 0.2	86 $\pm$ 9
S17 - Looe Key RO**	24° 33.923	81° 23.646	8.5 $\pm$ 0.1	71 $\pm$ 8
S18 - Looe Key RO**	24° 34.103	81° 23.070	6.5 $\pm$ 0.1	113 $\pm$ 13
Lower Florida Keys Total (8)			8.4 $\pm$ 0.5	98 $\pm$ 16

Site number/site location	Latitude (N)	Longitude (W)	Mean depth (m)	Max. vertical relief (cm)
Middle Florida Keys				
S60 - NE of Delta Shoal	24° 38.873	81° 04.645	6.0 ± 0.0	37 ± 4
S61 - West Turtle Shoal	24° 42.096	80° 57.862	5.2 ± 0.1	66 ± 12
S63 - Coffins Patch SPA**	24° 40.948	80° 58.391	4.7 ± 0.1	45 ± 2
S62 - Coffins Patch SPA**	24° 40.879	80° 58.314	6.4 ± 0.1	44 ± 6
S69 - Coffins Patch SPA**	24° 41.156	80° 57.792	3.6 ± 0.1	49 ± 8
S70 - Coffins Patch SPA**	24° 41.175	80° 57.726	5.1 ± 0.1	61 ± 14
S64 - South of Coffins Patch	24° 40.469	80° 57.579	5.7 ± 0.1	25 ± 4
U42 - East of Coffins Patch	24° 41.847	80° 57.479	6.0 ± 0.1	40 ± 4
Middle Florida Keys Total (8)			5.3 ± 0.3	46 ± 5
Upper Florida Keys				
S99 - Wolf Reef	25° 01.311	80° 23.774	5.0 ± 0.1	77 ± 25
T04 - Inshore of Sand Island	25° 01.488	80° 22.848	8.6 ± 0.1	50 ± 2
T03 - White Bank	25° 02.490	80° 22.832	3.2 ± 0.0	31 ± 7
T05 - White Bank	25° 02.555	80° 22.286	3.8 ± 0.1	47 ± 3
T09 - South of Key Largo Dry Rocks	25° 07.340	80° 18.120	5.8 ± 0.1	53 ± 5
T08 - West of Key Largo Dry Rocks	25° 07.697	80° 17.983	5.9 ± 0.1	66 ± 10
T06 - West of Elbow Reef	25° 09.251	80° 16.131	5.3 ± 0.1	56 ± 6
T07 - SW of Watson's Reef	25° 10.263	80° 15.516	5.4 ± 0.2	48 ± 4
T31 - South of Watson's Reef	25° 10.694	80° 15.218	7.2 ± 0.2	70 ± 7
T20 - Carysfort Reef SPA**	25° 12.283	80° 13.720	5.3 ± 0.0	46 ± 7
T19 - Carysfort Reef SPA**	25° 14.104	80° 12.794	6.9 ± 0.3	75 ± 9
T24 - North of Carysfort Reef	25° 14.218	80° 12.740	9.1 ± 0.1	69 ± 2
Upper Florida Keys Total (12)			6.0 ± 0.5	57 ± 4
Offshore Patch Reef Total (28)			6.5 ± 0.4	66 ± 6
<i>Low-relief hard-bottom (< 6 m)</i>				
Lower Florida Keys				
S21 - East of Eastern Dry Rocks SPA	24° 28.531	81° 49.855	5.6 ± 0.0	23 ± 0
S22 - West of Looe Key SPA	24° 33.216	81° 26.431	7.8 ± 0.0	31 ± 2
Lower Florida Keys Total (2)			6.7 ± 1.1	27 ± 4
Middle Florida Keys				
S65 - SE of Coffins Patch	24° 41.839	80° 55.920	5.7 ± 0.0	32 ± 1
S66 - Tennessee Reef	24° 46.993	80° 45.770	5.5 ± 0.1	53 ± 4
S68 - Tennessee Reef RO**	24° 45.924	80° 45.335	5.6 ± 0.1	37 ± 4
S67 - Tennessee Reef RO**	24° 45.992	80° 45.252	5.3 ± 0.0	33 ± 5
T16 - West of Alligator Reef	24° 49.138	80° 41.007	5.8 ± 0.1	18 ± 3
T45 - Alligator Reef SPA**	24° 50.734	80° 37.439	5.8 ± 0.1	30 ± 5
T46 - Alligator Reef SPA**	24° 50.826	80° 37.307	5.0 ± 0.1	35 ± 3
V03 - Davis Reef SPA**	24° 55.352	80° 30.348	6.5 ± 0.0	73 ± 15
T36 - Davis Reef SPA**	24° 55.356	80° 30.341	7.1 ± 0.0	58 ± 13
T21 - Conch Reef SPA**	24° 57.135	80° 27.572	5.2 ± 0.0	43 ± 3
T22 - Conch Reef SPA**	24° 57.385	80° 27.442	5.9 ± 0.1	82 ± 27
Middle Florida Keys Total (11)			5.7 ± 0.2	45 ± 6
Upper Florida Keys				
T28 - Molasses Reef SPA**	25° 00.654	80° 22.597	3.5 ± 0.0	53 ± 7
T29 - Molasses Reef SPA**	25° 00.768	80° 22.388	2.3 ± 0.1	56 ± 11
T17 - North of French Reef	25° 02.416	80° 20.699	4.1 ± 0.1	36 ± 9
T18 - Watson's Reef	25° 10.925	80° 15.866	4.8 ± 0.2	58 ± 9
Upper Florida Keys Total (4)			3.7 ± 0.5	51 ± 5
Shallow Hard-bottom Total (17)			5.4 ± 0.3	44 ± 4
<i>High-relief spur & groove</i>				
Lower Florida Keys				
S32 - Western Dry Rocks	24° 26.706	81° 55.632	2.9 ± 0.3	91 ± 19
S46 - Sand Key SPA**	24° 27.119	81° 52.778	4.5 ± 0.1	111 ± 32
S47 - Sand Key SPA**	24° 27.123	81° 52.666	3.6 ± 0.1	80 ± 21
S44 - Rock Key SPA**	24° 27.284	81° 51.562	3.4 ± 0.5	69 ± 3
S45 - Rock Key SPA**	24° 27.278	81° 51.457	3.4 ± 0.4	97 ± 23

Site number/site location	Latitude (N)	Longitude (W)	Mean depth (m)	Max. vertical relief (cm)
S42 - Eastern Dry Rocks SPA**	24° 27.548	81° 50.732	5.1 ± 0.4	83 ± 9
S43 - Eastern Dry Rocks SPA**	24° 27.560	81° 50.655	2.7 ± 0.3	82 ± 20
S40 - Western Sambo ER**	24° 28.800	81° 42.885	3.3 ± 0.2	100 ± 20
S41 - Western Sambo ER**	24° 28.795	81° 42.858	2.9 ± 0.1	83 ± 3
S33 - Middle Sambo Reef	24° 29.336	81° 40.442	2.5 ± 0.2	99 ± 30
S38 - Eastern Sambo RO**	24° 29.509	81° 39.789	3.3 ± 0.3	114 ± 22
S39 - Eastern Sambo RO**	24° 29.561	81° 39.657	3.3 ± 0.3	94 ± 23
U15 - No Name Reef	24° 29.752	81° 38.889	3.8 ± 0.1	83 ± 19
S24 - East of Eastern Sambo RO	24° 29.930	81° 38.878	4.1 ± 0.0	82 ± 22
U24 - Pelican Shoal	24° 30.828	81° 37.789	3.7 ± 0.3	95 ± 10
U23 - Maryland Shoal	24° 30.668	81° 34.129	5.1 ± 0.1	50 ± 9
S34 - Maryland Shoal	24° 30.688	81° 34.033	6.8 ± 0.1	64 ± 21
S35 - American Shoal	24° 31.399	81° 30.988	5.9 ± 0.2	40 ± 2
S36 - Looe Key SPA**	24° 32.699	81° 24.507	5.5 ± 0.1	141 ± 21
S37 - Looe Key SPA**	24° 32.734	81° 24.354	6.4 ± 0.3	168 ± 19
Lower Florida Keys Total (20)			4.1 ± 0.3	91 ± 6
Middle Florida Keys				
S78 - Sombrero Key SPA**	24° 37.555	81° 6.730	5.2 ± 0.3	125 ± 22
S79 - Sombrero Key SPA**	24° 37.587	81° 6.581	3.4 ± 0.2	134 ± 38
S76 - Delta Shoal	24° 37.909	81° 5.524	4.3 ± 0.1	108 ± 25
S77 - Delta Shoal	24° 37.975	81° 5.257	4.5 ± 0.1	31 ± 7
Middle Florida Keys Total (4)			4.4 ± 0.4	99 ± 23
Upper Florida Keys				
T32 - Pickles Reef	24° 59.251	80° 24.866	3.6 ± 0.1	55 ± 6
T43 - Molasses Reef SPA**	25° 00.536	80° 22.568	4.1 ± 0.1	188 ± 21
T44 - Molasses Reef SPA**	25° 00.671	80° 22.384	3.5 ± 0.1	88 ± 14
T33 - Sand Island	25° 01.096	80° 22.067	4.1 ± 0.2	138 ± 26
T34 - Sand Island	25° 01.141	80° 22.019	4.9 ± 0.3	101 ± 3
T41 - French Reef SPA**	25° 02.029	80° 20.999	6.6 ± 0.2	54 ± 3
T42 - French Reef SPA**	25° 02.103	80° 20.861	7.3 ± 0.2	55 ± 10
T14 - Grecian Rocks SPA**	25° 06.551	80° 18.364	2.2 ± 0.1	86 ± 15
T15 - Grecian Rocks SPA**	25° 06.630	80° 18.231	3.8 ± 0.2	85 ± 25
T12 - Key Largo Dry Rocks SPA**	25° 07.362	80° 17.854	3.6 ± 0.5	135 ± 21
T13 - Key Largo Dry Rocks SPA**	25° 07.462	80° 17.849	4.1 ± 0.1	97 ± 13
T10 - North-North Dry Rocks	25° 08.195	80° 17.385	3.9 ± 0.2	118 ± 32
T39 - Elbow Reef SPA**	25° 08.458	80° 15.553	5.3 ± 0.3	160 ± 13
T40 - Elbow Reef SPA**	25° 08.627	80° 15.439	7.3 ± 0.2	112 ± 20
T35 - South of South Carysfort	25° 11.940	80° 13.539	3.8 ± 0.1	71 ± 11
T37 - South Carysfort Reef SPA**	25° 12.412	80° 13.269	4.8 ± 0.1	137 ± 20
T38 - Carysfort Reef SPA**	25° 13.333	80° 12.617	3.9 ± 0.2	134 ± 25
T11 - North of Turtle Reef	25° 18.149	80° 12.821	4.3 ± 0.1	103 ± 23
Upper Florida Keys Total (20)			4.5 ± 0.3	106 ± 9
High-relief Spur & Groove Total (42)			4.3 ± 0.2	98 ± 5
<i>Deeper Fore-reef (6-15 m)</i>				
Lower Florida Keys				
U19 - Sand Key SPA**	24° 27.070	81° 52.862	10.3 ± 0.1	56 ± 4
S27 - Sand Key SPA**	24° 27.113	81° 52.537	9.6 ± 0.1	64 ± 6
S23 - East of Rock Key SPA	24° 27.783	81° 51.098	6.2 ± 0.0	37 ± 2
S54 - Western Sambo ER**	24° 28.657	81° 43.536	12.0 ± 0.1	82 ± 7
S55 - Western Sambo ER**	24° 28.720	81° 43.138	9.7 ± 0.1	95 ± 16
S48 - East of Western Sambo ER	24° 29.065	81° 41.636	6.8 ± 0.0	36 ± 4
S49 - Middle Sambo Reef	24° 29.228	81° 40.509	10.7 ± 0.0	55 ± 5
S52 - Eastern Sambo RO**	24° 29.419	81° 39.885	9.3 ± 0.1	72 ± 3
S53 - Eastern Sambo RO**	24° 29.410	81° 39.779	11.0 ± 0.1	66 ± 6
U22 - West of Pelican Shoal	24° 30.008	81° 38.237	7.5 ± 0.0	57 ± 13
S30 - East of Pelican Shoal	24° 30.442	81° 36.624	9.6 ± 0.3	93 ± 18
S31 - East of Maryland Shoal	24° 31.028	81° 32.962	8.9 ± 0.1	79 ± 5
S51 - American Shoal	24° 31.382	81° 30.724	9.4 ± 0.1	41 ± 3

Site number/site location	Latitude (N)	Longitude (W)	Mean depth (m)	Max. vertical relief (cm)
S50 - American Shoal	24° 31.376	81° 30.656	10.1 ± 0.1	87 ± 19
Lower Florida Keys Total (14)			9.4 ± 0.4	65 ± 5
Middle Florida Keys				
S71 - South of Bahia Honda	24° 35.656	81° 13.359	9.9 ± 0.1	53 ± 7
S80 - West of Sombrero Key	24° 36.415	81° 10.995	9.2 ± 0.1	37 ± 16
S74 - West of Sombrero Key	24° 36.769	81° 09.775	8.5 ± 0.0	47 ± 9
S72 - West of Sombrero Key	24° 37.389	81° 07.881	8.7 ± 0.0	34 ± 5
S86 - Sombrero Key SPA	24° 37.495	81° 06.620	9.6 ± 0.0	23 ± 4
S85 - Sombrero Key SPA	24° 37.534	81° 06.449	10.2 ± 0.0	39 ± 4
S73 - East of Delta Shoal	24° 39.244	81° 01.221	6.9 ± 0.0	34 ± 5
S81 - SW of Coffins Patch	24° 39.797	80° 59.278	10.6 ± 0.0	32 ± 1
S75 - Marker 20	24° 40.732	80° 56.746	9.4 ± 0.1	61 ± 14
S82 - Tennessee Reef	24° 45.532	80° 45.903	7.6 ± 0.0	27 ± 5
S83 - Tennessee Reef RO**	24° 45.741	80° 45.436	9.9 ± 0.2	32 ± 2
S84 - Tennessee Reef RO**	24° 45.992	80° 45.106	9.1 ± 0.0	52 ± 9
T56 - Alligator Reef SPA**	24° 50.653	80° 37.465	9.3 ± 0.0	31 ± 2
T57 - Alligator Reef SPA**	24° 50.763	80° 37.270	8.8 ± 0.1	28 ± 1
T54 - Davis Reef SPA**	24° 55.259	80° 30.341	10.4 ± 0.1	25 ± 2
T55 - Davis Reef SPA**	24° 55.343	80° 30.270	10.2 ± 0.0	23 ± 1
T47 - Little Conch Reef	24° 55.939	80° 29.534	7.7 ± 0.1	51 ± 4
T23 - Little Conch Reef	24° 56.344	80° 28.708	8.3 ± 0.3	40 ± 4
T52 - Conch Reef SPA**	24° 57.068	80° 27.513	9.8 ± 0.2	43 ± 9
T53 - Conch Reef SPA**	24° 57.338	80° 27.389	10.1 ± 0.0	27 ± 10
V09 - Conch Reef RO**	24° 56.979	80° 27.351	11.8 ± 0.1	43 ± 12
V10 - Conch Reef RO**	24° 57.006	80° 27.265	12.3 ± 0.1	49 ± 2
Middle Florida Keys Total (22)			9.5 ± 0.3	38 ± 2
Upper Florida Keys				
U98 - Pickles Reef	24° 59.117	80° 24.844	11.1 ± 0.1	34 ± 1
U87 - Dixie Shoal	25° 03.739	80° 19.682	7.3 ± 0.1	56 ± 6
U84 - North of Dixie Shoal	25° 06.060	80° 18.262	9.0 ± 0.0	40 ± 2
T30 - South of Elbow Reef	25° 07.888	80° 16.575	10.0 ± 0.0	33 ± 2
T50 - Carysfort Reef SPA**	25° 12.263	80° 13.302	10.3 ± 0.3	49 ± 8
T26 - Carysfort Reef SPA**	25° 13.069	80° 12.524	7.0 ± 0.0	48 ± 7
T51 - Carysfort Reef SPA**	25° 13.541	80° 12.435	9.2 ± 0.0	27 ± 4
T27 - Carysfort Reef SPA**	25° 13.707	80° 12.226	8.1 ± 0.1	42 ± 7
T25 - North of Carysfort Reef	25° 14.060	80° 12.320	8.6 ± 0.1	43 ± 7
T48 - North of Carysfort Reef	25° 14.272	80° 12.288	11.1 ± 0.1	75 ± 14
T49 - SE of Turtle Rocks	25° 15.911	80° 11.094	8.3 ± 0.3	54 ± 13
Upper Florida Keys Total (11)			9.1 ± 0.4	46 ± 4
Deeper Fore-reef Total (47)			9.3 ± 0.2	48 ± 3

Table 2-4. SCUBA diving effort for benthic coral reef surveys in the Florida Keys National Marine Sanctuary during May-September 2009.

Scientific Diver	Affiliation	No. of dives	Depth range (m)	Bottom time
Mark Chiappone	CMS/UNCW	169	1.8-13.1 m	231 hr 20 min
Leanne Rutten	CMS/UNCW	166	2.1-13.1 m	234 hr 20 min
Thor Dunmire	CMS/UNCW	143	2.7-13.1 m	200 hr 46 min
Nancy Sheridan	FWRI/FWCC	27	3.0-10.7 m	33 hr 52 min
Total all divers		505	0.5-16.8 m	700 hr 18 min

III. Species Richness and Benthic Cover

Background

The most species-rich marine communities probably occur on coral reefs and this pattern is at least partly due to the diversity of available habitats and the degree to which species are ecologically restricted to particular niches. Coral reefs in the Indo-Pacific and Caribbean in particular are usually thought to hold the greatest diversity of marine life at several levels of biological diversity. Diversity on coral reefs is strongly influenced by environmental conditions and geographic location, and variations in diversity can be correlated with differences in reef structure. For example, shallow and mid-depth fore-reef habitats in the Caribbean were historically dominated by largely mono-specific zones of just two *Acropora* species, while the Indo-Pacific has a much greater number of coral species and growth forms.

Coral reefs are in a state of decline worldwide from multiple stressors, including physical impacts to habitat, changes in water quality, overfishing, disease outbreaks, and climate change. Coral reefs in a degraded state are often characterized by one or more signs, including low abundances of top-level predators, herbivores, and reef-building corals, but higher abundances of non-hermatypic organisms such as seaweeds. For the Florida Keys, there is little doubt that areas historically dominated by *Acropora* corals, particularly the shallow (< 6 m) and deeper (8-15 m) fore reef, have changed substantially, largely due to Caribbean-wide disease events and bleaching. However, debate continues regarding other causes of coral reef decline, thus often making it difficult for resource managers to determine which courses of action to take to minimize localized threats in lieu of larger-scale factors such as climate change.

The results described below summarize observations of species richness of stony corals, gorgonians, and sponges, as well as patterns of benthic cover of major biotic components (corals, sponges, *Palythoa*, algae) from surveys of 160 sites in the Florida Keys during 2009. Similar surveys of species richness and benthic cover were conducted in 1999-2001 (211 sites) and 1995 (195 sites) in the Florida Keys. In addition, we surveyed stony coral species richness at 235 sites during 2007 from the northern terminus of Biscayne National Park to Satan Shoal west of Key West. Species richness and cover tend to be two of the more commonly measured metrics during coral reef assessment and monitoring, so they have been included in our overall sampling design for comparative purposes, but we also measure many other parameters (see chapters 4-8). Our purpose here is to illustrate the following patterns. First, the pool of stony coral species in the Florida Keys is representative of the Caribbean and species that have suffered declines are still present in particular habitats. Secondly, habitat cross-shelf position, reflecting variations in shore distance, depth, and topographic complexity, varies tremendously and has a significant effect on species richness and coverage patterns. Third, certain habitats under-sampled or ignored in historical and

ongoing Florida Keys monitoring programs yield relatively high species richness and/or coral cover, some of which are relatively close to shore and contrast with both spatial and temporal patterns of coral reef benthic organisms along the main reef tract. Finally, the significant spatial variation in stony coral richness and cover has implications for reporting “average” reef status and underscores the significant reef-to-reef variability and provides a cautionary note about extrapolating results from a few locations to the entire system (e.g. Murdoch and Aronson 1999; Somerfield et al. 2008).

2009 Species Richness

Species richness surveys consisted of assessments of the presence-absence of all stony coral, gorgonian, and sponge taxa in four 15-m x 1-m belt transects per site. Data presented below for richness are reported as the total numbers of species recorded from 60-m² sampling areas per site. Table 3-1 provides site-level species richness data for stony corals, gorgonians, and sponges for the 160 sites surveyed in 2009.

A total of 43 taxa (species, subspecies, and morphotypes) of stony corals among the Orders Milleporina and Scleractinia were recorded during 2009, with a range of five to 26 species per 60 m² sampling area per site. Figures 3-1 to 3-6 illustrate the geographic patterns in stony coral site species richness throughout the Florida Keys sampling area, while figures 3-7 and 3-8 illustrate stony coral site species richness patterns among sites by region and management zone. Similar to surveys in previous years, mid-channel (19.0 ± 0.6 species per site) and offshore patch reefs (16.0 ± 0.9) yielded the greatest mean coral species richness, while inshore patch reefs (12.0 ± 3.5) and shallow spur and groove (12.1 ± 0.5) yielded the fewest species (Table 3-1). Regional patterns in coral species richness were specific to particular habitat types. On mid-channel patch reefs, there was slightly higher site species richness (20.4 ± 0.7 species per site) in the lower Keys compared to the middle Keys (17.9 ± 0.7) and upper Keys (17.8 ± 1.7) (Figure 3-2). A similar pattern was evident for offshore patch reefs, where species richness (21.6 ± 1.1 species per site) was greater in the lower Keys compared to the middle Keys (13.6 ± 1.5) and upper Keys (13.8 ± 0.9), as well as the deeper fore reef. In contrast, coral species richness on high-relief spur and groove reefs was greater in the middle Keys (14.8 ± 1.1 species per site) compared to the lower Keys (12.0 ± 0.7) and upper Keys (11.7 ± 0.9) (Figure 3-3). By management zone, stony coral species richness was generally similar between no-take zones and reference areas for most habitat types (Table 3-1). On inshore patch reefs, however, reference sites had roughly three times the site species richness (17-19 species per 60 m²) compared to Newfound Harbor SPA (6 species per 60 m²). On high-relief spur and groove reefs in the lower Keys, Looe Key SPA (18-19 species per 60 m²) had higher species richness than reference areas and other no-take zones in the region.

A total of 31 gorgonian taxa were recorded from the 160 sites, with a range of two to 25 species per 60 m² per site (Table 3-1). Figures 3-9 to 3-14 illustrate the geographic patterns in gorgonian site species richness and figures 3-15 and 3-16 compare gorgonian site species richness among sites by region and management zone. Gorgonian species richness among habitats was similar to coral richness, with greater mean richness on offshore patch reefs (19.0 ± 0.5 species per site) and the deeper fore reef (18.8 ± 0.4), and lowest on inshore patch reefs (5.5 ± 2.0) and high-relief spur and groove (13.6 ± 0.5) (Table 3-1). Regional and management zone variations in gorgonian species richness were specific to particular habitat types (Figures 3-15 and 3-16). Inshore patch reefs within the Newfound Harbor SPA (2-3 species) yielded lower gorgonian richness compared to reference areas (6-11 species). On mid-channel patch reefs, gorgonian species richness was lower in the middle Keys (12.9 ± 2.1 species per site) compared to the lower Keys (18.2 ± 1.7) and upper Keys (19.6 ± 0.8); this patterns reflects the relatively few gorgonians at Cheeca Rocks SPA (5-7 species) and Hen and Chickens SPA (12-13 species) (Table 3-1).

A total of 82 sponge taxa were identified during 2009, with a range of one to 46 species per site (Table 3-1). Figures 3-17 to 3-22 illustrate the geographic patterns in sponge site species richness in the Florida Keys study area, while figures 3-23 and 3-24 illustrate sponge site species richness among sites by region and management zone. Relative to stony corals and gorgonians, the sponges were usually represented by significantly more species per site. Habitat-based patterns in sponge species richness indicated that, similar to gorgonians, offshore patch reefs (37.5 ± 1.0 species per site) and the deeper fore reef (32.2 ± 1.1) yielded the greatest mean site species richness, while inshore patch reefs (4.8 ± 2.5) and high-relief spur and groove (22.1 ± 1.1) yielded the fewest species per site (Table 3-1). Regional patterns in sponge species richness were specific to particular habitat types. Similar to gorgonians, reference inshore patch reefs (4-12 species) yielded greater numbers of species than sites within Newfound Harbor SPA (1-2 species per 60 m²) (Figure 3-23). On mid-channel patch reefs, a decreasing pattern in sponge richness from the lower Keys (32.2 ± 1.1 species per site) to the upper Keys (19.2 ± 1.3 species per site) was apparent. A similar pattern was evident on offshore patch reefs, where sponge richness was greater in the lower Keys (41.0 ± 1.6 species per site) compared to the middle (34.4 ± 1.7 species per site) and upper Keys (37.3 ± 1.3 species per site), as well as the deeper fore reef. On high-relief spur and groove reefs, sponge richness was greater in the middle Keys (29.8 ± 2.0 species per site) compared to the other two regions (range in mean of 20.9-21.6) (Figure 3-24).

2009 Benthic Cover

Coverage of abiotic (e.g. sand, rubble) and biotic components of the substratum was assessed at each site by determining the bottom type every 15 cm per 15-m transect (100 points per transect) along four

transects per site. Tables 3-2 and 3-3 provide site-level data for total coral cover, sponges, the colonial zoanthid *Palythoa*, and the major functional groups of algae (e.g. turfs, crustose coralline algae, macroalgae). Total stony coral cover ranged from 0.3% to 58.3% among the 160 sites. Figures 3-25 to 3-30 illustrate the geographic patterns in coral cover throughout the Florida Keys during 2009. In general, coral cover was relatively high ($> 10\%$) on many inshore, mid-channel, and offshore patch reefs (Figure 3-31) and substantially lower (generally $< 5\%$) on the shallow platform margin and deeper fore reef (Table 3-2). Total coral cover varied substantially among habitats, with the greatest coverage recorded from mid-channel (mean of $17.8\% \pm 2.4\%$) and inshore patch reefs ($15.2\% \pm 7.5\%$) and the lowest from shallow hard-bottom ($2.4\% \pm 0.4\%$) and the deeper fore reef ($2.4\% \pm 0.3\%$). Higher coral cover sites reflected the relatively high densities of larger corals such as *Colpophyllia*, *Diploria*, *Montastraea*, *Siderastrea*, and *Stephanocoenia*. Regional patterns in total coral cover were specific to particular habitat types (Figures 3-32 to 3-35). Cover on mid-channel patch reefs was greater in the middle Keys, while coverage was greater in the lower Keys (8.8%) compared to the middle Keys (6.8%) and upper Keys (3.1%) on offshore patch reefs (Table 3-2). On high-relief spur and groove reefs, coral cover was greater in the upper Keys (7.4%) compared to other regions; this pattern reflected the abundance of *Millepora complanata* at several bank reefs in this region. Comparisons of coral cover between no-take zones and reference areas did not reveal a consistent pattern by habitat type or region. On inshore patch reefs, coral cover at two sites in Newfound Harbor SPA was either similar or lower compared to reference patch reefs. On mid-channel patch reefs in the lower Keys, sites within Western Sambo ER yielded either similar or lower coral cover than reference sites. In the middle Keys, however, sites within Cheeca Rocks SPA and Hen and Chickens SPA were generally higher than reference sites, except for an unusually high-coral cover site (58.3%) at Marker 48 south of Moser Channel. On offshore patch reefs, no-take zones were either similar (Western Sambo ER) or had higher coral cover (Looe Key RO) than reference sites in the lower Keys. On high-relief spur and groove reefs, no-take zones generally yielded similar or slightly greater coral cover than reference sites for all three regions.

Total sponge cover ranged from 0% to 17.3% among the 160 sites (Table 3-2). Among habitat types, sponge cover was very low ($< 2\%$) on inshore patch reefs, higher on mid-channel ($8.5\% \pm 1.0\%$) and offshore patch reefs ($7.2\% \pm 0.6\%$) (Figures 3-32 and 3-33), and then relatively low on shallow hard-bottom, high-relief spur and groove, and the deeper fore reef (Figures 3-34 and 3-35). Regional patterns in sponge cover were particularly evident on mid-channel patch reefs, where total sponge cover was two to three greater in the lower Keys ($12.4\% \pm 0.8\%$) compared to the middle and upper Keys; a similar pattern was evident on offshore patch reefs. Coverage by the colonial zoanthid *Palythoa* ranged from 0% to 19.5% among the 160 sites. *Palythoa* cover was very low ($< 5\%$) cover on most patch reefs, shallow

hard-bottom, and deeper fore reef sites (Table 3-2). In contrast, high-relief spur and groove reefs, especially those in the middle Keys (12.8%), yielded the greatest coverage, which was upwards of 19.5% at Sombrero Key SPA (Figure 3-34).

Algae were the dominant biotic component at most of the sites surveyed during 2009. Figures 3-36 to 3-39 show site-level cover values for algal turf, crustose coralline algae, and total macroalgae for patch reef and platform margin habitats. Total algal cover (all species and functional groups) ranged from 26.8% to 96.8% among sites; algae generally covered more than 50% of the substratum at most sites, and in some locations covered more than 85% of the bottom. However, there were habitat-specific patterns in terms of the functional groups comprising the total algal cover. Coverage by cyanobacteria/benthic diatoms ranged from 0% to 19.8% (Table 3-3) and were generally the least abundant of the algal groups ($< 2\%$) for most habitats. Coverage by algal turf ranged from 3% to 86.3% (Table 3-3); this was generally the dominant functional group at most sites. Turf algae were particularly abundant on shallow hard-bottom ($47.0\% \pm 3.6\%$) and high-relief spur and groove sites ($56.0\% \pm 2.8\%$), particularly in the lower Keys. Coverage by crustose coralline algae ranged from 0% to 35% (Table 3-3). Coralline algae were most abundant on shallow spur and groove, with greater mean cover in the upper Keys ($9.4\% \pm 2.8\%$) compared to the middle Keys ($0.9\% \pm 0.3\%$) and lower Keys ($3.4\% \pm 0.8\%$). Macroalgae were represented by diverse genera, including *Halimeda*, *Udotea*, *Dictyota*, *Lobophora*, *Sargassum*, and *Stypopodium*. Total macroalgal cover ranged from 0% to 64.5% (Table 3-3) and was relatively high on inshore patch reefs ($35.7\% \pm 5.3\%$), low on mid-channel patch reefs ($11.6\% \pm 2.2\%$), and higher on offshore patch reefs and platform margin habitats (Figures 3-36 to 3-39). On mid-channel patch reefs in the middle Keys, macroalgal cover was generally higher (range of 12.3-31.0% among sites) in no-take zones compared to reference sites (0-14.8%). A similar pattern was also apparent on offshore patch reefs in the middle Keys between Coffins Patch SPA (range of 16.5-33.0% among sites) and reference sites (3.3-43.5%). On high-relief spur and groove reefs, there was substantially greater macroalgal cover ($30.7\% \pm 4.1\%$) in the upper Keys compared to the middle and lower Keys (10.6-12.5%). In contrast, on the deeper fore reef, macroalgal cover was substantially higher, on average, in the lower Keys ($38.5\% \pm 3.8\%$) and upper Keys ($40.0\% \pm 3.4\%$) compared to the middle Keys ($21.0\% \pm 4.0\%$).

Discussion

The patterns and processes governing species richness and community structure are complex and scale-dependent. Species richness inventories can emphasize biodiversity hotspots, cold-spots, or the full gradient of species richness values. In addition, there have been attempts to identify indicator species whose occurrence patterns are correlated with the species richness of a larger group of organisms (Mac

Nally and Fleishman 2004). For the Florida Keys surveys, taxon richness was measured in terms of the number of species identified in standardized search areas along belt transects sampled at each site. One of the most significant factors related to species distribution in the Florida Keys is habitat type, which reflects a combination of distance from shore, depth, and geomorphology (i.e. Pleistocene topography) (Shinn et al. 1989; Lidz et al. 2003). Greater numbers of coral, gorgonian, and sponge species were recorded from inner shelf-margin patch reefs, followed by deeper fore-reef slope habitats that extended to the 13 m depth limit of the 2009 surveys. In other words, the greatest species richness of corals was recorded on either side of the main reef tract, including inner shelf margin patch reefs and offshore of the main reef tract on the deeper fore-reef slope. In contrast, the shallow fore-reef, especially in areas historically dominated by the branching coral *Acropora palmata*, yielded relatively low numbers of species that are either widely distributed and frequently encountered (*Porites astreoides*) or species that are relatively rare in other habitats. In their survey of 599 Great Barrier Reef sites encompassing 135 reefs, DeVantier et al. (2006) found that most coral species were widely distributed, but sparse in abundance across sites. In the Florida Keys, however, species are easily categorized based upon habitat distribution and frequency of occurrence, many of which were common to several habitats.

Relative to species richness, coral cover on Florida Keys reefs is highly variable among sites within particular habitats, as well as among habitat types, but exhibited somewhat similar cross-shelf patterns to species richness. Coral cover was greater on patch reefs closer to shore and was significantly lower on the shallow platform margin, even on highly structured reefs where live *Acropora* cover was historically much greater. Massive, mounding coral species dominated coverage inshore and some of these same species are prevalent on the deeper fore-reef, but not on the shallower platform margin. Previous large-scale surveys encompassing large spatial domains (Murdoch and Aronson 1999; Chiappone and Sullivan 1997; Miller et al. 2002) or a relatively long time-frame (Somerfield et al. 2008) confirm the substantial inter-reef variability in the Florida Keys. Overlain on the geologic history of particular sites (Shinn et al. 1989; Lidz et al. 2003) and along-shelf position (Marszalek et al. 1977; Smith 1994) are the responses of individual reefs to perturbations such as disease, bleaching, and hurricanes, further complicating cause-and-effect conclusions (Somerfield et al. 2008).

Cover and species richness are most frequently used with a focus on corals, because after all, corals are often the dominant organism or they are of high interest to managers. However, when coral cover is regionally low for most habitats as it currently is in the Florida Keys, a broader suite of metrics may be needed to evaluate ecosystem condition (Miller et al. 2002). In addition, there are so many potential indirect effects that might result from various management measures (e.g. no-take zones), in addition to

larger-scale system variability, none of which can be predicted with any degree of certainty. Many previous and ongoing studies of coral reef community structure in the Florida Keys and elsewhere have focused on benthic cover as the metric of choice for stony corals (e.g. Dustan and Halas 1987; Porter and Meier 1992; Somerfield et al. 2008). Benthic cover represents the net outcome of dynamic rate processes such as colony recruitment, growth, and survivorship, whereas density and size structure, the two basic components of cover, provide information on the rate processes themselves, as well as on the net outcome. For example, a particular area with high densities of mostly small colonies versus another area with low densities of mostly large colonies may produce similar estimates of stony coral cover, but the two areas reflect very different demographic histories. Spatially explicit estimates of coral population density and size structure not only allow for tracking changes in abundance metrics over time, but can provide baseline data for further investigations of population dynamics and community ecology. We report on estimates of coral density in Chapter 4.

Figure 3-1. Species richness (no. taxa per 60 m²) of stony corals (Milleporina and Scleractinia) in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

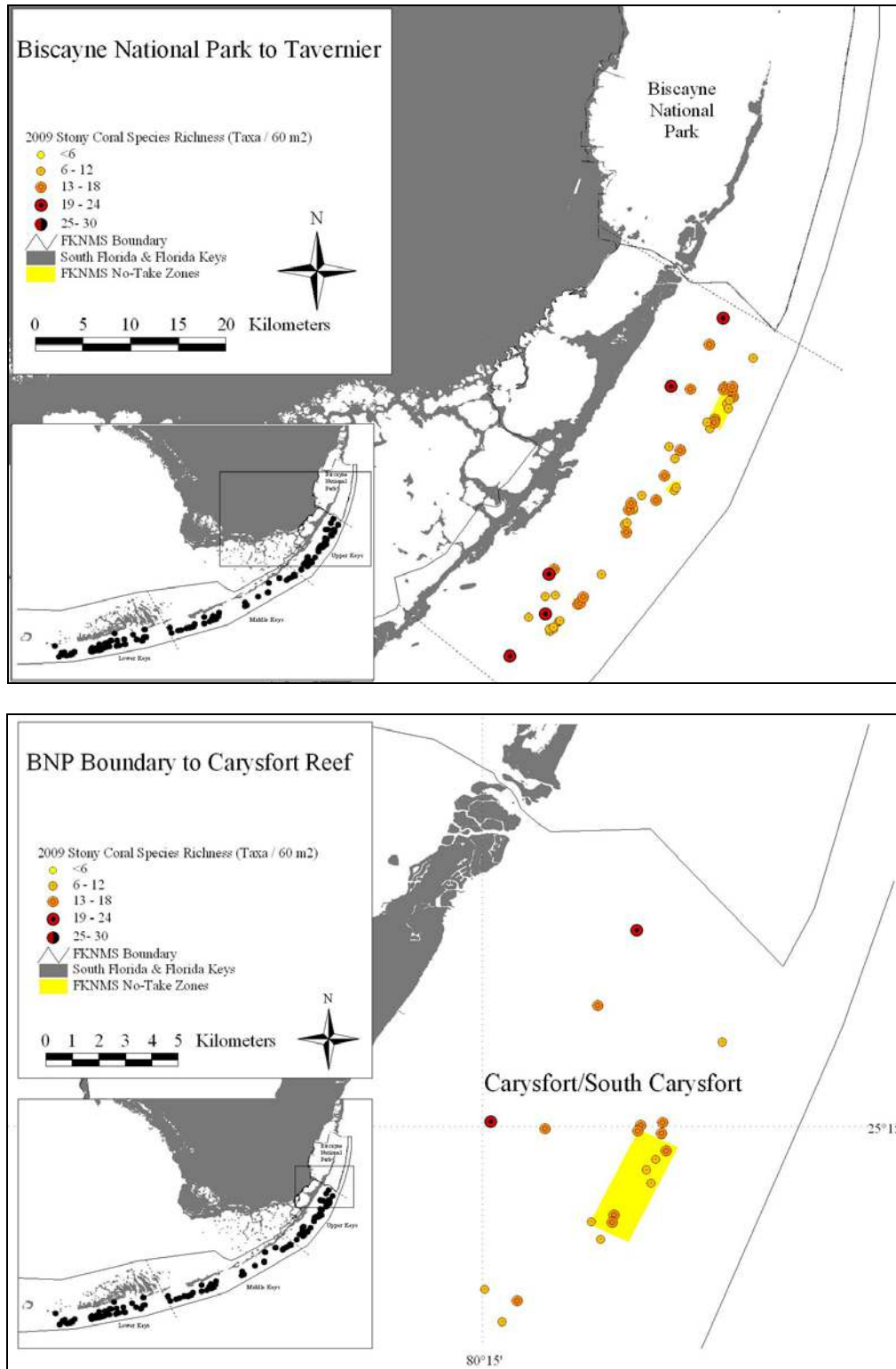


Figure 3-2. Species richness (no. taxa per 60 m²) of stony corals (Milleporina and Scleractinia) in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region during May-September 2009.

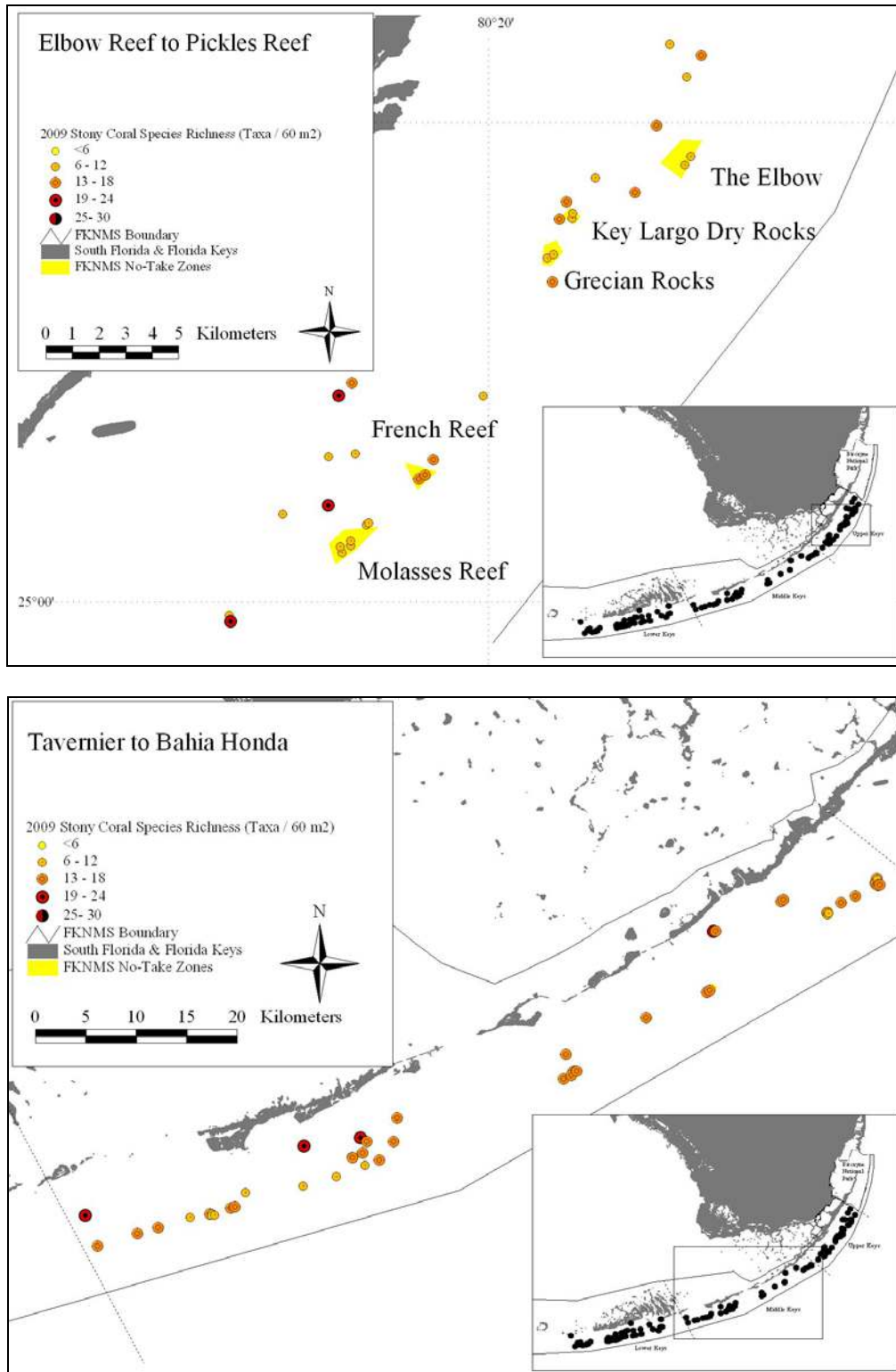


Figure 3-3. Species richness (no. taxa per 60 m²) of stony corals (Milleporina and Scleractinia) in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

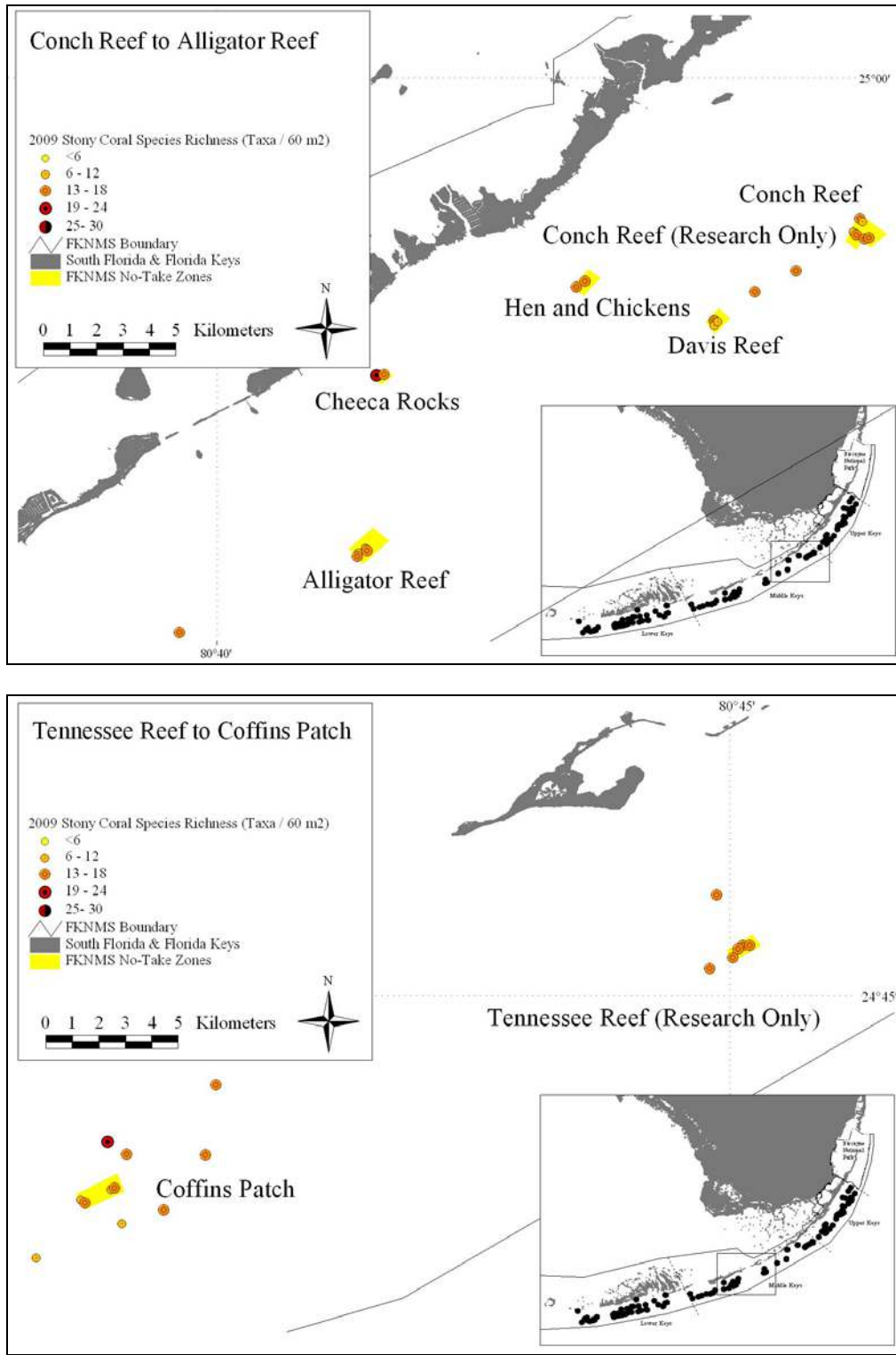


Figure 3-4. Species richness (no. taxa per 60 m²) of stony corals (*Milleporina* and *Scleractinia*) in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

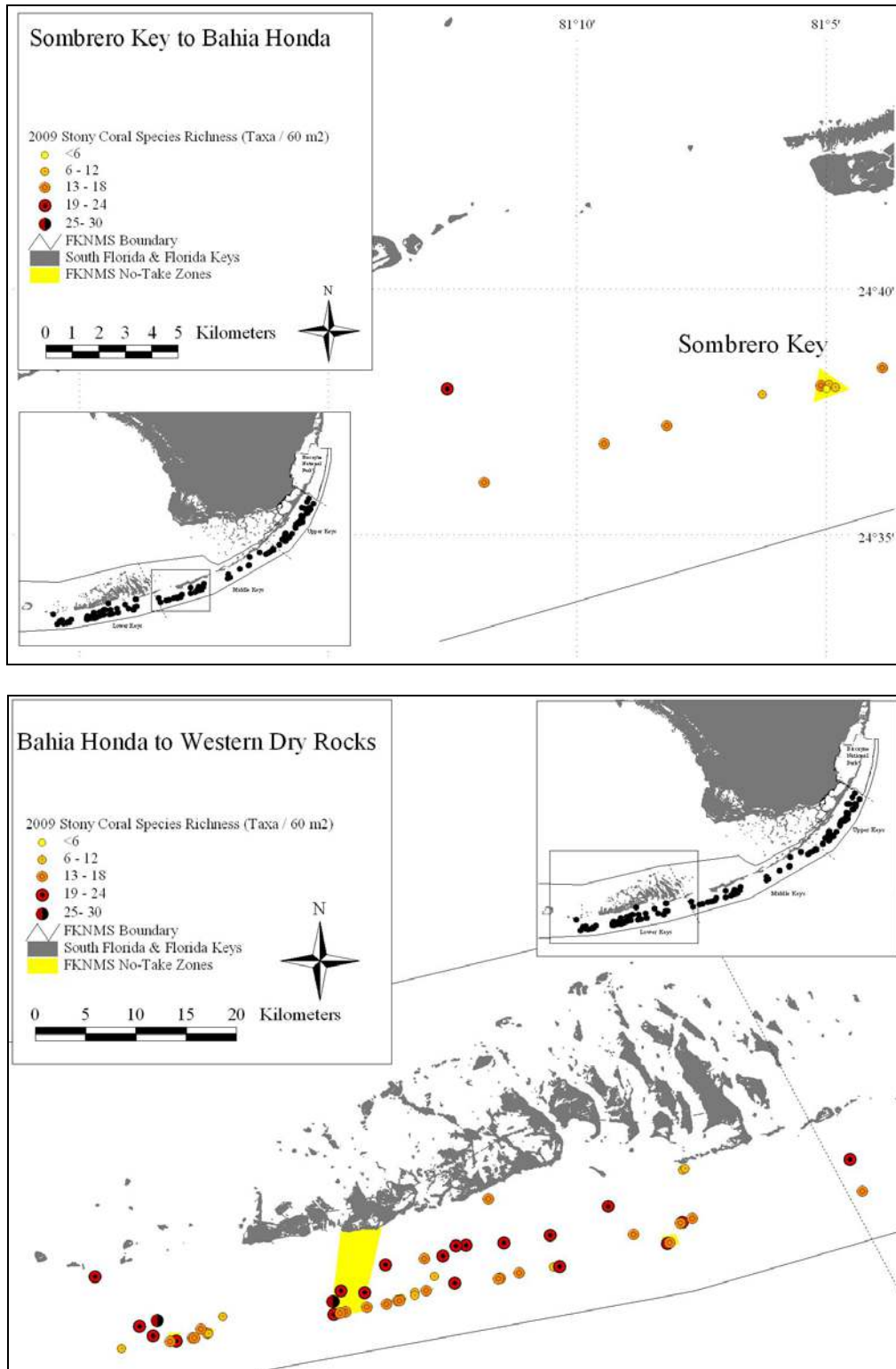


Figure 3-5. Species richness (no. taxa per 60 m²) of stony corals (*Milleporina* and *Scleractinia*) in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

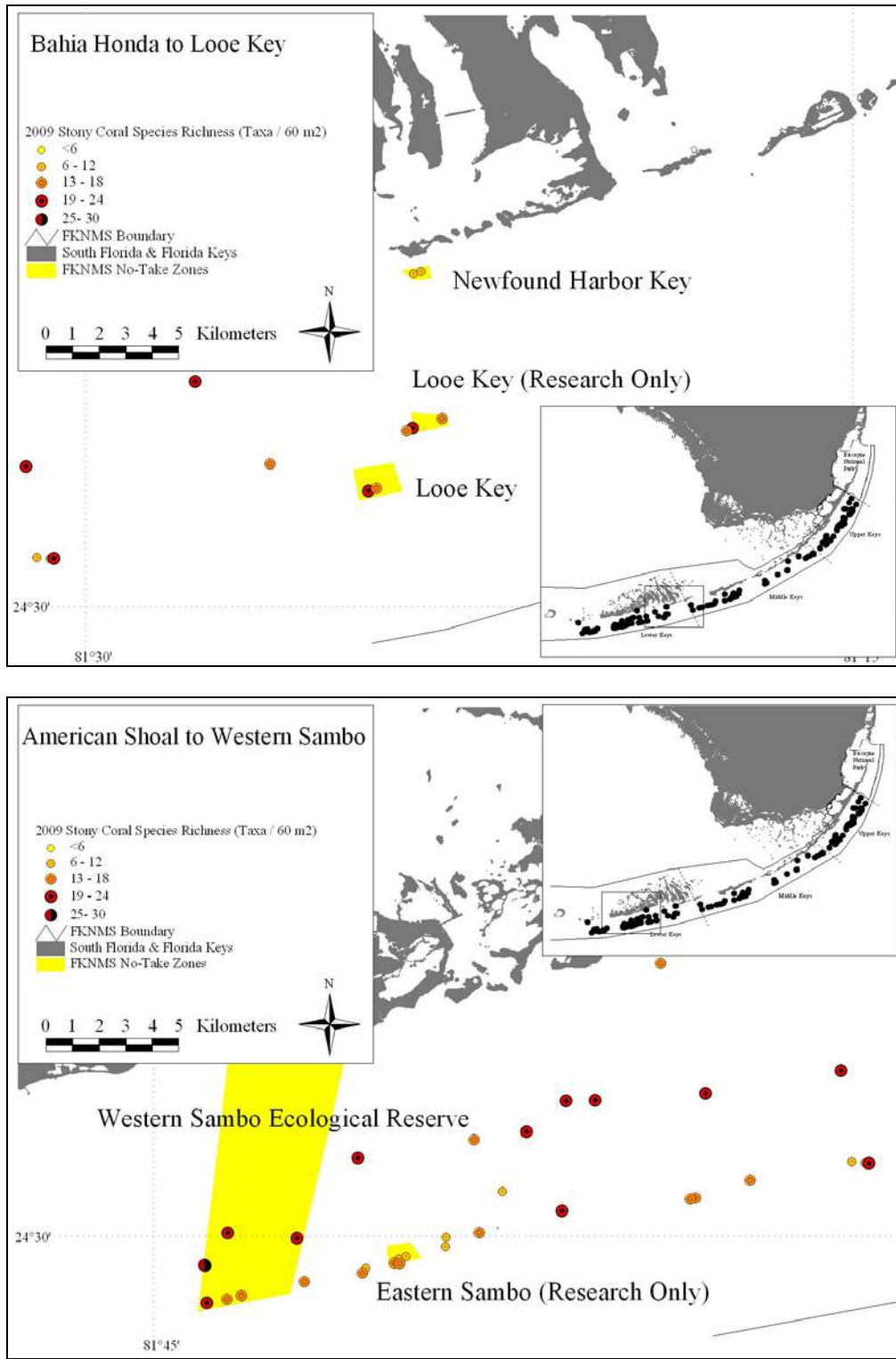


Figure 3-6. Species richness (no. taxa per 60 m²) of stony corals (Milleporina and Scleractinia) in the lower Florida Keys region from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

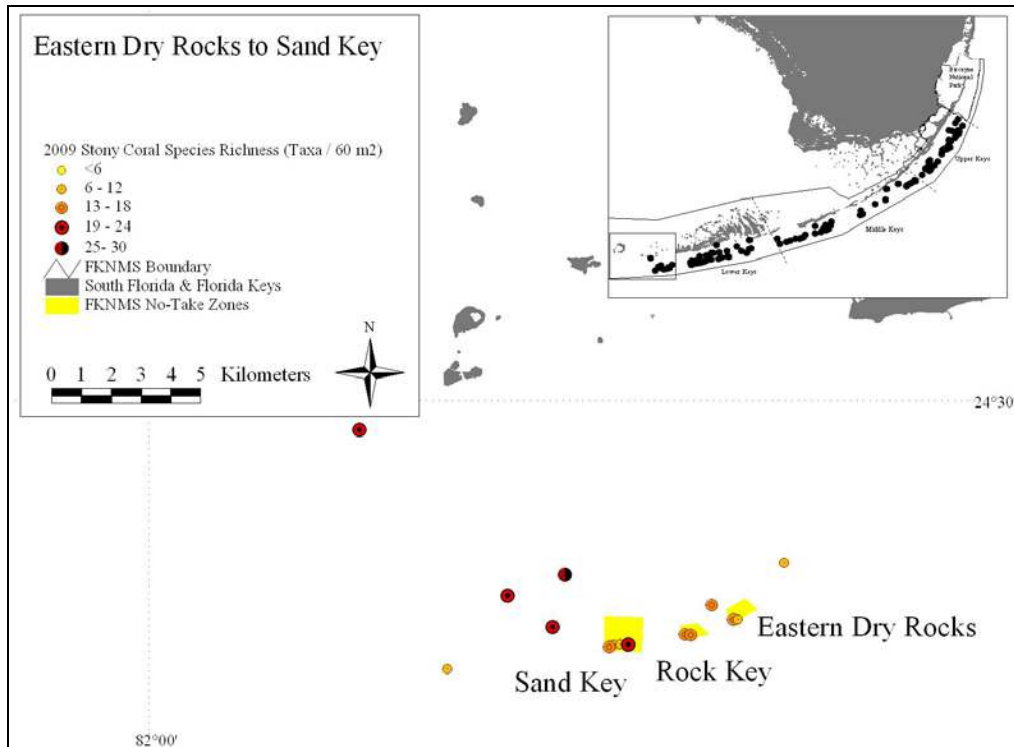


Figure 3-7. Site species richness of stony corals (Milleporina and Scleractinia) on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Data represent the total number of taxa recorded from a 60-m² sampling area. Open bars = FKNMS no-take zones; filled bars = reference areas.

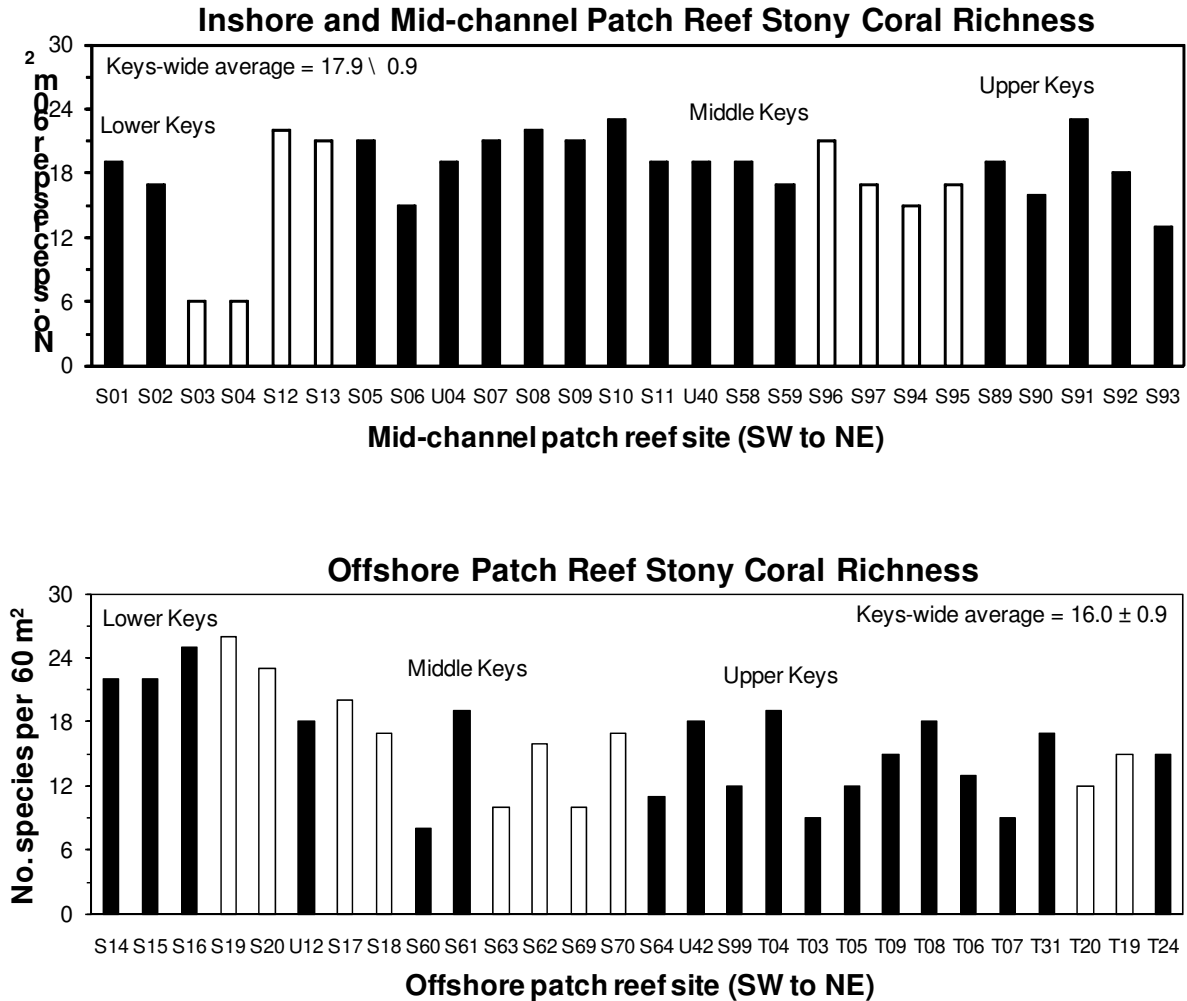


Figure 3-8. Site species richness of stony corals (Milleporina and Scleractinia) on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Data represent the total number of taxa recorded from a 60-m² sampling area. Open bars = FKNMS no-take zones; filled bars = reference areas.

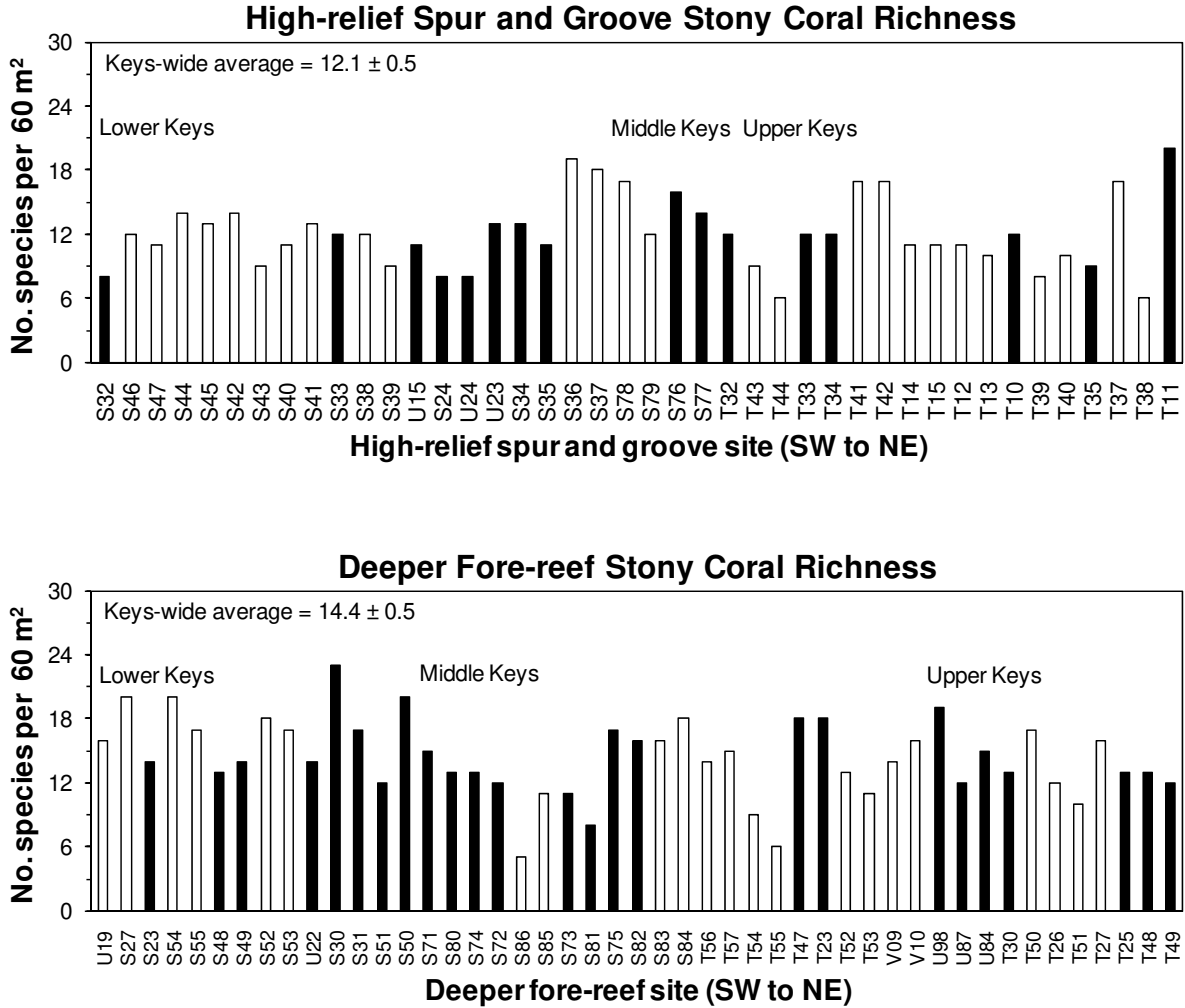


Figure 3-9. Species richness (no. taxa per 60 m²) of gorgonians (Octocorallia) in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

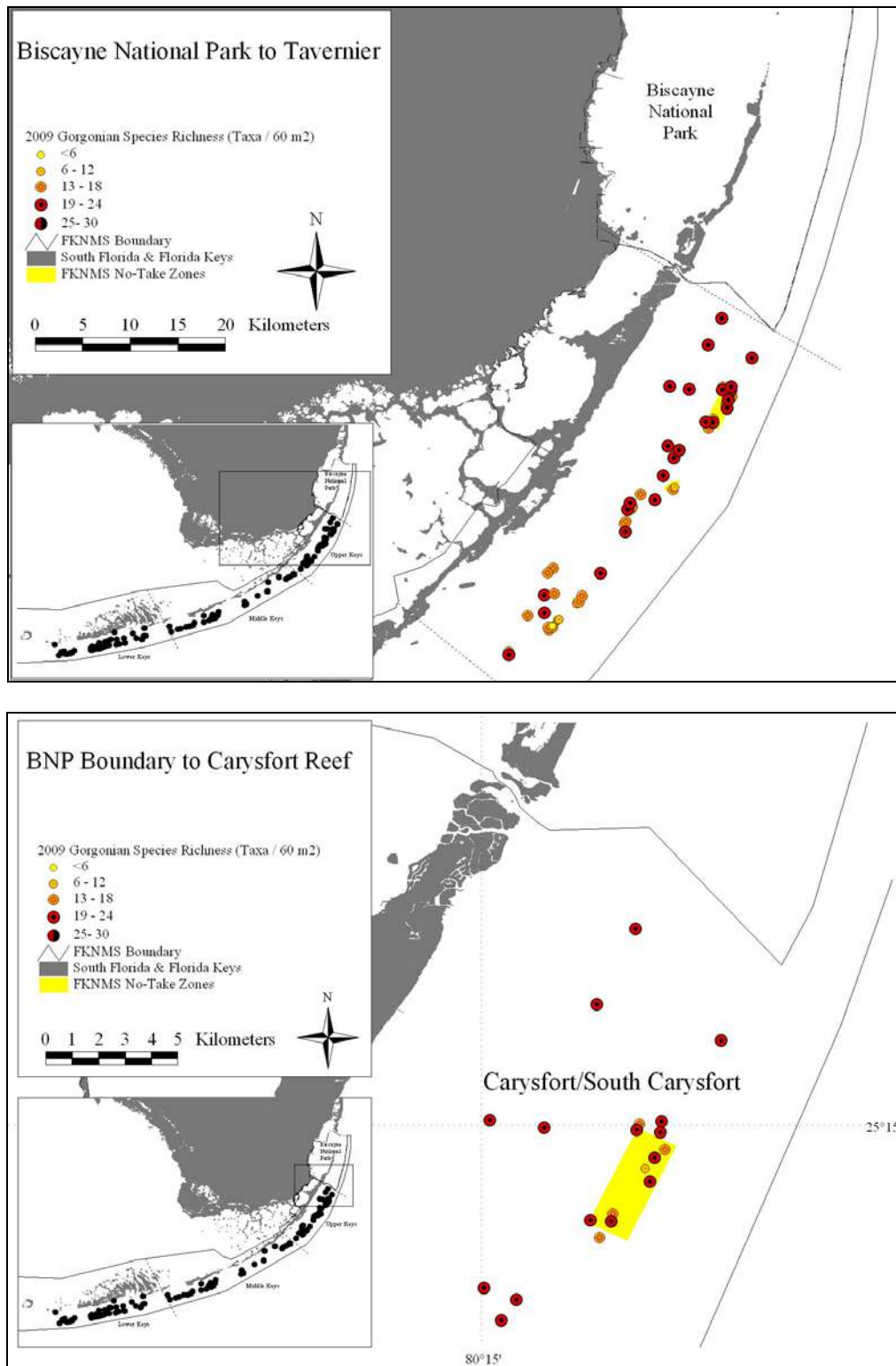


Figure 3-10. Species richness (no. taxa per 60 m²) of gorgonians (Octocorallia) in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region during May-September 2009.

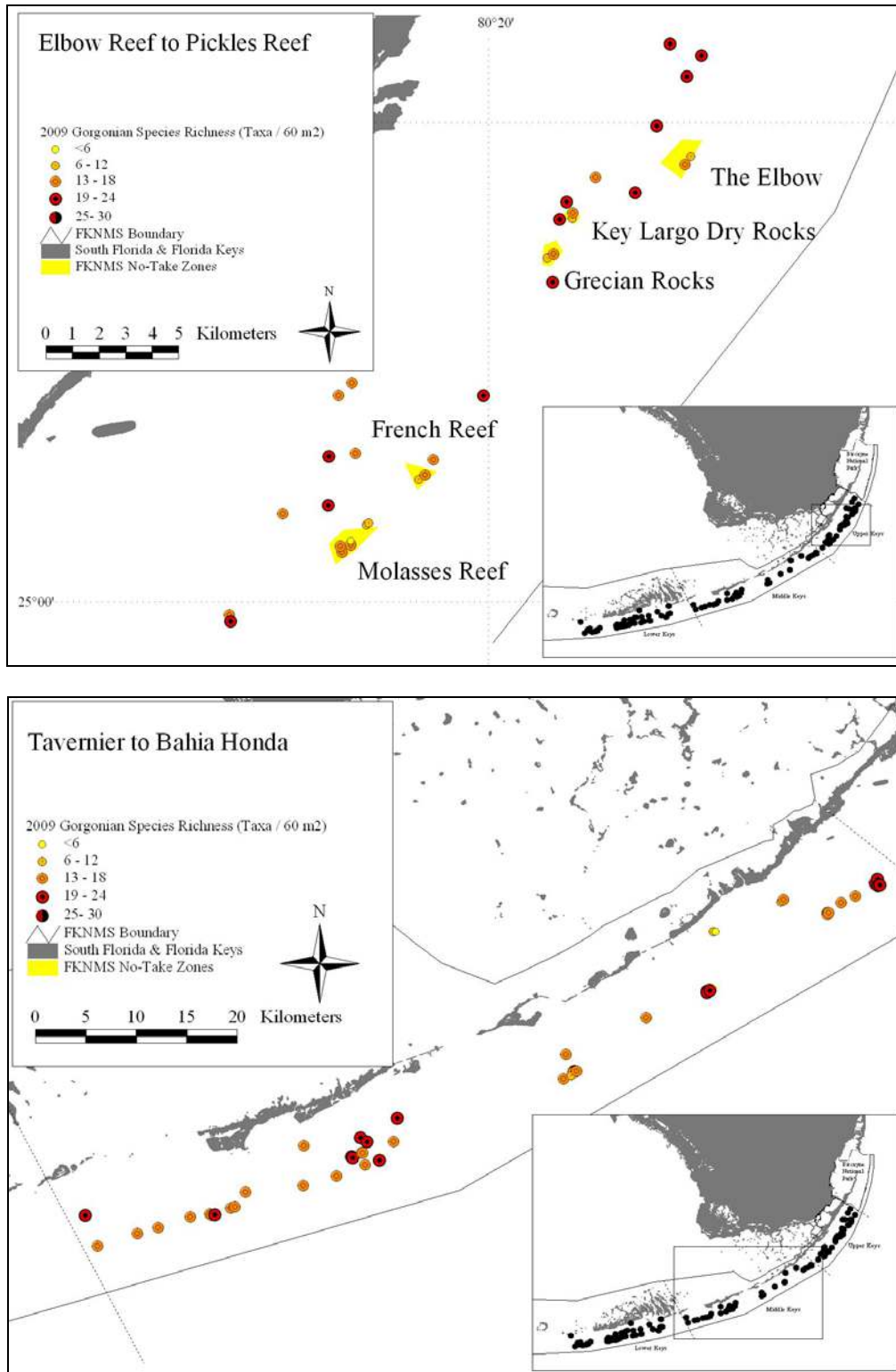


Figure 3-11. Species richness (no. taxa per 60 m²) of gorgonians (*Octocorallia*) in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

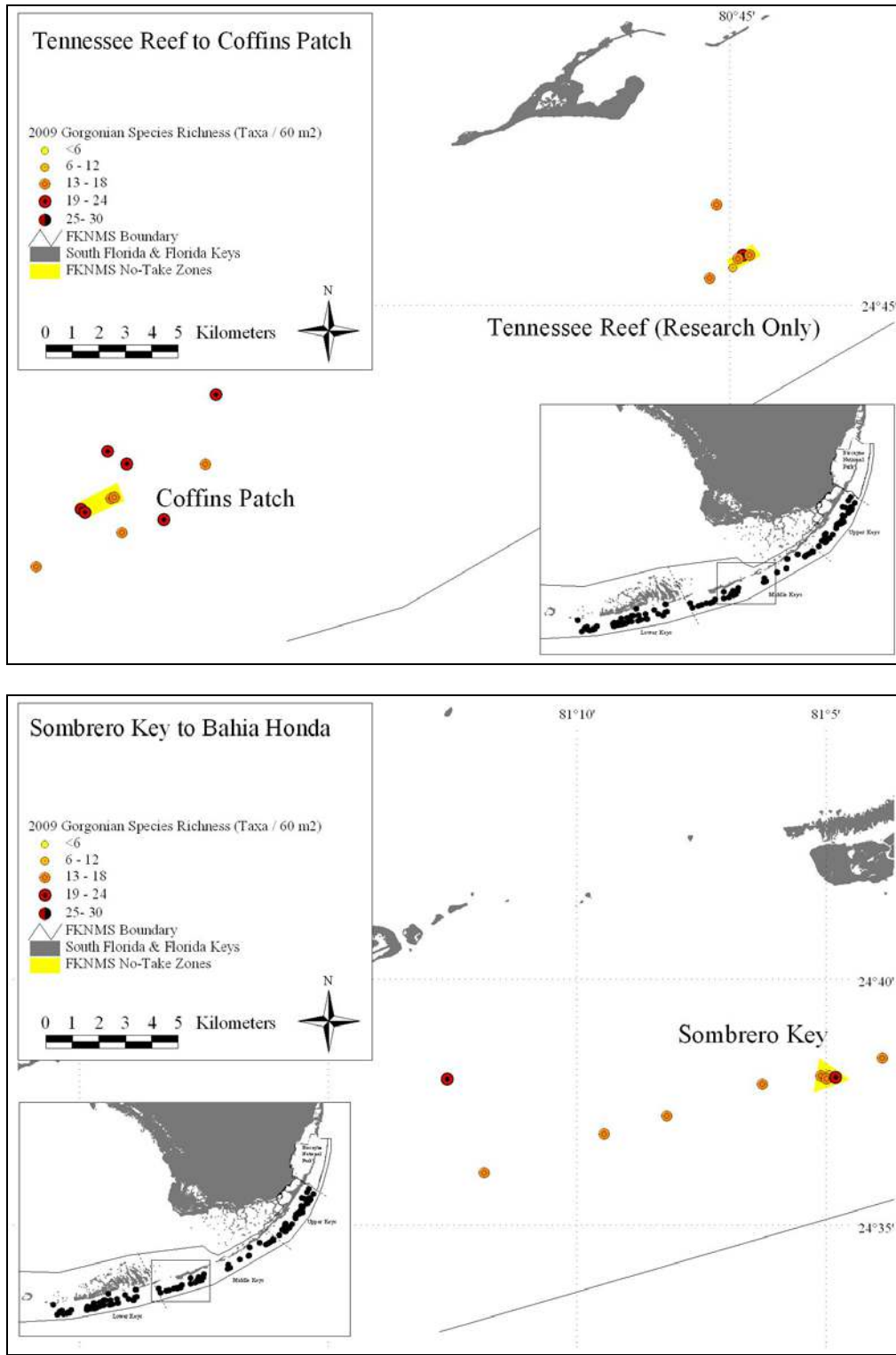


Figure 3-12. Species richness (no. taxa per 60 m²) of gorgonians (Octocorallia) in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

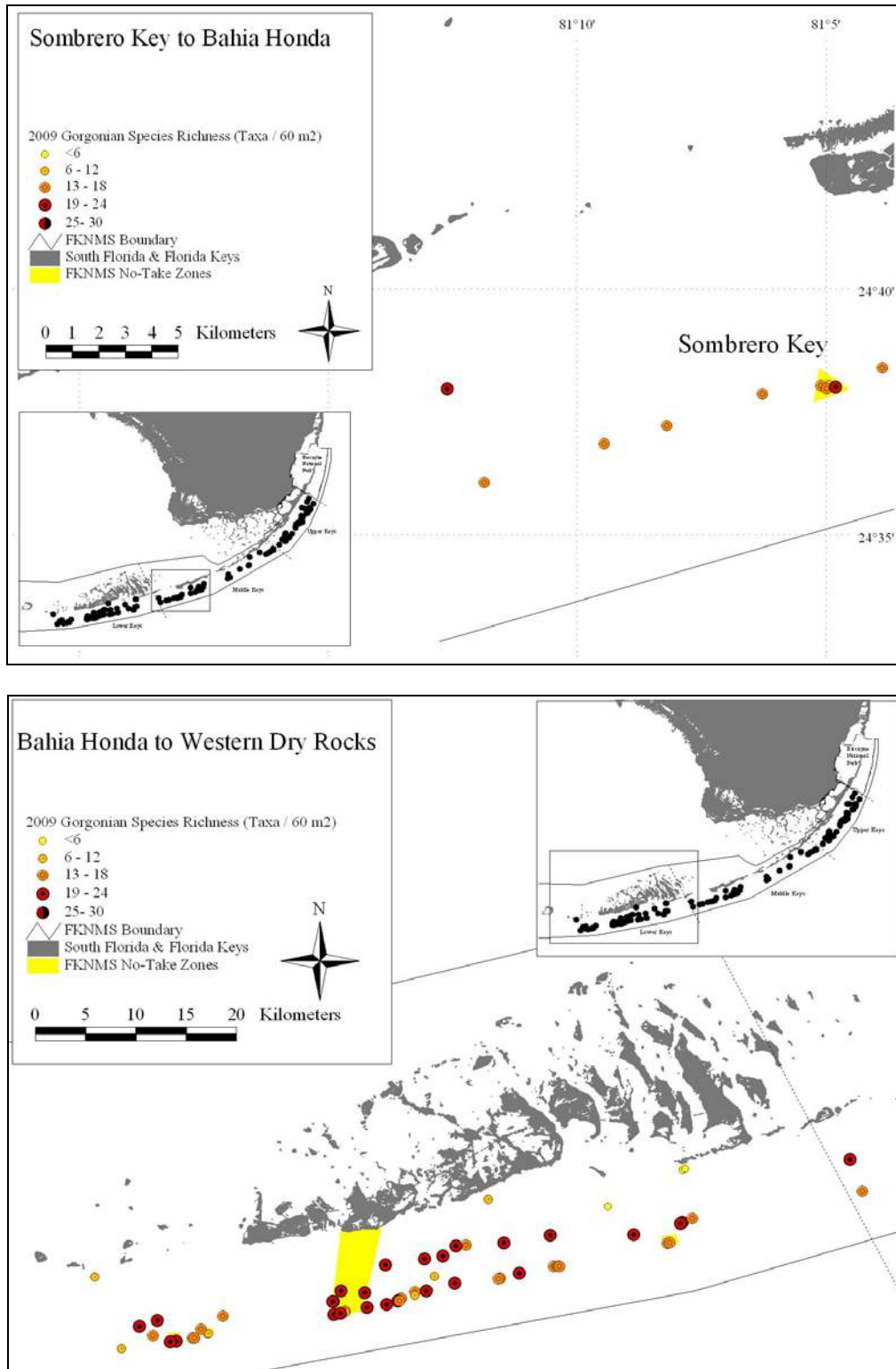


Figure 3-13. Species richness (no. taxa per 60 m²) of gorgonians (Octocorallia) in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

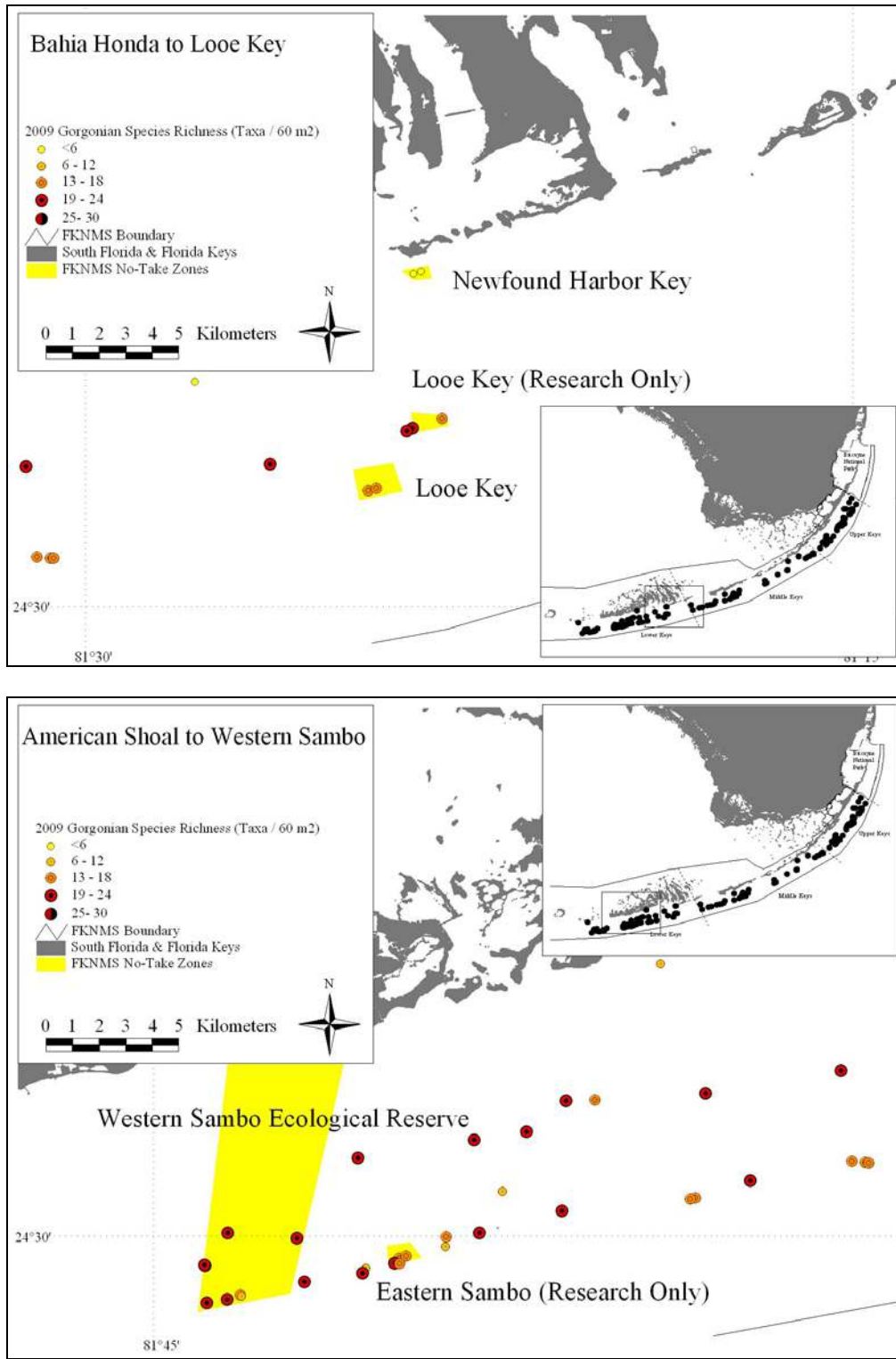


Figure 3-14. Species richness (no. taxa per 60 m²) of gorgonians (Octocorallia) in the lower Florida Keys from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

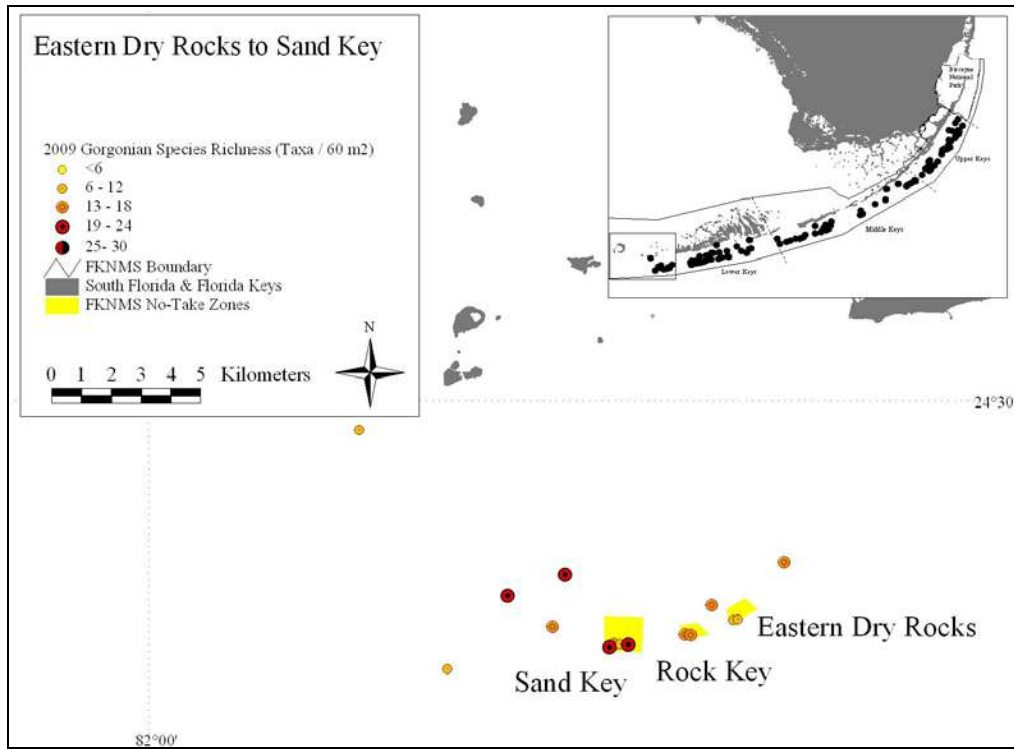


Figure 3-15. Site species richness of gorgonians (Octocorallia) on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Data represent the total number of taxa recorded from a 60-m² sampling area. Open bars = FKNMS no-take zones; filled bars = reference areas.

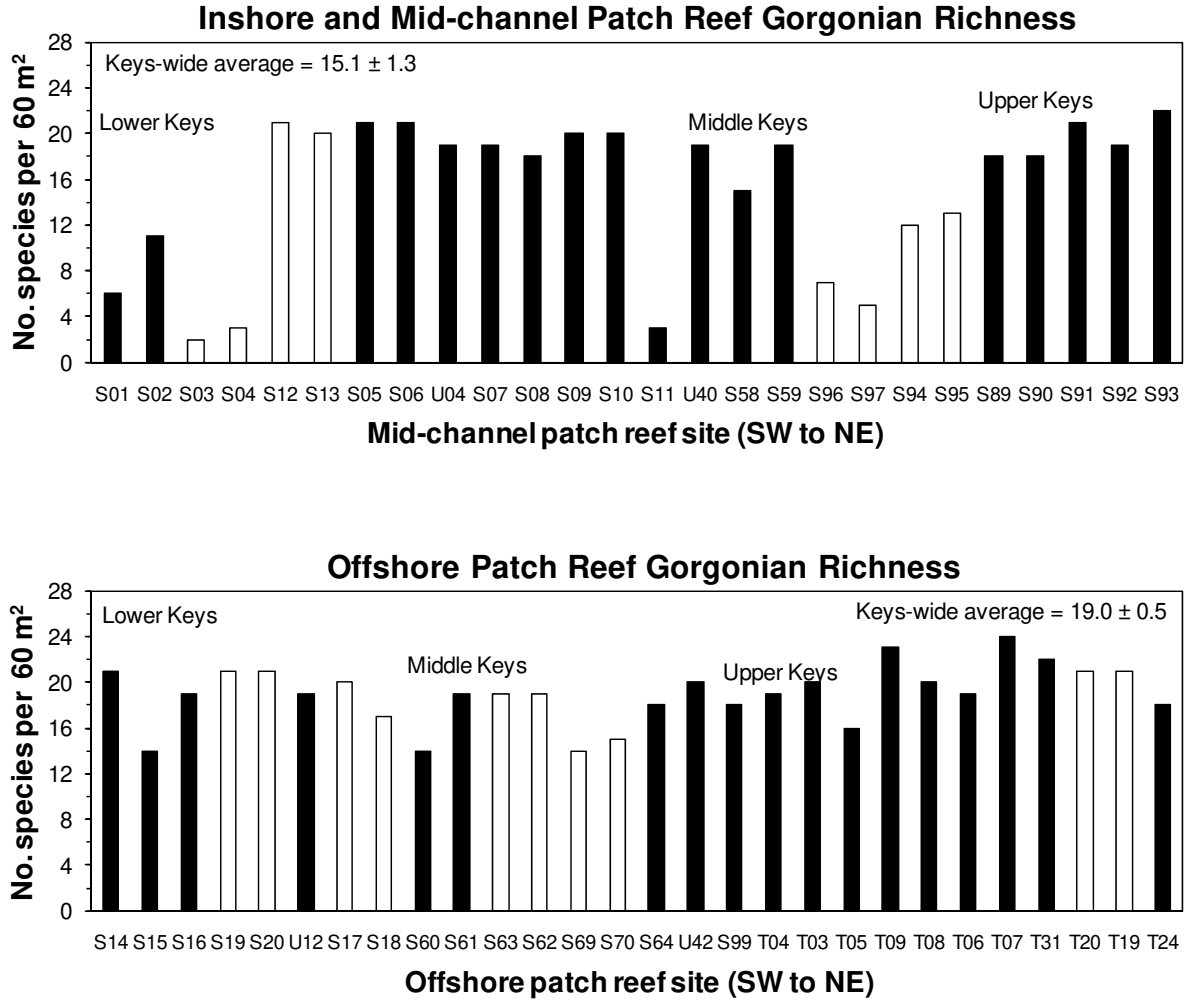


Figure 3-16. Site species richness of gorgonians (Octocorallia) on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Data represent the total number of taxa recorded from a 60-m² sampling area. Open bars = FKNMS no-take zones; filled bars = reference areas.

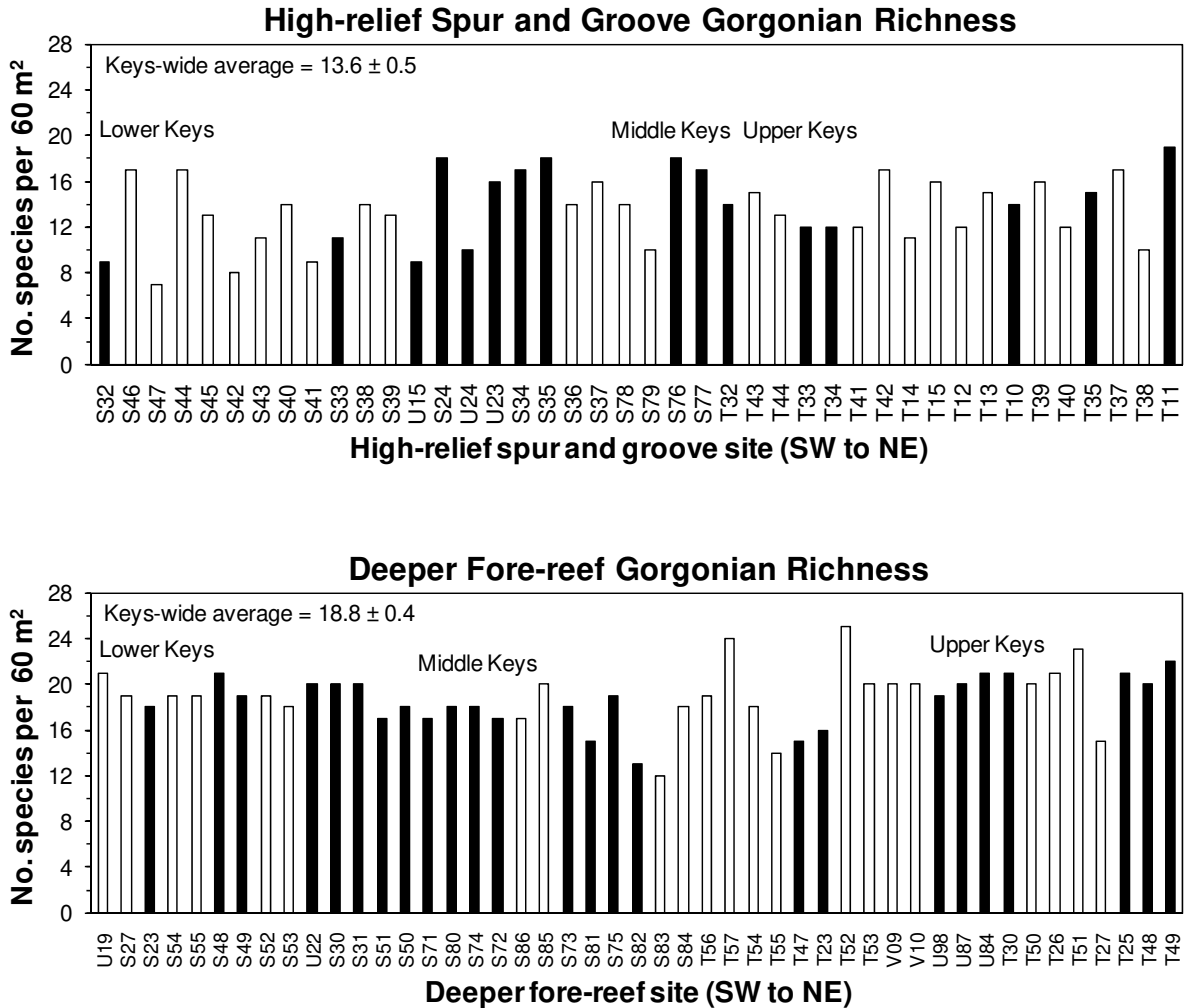


Figure 3-17. Species richness (no. taxa per 60 m²) of sponges in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

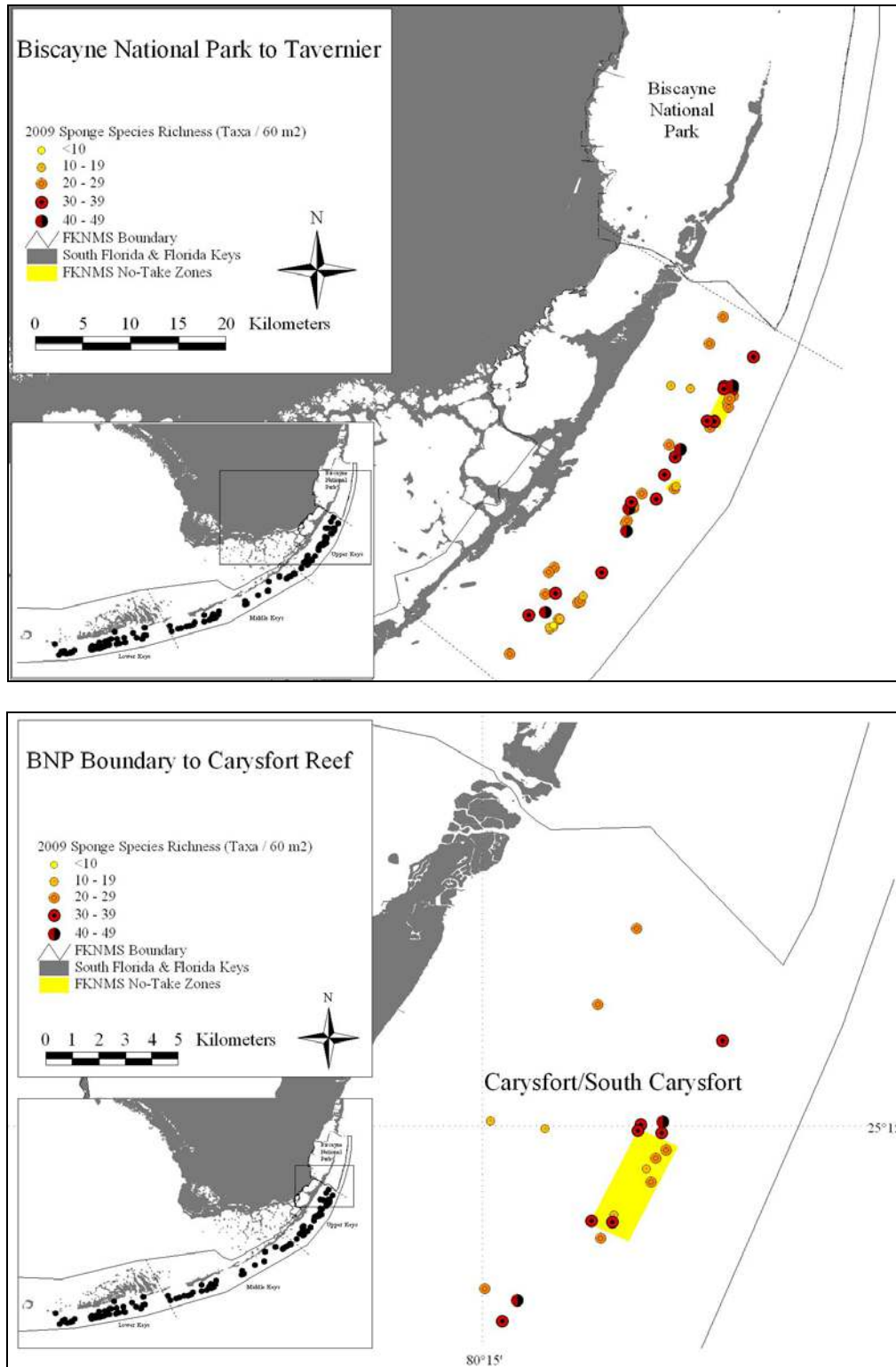


Figure 3-18. Species richness (no. taxa per 60 m²) of sponges in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region during May-September 2009.

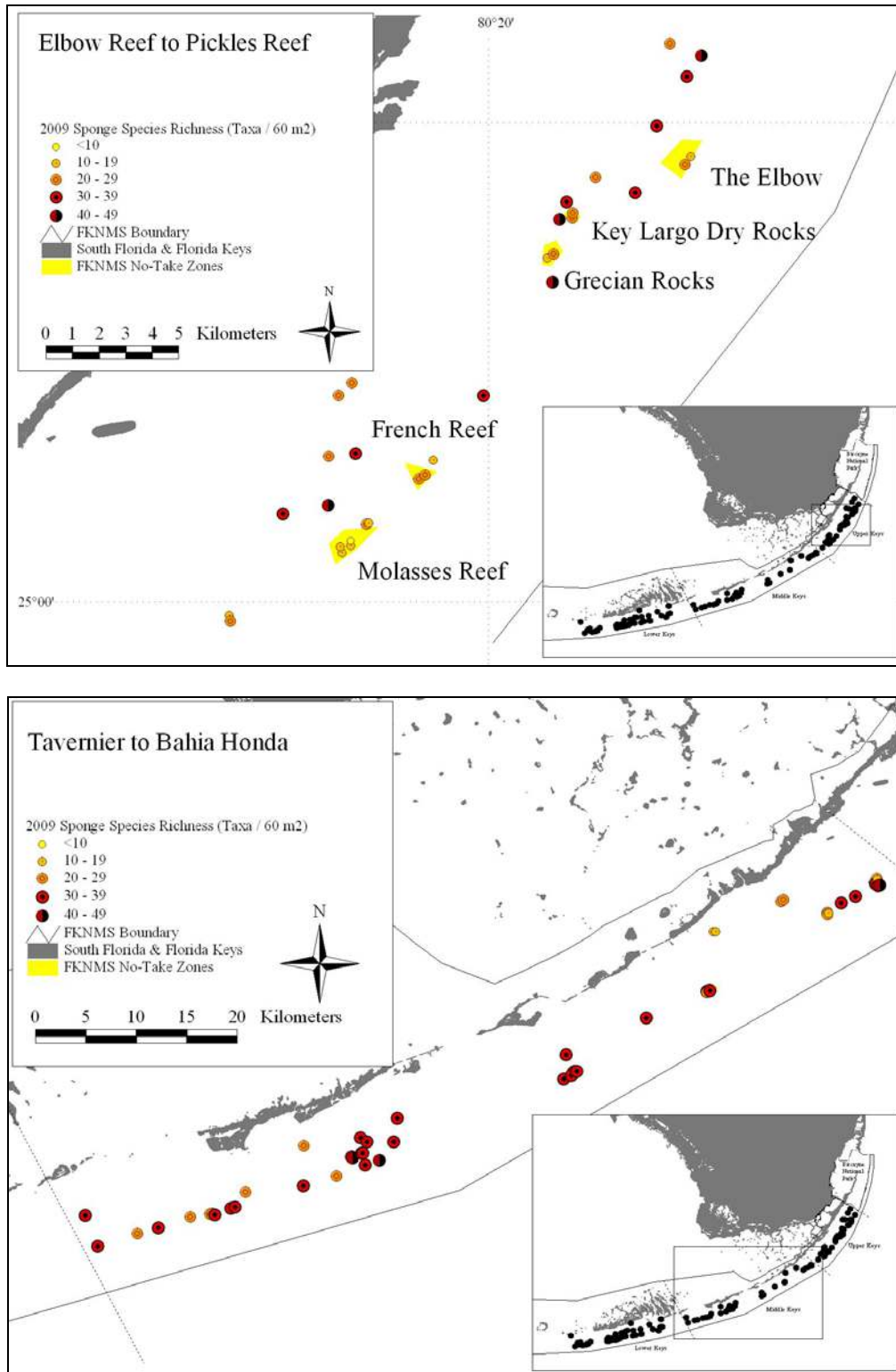


Figure 3-19. Species richness (no. taxa per 60 m²) of sponges in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

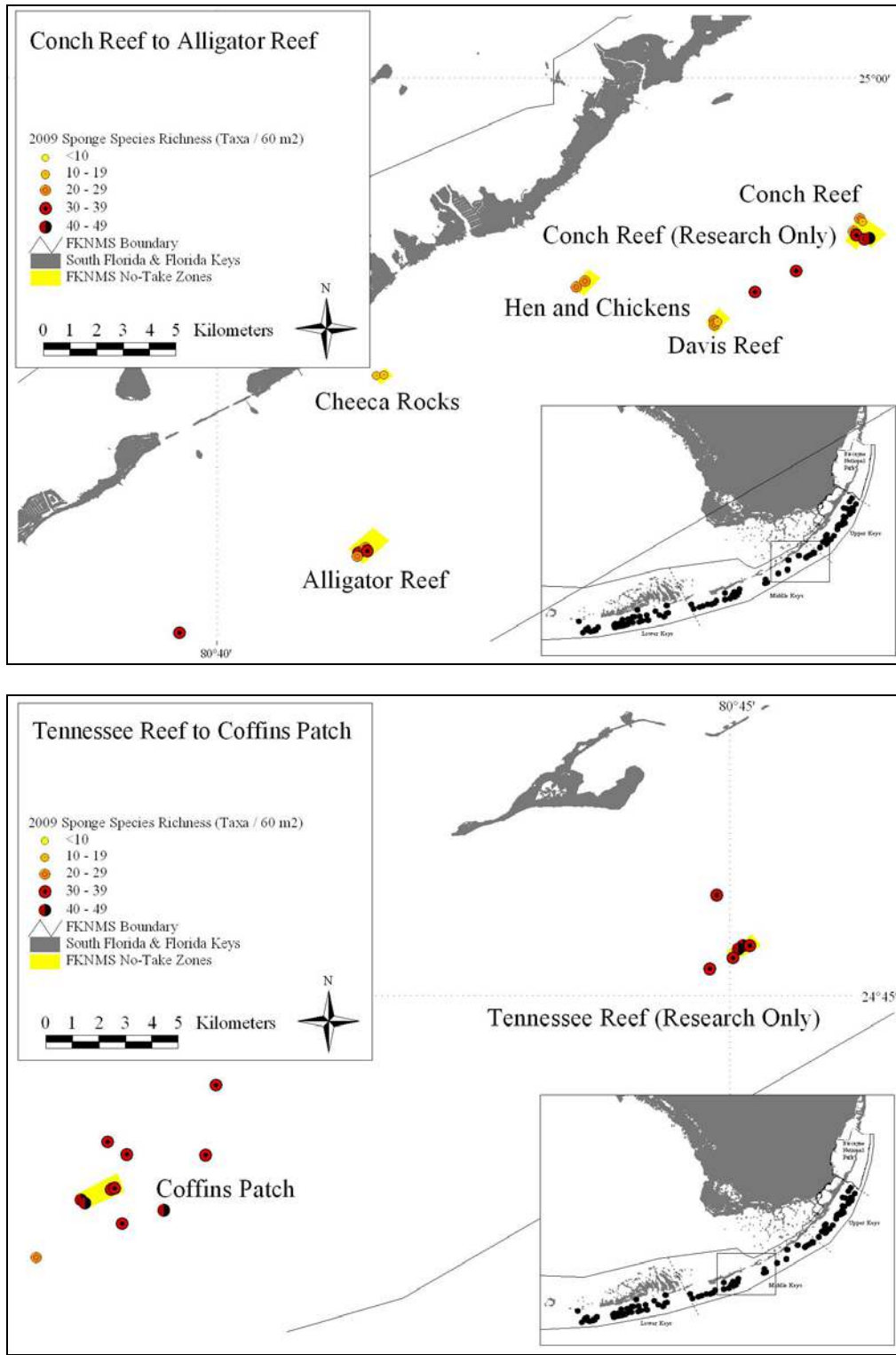


Figure 3-20. Species richness (no. taxa per 60 m²) of sponges in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

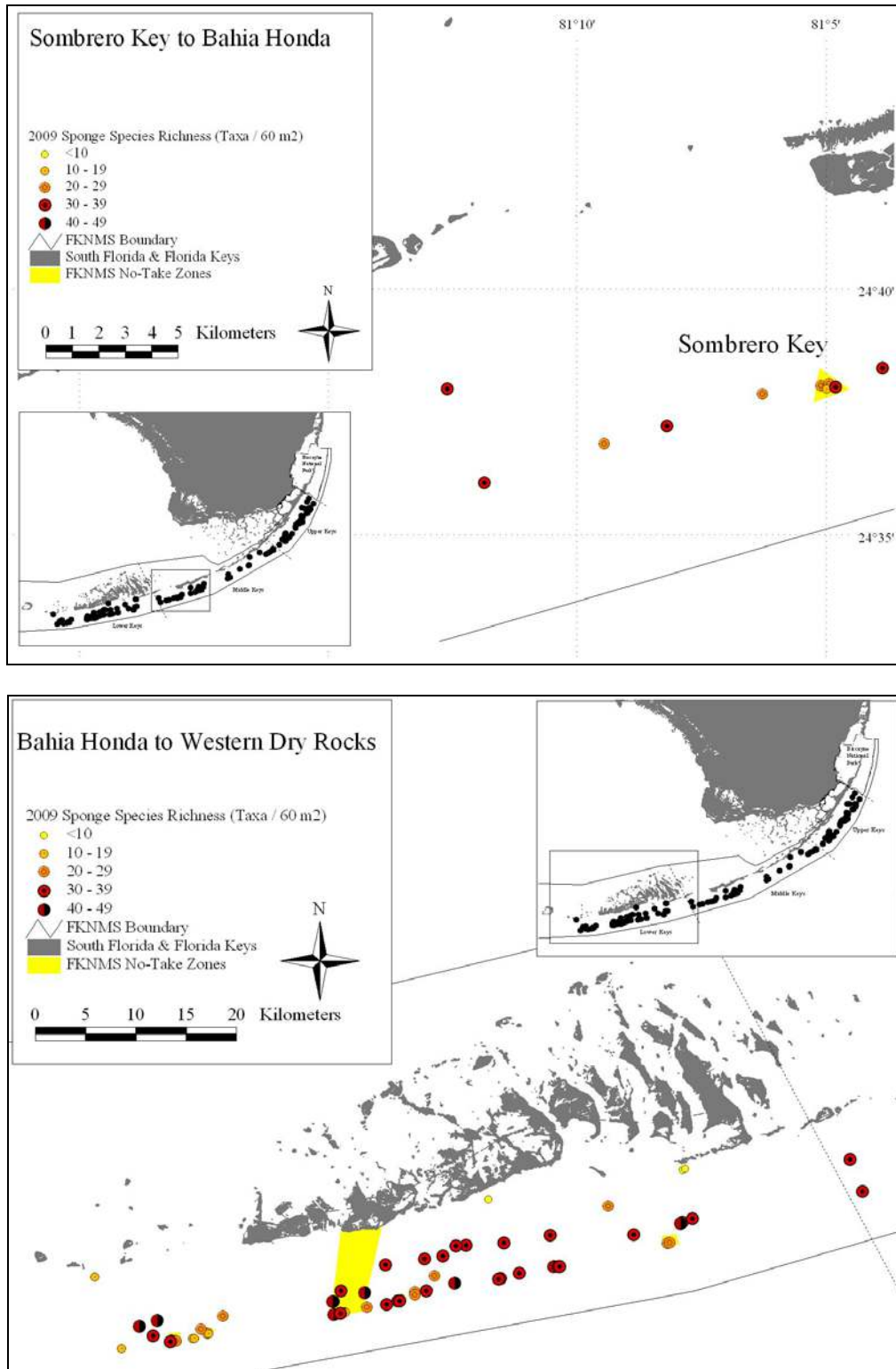


Figure 3-21. Species richness (no. taxa per 60 m²) of sponges in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

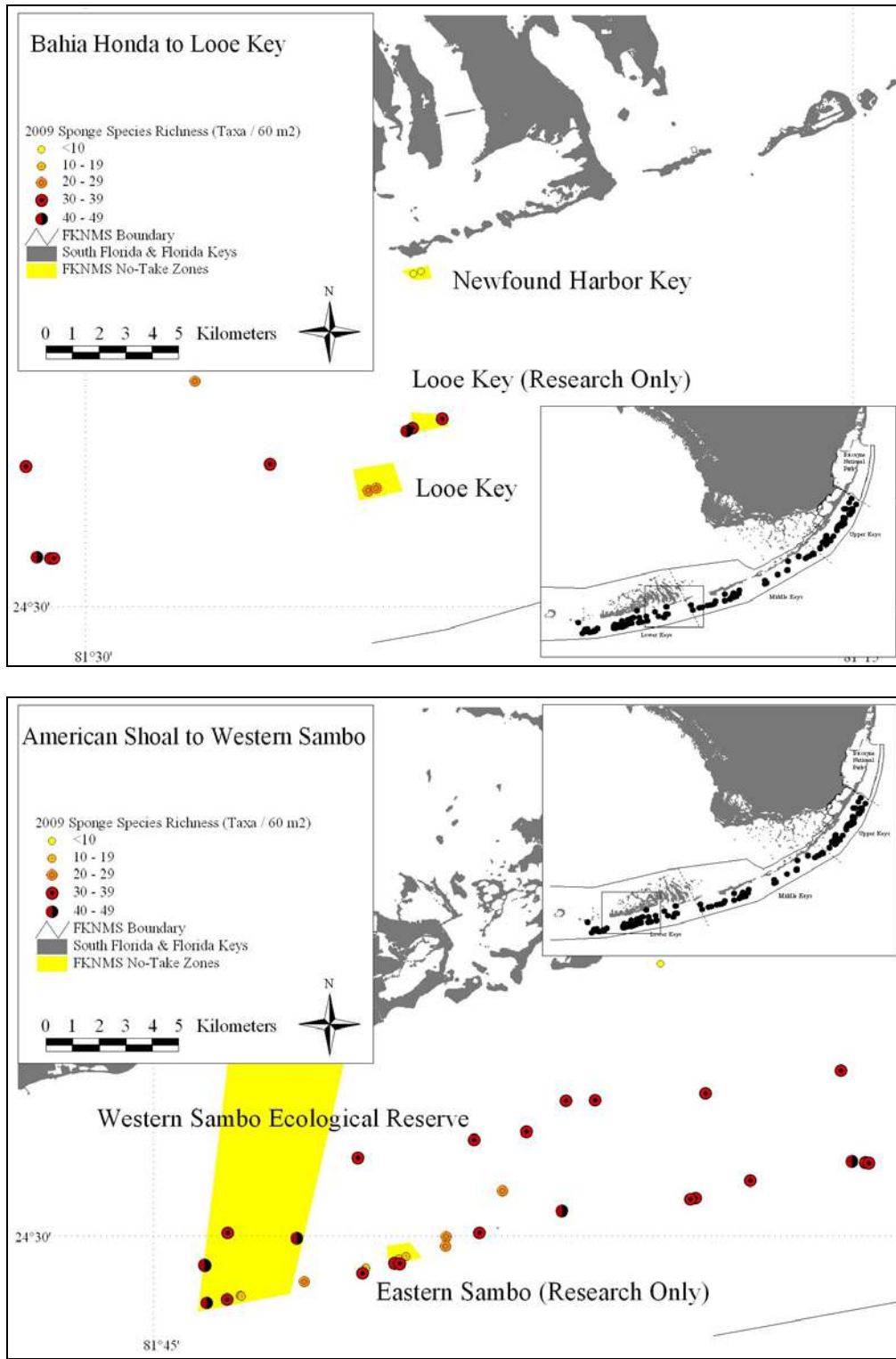


Figure 3-22. Species richness (no. taxa per 60 m²) of sponges in the lower Florida Keys region from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

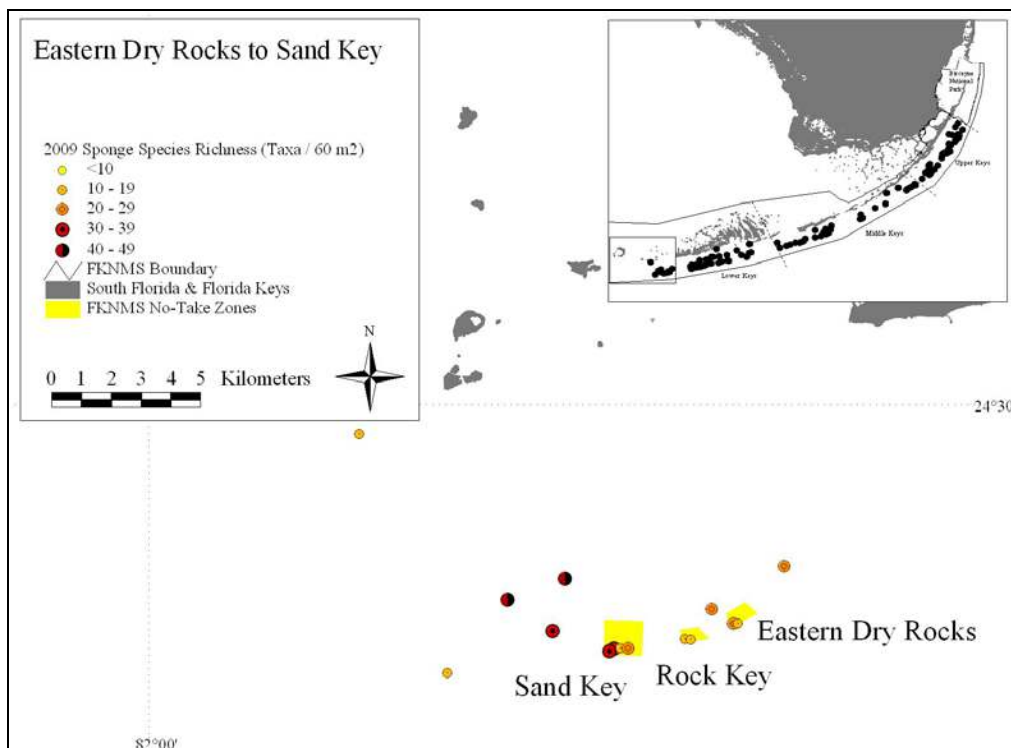


Figure 3-23. Site species richness of sponges on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Data represent the total number of taxa recorded from a 60-m² sampling area. Open bars = FKNMS no-take zones; filled bars = reference areas.

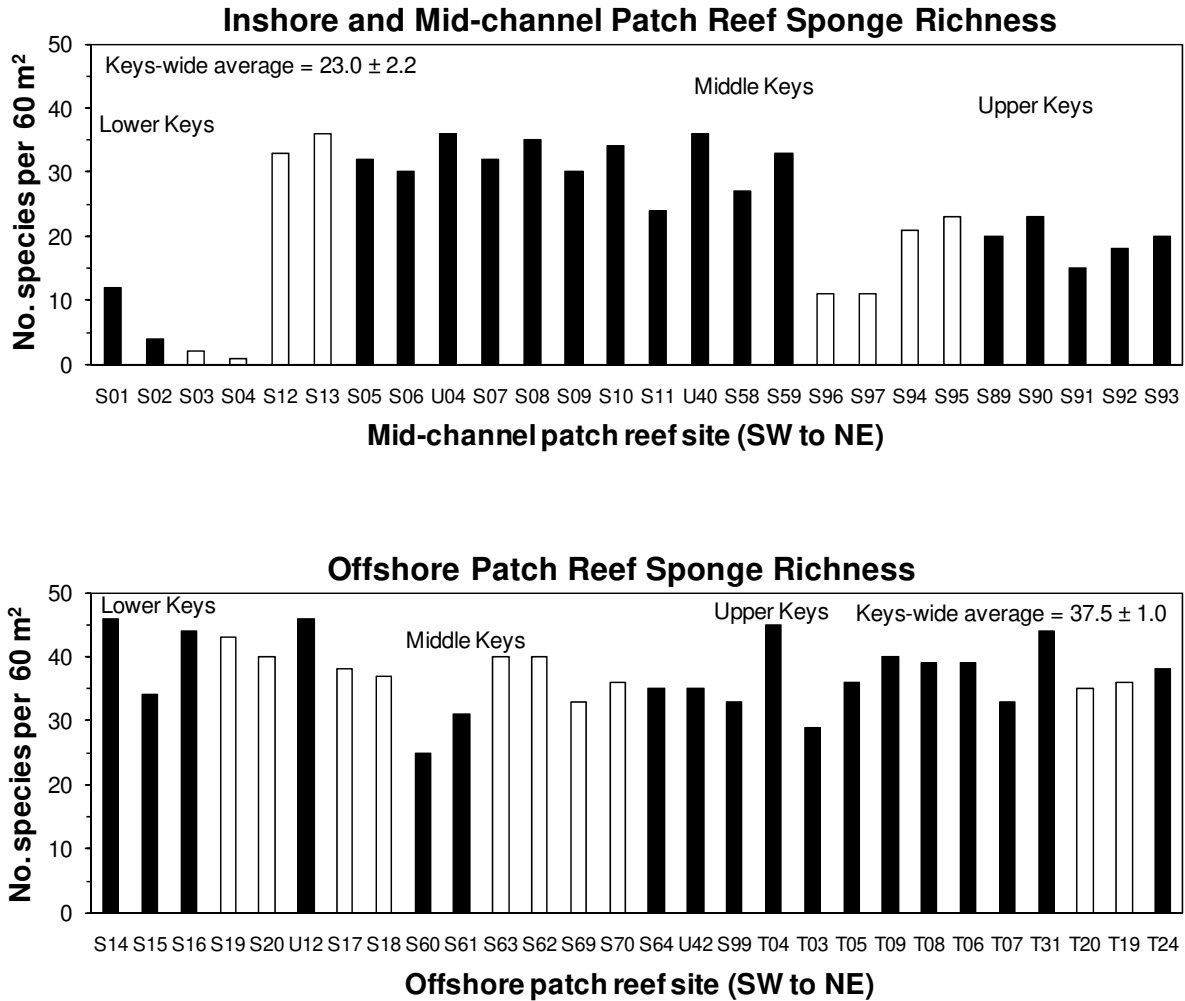


Figure 3-24. Site species richness of sponges on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Data represent the total number of taxa recorded from a 60-m² sampling area. Open bars = FKNMS no-take zones; filled bars = reference areas.

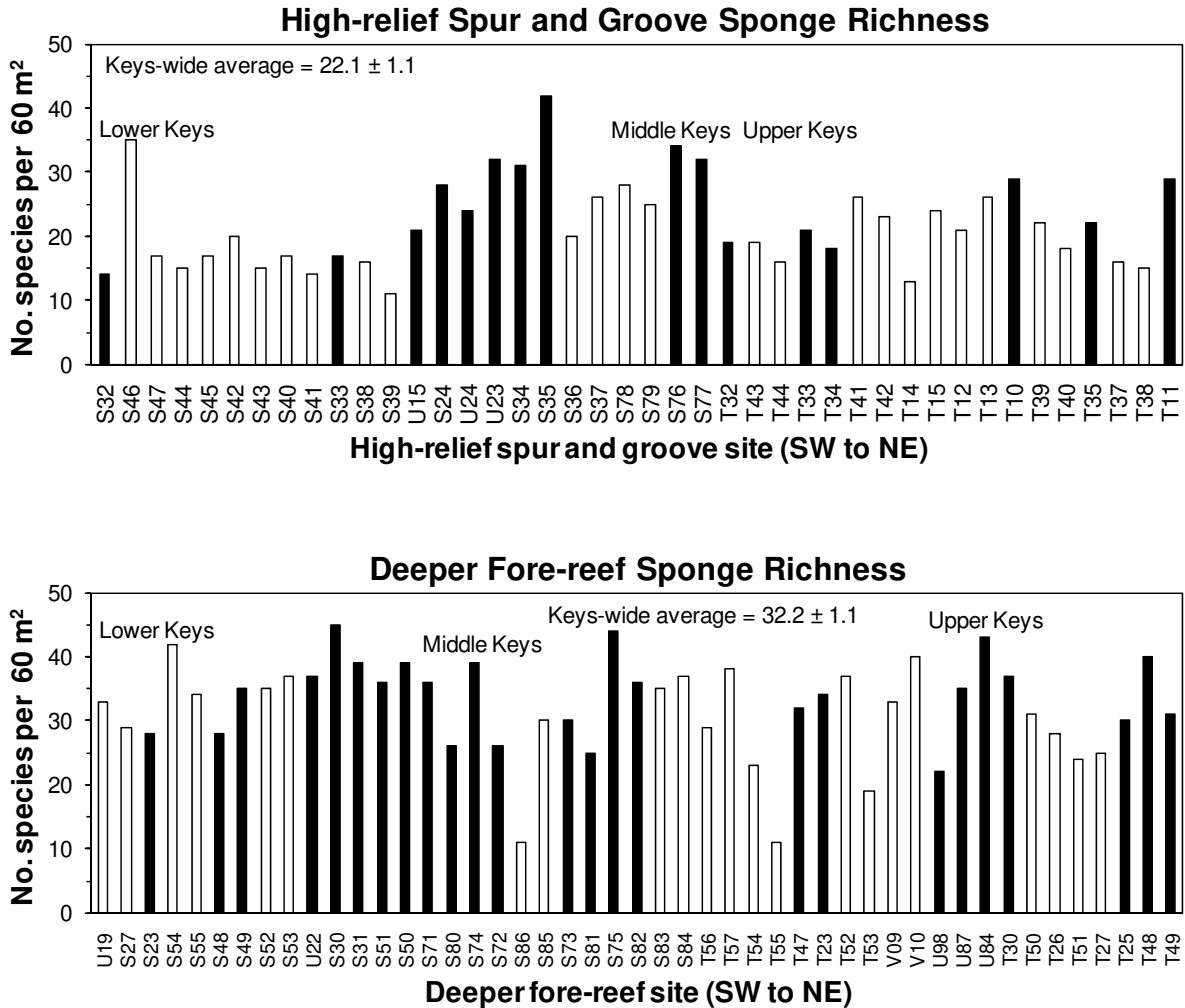


Figure 3-25. Mean total stony coral cover (%) in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

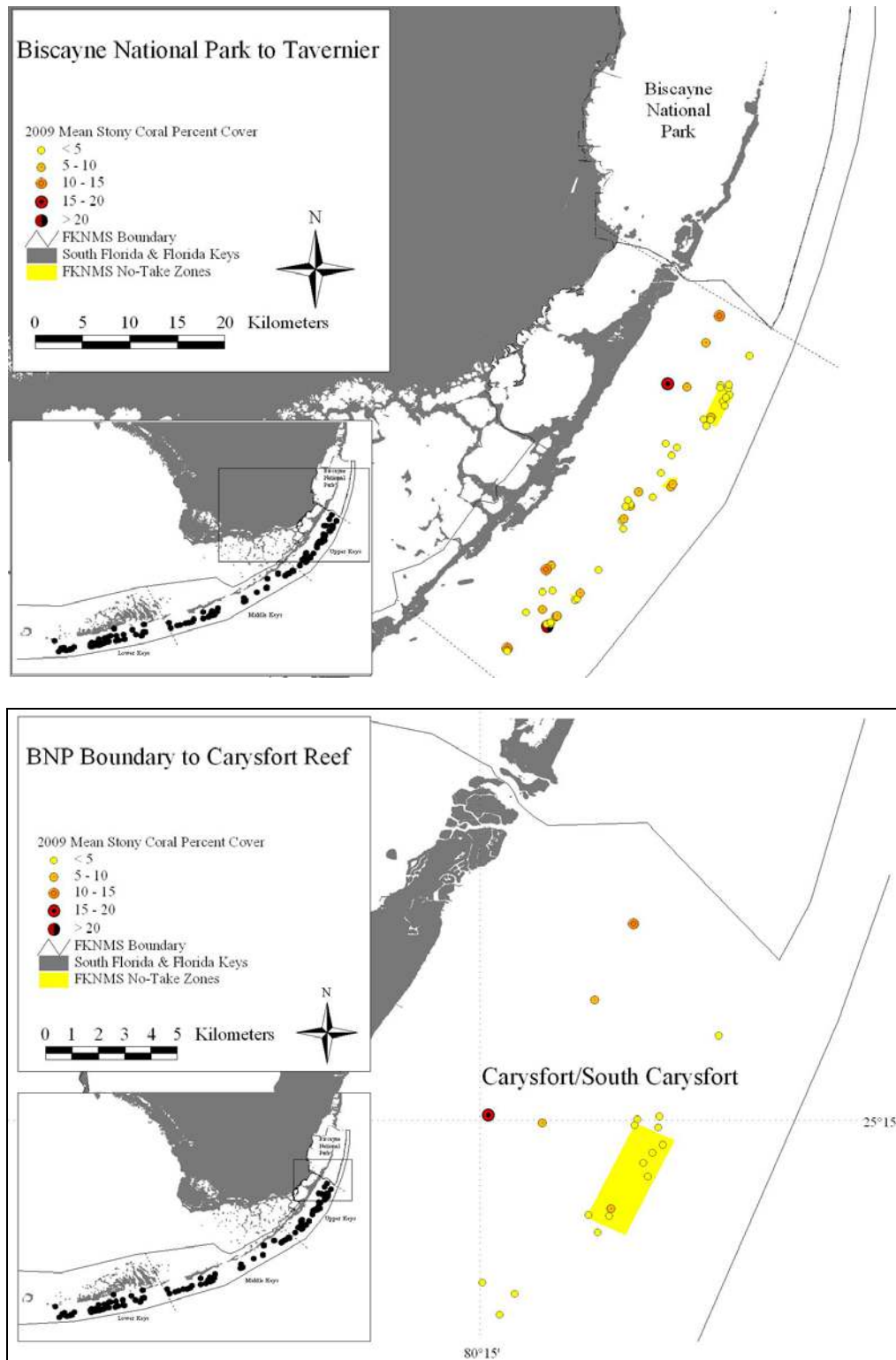


Figure 3-26. Mean total stony coral cover (%) in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region during May-September 2009.

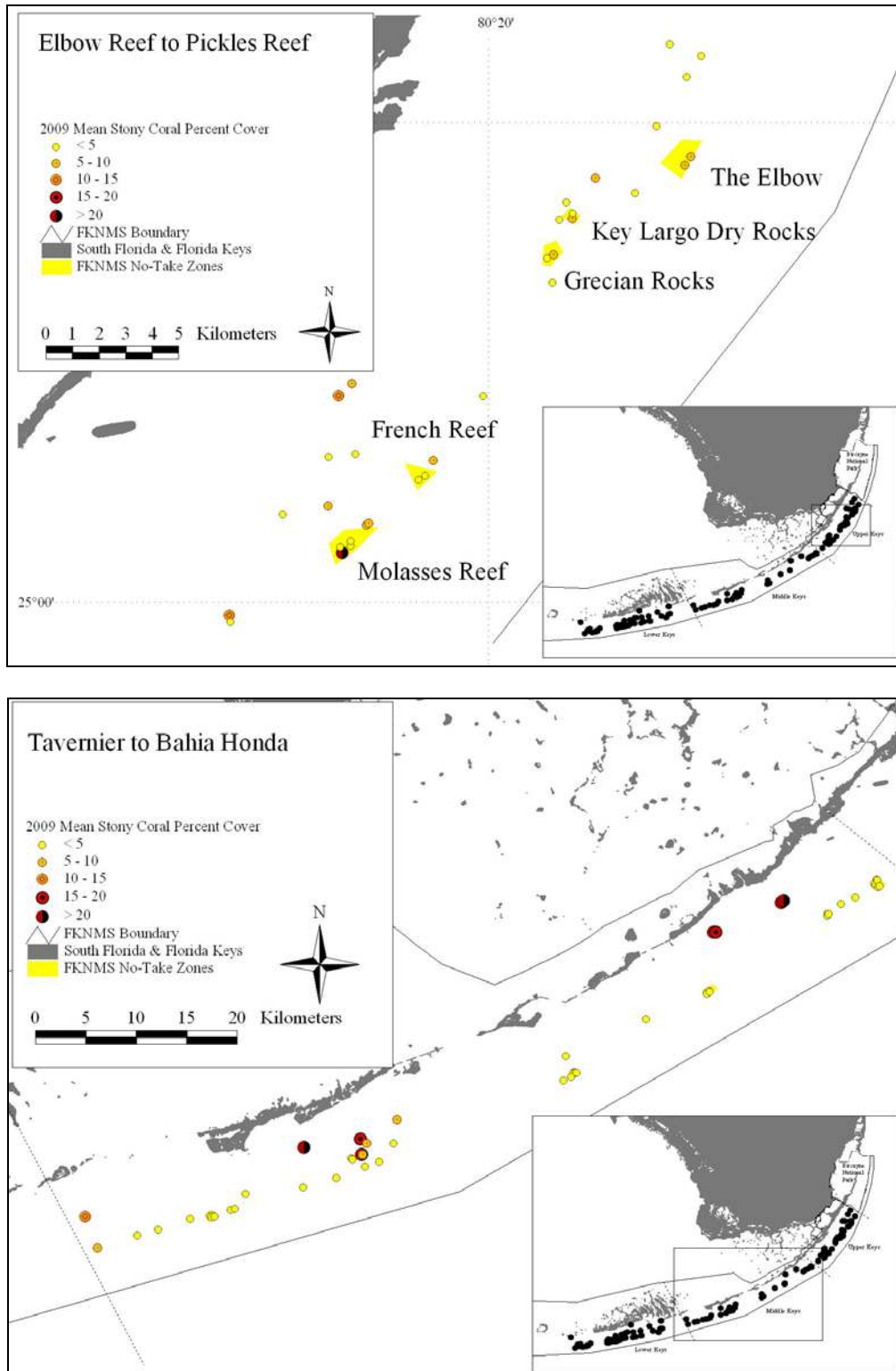


Figure 3-27. Mean total stony coral cover (%) in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

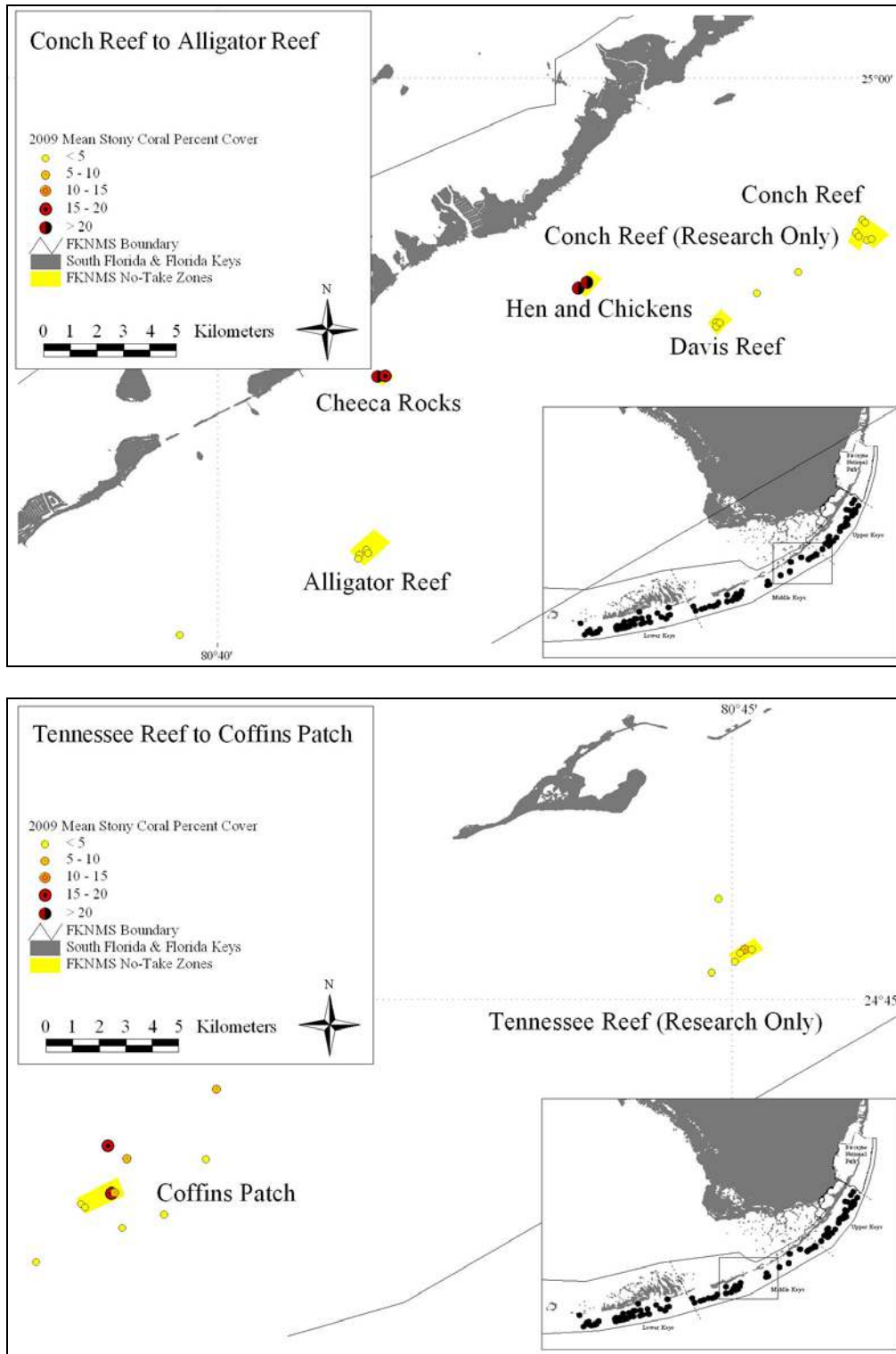


Figure 3-28. Mean total stony coral cover (%) in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

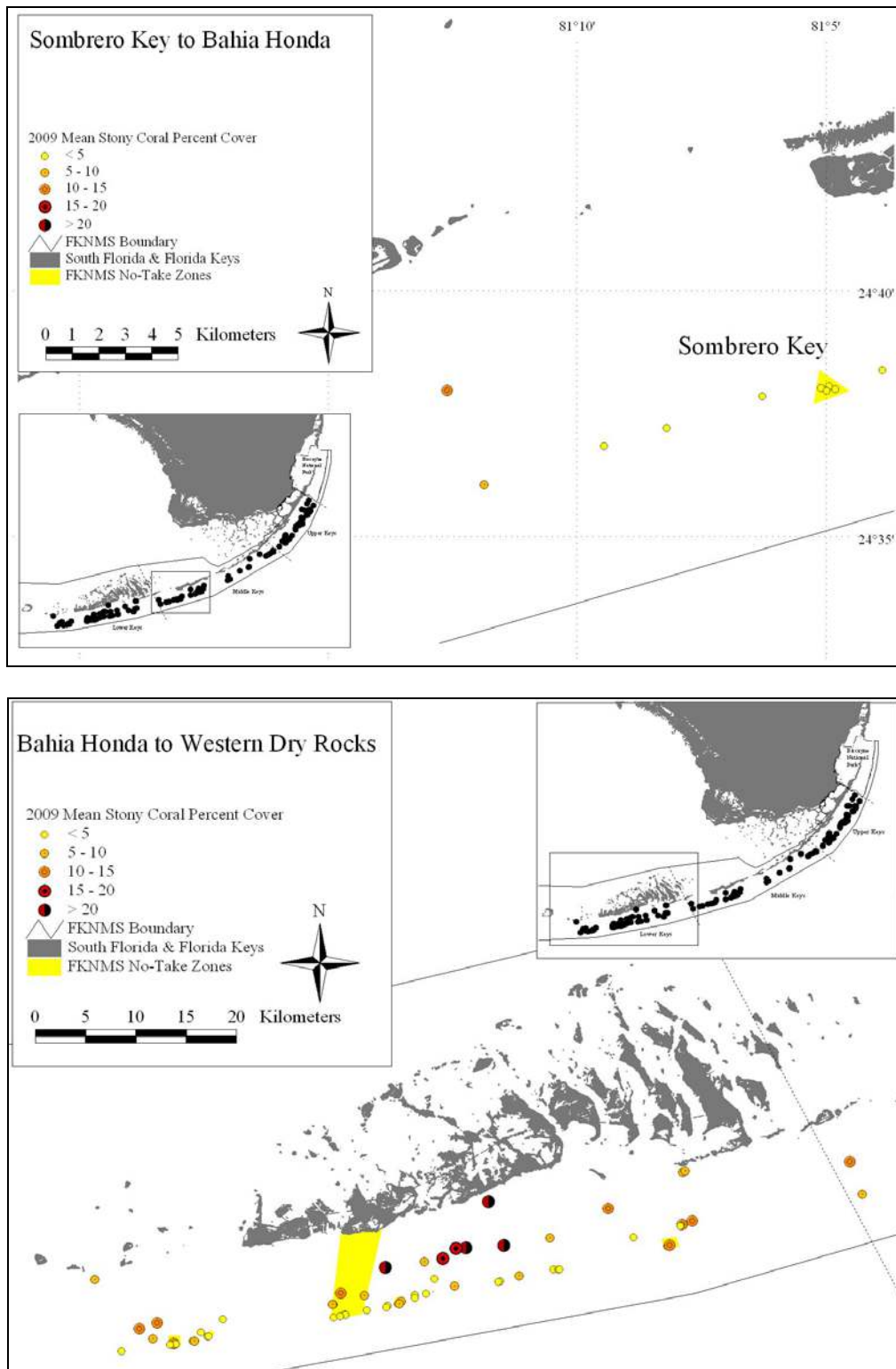


Figure 3-29. Mean total stony coral cover (%) in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

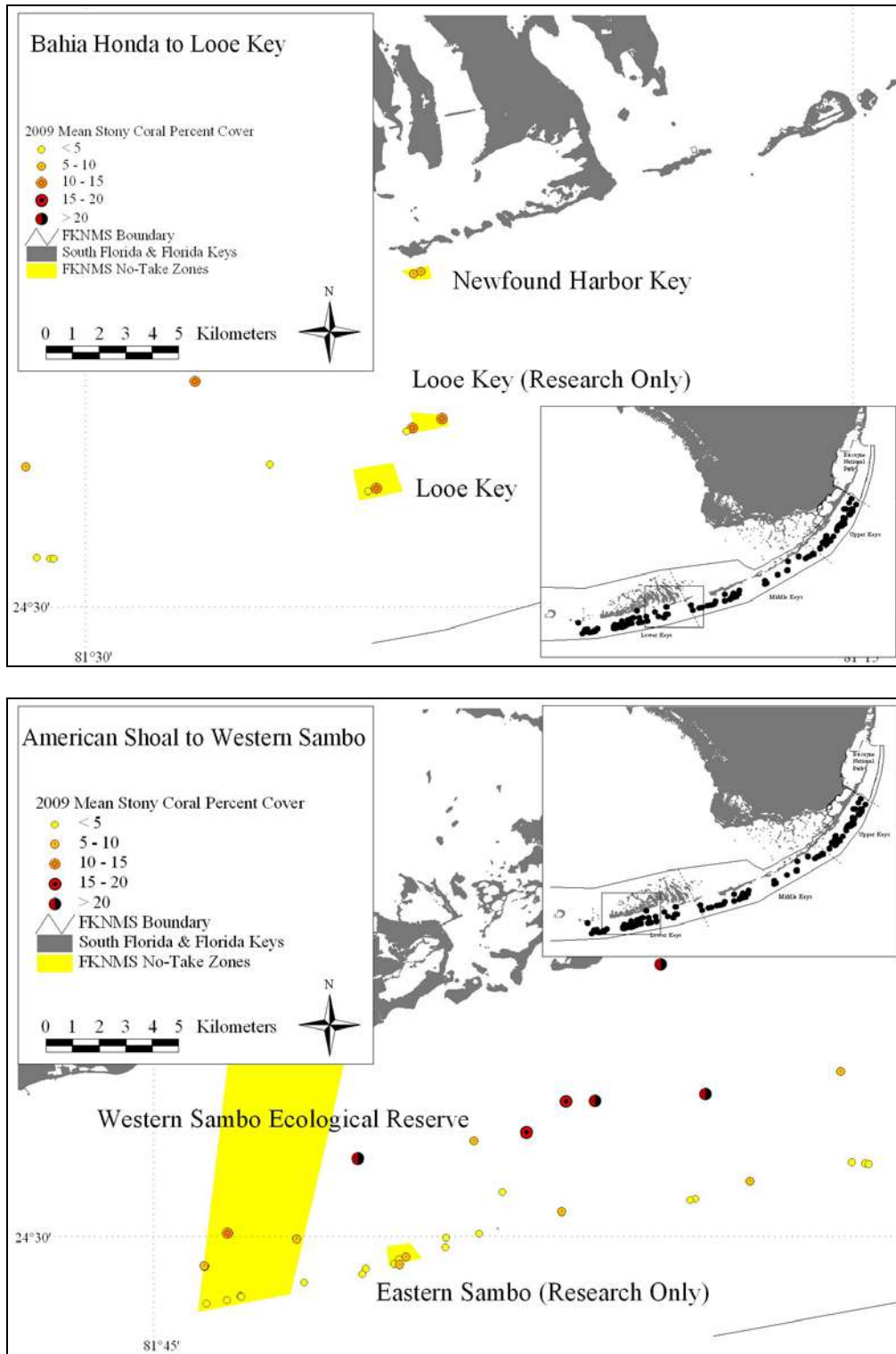


Figure 3-30. Mean total stony coral cover (%) in the lower Florida Keys from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

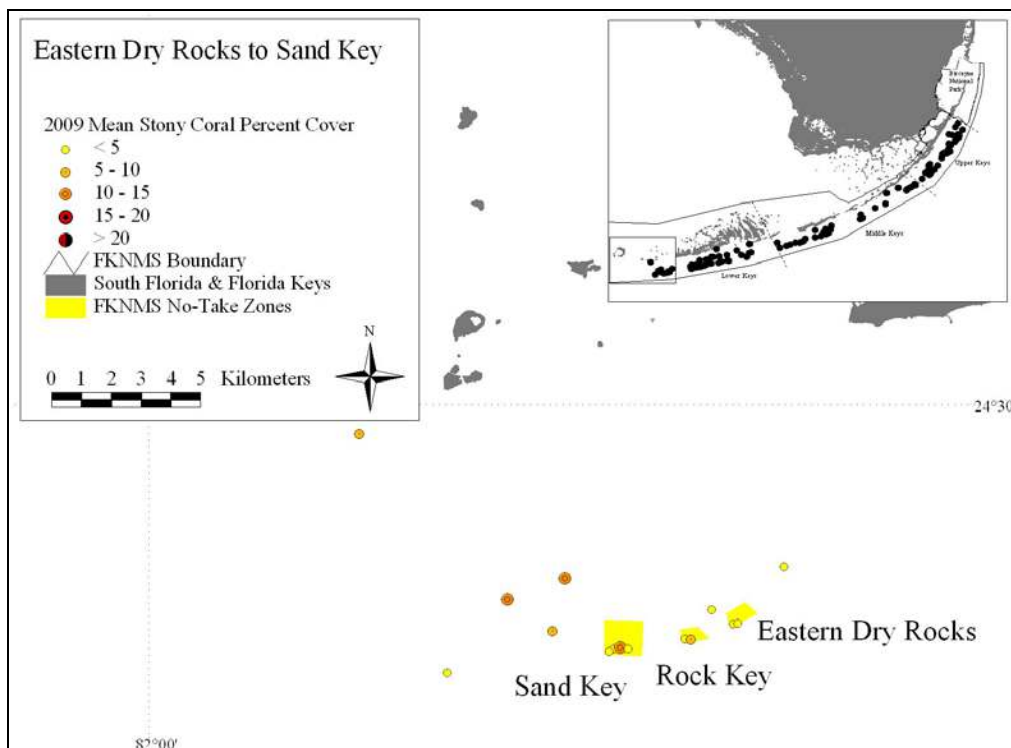


Figure 3-31. Examples of sites with relatively high (> 20%) total coral cover sampled in the Florida Keys during 2009. Note the predominance of massive, frame-building species on various types of patch reefs.

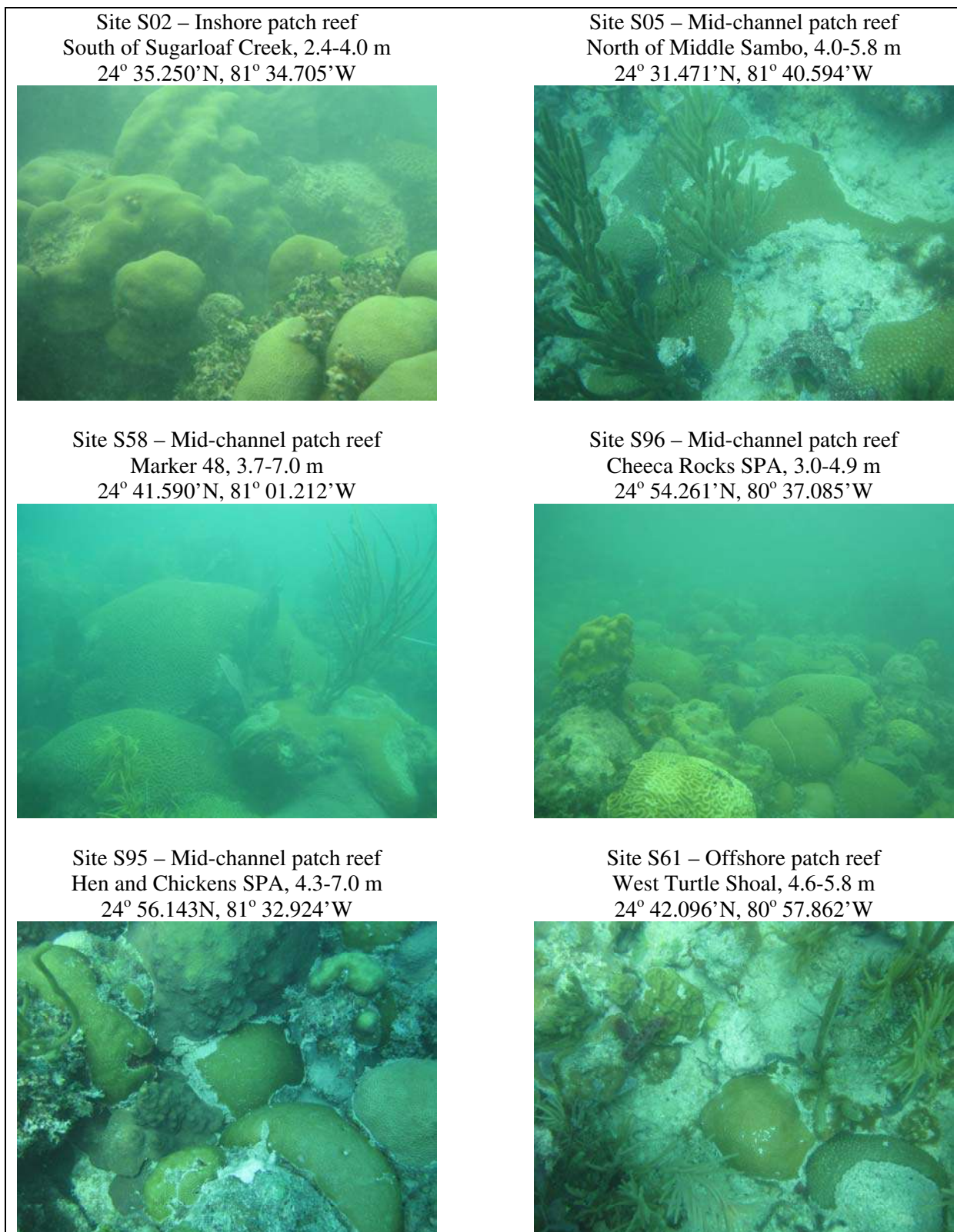


Figure 3-32. Mean (+ 1 SE) percent cover of stony corals, sponges, and the colonial zoanthid *Palythoa* on inshore and mid-channel patch reefs in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

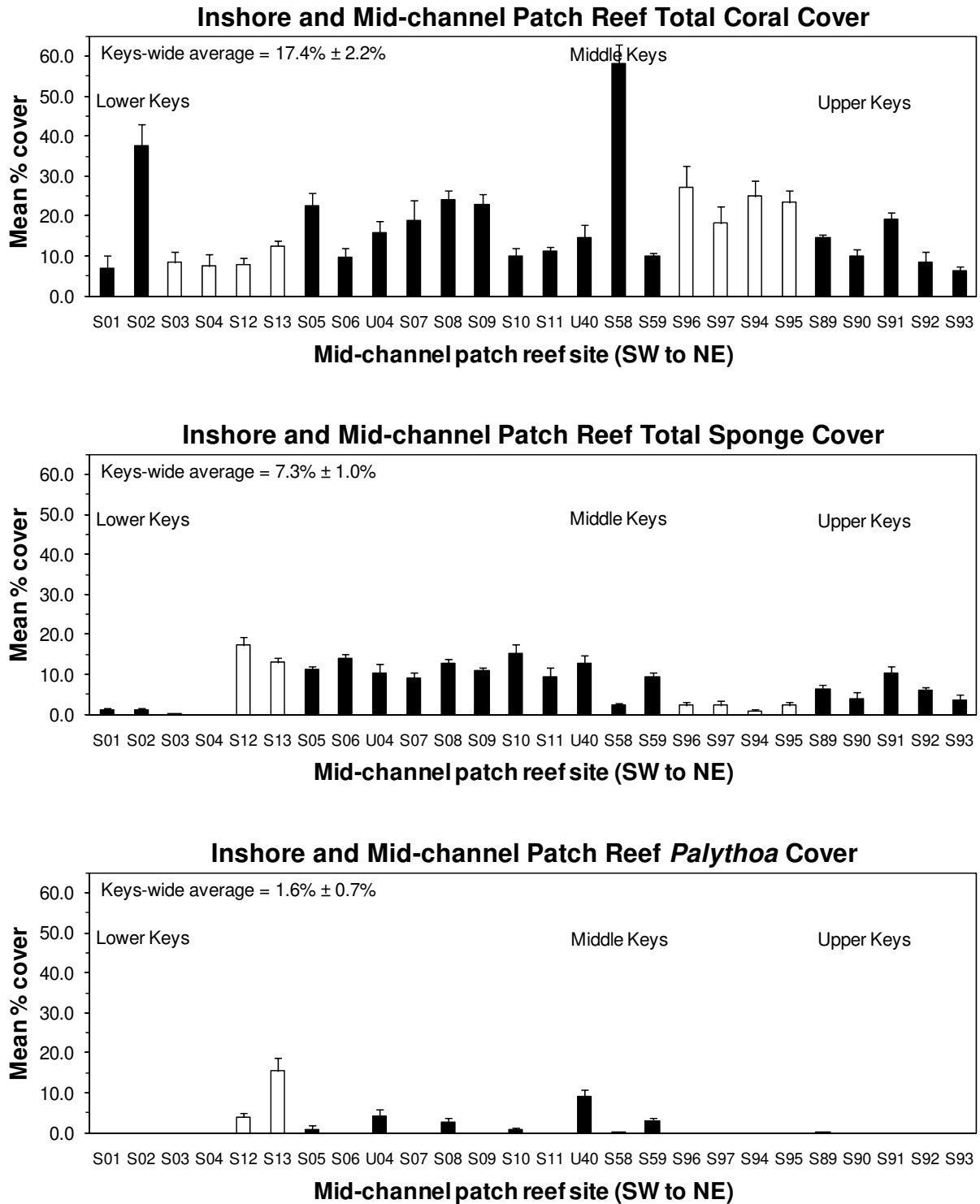


Figure 3-33. Mean (+ 1 SE) percent cover of stony corals, sponges, and the colonial zoanthid *Palythoa* on offshore patch reefs in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

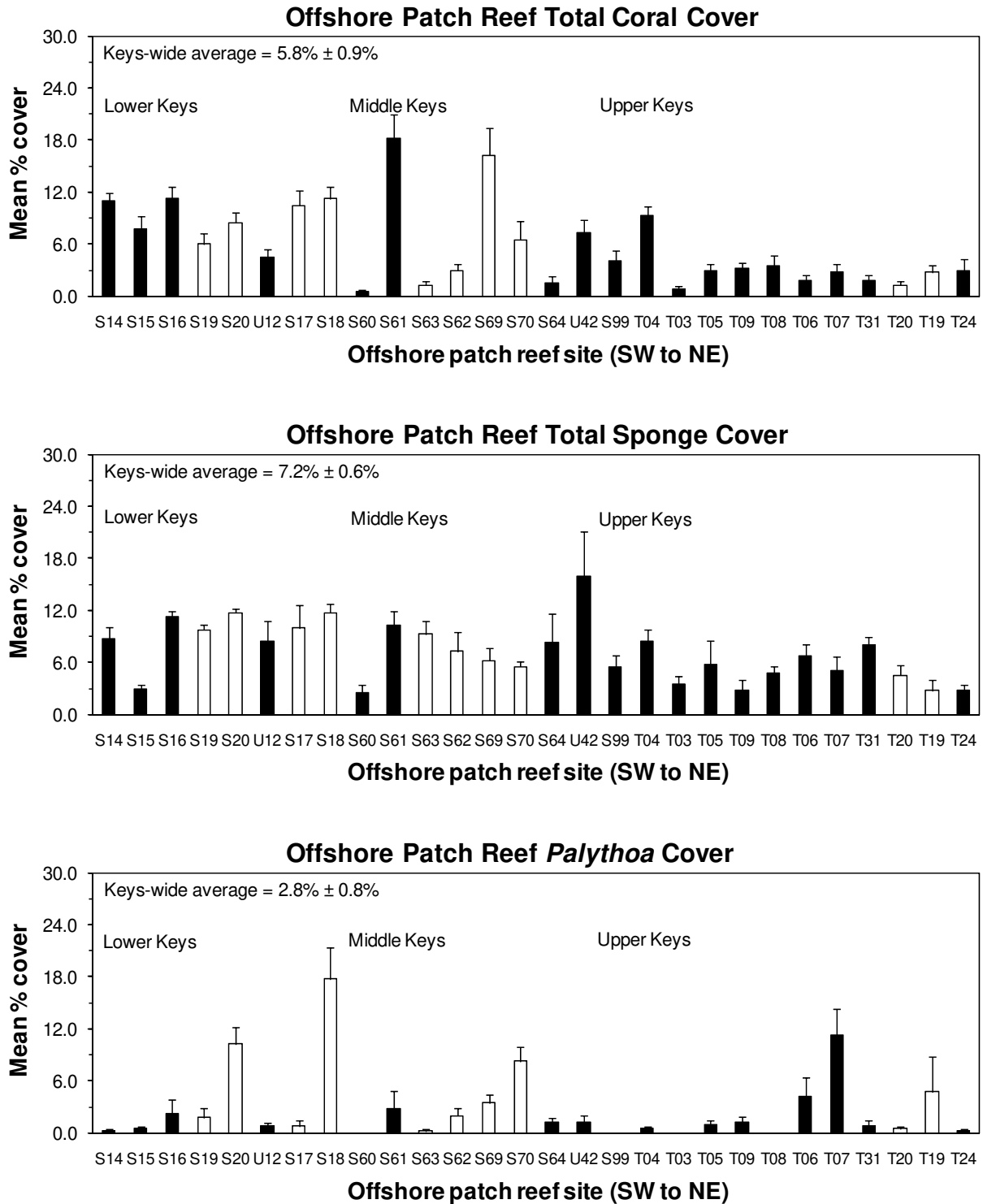


Figure 3-34. Mean (+ 1 SE) percent cover of stony corals, sponges, and the colonial zoanthid *Palythoa* on shallow (< 6 m), high-relief spur and groove reefs in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

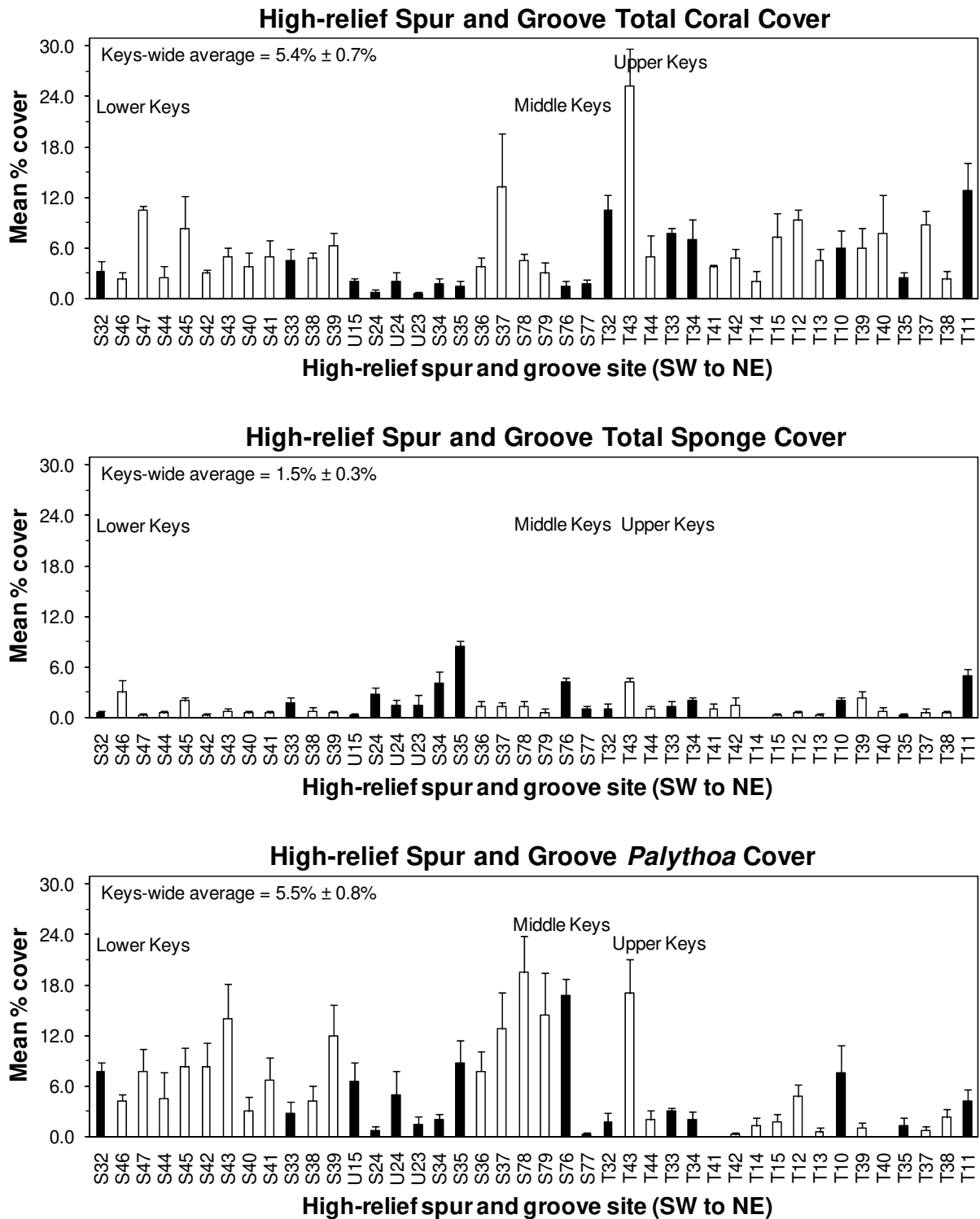


Figure 3-35. Mean (+ 1 SE) percent cover of stony corals, sponges, and the colonial zoanthid *Palythoa* on deeper (6-15 m) fore reef habitats in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

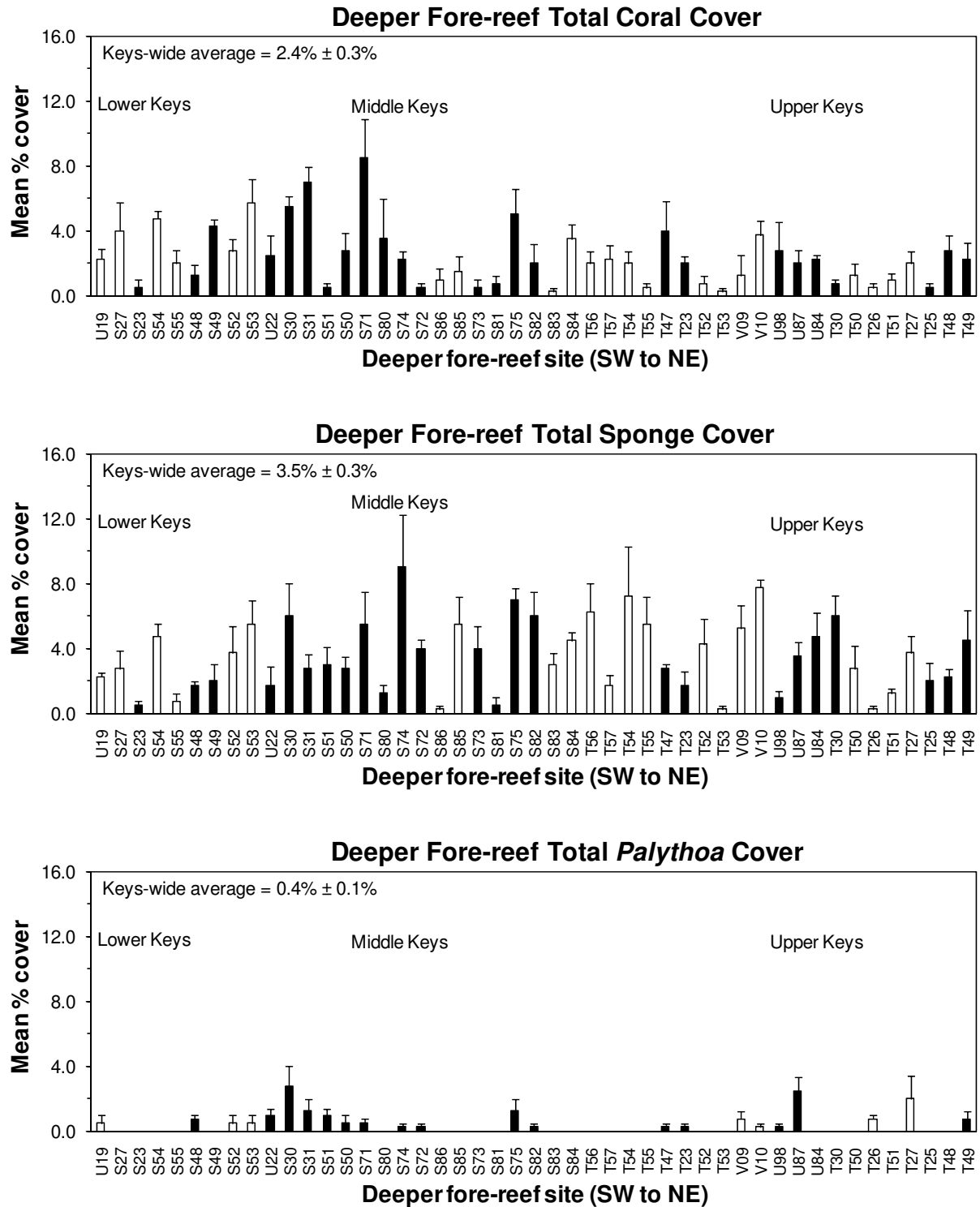


Figure 3-36. Mean (+ 1 SE) percent cover of algal turfs, crustose coralline algae, and macroalgae on inshore and mid-channel patch reefs in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

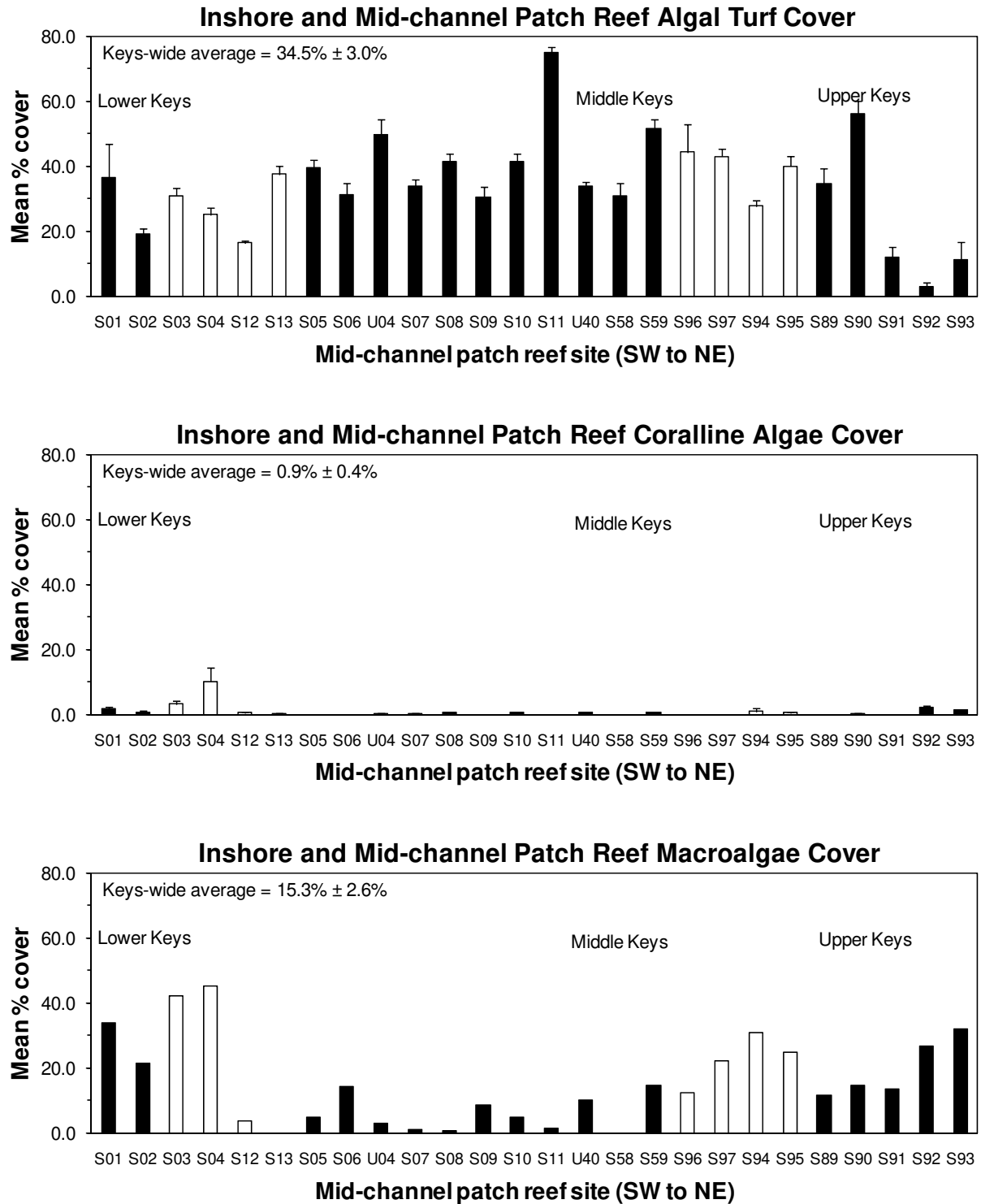


Figure 3-37. Mean (+ 1 SE) percent cover of algal turfs, crustose coralline algae, and macroalgae on offshore patch reefs in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

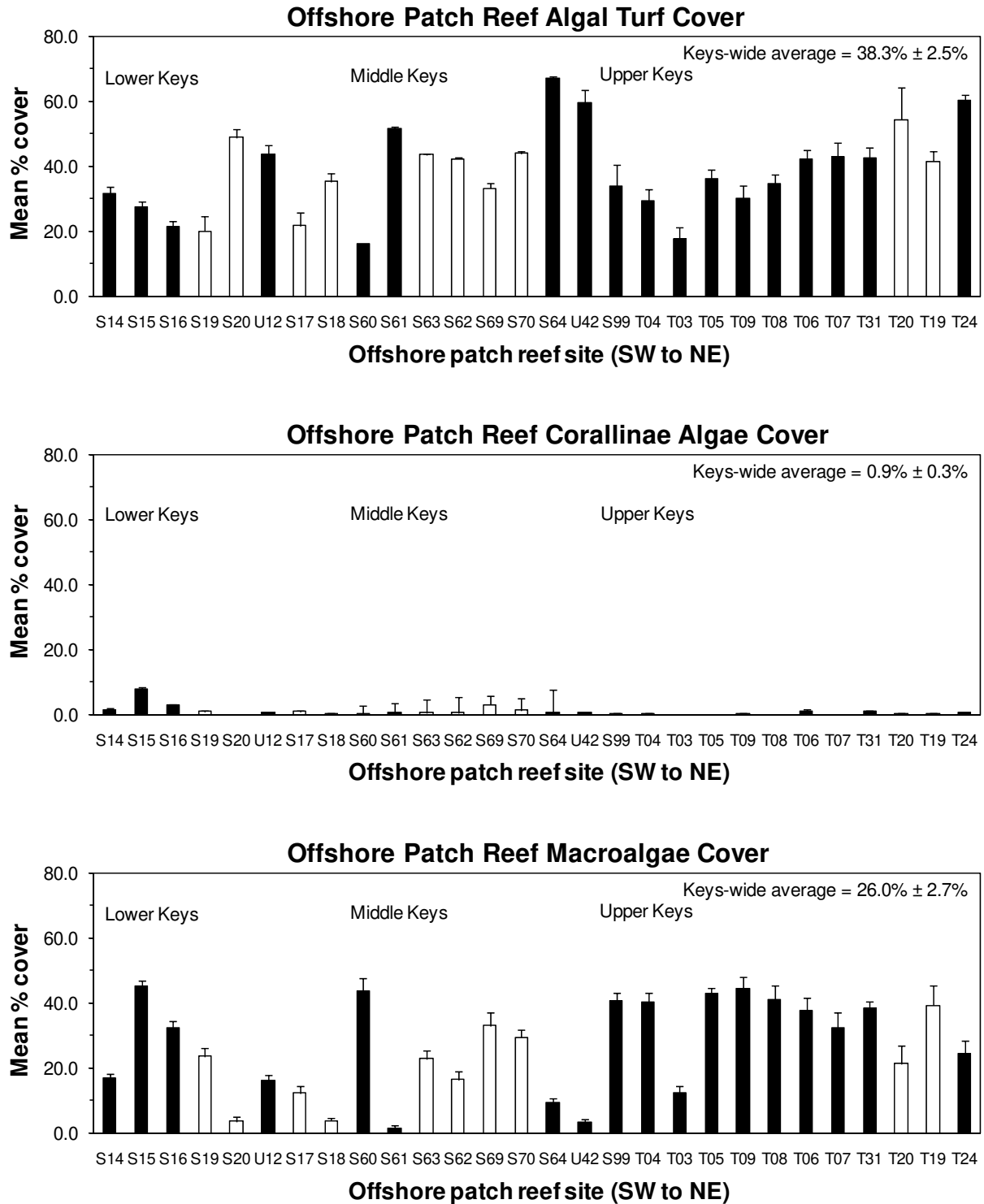


Figure 3-38. Mean (+ 1 SE) percent cover of algal turfs, crustose coralline algae, and macroalgae on shallow (< 6 m), high-relief spur and groove reefs in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

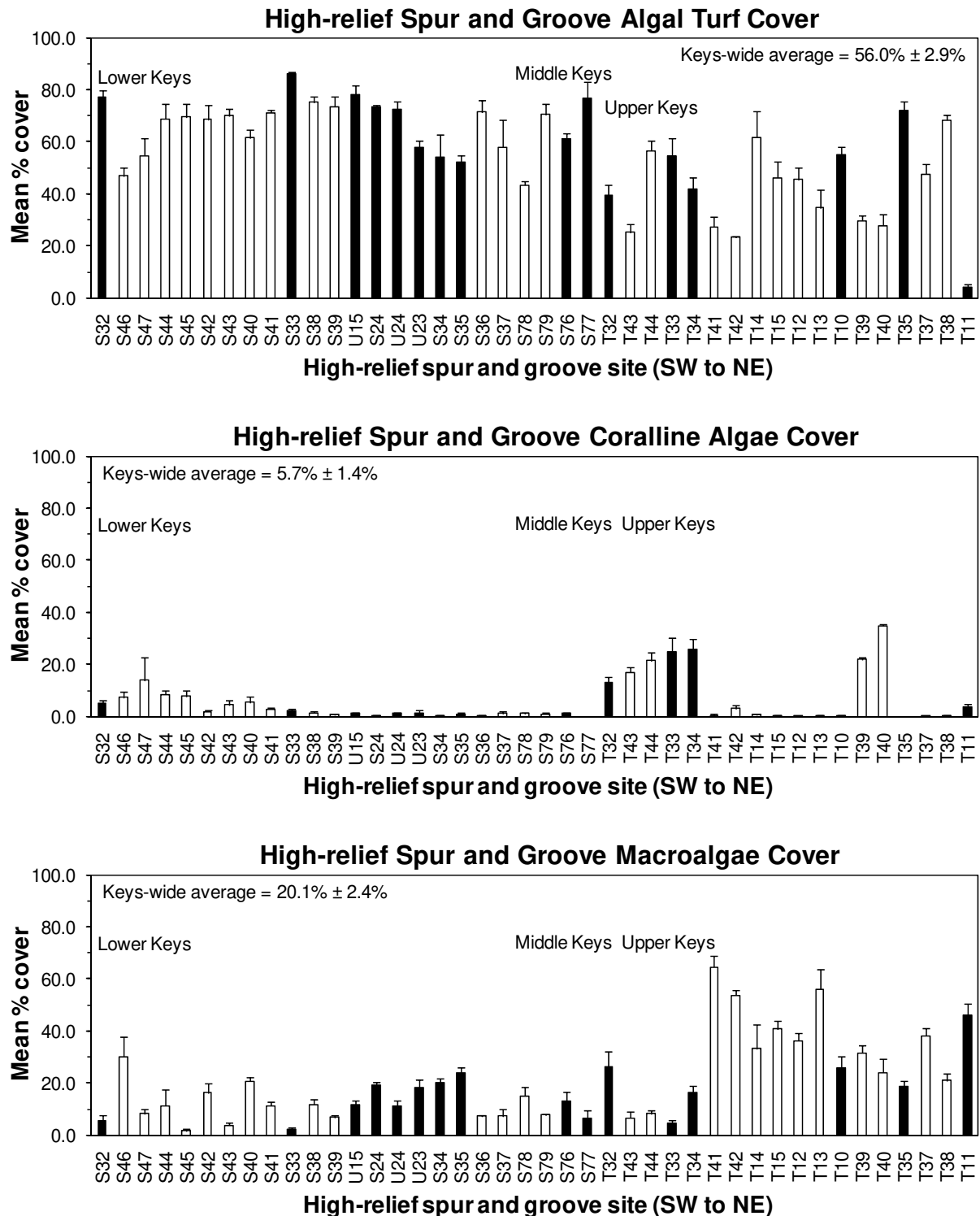


Figure 3-39. Mean (+ 1 SE) percent cover of algal turfs, crustose coralline algae, and macroalgae on deeper (6-15 m) fore reef habitats in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

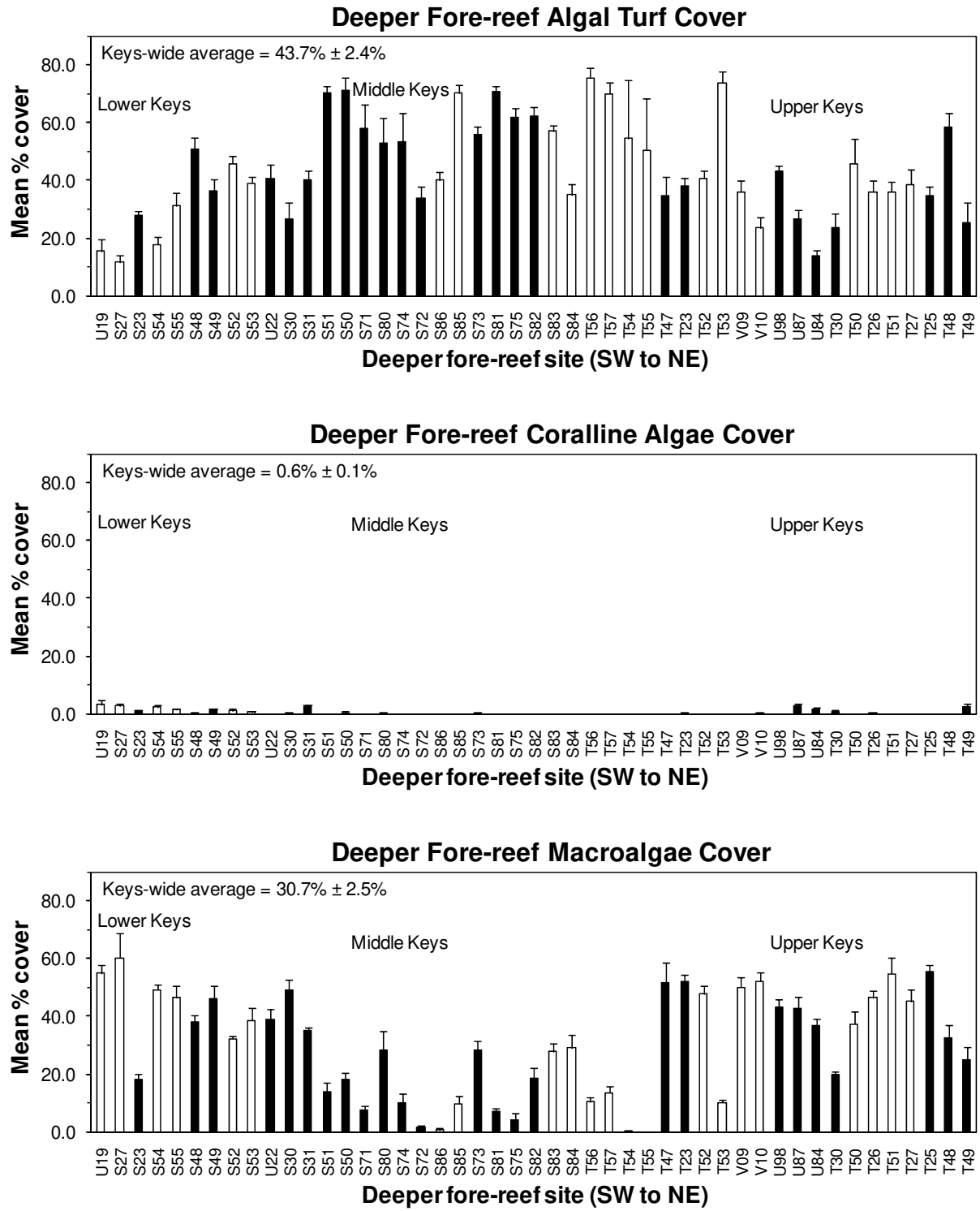


Table 3-1. Site species richness and mean $\pm$ 1 SE numbers of species per 15 m² for stony corals (Milleporina and Scleractinia), gorgonians (Octocorallia), and sponges in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	Stony Corals		Gorgonians		Sponges	
	Total species	No. species per 15 m ²	Total species	No. species per 15 m ²	Total species	No. species per 15 m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	19	13.0 $\pm$ 0.7	6	4.5 $\pm$ 0.5	12	7.8 $\pm$ 1.3
S02 – South of Sugarloaf Creek	17	12.3 $\pm$ 1.1	11	6.3 $\pm$ 1.7	4	2.5 $\pm$ 0.3
S03 – Newfound Harbor SPA**	6	3.3 $\pm$ 1.1	2	1.3 $\pm$ 0.5	2	1.5 $\pm$ 0.3
S04 – Newfound Harbor SPA**	6	2.8 $\pm$ 0.6	3	2.8 $\pm$ 0.3	1	1.0 $\pm$ 0.0
Lower Florida Keys Total (4)	12.0 $\pm$ 3.5	7.8 $\pm$ 2.8	5.5 $\pm$ 2.0	3.7 $\pm$ 1.1	4.8 $\pm$ 2.5	3.2 $\pm$ 1.6
Inshore Patch Reef Total (4)	12.0 $\pm$ 3.5	7.8 $\pm$ 2.8	5.5 $\pm$ 2.0	3.7 $\pm$ 1.1	4.8 $\pm$ 2.5	3.2 $\pm$ 1.6
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	22	13.3 $\pm$ 1.4	21	17.0 $\pm$ 1.3	33	23.3 $\pm$ 1.3
S13 - Western Sambo ER**	21	12.3 $\pm$ 1.3	20	16.8 $\pm$ 0.5	36	26.8 $\pm$ 2.1
S05 - North of Middle Sambo Reef	21	14.8 $\pm$ 0.9	21	16.3 $\pm$ 1.1	32	23.5 $\pm$ 1.0
S06 - North of Pelican Shoal	15	11.5 $\pm$ 0.6	21	18.0 $\pm$ 0.7	30	18.8 $\pm$ 1.5
U04 - North of Pelican Shoal	19	12.8 $\pm$ 0.6	19	16.0 $\pm$ 1.1	36	26.0 $\pm$ 1.2
S07 - West Washerwoman Shoal	21	15.8 $\pm$ 0.5	19	13.8 $\pm$ 1.7	32	21.8 $\pm$ 0.6
S08 - West Washerwoman Shoal	22	16.5 $\pm$ 0.6	18	15.8 $\pm$ 0.5	35	25.0 $\pm$ 1.1
S09 - North of Maryland Shoal	21	16.5 $\pm$ 1.0	20	17.8 $\pm$ 0.9	30	23.0 $\pm$ 0.8
S10 - North of American Shoal	23	17.3 $\pm$ 1.0	20	16.5 $\pm$ 0.9	34	25.0 $\pm$ 0.7
S11 - North of American Shoal	19	13.0 $\pm$ 0.4	3	1.8 $\pm$ 0.6	24	16.3 $\pm$ 1.2
Lower Florida Keys Total (10)	20.4 $\pm$ 0.7	14.4 $\pm$ 0.6	18.2 $\pm$ 1.7	15.0 $\pm$ 1.5	32.2 $\pm$ 1.1	22.9 $\pm$ 1.0
Middle Florida Keys						
U40 - Marker 49A	19	11.5 $\pm$ 1.2	19	15.0 $\pm$ 0.4	36	23.8 $\pm$ 1.5
S58 - Marker 48	19	12.5 $\pm$ 1.0	15	10.3 $\pm$ 0.9	27	17.8 $\pm$ 0.9
S59 - East Turtle Shoal	17	11.8 $\pm$ 0.3	19	15.5 $\pm$ 1.2	33	23.5 $\pm$ 0.6
S96 - Cheeca Rocks SPA**	21	15.5 $\pm$ 0.6	7	4.0 $\pm$ 0.9	11	6.3 $\pm$ 0.8
S97 - Cheeca Rocks SPA**	17	11.8 $\pm$ 0.9	5	4.0 $\pm$ 0.4	11	6.3 $\pm$ 0.6
S94 - Hen and Chickens Reef SPA**	15	9.8 $\pm$ 1.0	12	7.3 $\pm$ 1.1	21	12.3 $\pm$ 1.3
S95 - Hen and Chickens Reef SPA**	17	13.8 $\pm$ 1.3	13	8.8 $\pm$ 0.6	23	14.0 $\pm$ 0.0
Middle Florida Keys Total (7)	17.9 $\pm$ 0.7	12.4 $\pm$ 0.7	12.9 $\pm$ 2.1	9.3 $\pm$ 1.8	23.1 $\pm$ 3.7	14.8 $\pm$ 2.8
Upper Florida Keys						
S89 - Mosquito Bank	19	13.3 $\pm$ 0.9	18	14.5 $\pm$ 0.6	20	13.8 $\pm$ 0.8
S90 - Mosquito Bank	16	13.0 $\pm$ 0.8	18	16.3 $\pm$ 0.5	23	15.5 $\pm$ 1.2
S91 - Basin Hill Shoals	23	16.5 $\pm$ 1.5	21	13.5 $\pm$ 0.5	15	10.5 $\pm$ 1.3
S92 - Basin Hill Shoals	18	13.0 $\pm$ 0.7	19	15.5 $\pm$ 1.0	18	12.5 $\pm$ 0.6
S93 - Turtle Rocks	13	8.5 $\pm$ 0.3	22	18.3 $\pm$ 0.6	20	11.3 $\pm$ 1.2
Upper Florida Keys Total (5)	17.8 $\pm$ 1.7	12.9 $\pm$ 1.3	19.6 $\pm$ 0.8	15.6 $\pm$ 0.8	19.2 $\pm$ 1.3	12.7 $\pm$ 0.9
Mid-channel Patch Reef Total (22)	19.0 $\pm$ 0.6	13.4 $\pm$ 0.5	16.8 $\pm$ 1.2	13.3 $\pm$ 1.1	26.4 $\pm$ 1.7	18.0 $\pm$ 1.4
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	22	14.0 $\pm$ 0.9	21	14.8 $\pm$ 1.3	46	31.8 $\pm$ 2.7
S15 - North of Sand Key	22	15.0 $\pm$ 0.7	14	9.5 $\pm$ 0.6	34	22.0 $\pm$ 1.5
S16 - North of Sand Key	25	17.5 $\pm$ 1.2	19	14.3 $\pm$ 1.7	44	31.0 $\pm$ 2.6
S19 - Western Sambo ER**	26	17.8 $\pm$ 0.5	21	15.8 $\pm$ 1.3	43	31.3 $\pm$ 0.9
S20 - Western Sambo ER**	23	15.5 $\pm$ 0.9	21	16.5 $\pm$ 1.0	40	28.5 $\pm$ 1.0
U12 - West of Looe Key RO	18	10.8 $\pm$ 1.5	19	14.8 $\pm$ 1.3	46	29.5 $\pm$ 1.2

Site number/site location	Stony Corals		Gorgonians		Sponges	
	Total species	No. species per 15 m ²	Total species	No. species per 15 m ²	Total species	No. species per 15 m ²
S17 - Looe Key RO**	20	14.0 ± 1.1	20	16.0 ± 0.4	38	27.3 ± 1.5
S18 - Looe Key RO**	17	12.8 ± 0.5	17	13.8 ± 0.9	37	27.8 ± 1.5
Lower Florida Keys Total (8)	21.6 ± 1.1	14.7 ± 0.8	19.0 ± 0.9	14.4 ± 0.8	41.0 ± 1.6	28.6 ± 1.1
Middle Florida Keys						
S60 - NE of Delta Shoal	8	6.0 ± 0.4	14	8.0 ± 0.9	25	16.3 ± 1.9
S61 - West Turtle Shoal	19	15.0 ± 0.4	19	16.3 ± 0.6	31	21.3 ± 0.9
S63 - Coffins Patch SPA**	10	6.8 ± 0.8	19	13.8 ± 0.3	40	24.8 ± 1.0
S62 - Coffins Patch SPA**	16	9.3 ± 1.2	19	13.0 ± 0.7	40	26.0 ± 2.0
S69 - Coffins Patch SPA**	10	8.5 ± 0.6	14	11.0 ± 0.7	33	22.5 ± 0.6
S70 - Coffins Patch SPA**	17	11.5 ± 0.5	15	10.3 ± 1.1	36	25.3 ± 0.3
S64 - South of Coffins Patch	11	7.5 ± 1.0	18	14.8 ± 0.9	35	23.0 ± 1.2
U42 - East of Coffins Patch	18	12.3 ± 1.3	20	16.8 ± 0.9	35	25.8 ± 0.3
Middle Florida Keys Total (8)	13.6 ± 1.5	9.6 ± 1.1	17.3 ± 0.9	13.0 ± 1.1	34.4 ± 1.7	23.1 ± 1.1
Upper Florida Keys						
S99 - Wolf Reef	12	8.3 ± 1.0	18	12.5 ± 0.6	33	22.3 ± 2.5
T04 - Inshore of Sand Island	19	13.5 ± 0.6	19	14.5 ± 1.0	45	31.5 ± 1.0
T03 - White Bank	9	6.5 ± 0.6	20	16.5 ± 0.6	29	16.5 ± 2.0
T05 - White Bank	12	9.5 ± 0.3	16	12.0 ± 1.2	36	21.8 ± 0.8
T09 - South of Key Largo Dry Rocks	15	11.0 ± 0.9	23	17.8 ± 0.9	40	28.5 ± 1.2
T08 - West of Key Largo Dry Rocks	18	11.0 ± 0.4	20	14.5 ± 1.2	39	29.5 ± 0.9
T06 - West of Elbow Reef	13	7.8 ± 0.9	19	15.0 ± 0.9	39	25.5 ± 1.2
T07 - SW of Watson's Reef	9	6.3 ± 0.6	24	18.8 ± 1.3	33	24.0 ± 0.9
T31 - South of Watson's Reef	17	12.0 ± 1.6	22	16.5 ± 0.6	44	28.0 ± 0.9
T20 - Carysfort Reef SPA**	12	8.3 ± 0.9	21	16.5 ± 0.6	35	23.8 ± 1.0
T19 - Carysfort Reef SPA**	15	10.0 ± 0.7	21	15.3 ± 0.3	36	23.5 ± 0.6
T24 - North of Carysfort Reef	15	10.8 ± 0.5	18	11.8 ± 0.6	38	25.0 ± 2.5
Upper Florida Keys Total (12)	13.8 ± 0.9	9.6 ± 0.6	20.1 ± 0.7	15.1 ± 0.6	37.3 ± 1.3	25.0 ± 1.2
Offshore Patch Reef Total (28)	16.0 ± 0.9	11.0 ± 0.6	19.0 ± 0.5	14.3 ± 0.5	37.5 ± 1.0	25.5 ± 0.8
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	6	3.0 ± 0.4	13	7.8 ± 1.4	22	8.8 ± 1.7
S22 - West of Looe Key SPA	15	10.0 ± 0.6	21	17.5 ± 0.6	33	20.8 ± 0.8
Lower Florida Keys Total (2)	10.5 ± 4.5	6.5 ± 3.5	17.0 ± 4.0	12.6 ± 4.9	27.5 ± 5.5	14.8 ± 6.0
Middle Florida Keys						
S65 - SE of Coffins Patch	16	9.8 ± 1.1	17	11.3 ± 1.5	38	24.0 ± 0.4
S66 - Tennessee Reef	16	12.0 ± 0.7	16	12.8 ± 0.6	31	23.8 ± 1.0
S68 - Tennessee Reef RO**	17	11.3 ± 0.9	18	13.5 ± 0.6	42	29.8 ± 2.4
S67 - Tennessee Reef RO**	17	11.3 ± 1.4	19	14.5 ± 0.6	43	27.8 ± 1.9
T16 - West of Alligator Reef	13	9.3 ± 0.6	17	10.8 ± 0.8	33	22.8 ± 0.5
T45 - Alligator Reef SPA**	12	7.5 ± 1.2	19	16.3 ± 1.2	31	18.5 ± 1.4
T46 - Alligator Reef SPA**	12	9.0 ± 0.4	18	14.8 ± 0.6	29	17.8 ± 1.3
V03 - Davis Reef SPA**	15	9.8 ± 0.9	14	9.3 ± 1.1	29	18.3 ± 2.3
T36 - Davis Reef SPA**	13	8.8 ± 0.5	14	9.0 ± 0.7	26	15.8 ± 1.8
T21 - Conch Reef SPA**	12	7.3 ± 0.5	18	12.3 ± 0.6	24	13.8 ± 0.9
T22 - Conch Reef SPA**	17	8.0 ± 0.8	17	12.3 ± 1.2	26	15.3 ± 1.6
Middle Florida Keys Total (11)	14.5 ± 0.7	9.4 ± 0.5	17.0 ± 0.5	12.4 ± 0.7	32.0 ± 1.9	20.7 ± 1.6
Upper Florida Keys						
T28 - Molasses Reef SPA**	9	5.8 ± 0.6	13	7.8 ± 0.6	12	6.8 ± 0.5
T29 - Molasses Reef SPA**	9	4.8 ± 0.9	5	3.3 ± 0.5	8	3.0 ± 0.9
T17 - North of French Reef	13	7.5 ± 0.6	15	11.5 ± 0.9	16	7.3 ± 0.9
T18 - Watson's Reef	9	7.3 ± 0.5	23	19.3 ± 0.5	28	17.0 ± 0.9
Upper Florida Keys Total (4)	10.0 ± 1.0	6.3 ± 0.6	14.0 ± 3.7	10.4 ± 3.4	16.0 ± 4.3	8.5 ± 3.0
Shallow Hard-bottom Total (17)	13.0 ± 0.8	8.4 ± 0.6	16.3 ± 1.0	12.0 ± 1.0	27.7 ± 2.3	17.1 ± 1.8

Site number/site location	Stony Corals		Gorgonians		Sponges	
	Total species	No. species per 15 m ²	Total species	No. species per 15 m ²	Total species	No. species per 15 m ²
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	8	6.3 ± 0.3	9	4.0 ± 1.5	14	7.5 ± 0.5
S46 - Sand Key SPA**	12	7.0 ± 0.9	17	11.0 ± 1.2	35	19.3 ± 0.9
S47 - Sand Key SPA**	11	6.5 ± 0.6	7	4.0 ± 0.4	17	6.8 ± 1.4
S44 - Rock Key SPA**	14	8.8 ± 0.5	17	10.5 ± 2.3	15	7.0 ± 1.2
S45 - Rock Key SPA**	13	8.8 ± 0.9	13	5.8 ± 1.4	17	10.8 ± 1.0
S42 - Eastern Dry Rocks SPA**	14	9.0 ± 0.7	8	5.3 ± 0.6	20	11.3 ± 1.3
S43 - Eastern Dry Rocks SPA**	9	6.0 ± 0.9	11	5.0 ± 2.0	15	9.3 ± 0.8
S40 - Western Sambo ER**	11	6.8 ± 0.9	14	7.3 ± 1.3	17	8.0 ± 1.1
S41 - Western Sambo ER**	13	7.5 ± 0.9	9	5.8 ± 0.3	14	8.3 ± 0.5
S33 - Middle Sambo Reef	12	6.5 ± 0.5	11	4.5 ± 1.2	17	9.8 ± 1.1
S38 - Eastern Sambo RO**	12	7.8 ± 0.5	14	6.8 ± 1.3	16	9.0 ± 0.9
S39 - Eastern Sambo RO**	9	5.5 ± 0.6	13	7.8 ± 0.5	11	7.5 ± 0.6
U15 - No Name Reef	11	7.0 ± 0.8	9	6.0 ± 0.4	21	10.5 ± 0.6
S24 - East of Eastern Sambo RO	8	5.5 ± 0.3	18	12.8 ± 0.8	28	16.0 ± 1.5
U24 - Pelican Shoal	8	5.3 ± 0.6	10	4.5 ± 1.7	24	13.8 ± 1.6
U23 - Maryland Shoal	13	6.8 ± 0.9	16	11.3 ± 0.6	32	19.0 ± 2.0
S34 - Maryland Shoal	13	7.3 ± 1.0	17	10.8 ± 0.8	31	17.3 ± 1.4
S35 - American Shoal	11	6.3 ± 0.5	18	15.5 ± 0.3	42	26.0 ± 2.2
S36 - Looe Key SPA**	19	11.5 ± 1.0	14	8.0 ± 0.4	20	12.8 ± 0.9
S37 - Looe Key SPA**	18	12.0 ± 0.7	16	10.5 ± 1.3	26	15.0 ± 0.7
Lower Florida Keys Total (20)	12.0 ± 0.7	7.4 ± 0.4	13.1 ± 0.8	7.8 ± 0.7	21.6 ± 1.8	12.2 ± 1.1
Middle Florida Keys						
S78 - Sombrero Key SPA**	17	10.0 ± 1.1	14	10.0 ± 0.7	28	17.0 ± 1.2
S79 - Sombrero Key SPA**	12	7.0 ± 0.7	10	6.3 ± 1.0	25	13.0 ± 1.4
S76 - Delta Shoal	16	9.0 ± 1.3	18	11.8 ± 1.8	34	20.3 ± 2.3
S77 - Delta Shoal	14	8.5 ± 0.9	17	13.5 ± 1.2	32	17.0 ± 1.8
Middle Florida Keys Total (4)	14.8 ± 1.1	8.6 ± 0.6	14.8 ± 1.8	10.4 ± 1.5	29.8 ± 2.0	16.8 ± 1.5
Upper Florida Keys						
T32 - Pickles Reef	12	8.5 ± 1.3	14	9.0 ± 0.7	19	9.5 ± 1.4
T43 - Molasses Reef SPA**	9	6.5 ± 0.6	15	8.8 ± 0.9	19	12.0 ± 1.2
T44 - Molasses Reef SPA**	6	4.8 ± 0.3	13	7.0 ± 0.8	16	9.3 ± 0.9
T33 - Sand Island	12	7.5 ± 0.6	12	6.5 ± 1.8	21	15.0 ± 0.8
T34 - Sand Island	12	9.5 ± 0.3	12	6.8 ± 0.9	18	11.8 ± 0.8
T41 - French Reef SPA**	17	9.3 ± 0.8	12	9.0 ± 0.4	26	14.0 ± 0.7
T42 - French Reef SPA**	17	9.8 ± 0.5	17	10.8 ± 1.5	23	12.5 ± 0.3
T14 - Grecian Rocks SPA**	11	6.3 ± 1.1	11	6.0 ± 1.1	13	7.5 ± 1.5
T15 - Grecian Rocks SPA**	11	7.5 ± 0.3	16	10.3 ± 1.0	24	15.0 ± 0.0
T12 - Key Largo Dry Rocks SPA**	11	7.0 ± 0.8	12	9.0 ± 0.7	21	13.0 ± 0.6
T13 - Key Largo Dry Rocks SPA**	10	7.0 ± 0.4	15	12.0 ± 0.8	26	12.8 ± 0.9
T10 - North-North Dry Rocks	12	6.3 ± 0.3	14	9.0 ± 1.4	29	15.5 ± 0.9
T39 - Elbow Reef SPA**	8	7.0 ± 0.4	16	10.5 ± 1.4	22	12.8 ± 0.9
T40 - Elbow Reef SPA**	10	7.8 ± 0.5	12	6.3 ± 0.6	18	10.5 ± 1.0
T35 - South of South Carysfort	9	6.8 ± 0.6	15	9.0 ± 0.9	22	12.3 ± 1.8
T37 - South Carysfort Reef SPA**	17	8.5 ± 1.0	17	11.8 ± 1.0	16	9.0 ± 1.0
T38 - Carysfort Reef SPA**	6	4.8 ± 0.3	10	7.5 ± 0.5	15	7.5 ± 1.6
T11 - North of Turtle Reef	20	13.3 ± 0.9	19	14.5 ± 0.3	29	18.3 ± 1.5
Upper Florida Keys Total (18)	11.7 ± 0.9	7.7 ± 0.5	14.0 ± 0.6	9.1 ± 0.5	20.9 ± 1.1	12.1 ± 0.7
Spur and Groove Total (44)	12.1 ± 0.5	7.6 ± 0.3	13.6 ± 0.5	8.6 ± 0.5	22.1 ± 1.1	12.6 ± 0.7
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	16	11.3 ± 0.5	21	18.3 ± 0.5	33	23.5 ± 1.0
S27 - Sand Key SPA**	20	12.0 ± 0.7	19	14.0 ± 1.1	29	16.5 ± 1.7
S23 - East of Rock Key SPA	14	8.3 ± 1.1	18	14.3 ± 1.0	28	14.5 ± 0.6
S54 - Western Sambo ER**	20	10.8 ± 1.4	19	14.3 ± 0.8	42	26.8 ± 2.0

Site number/site location	Stony Corals		Gorgonians		Sponges	
	Total species	No. species per 15 m ²	Total species	No. species per 15 m ²	Total species	No. species per 15 m ²
S55 - Western Sambo ER**	17	9.8 ± 0.9	19	13.5 ± 0.5	34	21.5 ± 1.5
S48 - East of Western Sambo ER	13	7.0 ± 1.1	21	16.3 ± 0.6	28	13.3 ± 1.0
S49 - Middle Sambo Reef	14	8.8 ± 0.5	19	15.8 ± 0.6	35	20.8 ± 0.8
S52 - Eastern Sambo RO**	18	11.8 ± 0.5	19	14.3 ± 1.0	35	24.0 ± 3.2
S53 - Eastern Sambo RO**	17	11.0 ± 0.4	18	15.0 ± 0.7	37	22.0 ± 2.3
U22 - West of Pelican Shoal	14	9.5 ± 0.9	20	18.5 ± 0.6	37	22.3 ± 1.3
S30 - East of Pelican Shoal	23	13.8 ± 0.9	20	17.5 ± 0.9	45	27.5 ± 1.4
S31 - East of Maryland Shoal	17	11.0 ± 1.5	20	16.8 ± 0.5	39	26.8 ± 1.4
S51 - American Shoal	12	6.8 ± 0.9	17	12.5 ± 1.4	36	21.3 ± 3.5
S50 - American Shoal	20	12.0 ± 1.2	18	14.0 ± 1.4	39	24.0 ± 1.7
Lower Florida Keys Total (14)	16.8 ± 0.9	10.3 ± 0.5	19.1 ± 0.3	15.3 ± 0.5	35.5 ± 1.3	21.8 ± 1.2
Middle Florida Keys						
S71 - South of Bahia Honda	15	9.0 ± 0.9	17	13.8 ± 0.3	36	19.5 ± 0.9
S80 - West of Sombrero Key	13	8.5 ± 0.5	18	10.5 ± 0.9	26	15.8 ± 2.4
S74 - West of Sombrero Key	13	10.5 ± 0.5	18	12.5 ± 0.6	39	22.0 ± 1.5
S72 - West of Sombrero Key	12	7.8 ± 0.5	17	9.5 ± 1.3	26	17.8 ± 1.8
S86 - Sombrero Key SPA	5	2.5 ± 0.6	17	9.8 ± 2.1	11	2.8 ± 1.0
S85 - Sombrero Key SPA	11	7.8 ± 0.5	20	15.8 ± 0.3	30	17.0 ± 1.1
S73 - East of Delta Shoal	11	7.5 ± 0.5	18	13.3 ± 0.3	30	21.0 ± 1.4
S81 - SW of Coffins Patch	8	4.8 ± 0.6	15	7.8 ± 1.3	25	13.0 ± 0.4
S75 - Marker 20	17	12.0 ± 0.4	19	14.3 ± 0.8	44	26.5 ± 0.9
S82 - Tennessee Reef	16	11.3 ± 1.0	13	10.0 ± 0.7	36	23.8 ± 1.8
S83 - Tennessee Reef RO**	16	10.0 ± 0.8	12	6.3 ± 0.9	35	23.3 ± 1.7
S84 - Tennessee Reef RO**	18	13.3 ± 1.3	18	10.5 ± 0.9	37	26.0 ± 2.0
T56 - Alligator Reef SPA**	14	6.8 ± 0.6	19	15.5 ± 0.6	29	17.5 ± 1.0
T57 - Alligator Reef SPA**	15	10.3 ± 0.5	24	17.8 ± 0.3	38	22.8 ± 2.5
T54 - Davis Reef SPA**	9	5.3 ± 0.9	18	10.3 ± 0.8	23	11.3 ± 1.6
T55 - Davis Reef SPA**	6	3.0 ± 0.4	14	8.0 ± 0.9	11	4.5 ± 1.0
T47 - Little Conch Reef	18	11.8 ± 1.1	15	9.5 ± 0.6	32	21.5 ± 1.8
T23 - Little Conch Reef	18	11.0 ± 0.4	16	13.3 ± 0.9	34	21.5 ± 1.7
T52 - Conch Reef SPA**	13	9.5 ± 1.0	25	20.0 ± 0.8	37	23.5 ± 0.5
T53 - Conch Reef SPA**	11	6.0 ± 1.1	20	14.5 ± 1.6	19	9.0 ± 1.9
V09 - Conch Reef RO**	14	10.0 ± 0.9	20	16.3 ± 0.5	33	23.0 ± 1.0
V10 - Conch Reef RO**	16	8.8 ± 0.5	20	14.0 ± 0.8	40	24.5 ± 1.3
Middle Florida Keys Total (22)	13.1 ± 0.8	8.5 ± 0.6	17.9 ± 0.7	12.4 ± 0.7	30.5 ± 1.9	18.5 ± 1.4
Upper Florida Keys						
U98 - Pickles Reef	19	11.8 ± 1.1	19	12.3 ± 1.1	22	15.0 ± 1.5
U87 - Dixie Shoal	12	9.0 ± 0.4	20	13.8 ± 1.0	35	21.0 ± 0.4
U84 - North of Dixie Shoal	15	10.3 ± 0.9	21	14.5 ± 1.3	43	28.3 ± 0.3
T30 - South of Elbow Reef	13	8.8 ± 0.5	21	15.3 ± 0.9	37	22.5 ± 1.3
T50 - Carysfort Reef SPA**	17	11.0 ± 0.7	20	14.8 ± 2.3	31	18.0 ± 1.1
T26 - Carysfort Reef SPA**	12	7.8 ± 0.3	21	13.8 ± 2.0	28	15.0 ± 2.0
T51 - Carysfort Reef SPA**	10	6.3 ± 0.6	23	16.8 ± 0.9	24	13.8 ± 0.5
T27 - Carysfort Reef SPA**	16	10.3 ± 0.6	15	11.0 ± 1.3	25	15.0 ± 1.6
T25 - North of Carysfort Reef	13	8.3 ± 0.9	21	15.8 ± 0.9	30	19.3 ± 1.8
T48 - North of Carysfort Reef	13	8.3 ± 0.5	20	14.3 ± 1.4	40	21.0 ± 0.6
T49 - SE of Turtle Rocks	12	9.5 ± 1.0	22	17.0 ± 1.1	31	16.8 ± 1.4
Upper Florida Keys Total (11)	13.8 ± 0.8	9.2 ± 0.5	20.3 ± 0.6	14.5 ± 0.5	31.5 ± 2.0	18.7 ± 1.3
Deeper Fore-reef Total (47)	14.4 ± 0.5	9.2 ± 0.4	18.8 ± 0.4	13.8 ± 0.4	32.2 ± 1.1	19.5 ± 0.8

Table 3-2. Mean $\pm$ 1 SE percent cover of *Millepora* hydrocorals, scleractinian corals, combined stony corals, the colonial zoanthid *Palythoa*, and total sponges in the Florida Keys, as determined from surveys of four 15-m transects per site (100 points per transect) at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>Millepora</i>	Scleractinia	Total coral	<i>Palythoa</i>	Sponges
<i>Inshore patch reefs</i>					
Lower Florida Keys					
S01 – SE of Ballast Key	0.25 $\pm$ 0.25	6.75 $\pm$ 3.40	7.00 $\pm$ 3.34	0 $\pm$ 0	1.25 $\pm$ 0.48
S02 – South of Sugarloaf Creek	0 $\pm$ 0	37.75 $\pm$ 5.12	37.75 $\pm$ 5.12	0 $\pm$ 0	1.25 $\pm$ 0.25
S03 – Newfound Harbor SPA**	0 $\pm$ 0	8.50 $\pm$ 2.66	8.50 $\pm$ 2.66	0 $\pm$ 0	0.25 $\pm$ 0.25
S04 – Newfound Harbor SPA**	0 $\pm$ 0	7.50 $\pm$ 2.90	7.50 $\pm$ 2.90	0 $\pm$ 0	0 $\pm$ 0
Lower Florida Keys Total (4)	0.06 $\pm$ 0.06	15.13 $\pm$ 7.55	15.19 $\pm$ 7.53	0 $\pm$ 0	0.69 $\pm$ 0.33
Inshore Patch Reef Total (4)	0.06 $\pm$ 0.06	15.13 $\pm$ 7.55	15.19 $\pm$ 7.53	0 $\pm$ 0	0.69 $\pm$ 0.33
<i>Mid-channel patch reefs</i>					
Lower Florida Keys					
S12 - Western Sambo ER**	1.00 $\pm$ 0.41	7.00 $\pm$ 1.58	8.00 $\pm$ 1.47	4.00 $\pm$ 0.91	17.25 $\pm$ 2.02
S13 - Western Sambo ER**	1.00 $\pm$ 0.41	11.50 $\pm$ 1.19	12.50 $\pm$ 1.44	15.50 $\pm$ 3.38	13.00 $\pm$ 1.08
S05 - North of Middle Sambo Reef	0.50 $\pm$ 0.29	22.25 $\pm$ 3.15	22.75 $\pm$ 3.20	1.00 $\pm$ 1.00	11.25 $\pm$ 0.85
S06 - North of Pelican Shoal	1.00 $\pm$ 1.00	8.75 $\pm$ 1.38	9.75 $\pm$ 2.25	0 $\pm$ 0	14.00 $\pm$ 1.08
U04 - North of Pelican Shoal	1.00 $\pm$ 0.41	15.00 $\pm$ 3.03	16.00 $\pm$ 2.86	4.25 $\pm$ 1.70	10.25 $\pm$ 2.50
S07 - West Washerwoman Shoal	0.75 $\pm$ 0.48	18.25 $\pm$ 5.01	19.00 $\pm$ 4.85	0 $\pm$ 0	9.25 $\pm$ 1.18
S08 - West Washerwoman Shoal	1.50 $\pm$ 0.50	22.75 $\pm$ 2.02	24.25 $\pm$ 2.25	2.75 $\pm$ 0.95	12.75 $\pm$ 1.03
S09 - North of Maryland Shoal	0.50 $\pm$ 0.50	22.50 $\pm$ 2.50	23.00 $\pm$ 2.65	0 $\pm$ 0	11.00 $\pm$ 0.71
S10 - North of American Shoal	0.50 $\pm$ 0.29	9.50 $\pm$ 2.25	10.00 $\pm$ 2.04	0.75 $\pm$ 0.48	15.25 $\pm$ 2.29
S11 - North of American Shoal	0.25 $\pm$ 0.25	11.00 $\pm$ 0.82	11.25 $\pm$ 1.03	0 $\pm$ 0	9.50 $\pm$ 2.22
Lower Florida Keys Total (10)	0.80 $\pm$ 0.12	14.85 $\pm$ 1.95	15.65 $\pm$ 1.96	2.83 $\pm$ 1.50	12.35 $\pm$ 0.82
Middle Florida Keys					
U40 - Marker 49A	0.25 $\pm$ 0.25	14.50 $\pm$ 3.12	14.75 $\pm$ 3.15	9.00 $\pm$ 1.87	12.75 $\pm$ 2.17
S58 - Marker 48	0.25 $\pm$ 0.25	58.00 $\pm$ 4.34	58.25 $\pm$ 4.48	0.25 $\pm$ 0.25	2.50 $\pm$ 0.29
S59 - East Turtle Shoal	0.75 $\pm$ 0.25	9.25 $\pm$ 0.48	10.00 $\pm$ 0.71	3.00 $\pm$ 0.91	9.50 $\pm$ 0.87
S96 - Cheeca Rocks SPA**	0 $\pm$ 0	27.25 $\pm$ 5.36	27.25 $\pm$ 5.36	0 $\pm$ 0	2.25 $\pm$ 0.75
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	18.25 $\pm$ 4.11	18.25 $\pm$ 4.11	0 $\pm$ 0	2.25 $\pm$ 1.11
S94 - Hen and Chickens Reef SPA**	1.25 $\pm$ 0.48	23.75 $\pm$ 4.07	25.00 $\pm$ 4.02	0 $\pm$ 0	1.00 $\pm$ 0.41
S95 - Hen and Chickens Reef SPA**	0.25 $\pm$ 0.25	23.25 $\pm$ 2.69	23.50 $\pm$ 2.90	0 $\pm$ 0	2.25 $\pm$ 1.03
Middle Florida Keys Total (7)	0.39 $\pm$ 0.17	24.89 $\pm$ 5.98	25.29 $\pm$ 5.95	1.75 $\pm$ 1.28	4.64 $\pm$ 1.72
Upper Florida Keys					
S89 - Mosquito Bank	0.50 $\pm$ 0.29	14.25 $\pm$ 0.95	14.75 $\pm$ 0.75	0.25 $\pm$ 0.25	6.50 $\pm$ 0.87
S90 - Mosquito Bank	1.00 $\pm$ 0.41	9.00 $\pm$ 1.87	10.00 $\pm$ 1.63	0 $\pm$ 0	4.00 $\pm$ 1.58
S91 - Basin Hill Shoals	0.50 $\pm$ 0.29	18.75 $\pm$ 1.44	19.25 $\pm$ 1.55	0 $\pm$ 0	10.25 $\pm$ 1.84
S92 - Basin Hill Shoals	0.50 $\pm$ 0.29	8.00 $\pm$ 2.61	8.50 $\pm$ 2.53	0 $\pm$ 0	6.00 $\pm$ 0.91
S93 - Turtle Rocks	2.25 $\pm$ 0.63	4.25 $\pm$ 0.75	6.50 $\pm$ 0.96	0 $\pm$ 0	3.50 $\pm$ 1.44
Upper Florida Keys Total (5)	0.95 $\pm$ 0.34	10.85 $\pm$ 2.54	11.80 $\pm$ 2.31	0.05 $\pm$ 0.05	6.05 $\pm$ 1.19
Mid-channel Patch Reef Total (22)	0.70 $\pm$ 0.11	17.14 $\pm$ 2.39	17.84 $\pm$ 2.35	1.85 $\pm$ 0.80	8.47 $\pm$ 1.04
<i>Offshore patch reefs</i>					
Lower Florida Keys					
S14 - North of Sand Key	2.00 $\pm$ 0.82	9.00 $\pm$ 1.08	11.00 $\pm$ 0.91	0.25 $\pm$ 0.25	8.75 $\pm$ 1.31
S15 - North of Sand Key	0.50 $\pm$ 0.29	7.25 $\pm$ 1.31	7.75 $\pm$ 1.49	0.50 $\pm$ 0.29	3.00 $\pm$ 0.41
S16 - North of Sand Key	1.50 $\pm$ 0.87	9.75 $\pm$ 1.49	11.25 $\pm$ 1.31	2.25 $\pm$ 1.60	11.25 $\pm$ 0.63
S19 - Western Sambo ER**	0.25 $\pm$ 0.25	5.75 $\pm$ 1.11	6.00 $\pm$ 1.22	1.75 $\pm$ 1.11	9.75 $\pm$ 0.63
S20 - Western Sambo ER**	0.25 $\pm$ 0.25	8.25 $\pm$ 0.95	8.50 $\pm$ 1.19	10.25 $\pm$ 1.93	11.75 $\pm$ 0.48
U12 - West of Looe Key RO	0.50 $\pm$ 0.29	4.00 $\pm$ 1.00	4.50 $\pm$ 0.87	0.75 $\pm$ 0.48	8.50 $\pm$ 2.22
S17 - Looe Key RO**	0.25 $\pm$ 0.25	10.25 $\pm$ 1.65	10.50 $\pm$ 1.76	0.75 $\pm$ 0.75	10.00 $\pm$ 2.68
S18 - Looe Key RO**	0 $\pm$ 0	11.25 $\pm$ 1.38	11.25 $\pm$ 1.38	17.75 $\pm$ 3.57	11.75 $\pm$ 1.03

Site number/site location	<i>Millepora</i>	<i>Scleractinia</i>	Total coral	<i>Palythoa</i>	Sponges
Lower Florida Keys Total (8)	0.66 ± 0.25	8.19 ± 0.86	8.84 ± 0.92	4.28 ± 2.25	9.34 ± 1.01
Middle Florida Keys					
S60 - NE of Delta Shoal	0.25 ± 0.25	0.25 ± 0.25	0.50 ± 0.29	0 ± 0	2.50 ± 0.87
S61 - West Turtle Shoal	0 ± 0	18.25 ± 2.72	18.25 ± 2.72	2.75 ± 2.14	10.25 ± 1.60
S63 - Coffins Patch SPA**	0.25 ± 0.25	1.00 ± 0.41	1.25 ± 0.48	0.25 ± 0.25	9.25 ± 1.55
S62 - Coffins Patch SPA**	0.75 ± 0.48	2.25 ± 0.25	3.00 ± 0.71	2.00 ± 0.91	7.25 ± 2.29
S69 - Coffins Patch SPA**	0.50 ± 0.29	15.75 ± 2.93	16.25 ± 3.17	3.50 ± 0.87	6.25 ± 1.44
S70 - Coffins Patch SPA**	0.25 ± 0.25	6.25 ± 2.06	6.50 ± 2.22	8.25 ± 1.65	5.50 ± 0.65
S64 - South of Coffins Patch	1.00 ± 0.71	0.50 ± 0.29	1.50 ± 0.87	1.25 ± 0.48	8.25 ± 3.45
U42 - East of Coffins Patch	0 ± 0	7.25 ± 1.55	7.25 ± 1.55	1.25 ± 0.75	16.00 ± 5.15
Middle Florida Keys Total (8)	0.38 ± 0.13	6.44 ± 2.49	6.81 ± 2.44	2.41 ± 0.93	8.16 ± 1.41
Upper Florida Keys					
S99 - Wolf Reef	0.50 ± 0.29	3.50 ± 1.32	4.00 ± 1.22	0 ± 0	5.50 ± 1.32
T04 - Inshore of Sand Island	0.50 ± 0.50	8.75 ± 1.49	9.25 ± 1.11	0.50 ± 0.29	8.50 ± 1.32
T03 - White Bank	0.25 ± 0.25	0.50 ± 0.29	0.75 ± 0.48	0 ± 0	3.50 ± 0.87
T05 - White Bank	0.50 ± 0.29	2.50 ± 0.50	3.00 ± 0.71	1.00 ± 0.41	5.75 ± 2.72
T09 - South of Key Largo Dry Rocks	0.75 ± 0.48	2.50 ± 0.29	3.25 ± 0.63	1.25 ± 0.63	2.75 ± 1.18
T08 - West of Key Largo Dry Rocks	0.25 ± 0.25	3.25 ± 1.44	3.50 ± 1.26	0 ± 0	4.75 ± 0.75
T06 - West of Elbow Reef	0.50 ± 0.29	1.25 ± 0.48	1.75 ± 0.63	4.25 ± 2.21	6.75 ± 1.31
T07 - SW of Watson's Reef	1.75 ± 0.63	1.00 ± 0.41	2.75 ± 0.95	11.25 ± 3.07	5.00 ± 1.68
T31 - South of Watson's Reef	0.75 ± 0.25	1.00 ± 0.41	1.75 ± 0.63	0.75 ± 0.75	8.00 ± 0.91
T20 - Carysfort Reef SPA**	1.25 ± 0.48	0 ± 0	1.25 ± 0.48	0.50 ± 0.29	4.50 ± 1.19
T19 - Carysfort Reef SPA**	1.00 ± 0.41	1.75 ± 0.85	2.75 ± 0.85	4.75 ± 4.11	2.75 ± 1.18
T24 - North of Carysfort Reef	0.25 ± 0.25	2.75 ± 1.38	3.00 ± 1.22	0.25 ± 0.25	2.75 ± 0.63
Upper Florida Keys Total (12)	0.69 ± 0.13	2.40 ± 0.66	3.08 ± 0.63	2.04 ± 0.96	5.04 ± 0.57
Offshore Patch Reef Total (28)	0.59 ± 0.10	5.21 ± 0.91	5.79 ± 0.89	2.79 ± 0.80	7.16 ± 0.64
<i>Low-relief hard-bottom (< 6 m)</i>					
Lower Florida Keys					
S21 - East of E. Dry Rocks SPA	0 ± 0	0.25 ± 0.25	0.25 ± 0.25	0 ± 0	1.00 ± 0.58
S22 - West of Looe Key SPA	0.50 ± 0.29	3.00 ± 0.71	3.50 ± 0.96	0.25 ± 0.25	4.25 ± 1.03
Lower Florida Keys Total (2)	0.25 ± 0.25	1.63 ± 1.38	1.88 ± 1.63	0.13 ± 0.13	2.63 ± 1.63
Middle Florida Keys					
S65 - SE of Coffins Patch	0 ± 0	0.75 ± 0.48	0.75 ± 0.48	0 ± 0	8.50 ± 1.44
S66 - Tennessee Reef	0 ± 0	4.75 ± 1.55	4.75 ± 1.55	1.50 ± 0.65	9.75 ± 1.03
S68 - Tennessee Reef RO**	1.00 ± 0.41	2.25 ± 1.11	3.25 ± 1.44	0.25 ± 0.25	5.50 ± 2.66
S67 - Tennessee Reef RO**	2.25 ± 0.25	4.00 ± 1.08	6.25 ± 1.03	0.75 ± 0.48	7.50 ± 1.71
T16 - West of Alligator Reef	0.25 ± 0.25	0 ± 0	0.25 ± 0.25	0.50 ± 0.50	3.75 ± 1.03
T45 - Alligator Reef SPA**	1.50 ± 0.29	0.25 ± 0.25	1.75 ± 0.48	4.00 ± 0.91	3.75 ± 0.63
T46 - Alligator Reef SPA**	1.25 ± 0.48	1.50 ± 0.96	2.75 ± 1.11	0.25 ± 0.25	2.00 ± 0.91
V03 - Davis Reef SPA**	0.25 ± 0.25	0 ± 0	0.25 ± 0.25	2.00 ± 1.08	2.25 ± 0.85
T36 - Davis Reef SPA**	0.75 ± 0.48	0.50 ± 0.29	1.25 ± 0.63	1.25 ± 0.48	1.25 ± 0.95
T21 - Conch Reef SPA**	1.25 ± 0.95	1.50 ± 0.50	2.75 ± 1.25	3.00 ± 2.68	1.50 ± 0.87
T22 - Conch Reef SPA**	0.50 ± 0.29	0.75 ± 0.25	1.25 ± 0.25	2.50 ± 0.96	1.50 ± 0.29
Middle Florida Keys Total (11)	0.82 ± 0.21	1.48 ± 0.48	2.30 ± 0.57	1.45 ± 0.39	4.30 ± 0.92
Upper Florida Keys					
T28 - Molasses Reef SPA**	2.00 ± 0.91	1.00 ± 0.41	3.00 ± 0.71	0.25 ± 0.25	0.25 ± 0.25
T29 - Molasses Reef SPA**	1.50 ± 0.29	0 ± 0	1.50 ± 0.29	0 ± 0	0 ± 0
T17 - North of French Reef	2.25 ± 0.85	3.00 ± 0.82	5.25 ± 1.55	0.50 ± 0.50	1.50 ± 0.29
T18 - Watson's Reef	0.50 ± 0.29	2.00 ± 1.41	2.50 ± 1.55	0.50 ± 0.29	3.75 ± 1.25
Upper Florida Keys Total (4)	1.56 ± 0.39	1.50 ± 0.65	3.06 ± 0.79	0.31 ± 0.12	1.38 ± 0.86
Shallow Hard-bottom Total (17)	0.93 ± 0.19	1.50 ± 0.36	2.43 ± 0.44	1.03 ± 0.29	3.41 ± 0.70
<i>High-relief spur and groove</i>					
Lower Florida Keys					
S32 - Western Dry Rocks	1.50 ± 1.19	1.75 ± 1.03	3.25 ± 1.11	7.75 ± 1.11	0.50 ± 0.29

Site number/site location	<i>Millepora</i>	<i>Scleractinia</i>	Total coral	<i>Palythoa</i>	Sponges
S46 - Sand Key SPA**	1.50 ± 0.96	0.75 ± 0.48	2.25 ± 0.85	4.25 ± 0.75	3.00 ± 1.41
S47 - Sand Key SPA**	0.75 ± 0.48	9.75 ± 0.25	10.50 ± 0.50	7.75 ± 2.66	0.25 ± 0.25
S44 - Rock Key SPA**	1.50 ± 0.96	1.00 ± 0.41	2.50 ± 1.32	4.50 ± 3.20	0.50 ± 0.29
S45 - Rock Key SPA**	1.25 ± 0.75	7.00 ± 3.34	8.25 ± 3.97	8.25 ± 2.36	2.00 ± 0.41
S42 - Eastern Dry Rocks SPA**	0.50 ± 0.29	2.50 ± 0.65	3.00 ± 0.41	8.25 ± 2.84	0.25 ± 0.25
S43 - Eastern Dry Rocks SPA**	1.50 ± 0.65	3.50 ± 1.04	5.00 ± 1.00	14.00 ± 4.18	0.75 ± 0.25
S40 - Western Sambo ER**	1.00 ± 0.41	2.75 ± 1.55	3.75 ± 1.65	3.00 ± 1.78	0.50 ± 0.29
S41 - Western Sambo ER**	1.00 ± 0.71	4.00 ± 1.73	5.00 ± 1.96	6.75 ± 2.59	0.50 ± 0.29
S33 - Middle Sambo Reef	1.00 ± 0.71	3.50 ± 0.96	4.50 ± 1.32	2.75 ± 1.31	1.75 ± 0.63
S38 - Eastern Sambo RO**	0 ± 0	4.75 ± 0.63	4.75 ± 0.63	4.25 ± 1.84	0.75 ± 0.48
S39 - Eastern Sambo RO**	0.75 ± 0.25	5.50 ± 1.71	6.25 ± 1.55	12.00 ± 3.65	0.50 ± 0.29
U15 - No Name Reef	0.25 ± 0.25	1.75 ± 0.48	2.00 ± 0.41	6.50 ± 2.36	0.25 ± 0.25
S24 - East of Eastern Sambo RO	0.25 ± 0.25	0.50 ± 0.29	0.75 ± 0.25	0.75 ± 0.48	2.75 ± 0.85
U24 - Pelican Shoal	0.25 ± 0.25	1.75 ± 1.03	2.00 ± 1.15	5.00 ± 2.74	1.50 ± 0.65
U23 - Maryland Shoal	0 ± 0	0.50 ± 0.29	0.50 ± 0.29	1.50 ± 0.87	1.50 ± 1.19
S34 - Maryland Shoal	1.50 ± 0.65	0.25 ± 0.25	1.75 ± 0.63	2.00 ± 0.71	4.00 ± 1.47
S35 - American Shoal	1.25 ± 0.48	0.25 ± 0.25	1.50 ± 0.65	8.75 ± 2.66	8.50 ± 0.65
S36 - Looe Key SPA**	0.50 ± 0.50	3.25 ± 1.49	3.75 ± 1.18	7.75 ± 2.32	1.25 ± 0.75
S37 - Looe Key SPA**	0.50 ± 0.29	12.75 ± 6.29	13.25 ± 6.34	12.75 ± 4.33	1.25 ± 0.48
Lower Florida Keys Total (20)	0.84 ± 0.12	3.39 ± 0.74	4.23 ± 0.73	6.43 ± 0.83	1.61 ± 0.43
Middle Florida Keys					
S78 - Sombrero Key SPA**	0.50 ± 0.29	4.00 ± 0.91	4.50 ± 0.87	19.50 ± 4.29	1.25 ± 0.75
S79 - Sombrero Key SPA**	1.00 ± 0.41	2.00 ± 0.91	3.00 ± 1.22	14.50 ± 4.99	0.50 ± 0.50
S76 - Delta Shoal	0 ± 0	1.50 ± 0.65	1.50 ± 0.65	16.75 ± 2.06	4.25 ± 0.48
S77 - Delta Shoal	1.25 ± 0.25	0.50 ± 0.29	1.75 ± 0.48	0.25 ± 0.25	1.00 ± 0.41
Middle Florida Keys Total (4)	0.69 ± 0.28	2.00 ± 0.74	2.69 ± 0.69	12.75 ± 4.29	1.75 ± 0.85
Upper Florida Keys					
T32 - Pickles Reef	8.00 ± 0.41	2.50 ± 1.89	10.50 ± 1.85	1.75 ± 1.11	1.00 ± 0.71
T43 - Molasses Reef SPA**	20.50 ± 3.40	4.75 ± 1.55	25.25 ± 4.48	17.00 ± 4.06	4.25 ± 0.48
T44 - Molasses Reef SPA**	3.50 ± 1.94	1.50 ± 0.65	5.00 ± 2.55	2.00 ± 1.08	1.00 ± 0.41
T33 - Sand Island	2.50 ± 0.65	5.25 ± 0.95	7.75 ± 0.63	3.00 ± 0.41	1.25 ± 0.63
T34 - Sand Island	6.50 ± 2.22	0.50 ± 0.29	7.00 ± 2.35	2.00 ± 1.00	2.00 ± 0.41
T41 - French Reef SPA**	1.25 ± 0.48	2.50 ± 0.29	3.75 ± 0.25	0 ± 0	1.00 ± 0.71
T42 - French Reef SPA**	1.00 ± 0.71	3.75 ± 0.63	4.75 ± 1.11	0.25 ± 0.25	1.50 ± 0.87
T14 - Grecian Rocks SPA**	0 ± 0	2.00 ± 1.22	2.00 ± 1.22	1.25 ± 0.95	0 ± 0
T15 - Grecian Rocks SPA**	3.00 ± 2.12	4.25 ± 2.10	7.25 ± 2.81	1.75 ± 0.85	0.25 ± 0.25
T12 - Key Largo Dry Rocks SPA**	1.75 ± 0.75	7.50 ± 1.04	9.25 ± 1.25	4.75 ± 1.38	0.50 ± 0.29
T13 - Key Largo Dry Rocks SPA**	1.00 ± 0.71	3.50 ± 0.65	4.50 ± 1.32	0.50 ± 0.50	0.25 ± 0.25
T10 - North-North Dry Rocks	2.75 ± 1.38	3.25 ± 0.85	6.00 ± 2.12	7.50 ± 3.28	2.00 ± 0.41
T39 - Elbow Reef SPA**	2.75 ± 1.11	3.25 ± 1.31	6.00 ± 2.42	1.00 ± 0.71	2.25 ± 0.85
T40 - Elbow Reef SPA**	1.75 ± 0.85	6.00 ± 3.79	7.75 ± 4.53	0 ± 0	0.75 ± 0.48
T35 - South of South Carysfort	0.75 ± 0.25	1.75 ± 0.75	2.50 ± 0.65	1.25 ± 0.95	0.25 ± 0.25
T37 - South Carysfort Reef SPA**	1.50 ± 0.29	7.25 ± 1.55	8.75 ± 1.65	0.75 ± 0.48	0.50 ± 0.50
T38 - Carysfort Reef SPA**	0.50 ± 0.29	1.75 ± 0.85	2.25 ± 0.95	2.25 ± 0.95	0.50 ± 0.29
T11 - North of Turtle Reef	2.75 ± 1.18	10.00 ± 2.80	12.75 ± 3.33	4.25 ± 1.31	5.00 ± 0.71
Upper Florida Keys Total (18)	3.43 ± 1.11	3.96 ± 0.58	7.39 ± 1.25	2.85 ± 0.94	1.35 ± 0.32
High-relief Spur and Groove Total (44)	1.93 ± 0.51	3.50 ± 0.44	5.43 ± 0.69	5.49 ± 0.80	1.51 ± 0.25
<i>Deeper Fore-reef (6-15 m)</i>					
Lower Florida Keys					
U19 - Sand Key SPA**	1.00 ± 0.41	1.25 ± 0.48	2.25 ± 0.63	0.50 ± 0.50	2.25 ± 0.25
S27 - Sand Key SPA**	1.00 ± 0.41	3.00 ± 1.68	4.00 ± 1.78	0 ± 0	2.75 ± 1.11
S23 - East of Rock Key SPA	0.25 ± 0.25	0.25 ± 0.25	0.50 ± 0.50	0 ± 0	0.50 ± 0.29
S54 - Western Sambo ER**	1.25 ± 0.48	3.50 ± 0.87	4.75 ± 0.48	0 ± 0	4.75 ± 0.75
S55 - Western Sambo ER**	0.25 ± 0.25	1.75 ± 0.63	2.00 ± 0.82	0 ± 0	0.75 ± 0.48
S48 - East of Western Sambo ER	0.50 ± 0.29	0.75 ± 0.48	1.25 ± 0.63	0.75 ± 0.25	1.75 ± 0.25
S49 - Middle Sambo Reef	1.50 ± 0.29	2.75 ± 0.63	4.25 ± 0.48	0 ± 0	2.00 ± 1.00
S52 - Eastern Sambo RO**	1.50 ± 0.29	1.25 ± 0.95	2.75 ± 0.75	0.50 ± 0.50	3.75 ± 1.60
S53 - Eastern Sambo RO**	1.00 ± 0.41	4.75 ± 1.31	5.75 ± 1.44	0.50 ± 0.50	5.50 ± 1.44
U22 - West of Pelican Shoal	0.25 ± 0.25	2.25 ± 1.25	2.50 ± 1.19	1.00 ± 0.41	1.75 ± 1.11

Site number/site location	<i>Millepora</i>	<i>Scleractinia</i>	Total coral	<i>Palythoa</i>	Sponges
S30 - East of Pelican Shoal	1.00 ± 0.41	4.50 ± 0.50	5.50 ± 0.65	2.75 ± 1.25	6.00 ± 2.04
S31 - East of Maryland Shoal	0.75 ± 0.48	6.25 ± 1.11	7.00 ± 0.91	1.25 ± 0.75	2.75 ± 0.85
S51 - American Shoal	0.25 ± 0.25	0.25 ± 0.25	0.50 ± 0.29	1.00 ± 0.41	3.00 ± 1.08
S50 - American Shoal	0.50 ± 0.29	2.25 ± 0.85	2.75 ± 1.11	0.50 ± 0.50	2.75 ± 0.75
Lower Florida Keys Total (14)	0.79 ± 0.12	2.48 ± 0.48	3.27 ± 0.53	0.63 ± 0.20	2.88 ± 0.44
Middle Florida Keys					
S71 - South of Bahia Honda	0.75 ± 0.75	7.75 ± 2.93	8.50 ± 2.40	0.50 ± 0.29	5.50 ± 2.02
S80 - West of Sombrero Key	0.75 ± 0.25	2.75 ± 2.43	3.50 ± 2.50	0 ± 0	1.25 ± 0.48
S74 - West of Sombrero Key	0.50 ± 0.29	1.75 ± 0.63	2.25 ± 0.48	0.25 ± 0.25	9.00 ± 3.24
S72 - West of Sombrero Key	0.50 ± 0.29	0 ± 0	0.50 ± 0.29	0.25 ± 0.25	4.00 ± 0.58
S86 - Sombrero Key SPA	0.75 ± 0.48	0.25 ± 0.25	1.00 ± 0.71	0 ± 0	0.25 ± 0.25
S85 - Sombrero Key SPA	1.00 ± 0.58	0.50 ± 0.50	1.50 ± 0.96	0 ± 0	5.50 ± 1.71
S73 - East of Delta Shoal	0.25 ± 0.25	0.25 ± 0.25	0.50 ± 0.50	0 ± 0	4.00 ± 1.35
S81 - SW of Coffins Patch	0.75 ± 0.48	0 ± 0	0.75 ± 0.48	0 ± 0	0.50 ± 0.50
S75 - Marker 20	0.75 ± 0.48	4.25 ± 1.25	5.00 ± 1.58	1.25 ± 0.75	7.00 ± 0.71
S82 - Tennessee Reef	1.50 ± 0.96	0.50 ± 0.29	2.00 ± 1.22	0.25 ± 0.25	6.00 ± 1.47
S83 - Tennessee Reef RO**	0.25 ± 0.25	0 ± 0	0.25 ± 0.25	0 ± 0	3.00 ± 0.71
S84 - Tennessee Reef RO**	1.25 ± 0.25	2.25 ± 1.03	3.50 ± 0.87	0 ± 0	4.50 ± 0.50
T56 - Alligator Reef SPA**	1.25 ± 0.63	0.75 ± 0.48	2.00 ± 0.71	0 ± 0	6.25 ± 1.80
T57 - Alligator Reef SPA**	1.75 ± 0.63	0.50 ± 0.29	2.25 ± 0.85	0 ± 0	1.75 ± 0.63
T54 - Davis Reef SPA**	1.75 ± 0.85	0.25 ± 0.25	2.00 ± 0.71	0 ± 0	7.25 ± 3.04
T55 - Davis Reef SPA**	0.50 ± 0.29	0 ± 0	0.50 ± 0.29	0 ± 0	5.50 ± 1.66
T47 - Little Conch Reef	1.00 ± 0.41	3.00 ± 1.47	4.00 ± 1.83	0.25 ± 0.25	2.75 ± 0.25
T23 - Little Conch Reef	0.75 ± 0.48	1.25 ± 0.25	2.00 ± 0.41	0.25 ± 0.25	1.75 ± 0.85
T52 - Conch Reef SPA**	0.50 ± 0.29	0.25 ± 0.25	0.75 ± 0.48	0 ± 0	4.25 ± 1.55
T53 - Conch Reef SPA**	0.25 ± 0.25	0 ± 0	0.25 ± 0.25	0 ± 0	0.25 ± 0.25
V09 - Conch Reef RO**	1.00 ± 1.00	0.25 ± 0.25	1.25 ± 1.25	0.75 ± 0.48	5.25 ± 1.38
V10 - Conch Reef RO**	1.50 ± 0.65	2.25 ± 0.48	3.75 ± 0.85	0.25 ± 0.25	7.75 ± 0.48
Middle Florida Keys Total (22)	0.88 ± 0.10	1.31 ± 0.40	2.18 ± 0.42	0.18 ± 0.07	4.24 ± 0.54
Upper Florida Keys					
U98 - Pickles Reef	0.75 ± 0.48	2.00 ± 1.35	2.75 ± 1.80	0.25 ± 0.25	1.00 ± 0.41
U87 - Dixie Shoal	0.75 ± 0.48	1.25 ± 0.95	2.00 ± 0.82	2.50 ± 0.87	3.50 ± 0.87
U84 - North of Dixie Shoal	0.75 ± 0.48	1.50 ± 0.65	2.25 ± 0.25	0 ± 0	4.75 ± 1.44
T30 - South of Elbow Reef	0.25 ± 0.25	0.50 ± 0.29	0.75 ± 0.25	0 ± 0	6.00 ± 1.29
T50 - Carysfort Reef SPA**	0.25 ± 0.25	1.00 ± 0.71	1.25 ± 0.75	0 ± 0	2.75 ± 1.44
T26 - Carysfort Reef SPA**	0 ± 0	0.50 ± 0.29	0.50 ± 0.29	0.75 ± 0.25	0.25 ± 0.25
T51 - Carysfort Reef SPA**	0.50 ± 0.29	0.50 ± 0.29	1.00 ± 0.41	0 ± 0	1.25 ± 0.25
T27 - Carysfort Reef SPA**	1.50 ± 0.65	0.50 ± 0.50	2.00 ± 0.71	2.00 ± 1.41	3.75 ± 1.03
T25 - North of Carysfort Reef	0.25 ± 0.25	0.25 ± 0.25	0.50 ± 0.29	0 ± 0	2.00 ± 1.08
T48 - North of Carysfort Reef	0.75 ± 0.25	2.00 ± 0.71	2.75 ± 0.95	0 ± 0	2.25 ± 0.48
T49 - SE of Turtle Rocks	1.25 ± 0.48	1.00 ± 0.71	2.25 ± 1.03	0.75 ± 0.48	4.50 ± 1.85
Upper Florida Keys Total (11)	0.64 ± 0.14	1.00 ± 0.19	1.64 ± 0.26	0.57 ± 0.27	2.91 ± 0.53
Deeper Fore-reef Total (47)	0.79 ± 0.07	1.59 ± 0.25	2.38 ± 0.27	0.40 ± 0.09	3.52 ± 0.32

Table 3-3. Mean $\pm$ 1 SE percent cover of cyanobacteria/benthic diatoms, turf algae, crustose coralline algae (CCA), macroalgae (e.g. *Halimeda* and *Dictyota*) and total algae in the Florida Keys, as determined from surveys of four 15-m transects per site (100 points per transect) at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	Cyanobacteria	Turf algae	CCA	Macroalgae	Total algae
<i>Inshore patch reefs</i>					
Lower Florida Keys					
S01 – SE of Ballast Key	0 $\pm$ 0	36.50 $\pm$ 10.27	1.75 $\pm$ 0.63	34.00 $\pm$ 10.97	72.25 $\pm$ 1.65
S02 – South of Sugarloaf Creek	0 $\pm$ 0	19.00 $\pm$ 1.87	0.75 $\pm$ 0.48	21.50 $\pm$ 2.90	41.25 $\pm$ 4.57
S03 – Newfound Harbor SPA**	0 $\pm$ 0	31.00 $\pm$ 2.12	3.25 $\pm$ 1.11	42.00 $\pm$ 3.67	76.25 $\pm$ 5.27
S04 – Newfound Harbor SPA**	0 $\pm$ 0	25.00 $\pm$ 2.20	10.25 $\pm$ 4.17	45.25 $\pm$ 5.79	80.50 $\pm$ 5.19
Lower Florida Keys Total (4)	0 $\pm$ 0	27.88 $\pm$ 3.78	4.00 $\pm$ 2.15	35.69 $\pm$ 5.29	67.56 $\pm$ 8.93
Inshore Patch Reef Total (4)	0 $\pm$ 0	27.88 $\pm$ 3.78	4.00 $\pm$ 2.15	35.69 $\pm$ 5.29	67.56 $\pm$ 8.93
<i>Mid-channel patch reefs</i>					
Lower Florida Keys					
S12 - Western Sambo ER**	19.75 $\pm$ 1.80	16.50 $\pm$ 0.65	0.50 $\pm$ 0.50	3.75 $\pm$ 1.18	40.50 $\pm$ 2.60
S13 - Western Sambo ER**	0.25 $\pm$ 0.25	37.50 $\pm$ 2.63	0.25 $\pm$ 0.25	0 $\pm$ 0	38.00 $\pm$ 2.42
S05 - North of Middle Sambo Reef	1.75 $\pm$ 0.85	39.50 $\pm$ 2.53	0 $\pm$ 0	5.00 $\pm$ 0.91	46.25 $\pm$ 1.80
S06 - North of Pelican Shoal	0.75 $\pm$ 0.48	31.25 $\pm$ 3.54	0 $\pm$ 0	14.25 $\pm$ 1.31	46.25 $\pm$ 1.93
U04 - North of Pelican Shoal	0 $\pm$ 0	49.50 $\pm$ 5.04	0.25 $\pm$ 0.25	3.00 $\pm$ 0.41	52.75 $\pm$ 4.99
S07 - West Washerwoman Shoal	1.00 $\pm$ 0.41	33.75 $\pm$ 2.06	0.25 $\pm$ 0.25	1.00 $\pm$ 1.00	36.00 $\pm$ 3.08
S08 - West Washerwoman Shoal	0 $\pm$ 0	41.25 $\pm$ 2.59	0.50 $\pm$ 0.50	0.75 $\pm$ 0.25	42.50 $\pm$ 2.53
S09 - North of Maryland Shoal	1.00 $\pm$ 0.71	30.50 $\pm$ 2.99	0 $\pm$ 0	8.75 $\pm$ 0.48	40.25 $\pm$ 3.57
S10 - North of American Shoal	0.25 $\pm$ 0.25	41.50 $\pm$ 2.22	0.50 $\pm$ 0.29	4.75 $\pm$ 1.70	47.00 $\pm$ 2.35
S11 - North of American Shoal	2.50 $\pm$ 0.87	74.75 $\pm$ 1.84	0 $\pm$ 0	1.25 $\pm$ 0.63	78.50 $\pm$ 2.40
Lower Florida Keys Total (10)	2.73 $\pm$ 1.91	39.60 $\pm$ 4.79	0.23 $\pm$ 0.07	4.25 $\pm$ 1.39	46.80 $\pm$ 3.85
Middle Florida Keys					
U40 - Marker 49A	3.25 $\pm$ 0.85	33.75 $\pm$ 1.31	0.50 $\pm$ 0.29	10.00 $\pm$ 1.96	47.50 $\pm$ 1.50
S58 - Marker 48	0 $\pm$ 0	31.00 $\pm$ 3.81	0 $\pm$ 0	0 $\pm$ 0	31.00 $\pm$ 3.81
S59 - East Turtle Shoal	0.25 $\pm$ 0.25	51.50 $\pm$ 2.90	0.50 $\pm$ 0.50	14.75 $\pm$ 1.11	67.00 $\pm$ 2.68
S96 - Cheeca Rocks SPA**	1.50 $\pm$ 0.29	44.25 $\pm$ 8.76	0 $\pm$ 0	12.25 $\pm$ 1.80	58.00 $\pm$ 8.44
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	43.00 $\pm$ 2.27	0 $\pm$ 0	22.25 $\pm$ 5.44	65.25 $\pm$ 7.65
S94 - Hen and Chickens Reef SPA**	1.00 $\pm$ 0.71	27.75 $\pm$ 1.89	1.00 $\pm$ 1.00	31.00 $\pm$ 4.92	60.75 $\pm$ 4.80
S95 - Hen and Chickens Reef SPA**	4.00 $\pm$ 0.82	40.00 $\pm$ 3.03	0.50 $\pm$ 0.29	24.75 $\pm$ 3.35	69.25 $\pm$ 2.78
Middle Florida Keys Total (7)	1.43 $\pm$ 0.61	38.75 $\pm$ 3.16	0.36 $\pm$ 0.14	16.43 $\pm$ 3.92	56.96 $\pm$ 5.12
Upper Florida Keys					
S89 - Mosquito Bank	3.50 $\pm$ 2.06	34.75 $\pm$ 4.50	0 $\pm$ 0	11.50 $\pm$ 2.06	49.75 $\pm$ 7.13
S90 - Mosquito Bank	1.25 $\pm$ 0.95	56.00 $\pm$ 4.14	0.25 $\pm$ 0.25	14.50 $\pm$ 1.04	72.00 $\pm$ 3.94
S91 - Basin Hill Shoals	1.25 $\pm$ 0.48	12.00 $\pm$ 3.00	0 $\pm$ 0	13.50 $\pm$ 1.71	26.75 $\pm$ 2.32
S92 - Basin Hill Shoals	0 $\pm$ 0	3.00 $\pm$ 1.22	2.00 $\pm$ 0.91	26.75 $\pm$ 1.60	31.75 $\pm$ 2.29
S93 - Turtle Rocks	0.50 $\pm$ 0.29	11.25 $\pm$ 5.44	1.50 $\pm$ 0.29	32.00 $\pm$ 5.45	45.25 $\pm$ 2.21
Upper Florida Keys Total (5)	1.30 $\pm$ 0.60	23.40 $\pm$ 9.71	0.75 $\pm$ 0.42	19.65 $\pm$ 4.08	45.10 $\pm$ 7.94
Mid-channel Patch Reef Total (22)	1.99 $\pm$ 0.88	35.65 $\pm$ 3.40	0.39 $\pm$ 0.11	11.63 $\pm$ 2.17	49.65 $\pm$ 3.03
<i>Offshore patch reefs</i>					
Lower Florida Keys					
S14 - North of Sand Key	1.25 $\pm$ 0.63	31.75 $\pm$ 1.93	1.25 $\pm$ 0.63	16.75 $\pm$ 1.49	51.00 $\pm$ 3.32
S15 - North of Sand Key	0 $\pm$ 0	27.25 $\pm$ 1.75	8.00 $\pm$ 0.58	45.00 $\pm$ 2.00	80.25 $\pm$ 1.70
S16 - North of Sand Key	2.25 $\pm$ 1.31	21.50 $\pm$ 1.71	2.75 $\pm$ 0.25	32.50 $\pm$ 1.85	59.00 $\pm$ 3.42
S19 - Western Sambo ER**	0 $\pm$ 0	20.00 $\pm$ 4.71	1.00 $\pm$ 0.41	23.50 $\pm$ 2.72	44.50 $\pm$ 4.73
S20 - Western Sambo ER**	1.50 $\pm$ 0.29	48.75 $\pm$ 2.46	0 $\pm$ 0	3.50 $\pm$ 1.55	53.75 $\pm$ 2.93
U12 - West of Looe Key RO	1.50 $\pm$ 0.65	43.50 $\pm$ 3.07	0.50 $\pm$ 0.29	16.00 $\pm$ 1.68	61.50 $\pm$ 2.33
S17 - Looe Key RO**	1.50 $\pm$ 0.87	21.75 $\pm$ 3.97	1.00 $\pm$ 0.41	12.25 $\pm$ 2.14	36.50 $\pm$ 5.06
S18 - Looe Key RO**	4.75 $\pm$ 2.43	35.25 $\pm$ 2.69	0.25 $\pm$ 0.25	3.75 $\pm$ 1.03	44.00 $\pm$ 5.12

Site number/site location	Cyanobacteria	Turf algae	CCA	Macroalgae	Total algae
Lower Florida Keys Total (8)	1.59 ± 0.53	31.22 ± 3.78	1.84 ± 0.93	19.16 ± 5.02	53.81 ± 4.77
Middle Florida Keys					
S60 - NE of Delta Shoal	0.25 ± 0.25	16.25 ± 2.50	0.25 ± 0.25	43.50 ± 3.95	60.25 ± 4.80
S61 - West Turtle Shoal	0.50 ± 0.50	51.50 ± 2.84	0.75 ± 0.75	1.50 ± 0.87	54.25 ± 2.87
S63 - Coffins Patch SPA**	0.75 ± 0.48	43.50 ± 4.13	0.50 ± 0.50	22.75 ± 2.50	67.50 ± 1.50
S62 - Coffins Patch SPA**	3.25 ± 0.75	42.25 ± 4.71	0.50 ± 0.29	16.50 ± 2.60	62.50 ± 5.20
S69 - Coffins Patch SPA**	1.75 ± 1.11	33.25 ± 2.66	3.00 ± 1.47	33.00 ± 4.06	71.00 ± 3.34
S70 - Coffins Patch SPA**	1.25 ± 0.63	44.00 ± 3.94	1.25 ± 0.48	29.50 ± 2.40	76.00 ± 2.04
S64 - South of Coffins Patch	0 ± 0	67.00 ± 6.87	0.75 ± 0.48	9.25 ± 1.44	77.00 ± 5.15
U42 - East of Coffins Patch	1.75 ± 0.85	59.50 ± 3.84	0.50 ± 0.29	3.25 ± 1.18	65.00 ± 3.72
Middle Florida Keys Total (8)	1.19 ± 0.37	44.66 ± 5.53	0.94 ± 0.31	19.91 ± 5.29	66.69 ± 2.77
Upper Florida Keys					
S99 - Wolf Reef	0.50 ± 0.50	34.00 ± 6.42	0.25 ± 0.25	40.50 ± 2.40	75.25 ± 6.22
T04 - Inshore of Sand Island	0 ± 0	29.50 ± 3.57	0.25 ± 0.25	40.25 ± 2.78	70.00 ± 1.41
T03 - White Bank	0.50 ± 0.29	17.75 ± 3.50	0 ± 0	12.50 ± 1.85	30.75 ± 5.39
T05 - White Bank	0.25 ± 0.25	36.25 ± 2.69	0 ± 0	43.00 ± 1.68	79.50 ± 3.52
T09 - South of Key Largo Dry Rocks	0.25 ± 0.25	30.00 ± 4.12	0.25 ± 0.25	44.50 ± 3.57	75.00 ± 4.10
T08 - West of Key Largo Dry Rocks	0.25 ± 0.25	34.75 ± 2.50	0 ± 0	41.00 ± 4.30	76.00 ± 3.24
T06 - West of Elbow Reef	0.25 ± 0.25	42.00 ± 3.03	1.00 ± 0.58	37.75 ± 3.64	81.00 ± 0.41
T07 - SW of Watson's Reef	0 ± 0	42.75 ± 4.39	0 ± 0	32.25 ± 4.63	75.00 ± 1.47
T31 - South of Watson's Reef	0 ± 0	42.50 ± 3.12	1.00 ± 0.41	38.25 ± 2.02	81.75 ± 1.11
T20 - Carysfort Reef SPA**	0 ± 0	54.25 ± 9.83	0.25 ± 0.25	21.25 ± 5.48	75.75 ± 4.87
T19 - Carysfort Reef SPA**	0 ± 0	41.50 ± 3.07	0.25 ± 0.25	39.25 ± 6.09	81.00 ± 4.78
T24 - North of Carysfort Reef	0.50 ± 0.29	60.25 ± 1.84	0.50 ± 0.50	24.50 ± 3.71	85.75 ± 2.29
Upper Florida Keys Total (12)	0.21 ± 0.06	38.79 ± 3.26	0.31 ± 0.10	34.58 ± 2.88	73.90 ± 4.10
Offshore Patch Reef Total (28)	0.88 ± 0.21	38.30 ± 2.48	0.93 ± 0.30	25.98 ± 2.73	66.10 ± 2.79
<i>Low-relief hard-bottom (< 6 m)</i>					
Lower Florida Keys					
S21 - East of E. Dry Rocks SPA	0.25 ± 0.25	18.50 ± 4.27	0 ± 0	26.50 ± 2.63	45.25 ± 3.84
S22 - West of Looe Key SPA	1.75 ± 0.48	37.00 ± 3.14	0.25 ± 0.25	29.75 ± 2.29	68.75 ± 2.21
Lower Florida Keys Total (2)	1.00 ± 0.75	27.75 ± 9.25	0.13 ± 0.13	28.13 ± 1.63	57.00 ± 11.75
Middle Florida Keys					
S65 - SE of Coffins Patch	1.00 ± 0.71	54.00 ± 3.56	0 ± 0	17.50 ± 2.75	72.50 ± 2.90
S66 - Tennessee Reef	5.50 ± 1.19	35.75 ± 4.87	0.50 ± 0.29	21.25 ± 2.06	63.00 ± 5.15
S68 - Tennessee Reef RO**	0.75 ± 0.75	53.75 ± 1.31	0.25 ± 0.25	27.00 ± 2.20	81.75 ± 2.84
S67 - Tennessee Reef RO**	4.00 ± 0.41	44.50 ± 6.30	0.25 ± 0.25	26.75 ± 6.10	75.50 ± 1.26
T16 - West of Alligator Reef	1.25 ± 0.25	39.00 ± 4.38	0 ± 0	39.00 ± 3.49	79.25 ± 3.64
T45 - Alligator Reef SPA**	0.25 ± 0.25	27.75 ± 1.03	0.25 ± 0.25	59.75 ± 1.31	88.00 ± 1.22
T46 - Alligator Reef SPA**	0.25 ± 0.25	61.00 ± 4.22	0.25 ± 0.25	22.75 ± 2.90	84.25 ± 1.93
V03 - Davis Reef SPA**	0 ± 0	42.75 ± 1.31	1.50 ± 0.65	43.00 ± 1.41	87.25 ± 2.17
T36 - Davis Reef SPA**	0 ± 0	49.25 ± 3.09	0.50 ± 0.29	41.75 ± 4.35	91.50 ± 1.55
T21 - Conch Reef SPA**	0.50 ± 0.29	57.00 ± 7.14	14.25 ± 2.32	10.25 ± 1.49	82.00 ± 6.57
T22 - Conch Reef SPA**	0 ± 0	29.75 ± 1.31	7.75 ± 2.93	42.50 ± 2.33	80.00 ± 4.65
Middle Florida Keys Total (11)	1.23 ± 0.55	44.95 ± 3.35	2.32 ± 1.37	31.95 ± 4.35	80.45 ± 2.41
Upper Florida Keys					
T28 - Molasses Reef SPA**	0 ± 0	64.75 ± 7.71	2.75 ± 0.95	1.00 ± 0.41	68.50 ± 7.41
T29 - Molasses Reef SPA**	0 ± 0	66.75 ± 3.50	5.50 ± 1.94	0.50 ± 0.50	72.75 ± 3.52
T17 - North of French Reef	0 ± 0	46.50 ± 2.90	2.00 ± 0.71	14.50 ± 0.87	63.00 ± 3.24
T18 - Watson's Reef	0 ± 0	70.75 ± 4.64	0 ± 0	19.50 ± 2.78	90.25 ± 2.56
Upper Florida Keys Total (4)	0 ± 0	62.19 ± 5.38	2.56 ± 1.14	8.88 ± 4.80	73.63 ± 5.89
Shallow Hard-bottom Total (17)	0.91 ± 0.38	46.99 ± 3.57	2.12 ± 0.92	26.07 ± 3.80	76.09 ± 2.90
<i>High-relief spur and groove</i>					
Lower Florida Keys					
S32 - Western Dry Rocks	0 ± 0	77.00 ± 2.68	5.25 ± 1.11	5.75 ± 1.89	88.00 ± 1.63

Site number/site location	Cyanobacteria	Turf algae	CCA	Macroalgae	Total algae
S46 - Sand Key SPA**	0.75 ± 0.48	47.00 ± 2.94	7.25 ± 2.29	30.25 ± 7.66	85.25 ± 2.10
S47 - Sand Key SPA**	0.25 ± 0.25	54.75 ± 6.57	14.00 ± 8.98	8.25 ± 1.97	77.25 ± 4.13
S44 - Rock Key SPA**	0.00 ± 0.00	68.75 ± 5.72	8.50 ± 1.50	11.25 ± 6.52	88.50 ± 3.40
S45 - Rock Key SPA**	1.25 ± 0.75	69.50 ± 4.94	7.75 ± 2.06	1.75 ± 0.75	80.25 ± 5.11
S42 - Eastern Dry Rocks SPA**	0.00 ± 0.00	68.50 ± 5.78	2.00 ± 0.71	16.25 ± 3.47	86.75 ± 2.87
S43 - Eastern Dry Rocks SPA**	0.00 ± 0.00	70.00 ± 2.71	4.50 ± 1.89	3.75 ± 1.03	78.25 ± 4.13
S40 - Western Sambo ER**	0 ± 0	61.50 ± 3.38	5.50 ± 2.22	20.75 ± 1.31	87.75 ± 0.85
S41 - Western Sambo ER**	0 ± 0	71.25 ± 0.85	2.75 ± 0.85	11.25 ± 1.65	85.25 ± 1.93
S33 - Middle Sambo Reef	0 ± 0	86.25 ± 0.75	2.25 ± 0.75	2.25 ± 0.85	90.75 ± 1.11
S38 - Eastern Sambo RO**	0 ± 0	75.25 ± 2.21	1.50 ± 0.29	11.75 ± 2.25	88.50 ± 2.22
S39 - Eastern Sambo RO**	0 ± 0	73.50 ± 3.93	0.75 ± 0.48	6.75 ± 0.75	81.00 ± 3.24
U15 - No Name Reef	0 ± 0	78.25 ± 3.33	1.25 ± 0.48	11.50 ± 1.85	91.00 ± 2.48
S24 - East of Eastern Sambo RO	0.25 ± 0.25	73.50 ± 0.65	0.25 ± 0.25	19.25 ± 0.95	93.25 ± 1.31
U24 - Pelican Shoal	0.25 ± 0.25	72.50 ± 2.90	1.25 ± 0.25	11.25 ± 2.02	85.25 ± 1.65
U23 - Maryland Shoal	0 ± 0	57.75 ± 2.69	1.25 ± 1.25	18.50 ± 3.07	77.50 ± 1.32
S34 - Maryland Shoal	0 ± 0	54.00 ± 8.58	0.25 ± 0.25	20.00 ± 1.78	74.25 ± 9.18
S35 - American Shoal	0.75 ± 0.48	52.25 ± 2.39	1.00 ± 0.71	24.00 ± 2.12	78.00 ± 3.03
S36 - Looe Key SPA**	3.00 ± 1.58	71.50 ± 4.27	0.25 ± 0.25	7.25 ± 0.48	82.00 ± 2.86
S37 - Looe Key SPA**	2.00 ± 1.22	58.00 ± 10.68	1.25 ± 0.63	7.25 ± 2.78	68.50 ± 9.65
Lower Florida Keys Total (20)	0.43 ± 0.18	67.05 ± 2.28	3.44 ± 0.81	12.45 ± 1.72	83.36 ± 1.43
Middle Florida Keys					
S78 - Sombbrero Key SPA**	2.25 ± 0.85	43.25 ± 1.44	1.25 ± 0.48	15.00 ± 3.58	61.75 ± 4.85
S79 - Sombbrero Key SPA**	0.25 ± 0.25	70.50 ± 4.21	1.00 ± 0.71	7.75 ± 0.25	79.50 ± 4.94
S76 - Delta Shoal	1.00 ± 0.41	61.25 ± 1.89	1.25 ± 0.25	13.25 ± 3.59	76.75 ± 2.25
S77 - Delta Shoal	6.75 ± 3.38	76.75 ± 6.45	0 ± 0	6.50 ± 3.12	90.00 ± 1.22
Middle Florida Keys Total (4)	2.56 ± 1.46	62.94 ± 7.29	0.88 ± 0.30	10.63 ± 2.07	77.00 ± 5.83
Upper Florida Keys					
T32 - Pickles Reef	0 ± 0	39.25 ± 4.09	13.00 ± 2.04	26.50 ± 5.87	78.75 ± 3.25
T43 - Molasses Reef SPA**	0 ± 0	25.25 ± 3.20	17.00 ± 1.96	6.50 ± 2.40	48.75 ± 6.79
T44 - Molasses Reef SPA**	0.25 ± 0.25	56.50 ± 3.97	21.50 ± 2.96	8.25 ± 1.44	86.50 ± 4.33
T33 - Sand Island	0 ± 0	54.50 ± 6.89	24.75 ± 5.66	4.50 ± 1.44	83.75 ± 1.31
T34 - Sand Island	0 ± 0	42.00 ± 4.42	26.00 ± 3.94	16.50 ± 2.33	84.50 ± 3.38
T41 - French Reef SPA**	0 ± 0	27.25 ± 3.75	0.50 ± 0.50	64.50 ± 4.41	92.25 ± 1.11
T42 - French Reef SPA**	0.25 ± 0.25	23.25 ± 0.63	3.00 ± 1.22	53.75 ± 1.80	80.25 ± 2.93
T14 - Grecian Rocks SPA**	0 ± 0	61.75 ± 10.08	0.75 ± 0.48	33.25 ± 9.41	95.75 ± 1.11
T15 - Grecian Rocks SPA**	0.25 ± 0.25	46.25 ± 6.20	0.25 ± 0.25	40.75 ± 3.30	87.50 ± 4.48
T12 - Key Largo Dry Rocks SPA**	0 ± 0	45.50 ± 4.35	0.50 ± 0.29	36.25 ± 2.84	82.25 ± 1.49
T13 - Key Largo Dry Rocks SPA**	0.50 ± 0.29	34.75 ± 6.97	0.25 ± 0.25	56.00 ± 7.53	91.50 ± 2.10
T10 - North-North Dry Rocks	0 ± 0	55.25 ± 2.95	0.25 ± 0.25	25.75 ± 4.40	81.25 ± 6.30
T39 - Elbow Reef SPA**	1.00 ± 0.71	29.75 ± 2.17	22.00 ± 0.71	31.50 ± 3.18	84.25 ± 2.21
T40 - Elbow Reef SPA**	0.75 ± 0.48	27.75 ± 4.61	35.00 ± 0.71	24.00 ± 5.40	87.50 ± 3.23
T35 - South of South Carysfort	0.25 ± 0.25	72.00 ± 3.39	0 ± 0	18.75 ± 2.29	91.00 ± 1.58
T37 - South Carysfort Reef SPA**	1.50 ± 0.29	47.50 ± 3.88	0.50 ± 0.29	38.25 ± 3.01	87.75 ± 2.25
T38 - Carysfort Reef SPA**	1.75 ± 0.25	68.25 ± 2.29	0.25 ± 0.25	21.00 ± 2.58	91.25 ± 1.11
T11 - North of Turtle Reef	1.75 ± 0.63	4.00 ± 1.15	3.50 ± 1.32	46.25 ± 4.09	55.50 ± 4.11
Upper Florida Keys Total (18)	0.46 ± 0.15	42.26 ± 4.16	9.39 ± 2.77	30.68 ± 4.06	82.79 ± 2.85
Spur and Groove Total (44)	0.64 ± 0.19	56.04 ± 2.84	5.74 ± 1.33	20.09 ± 2.38	82.51 ± 1.49
<i>Deeper Fore-reef (6-15 m)</i>					
Lower Florida Keys					
U19 - Sand Key SPA**	0.50 ± 0.50	15.50 ± 4.17	3.25 ± 1.38	55.00 ± 2.68	74.25 ± 5.72
S27 - Sand Key SPA**	0 ± 0	11.75 ± 2.56	2.75 ± 0.63	60.25 ± 8.39	74.75 ± 6.81
S23 - East of Rock Key SPA	1.25 ± 0.63	27.75 ± 1.44	1.25 ± 0.25	18.00 ± 2.12	48.25 ± 3.22
S54 - Western Sambo ER**	0.25 ± 0.25	17.75 ± 2.63	2.25 ± 0.63	49.25 ± 1.65	69.50 ± 2.63
S55 - Western Sambo ER**	0 ± 0	31.25 ± 4.29	1.50 ± 0.29	46.50 ± 4.29	79.25 ± 4.09
S48 - East of Western Sambo ER	0 ± 0	51.00 ± 4.02	0.25 ± 0.25	38.25 ± 2.25	89.50 ± 1.71
S49 - Middle Sambo Reef	0 ± 0	36.25 ± 4.13	1.50 ± 0.29	46.25 ± 4.17	84.00 ± 1.22
S52 - Eastern Sambo RO**	0.25 ± 0.25	45.75 ± 2.87	1.00 ± 0.71	32.25 ± 1.11	79.25 ± 2.02
S53 - Eastern Sambo RO**	0.25 ± 0.25	39.00 ± 2.08	0.75 ± 0.25	38.50 ± 4.59	78.50 ± 3.80
U22 - West of Pelican Shoal	1.00 ± 0.41	40.75 ± 4.92	0 ± 0	39.00 ± 3.67	80.75 ± 2.87

Site number/site location	Cyanobacteria	Turf algae	CCA	Macroalgae	Total algae
S30 - East of Pelican Shoal	0 ± 0	26.75 ± 5.56	0.25 ± 0.25	49.00 ± 3.54	76.00 ± 3.24
S31 - East of Maryland Shoal	0 ± 0	40.00 ± 3.34	2.75 ± 0.48	35.00 ± 1.08	77.75 ± 3.86
S51 - American Shoal	0.25 ± 0.25	70.25 ± 2.46	0 ± 0	14.00 ± 3.19	84.50 ± 2.40
S50 - American Shoal	0 ± 0	71.00 ± 4.81	0.50 ± 0.50	18.00 ± 2.68	89.50 ± 2.33
Lower Florida Keys Total (14)	0.27 ± 0.11	37.48 ± 4.83	1.29 ± 0.29	38.52 ± 3.77	77.55 ± 2.71
Middle Florida Keys					
S71 - South of Bahia Honda	1.00 ± 1.00	58.00 ± 8.12	0 ± 0	7.75 ± 1.18	66.75 ± 7.70
S80 - West of Sombrero Key	0 ± 0	52.75 ± 8.94	0.25 ± 0.25	28.25 ± 6.45	81.25 ± 4.57
S74 - West of Sombrero Key	1.00 ± 0.71	53.25 ± 9.93	0 ± 0	10.25 ± 2.90	64.50 ± 9.53
S72 - West of Sombrero Key	0 ± 0	33.75 ± 3.90	0 ± 0	1.75 ± 0.63	35.50 ± 4.19
S86 - Sombrero Key SPA	0.25 ± 0.25	40.00 ± 3.08	0 ± 0	0.75 ± 0.48	41.00 ± 3.72
S85 - Sombrero Key SPA	0.75 ± 0.48	70.25 ± 2.78	0 ± 0	9.75 ± 2.66	80.75 ± 0.63
S73 - East of Delta Shoal	0.50 ± 0.29	56.00 ± 2.61	0.25 ± 0.25	28.50 ± 3.18	85.25 ± 3.47
S81 - SW of Coffins Patch	0 ± 0	70.75 ± 1.75	0 ± 0	7.25 ± 0.85	78.00 ± 1.41
S75 - Marker 20	4.50 ± 2.06	61.75 ± 3.30	0 ± 0	4.25 ± 2.17	70.50 ± 3.07
S82 - Tennessee Reef	0 ± 0	62.25 ± 3.35	0 ± 0	18.75 ± 3.57	81.00 ± 2.12
S83 - Tennessee Reef RO**	2.00 ± 0.91	57.00 ± 2.20	0 ± 0	27.75 ± 2.87	86.75 ± 3.38
S84 - Tennessee Reef RO**	8.50 ± 1.85	35.00 ± 3.72	0 ± 0	29.00 ± 4.60	72.50 ± 1.26
T56 - Alligator Reef SPA**	1.75 ± 0.85	75.50 ± 3.59	0 ± 0	10.50 ± 1.32	87.75 ± 2.32
T57 - Alligator Reef SPA**	0.50 ± 0.29	70.00 ± 3.89	0 ± 0	13.50 ± 2.10	84.00 ± 2.80
T54 - Davis Reef SPA**	0 ± 0	54.50 ± 20.27	0 ± 0	0.25 ± 0.25	54.75 ± 20.35
T55 - Davis Reef SPA**	1.00 ± 1.00	50.50 ± 18.08	0 ± 0	0 ± 0	51.50 ± 18.79
T47 - Little Conch Reef	0.25 ± 0.25	34.50 ± 6.76	0 ± 0	51.50 ± 7.35	86.25 ± 1.25
T23 - Little Conch Reef	0 ± 0	38.00 ± 2.80	0.25 ± 0.25	52.25 ± 2.14	90.50 ± 1.44
T52 - Conch Reef SPA**	0 ± 0	40.75 ± 2.46	0 ± 0	47.75 ± 2.78	88.50 ± 1.44
T53 - Conch Reef SPA**	12.75 ± 2.75	73.75 ± 3.97	0 ± 0	10.25 ± 0.75	96.75 ± 1.65
V09 - Conch Reef RO**	0 ± 0	36.00 ± 3.81	0 ± 0	50.00 ± 3.51	86.00 ± 2.12
V10 - Conch Reef RO**	4.00 ± 0.91	23.50 ± 3.84	0.25 ± 0.25	52.25 ± 3.01	80.00 ± 2.04
Middle Florida Keys Total (22)	1.76 ± 0.68	52.17 ± 3.22	0.05 ± 0.02	21.01 ± 4.03	74.99 ± 3.50
Upper Florida Keys					
U98 - Pickles Reef	0 ± 0	43.00 ± 2.27	0 ± 0	43.25 ± 2.81	86.25 ± 1.31
U87 - Dixie Shoal	0.75 ± 0.48	26.50 ± 3.18	3.00 ± 0.71	42.75 ± 4.13	73.00 ± 3.44
U84 - North of Dixie Shoal	7.50 ± 2.78	14.00 ± 2.00	1.50 ± 0.65	36.75 ± 2.36	59.75 ± 2.29
T30 - South of Elbow Reef	0 ± 0	23.75 ± 4.87	0.75 ± 0.48	19.75 ± 1.31	44.25 ± 5.30
T50 - Carysfort Reef SPA**	0 ± 0	45.75 ± 8.67	0 ± 0	37.25 ± 4.42	83.00 ± 5.24
T26 - Carysfort Reef SPA**	0 ± 0	36.00 ± 4.02	0.25 ± 0.25	46.50 ± 2.22	82.75 ± 4.59
T51 - Carysfort Reef SPA**	0 ± 0	36.00 ± 3.54	0 ± 0	54.75 ± 5.44	90.75 ± 2.25
T27 - Carysfort Reef SPA**	0.25 ± 0.25	38.50 ± 5.48	0 ± 0	45.25 ± 4.01	84.00 ± 3.67
T25 - North of Carysfort Reef	1.00 ± 0.71	34.50 ± 3.20	0 ± 0	55.50 ± 2.18	91.00 ± 1.91
T48 - North of Carysfort Reef	0.25 ± 0.25	58.25 ± 5.09	0 ± 0	32.75 ± 4.46	91.25 ± 1.31
T49 - SE of Turtle Rocks	0.50 ± 0.50	25.25 ± 7.25	2.50 ± 0.87	25.00 ± 4.49	53.25 ± 10.64
Upper Florida Keys Total (11)	0.93 ± 0.66	34.68 ± 3.65	0.73 ± 0.33	39.95 ± 3.37	76.30 ± 4.99
Deeper Fore-reef Total (47)	1.12 ± 0.36	43.70 ± 2.50	0.57 ± 0.14	30.66 ± 2.65	76.06 ± 2.13

IV. Abundance of Adult and Juvenile Corals

Background

The declines in abundance of two of the principal Caribbean reef-building corals, staghorn coral (*Acropora cervicornis*) and elkhorn coral (*A. palmata*) (Figure 7), are often-cited examples of the changes in western Atlantic reefs that have occurred during the past several decades (Bruckner 2002; Gardner et al. 2003). 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 (Gladfelter 1982; Aronson and Precht 2001), as well as smaller-scale effects from storms and continued predation by corallivorous snails and damselfishes (Miller et al. 2002). Both coral species were under consideration for addition to the U.S. Endangered Species List since the early 1990s and were formally determined to be “threatened” based upon range-wide population declines and poor recovery (*Acropora* Biological Review Team 2005). Although there is increased awareness of the fragility of Atlantic *Acropora* corals and the potential for further population decline, as well as recovery at some locations, there is little information on habitat distribution, colony size, density, and population abundance estimates for wider Caribbean reefs. Notable exceptions to this pattern include recent population assessments of *A. palmata* in the U.S. Virgin Islands (Mayor et al. 2006), southern Caribbean (Zubillaga et al. 2008), in the Florida Keys at Looe Key (Miller et al. 2002) and by our program Keys-wide in 2007 and 2008 (see 2008 Quick Look Report at <http://people.uncw.edu/millers>). While some recovery is apparent in localized areas, populations of both species remain well-below historical levels, including populations in the Florida Keys (Dustan and Halas 1987; Porter and Meier 1992), and threats continue that will potentially inhibit population recovery (*Acropora* Biological Review Team 2005).

To document the current population status of stony corals, including *Acropora* spp., we conducted an intensive assessment of the spatial distribution, colony abundance, size, and condition of these species, as well as all other stony corals, throughout the Florida Keys during 2009. These efforts contribute to a temporal record dating back to 1999 on the abundance, size, and condition of coral colonies throughout the Florida Keys. Using a stratified random sampling design, the goals of the 2009 surveys were to determine patterns in habitat distribution, colony abundances, and sizes of all corals encountered in belt transect surveys, similar to previous Keys-wide assessments in 1999-2001 and 2005.

We also surveyed in 2009 the species composition and abundance of smaller (< 4 cm) juvenile corals. Recruitment and establishment of new coral colonies are important factors in determining patterns in reef community structure, along with factors that disrupt this pattern and clear space for recruitment. Coral populations are dependent upon sexual recruits and in some cases fragmentation for recovery after

catastrophic disturbance. The abundance of coral recruits represents the combined processes of settlement, metamorphosis, and early survival. Larvae, either those that develop in the water column or those that are released from brooding corals, suffer considerably mortality (up to 90% or more) from predation or other factors prior to settlement and metamorphosis. Once larvae are able to settle into appropriate hard substrata, metabolic energy is diverted to colony growth and maintenance. Because newly settled corals barely protrude above the substratum, juveniles need to reach a certain size to reduce damage or mortality from impacts such as grazing, sediment burial, and algal overgrowth. Spatial and temporal patterns of coral recruitment have been intensively studied on western Atlantic and Indo-Pacific reefs, as well as the modes and frequencies of reproduction. Biological and physical factors that have been shown to affect spatial and temporal patterns of coral recruitment to reefs include substratum availability and community structure, grazing pressure, fecundity, mode, and timing of reproduction, larval behavior, hurricane disturbance, physical oceanography, the structure of established coral assemblages, and chemical cues. Few studies, however, have examined variation in recruitment over large spatial scales (10-100 km) and among multiple hard-bottom and coral reef types, as we report here.

Coral Species Composition and Density

Two 10-m x 1-m belt transects per site (20 m²) were surveyed for all stony corals (Milleporina and Scleractinia) at 160 sites during 2009, representing a total search area of 3,200 m². Each colony greater than 4 cm in maximum diameter was identified, measured (minor axis, major axis, height), and assessed for percent live tissue and condition (e.g. overgrowth causing tissue damage, bleaching, disease, predation). Figure 4-1 provides representative examples of some of the larger coral species surveyed and Figure 4-2 illustrates some of the *Acropora* colonies encountered. A total of 21,695 stony coral colonies were assessed during 2009, represented by 7,008 milleporid hydrocorals (*Millepora alcicornis* and *M. complanata*) and 14,687 scleractinian corals (40 taxa) (Table 4-1). Figures 4-3 to 4-8 illustrate geographic patterns in scleractinian coral densities in the Florida Keys during 2009 and Table 4-1 provides site-level data on colony numbers assessed and mean densities. Of the 7,008 *Millepora* colonies counted, 95% were represented by *M. alcicornis*. Of the 14,687 scleractinian corals assessed, five taxa accounted for ~84% of all scleractinian corals encountered: *Porites astreoides* (3,987 colonies, 27.1%), *Siderastrea siderea* (3,667 colonies, 25.0%), *Agaricia agaricites* (1,687 colonies, 11.5%), *Stephanocoenia michelini* (1,537 colonies, 10.5%), and branching *Porites* corals (1,414 colonies, 9.6%). These results parallel the patterns observed in the juvenile coral assemblage (see below). Relatively rare species (< 10 colonies encountered from all 160 sites) included *Acropora palmata*, *Cladocora arbuscula*, *Dendrogyra cylindrus*, *Montastraea franksi*, *Mussa angulosa*, *Mycetophyllia ferox*, and *Scolymia* spp.

Habitat variations in stony coral densities mirrored those of the juvenile corals. Densities of *Millepora* were greatest on offshore patch reefs (2.71 ± 0.35 colonies per m^2), followed by shallow-hard-bottom (1.96 ± 0.29) and high-relief spur and groove (1.85 ± 0.26) (Tables 4-1). Densities of scleractinian corals were also variable among the habitats sampled, with mid-channel (9.51 ± 0.86 colonies per m^2) and offshore patch reefs (6.24 ± 0.79) yielding the greatest mean densities, followed by high-relief spur and groove (4.25 ± 0.52). Mean scleractinian coral densities were relatively low (< 3 per m^2) on shallow hard-bottom and the deeper fore reef. Differences in dominant species by habitat were apparent. Inshore patch reefs were dominated (79% of total Scleractinia) by four species, all of which are dominant framework corals: *Montastraea annularis* (46.6%), *Siderastrea siderea* (12.7%), *M. cavernosa* (12.0%), and *M. faveolata* (7.8%). Mid-channel patch and offshore patch reefs were similarly dominated by *S. siderea* (29.1-33.5% of the total colonies), as well as *Porites astreoides* (17.0-22.3%), *Stephanocoenia michelini* (14.9-15.8%), and branching *Porites* corals (9.1-9.6%). Offshore patch reefs differed in the relative abundance of *Agaricia agaricites*, which was more dominant further offshore. High-relief spur and groove reefs were the most distinctive habitats in terms of coral composition, with a substantial dominance by *P. astreoides* (52.1% of the total), followed by *A. agaricites* (25.5%). Deeper fore reef habitats were similar to the patch reefs in terms of relative abundance patterns, with *S. siderea* (29.6%), *P. astreoides* (16.3%), branching *Porites* corals (14.9%), *A. agaricites* (12.5%), and *S. michelini* (10.9%) comprising more than 80% of all scleractinian corals encountered.

Regional variations in stony coral densities were apparent and resembled those documented for juvenile corals (see Figures 4-9 and 4-10). On mid-channel patch reefs, scleractinian coral density was greater in the lower Keys (11.46 ± 1.04 colonies per m^2) compared to the middle (8.36 ± 1.48) and upper Keys (7.22 ± 2.00). This pattern was primarily due to substantially greater (4-8 times) greater densities of *Stephanocoenia michelini* in the lower Keys, as well as greater densities of *Acropora cervicornis*, *Agaricia agaricites*, *Colpophyllia natans*, *Diploria strigosa*, and *Mycetophyllia* corals in this region. In contrast, branching *Porites* corals were more abundant in the upper Keys region. Offshore patch reefs also yielded greater scleractinian coral densities in the lower Keys (10.33 ± 1.24 colonies per m^2) compared to the middle (5.33 ± 1.47) and upper Keys (4.13 ± 0.76). This pattern was primarily due to greater densities of several species (e.g. *C. natans*, *Dichocoenia stokesi*, *Montastraea faveolata*, *Oculina diffusa*, *S. michelini*) in the lower Keys. In contrast, *A. agaricites* and branching *Porites* corals were more abundant on upper Keys offshore patch reefs. Scleractinian corals on high-relief spur and groove reefs exhibited greater mean density in the lower Keys (5.12 ± 0.98 colonies per m^2) compared to the middle (2.63 ± 0.56) and upper Keys (3.64 ± 0.44), due primarily to a greater abundance of *P. astreoides* in the lower Keys. In contrast, branching *Porites* corals were approximately two times more abundant in the middle

and upper Keys, and the overall density of *Millepora complanata* was 4-5 times greater in the upper Keys compared to other regions. In contrast to patch reefs and high-relief spur and groove, scleractinian corals on shallow hard-bottom and the deeper fore reef exhibited less regional variation.

Both *Acropora* coral species encountered during 2009 exhibited distribution and abundance patterns similar to 2007 and 2008. *Acropora cervicornis* was found in all of the habitats sampled, but frequency of occurrence and density were greatest on patch reefs. Frequency of occurrence (percentage of transects present) was greatest on inshore ($19\% \pm 19\%$) and mid-channel patch reefs ($19\% \pm 6\%$), followed by offshore patch reefs ($11\% \pm 4\%$). *A. cervicornis* frequency of occurrence was relatively low ($< 6\%$ of all sampled transects) on shallow hard-bottom, high-relief spur and groove, and deeper fore reef habitats. On inshore patch reefs, *A. cervicornis* was found on one reference site out of four total sites sampled. On mid-channel patch reefs, *A. cervicornis* was more frequent in the lower Keys ($23\% \pm 6\%$) compared to the middle ($18\% \pm 14\%$) and upper Keys ($15\% \pm 15\%$). In the lower Keys, *A. cervicornis* was present on 38% of the transects in the Western Sambo ER, but only 19% of the transects at reference sites. *A. cervicornis* colony density was 6-9 times greater in the lower Keys (0.18 ± 0.09 per m^2) compared to the middle (0.03 ± 0.02 per m^2) and upper Keys (0.02 ± 0.02 per m^2). On offshore patch reefs, *A. cervicornis* was more frequently encountered in the middle Keys ($19\% \pm 10\%$) compared to the lower ($13\% \pm 7\%$) and upper Keys ($4\% \pm 4\%$). Mean colony density was seven times greater in the middle Keys compared to other regions. In the lower Keys, *A. cervicornis* was present on $25\% \pm 10\%$ of the sampled transects in no-take zones (Western Sambo ER and Looe Key RO), but was absent from all transects sampled at reference sites. In the middle Keys, *A. cervicornis* occurred on 13% of the sampled transects in Coffins Patch SPA, but was found on 25% of the transects in reference sites. On upper Keys offshore patch reefs, *A. cervicornis* was only encountered in one out of 12 sites.

Acropora palmata was found in two of the six major habitats sampled, both of which occur on the shallow platform margin seaward of Hawk Channel: shallow (< 6 m) hard-bottom and high-relief spur and groove. As documented in previous years, no colonies were found on patch reefs or the deeper fore reef. Only one colony was sampled on shallow hard-bottom (Conch Reef SPA) out of 17 sites surveyed Keyswide. On high-relief spur and groove reefs, *A. palmata* was found on $8\% \pm 3\%$ of the 168 transects sampled (42 sites), with low frequency of occurrence in the middle Keys (no colonies encountered in transects) and the lower Keys ($5\% \pm 3\%$, present in 3 out of 20 sites). In the upper Keys, *A. palmata* was found on $13\% \pm 10\%$ of the sampled transects and was present at six out of 18 sites. *A. palmata* was found on 15% of the sampled transects in no-take zones, but only 8% in reference sites.

Juvenile Scleractinian Corals

Juvenile scleractinian corals were sampled along two 15-m transects per site by randomly placing and sampling ten 0.65-cm x 0.48-cm quadrats along each transect (6.24 m² area per site). The majority of corals less than four cm in maximum diameter encountered in the quadrats were considered recruits or juveniles (see Figure 4-11). Newly settled corals are visible in the field at approximately 1-10 mm diameter, corresponding to an age less than one year old, while colonies of most species approaching four cm in diameter are approximately 1-3 years old. As colonies attain larger sizes, it becomes difficult to distinguish recently settled recruits from colonies resulting from fragmentation. Larval recruits can be distinguished from new daughter colonies because they are smaller than post-fission products, most are roughly circular in shape, and recruits generally settle on coralline rock made by different species. Based on previous studies of the size at first reproduction of Caribbean reef corals, we used the 4-cm size criterion as a conservative estimate of juvenile coral abundance. Although *Siderastrea radians* and *Favia fragum* reproduce at smaller sizes (< 2 cm diameter), colonies of these species were incorporated into the juvenile surveys. Juveniles of all scleractinian corals found were identified to the lowest taxonomic level possible in the field.

A total of 995 m² of substratum was sampled for juvenile scleractinian corals during 2009. Over 5,500 juveniles were identified and counted, representing at least 32 different coral taxa. Juvenile sizes ranged from 0.1 cm to 4.0 cm and averaged 1.84 ± 0.01 cm in maximum diameter. Approximately 55% of the juvenile corals surveyed were 2.0 cm or smaller in maximum diameter. Table 4-2 provides site-level data on the number of species observed as juveniles, total juveniles surveyed, and mean juvenile densities, while Tables 4-3 to 4-12 provide site-level data for each coral taxa. Figures 4-12 to 4-17 show the geographic patterns of total juvenile coral densities in the Florida Keys. Out of the total juvenile coral assemblage of 5,544 juveniles inventoried, five species accounted for ~87% of the assemblage during 2009, three of which are brooding species, two of which are broadcast spawning corals: *Agaricia agaricites* (573 juveniles, 10.3%), *Porites astreoides* (1,126 juveniles, 20.3%), *Siderastrea radians* (1,081 juveniles, 19.5%), *S. siderea* (1,638 juveniles, 29.6%), and *Stephanocoenia michelini* (423 juveniles, 7.6%). From the 160 sites, only three recruits of *Acropora* and two recruits from the *Montastraea annularis* species complex were recorded.

A range of one to 13 scleractinian coral species per site were observed as juveniles (Table 4-2). Mean juvenile density per site ranged from a low of 0.32 ± 0.32 per m² upwards to 22.60 ± 2.40 per m². There were substantial differences in mean numbers of species observed as juveniles and juvenile densities among the habitats sampled (Table 4-2). Inshore patch reefs (3.3 ± 1.4 species per site, 1.16 ± 0.38

juveniles per m²) yielded the lowest richness and abundance of juvenile corals, while offshore patch reefs (6.9 ± 0.5 species, 6.89 ± 1.05 per m²), the deeper fore reef (6.9 ± 0.4 species, 5.81 ± 0.60 per m²), and mid-channel patch reefs (6.4 ± 0.5 species, 7.39 ± 0.95 per m²) yielded the greater species richness and juvenile densities. Low-relief and high-relief habitats on the shallow platform margin were intermediate between inshore patch reefs and the deeper fore reef. The dominant species by habitat also differed by distance from shore. *Siderastrea radians* (52%) and *S. siderea* (17%) accounted for most of the juveniles on inshore patch reefs, while the juvenile assemblages on mid-channel and offshore patch reefs were dominated by these two species, as well *Porites astreoides* and *Stephanocoenia michelini*. Further offshore on low-relief hard-bottom and high-relief spur and groove, *Agaricia agaricites* (9-30%) and *P. astreoides* (22-40%) comprised a greater percentage of the juvenile assemblage. Similar to patch reefs, juveniles on the deeper fore reef were mostly *Porites* spp. (19%), *Siderastrea* spp. (59%), and *S. michelini* (9%).

Variations in juvenile coral densities among regions by habitat and between no-take zones and reference areas were specific to particular habitat types (Figures 4-18 and 4-19). Juvenile densities on reference inshore patch reefs were greater than at two sites in Newfound Harbor SPA. On mid-channel patch reefs, there were greater numbers of species observed as juveniles (7.8 ± 0.4 species per site) in the lower Keys, and much greater (> 2 times) densities in the lower Keys (10.71 ± 0.97 per m²) compared to the middle and upper Keys. While reference sites and no-take zones were similar in the lower Keys, overall juvenile density was three times greater at reference sites compared to no-take zones (Cheeca Rocks and Hen and Chickens SPA) in the middle Keys. A similar regional pattern was observed on offshore patch reefs, especially with respect to juvenile density, which was three times greater in the lower Keys compared to the middle and upper Keys. Reference patch reefs in all three regions yielded greater overall mean juvenile densities than no-take zones. On shallow hard-bottom and high-relief spur and groove, there was less regional variability. On high-relief spur and groove reefs, mean juvenile density was slightly greater in no-take zones in the lower Keys, but lower in Sombrero Key SPA compared to reference areas in the middle Keys, yet similar between no-take zones and reference sites in the upper Keys. The deeper fore reef exhibited a similar regional pattern in juvenile densities to patch reefs. Mean juvenile density was slightly greater in no-take zones in the lower Keys and middle Keys, yet was more similar between management zones in the upper Keys.

Discussion

Relatively few coral reef assessment or monitoring programs sample for coral recruits of the smallest size classes (< 4 cm). Yet, it is this element of the life cycle that contributes to population growth or is

responsible for decline if adults are not replaced. Variable patterns in recruitment were revealed throughout the Florida Keys, with multiple factors and combinations of factors such as geographic location, habitat type, management protection, and reproductive strategies (brooders and broadcasters) contributing to the variability. At the broadest spatial scales, only five taxa accounted for almost 85 percent of all adult scleractinian corals encountered: *Porites astreoides* (27.1%), *Siderastrea siderea* (25.0%), *Agaricia agaricites* (colonies, 11.5%), *Stephanocoenia michelini* (1,537 colonies, 10.5%), and branching *Porites* corals (colonies, 9.6%). Notably absent from this list are important reef-building genera such as *Montastraea*, *Diploria* and *Acropora*, though their relative abundance was variable by habitat type and especially in nearshore habitats where mounding head corals such as *M. annularis*, *M. cavernosa*, and *Siderastrea siderea* were among the dominant species.

Among juvenile corals, again five species accounted for over 85% of the assemblage, three of which are brooding species, two of which are broadcast spawning corals: *Agaricia agaricites* (573 juveniles, 10.3%), *Porites astreoides* (1,126 juveniles, 20.3%), *Siderastrea radians* (1,081 juveniles, 19.5%), *S. siderea* (1,638 juveniles, 29.6%), and *Stephanocoenia michelini* (423 juveniles, 7.6%). The juvenile list is, not surprisingly, similar to the adult list of most abundant corals encountered, except for the addition of *S. radians* and loss of branching *Porites* corals. However, because there is so much within, between, and among-site variability, it will be important to compare juvenile and adult populations across all stratifications in our design to assess the longer-term trajectories of species populations.

Figure 4-1. Examples of stony coral species in the Florida Keys.

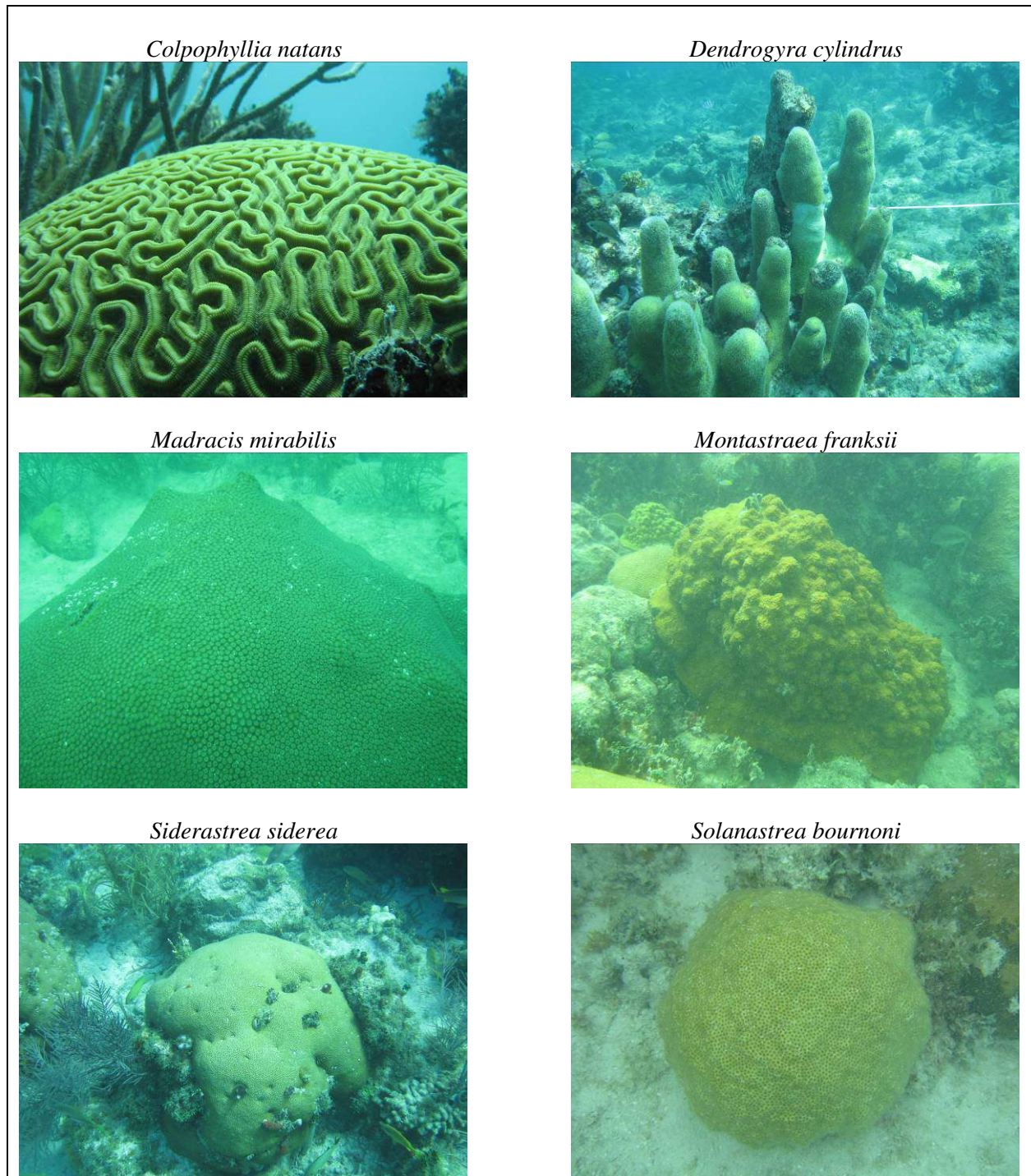


Figure 4-2. Staghorn coral (*Acropora cervicornis*) and elkhorn corals (*A. palmata*) in the Florida Keys.

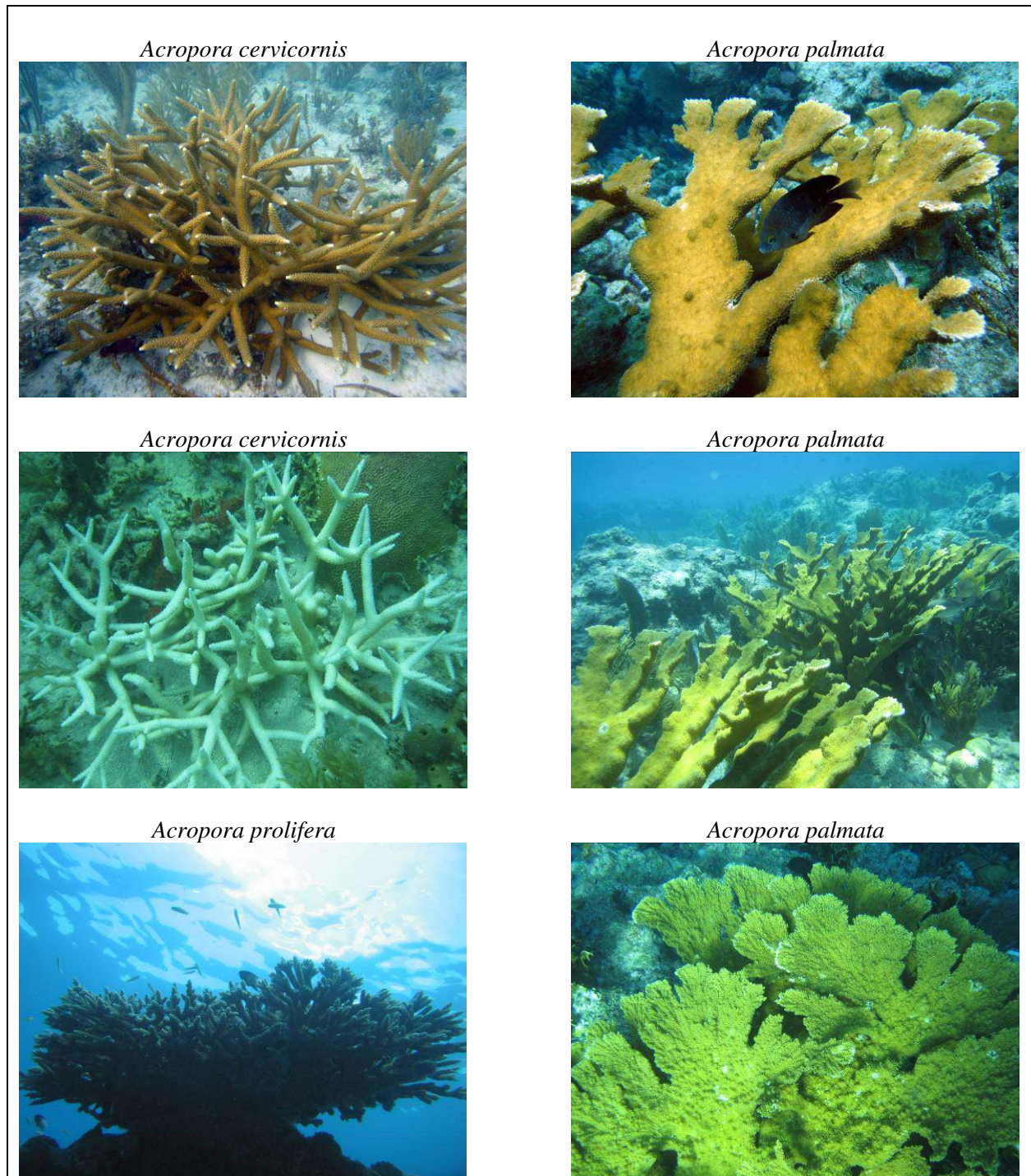


Figure 4-3. Densities of scleractinian corals (no. colonies per m²) larger than 4 cm in max. diameter in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

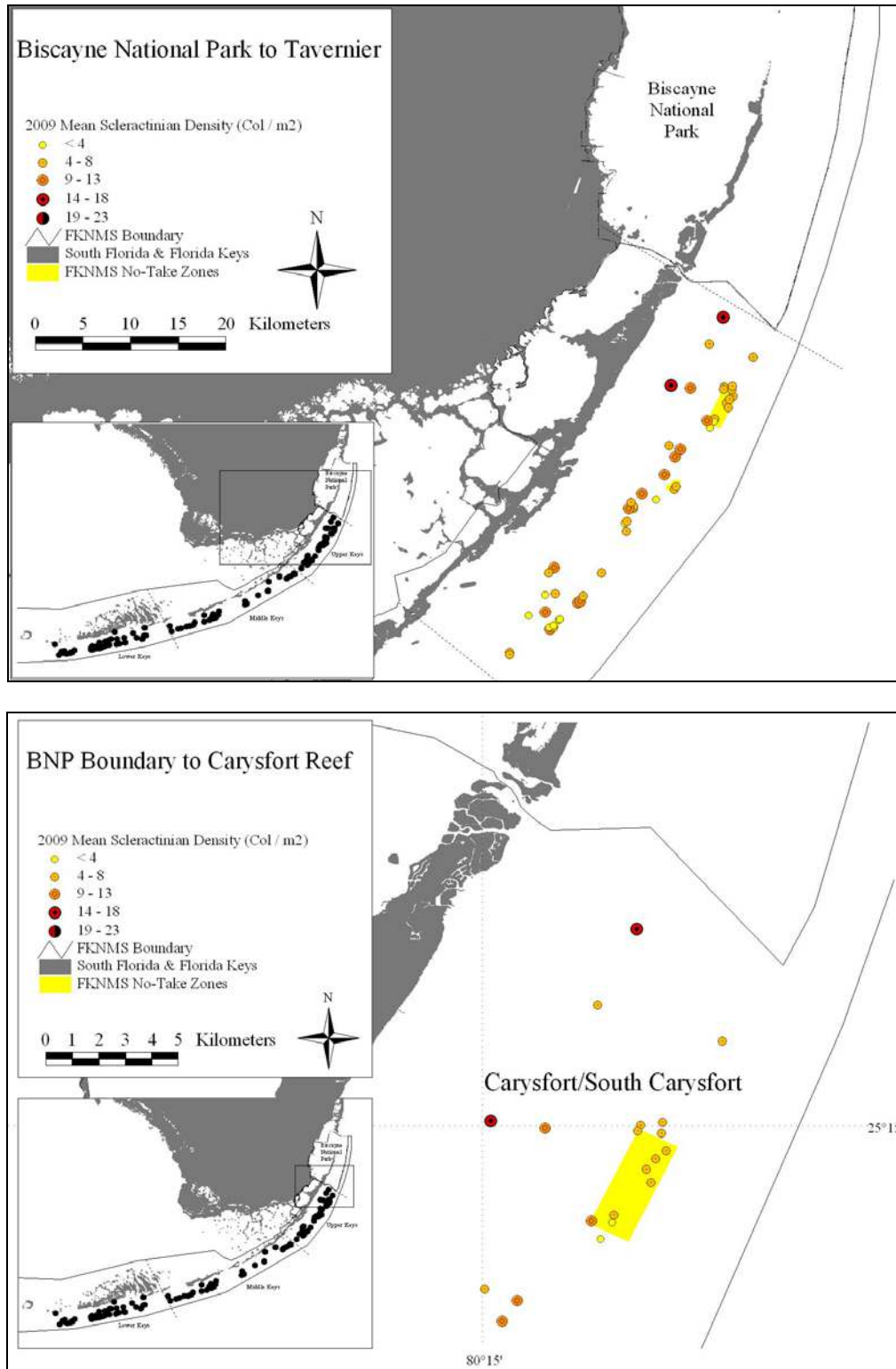


Figure 4-4. Densities of scleractinian corals (no. colonies per m²) larger than 4 cm in max. diameter in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region (bottom) during May-September 2009.

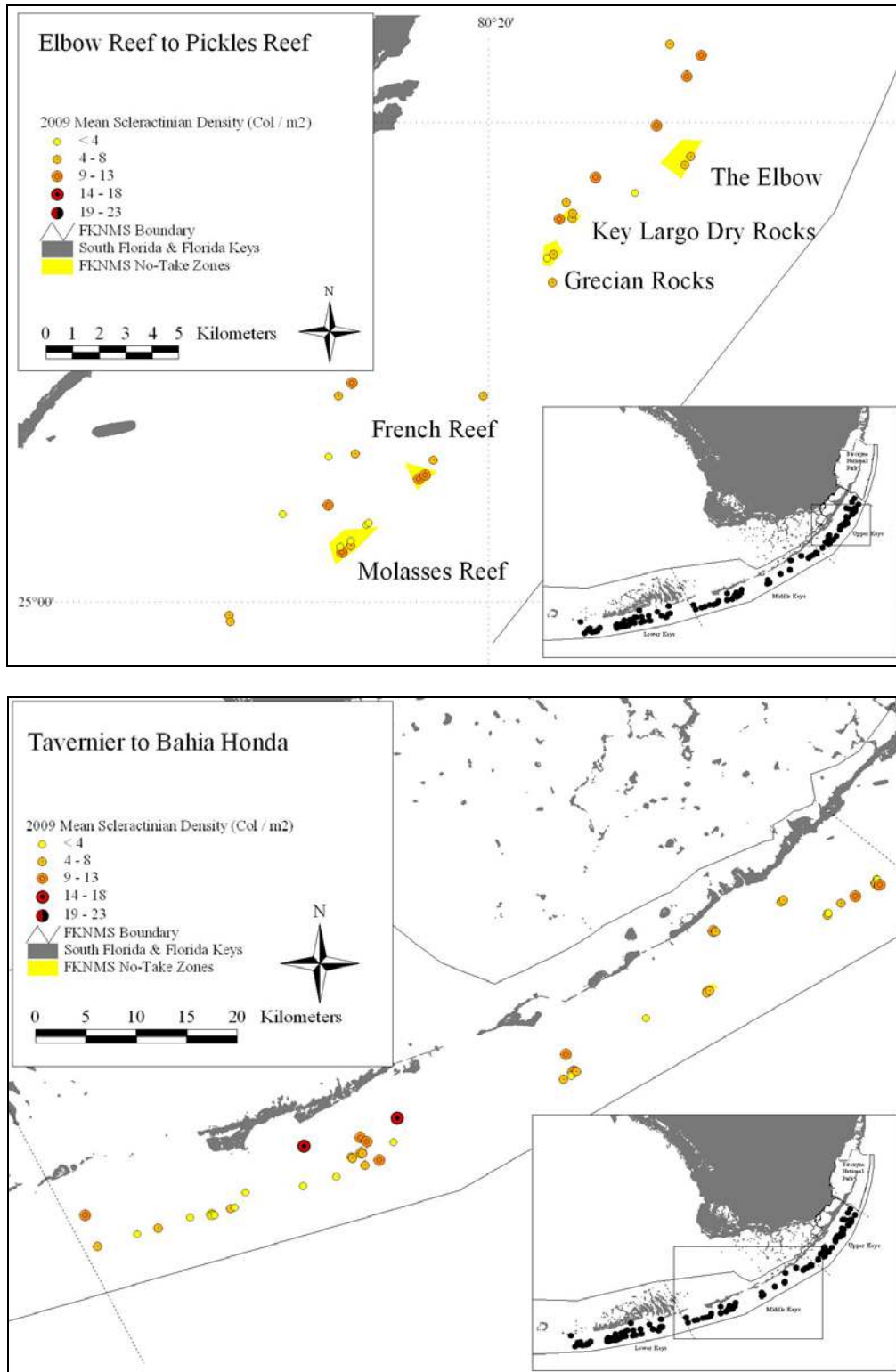


Figure 4-5. Densities of scleractinian corals (no. colonies per m²) larger than 4 cm in max. diameter in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

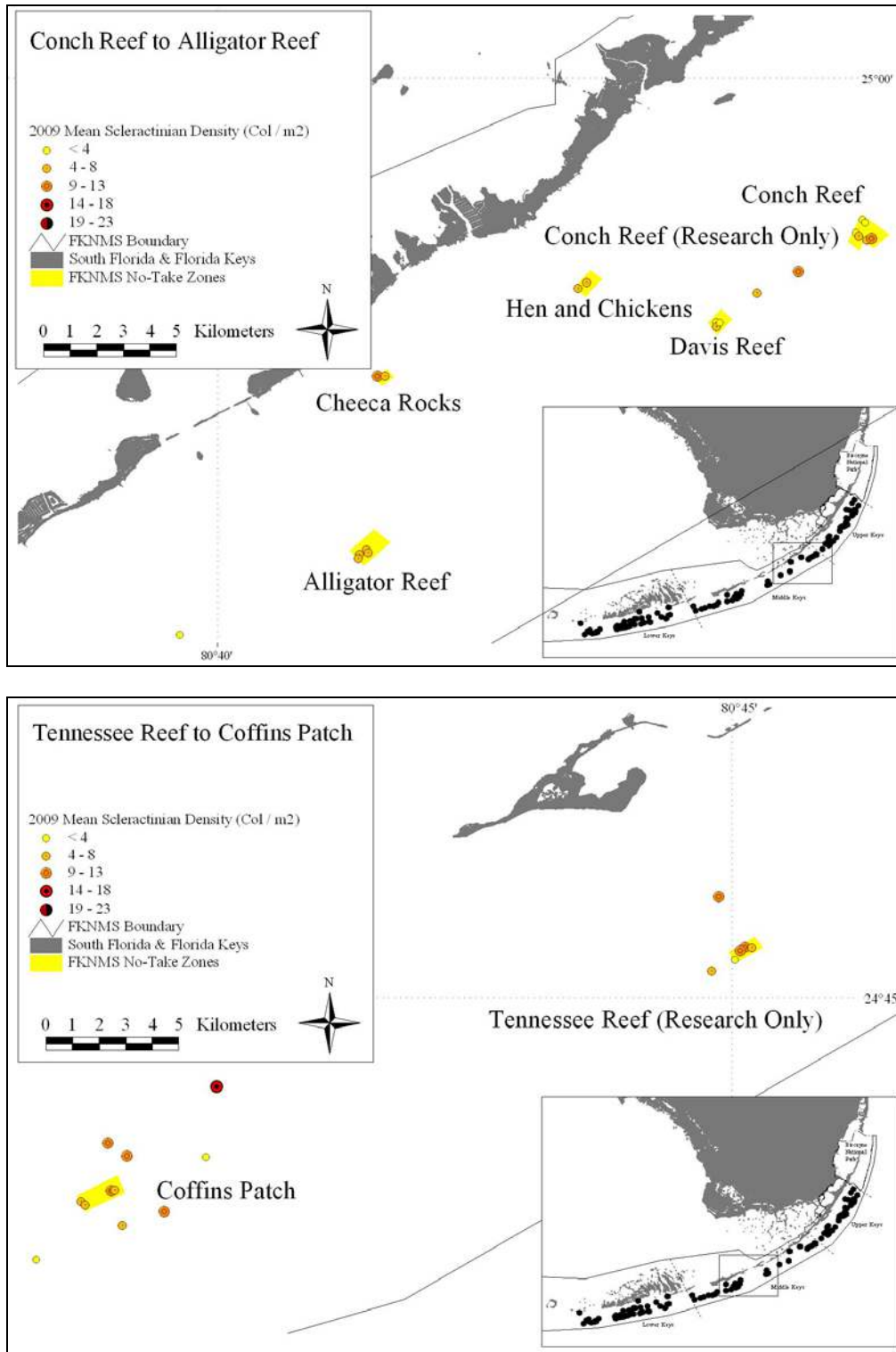


Figure 4-6. Densities of scleractinian corals (no. colonies per m²) larger than 4 cm in max. diameter in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys (bottom) during May-September 2009.

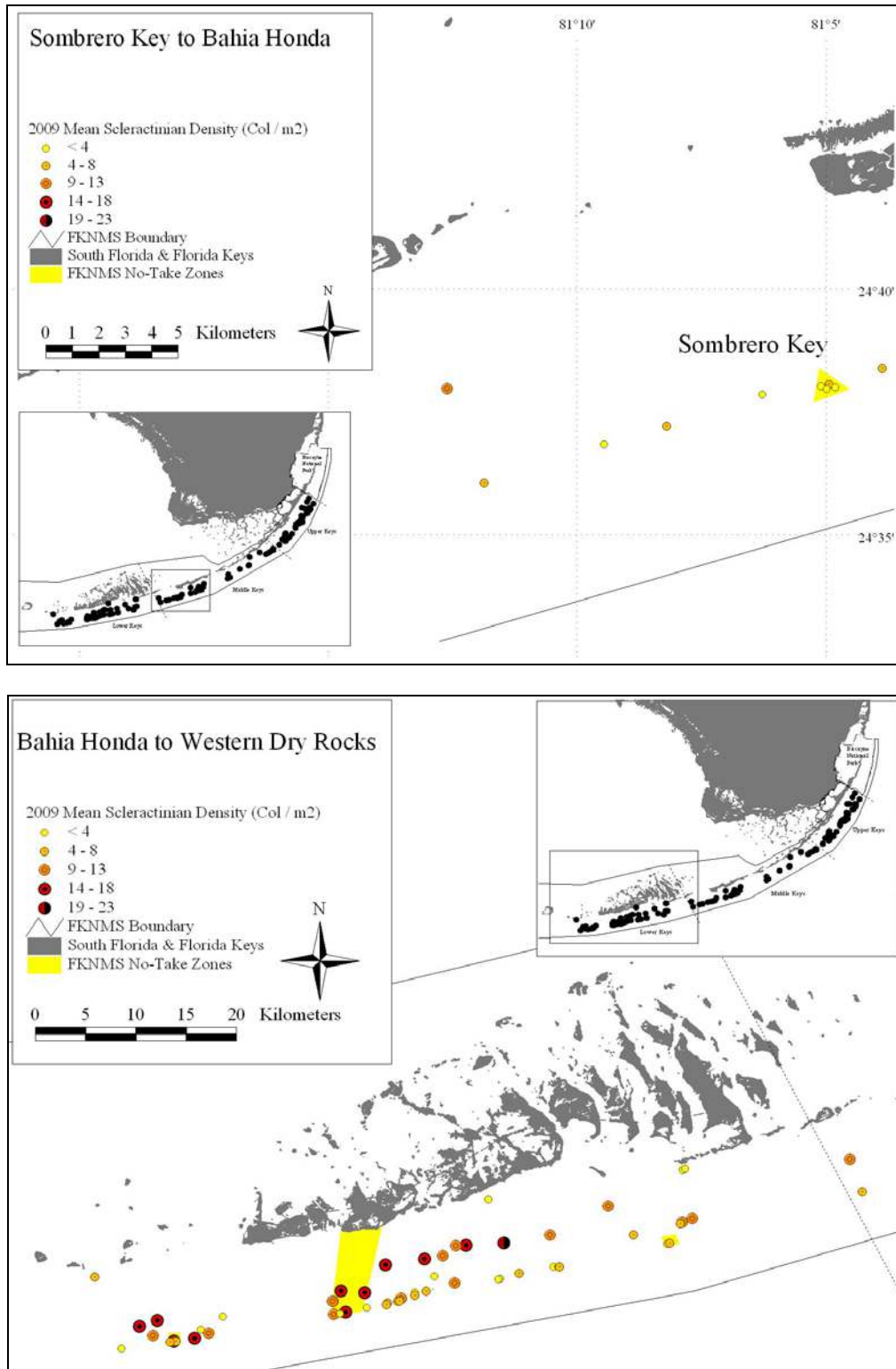


Figure 4-7. Densities of scleractinian corals (no. colonies per m²) larger than 4 cm in max. diameter in the lower Florida Keys from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

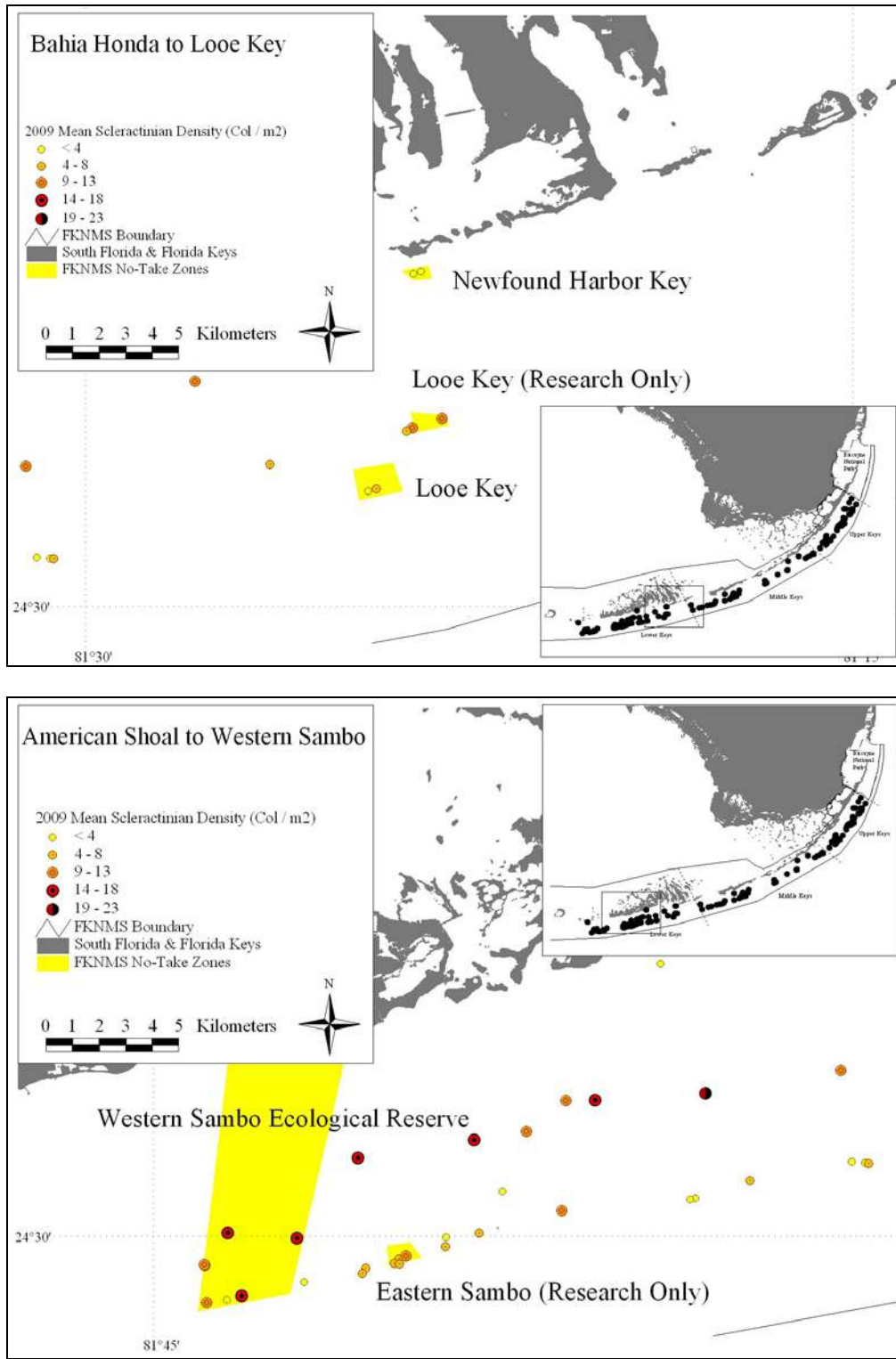


Figure 4-8. Densities of scleractinian corals (no. colonies per m²) larger than 4 cm in max. diameter in the lower Florida Keys from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

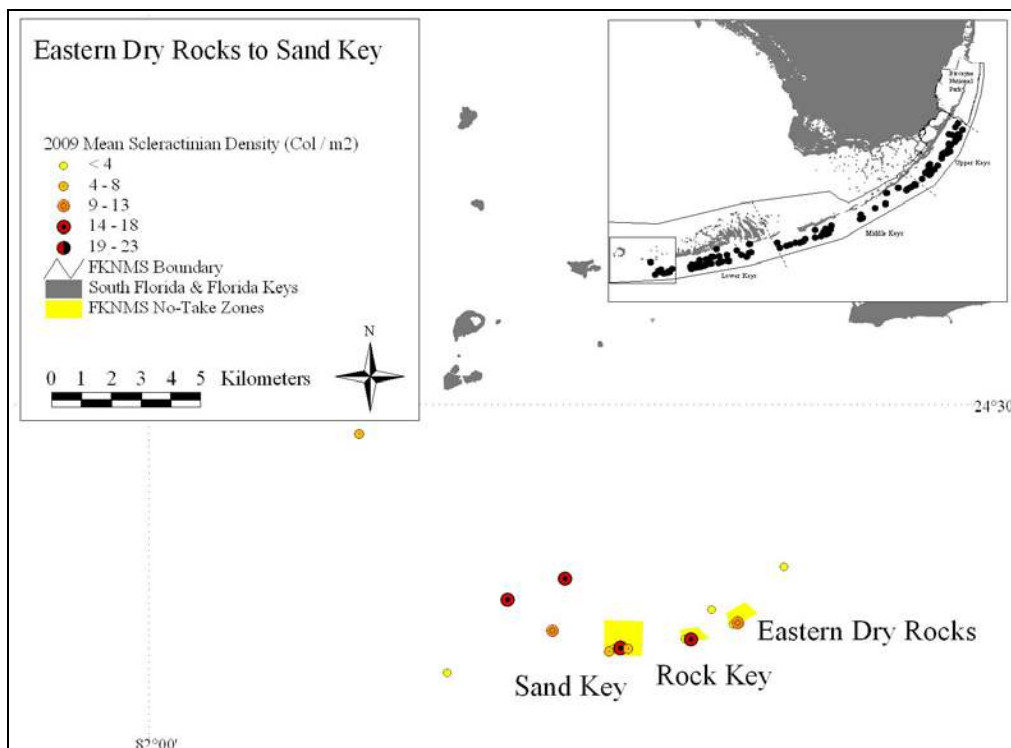


Figure 4-9. Mean (± 1 SE) densities (no. colonies per m^2) of scleractinian corals > 4 cm in max. diameter on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

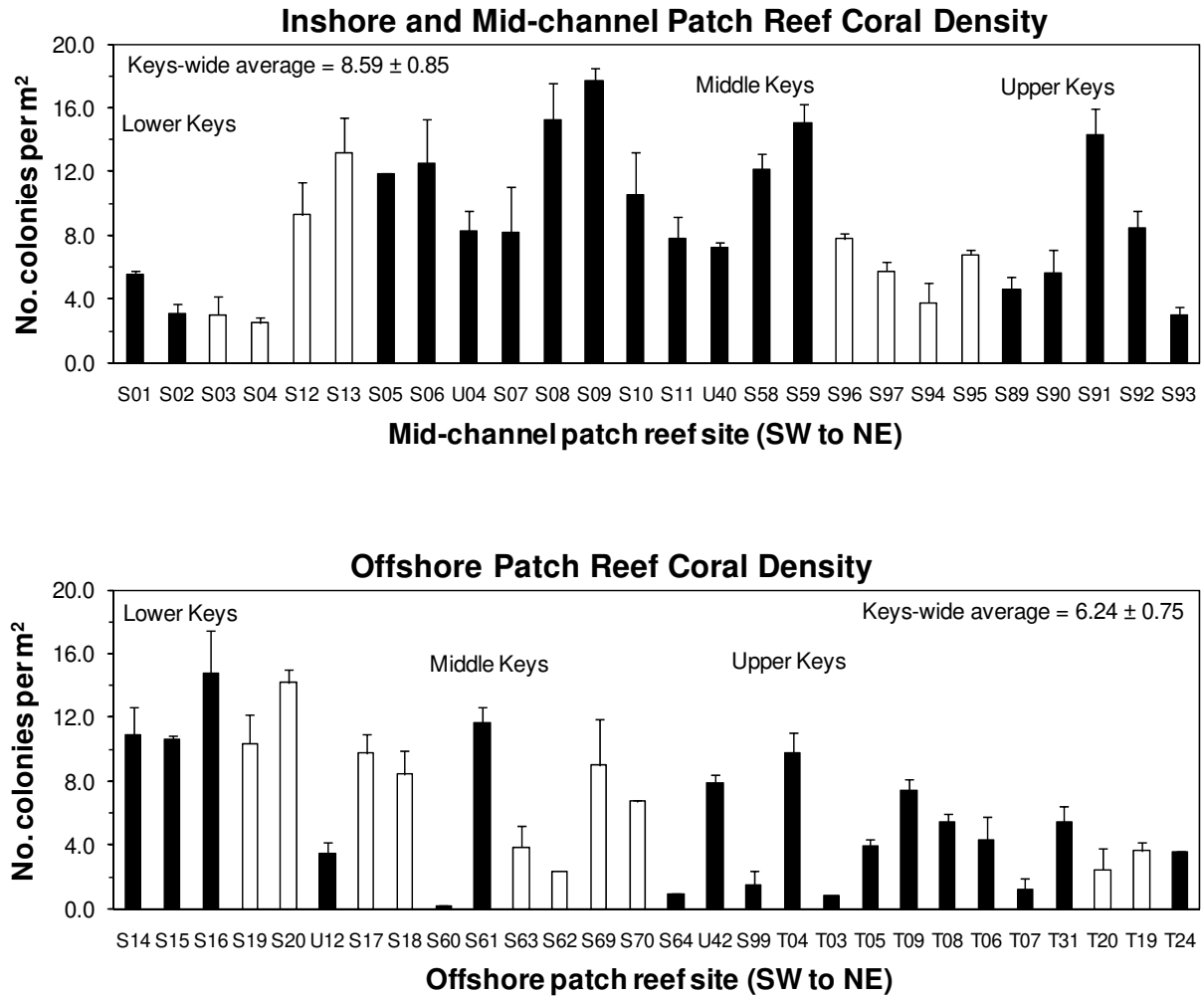


Figure 4-10. Mean (± 1 SE) densities (no. colonies per m^2) of scleractinian corals > 4 cm in max. diameter on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

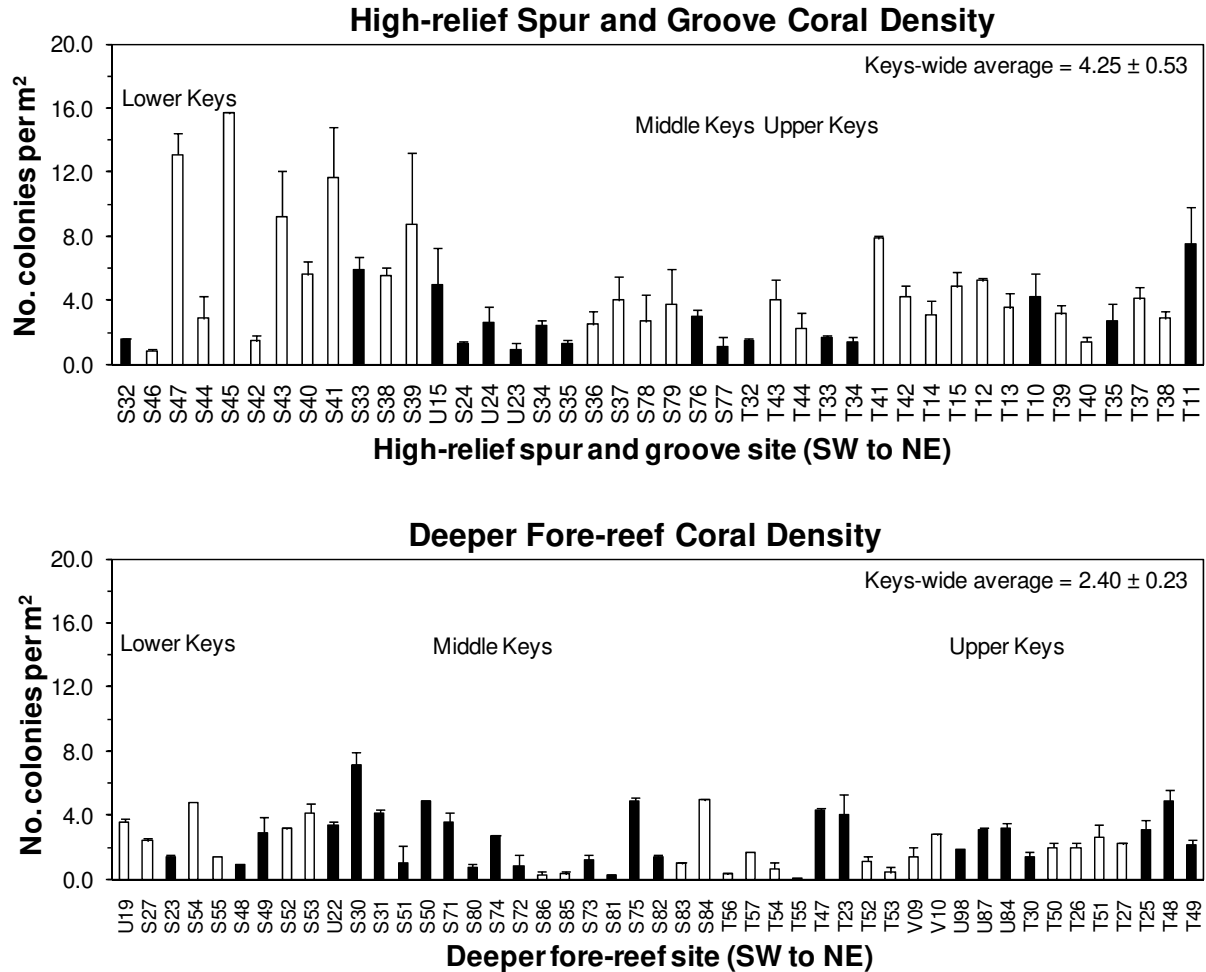


Figure 4-11. Examples of juvenile (< 4 cm max. diameter) scleractinian corals sampled in the Florida Keys during 2009.

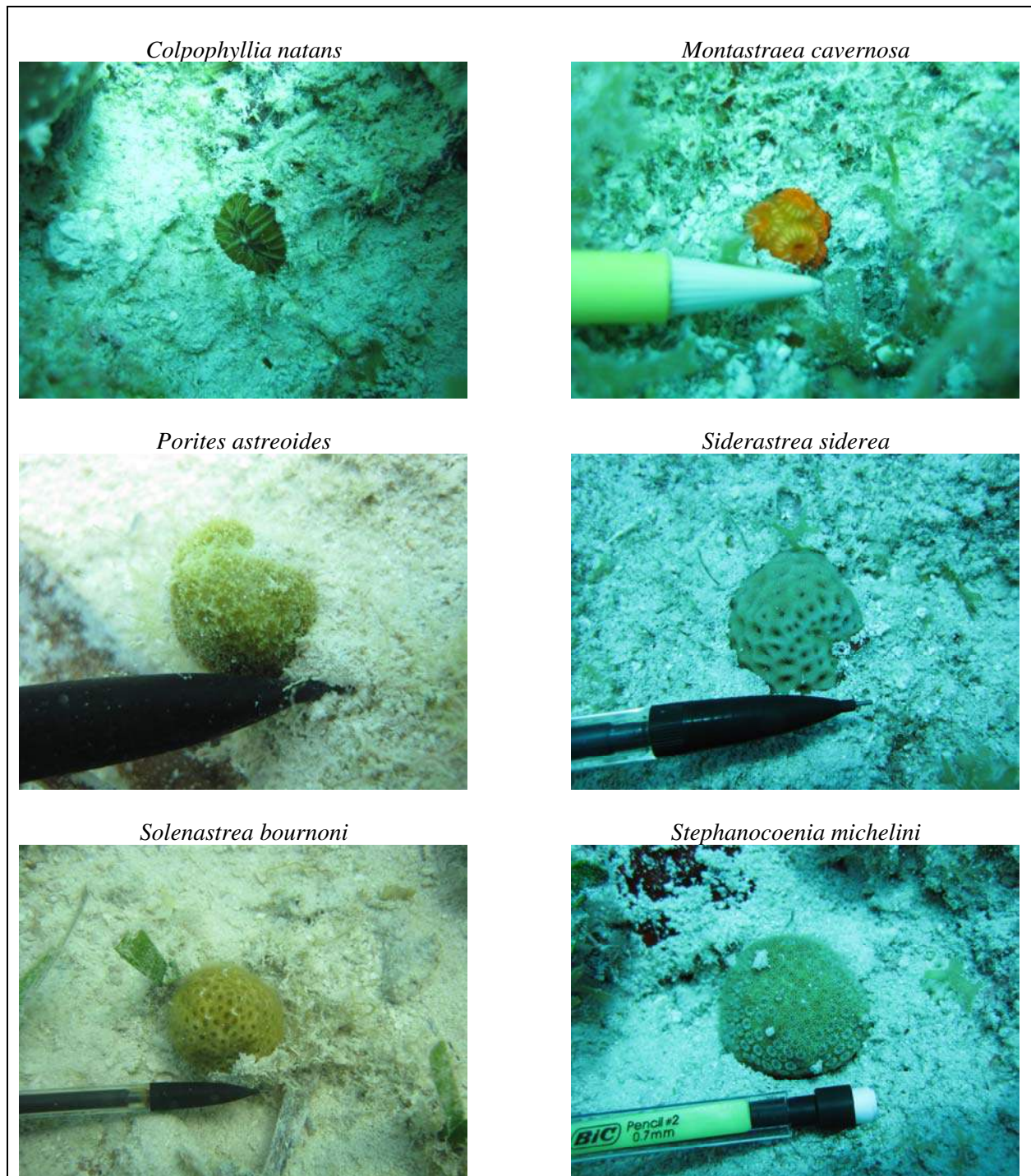


Figure 4-12. Densities of juvenile (< 4 cm max. diameter) scleractinian corals (no. colonies per m²) in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

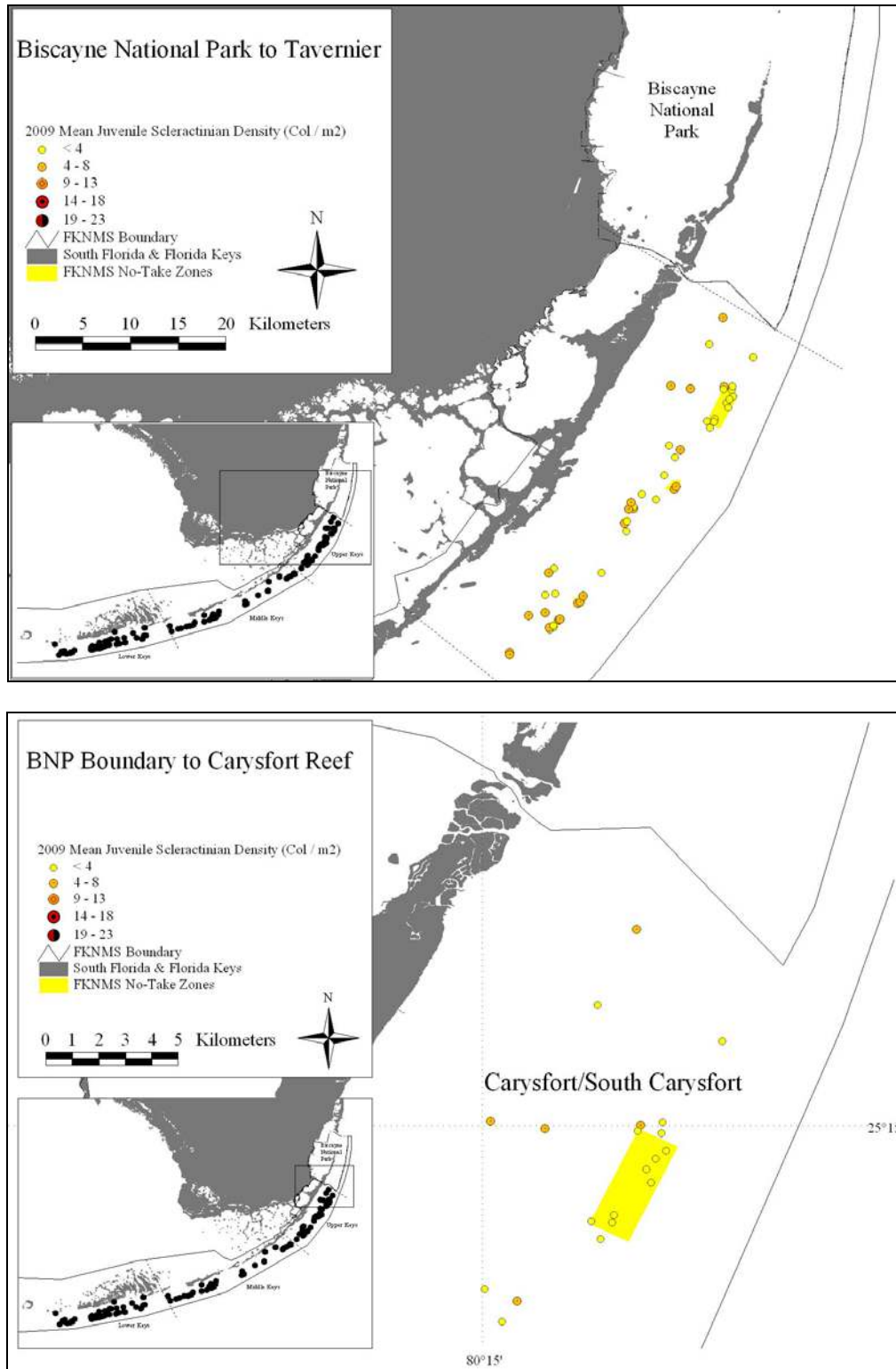


Figure 4-13. Densities of juvenile (< 4 cm max. diameter) scleractinian corals (no. colonies per m²) in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region (bottom) during May-September 2009.

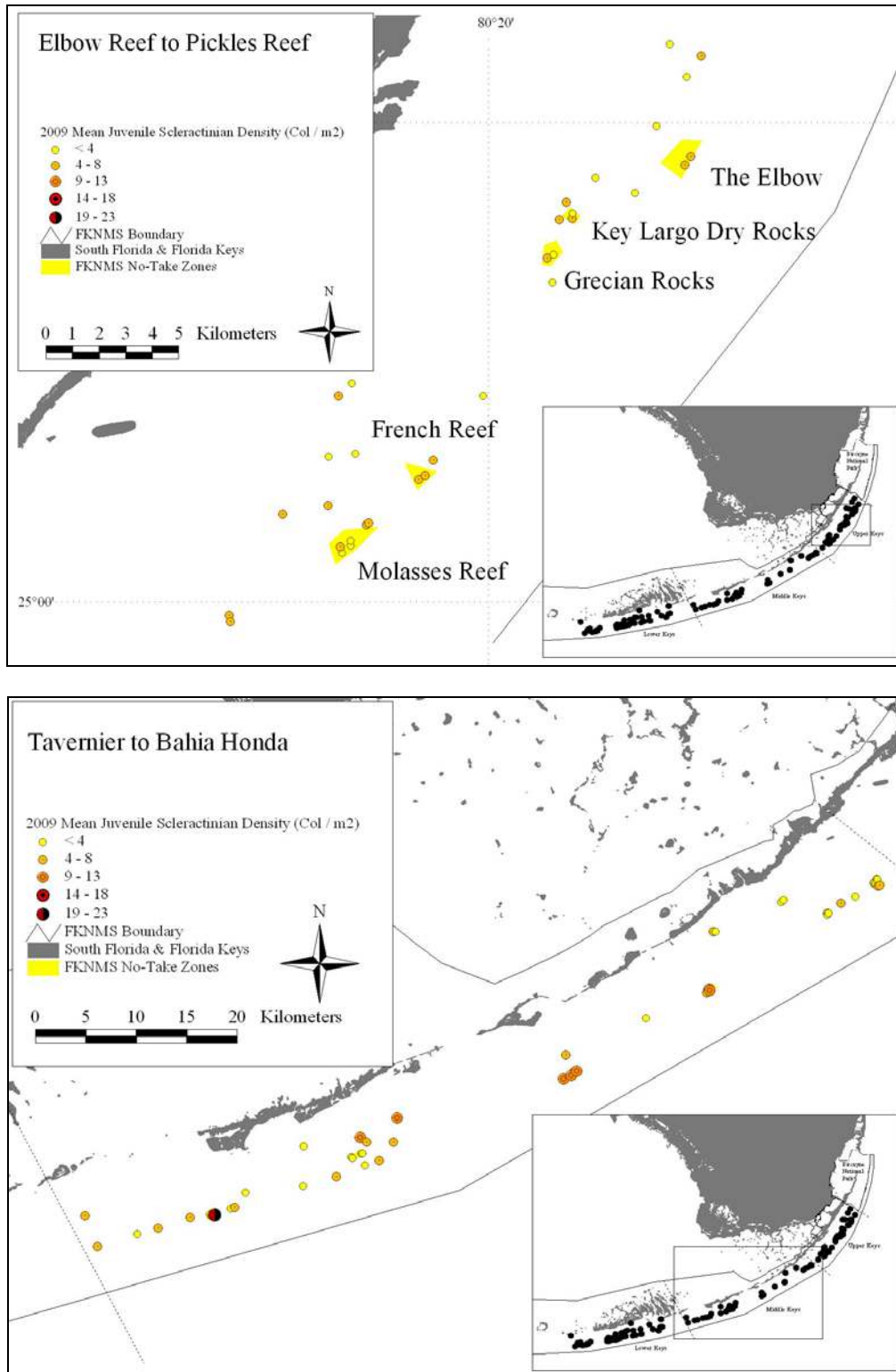


Figure 4-14. Densities of juvenile (< 4 cm max. diameter) scleractinian corals (no. colonies per m²) in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

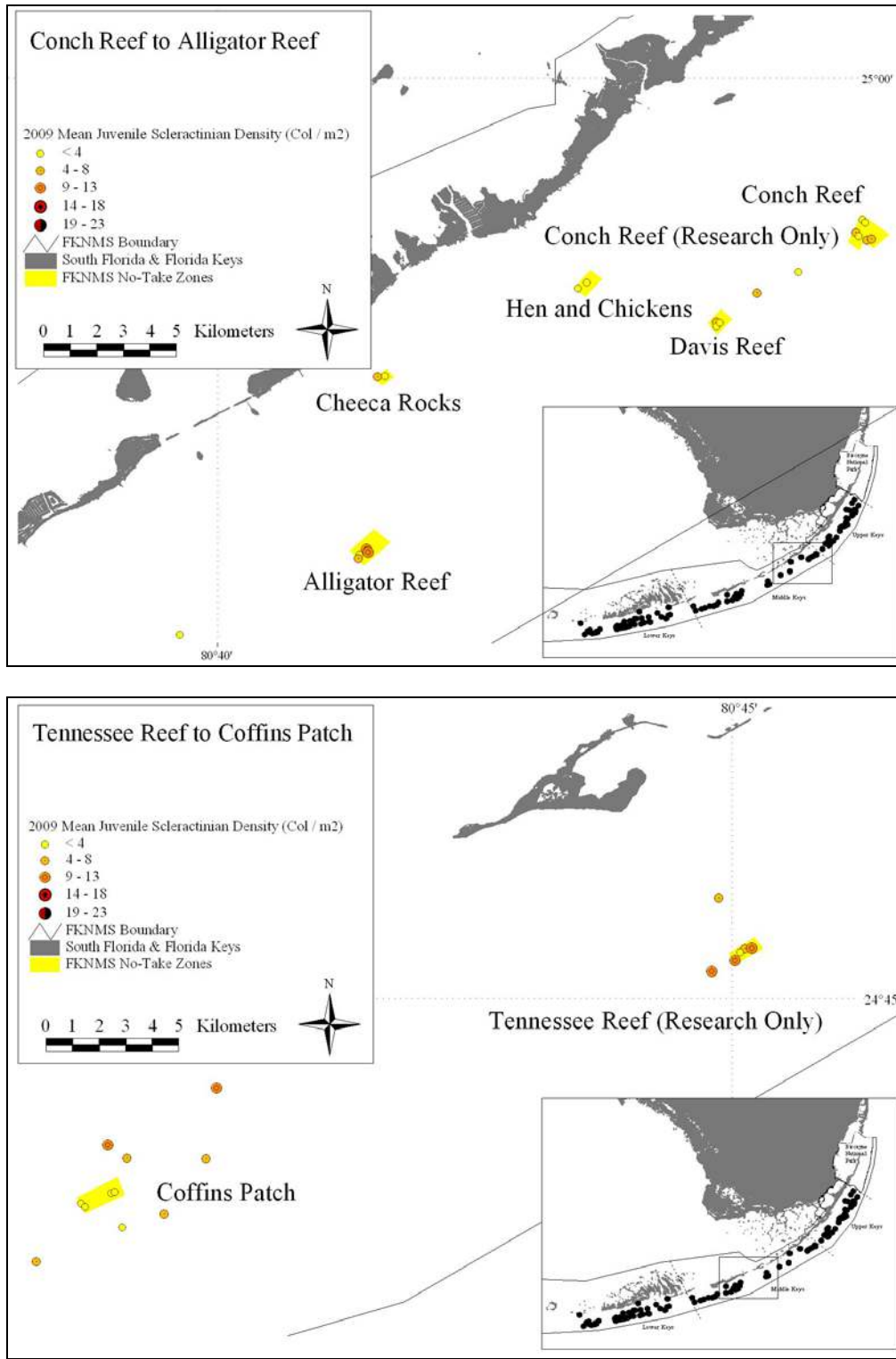


Figure 4-15. Densities of juvenile (< 4 cm max. diameter) scleractinian corals (no. colonies per m²) in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

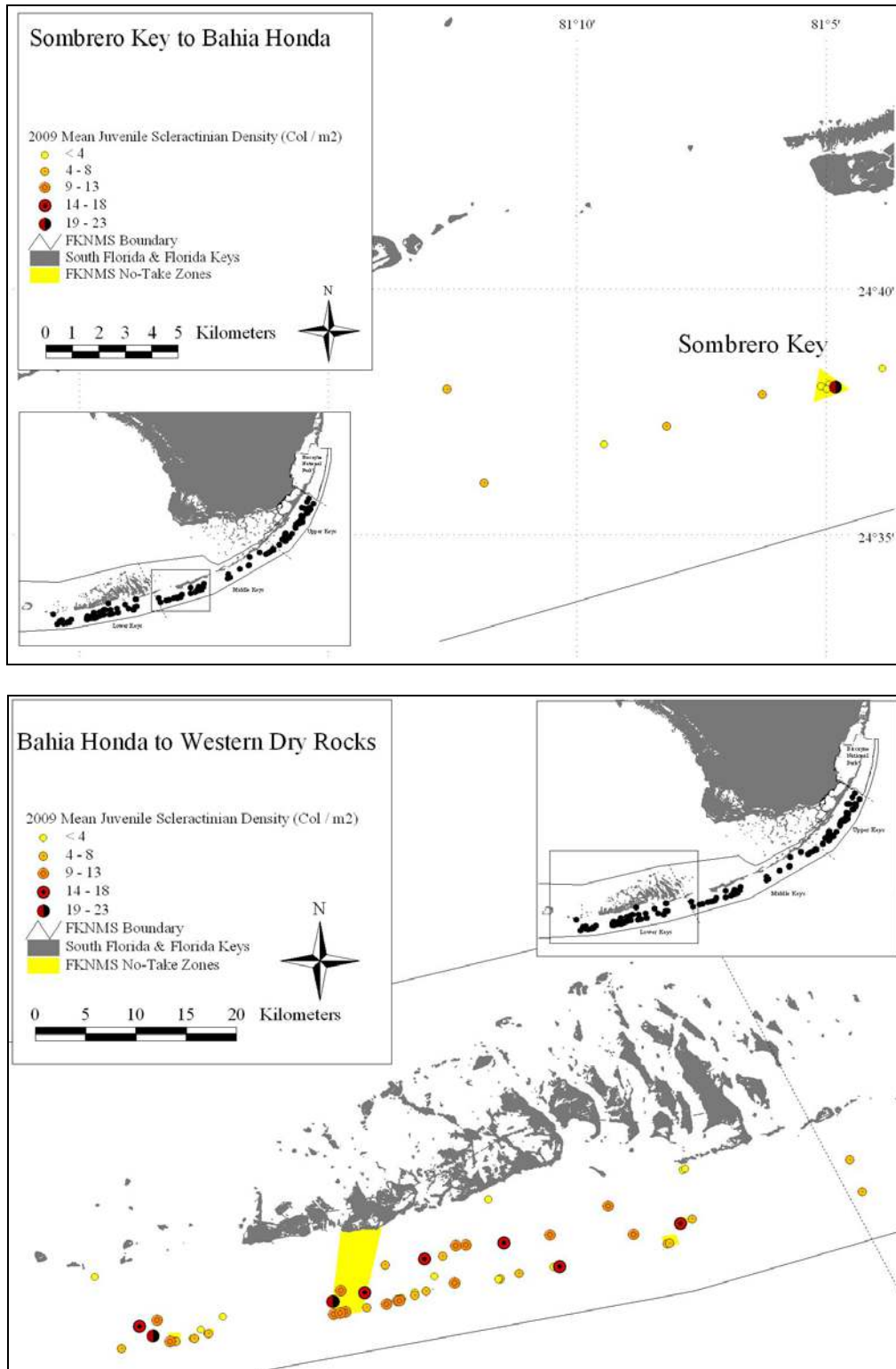


Figure 4-16. Densities of juvenile (< 4 cm max. diameter) scleractinian corals (no. colonies per m²) in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

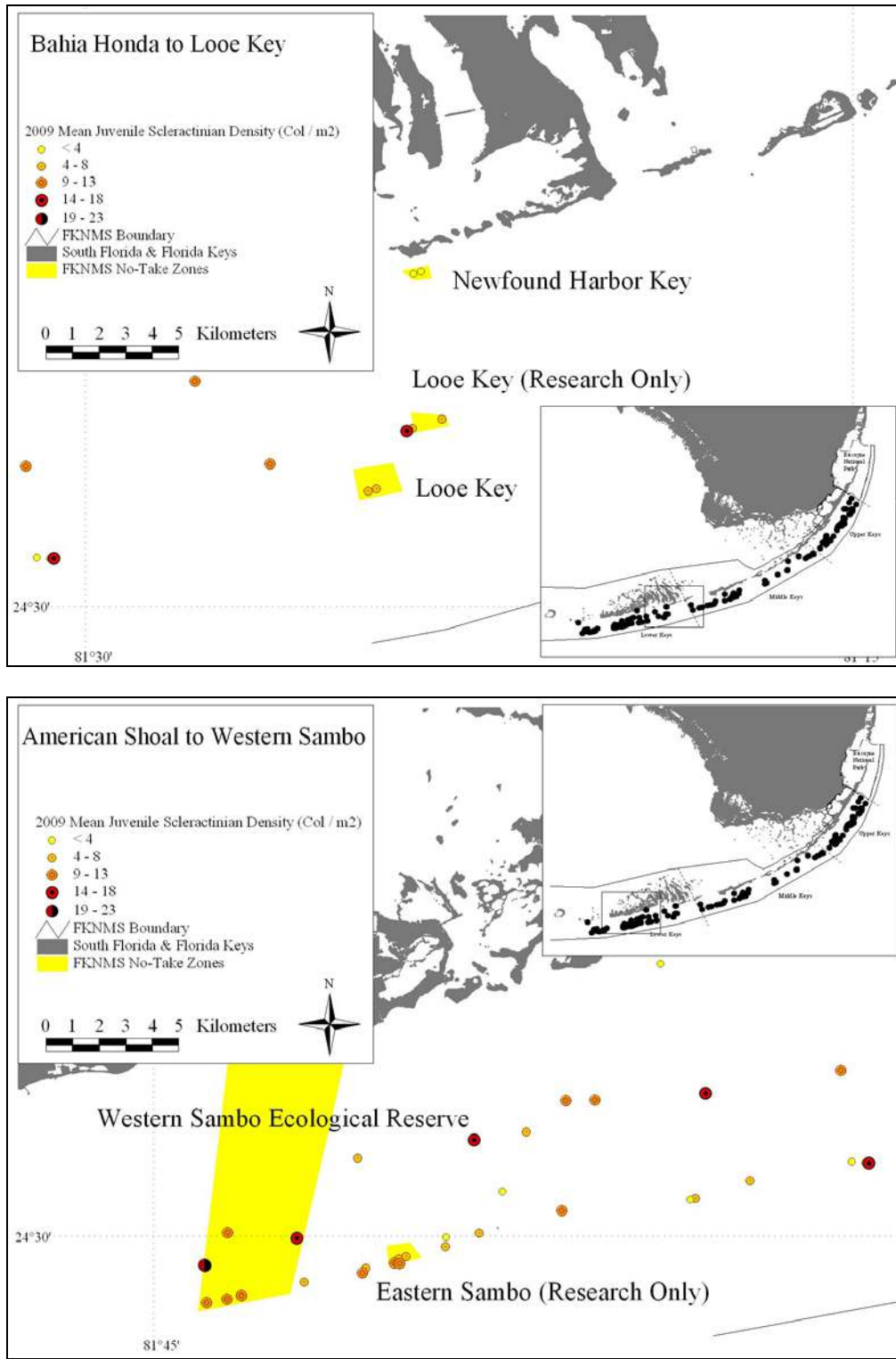


Figure 4-17. Densities of juvenile (< 4 cm max. diameter) scleractinian corals (no. colonies per m²) in the lower Florida Keys from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

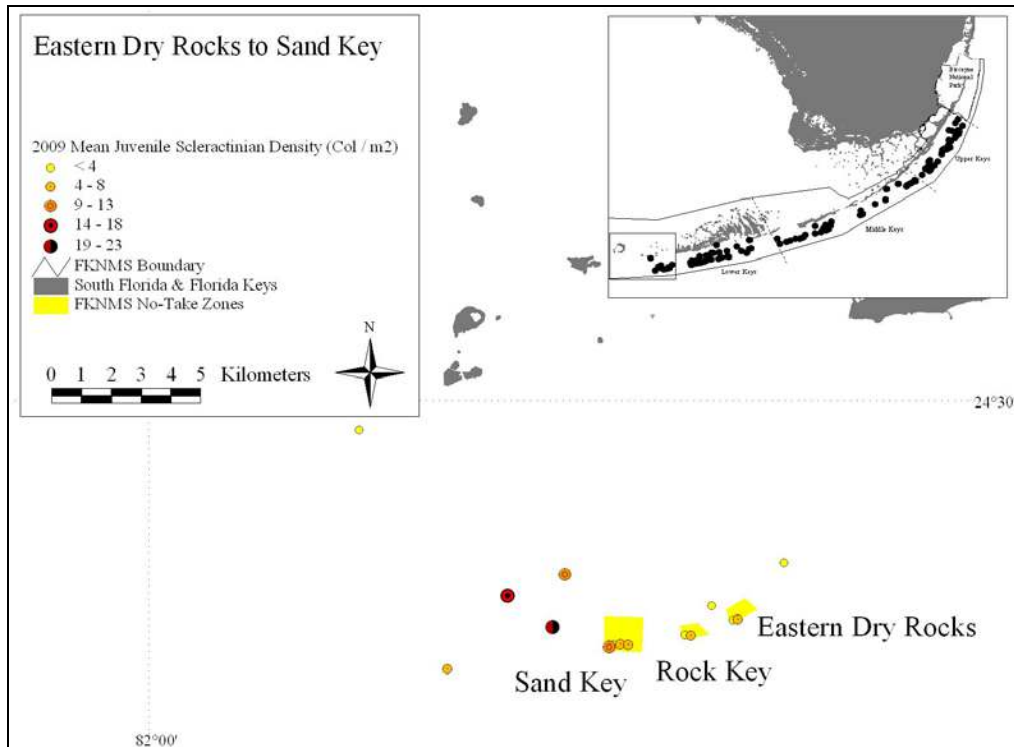


Figure 4-18. Mean (+ 1 SE) densities (no. per m²) of juvenile scleractinian corals < 4 cm in max. diameter on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

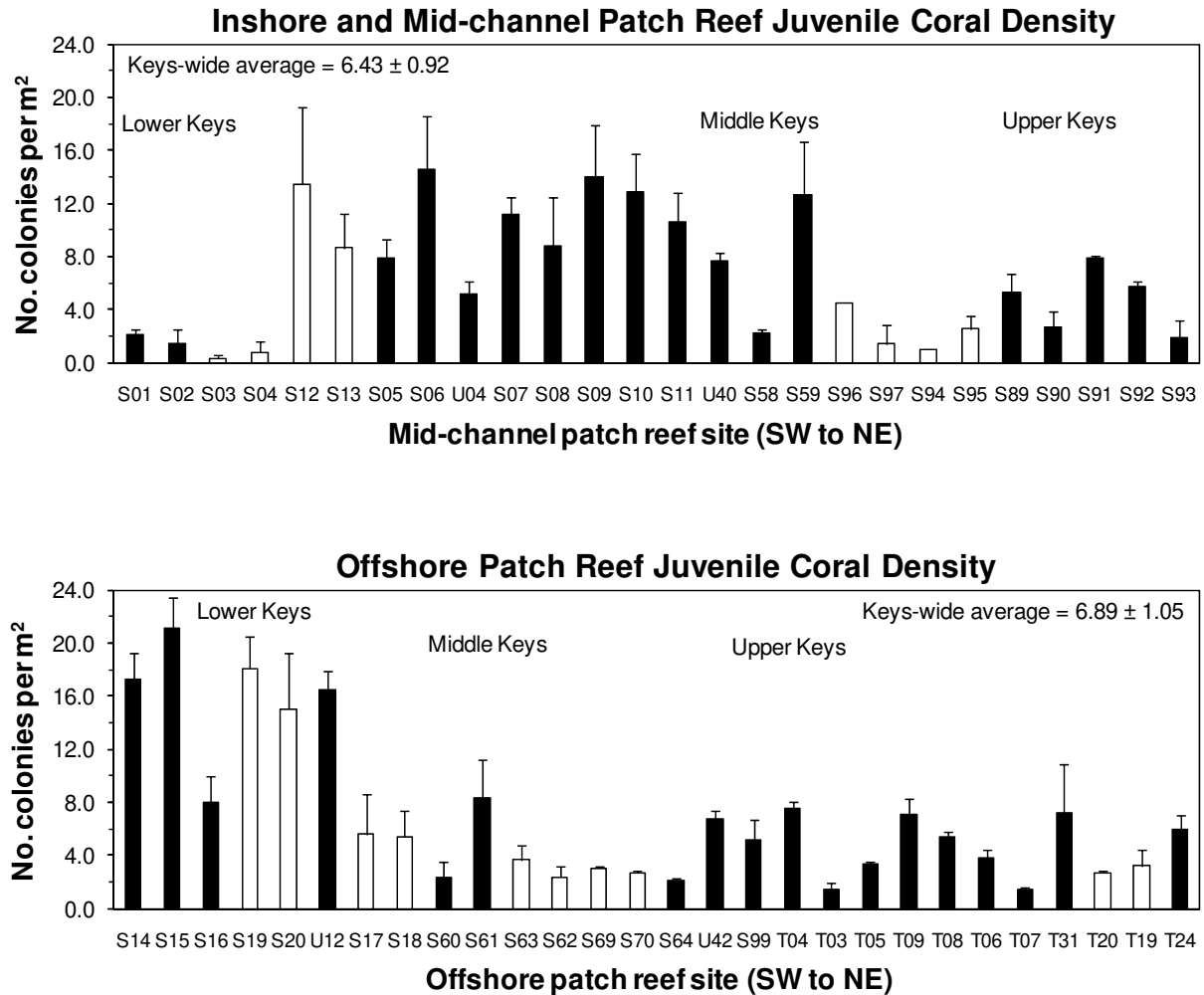


Figure 4-19. Mean (± 1 SE) densities (no. per m^2) of juvenile scleractinian corals < 4 cm in max. diameter on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

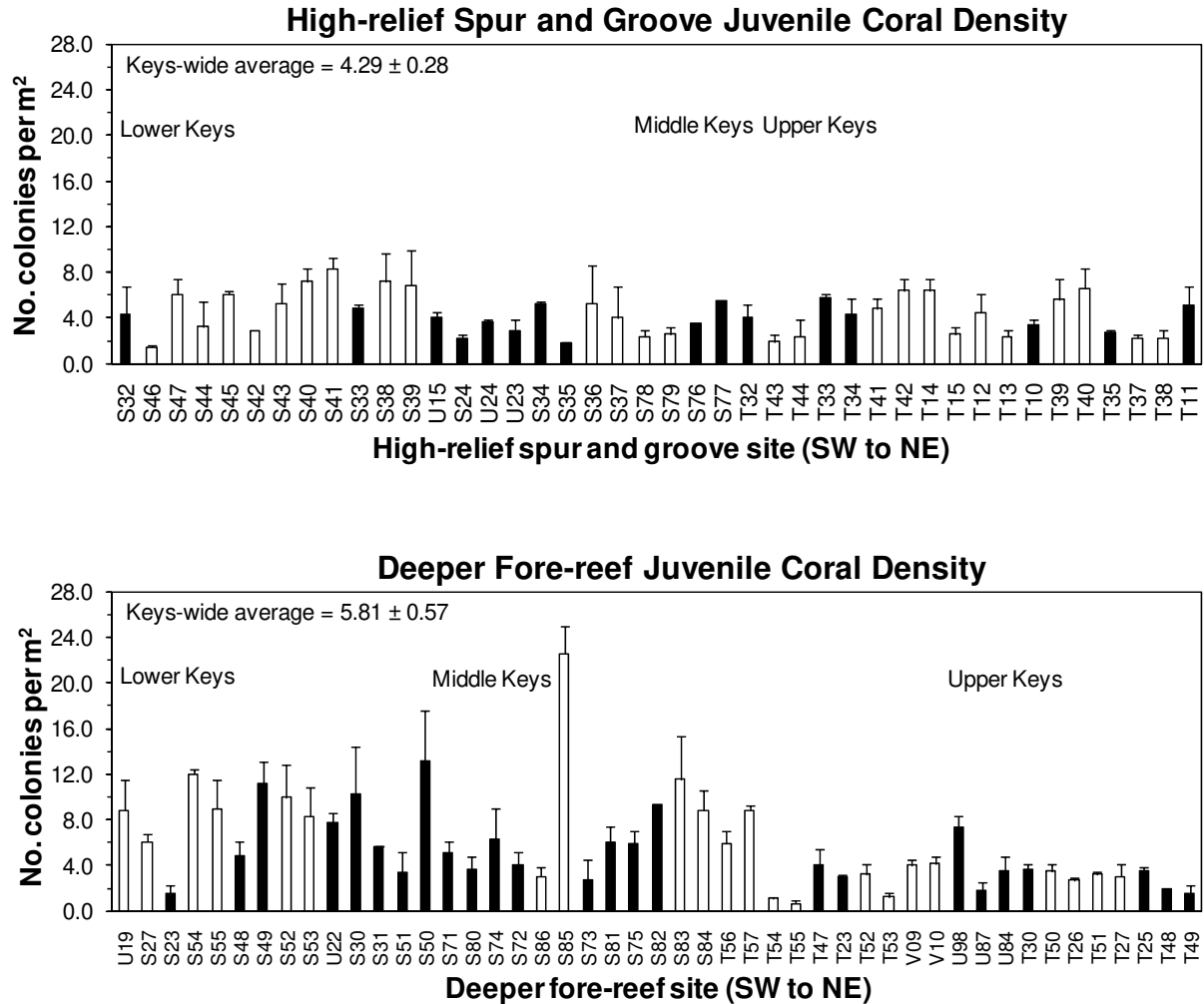


Table 4-1. Numbers of colonies (N) and mean $\pm$ 1 SE colony densities (no. per m²) of milleporid hydrocorals, total scleractinian corals, and total stony corals in the Florida Keys, as determined from surveys of two 10-m x 1-m transects (20 m²) per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>Millepora</i> spp.		Scleractinian corals		Total stony corals	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	8	0.40 $\pm$ 0.10	111	5.55 $\pm$ 0.25	119	5.95 $\pm$ 0.15
S02 – South of Sugarloaf Creek	5	0.25 $\pm$ 0.05	62	3.10 $\pm$ 0.60	67	3.35 $\pm$ 0.65
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	60	3.00 $\pm$ 1.20	60	3.00 $\pm$ 1.20
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	50	2.50 $\pm$ 0.40	50	2.50 $\pm$ 0.40
Lower Florida Keys Total (4)	13	0.16 $\pm$ 0.10	283	3.54 $\pm$ 0.68	296	3.70 $\pm$ 0.77
Inshore Patch Reef Total (4)	13	0.16 $\pm$ 0.10	283	3.54 $\pm$ 0.68	296	3.70 $\pm$ 0.77
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	45	2.25 $\pm$ 0.65	186	9.30 $\pm$ 2.00	231	11.55 $\pm$ 1.35
S13 - Western Sambo ER**	44	2.20 $\pm$ 0.10	264	13.20 $\pm$ 2.20	308	15.40 $\pm$ 2.10
S05 - North of Middle Sambo Reef	34	1.70 $\pm$ 0.60	237	11.85 $\pm$ 0.05	271	13.55 $\pm$ 0.55
S06 - North of Pelican Shoal	43	2.15 $\pm$ 0.35	251	12.55 $\pm$ 2.75	294	14.70 $\pm$ 2.40
U04 - North of Pelican Shoal	25	1.25 $\pm$ 0.05	165	8.25 $\pm$ 1.25	190	9.50 $\pm$ 1.20
S07 - West Washerwoman Shoal	19	0.95 $\pm$ 0.15	163	8.15 $\pm$ 2.95	182	9.10 $\pm$ 3.10
S08 - West Washerwoman Shoal	51	2.55 $\pm$ 0.05	305	15.25 $\pm$ 2.35	356	17.80 $\pm$ 2.40
S09 - North of Maryland Shoal	36	1.80 $\pm$ 0.10	354	17.70 $\pm$ 0.80	390	19.50 $\pm$ 0.90
S10 - North of American Shoal	32	1.60 $\pm$ 0.40	211	10.55 $\pm$ 2.65	243	12.15 $\pm$ 3.05
S11 - North of American Shoal	14	0.70 $\pm$ 0.10	156	7.80 $\pm$ 1.40	170	8.50 $\pm$ 1.50
Lower Florida Keys Total (10)	343	1.72 $\pm$ 0.19	2,292	11.46 $\pm$ 1.04	2,635	13.18 $\pm$ 1.18
Middle Florida Keys						
U40 - Marker 49A	47	2.35 $\pm$ 0.15	144	7.20 $\pm$ 0.40	191	9.55 $\pm$ 0.55
S58 - Marker 48	19	0.95 $\pm$ 0.65	243	12.15 $\pm$ 0.95	262	13.10 $\pm$ 0.30
S59 - East Turtle Shoal	43	2.15 $\pm$ 0.55	302	15.10 $\pm$ 1.10	345	17.25 $\pm$ 0.55
S96 - Cheeca Rocks SPA**	5	0.25 $\pm$ 0.15	156	7.80 $\pm$ 0.30	161	8.05 $\pm$ 0.45
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	115	5.75 $\pm$ 0.55	115	5.75 $\pm$ 0.55
S94 - Hen and Chickens Reef SPA**	9	0.45 $\pm$ 0.25	75	3.75 $\pm$ 1.25	84	4.20 $\pm$ 1.00
S95 - Hen and Chickens Reef SPA**	12	0.60 $\pm$ 0.40	136	6.80 $\pm$ 0.30	148	7.40 $\pm$ 0.70
Middle Florida Keys Total (7)	136	0.96 $\pm$ 0.35	1,171	8.36 $\pm$ 1.48	1,306	9.33 $\pm$ 1.70
Upper Florida Keys						
S89 - Mosquito Bank	15	0.75 $\pm$ 0.25	92	4.60 $\pm$ 0.80	107	5.35 $\pm$ 1.05
S90 - Mosquito Bank	64	3.20 $\pm$ 0.70	113	5.65 $\pm$ 1.45	177	8.85 $\pm$ 2.15
S91 - Basin Hill Shoals	13	0.65 $\pm$ 0.15	287	14.35 $\pm$ 1.65	300	15.00 $\pm$ 1.50
S92 - Basin Hill Shoals	22	1.10 $\pm$ 0.10	170	8.50 $\pm$ 1.00	192	9.60 $\pm$ 1.10
S93 - Turtle Rocks	46	2.30 $\pm$ 0.00	60	3.00 $\pm$ 0.50	106	5.30 $\pm$ 0.50
Upper Florida Keys Total (5)	160	1.60 $\pm$ 0.50	722	7.22 $\pm$ 2.00	882	8.82 $\pm$ 1.78
Mid-channel Patch Reef Total (22)	638	1.45 $\pm$ 0.19	4,185	9.51 $\pm$ 0.86	4,823	10.96 $\pm$ 0.93
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	70	3.50 $\pm$ 0.70	219	10.95 $\pm$ 1.75	289	14.45 $\pm$ 2.45
S15 - North of Sand Key	46	2.30 $\pm$ 0.50	213	10.65 $\pm$ 0.25	259	12.95 $\pm$ 0.75
S16 - North of Sand Key	50	2.50 $\pm$ 0.20	296	14.80 $\pm$ 2.70	346	17.30 $\pm$ 2.50
S19 - Western Sambo ER**	38	1.90 $\pm$ 0.20	207	10.35 $\pm$ 1.85	245	12.25 $\pm$ 1.65
S20 - Western Sambo ER**	71	3.55 $\pm$ 0.65	284	14.20 $\pm$ 0.80	355	17.75 $\pm$ 1.45
U12 - West of Looe Key RO	44	2.20 $\pm$ 0.00	69	3.45 $\pm$ 0.75	113	5.65 $\pm$ 0.75
S17 - Looe Key RO**	27	1.35 $\pm$ 0.35	195	9.75 $\pm$ 1.25	222	11.10 $\pm$ 0.90
S18 - Looe Key RO**	52	2.60 $\pm$ 0.60	169	8.45 $\pm$ 1.45	221	11.05 $\pm$ 0.85
Lower Florida Keys Total (8)	398	2.49 $\pm$ 0.26	1,652	10.33 $\pm$ 1.24	2,050	12.81 $\pm$ 1.37
Middle Florida Keys						
S60 - NE of Delta Shoal	12	0.60 $\pm$ 0.20	3	0.15 $\pm$ 0.05	15	0.75 $\pm$ 0.25

Site number/site location	<i>Millepora</i> spp.		Scleractinian corals		Total stony corals	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	21	1.05 ± 0.25	234	11.70 ± 1.00	255	12.75 ± 1.25
S63 - Coffins Patch SPA**	24	1.20 ± 0.20	77	3.85 ± 1.35	101	5.05 ± 1.15
S62 - Coffins Patch SPA**	50	2.50 ± 0.30	47	2.35 ± 0.05	97	4.85 ± 0.35
S69 - Coffins Patch SPA**	25	1.25 ± 0.45	180	9.00 ± 2.90	205	10.25 ± 2.45
S70 - Coffins Patch SPA**	18	0.90 ± 0.00	135	6.75 ± 0.05	153	7.65 ± 0.05
S64 - South of Coffins Patch	65	3.25 ± 0.15	18	0.90 ± 0.10	83	4.15 ± 0.25
U42 - East of Coffins Patch	26	1.30 ± 0.30	158	7.90 ± 0.50	184	9.20 ± 0.20
Middle Florida Keys Total (8)	241	1.51 ± 0.32	852	5.33 ± 1.47	1,093	6.83 ± 1.36
Upper Florida Keys						
S99 - Wolf Reef	16	0.80 ±	30	1.50 ± 0.90	46	2.30 ± 1.10
T04 - Inshore of Sand Island	48	2.40 ±	196	9.80 ± 1.30	244	12.20 ± 2.30
T03 - White Bank	59	2.95 ±	17	0.85 ± 0.05	76	3.80 ± 0.10
T05 - White Bank	56	2.80 ±	78	3.90 ± 0.50	134	6.70 ± 1.50
T09 - South of Key Largo Dry Rocks	58	2.90 ±	148	7.40 ± 0.70	206	10.30 ± 0.00
T08 - West of Key Largo Dry Rocks	43	2.15 ±	109	5.45 ± 0.55	152	7.60 ± 0.90
T06 - West of Elbow Reef	118	5.90 ±	86	4.30 ± 1.50	204	10.20 ± 2.40
T07 - SW of Watson's Reef	185	9.25 ±	25	1.25 ± 0.65	210	10.50 ± 2.50
T31 - South of Watson's Reef	83	4.15 ±	108	5.40 ± 1.00	191	9.55 ± 0.95
T20 - Carysfort Reef SPA**	119	5.95 ±	49	2.45 ± 1.35	168	8.40 ± 1.20
T19 - Carysfort Reef SPA**	49	2.45 ±	73	3.65 ± 0.55	122	6.10 ± 1.30
T24 - North of Carysfort Reef	42	2.10 ±	71	3.55 ± 0.05	113	5.65 ± 0.15
Upper Florida Keys Total (12)	876	3.65 ± 0.67	990	4.13 ± 0.76	1,866	7.78 ± 0.86
Offshore Patch Reef Total (28)	1,515	2.71 ± 0.35	3,494	6.24 ± 0.79	5,009	8.94 ± 0.80
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	4	0.20 ± 0.10	2	0.10 ± 0.00	6	0.30 ± 0.10
S22 - West of Looe Key SPA	39	1.95 ± 0.05	90	4.50 ± 0.70	129	6.45 ± 0.65
Lower Florida Keys Total (2)	43	1.08 ± 0.88	92	2.30 ± 2.20	135	3.38 ± 3.08
Middle Florida Keys						
S65 - SE of Coffins Patch	36	1.80 ± 0.00	37	1.85 ± 0.15	73	3.65 ± 0.15
S66 - Tennessee Reef	37	1.85 ± 0.35	138	6.90 ± 0.40	175	8.75 ± 0.75
S68 - Tennessee Reef RO**	85	4.25 ± 0.15	84	4.20 ± 0.50	169	8.45 ± 0.35
S67 - Tennessee Reef RO**	75	3.75 ± 0.45	130	6.50 ± 1.30	205	10.25 ± 0.85
T16 - West of Alligator Reef	24	1.20 ± 0.40	48	2.40 ± 0.60	72	3.60 ± 1.00
T45 - Alligator Reef SPA**	87	4.35 ± 1.05	25	1.25 ± 0.25	112	5.60 ± 0.80
T46 - Alligator Reef SPA**	30	1.50 ± 0.40	70	3.50 ± 0.70	100	5.00 ± 1.10
V03 - Davis Reef SPA**	33	1.65 ± 0.25	41	2.05 ± 0.65	74	3.70 ± 0.40
T36 - Davis Reef SPA**	43	2.15 ± 0.05	27	1.35 ± 0.05	70	3.50 ± 0.10
T21 - Conch Reef SPA**	26	1.30 ± 1.00	25	1.25 ± 0.05	51	2.55 ± 0.95
T22 - Conch Reef SPA**	21	1.05 ± 0.55	33	1.65 ± 0.15	54	2.70 ± 0.40
Middle Florida Keys Total (11)	497	2.26 ± 0.37	658	2.99 ± 0.62	1,155	5.25 ± 0.81
Upper Florida Keys						
T28 - Molasses Reef SPA**	28	1.40 ± 0.30	44	2.20 ± 0.80	72	3.60 ± 0.50
T29 - Molasses Reef SPA**	10	0.50 ± 0.20	8	0.40 ± 0.00	18	0.90 ± 0.20
T17 - North of French Reef	40	2.00 ± 0.30	57	2.85 ± 0.75	97	4.85 ± 1.05
T18 - Watson's Reef	48	2.40 ± 0.10	39	1.95 ± 0.35	87	4.35 ± 0.45
Upper Florida Keys Total (4)	126	1.58 ± 0.41	148	1.85 ± 0.52	274	3.43 ± 0.88
Shallow Hard-bottom Total (17)	666	1.96 ± 0.29	898	2.64 ± 0.47	1,564	4.60 ± 0.65
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	37	1.85 ± 1.65	31	1.55 ± 0.05	68	3.40 ± 1.70
S46 - Sand Key SPA**	39	1.95 ± 0.35	17	0.85 ± 0.15	56	2.80 ± 0.20
S47 - Sand Key SPA**	7	0.35 ± 0.05	262	13.10 ± 1.30	269	13.45 ± 1.35
S44 - Rock Key SPA**	14	0.70 ± 0.30	58	2.90 ± 1.40	72	3.60 ± 1.10
S45 - Rock Key SPA**	21	1.05 ± 0.45	314	15.70 ± 0.10	335	16.75 ± 0.35
S42 - Eastern Dry Rocks SPA**	21	1.05 ± 0.15	29	1.45 ± 0.35	50	2.50 ± 0.20
S43 - Eastern Dry Rocks SPA**	18	0.90 ± 0.50	185	9.25 ± 2.85	203	10.15 ± 3.35

Site number/site location	<i>Millepora</i> spp.		Scleractinian corals		Total stony corals	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	14	0.70 ± 0.20	112	5.60 ± 2.85	126	6.30 ± 1.00
S41 - Western Sambo ER**	31	1.55 ± 0.25	234	11.70 ± 0.80	265	13.25 ± 2.85
S33 - Middle Sambo Reef	23	1.15 ± 0.45	118	5.90 ± 3.10	141	7.05 ± 1.25
S38 - Eastern Sambo RO**	5	0.25 ± 0.05	111	5.55 ± 0.80	116	5.80 ± 0.50
S39 - Eastern Sambo RO**	11	0.55 ± 0.15	175	8.75 ± 0.55	186	9.30 ± 4.30
U15 - No Name Reef	7	0.35 ± 0.25	100	5.00 ± 4.45	107	5.35 ± 2.55
S24 - East of Eastern Sambo RO	10	0.50 ± 0.20	26	1.30 ± 2.30	36	1.80 ± 0.10
U24 - Pelican Shoal	4	0.20 ± 0.10	52	2.60 ± 1.00	56	2.80 ± 0.90
U23 - Maryland Shoal	9	0.45 ± 0.05	19	0.95 ± 0.35	28	1.40 ± 0.40
S34 - Maryland Shoal	22	1.10 ± 0.10	49	2.45 ± 0.35	71	3.55 ± 0.25
S35 - American Shoal	26	1.30 ± 0.00	26	1.30 ± 0.20	52	2.60 ± 0.20
S36 - Looe Key SPA**	21	1.05 ± 0.05	50	2.50 ± 0.80	71	3.55 ± 0.85
S37 - Looe Key SPA**	18	0.90 ± 0.60	80	4.00 ± 1.50	98	4.90 ± 2.10
Lower Florida Keys Total (20)	358	0.90 ± 0.11	2,048	5.12 ± 0.98	2,406	6.02 ± 0.98
Middle Florida Keys						
S78 - Sombrero Key SPA**	21	1.05 ± 0.65	54	2.70 ± 1.70	75	3.75 ± 2.35
S79 - Sombrero Key SPA**	26	1.30 ± 0.20	75	3.75 ± 2.25	101	5.05 ± 2.45
S76 - Delta Shoal	26	1.30 ± 0.00	59	2.95 ± 0.45	85	4.25 ± 0.45
S77 - Delta Shoal	57	2.85 ± 0.75	22	1.10 ± 0.60	79	3.95 ± 1.35
Middle Florida Keys Total (4)	130	1.63 ± 0.41	210	2.63 ± 0.56	340	4.25 ± 0.29
Upper Florida Keys						
T32 - Pickles Reef	79	3.95 ± 0.45	29	1.45 ± 0.15	108	5.40 ± 0.30
T43 - Molasses Reef SPA**	139	6.95 ± 0.85	81	4.05 ± 1.25	220	11.00 ± 0.40
T44 - Molasses Reef SPA**	38	1.90 ± 0.90	45	2.25 ± 0.95	83	4.15 ± 0.05
T33 - Sand Island	42	2.10 ± 0.10	33	1.65 ± 0.15	75	3.75 ± 0.25
T34 - Sand Island	32	1.60 ± 0.10	28	1.40 ± 0.30	60	3.00 ± 0.40
T41 - French Reef SPA**	55	2.75 ± 0.85	157	7.85 ± 0.15	212	10.60 ± 1.00
T42 - French Reef SPA**	91	4.55 ± 0.95	85	4.25 ± 0.65	176	8.80 ± 0.30
T14 - Grecian Rocks SPA**	5	0.25 ± 0.15	62	3.10 ± 0.90	67	3.35 ± 1.05
T15 - Grecian Rocks SPA**	26	1.30 ± 0.70	97	4.85 ± 0.95	123	6.15 ± 1.65
T12 - Key Largo Dry Rocks SPA**	13	0.65 ± 0.25	105	5.25 ± 0.15	118	5.90 ± 0.40
T13 - Key Largo Dry Rocks SPA**	77	3.85 ± 0.55	71	3.55 ± 0.95	148	7.40 ± 0.40
T10 - North-North Dry Rocks	80	4.00 ± 0.10	84	4.20 ± 1.50	164	8.20 ± 1.40
T39 - Elbow Reef SPA**	72	3.60 ± 0.10	63	3.15 ± 0.55	135	6.75 ± 0.65
T40 - Elbow Reef SPA**	53	2.65 ± 0.55	28	1.40 ± 0.30	81	4.05 ± 0.85
T35 - South of South Carysfort	18	0.90 ± 0.10	54	2.70 ± 1.10	72	3.60 ± 1.20
T37 - South Carysfort Reef SPA**	68	3.40 ± 0.70	82	4.10 ± 0.70	150	7.50 ± 1.40
T38 - Carysfort Reef SPA**	33	1.65 ± 0.55	58	2.90 ± 0.40	91	4.55 ± 0.95
T11 - North of Turtle Reef	143	7.15 ± 0.85	150	7.50 ± 2.30	293	14.65 ± 3.15
Upper Florida Keys Total (18)	1,064	2.96 ± 0.46	1,312	3.64 ± 0.44	2,376	6.60 ± 0.74
Spur and Groove Total (44)	1,552	1.85 ± 0.26	3,570	4.25 ± 0.52	5,122	6.10 ± 0.57
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	60	3.00 ± 0.10	72	3.60 ± 0.20	132	6.60 ± 0.10
S27 - Sand Key SPA**	52	2.60 ± 0.80	48	2.40 ± 0.20	100	5.00 ± 1.00
S23 - East of Rock Key SPA	25	1.25 ± 0.15	28	1.40 ± 0.10	53	2.65 ± 0.25
S54 - Western Sambo ER**	83	4.15 ± 0.35	96	4.80 ± 0.00	179	8.95 ± 0.35
S55 - Western Sambo ER**	30	1.50 ± 0.80	28	1.40 ± 0.00	58	2.90 ± 0.80
S48 - East of Western Sambo ER	22	1.10 ± 0.10	19	0.95 ± 0.05	41	2.05 ± 0.05
S49 - Middle Sambo Reef	38	1.90 ± 0.30	58	2.90 ± 1.00	96	4.80 ± 0.70
S52 - Eastern Sambo RO**	43	2.15 ± 0.05	63	3.15 ± 0.05	106	5.30 ± 0.10
S53 - Eastern Sambo RO**	45	2.25 ± 0.55	83	4.15 ± 0.55	128	6.40 ± 0.00
U22 - West of Pelican Shoal	29	1.45 ± 0.35	67	3.35 ± 0.25	96	4.80 ± 0.60
S30 - East of Pelican Shoal	56	2.80 ± 0.10	142	7.10 ± 0.80	198	9.90 ± 0.90
S31 - East of Maryland Shoal	31	1.55 ± 0.15	82	4.10 ± 0.30	113	5.65 ± 1.15
S51 - American Shoal	30	1.50 ± 0.60	21	1.05 ± 1.05	51	2.55 ± 1.65
S50 - American Shoal	46	2.30 ± 0.40	97	4.85 ± 0.05	143	7.15 ± 0.35
Lower Florida Keys Total (14)	590	2.11 ± 0.22	904	3.23 ± 0.46	1,494	5.34 ± 0.63

Site number/site location	<i>Millepora</i> spp.		Scleractinian corals		Total stony corals	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	58	2.90 ± 0.10	72	3.60 ± 0.60	130	6.50 ± 0.70
S80 - West of Sombrero Key	26	1.30 ± 0.10	15	0.75 ± 0.25	41	2.05 ± 0.35
S74 - West of Sombrero Key	39	1.95 ± 0.05	54	2.70 ± 0.10	93	4.65 ± 0.05
S72 - West of Sombrero Key	33	1.65 ± 0.25	17	0.85 ± 0.65	50	2.50 ± 0.40
S86 - Sombrero Key SPA	21	1.05 ± 0.45	6	0.30 ± 0.20	27	1.35 ± 0.65
S85 - Sombrero Key SPA	28	1.40 ± 0.30	7	0.35 ± 0.15	35	1.75 ± 0.15
S73 - East of Delta Shoal	51	2.55 ± 1.55	24	1.20 ± 0.30	75	3.75 ± 1.85
S81 - SW of Coffins Patch	29	1.45 ± 0.65	5	0.25 ± 0.05	34	1.70 ± 0.70
S75 - Marker 20	71	3.55 ± 0.55	98	4.90 ± 0.20	169	8.45 ± 0.35
S82 - Tennessee Reef	102	5.10 ± 1.60	27	1.35 ± 0.15	129	6.45 ± 1.75
S83 - Tennessee Reef RO**	39	1.95 ± 1.15	20	1.00 ± 0.10	59	2.95 ± 1.05
S84 - Tennessee Reef RO**	49	2.45 ± 0.25	99	4.95 ± 0.05	148	7.40 ± 0.20
T56 - Alligator Reef SPA**	88	4.40 ± 0.30	7	0.35 ± 0.05	95	4.75 ± 0.35
T57 - Alligator Reef SPA**	114	5.70 ± 0.60	34	1.70 ± 0.00	148	7.40 ± 0.60
T54 - Davis Reef SPA**	147	7.35 ± 0.85	13	0.65 ± 0.45	160	8.00 ± 1.30
T55 - Davis Reef SPA**	54	2.70 ± 1.00	2	0.10 ± 0.00	56	2.80 ± 1.00
T47 - Little Conch Reef	29	1.45 ± 0.45	86	4.30 ± 0.20	115	5.75 ± 0.25
T23 - Little Conch Reef	84	4.20 ± 0.80	81	4.05 ± 1.25	165	8.25 ± 0.45
T52 - Conch Reef SPA**	80	4.00 ± 1.30	23	1.15 ± 0.25	103	5.15 ± 1.55
T53 - Conch Reef SPA**	24	1.20 ± 0.60	9	0.45 ± 0.35	33	1.65 ± 0.95
V09 - Conch Reef RO**	110	5.50 ± 0.00	28	1.40 ± 0.60	138	6.90 ± 0.60
V10 - Conch Reef RO**	133	6.65 ± 0.15	56	2.80 ± 0.10	189	9.45 ± 0.25
Middle Florida Keys Total (22)	1,409	3.20 ± 0.41	783	1.78 ± 0.34	2,192	4.98 ± 0.56
Upper Florida Keys						
U98 - Pickles Reef	90	4.50 ± 0.30	38	1.90 ± 0.00	128	6.40 ± 0.30
U87 - Dixie Shoal	50	2.50 ± 0.40	62	3.10 ± 0.10	112	5.60 ± 0.30
U84 - North of Dixie Shoal	24	1.20 ± 0.50	63	3.15 ± 0.35	87	4.35 ± 0.15
T30 - South of Elbow Reef	39	1.95 ± 0.15	27	1.35 ± 0.35	66	3.30 ± 0.20
T50 - Carysfort Reef SPA**	35	1.75 ± 0.05	40	2.00 ± 0.30	75	3.75 ± 0.25
T26 - Carysfort Reef SPA**	54	2.70 ± 0.30	40	2.00 ± 0.30	94	4.70 ± 0.00
T51 - Carysfort Reef SPA**	68	3.40 ± 0.10	53	2.65 ± 0.75	121	6.05 ± 0.85
T27 - Carysfort Reef SPA**	75	3.75 ± 1.15	44	2.20 ± 0.10	119	5.95 ± 1.05
T25 - North of Carysfort Reef	53	2.65 ± 0.35	62	3.10 ± 0.60	115	5.75 ± 0.95
T48 - North of Carysfort Reef	41	2.05 ± 0.05	98	4.90 ± 0.70	139	6.95 ± 0.65
T49 - SE of Turtle Rocks	96	4.80 ± 0.50	43	2.15 ± 0.35	139	6.95 ± 0.15
Upper Florida Keys Total (11)	625	2.84 ± 0.35	570	2.59 ± 0.29	1,195	5.43 ± 0.37
Deeper Fore-reef Total (47)	2,624	2.79 ± 0.22	2,257	2.40 ± 0.24	4,881	5.19 ± 0.33

Table 4-2. Numbers of species, juveniles, and mean ± 1 SE densities (no. per m²) of juvenile (< 4 cm max. diameter) scleractinian corals in the Florida Keys, as determined from surveys of ten 0.65-cm x 0.48-cm quadrats sampled along each of two transects (6.24 m² per site) during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	No. species	No. juveniles	Mean no. per m ²	SE
<i>Inshore patch reefs</i>				
Lower Florida Keys				
S01 – SE of Ballast Key	7	13	2.08	0.48
S02 – South of Sugarloaf Creek	4	9	1.44	1.12
S03 – Newfound Harbor SPA**	1	2	0.32	0.32
S04 – Newfound Harbor SPA**	1	5	0.80	0.80
Lower Florida Keys Total (4)	3.3 $\pm$ 1.4	29	1.16	0.38
Inshore Patch Reef Total (4)	3.3 $\pm$ 1.4	29	1.16	0.38
<i>Mid-channel patch reefs</i>				
Lower Florida Keys				
S12 - Western Sambo ER**	9	84	13.46	5.77
S13 - Western Sambo ER**	6	54	8.65	2.56
S05 - North of Middle Sambo Reef	7	49	7.85	1.44
S06 - North of Pelican Shoal	8	91	14.58	4.01
U04 - North of Pelican Shoal	7	32	5.13	0.96
S07 - West Washerwoman Shoal	9	70	11.22	1.28
S08 - West Washerwoman Shoal	7	55	8.81	3.69
S09 - North of Maryland Shoal	7	87	13.94	4.01
S10 - North of American Shoal	9	80	12.82	2.88
S11 - North of American Shoal	9	66	10.58	2.24
Lower Florida Keys Total (10)	7.8 $\pm$ 0.4	668	10.71	0.97
Middle Florida Keys				
U40 - Marker 49A	8	48	7.69	0.64
S58 - Marker 48	5	14	2.24	0.32
S59 - East Turtle Shoal	8	79	12.66	4.01
S96 - Cheeca Rocks SPA**	3	28	4.49	0.00
S97 - Cheeca Rocks SPA**	2	9	1.44	1.44
S94 - Hen and Chickens Reef SPA**	1	6	0.96	0.00
S95 - Hen and Chickens Reef SPA**	6	16	2.56	0.96
Middle Florida Keys Total (7)	4.7 $\pm$ 1.1	200	4.58	1.60
Upper Florida Keys				
S89 - Mosquito Bank	5	33	5.29	1.44
S90 - Mosquito Bank	4	17	2.72	1.12
S91 - Basin Hill Shoals	10	49	7.85	0.16
S92 - Basin Hill Shoals	6	36	5.77	0.32
S93 - Turtle Rocks	5	12	1.92	1.28
Upper Florida Keys Total (5)	6.0 $\pm$ 1.0	147	4.71	1.07
Mid-channel Patch Reef Total (22)	6.4 $\pm$ 0.5	1,015	7.39	0.95
<i>Offshore patch reefs</i>				
Lower Florida Keys				
S14 - North of Sand Key	13	108	17.31	1.92
S15 - North of Sand Key	12	132	21.15	2.24
S16 - North of Sand Key	7	50	8.01	1.92
S19 - Western Sambo ER**	10	113	18.11	2.40
S20 - Western Sambo ER**	8	94	15.06	4.17
U12 - West of Looe Key RO	10	103	16.51	1.44
S17 - Looe Key RO**	6	35	5.61	3.04
S18 - Looe Key RO**	6	34	5.45	1.92
Lower Florida Keys Total (8)	9.0 $\pm$ 0.9	669	13.40	2.17
Middle Florida Keys				
S60 - NE of Delta Shoal	2	15	2.40	1.12
S61 - West Turtle Shoal	5	52	8.33	2.88

S63 - Coffins Patch SPA**	7	23	3.69	1.12
S62 - Coffins Patch SPA**	5	15	2.40	0.80
S69 - Coffins Patch SPA**	3	19	3.04	0.16
S70 - Coffins Patch SPA**	5	17	2.72	0.16
S64 - South of Coffins Patch	5	13	2.08	0.16
U42 - East of Coffins Patch	11	42	6.73	0.64
Middle Florida Keys Total (8)	5.4 ± 1.0	196	3.93	0.82
Upper Florida Keys				
S99 - Wolf Reef	6	32	5.13	1.60
T04 - Inshore of Sand Island	6	47	7.53	0.48
T03 - White Bank	4	9	1.44	0.48
T05 - White Bank	6	21	3.37	0.16
T09 - South of Key Largo Dry Rocks	8	44	7.05	1.28
T08 - West of Key Largo Dry Rocks	7	34	5.45	0.32
T06 - West of Elbow Reef	6	24	3.85	0.64
T07 - SW of Watson's Reef	5	9	1.44	0.16
T31 - South of Watson's Reef	11	45	7.21	3.69
T20 - Carysfort Reef SPA**	4	17	2.72	0.16
T19 - Carysfort Reef SPA**	8	20	3.21	1.28
T24 - North of Carysfort Reef	7	37	5.93	1.12
Upper Florida Keys Total (12)	6.5 ± 0.6	339	4.53	0.63
Offshore Patch Reef Total (28)	6.9 ± 0.5	1,204	6.89	1.05
<i>Low-relief hard-bottom (< 6 m)</i>				
Lower Florida Keys				
S21 - East of E. Dry Rocks SPA	1	2	0.32	0.32
S22 - West of Looe Key SPA	7	56	8.97	1.60
Lower Florida Keys Total (2)	4.0 ± 3.0	58	4.65	4.33
Middle Florida Keys				
S65 - SE of Coffins Patch	6	27	4.33	0.48
S66 - Tennessee Reef	6	37	5.93	0.80
S68 - Tennessee Reef RO**	6	24	3.85	0.32
S67 - Tennessee Reef RO**	5	39	6.25	1.76
T16 - West of Alligator Reef	8	24	3.85	0.64
T45 - Alligator Reef SPA**	5	13	2.08	0.16
T46 - Alligator Reef SPA**	8	70	11.22	1.28
V03 - Davis Reef SPA**	8	31	4.97	0.48
T36 - Davis Reef SPA**	8	24	3.85	0.64
T21 - Conch Reef SPA**	5	27	4.33	0.80
T22 - Conch Reef SPA**	4	9	1.44	0.16
Middle Florida Keys Total (11)	6.3 ± 0.4	325	4.73	0.78
Upper Florida Keys				
T28 - Molasses Reef SPA**	3	28	4.49	2.24
T29 - Molasses Reef SPA**	2	6	0.96	0.00
T17 - North of French Reef	4	32	5.13	0.00
T18 - Watson's Reef	5	18	2.88	0.32
Upper Florida Keys Total (4)	3.5 ± 0.6	84	3.37	0.93
Shallow Hard-bottom Total (17)	5.4 ± 0.5	467	4.4	0.7
<i>High-relief spur and groove</i>				
Lower Florida Keys				
S32 - Western Dry Rocks	4	27	4.33	2.40
S46 - Sand Key SPA**	4	9	1.44	0.16
S47 - Sand Key SPA**	4	38	6.09	1.28
S44 - Rock Key SPA**	4	20	3.21	2.24
S45 - Rock Key SPA**	5	38	6.09	0.32
S42 - Eastern Dry Rocks SPA**	6	18	2.88	0.00
S43 - Eastern Dry Rocks SPA**	4	33	5.29	1.76
S40 - Western Sambo ER**	5	45	7.21	1.12
S41 - Western Sambo ER**	6	52	8.33	0.96
S33 - Middle Sambo Reef	3	30	4.81	0.32

S38 - Eastern Sambo RO**	4	45	7.21	2.40
S39 - Eastern Sambo RO**	2	43	6.89	3.04
U15 - No Name Reef	5	25	4.01	0.48
S24 - East of Eastern Sambo RO	5	14	2.24	0.32
U24 - Pelican Shoal	6	23	3.69	0.16
U23 - Maryland Shoal	7	18	2.88	0.96
S34 - Maryland Shoal	7	33	5.29	0.16
S35 - American Shoal	4	11	1.76	0.16
S36 - Looe Key SPA**	7	33	5.29	3.37
S37 - Looe Key SPA**	5	25	4.01	2.72
Lower Florida Keys Total (20)	4.9 ± 0.3	580	4.65	0.43
Middle Florida Keys				
S78 - Sombrero Key SPA**	5	15	2.40	0.48
S79 - Sombrero Key SPA**	4	16	2.56	0.64
S76 - Delta Shoal	6	22	3.53	0.00
S77 - Delta Shoal	5	34	5.45	0.00
Middle Florida Keys Total (4)	5.0 ± 0.4	87	3.49	0.70
Upper Florida Keys				
T32 - Pickles Reef	5	25	4.01	1.12
T43 - Molasses Reef SPA**	4	12	1.92	0.64
T44 - Molasses Reef SPA**	3	15	2.40	1.44
T33 - Sand Island	6	36	5.77	0.32
T34 - Sand Island	4	27	4.33	1.44
T41 - French Reef SPA**	3	30	4.81	0.96
T42 - French Reef SPA**	6	40	6.41	0.96
T14 - Grecian Rocks SPA**	3	40	6.41	0.96
T15 - Grecian Rocks SPA**	3	16	2.56	0.64
T12 - Key Largo Dry Rocks SPA**	3	28	4.49	1.60
T13 - Key Largo Dry Rocks SPA**	3	15	2.40	0.48
T10 - North-North Dry Rocks	3	21	3.37	0.48
T39 - Elbow Reef SPA**	7	35	5.61	1.76
T40 - Elbow Reef SPA**	4	41	6.57	1.76
T35 - South of South Carysfort	2	17	2.72	0.16
T37 - South Carysfort Reef SPA**	2	14	2.24	0.32
T38 - Carysfort Reef SPA**	2	14	2.24	0.64
T11 - North of Turtle Reef	7	32	5.13	1.60
Upper Florida Keys Total (18)	3.9 ± 0.4	458	4.08	0.39
Spur and Groove Total (44)	4.5 ± 0.2	1,125	4.29	0.27
<i>Deeper Fore-reef (6-15 m)</i>				
Lower Florida Keys				
U19 - Sand Key SPA**	11	55	8.81	2.72
S27 - Sand Key SPA**	8	38	6.09	0.64
S23 - East of Rock Key SPA	5	10	1.60	0.64
S54 - Western Sambo ER**	10	75	12.02	0.48
S55 - Western Sambo ER**	9	56	8.97	2.56
S48 - East of Western Sambo ER	5	30	4.81	1.28
S49 - Middle Sambo Reef	11	70	11.22	1.92
S52 - Eastern Sambo RO**	11	62	9.94	2.88
S53 - Eastern Sambo RO**	10	52	8.33	2.56
U22 - West of Pelican Shoal	7	48	7.69	0.96
S30 - East of Pelican Shoal	7	64	10.26	4.17
S31 - East of Maryland Shoal	6	35	5.61	0.16
S51 - American Shoal	4	21	3.37	1.76
S50 - American Shoal	10	82	13.14	4.49
Lower Florida Keys Total (14)	8.1 ± 0.7	698	7.99	0.89
Middle Florida Keys				
S71 - South of Bahia Honda	6	32	5.13	0.96
S80 - West of Sombrero Key	7	23	3.69	1.12
S74 - West of Sombrero Key	10	39	6.25	2.72
S72 - West of Sombrero Key	7	25	4.01	1.12

S86 - Sombrero Key SPA	1	19	3.04	0.80
S85 - Sombrero Key SPA	9	141	22.60	2.40
S73 - East of Delta Shoal	4	17	2.72	1.76
S81 - SW of Coffins Patch	8	38	6.09	1.28
S75 - Marker 20	8	37	5.93	1.12
S82 - Tennessee Reef	7	58	9.29	0.00
S83 - Tennessee Reef RO**	7	72	11.54	3.85
S84 - Tennessee Reef RO**	10	55	8.81	1.76
T56 - Alligator Reef SPA**	6	37	5.93	1.12
T57 - Alligator Reef SPA**	9	55	8.81	0.48
T54 - Davis Reef SPA**	3	7	1.12	0.16
T55 - Davis Reef SPA**	1	4	0.64	0.32
T47 - Little Conch Reef	7	25	4.01	1.44
T23 - Little Conch Reef	7	19	3.04	0.16
T52 - Conch Reef SPA**	6	20	3.21	0.96
T53 - Conch Reef SPA**	3	8	1.28	0.32
V09 - Conch Reef RO**	9	25	4.01	0.48
V10 - Conch Reef RO**	7	26	4.17	0.64
Middle Florida Keys Total (22)	6.5 ± 0.6	782	5.70	1.00
Upper Florida Keys				
U98 - Pickles Reef	7	46	7.37	0.96
U87 - Dixie Shoal	5	11	1.76	0.80
U84 - North of Dixie Shoal	8	22	3.53	1.28
T30 - South of Elbow Reef	6	23	3.69	0.48
T50 - Carysfort Reef SPA**	8	22	3.53	0.64
T26 - Carysfort Reef SPA**	6	17	2.72	0.16
T51 - Carysfort Reef SPA**	6	20	3.21	0.32
T27 - Carysfort Reef SPA**	7	19	3.04	1.12
T25 - North of Carysfort Reef	9	22	3.53	0.32
T48 - North of Carysfort Reef	4	12	1.92	0.00
T49 - SE of Turtle Rocks	4	10	1.60	0.64
Upper Florida Keys Total (11)	6.4 ± 0.5	224	3.26	0.47
Deeper Fore-reef Total (47)	6.9 ± 0.4	1,704	5.81	0.60

Table 4-3. Numbers of juveniles (N) and mean $\pm$ 1 SE densities (no. per m²) of juvenile corals for the species *Acropora cervicornis*, *A. palmata*, and *Agaricia agaricites* in the Florida Keys, as determined from surveys of ten 0.65-cm x 0.48-cm quadrats along each of two transects per site (6.24 m² per site) during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>A. cervicornis</i>		<i>A. palmata</i>		<i>A. agaricites</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	3	0.48 $\pm$ 0.16
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	3	0.12 $\pm$ 0.12
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	3	0.12 $\pm$ 0.12
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32
S13 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32
U04 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	5	0.80 $\pm$ 0.48
S08 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	10	1.60 $\pm$ 0.00
S10 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	3	0.48 $\pm$ 0.16
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	2	0.32 $\pm$ 0.00
Lower Florida Keys Total (10)	0	0 $\pm$ 0	0	0 $\pm$ 0	24	0.38 $\pm$ 0.16
Middle Florida Keys						
U40 - Marker 49A	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S58 - Marker 48	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
Middle Florida Keys Total (7)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32
S90 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S91 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32
S92 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S93 - Turtle Rocks	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	0	0 $\pm$ 0	0	0 $\pm$ 0	6	0.19 $\pm$ 0.06
Mid-channel Patch Reef Total (22)	0	0 $\pm$ 0	0	0 $\pm$ 0	33	0.24 $\pm$ 0.08
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	4	0.64 $\pm$ 0.32
S15 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	5	0.80 $\pm$ 0.80
S16 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S19 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	8	1.28 $\pm$ 0.64
S20 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S17 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S18 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (8)	0	0 $\pm$ 0	0	0 $\pm$ 0	19	0.38 $\pm$ 0.17
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>A. cervicornis</i>		<i>A. palmata</i>		<i>A. agaricites</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	8	1.28 ± 0.00
S64 - South of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	1	0.16 ± 0.16	1	0.16 ± 0.16	2	0.32 ± 0.00
Middle Florida Keys Total (8)	1	0.02 ± 0.02	1	0.02 ± 0.02	10	0.20 ± 0.16
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
T04 - Inshore of Sand Island	0	0 ± 0	0	0 ± 0	21	3.37 ± 0.48
T03 - White Bank	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T05 - White Bank	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
T09 - South of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	5	0.80 ± 0.16
T08 - West of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	5	0.80 ± 0.16
T06 - West of Elbow Reef	0	0 ± 0	0	0 ± 0	7	1.12 ± 0.80
T07 - SW of Watson's Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T31 - South of Watson's Reef	0	0 ± 0	0	0 ± 0	8	1.28 ± 0.96
T20 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T19 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.00
T24 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
Upper Florida Keys Total (12)	0	0 ± 0	0	0 ± 0	58	0.77 ± 0.26
Offshore Patch Reef Total (28)	1	0.01 ± 0.01	1	0.01 ± 0.01	87	0.50 ± 0.13
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.32
V03 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	10	1.60 ± 0.64
T36 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	8	1.28 ± 1.28
T21 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	10	1.60 ± 0.96
T22 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	6	0.96 ± 0.32
Middle Florida Keys Total (11)	0	0 ± 0	0	0 ± 0	38	0.55 ± 0.21
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
T18 - Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	2	0.08 ± 0.08
Shallow Hard-bottom Total (17)	0	0 ± 0	0	0 ± 0	40	0.38 ± 0.15
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	1	0.16 ± 0.16	12	1.92 ± 0.96
S46 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.32
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	15	2.40 ± 0.80
S44 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	12	1.92 ± 1.92
S45 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	24	3.85 ± 0.32
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.32
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.32

Site number/site location	<i>A. cervicornis</i>		<i>A. palmata</i>		<i>A. agaricites</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	11	1.76 ± 0.80
S41 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	24	3.85 ± 0.64
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	10	1.60 ± 1.28
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S39 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	22	3.53 ± 2.88
U15 - No Name Reef	0	0 ± 0	0	0 ± 0	10	1.60 ± 0.00
S24 - East of Eastern Sambo RO	0	0 ± 0	0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0	0 ± 0	0	0 ± 0	10	1.60 ± 0.64
U23 - Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
S35 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.64
S37 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	6	0.96 ± 0.96
Lower Florida Keys Total (20)	0	0 ± 0	1	0.01 ± 0.01	175	1.40 ± 0.28
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	7	1.12 ± 0.48
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	5	0.80 ± 0.16
S76 - Delta Shoal	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.00
S77 - Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	16	0.64 ± 0.24
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	0	0 ± 0	7	1.12 ± 0.80
T43 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.32
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.64
T33 - Sand Island	0	0 ± 0	0	0 ± 0	17	2.72 ± 1.12
T34 - Sand Island	0	0 ± 0	0	0 ± 0	20	3.21 ± 1.60
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	23	3.69 ± 0.16
T42 - French Reef SPA**	0	0 ± 0	0	0 ± 0	8	1.28 ± 0.32
T14 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	8	1.28 ± 1.28
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T10 - North-North Dry Rocks	0	0 ± 0	0	0 ± 0	5	0.80 ± 0.80
T39 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	10	1.60 ± 0.64
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	24	3.85 ± 0.64
T35 - South of South Carysfort	0	0 ± 0	0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	7	1.12 ± 0.48
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	5	0.80 ± 0.16
T11 - North of Turtle Reef	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
Upper Florida Keys Total (18)	0	0 ± 0	0	0 ± 0	146	1.30 ± 0.29
Spur and Groove Total (44)	0	0 ± 0	1	<0.01 ± <0.01	337	1.29 ± 0.18
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
S27 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
S54 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.48
S55 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S48 - East of Western Sambo ER	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S49 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	7	1.12 ± 0.48
S52 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
S53 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
U22 - West of Pelican Shoal	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
S30 - East of Pelican Shoal	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
S31 - East of Maryland Shoal	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S51 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S50 - American Shoal	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
Lower Florida Keys Total (14)	0	0 ± 0	0	0 ± 0	28	0.32 ± 0.08

Site number/site location	<i>A. cervicornis</i>		<i>A. palmata</i>		<i>A. agaricites</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S80 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S74 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
S75 - Marker 20	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S82 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
T56 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T54 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0	0 ± 0	0	0 ± 0	6	0.96 ± 0.64
T23 - Little Conch Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T52 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
V10 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.48
Middle Florida Keys Total (22)	0	0 ± 0	0	0 ± 0	17	0.12 ± 0.05
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	0	0 ± 0	6	0.96 ± 0.32
U87 - Dixie Shoal	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.00
U84 - North of Dixie Shoal	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T30 - South of Elbow Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
T26 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T51 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
T27 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.00
T25 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.32
T48 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
T49 - SE of Turtle Rocks	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
Upper Florida Keys Total (11)	0	0 ± 0	0	0 ± 0	28	0.41 ± 0.08
Deeper Fore-reef Total (47)	0	0 ± 0	0	0 ± 0	73	0.25 ± 0.04

Table 4-4. Numbers of juveniles (N) and mean $\pm$ 1 SE densities (no. per m²) of juvenile corals for the species *Agaricia fragilis*, *A. humilis*, and *Colpophyllia natans* in the Florida Keys, as determined from surveys of ten 0.65-cm x 0.48-cm quadrats along each of two transects per site (6.24 m² per site) during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>A. fragilis</i>		<i>A. humilis</i>		<i>C. natans</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32
S05 - North of Middle Sambo Reef	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
U04 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32
S09 - North of Maryland Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	2	0.32 $\pm$ 0.00
Lower Florida Keys Total (10)	0	0 $\pm$ 0	0	0 $\pm$ 0	6	0.10 $\pm$ 0.05
Middle Florida Keys						
U40 - Marker 49A	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S59 - East Turtle Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.02 $\pm$ 0.02
Upper Florida Keys						
S89 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	0	0 $\pm$ 0	0	0 $\pm$ 0	7	0.05 $\pm$ 0.02
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
S15 - North of Sand Key	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S16 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S20 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
U12 - West of Looe Key RO	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
S17 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S18 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (8)	1	0.02 $\pm$ 0.02	2	0.04 $\pm$ 0.03	3	0.06 $\pm$ 0.03
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>A. fragilis</i>		<i>A. humilis</i>		<i>C. natans</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
Middle Florida Keys Total (8)	0	0 ± 0	0	0 ± 0	1	0.02 ± 0.02
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T03 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T05 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T08 - West of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T07 - SW of Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T20 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T24 - North of Carysfort Reef	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	1	0.01 ± 0.01	0	0 ± 0	1	0.01 ± 0.01
Offshore Patch Reef Total (28)	2	0.01 ± 0.01	2	0.01 ± 0.01	5	0.03 ± 0.01
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	1	0.01 ± 0.01	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Shallow Hard-bottom Total (17)	1	0.01 ± 0.01	0	0 ± 0	0	0 ± 0
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0

Site number/site location	<i>A. fragilis</i>		<i>A. humilis</i>		<i>C. natans</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0	0 ± 0	0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S35 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	1	0.01 ± 0.01	0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T33 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T34 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0	0 ± 0	0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Spur and Groove Total (44)	1	<0.01 ± <0.01	0	0 ± 0	0	0 ± 0
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S55 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S48 - East of Western Sambo ER	0	0 ± 0	0	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S52 - Eastern Sambo RO**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S53 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
U22 - West of Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S51 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S50 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (14)	1	0.01 ± 0.01	0	0 ± 0	2	0.02 ± 0.02

Site number/site location	<i>A. fragilis</i>		<i>A. humilis</i>		<i>C. natans</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0	0 ± 0	0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
S75 - Marker 20	0	0 ± 0	0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T54 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V10 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	1	0.01 ± 0.01	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
U87 - Dixie Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Deeper Fore-reef Total (47)	2	0.01 ± 0.00	0	0 ± 0	2	0.01 ± 0.00

Table 4-5. Numbers of juveniles (N) and mean $\pm$ 1 SE densities (no. per m²) of juvenile corals for the species *Dichocoenia stokesi*, *Diploria labyrinthiformis*, and *D. strigosa* in the Florida Keys, as determined from ten 0.65-cm x 0.48-cm quadrats sampled along each of two transects (6.24 m² per site) during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>D. stokesi</i>		<i>D. labyrinthiformis</i>		<i>D. strigosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.04 $\pm$ 0.04
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.04 $\pm$ 0.04
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	1	0.16 $\pm$ 0.16	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
U04 - North of Pelican Shoal	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	3	0.05 $\pm$ 0.02	1	0.02 $\pm$ 0.02	0	0 $\pm$ 0
Middle Florida Keys						
U40 - Marker 49A	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S58 - Marker 48	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	2	0.32 $\pm$ 0.00	0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	2	0.05 $\pm$ 0.05	0	0 $\pm$ 0	1	0.02 $\pm$ 0.02
Upper Florida Keys						
S89 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	1	0.03 $\pm$ 0.03	0	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	6	0.04 $\pm$ 0.02	1	<0.01 $\pm$ <0.01	1	0.01 $\pm$ 0.01
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0	0	0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	3	0.48 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	0	0	0	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	0	0	0	0 $\pm$ 0	0	0 $\pm$ 0
S20 - Western Sambo ER**	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0	0	0	0 $\pm$ 0	0	0 $\pm$ 0
S17 - Looe Key RO**	0	0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S18 - Looe Key RO**	2	0.32 $\pm$ 0.32	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (8)	6	0.12 $\pm$ 0.07	0	0 $\pm$ 0	1	0.02 $\pm$ 0.02
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>D. stokesi</i>		<i>D. labyrinthiformis</i>		<i>D. strigosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	3	0.48 ± 0.48	0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0	0	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0	0	0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	0	0	0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	6	0.12 ± 0.06	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	0	0	0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0	0	0	0 ± 0	0	0 ± 0
T03 - White Bank	0	0	0	0 ± 0	0	0 ± 0
T05 - White Bank	0	0	0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T08 - West of Key Largo Dry Rocks	2	0.32 ± 0.00	0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0	0	0	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	0	0	0	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	0	0	0	0 ± 0	0	0 ± 0
T20 - Carysfort Reef SPA**	0	0	0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	2	0.32 ± 0.00	0	0 ± 0	0	0 ± 0
T24 - North of Carysfort Reef	0	0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	5	0.07 ± 0.04	0	0 ± 0	0	0 ± 0
Offshore Patch Reef Total (28)	17	0.10 ± 0.03	0	0 ± 0	1	0.01 ± 0.01
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	2	0.32 ± 0.00	0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	1	0.16 ± 0.16	0	0 ± 0	1	0.16 ± 0.16
V03 - Davis Reef SPA**	2	0.32 ± 0.32	1	0.16 ± 0.16	0	0 ± 0
T36 - Davis Reef SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	6	0.09 ± 0.04	1	0.01 ± 0.01	1	0.01 ± 0.01
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Shallow Hard-bottom Total (17)	6	0.06 ± 0.03	1	0.01 ± 0	1	0.01 ± 0.01
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0

Site number/site location	<i>D. stokesi</i>		<i>D. labyrinthiformis</i>		<i>D. strigosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S39 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
U24 - Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S35 - American Shoal	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	4	0.03 ± 0.01	0	0 ± 0	2	0.02 ± 0.01
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T33 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T34 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0	0 ± 0	0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	3	0.03 ± 0.02	0	0 ± 0	0	0 ± 0
Spur and Groove Total (44)	7	0.03 ± 0.01	0	0 ± 0	2	0.01 ± 0.01
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	3	0.48 ± 0.16	0	0 ± 0	2	0.32 ± 0.32
S27 - Sand Key SPA**	3	0.48 ± 0.16	0	0 ± 0	2	0.32 ± 0.32
S23 - East of Rock Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	2	0.32 ± 0.00	0	0 ± 0	1	0.16 ± 0.16
S55 - Western Sambo ER**	3	0.48 ± 0.48	0	0 ± 0	0	0 ± 0
S48 - East of Western Sambo ER	0	0 ± 0	0	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	1	0.16 ± 0.16	0	0 ± 0	1	0.16 ± 0.16
S52 - Eastern Sambo RO**	4	0.64 ± 0.64	0	0 ± 0	1	0.16 ± 0.16
S53 - Eastern Sambo RO**	2	0.32 ± 0.00	0	0 ± 0	1	0.16 ± 0.16
U22 - West of Pelican Shoal	2	0.32 ± 0.00	0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S51 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S50 - American Shoal	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (14)	23	0.26 ± 0.06	0	0 ± 0	8	0.09 ± 0.03

Site number/site location	<i>D. stokesi</i>		<i>D. labyrinthiformis</i>		<i>D. strigosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0	0 ± 0	0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	1	0.16 ± 0.16	0	0 ± 0	3	0.48 ± 0.48
S72 - West of Sombrero Key	2	0.32 ± 0.00	0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	4	0.64 ± 0.00	0	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
S75 - Marker 20	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	3	0.48 ± 0.16	0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	2	0.32 ± 0.32	1	0.16 ± 0.16	1	0.16 ± 0.16
T54 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V10 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	22	0.16 ± 0.04	1	0.01 ± 0.01	4	0.03 ± 0.02
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
U87 - Dixie Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	2	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	5	0.07 ± 0.04	0	0 ± 0	0	0 ± 0
Deeper Fore-reef Total (47)	50	0.17 ± 0.13	1	<0.01 ± <0.01	12	0.04 ± 0.01

Table 4-6. Numbers of juveniles (N) and mean $\pm$ 1 SE densities (no. per m²) of juvenile corals for the species *Eusmilia fastigiata*, *Favia fragum*, and *Leptoseris cucullata* in the Florida Keys, as determined from surveys of ten 0.65-cm x 0.48-cm quadrats along each of two transects per site (6.24 m² per site) during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>E. fastigiata</i>		<i>F. fragum</i>		<i>L. cucullata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
U04 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S11 - North of American Shoal	2	0.32 $\pm$ 0.32	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	4	0.06 $\pm$ 0.04	1	0.02 $\pm$ 0.02	0	0 $\pm$ 0
Middle Florida Keys						
U40 - Marker 49A	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	6	0.96 $\pm$ 0.32	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0	0 $\pm$ 0	7	0.16 $\pm$ 0.14	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	1	0.03 $\pm$ 0.03	0	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	5	0.04 $\pm$ 0.02	8	0.06 $\pm$ 0.04	0	0 $\pm$ 0
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S15 - North of Sand Key	5	0.80 $\pm$ 0.48	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
S16 - North of Sand Key	0	0	5	0.80 $\pm$ 0.16	0	0 $\pm$ 0
S19 - Western Sambo ER**	0	0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S20 - Western Sambo ER**	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0	0	0	0 $\pm$ 0	0	0 $\pm$ 0
S17 - Looe Key RO**	2	0.32 $\pm$ 0.00	0	0 $\pm$ 0	0	0 $\pm$ 0
S18 - Looe Key RO**	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (8)	10	0.20 $\pm$ 0.09	6	0.12 $\pm$ 0.10	2	0.04 $\pm$ 0.03
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>E. fastigiata</i>		<i>F. fragum</i>		<i>L. cucullata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	1	0.02 ± 0.02	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T03 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T05 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T08 - West of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T06 - West of Elbow Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	1	0.16 ± 0.16	0	0 ± 0	1	0.16 ± 0.16
T20 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T24 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	1	0.01 ± 0.01	0	0 ± 0	3	0.04 ± 0.02
Offshore Patch Reef Total (28)	12	0.07 ± 0.03	6	0.03 ± 0.03	5	0.03 ± 0.01
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T36 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	0	0 ± 0	1	0.01 ± 0.01	0	0 ± 0
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Shallow Hard-bottom Total (17)	0	0 ± 0	1	0.01 ± 0.01	0	0 ± 0
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
S44 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0

Site number/site location	<i>E. fastigiata</i>		<i>F. fragum</i>		<i>L. cucullata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0	0 ± 0	3	0.48 ± 0.48	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	1	0.32 ± 0.00	0	0 ± 0
S24 - East of Eastern Sambo RO	0	0 ± 0	1	0.32 ± 0.32	0	0 ± 0
U24 - Pelican Shoal	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
U23 - Maryland Shoal	0	0 ± 0	1	0.32 ± 0.00	0	0 ± 0
S34 - Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S35 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
S37 - Looe Key SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
Lower Florida Keys Total (20)	1	0.01 ± 0.01	13	0.10 ± 0.03	0	0 ± 0
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	0	0	0	0 ± 0
T43 - Molasses Reef SPA**	0	0 ± 0	0	0	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	3	0.48 ± 0.48	0	0 ± 0
T33 - Sand Island	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T34 - Sand Island	0	0 ± 0	3	0.48 ± 0.48	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	0	0	0	0 ± 0
T42 - French Reef SPA**	0	0 ± 0	0	0	0	0 ± 0
T14 - Grecian Rocks SPA**	0	0 ± 0	0	0	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	0	0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0	0	0 ± 0
T10 - North-North Dry Rocks	0	0 ± 0	0	0	0	0 ± 0
T39 - Elbow Reef SPA**	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
T40 - Elbow Reef SPA**	0	0 ± 0	15	2.40 ± 1.44	0	0 ± 0
T35 - South of South Carysfort	0	0 ± 0	0	0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	0	0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0	0	0 ± 0
T11 - North of Turtle Reef	0	0 ± 0	0	0	0	0 ± 0
Upper Florida Keys Total (18)	0	0 ± 0	25	0.22 ± 0.14	0	0 ± 0
Spur and Groove Total (44)	1	<0.01 ± <0.01	38	0.14 ± 0.06	0	0 ± 0
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S55 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S48 - East of Western Sambo ER	0	0 ± 0	0	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S52 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S53 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S51 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S50 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (14)	1	0.01 ± 0.01	0	0 ± 0	1	0.01 ± 0.01

Site number/site location	<i>E. fastigiata</i>		<i>F. fragum</i>		<i>L. cucullata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0	0 ± 0	0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
S75 - Marker 20	0	0 ± 0	0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T54 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
V10 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	1	0.01 ± 0.01	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
U87 - Dixie Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Deeper Fore-reef Total (47)	2	0.01 ± 0.00	0	0 ± 0	1	<0.01 ± <0.01

Table 4-7. Numbers of juveniles (N) and mean $\pm$ 1 SE densities (no. per m²) of juvenile corals for the species *Manicina areolata*, *Meandrina meandrites*, and *Montastraea annularis* spp. in the Florida Keys, as determined from ten 0.65-cm x 0.48-cm quadrats sampled along each of two transects (6.24 m² per site). Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>M. areolata</i>		<i>M. meandrites</i>		<i>M. annularis</i> spp.	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
U04 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys						
U40 - Marker 49A	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	3	0.48 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	4	0.13 $\pm$ 0.09	0	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	4	0.03 $\pm$ 0.02	0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32	0	0 $\pm$ 0
S20 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
S17 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S18 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (8)	0	0 $\pm$ 0	3	0.06 $\pm$ 0.04	0	0 $\pm$ 0
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>M. areolata</i>		<i>M. meandrites</i>		<i>M. annularis spp.</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T03 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T05 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T08 - West of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T20 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T24 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	0	0 ± 0	0	0 ± 0	1	0.01 ± 0.01
Offshore Patch Reef Total (28)	0	0 ± 0	3	0.02 ± 0.01	1	0.01 ± 0.01
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Shallow Hard-bottom Total (17)	0	0 ± 0	0	0 ± 0	0	0 ± 0
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0

Site number/site location	<i>M. areolata</i>		<i>M. meandrites</i>		<i>M. annularis spp.</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0	0 ± 0	0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S35 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T33 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T34 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0	0 ± 0	0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Spur and Groove Total (44)	0	0 ± 0	0	0 ± 0	0	0 ± 0
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S55 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S48 - East of Western Sambo ER	0	0 ± 0	0	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S52 - Eastern Sambo RO**	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
S53 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S51 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S50 - American Shoal	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
Lower Florida Keys Total (14)	4	0.05 ± 0.03	1	0.01 ± 0.01	0	0 ± 0

Site number/site location	<i>M. areolata</i>		<i>M. meandrites</i>		<i>M. annularis</i> spp.	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0	0 ± 0	0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
S75 - Marker 20	0	0 ± 0	0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T54 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T52 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
V10 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	0	0 ± 0	2	0.01 ± 0.01	0	0 ± 0
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
U87 - Dixie Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	0	0 ± 0	0	0 ± 0	1	0.01 ± 0.01
Deeper Fore-reef Total (47)	4	0.01 ± 0.01	3	0.01 ± 0.01	1	<0.01 ± <0.01

Table 4-8. Numbers of juveniles (N) and mean $\pm$ 1 SE densities (no. per m²) of juvenile corals for the species *M. cavernosa*, *Mycetophyllia aliciae*, and *Mycetophyllia* spp. in the Florida Keys, as determined from ten 0.65-cm x 0.48-cm quadrats sampled along each of two transects (6.24 m² per site) during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>M. cavernosa</i>		<i>M. aliciae</i>		<i>Mycetophyllia</i> spp.	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	2	0.32 $\pm$ 0.32	0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
U04 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32
S08 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S11 - North of American Shoal	3	0.48 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	0	0 $\pm$ 0	0	0 $\pm$ 0	2	0.03 $\pm$ 0.03
Middle Florida Keys						
U40 - Marker 49A	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	1	0.03 $\pm$ 0.03	0	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	10	0.07 $\pm$ 0.03	0	0 $\pm$ 0	2	0.01 $\pm$ 0.01
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	2	0.32 $\pm$ 0.32	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S15 - North of Sand Key	3	0.48 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S20 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S17 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S18 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (8)	6	0.12 $\pm$ 0.07	0	0 $\pm$ 0	2	0.04 $\pm$ 0.03
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>M. cavernosa</i>		<i>M. aliciae</i>		<i>Mycetophyllia</i> spp.	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	3	0.06 ± 0.03	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T03 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T05 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T08 - West of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	2	0.32 ± 0.00	0	0 ± 0	0	0 ± 0
T20 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T24 - North of Carysfort Reef	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	6	0.08 ± 0.04	0	0 ± 0	0	0 ± 0
Offshore Patch Reef Total (28)	15	0.09 ± 0.03	0	0 ± 0	2	0.01 ± 0.01
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	2	0.32 ± 0.00	0.00	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	1	0.16 ± 0.16	0.16	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	1	0.16 ± 0.16	0.16	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	1	0.16 ± 0.16	0.16	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	1	0.16 ± 0.16	0.16	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	1	0.16 ± 0.16	0.16	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	1	0.16 ± 0.16	0.16	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	1	0.16 ± 0.16	0.16	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	9	0.13 ± 0.03	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	1	0.16 ± 0.16	0.16	0 ± 0	0	0 ± 0
Upper Florida Keys Total (4)	1	0.04 ± 0.04	0	0 ± 0	0	0 ± 0
Shallow Hard-bottom Total (17)	10	0.09 ± 0.02	0	0 ± 0	0	0 ± 0
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0

Site number/site location	<i>M. cavernosa</i>		<i>M. aliciae</i>		<i>Mycetophyllia</i> spp.	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0	0 ± 0	0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S35 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	3	0.02 ± 0.01	0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T33 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T34 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	1	0.16 ± 0.16	0	0 ± 0	1	0.16 ± 0.16
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0	0 ± 0	0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	4	0.04 ± 0.02	0	0 ± 0	1	0.01 ± 0.01
Spur and Groove Total (44)	7	0.03 ± 0.01	0	0 ± 0	1	<0.01 ± <0.01
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	5	0.80 ± 0.80	0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	4	0.64 ± 0.32	0	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	0	0	0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S55 - Western Sambo ER**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S48 - East of Western Sambo ER	4	0.64 ± 0.00	0	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	1	0.16 ± 0.16	0	0 ± 0	1	0.16 ± 0.16
S52 - Eastern Sambo RO**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S53 - Eastern Sambo RO**	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S51 - American Shoal	0	0	0	0 ± 0	0	0 ± 0
S50 - American Shoal	8	1.28 ± 0.64	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (14)	30	0.34 ± 0.10	0	0 ± 0	1	0.01 ± 0.01

Site number/site location	<i>M. cavernosa</i>		<i>M. aliciae</i>		<i>Mycetophyllia</i> spp.	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0	0	0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	3	0.48 ± 0.16	0	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	0	0	0	0 ± 0	0	0 ± 0
S75 - Marker 20	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0	0	0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0	0	0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	3	0.48 ± 0.16	0	0 ± 0	0	0 ± 0
T54 - Davis Reef SPA**	0	0	0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0	0	0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0	0	0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	2	0.32 ± 0.32	0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	1	0.16 ± 0.16	1	0.16 ± 0.16	0	0 ± 0
V10 - Conch Reef RO**	6	0.96 ± 0.64	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	26	0.19 ± 0.05	1	0.01 ± 0.01	0	0 ± 0
Upper Florida Keys						
U98 - Pickles Reef	3	0.48 ± 0.48	0	0 ± 0	0	0 ± 0
U87 - Dixie Shoal	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	3	0.48 ± 0.48	0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0	0	0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0	0	0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	1	0.16 ± 0.16	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	13	0.19 ± 0.05	0	0 ± 0	0	0 ± 0
Deeper Fore-reef Total (47)	69	0.24 ± 0.04	1	<0.01 ± <0.01	1	<0.01 ± <0.01

Table 4-9. Numbers of juveniles (N) and mean $\pm$ 1 SE densities (no. per m²) of juvenile corals for the species *Oculina diffusa*, *Porites astreoides*, and *P. branneri* in the Florida Keys, as determined from ten 0.65-cm x 0.48-cm quadrats sampled along each of two transects (6.24 m² per site) during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>O. diffusa</i>		<i>P. astreoides</i>		<i>P. branneri</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	2	0.08 $\pm$ 0.05	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	2	0.08 $\pm$ 0.05	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0	0 $\pm$ 0	11	1.76 $\pm$ 0.16	0	0 $\pm$ 0
S13 - Western Sambo ER**	0	0 $\pm$ 0	3	0.48 $\pm$ 0.16	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	0	0 $\pm$ 0	4	0.64 $\pm$ 0.32	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0	0 $\pm$ 0	11	1.76 $\pm$ 0.16	0	0 $\pm$ 0
U04 - North of Pelican Shoal	1	0.16 $\pm$ 0.16	3	0.48 $\pm$ 0.16	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	0	0 $\pm$ 0	11	1.76 $\pm$ 0.80	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	1	0.16 $\pm$ 0.16	2	0.32 $\pm$ 0.32	0	0 $\pm$ 0
S09 - North of Maryland Shoal	0	0 $\pm$ 0	30	4.81 $\pm$ 1.60	0	0 $\pm$ 0
S10 - North of American Shoal	0	0 $\pm$ 0	12	1.92 $\pm$ 0.00	0	0 $\pm$ 0
S11 - North of American Shoal	0	0 $\pm$ 0	14	2.24 $\pm$ 0.64	0	0 $\pm$ 0
Lower Florida Keys Total (10)	2	0.03 $\pm$ 0.02	101	1.62 $\pm$ 0.42	0	0 $\pm$ 0
Middle Florida Keys						
U40 - Marker 49A	0	0 $\pm$ 0	13	2.08 $\pm$ 0.16	0	0 $\pm$ 0
S58 - Marker 48	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
S59 - East Turtle Shoal	0	0 $\pm$ 0	33	5.29 $\pm$ 1.76	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	2	0.32 $\pm$ 0.0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0	0 $\pm$ 0	51	1.17 $\pm$ 0.74	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	0	0 $\pm$ 0	3	0.48 $\pm$ 0.16	1	0.16 $\pm$ 0.16
S90 - Mosquito Bank	0	0 $\pm$ 0	4	0.64 $\pm$ 0.64	0	0 $\pm$ 0
S91 - Basin Hill Shoals	0	0 $\pm$ 0	11	1.76 $\pm$ 0.16	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0	0 $\pm$ 0	3	0.48 $\pm$ 0.16	0	0 $\pm$ 0
S93 - Turtle Rocks	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
Upper Florida Keys Total (5)	0	0 $\pm$ 0	22	0.71 $\pm$ 0.28	1	0.03 $\pm$ 0.03
Mid-channel Patch Reef Total (22)	2	0.01 $\pm$ 0.01	174	1.27 $\pm$ 0.31	1	0.01 $\pm$ 0.01
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	1	0.16 $\pm$ 0.16	6	0.96 $\pm$ 0.32	0	0 $\pm$ 0
S15 - North of Sand Key	0	0 $\pm$ 0	13	2.08 $\pm$ 1.12	0	0 $\pm$ 0
S16 - North of Sand Key	0	0 $\pm$ 0	8	1.28 $\pm$ 0.96	0	0 $\pm$ 0
S19 - Western Sambo ER**	0	0 $\pm$ 0	13	2.08 $\pm$ 0.48	0	0 $\pm$ 0
S20 - Western Sambo ER**	0	0 $\pm$ 0	6	0.96 $\pm$ 0.32	0	0 $\pm$ 0
U12 - West of Looe Key RO	0	0 $\pm$ 0	6	0.96 $\pm$ 0.32	0	0 $\pm$ 0
S17 - Looe Key RO**	0	0 $\pm$ 0	4	0.64 $\pm$ 0.32	0	0 $\pm$ 0
S18 - Looe Key RO**	0	0 $\pm$ 0	3	0.48 $\pm$ 0.48	0	0 $\pm$ 0
Lower Florida Keys Total (8)	1	0.02 $\pm$ 0.02	59	1.18 $\pm$ 0.21	0	0 $\pm$ 0
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>O. diffusa</i>		<i>P. astreoides</i>		<i>P. branneri</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	0	0 ± 0	14	2.24 ± 0.64	0	0 ± 0
S63 - Coffins Patch SPA**	0	0 ± 0	5	0.80 ± 0.80	0	0 ± 0
S62 - Coffins Patch SPA**	0	0 ± 0	2	0.32 ± 0.32	0	0 ± 0
S69 - Coffins Patch SPA**	0	0 ± 0	14	2.24 ± 0.00	0	0 ± 0
S70 - Coffins Patch SPA**	0	0 ± 0	2	0.32 ± 0.00	0	0 ± 0
S64 - South of Coffins Patch	0	0 ± 0	4	0.64 ± 0.32	0	0 ± 0
U42 - East of Coffins Patch	0	0 ± 0	12	1.92 ± 0.64	0	0 ± 0
Middle Florida Keys Total (8)	0	0 ± 0	53	1.06 ± 0.33	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	10	1.60 ± 0.32	0	0 ± 0
T04 - Inshore of Sand Island	0	0 ± 0	3	0.48 ± 0.8	0	0 ± 0
T03 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T05 - White Bank	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0	0 ± 0	9	1.44 ± 0.16	0	0 ± 0
T08 - West of Key Largo Dry Rocks	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
T06 - West of Elbow Reef	0	0 ± 0	6	0.96 ± 0.00	0	0 ± 0
T07 - SW of Watson's Reef	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
T31 - South of Watson's Reef	0	0 ± 0	9	1.44 ± 0.80	0	0 ± 0
T20 - Carysfort Reef SPA**	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
T19 - Carysfort Reef SPA**	0	0 ± 0	4	0.64 ± 0.32	0	0 ± 0
T24 - North of Carysfort Reef	0	0 ± 0	10	1.60 ± 0.32	0	0 ± 0
Upper Florida Keys Total (12)	0	0 ± 0	69	0.92 ± 0.15	0	0 ± 0
Offshore Patch Reef Total (28)	1	0.01 ± 0.01	181	1.04 ± 0.12	0	0 ± 0
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0	0 ± 0	5	0.80 ± 0.48	0	0 ± 0
Lower Florida Keys Total (2)	0	0 ± 0	5	0.40 ± 0.40	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	5	0.80 ± 0.48	0	0 ± 0
S66 - Tennessee Reef	0	0 ± 0	7	1.12 ± 0.80	0	0 ± 0
S68 - Tennessee Reef RO**	0	0 ± 0	6	0.96 ± 0.32	1	0.16 ± 0.16
S67 - Tennessee Reef RO**	0	0 ± 0	15	2.40 ± 0.48	0	0 ± 0
T16 - West of Alligator Reef	0	0 ± 0	1	0.16 ± 0.16	1	0.16 ± 0.16
T45 - Alligator Reef SPA**	0	0 ± 0	2	0.32 ± 0.32	0	0 ± 0
T46 - Alligator Reef SPA**	0	0 ± 0	14	2.24 ± 0.32	0	0 ± 0
V03 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T21 - Conch Reef SPA**	0	0 ± 0	2	0.32 ± 0.32	0	0 ± 0
T22 - Conch Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
Middle Florida Keys Total (11)	0	0 ± 0	54	0.79 ± 0.25	2	0.03 ± 0.02
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	17	2.72 ± 0.80	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	19	3.04 ± 0.48	0	0 ± 0
T18 - Watson's Reef	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
Upper Florida Keys Total (4)	0	0 ± 0	44	1.76 ± 0.65	0	0 ± 0
Shallow Hard-bottom Total (17)	0	0 ± 0	103	0.97 ± 0.24	2	0.02 ± 0.01
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	13	2.08 ± 1.12	0	0 ± 0
S46 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0	0 ± 0	21	3.37 ± 0.48	0	0 ± 0
S44 - Rock Key SPA**	0	0 ± 0	4	0.64 ± 0.64	0	0 ± 0
S45 - Rock Key SPA**	0	0 ± 0	9	1.44 ± 0.48	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	7	1.12 ± 0.48	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	26	4.17 ± 0.96	0	0 ± 0

Site number/site location	<i>O. diffusa</i>		<i>P. astreoides</i>		<i>P. branneri</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	17	2.72 ± 0.16	0	0 ± 0
S41 - Western Sambo ER**	0	0 ± 0	20	3.21 ± 0.32	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	18	2.88 ± 0.64	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	27	4.33 ± 0.80	0	0 ± 0
S39 - Eastern Sambo RO**	0	0 ± 0	21	3.37 ± 0.16	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	10	1.60 ± 0.96	0	0 ± 0
S24 - East of Eastern Sambo RO	0	0 ± 0	3	0.48 ± 0.48	0	0 ± 0
U24 - Pelican Shoal	0	0 ± 0	8	1.28 ± 0.64	0	0 ± 0
U23 - Maryland Shoal	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
S34 - Maryland Shoal	0	0 ± 0	12	1.92 ± 0.32	0	0 ± 0
S35 - American Shoal	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
S36 - Looe Key SPA**	0	0 ± 0	14	2.24 ± 1.28	0	0 ± 0
S37 - Looe Key SPA**	0	0 ± 0	6	0.96 ± 0.96	0	0 ± 0
Lower Florida Keys Total (20)	0	0 ± 0	242	1.94 ± 0.29	0	0 ± 0
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	2	0.32 ± 0.32	0	0 ± 0
S79 - Sombrero Key SPA**	0	0 ± 0	8	1.28 ± 0.00	0	0 ± 0
S76 - Delta Shoal	0	0 ± 0	8	1.28 ± 0.00	0	0 ± 0
S77 - Delta Shoal	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
Middle Florida Keys Total (4)	0	0 ± 0	23	0.92 ± 0.23	0	0 ± 0
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
T43 - Molasses Reef SPA**	0	0 ± 0	6	0.96 ± 0.64	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	8	1.28 ± 1.28	0	0 ± 0
T33 - Sand Island	0	0 ± 0	8	1.28 ± 0.96	0	0 ± 0
T34 - Sand Island	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	4	0.64 ± 0.64	0	0 ± 0
T42 - French Reef SPA**	0	0 ± 0	13	2.08 ± 0.48	0	0 ± 0
T14 - Grecian Rocks SPA**	0	0 ± 0	38	6.09 ± 0.64	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	11	1.76 ± 0.16	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	16	2.56 ± 0.32	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	13	2.08 ± 0.16	0	0 ± 0
T10 - North-North Dry Rocks	0	0 ± 0	14	2.24 ± 1.60	0	0 ± 0
T39 - Elbow Reef SPA**	0	0 ± 0	15	2.40 ± 0.80	0	0 ± 0
T40 - Elbow Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T35 - South of South Carysfort	0	0 ± 0	13	2.08 ± 0.48	0	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	7	1.12 ± 0.16	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	9	1.44 ± 0.48	0	0 ± 0
T11 - North of Turtle Reef	0	0 ± 0	4	0.64 ± 0.64	0	0 ± 0
Upper Florida Keys Total (18)	0	0 ± 0	188	1.67 ± 0.31	0	0 ± 0
Spur and Groove Total (44)	0	0 ± 0	453	1.73 ± 0.20	0	0 ± 0
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0	0 ± 0	2	0.32 ± 0.32	0	0 ± 0
S27 - Sand Key SPA**	0	0 ± 0	13	2.08 ± 0.16	0	0 ± 0
S23 - East of Rock Key SPA	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
S54 - Western Sambo ER**	0	0 ± 0	8	1.28 ± 0.32	0	0 ± 0
S55 - Western Sambo ER**	0	0 ± 0	9	1.44 ± 1.12	0	0 ± 0
S48 - East of Western Sambo ER	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
S49 - Middle Sambo Reef	0	0 ± 0	15	2.40 ± 0.48	0	0 ± 0
S52 - Eastern Sambo RO**	0	0 ± 0	2	0.32 ± 0.00	0	0 ± 0
S53 - Eastern Sambo RO**	0	0 ± 0	7	1.12 ± 0.16	0	0 ± 0
U22 - West of Pelican Shoal	0	0 ± 0	7	1.12 ± 0.48	0	0 ± 0
S30 - East of Pelican Shoal	0	0 ± 0	3	0.48 ± 0.48	0	0 ± 0
S31 - East of Maryland Shoal	0	0 ± 0	7	1.12 ± 0.80	0	0 ± 0
S51 - American Shoal	0	0 ± 0	5	0.80 ± 0.48	0	0 ± 0
S50 - American Shoal	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
Lower Florida Keys Total (14)	0	0 ± 0	87	1.00 ± 0.18	0	0 ± 0

Site number/site location	<i>O. diffusa</i>		<i>P. astreoides</i>		<i>P. branneri</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0	0 ± 0	9	1.44 ± 0.48	0	0 ± 0
S80 - West of Sombrero Key	0	0 ± 0	4	0.64 ± 0.00	0	0 ± 0
S74 - West of Sombrero Key	0	0 ± 0	2	0.32 ± 0.00	0	0 ± 0
S72 - West of Sombrero Key	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
S86 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	0	0 ± 0	10	1.60 ± 0.64	0	0 ± 0
S73 - East of Delta Shoal	0	0 ± 0	9	1.44 ± 1.44	0	0 ± 0
S81 - SW of Coffins Patch	0	0 ± 0	4	0.64 ± 0.32	0	0 ± 0
S75 - Marker 20	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
S82 - Tennessee Reef	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
S83 - Tennessee Reef RO**	0	0 ± 0	6	0.96 ± 0.00	2	0.32 ± 0.32
S84 - Tennessee Reef RO**	0	0 ± 0	3	0.48 ± 0.16	1	0.16 ± 0.16
T56 - Alligator Reef SPA**	0	0 ± 0	2	0.32 ± 0.00	0	0 ± 0
T57 - Alligator Reef SPA**	0	0 ± 0	6	0.96 ± 0.00	0	0 ± 0
T54 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0	0 ± 0	9	1.44 ± 0.48	0	0 ± 0
T23 - Little Conch Reef	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
T52 - Conch Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T53 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V10 - Conch Reef RO**	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
Middle Florida Keys Total (22)	0	0 ± 0	88	0.64 ± 0.11	3	0.02 ± 0.02
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	8	1.28 ± 0.96	0	0 ± 0
U97 - Dixie Shoal	0	0 ± 0	2	0.32 ± 0.32	0	0 ± 0
U94 - North of Dixie Shoal	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
T30 - South of Elbow Reef	0	0 ± 0	6	0.96 ± 0.00	0	0 ± 0
T50 - Carysfort Reef SPA**	0	0 ± 0	4	0.64 ± 0.64	0	0 ± 0
T26 - Carysfort Reef SPA**	0	0 ± 0	2	0.32 ± 0.00	0	0 ± 0
T51 - Carysfort Reef SPA**	0	0 ± 0	2	0.32 ± 0.32	0	0 ± 0
T27 - Carysfort Reef SPA**	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
T25 - North of Carysfort Reef	0	0 ± 0	2	0.32 ± 0.32	2	0.32 ± 0.32
T48 - North of Carysfort Reef	0	0 ± 0	6	0.96 ± 0.32	0	0 ± 0
T49 - SE of Turtle Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	0	0 ± 0	38	0.55 ± 0.11	2	0.03 ± 0.03
Deeper Fore-reef Total (47)	0	0 ± 0	213	0.73 ± 0.08	5	0.02 ± 0.01

Table 4-10. Numbers of juveniles (N) and mean $\pm$ 1 SE densities (no. per m²) of juvenile corals for the species *Porites porites divaricata*, *P. porites furcata*, and *P. porites* spp. in the Florida Keys, as determined from ten 0.65-cm x 0.48-cm quadrats sampled along each of two transects (6.24 m² per site) during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>P. porites divaricata</i>		<i>P. porites furcata</i>		<i>P. porites</i> spp.	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	1	0.04 $\pm$ 0.04	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	1	0.04 $\pm$ 0.04	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S13 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	6	0.96 $\pm$ 0.64
U04 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S08 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S10 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	0	0 $\pm$ 0	0	0 $\pm$ 0	10	0.16 $\pm$ 0.09
Middle Florida Keys						
U40 - Marker 49A	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	6	0.96 $\pm$ 0.32
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0	0 $\pm$ 0	0	0 $\pm$ 0	6	0.14 $\pm$ 0.14
Upper Florida Keys						
S89 - Mosquito Bank	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	3	0.48 $\pm$ 0.16
S92 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	5	0.80 $\pm$ 0.16
S93 - Turtle Rocks	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	2	0.32 $\pm$ 0.32
Upper Florida Keys Total (5)	1	0.03 $\pm$ 0.03	1	0.03 $\pm$ 0.03	10	0.32 $\pm$ 0.15
Mid-channel Patch Reef Total (22)	1	0.01 $\pm$ 0.01	1	0.01 $\pm$ 0.01	26	0.19 $\pm$ 0.07
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16
S20 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0	0 $\pm$ 0	0	0 $\pm$ 0	2	0.32 $\pm$ 0.00
S17 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S18 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (8)	0	0 $\pm$ 0	0	0 $\pm$ 0	3	0.06 $\pm$ 0.04
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>P. porites divaricata</i>		<i>P. porites furcata</i>		<i>P. porites spp.</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.48
S62 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S64 - South of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
Middle Florida Keys Total (8)	0	0 ± 0	0	0 ± 0	5	0.10 ± 0.06
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	0	0 ± 0	5	0.80 ± 0.48
T04 - Inshore of Sand Island	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.00
T03 - White Bank	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T05 - White Bank	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.48
T09 - South of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
T08 - West of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.00
T06 - West of Elbow Reef	0	0 ± 0	0	0 ± 0	6	0.96 ± 0.96
T07 - SW of Watson's Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T31 - South of Watson's Reef	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
T20 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
T19 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
T24 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
Upper Florida Keys Total (12)	0	0 ± 0	0	0 ± 0	34	0.45 ± 0.07
Offshore Patch Reef Total (28)	0	0 ± 0	0	0 ± 0	42	0.24 ± 0.05
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.00
Lower Florida Keys Total (2)	0	0 ± 0	0	0 ± 0	2	0.16 ± 0.16
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S66 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S67 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
T16 - West of Alligator Reef	1	0.16 ± 0.16	2	0.32 ± 0.32	9	1.44 ± 0.80
T45 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
T46 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.64
V03 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
T36 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T22 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	1	0.01 ± 0.01	2	0.03 ± 0.03	22	0.32 ± 0.13
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	9	1.44 ± 1.12
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T17 - North of French Reef	0	0 ± 0	0	0 ± 0	8	1.28 ± 0.32
T18 - Watson's Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
Upper Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	19	0.76 ± 0.35
Shallow Hard-bottom Total (17)	1	0.01 ± 0.01	2	0.02 ± 0.02	43	0.41 ± 0.12
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
S45 - Rock Key SPA**	0	0 ± 0	1	0.32 ± 0.00	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0

Site number/site location	<i>P. porites divaricata</i>		<i>P. porites furcata</i>		<i>P. porites spp.</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0	0 ± 0	0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	0	0 ± 0	0	0 ± 0	5	0.80 ± 0.16
S34 - Maryland Shoal	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.48
S35 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S37 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.48
Lower Florida Keys Total (20)	0	0 ± 0	3	0.02 ± 0.02	18	0.14 ± 0.05
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
S76 - Delta Shoal	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.00
S77 - Delta Shoal	0	0 ± 0	0	0 ± 0	6	0.96 ± 0.64
Middle Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	11	0.44 ± 0.18
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T43 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T33 - Sand Island	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
T34 - Sand Island	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
T42 - French Reef SPA**	0	0 ± 0	0	0 ± 0	10	1.60 ± 0.32
T14 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T15 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
T39 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.64
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T35 - South of South Carysfort	0	0 ± 0	0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.48
Upper Florida Keys Total (18)	0	0 ± 0	0	0 ± 0	29	0.26 ± 0.09
Spur and Groove Total (44)	0	0 ± 0	3	0.01 ± 0.01	58	0.22 ± 0.05
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0
S27 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S23 - East of Rock Key SPA	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S54 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0
S55 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S48 - East of Western Sambo ER	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S49 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S52 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0
S53 - Eastern Sambo RO**	0	0 ± 0	1	0.16 ± 0.16	1	0.16 ± 0.16
U22 - West of Pelican Shoal	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S30 - East of Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0
S31 - East of Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0
S51 - American Shoal	0	0 ± 0	0	0 ± 0	0	0
S50 - American Shoal	0	0 ± 0	1	0.16 ± 0.16	0	0
Lower Florida Keys Total (14)	0	0 ± 0	2	0.02 ± 0.02	7	0.08 ± 0.02

Site number/site location	<i>P. porites divaricata</i>		<i>P. porites furcata</i>		<i>P. porites</i> spp.	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S80 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0
S74 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S72 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0
S86 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0
S85 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
S73 - East of Delta Shoal	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
S81 - SW of Coffins Patch	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
S75 - Marker 20	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S82 - Tennessee Reef	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.32
S83 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
S84 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
T56 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0
T57 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	8	1.28 ± 0.64
T54 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T55 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0
T47 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0
T23 - Little Conch Reef	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
T52 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	5	0.80 ± 0.48
T53 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0
V09 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.32
V10 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
Middle Florida Keys Total (22)	0	0 ± 0	0	0 ± 0	44	0.32 ± 0.07
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	0	0 ± 0	9	1.44 ± 0.80
U87 - Dixie Shoal	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
U84 - North of Dixie Shoal	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.32
T30 - South of Elbow Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T50 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.32
T26 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.32
T51 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	8	1.28 ± 0.32
T27 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.00
T25 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T48 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T49 - SE of Turtle Rocks	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.32
Upper Florida Keys Total (11)	0	0 ± 0	0	0 ± 0	41	0.60 ± 0.13
Deeper Fore-reef Total (47)	0	0 ± 0	2	0.01 ± 0.00	92	0.31 ± 0.05

Table 4-11. Numbers of juveniles (N) and mean $\pm$ 1 SE densities (no. per m²) of juvenile corals for the species *Scolymia* spp., *Siderastrea radians*, and *S. siderea* in the Florida Keys, as determined from ten 0.65-cm x 0.48-cm quadrats sampled along each of two transects (6.24 m² per site) during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>Scolymia</i> spp.		<i>S. radians</i>		<i>S. siderea</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	3	0.48 $\pm$ 0.48	3	0.48 $\pm$ 0.16
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	5	0.80 $\pm$ 0.80	2	0.32 $\pm$ 0.32
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	5	0.80 $\pm$ 0.80	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	15	0.60 $\pm$ 0.12	5	0.20 $\pm$ 0.12
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	15	0.60 $\pm$ 0.12	5	0.20 $\pm$ 0.12
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	1	0.16 $\pm$ 0.16	4	0.64 $\pm$ 0.64	42	6.73 $\pm$ 3.85
S13 - Western Sambo ER**	0	0 $\pm$ 0	5	0.80 $\pm$ 0.16	34	5.45 $\pm$ 2.56
S05 - North of Middle Sambo Reef	0	0 $\pm$ 0	19	3.04 $\pm$ 0.48	17	2.72 $\pm$ 0.48
S06 - North of Pelican Shoal	0	0 $\pm$ 0	20	3.21 $\pm$ 2.56	40	6.41 $\pm$ 0.32
U04 - North of Pelican Shoal	1	0.16 $\pm$ 0.16	6	0.96 $\pm$ 0.64	15	2.40 $\pm$ 0.16
S07 - West Washerwoman Shoal	1	0.16 $\pm$ 0.16	29	4.65 $\pm$ 0.80	16	2.56 $\pm$ 0.64
S08 - West Washerwoman Shoal	0	0 $\pm$ 0	23	3.69 $\pm$ 2.72	19	3.04 $\pm$ 0.80
S09 - North of Maryland Shoal	0	0 $\pm$ 0	18	2.88 $\pm$ 1.92	20	3.21 $\pm$ 0.64
S10 - North of American Shoal	0	0 $\pm$ 0	21	3.37 $\pm$ 1.12	21	3.37 $\pm$ 1.12
S11 - North of American Shoal	0	0 $\pm$ 0	34	5.45 $\pm$ 0.64	3	0.48 $\pm$ 0.16
Lower Florida Keys Total (10)	3	0.05 $\pm$ 0.02	179	2.87 $\pm$ 0.51	227	3.64 $\pm$ 0.62
Middle Florida Keys						
U40 - Marker 49A	0	0 $\pm$ 0	8	1.28 $\pm$ 0.64	11	1.76 $\pm$ 0.16
S58 - Marker 48	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32	8	1.28 $\pm$ 0.00
S59 - East Turtle Shoal	0	0 $\pm$ 0	25	4.01 $\pm$ 2.40	8	1.28 $\pm$ 0.64
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	20	3.21 $\pm$ 0.32	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	8	1.28 $\pm$ 1.28	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	6	0.96 $\pm$ 0.00
S95 - Hen and Chickens Reef SPA**	1	0.16 $\pm$ 0.16	5	0.80 $\pm$ 0.80	6	0.96 $\pm$ 0.96
Middle Florida Keys Total (7)	1	0.02 $\pm$ 0.02	68	1.56 $\pm$ 0.56	39	0.89 $\pm$ 0.25
Upper Florida Keys						
S89 - Mosquito Bank	0	0 $\pm$ 0	17	2.72 $\pm$ 1.12	10	1.60 $\pm$ 0.32
S90 - Mosquito Bank	0	0 $\pm$ 0	10	1.60 $\pm$ 0.64	2	0.32 $\pm$ 0.32
S91 - Basin Hill Shoals	4	0.64 $\pm$ 0.32	8	1.28 $\pm$ 0.00	16	2.56 $\pm$ 0.32
S92 - Basin Hill Shoals	0	0 $\pm$ 0	14	2.24 $\pm$ 0.32	10	1.60 $\pm$ 0.00
S93 - Turtle Rocks	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32	5	0.80 $\pm$ 0.48
Upper Florida Keys Total (5)	4	0.13 $\pm$ 0.13	51	1.63 $\pm$ 0.41	43	1.38 $\pm$ 0.38
Mid-channel Patch Reef Total (22)	8	0.06 $\pm$ 0.03	298	2.17 $\pm$ 0.33	309	2.25 $\pm$ 0.41
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	2	0.32 $\pm$ 0.32	2	0.32 $\pm$ 0.00	63	10.10 $\pm$ 2.08
S15 - North of Sand Key	1	0.16 $\pm$ 0.16	3	0.48 $\pm$ 0.16	88	14.10 $\pm$ 0.96
S16 - North of Sand Key	3	0.48 $\pm$ 0.48	4	0.64 $\pm$ 0.32	27	4.33 $\pm$ 0.80
S19 - Western Sambo ER**	2	0.32 $\pm$ 0.00	0	0 $\pm$ 0	62	9.94 $\pm$ 1.28
S20 - Western Sambo ER**	0	0 $\pm$ 0	6	0.96 $\pm$ 0.96	48	7.69 $\pm$ 3.53
U12 - West of Looe Key RO	0	0 $\pm$ 0	5	0.80 $\pm$ 0.48	69	11.06 $\pm$ 1.76
S17 - Looe Key RO**	2	0.32 $\pm$ 0.32	0	0 $\pm$ 0	13	2.08 $\pm$ 1.44
S18 - Looe Key RO**	0	0 $\pm$ 0	9	1.44 $\pm$ 0.80	8	1.28 $\pm$ 0.96
Lower Florida Keys Total (8)	10	0.20 $\pm$ 0.07	29	0.58 $\pm$ 0.17	378	7.57 $\pm$ 1.62
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	14	2.24 $\pm$ 0.96	1	0.16 $\pm$ 0.16

Site number/site location	<i>Scolymia</i> spp.		<i>S. radians</i>		<i>S. siderea</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	0	0 ± 0	21	3.37 ± 2.40	11	1.76 ± 0.16
S63 - Coffins Patch SPA**	0	0 ± 0	5	0.80 ± 0.16	2	0.32 ± 0.32
S62 - Coffins Patch SPA**	0	0 ± 0	4	0.64 ± 0.64	2	0.32 ± 0.32
S69 - Coffins Patch SPA**	0	0 ± 0	2	0.32 ± 0.32	3	0.48 ± 0.16
S70 - Coffins Patch SPA**	0	0 ± 0	1	0.16 ± 0.16	5	0.80 ± 0.48
S64 - South of Coffins Patch	0	0 ± 0	3	0.48 ± 0.16	3	0.48 ± 0.16
U42 - East of Coffins Patch	0	0 ± 0	7	1.12 ± 0.16	9	1.44 ± 0.48
Middle Florida Keys Total (8)	0	0 ± 0	57	1.14 ± 0.39	36	0.72 ± 0.21
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	8	1.28 ± 0.32	4	0.64 ± 0.32
T04 - Inshore of Sand Island	0	0 ± 0	11	1.76 ± 1.44	9	1.44 ± 0.80
T03 - White Bank	0	0 ± 0	5	0.80 ± 0.48	2	0.32 ± 0.32
T05 - White Bank	0	0 ± 0	5	0.80 ± 0.16	4	0.64 ± 0.32
T09 - South of Key Largo Dry Rocks	0	0 ± 0	11	1.76 ± 0.80	13	2.08 ± 0.16
T08 - West of Key Largo Dry Rocks	0	0 ± 0	15	2.40 ± 0.48	6	0.96 ± 0.32
T06 - West of Elbow Reef	0	0 ± 0	1	0.16 ± 0.16	3	0.48 ± 0.16
T07 - SW of Watson's Reef	0	0 ± 0	1	0.16 ± 0.16	1	0.16 ± 0.16
T31 - South of Watson's Reef	0	0 ± 0	6	0.96 ± 0.32	12	1.92 ± 0.96
T20 - Carysfort Reef SPA**	0	0 ± 0	8	1.28 ± 0.32	0	0 ± 0
T19 - Carysfort Reef SPA**	1	0.16 ± 0.16	6	0.96 ± 0.96	2	0.32 ± 0.00
T24 - North of Carysfort Reef	0	0 ± 0	19	3.04 ± 0.48	2	0.32 ± 0.00
Upper Florida Keys Total (12)	1	0.01 ± 0.01	96	1.28 ± 0.25	58	0.77 ± 0.20
Offshore Patch Reef Total (28)	11	0.06 ± 0.03	182	1.04 ± 0.17	472	2.70 ± 0.75
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	2	0.32 ± 0.32	0	0 ± 0
S22 - West of Looe Key SPA	0	0 ± 0	22	3.53 ± 1.28	16	2.56 ± 0.64
Lower Florida Keys Total (2)	0	0 ± 0	24	1.92 ± 1.60	16	1.28 ± 1.28
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	11	1.76 ± 0.16	7	1.12 ± 0.80
S66 - Tennessee Reef	0	0 ± 0	12	1.92 ± 0.32	11	1.76 ± 0.16
S68 - Tennessee Reef RO**	0	0 ± 0	5	0.80 ± 0.48	10	1.60 ± 0.32
S67 - Tennessee Reef RO**	0	0 ± 0	15	2.40 ± 1.44	4	0.64 ± 0.00
T16 - West of Alligator Reef	0	0 ± 0	5	0.80 ± 0.48	4	0.64 ± 0.64
T45 - Alligator Reef SPA**	0	0 ± 0	2	0.32 ± 0.32	6	0.96 ± 0.32
T46 - Alligator Reef SPA**	0	0 ± 0	7	1.12 ± 0.16	38	6.09 ± 0.00
V03 - Davis Reef SPA**	0	0 ± 0	4	0.64 ± 0.00	10	1.60 ± 0.64
T36 - Davis Reef SPA**	0	0 ± 0	5	0.80 ± 0.48	6	0.96 ± 0.32
T21 - Conch Reef SPA**	0	0 ± 0	2	0.32 ± 0.32	12	1.92 ± 0.64
T22 - Conch Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
Middle Florida Keys Total (11)	0	0 ± 0	69	1.01 ± 0.22	108	1.57 ± 0.48
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	2	0.32 ± 0.32	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	3	0.48 ± 0.48	0	0 ± 0
T18 - Watson's Reef	0	0 ± 0	12	1.92 ± 0.32	1	0.16 ± 0.16
Upper Florida Keys Total (4)	0	0 ± 0	17	0.68 ± 0.43	1	0.04 ± 0.04
Shallow Hard-bottom Total (17)	0	0 ± 0	110	1.04 ± 0.23	125	1.18 ± 0.36
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S44 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32

Site number/site location	<i>Scolymia</i> spp.		<i>S. radians</i>		<i>S. siderea</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	6	0.96 ± 0.00	10	1.60 ± 0.32
S41 - Western Sambo ER**	0	0 ± 0	1	0.16 ± 0.16	3	0.48 ± 0.48
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	16	2.56 ± 1.92
S39 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
S24 - East of Eastern Sambo RO	0	0 ± 0	0	0 ± 0	7	1.12 ± 0.16
U24 - Pelican Shoal	0	0 ± 0	1	0.16 ± 0.16	2	0.32 ± 0.00
U23 - Maryland Shoal	0	0 ± 0	3	0.48 ± 0.48	1	0.16 ± 0.16
S34 - Maryland Shoal	0	0 ± 0	8	1.28 ± 0.32	6	0.96 ± 0.32
S35 - American Shoal	0	0 ± 0	0	0 ± 0	8	1.28 ± 0.00
S36 - Looe Key SPA**	0	0 ± 0	2	0.32 ± 0.32	10	1.60 ± 0.64
S37 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	9	1.44 ± 0.16
Lower Florida Keys Total (20)	0	0 ± 0	21	0.17 ± 0.08	87	0.70 ± 0.16
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	2	0.32 ± 0.32	3	0.48 ± 0.16
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S76 - Delta Shoal	0	0 ± 0	2	0.32 ± 0.32	5	0.80 ± 0.48
S77 - Delta Shoal	0	0 ± 0	8	1.28 ± 0.32	13	2.08 ± 1.12
Middle Florida Keys Total (4)	0	0 ± 0	12	0.48 ± 0.28	22	0.88 ± 0.42
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	8	1.28 ± 1.28	4	0.64 ± 0.32
T43 - Molasses Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T33 - Sand Island	0	0 ± 0	4	0.64 ± 0.32	4	0.64 ± 0.00
T34 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0	0 ± 0	0	0 ± 0	6	0.96 ± 0.64
T14 - Grecian Rocks SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	2	0.32 ± 0.32	3	0.48 ± 0.16
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	4	0.64 ± 0.64
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T10 - North-North Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0	0 ± 0	4	0.64 ± 0.32	0	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0	0 ± 0	3	0.48 ± 0.16	16	2.56 ± 0.00
Upper Florida Keys Total (18)	0	0 ± 0	23	0.20 ± 0.08	39	0.35 ± 0.15
Spur and Groove Total (44)	0	0 ± 0	56	0.21 ± 0.06	148	0.56 ± 0.11
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0	0 ± 0	3	0.48 ± 0.16	23	3.69 ± 2.40
S27 - Sand Key SPA**	0	0 ± 0	4	0.64 ± 0.32	10	1.60 ± 0.64
S23 - East of Rock Key SPA	0	0 ± 0	1	0.16 ± 0.16	5	0.80 ± 0.16
S54 - Western Sambo ER**	2	0.32 ± 0.32	1	0.16 ± 0.16	46	7.37 ± 0.32
S55 - Western Sambo ER**	0	0 ± 0	1	0.16 ± 0.16	35	5.61 ± 0.48
S48 - East of Western Sambo ER	0	0 ± 0	0	0 ± 0	21	3.37 ± 0.80
S49 - Middle Sambo Reef	0	0 ± 0	6	0.96 ± 0.00	33	5.29 ± 1.76
S52 - Eastern Sambo RO**	0	0 ± 0	2	0.32 ± 0.32	39	6.25 ± 3.04
S53 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	32	5.13 ± 3.21
U22 - West of Pelican Shoal	0	0 ± 0	0	0 ± 0	29	4.65 ± 0.80
S30 - East of Pelican Shoal	0	0 ± 0	20	3.21 ± 0.96	29	4.65 ± 1.76
S31 - East of Maryland Shoal	0	0 ± 0	5	0.80 ± 0.48	14	2.24 ± 0.96
S51 - American Shoal	0	0 ± 0	9	1.44 ± 1.12	4	0.64 ± 0.32
S50 - American Shoal	0	0 ± 0	7	1.12 ± 0.80	44	7.05 ± 3.53
Lower Florida Keys Total (14)	2	0.02 ± 0.02	59	0.68 ± 0.23	364	4.17 ± 0.59

Site number/site location	<i>Scolymia</i> spp.		<i>S. radians</i>		<i>S. siderea</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0	0 ± 0	0	0 ± 0	8	1.28 ± 0.00
S80 - West of Sombrero Key	0	0 ± 0	9	1.44 ± 0.80	4	0.64 ± 0.00
S74 - West of Sombrero Key	0	0 ± 0	8	1.28 ± 0.96	15	2.40 ± 0.80
S72 - West of Sombrero Key	0	0 ± 0	12	1.92 ± 1.28	2	0.32 ± 0.32
S86 - Sombrero Key SPA	0	0 ± 0	19	3.04 ± 0.80	0	0 ± 0
S85 - Sombrero Key SPA	0	0 ± 0	78	12.50 ± 3.85	29	4.65 ± 2.08
S73 - East of Delta Shoal	0	0 ± 0	3	0.48 ± 0.16	2	0.32 ± 0.32
S81 - SW of Coffins Patch	0	0 ± 0	14	2.24 ± 0.64	7	1.12 ± 0.48
S75 - Marker 20	0	0 ± 0	10	1.60 ± 0.64	14	2.24 ± 0.64
S82 - Tennessee Reef	0	0 ± 0	38	6.09 ± 0.00	4	0.64 ± 0.00
S83 - Tennessee Reef RO**	0	0 ± 0	32	5.13 ± 1.60	19	3.04 ± 0.80
S84 - Tennessee Reef RO**	0	0 ± 0	16	2.56 ± 1.28	20	3.21 ± 0.32
T56 - Alligator Reef SPA**	0	0 ± 0	25	4.01 ± 1.12	4	0.64 ± 0.64
T57 - Alligator Reef SPA**	0	0 ± 0	24	3.85 ± 2.56	9	1.44 ± 0.80
T54 - Davis Reef SPA**	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
T55 - Davis Reef SPA**	0	0 ± 0	4	0.64 ± 0.32	0	0 ± 0
T47 - Little Conch Reef	0	0 ± 0	1	0.16 ± 0.16	6	0.96 ± 0.32
T23 - Little Conch Reef	0	0 ± 0	6	0.96 ± 0.32	3	0.48 ± 0.16
T52 - Conch Reef SPA**	0	0 ± 0	3	0.48 ± 0.16	8	1.28 ± 0.32
T53 - Conch Reef SPA**	0	0 ± 0	6	0.96 ± 0.64	1	0.16 ± 0.16
V09 - Conch Reef RO**	0	0 ± 0	3	0.48 ± 0.16	10	1.60 ± 0.64
V10 - Conch Reef RO**	0	0 ± 0	1	0.16 ± 0.16	7	1.12 ± 0.48
Middle Florida Keys Total (22)	0	0 ± 0	317	2.31 ± 0.60	172	1.25 ± 0.26
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	6	0.96 ± 0.32	10	1.60 ± 0.64
U97 - Dixie Shoal	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
U94 - North of Dixie Shoal	0	0 ± 0	7	1.12 ± 0.48	4	0.64 ± 0.64
T30 - South of Elbow Reef	0	0 ± 0	4	0.64 ± 0.32	8	1.28 ± 0.32
T50 - Carysfort Reef SPA**	0	0 ± 0	6	0.96 ± 0.00	3	0.48 ± 0.48
T26 - Carysfort Reef SPA**	0	0 ± 0	6	0.96 ± 0.32	3	0.48 ± 0.48
T51 - Carysfort Reef SPA**	0	0 ± 0	4	0.64 ± 0.64	2	0.32 ± 0.32
T27 - Carysfort Reef SPA**	0	0 ± 0	5	0.80 ± 0.80	4	0.64 ± 0.32
T25 - North of Carysfort Reef	1	0.16 ± 0.16	6	0.96 ± 0.32	3	0.48 ± 0.16
T48 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	3	0.48 ± 0.16
T49 - SE of Turtle Rocks	0	0 ± 0	0	0 ± 0	2	0.32 ± 0.32
Upper Florida Keys Total (11)	1	0.01 ± 0.01	44	0.64 ± 0.13	43	0.63 ± 0.13
Deeper Fore-reef Total (47)	3	0.01 ± 0.01	420	1.43 ± 0.31	579	1.97 ± 0.30

Table 4-12. Numbers of juveniles (N) and mean $\pm$ 1 SE densities (no. per m²) of juvenile corals for the species *Solenastrea bournoni*, *Stephanocoenia michelini*, and unidentified juveniles in the Florida Keys, as determined from ten 0.65-cm x 0.48-cm quadrats sampled along two transects (6.24 m² per site) during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>S. bournoni</i>		<i>S. michelini</i>		Unidentified juveniles	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	1	0.16 $\pm$ 0.16	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	2	0.08 $\pm$ 0.05	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	2	0.08 $\pm$ 0.05	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	2	0.32 $\pm$ 0.32	20	3.21 $\pm$ 0.64	0	0 $\pm$ 0
S13 - Western Sambo ER**	0	0	8	1.28 $\pm$ 0.00	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	0	0	6	0.96 $\pm$ 0.00	0	0 $\pm$ 0
S06 - North of Pelican Shoal	2	0.32 $\pm$ 0.32	9	1.44 $\pm$ 0.16	0	0 $\pm$ 0
U04 - North of Pelican Shoal	0	0	5	0.80 $\pm$ 0.48	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	1	0.16 $\pm$ 0.16	3	0.48 $\pm$ 0.16	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	0	0	6	0.96 $\pm$ 0.00	2	0.32 $\pm$ 0.32
S09 - North of Maryland Shoal	0	0	7	1.12 $\pm$ 0.48	0	0 $\pm$ 0
S10 - North of American Shoal	2	0.32 $\pm$ 0.32	16	2.56 $\pm$ 0.32	3	0.48 $\pm$ 0.16
S11 - North of American Shoal	4	0.64 $\pm$ 0.32	2	0.32 $\pm$ 0.32	0	0 $\pm$ 0
Lower Florida Keys Total (10)	11	0.18 $\pm$ 0.07	82	1.31 $\pm$ 0.29	5	0.08 $\pm$ 0.05
Middle Florida Keys						
U40 - Marker 49A	0	0 $\pm$ 0	12	1.92 $\pm$ 0.32	1	0.16 $\pm$ 0.16
S58 - Marker 48	0	0 $\pm$ 0	2	0.32 $\pm$ 0.00	0	0 $\pm$ 0
S59 - East Turtle Shoal	1	0.16 $\pm$ 0.16	3	0.48 $\pm$ 0.16	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	1	0.02 $\pm$ 0.02	17	0.39 $\pm$ 0.27	1	0.02 $\pm$ 0.02
Upper Florida Keys						
S89 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	0	0 $\pm$ 0	2	0.32 $\pm$ 0.32	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	0	0 $\pm$ 0	2	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	12	0.09 $\pm$ 0.04	101	0 $\pm$ 0	6	0.04 $\pm$ 0.03
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0	0 $\pm$ 0	21	3.37 $\pm$ 0.48	3	0.48 $\pm$ 0.48
S15 - North of Sand Key	0	0 $\pm$ 0	8	1.28 $\pm$ 0.32	0	0 $\pm$ 0
S16 - North of Sand Key	0	0 $\pm$ 0	2	0.32 $\pm$ 0.00	0	0 $\pm$ 0
S19 - Western Sambo ER**	0	0 $\pm$ 0	22	3.53 $\pm$ 0.00	0	0 $\pm$ 0
S20 - Western Sambo ER**	0	0 $\pm$ 0	30	4.81 $\pm$ 0.96	1	0.16 $\pm$ 0.16
U12 - West of Looe Key RO	0	0 $\pm$ 0	14	2.24 $\pm$ 0.96	3	0.48 $\pm$ 0.16
S17 - Looe Key RO**	0	0 $\pm$ 0	13	2.08 $\pm$ 0.80	0	0 $\pm$ 0
S18 - Looe Key RO**	0	0 $\pm$ 0	11	1.76 $\pm$ 1.12	0	0 $\pm$ 0
Lower Florida Keys Total (8)	0	0 $\pm$ 0	121	2.42 $\pm$ 0.50	7	0.14 $\pm$ 0.08
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>S. bournoni</i>		<i>S. michelini</i>		Unidentified juveniles	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
S63 - Coffins Patch SPA**	0	0 ± 0	6	0.96 ± 0.32	0	0 ± 0
S62 - Coffins Patch SPA**	0	0 ± 0	4	0.64 ± 0.00	0	0 ± 0
S69 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	0	0 ± 0	2	0.32 ± 0.32	0	0 ± 0
U42 - East of Coffins Patch	0	0 ± 0	6	0.96 ± 0.00	0	0 ± 0
Middle Florida Keys Total (8)	0	0 ± 0	23	0.46 ± 0.15	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T03 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T05 - White Bank	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T08 - West of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	0	0 ± 0	1	0.16 ± 0.16	1	0.16 ± 0.16
T20 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T24 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	0	0 ± 0	4	0.05 ± 0.02	1	0.01 ± 0.01
Offshore Patch Reef Total (28)	0	0 ± 0	148	0.85 ± 0.24	8	0.05 ± 0.02
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	1	0.16 ± 0.16	9	1.44 ± 0.16	1	0.16 ± 0.16
Lower Florida Keys Total (2)	1	0.08 ± 0.08	9	0.72 ± 0.72	1	0.08 ± 0.08
Middle Florida Keys						
S65 - SE of Coffins Patch	1	0.16 ± 0.16	2	0.32 ± 0.32	0	0 ± 0
S66 - Tennessee Reef	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
S68 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
T16 - West of Alligator Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T21 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	1	0.01 ± 0.01	9	0 ± 0	0	0 ± 0
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (4)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Shallow Hard-bottom Total (17)	2	0.02 ± 0.01	18	0.17 ± 0.09	1	0.01 ± 0.01
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
S45 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0

Site number/site location	<i>S. bournoni</i>		<i>S. michelini</i>		Unidentified juveniles	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0	0 ± 0	0	0 ± 0	1	0.16 ± 0.16
U24 - Pelican Shoal	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
U23 - Maryland Shoal	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
S34 - Maryland Shoal	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
S35 - American Shoal	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
S36 - Looe Key SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
S37 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	0	0 ± 0	6	0.05 ± 0.02	2	0.02 ± 0.01
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
S77 - Delta Shoal	0	0 ± 0	2	0.32 ± 0.32	0	0 ± 0
Middle Florida Keys Total (4)	0	0 ± 0	3	0.12 ± 0.08	0	0 ± 0
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T33 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T34 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0	0 ± 0	0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	0	0 ± 0	0	0 ± 0	0	0 ± 0
Spur and Groove Total (44)	0	0 ± 0	9	0.03 ± 0.01	2	0.01 ± 0.01
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0	0 ± 0	12	1.92 ± 0.32	1	0.16 ± 0.16
S27 - Sand Key SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
S23 - East of Rock Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	0	0 ± 0	10	1.60 ± 0.00	0	0 ± 0
S55 - Western Sambo ER**	1	0.16 ± 0.16	4	0.64 ± 0.00	0	0 ± 0
S48 - East of Western Sambo ER	0	0 ± 0	0	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	0	0 ± 0	3	0.48 ± 0.48	0	0 ± 0
S52 - Eastern Sambo RO**	0	0 ± 0	7	1.12 ± 0.16	0	0 ± 0
S53 - Eastern Sambo RO**	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
U22 - West of Pelican Shoal	0	0 ± 0	5	0.80 ± 0.16	0	0 ± 0
S30 - East of Pelican Shoal	0	0 ± 0	6	0.96 ± 0.64	0	0 ± 0
S31 - East of Maryland Shoal	0	0 ± 0	7	1.12 ± 0.48	0	0 ± 0
S51 - American Shoal	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
S50 - American Shoal	2	0.32 ± 0.00	12	1.92 ± 0.96	0	0 ± 0
Lower Florida Keys Total (14)	3	0.03 ± 0.02	73	0.84 ± 0.17	1	0.01 ± 0.01

Site number/site location	<i>S. bournoni</i>		<i>S. michelini</i>		Unidentified juveniles	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0	0 ± 0	12	1.92 ± 0.32	0	0 ± 0
S80 - West of Sombrero Key	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
S74 - West of Sombrero Key	1	0.16 ± 0.16	6	0.96 ± 0.00	1	0.16 ± 0.16
S72 - West of Sombrero Key	2	0.32 ± 0.32	0	0 ± 0	1	0.16 ± 0.16
S86 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	4	0.64 ± 0.32	9	1.44 ± 0.16	1	0.16 ± 0.16
S73 - East of Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	1	0.16 ± 0.16	6	0.96 ± 0.32	1	0.16 ± 0.16
S75 - Marker 20	0	0 ± 0	6	0.96 ± 0.64	0	0 ± 0
S82 - Tennessee Reef	0	0 ± 0	3	0.48 ± 0.16	2	0.32 ± 0.32
S83 - Tennessee Reef RO**	0	0 ± 0	9	1.44 ± 1.12	1	0.16 ± 0.16
S84 - Tennessee Reef RO**	0	0 ± 0	6	0.96 ± 0.00	1	0.16 ± 0.16
T56 - Alligator Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T57 - Alligator Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T54 - Davis Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T55 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0	0 ± 0	2	0.32 ± 0.32	0	0 ± 0
V10 - Conch Reef RO**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
Middle Florida Keys Total (22)	8	0.06 ± 0.03	66	0.48 ± 0.12	8	0.06 ± 0.02
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	3	0.48 ± 0.16	0	0 ± 0
U87 - Dixie Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0	0 ± 0	1	0.16 ± 0.16	1	0.16 ± 0.16
T30 - South of Elbow Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	1	0.16 ± 0.16
T26 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0	0 ± 0	1	0.16 ± 0.16	0	0 ± 0
T27 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	0	0 ± 0	6	0.09 ± 0.05	2	0.03 ± 0.02
Deeper Fore-reef Total (47)	11	0.04 ± 0.02	145	0.49 ± 0.09	11	0.04 ± 0.01

V. Density and Species Richness of Gorgonians and *Cyphoma* Snails

Background

Gorgonians (Octocorallia, Alcyonaria) occur at their greatest diversity in the wider Caribbean, often exceeding reef-building corals in species richness and colony density. They often dominate coral reef and hard-bottom communities and their contribution to spatial complexity can be substantial, particularly in sediment-rich areas and on reefs with lower stony coral cover (Wheaton and Jaap 1988; Chiappone and Sullivan 1997). Gorgonian distribution patterns are primarily influenced by physical environmental conditions such as substrate availability, water depth and flow, wave energy, and light intensity. Factors affecting gorgonian population dynamics include recruitment variability, mortality due to toppling, predation, and disease. Additional factors such as episodic storms, anthropogenic impacts, reef morphology, and geographic setting also contribute to spatial and temporal variability.

Most gorgonian predators, such as ovulid gastropods like the flamingo tongue snail *Cyphoma gibbosum* Linnaeus (Figure 5-1), cause only partial colony mortality, ranging from consumption of the polyps to rasping of the axial coenochyme, sometimes to the depth of the proteinaceous axis (Harvell and Fenical 1989; Neudecker 1985). Usually found in male and female pairs, *C. gibbosum* is a generalist browser and has been the subject of numerous studies concerned with distribution and gorgonian occupancy patterns in the Caribbean (e.g. Birkeland and Gregory 1975; Hazlett and Bach 1982; Harvell and Suchanek 1987). Several hypotheses have been proposed to explain the factors that control *C. gibbosum* populations in typically prey-rich environments: recruitment limitation (which has yet to be adequately studied), predation by hogfish (*Lachnolaimus maximus*) and other predators (Randall and Warmke 1967; Shoup 1968), gorgonian structural defenses (Lewis and Von Wallis, 1991; Van Alstyne and Paul 1992; West 1997), and chemical defenses (Pawlik et al. 1987; Sammarco and Coll 1992; Pawlik and Fenical 1989; Van Alstyne and Paul 1992). Although food abundance may be expected to lead to significant prey preference, considerable variability exists in observed patterns of gorgonian host occupancy by *C. gibbosum*. These patterns range from preference of several species (Birkeland and Gregory, 1975; Lasker et al. 1988) to occupancy of gorgonian species in proportion to their availability (Kinzie 1970; Harvell and Suchanek 1987). The variability in experimental results may reflect temporal or geographic differences in preferences or variability in prey quality (Lasker et al., 1988). Gorgonian defenses such as sclerite content (Harvell and Suchanek, 1987; Van Alstyne and Paul, 1992; West, 1997) and secondary metabolites (Hazlett and Bach 1982; Pawlik et al. 1987; Sammarco and Coll 1992) do not clearly explain prey utilization patterns. *Cyphoma gibbosum* apparently tolerates high levels of gorgonian terpenes (Vrolijk and Targett 1992) and may sequester these compounds in its mantle, similar to other ovulid gastropods do (Coll et al. 1983). We include *C. gibbosum* as part of our gorgonian surveys as one

potential indicator of change inside no-take managed areas that might result from changing predator densities (Chiappone et al. 2003).

2009 Survey Results

Similar to surveys conducted during 1999-2001, 2005, and 2008 in the Florida Keys (Chiappone et al. 2003), we quantified gorgonian numbers by species for all 160 sites visited during 2009, including both branching and encrusting species (e.g. *Briareum asbestinum* and *Erythropodium caribaeorum*). The numbers, shell lengths, and gorgonian host occupation patterns of flamingo-tongue snails were also collected (Figure 5-1), similar to surveys in 2001 and 2008. Gorgonians were enumerated in two 8-m x 1-m belt transects per site at all 160 sites during 2009 (a total area of 2,560 m²) and four 15-m x 1-m belt transect areas were surveyed for *Cyphoma* snails (a total area of 9,600 m²). Table 5-1 provides site-level density and size data for *Cyphoma* snails, as well as total gorgonian densities, while Figures 5-2 to 5-7 provide distribution maps of total gorgonian densities. Table 5-2 provides data on *Cyphoma* sizes and gorgonian host occupation patterns. Tables 5-3 to 5-12 provide site-level, habitat, and regional density data for all gorgonian species encountered during 2009.

A total of 34,956 gorgonians representing 31 species were identified and counted during 2009. Site-level mean (± 1 SE) colony densities ranged from 0 to 38.4 ± 1.3 per m² among the 160 sites (Table 5-1). Similar to previous years, offshore patch reefs (17.81 ± 1.67 colonies per m²) and mid-channel patch reefs (17.45 ± 2.03 colonies per m²) yielded the greatest mean densities, while inshore patch reefs (3.75 ± 1.88) and shallow hard-bottom (10.50 ± 1.52) had the lowest. A total of 111 *Cyphoma* snails, represented exclusively by *C. gibbosum*, were recorded from surveys of 9,600 m² of benthic habitat; no *C. signatum* individuals were found during 2009, in contrast to previous years. *C. gibbosum* shell length (SL) averaged 2.78 ± 0.03 cm and ranged from 1.6 cm to 3.5 cm (Table 5-2). Nearly 80% of all individuals found were between 2.0 cm and 2.9 cm SL. The maximum site-level density of 0.200 ± 0.098 individuals per m² was recorded from a mid-channel patch reef north of Pelican Shoal in the lower Keys (Table 5-1). *C. gibbosum* was recorded from all habitats, but frequency of occurrence and density varied somewhat among habitat types. Mid-channel ($14\% \pm 5\%$ frequency of occurrence, 0.023 ± 0.011 per m²) and offshore patch reefs ($12\% \pm 5\%$ frequency of occurrence, 0.011 ± 0.004 per m²), along with high-relief spur and groove ($13\% \pm 3\%$ frequency of occurrence, 0.019 ± 0.005 per m²), yielded the greatest transect frequencies and mean density values. Thus, there was not complete correspondence between total gorgonian and *Cyphoma* snail densities by habitat (Tables 5-1 and 5-2).

Of the 111 *Cyphoma* snails encountered, all except one individual were found on living gorgonian hosts (Table 5-2). The most frequently occupied gorgonian genera by *Cyphoma* snails were *Eunicea* (21.6%), *Plexaura* (16.2%), and *Pseudopterogorgia* (16.2%). These three genera represented 9.9%, 6.5%, and 50.0% of the branching gorgonians sampled, respectively (Tables 5-3 to 5-12). It appears that some gorgonian species were occupied by *Cyphoma* disproportionately relative to their abundance (e.g. *Eunicea*, *Plexaura*, *Plexaurella*), while others were not (e.g. *Gorgonia*). Regional variations in *Cyphoma* distribution and abundance were not consistent and varied by habitat. On mid-channel patch reefs, frequency of occurrence ($23\% \pm 9\%$) and mean density (0.038 ± 0.020 per m^2) were greater in the lower Keys, especially in reference areas compared to no-take zones. On offshore patch reefs, *C. gibbosum* was more abundant in the middle Keys ($31\% \pm 13\%$ transect frequency, 0.025 ± 0.010 per m^2) in both Coffins Patch SPA and reference sites compared to the lower and upper Keys. On high-relief spur and groove reefs, *C. gibbosum* was more frequently encountered in the middle and lower Keys, especially in reference areas.

Regional patterns in the composition of gorgonian assemblages were specific to particular habitat types. Among all sites, the dominant species were *Gorgonia ventalina* (4,724 colonies, 13.5%) and *Pseudopterogorgia americana* (10,153 colonies, 29%), followed by *Erythropodium caribaeorum*, *Plexaura flexuosa*, *Pseudoplexaura porosa*, and *P. acerosa* (Tables 5-3 to 5-12). On mid-channel patch reefs, mean gorgonian density was substantially greater in the lower Keys (21.30 ± 2.59) and upper Keys (22.24 ± 2.91) compared to the middle Keys (8.54 ± 2.73) (Figure 5-8). On offshore patch reefs, mean density was ~2 times greater in the upper Keys (Figure 5-8) and there appeared to be an increasing pattern from the lower to the upper Keys, similar to that observed in high-relief spur and groove (Figure 5-9). In other habitats such as low-relief hard-bottom and the deeper fore reef, there was a greater degree of similarity in total gorgonian densities among regions.

Discussion

During 2001 and 2008, we assessed *Cyphoma* and gorgonians at 208 sites. Although considerable variability occurred between sites and years, *Cyphoma* densities were similar to those reported by Lasker and Coffroth (1988). In 2009, we found greater numbers of snails than in 2008, but not compared to 2001, although there were similar patterns relative to habitat type and management zone. Chiappone et al. 2003 found that the snails exhibited a clumped distribution on gorgonian hosts, mirroring previous results from the Virgin Islands (Birkeland and Gregory 1975; Hazlett and Bach 1982) and Panama (Lasker and Coffroth 1988). Although more solitary individuals were found than pairs or aggregations, it is possible that these individuals were searching for mates (Ghiselin and Wilson 1966). Lasker and Coffroth (1988)

proposed that the clumped distribution of *C. gibbosum* could be due to intra-colony variation in secondary metabolite content of gorgonians, while Gerhart (1986) stated that gregariousness is due to mucous trail following. All but one of the snails encountered during 2009 were found on gorgonian hosts. Birkeland and Gregory (1975) found only 1 % of individuals on the substratum, and Harvell and Suchanek (1987) showed that *C. gibbosum* generally avoids even the basal regions of gorgonians.

Our results indicate that Florida Keys gorgonian hosts are readily available and that *C. gibbosum* is probably not food-limited. The distribution patterns of *C. gibbosum* are produced by at least two independent processes: the movement of individuals to colonies (Lasker et al. 1988) and the time spent on a colony (Gerhart 1986; Lasker and Coffroth 1988). Considering the differences in gorgonian density patterns and management histories of the various regions surveyed in the Florida Keys, one may expect differences in snail densities among habitats, regions, and management zones. More snails were found on patch reef and platform margin spur and groove sites. Snail densities did not correspond exactly with total gorgonian densities, and this lack of correspondence, while not unexpected in a prey-rich environment, indicates that factors in addition to host availability affect *C. gibbosum* densities. For example, if fishing affects snail predators (such as hogfish, *Lachnolaimus maximus*) (Randall and Warmke 1967), it is possible that higher snail densities within the spur and groove habitat in particular regions could be explained by protection from fishing. Snail densities were lower in the upper Keys, which have been long-protected from spear-fishing, than in the middle and lower Keys. All of the snails found on upper Keys spur and groove reefs were in reference areas. Similar patterns were observed in the spur and groove habitat in the middle Keys between fished and protected sites, but not in the lower Keys.

Surveys conducted in 2001 found that most gorgonians were occupied in proportion to their abundance or were under-occupied by snails, while a few species were occupied in disproportion to their availability, indicating possible host preference (Chiappone et al. 2003). We observed that the plexaurids *Eunicea tourneforti*, *Plexaura flexuosa*, *P. homomalla*, *Plexaurella dichotoma*, and *Pseudoplexaura porosa* were occupied preferentially relative to their densities. These results agree somewhat with previous studies, although increasing densities of these gorgonian hosts did not correlate with increased snail densities. The most common gorgonians occupied in Panama were *P. homomalla*, *Pseudoplexaura* spp., and *Pseudopterogorgia* spp. (Lasker and Coffroth 1988; Lasker et al. 1988), and Lasker and Coffroth (1988) found a strong bias for sea plumes and lesser preferences for other species. Strong preferences for Gorgoniidae, especially sea plumes and *G. ventalina*, were also documented in the Virgin Islands (Birkeland and Gregory 1975; Harvell and Suchanek 1987), but in the Florida Keys there was no strong preference for Gorgoniidae despite relatively high densities. Several mechanisms have been proposed to

explain the host occupancy patterns of *Cyphoma gibbosum*, principally among them structural and chemical defenses of gorgonians. Harvell and Suchanek (1987) observed that foraging times were negatively correlated with the proportion and size of component sclerites in gorgonians. *C. gibbosum* seems capable of tolerating the unusually high levels of gorgonian chemical defenses (Pawlik et al. 1987; Sammarco and Coll 1992). For example, this snail is immune to prostaglandins produced by *Plexaura homomalla* (Gerhart 1986), one of the commonly occupied gorgonians in the Florida Keys.

Previous studies have concluded that predation, especially by *Cyphoma gibbosum*, imposes a minor effect on gorgonians relative to other factors such as colony toppling during storms, structural failure of the underlying substratum, and sediment scouring and burial. Predation by *C. gibbosum* played a negligible role in gorgonian mortality during a five-year study at two reefs on the southwest coast of Puerto Rico, even though individuals were noted frequently (Yoshioka and Yoshioka 1991). In the Florida Keys, of the 9,911 colonies assessed during 2001, approximately 0.5% were occupied by *C. gibbosum* (Chiappone et al. 2003). In 2008, over 32,000 colonies were counted, but only 0.13% was occupied by snails, while in 2009, snail occupancy was 0.36%. Although lower occupancy rates were found in 2008 and 2009 compared to 2001, all three sampling periods yielded relatively similar distribution patterns in snail host occupation, especially between no-fishing zones and reference areas. Targeted studies on the relationships between predators and prey, such as hogfish (*Lachnolaimus maximus*) and *C. gibbosum*, including detailed censuses of fishes and snails in multiple habitat types, and experimental work to document predation, will provide important insight into how changing fish communities in marine reserves help to structure the benthos. Other factors that may influence patterns of ovulid gastropods in the Florida Keys, and thus warrant further study, include recruitment variability and removal by recreational and commercial aquarium (marine ornamental) collectors.

Figure 5-1. Flamingo-tongue snails (*Cyphoma gibbosum*) surveyed for density, size, and gorgonian host occupation patterns in the Florida Keys during 2009.

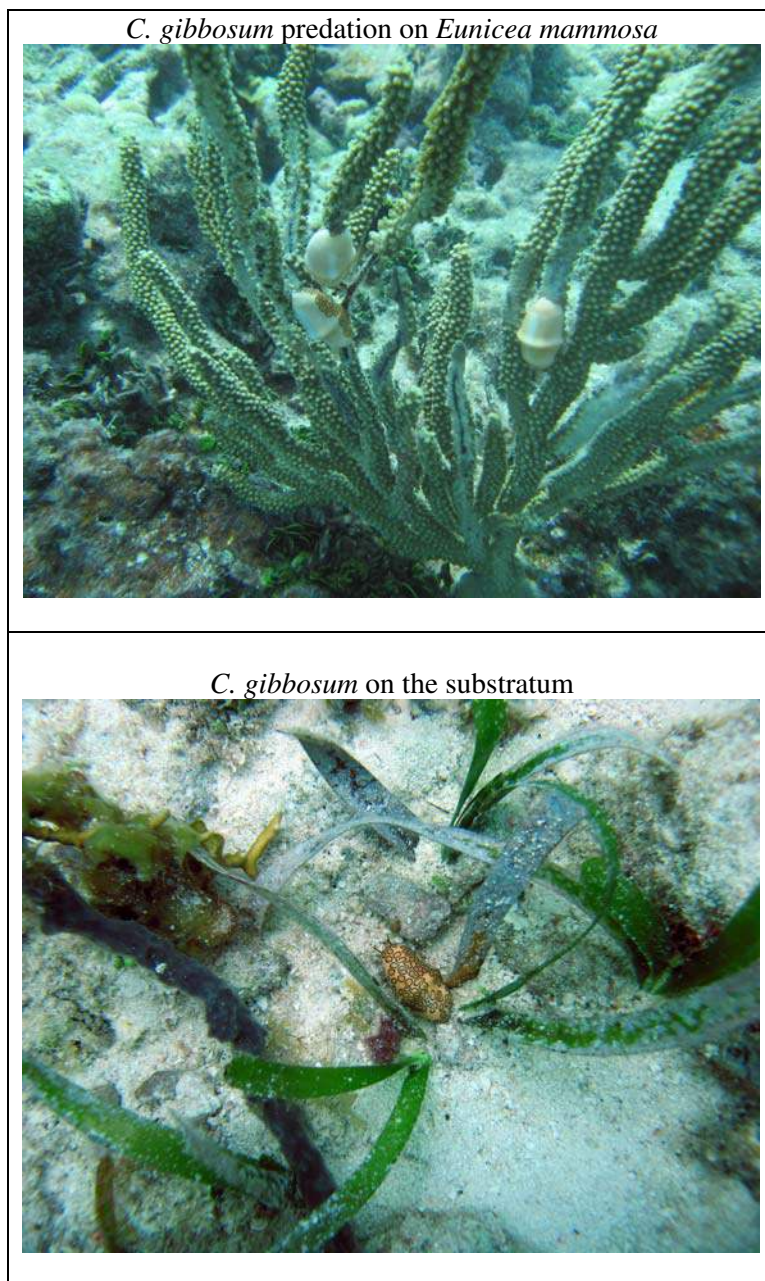


Figure 5-2. Total gorgonian densities (no. colonies per m²) in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

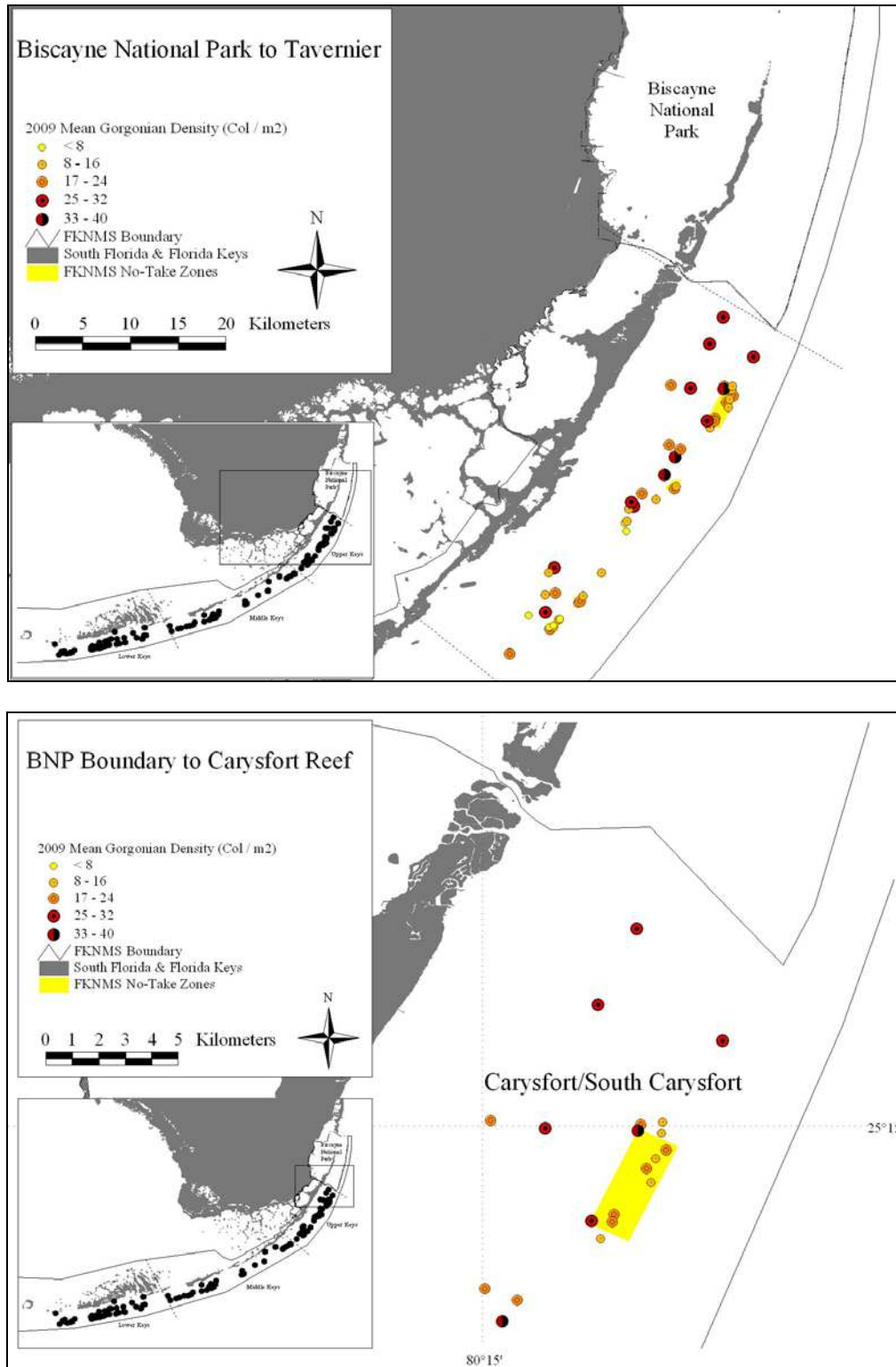


Figure 5-3. Total gorgonian densities (no. colonies per m²) in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region during May-September 2009.

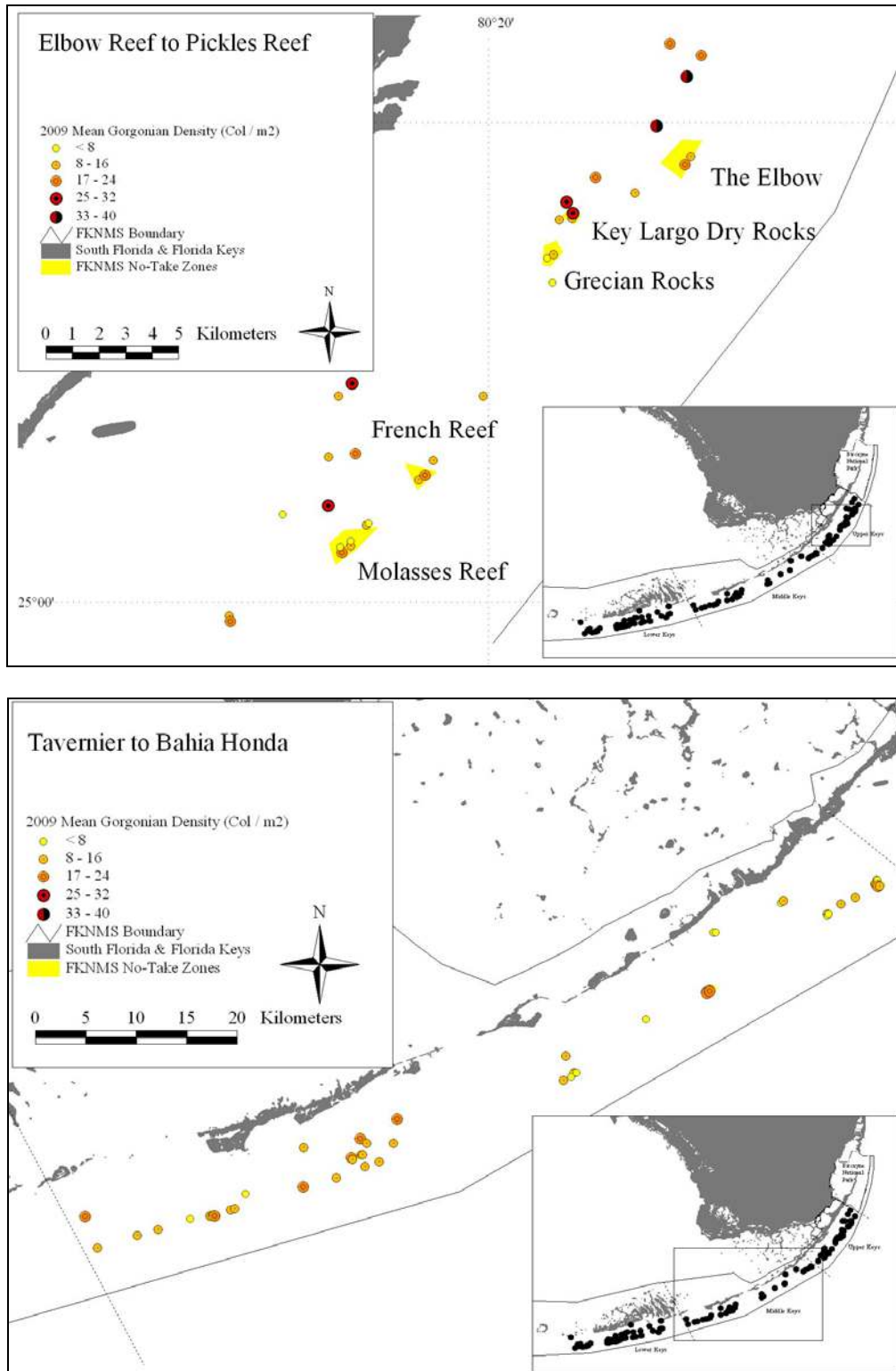


Figure 5-4. Total gorgonian densities (no. colonies per m²) in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

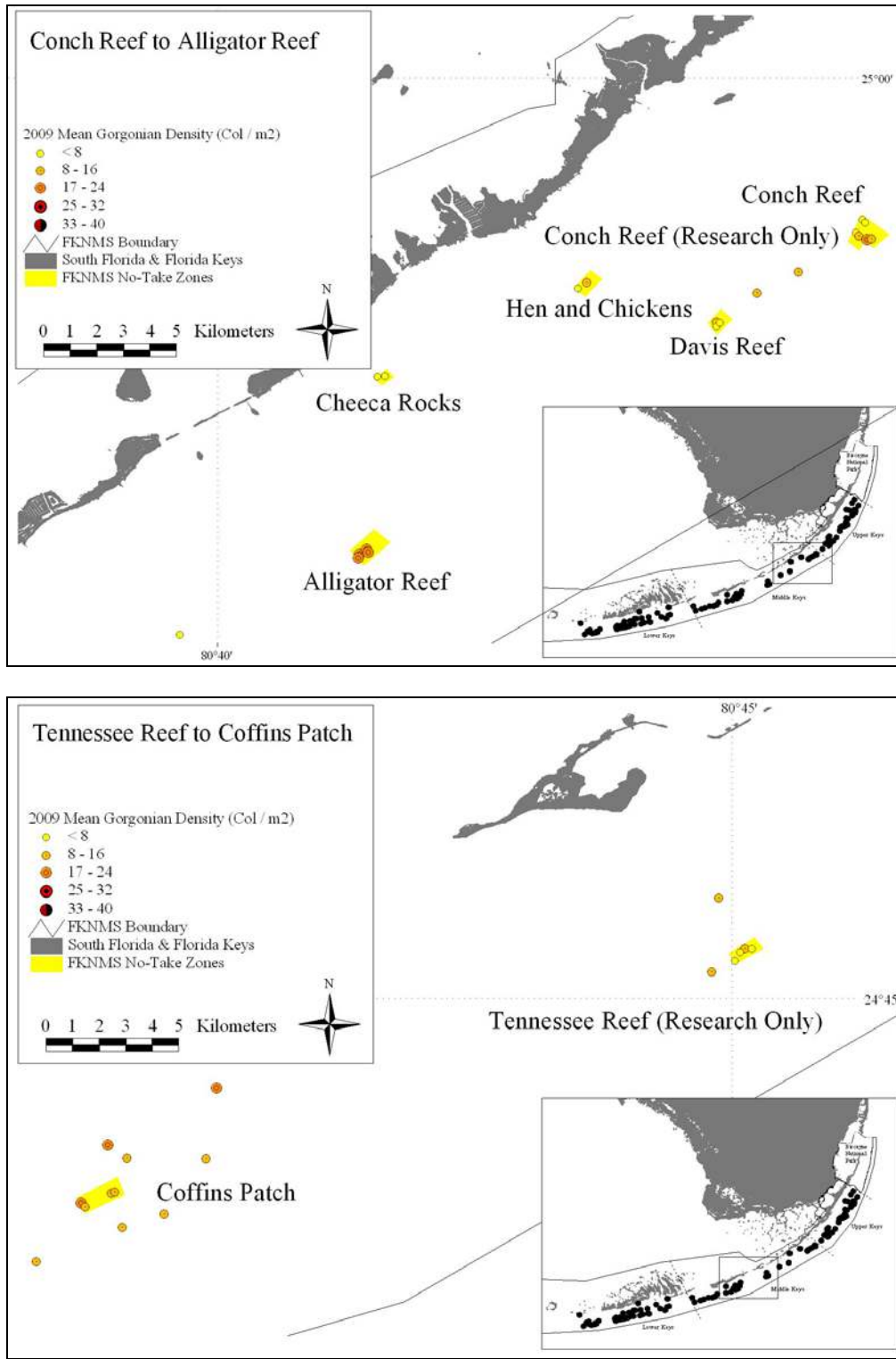


Figure 5-5. Total gorgonian densities (no. colonies per m²) in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

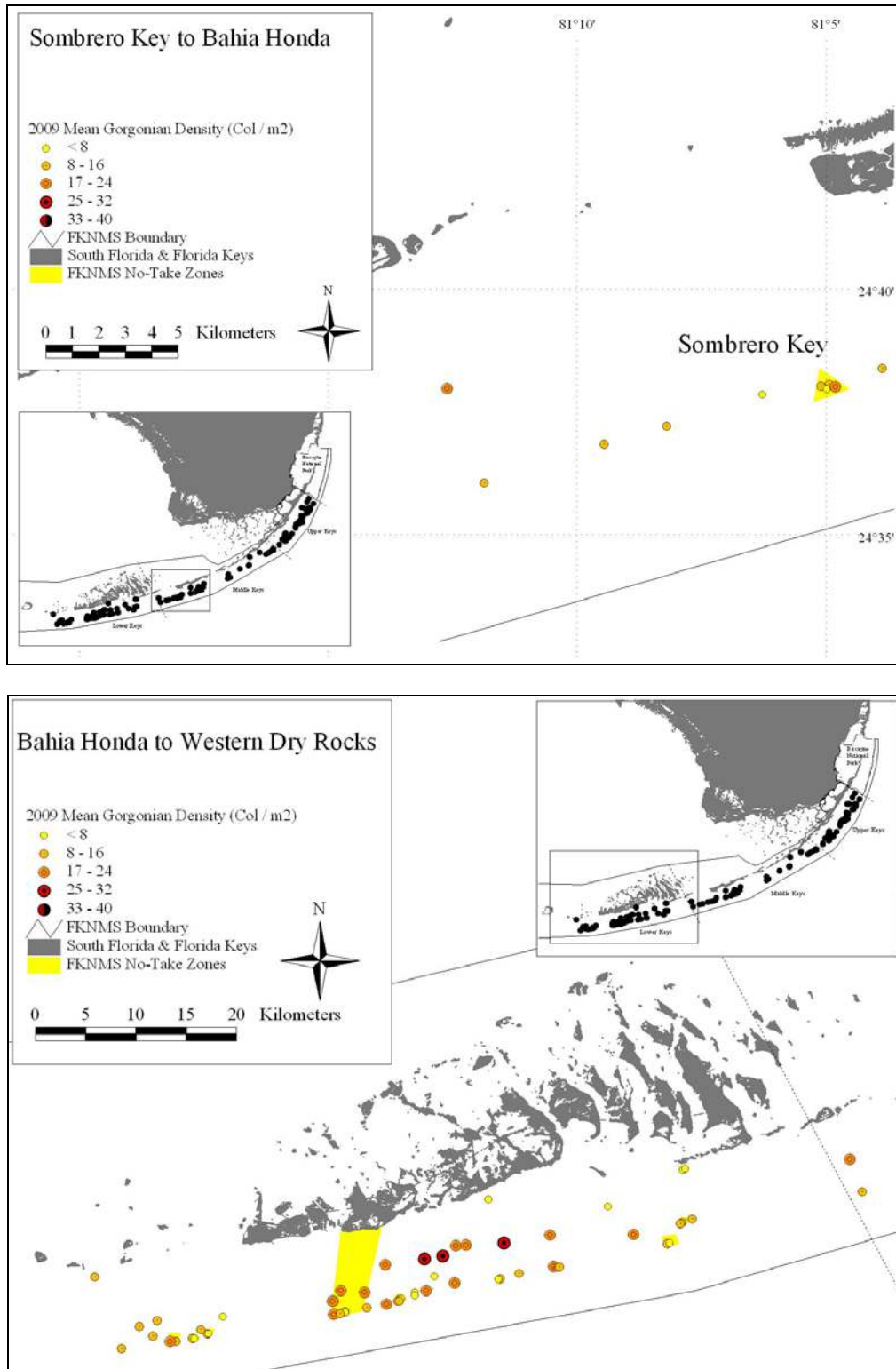


Figure 5-6. Total gorgonian densities (no. colonies per m²) in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

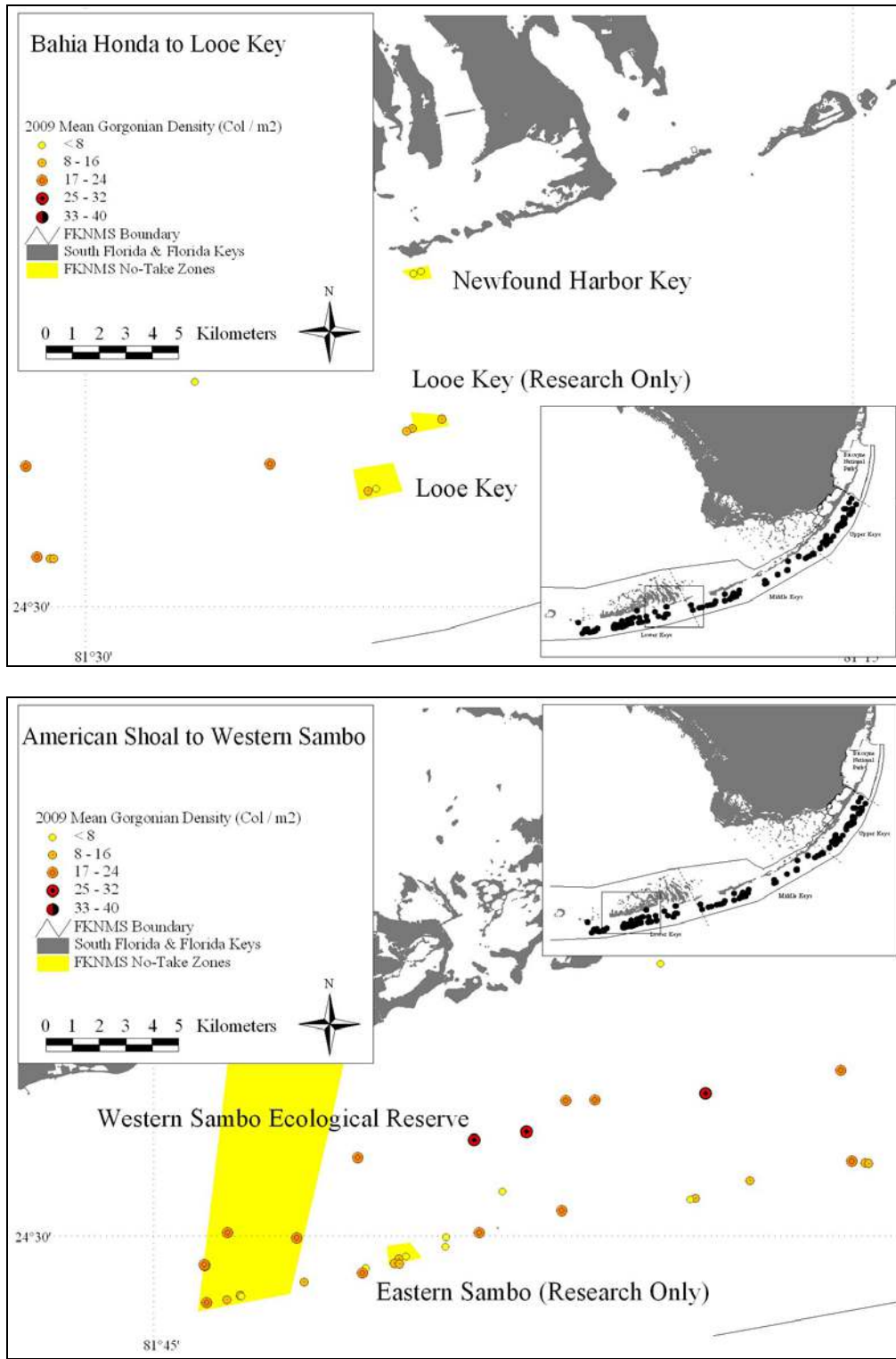


Figure 5-7. Total gorgonian densities (no. colonies per m²) in the lower Florida Keys region from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

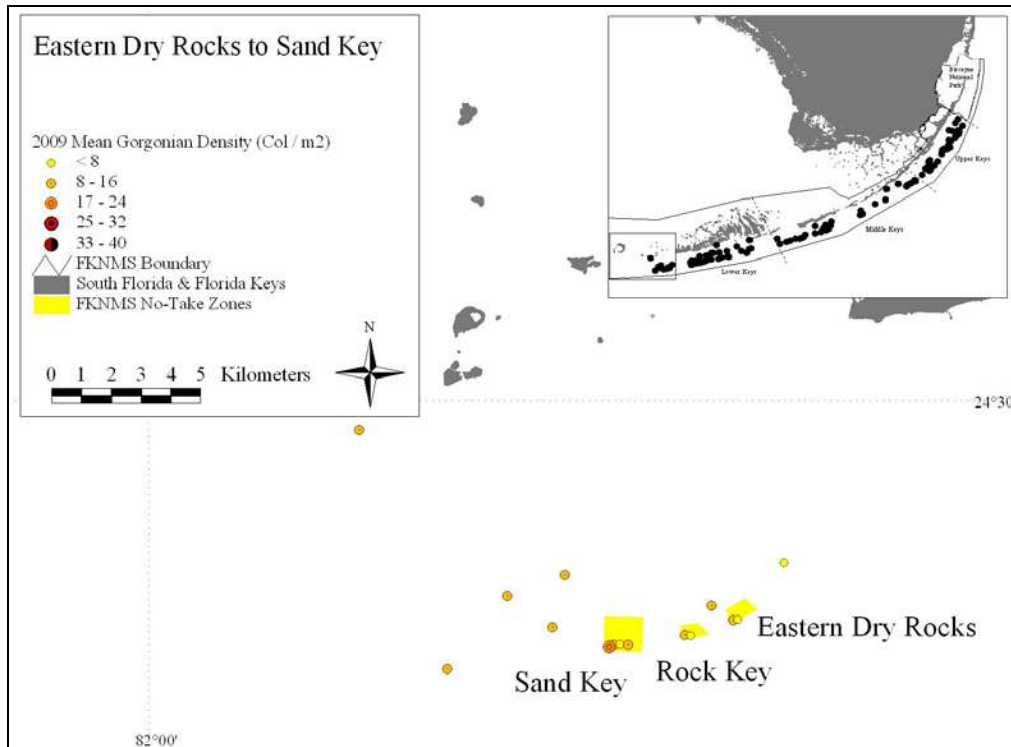


Figure 5-8. Mean (+ 1 SE) densities (no. colonies per m²) of all gorgonians on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

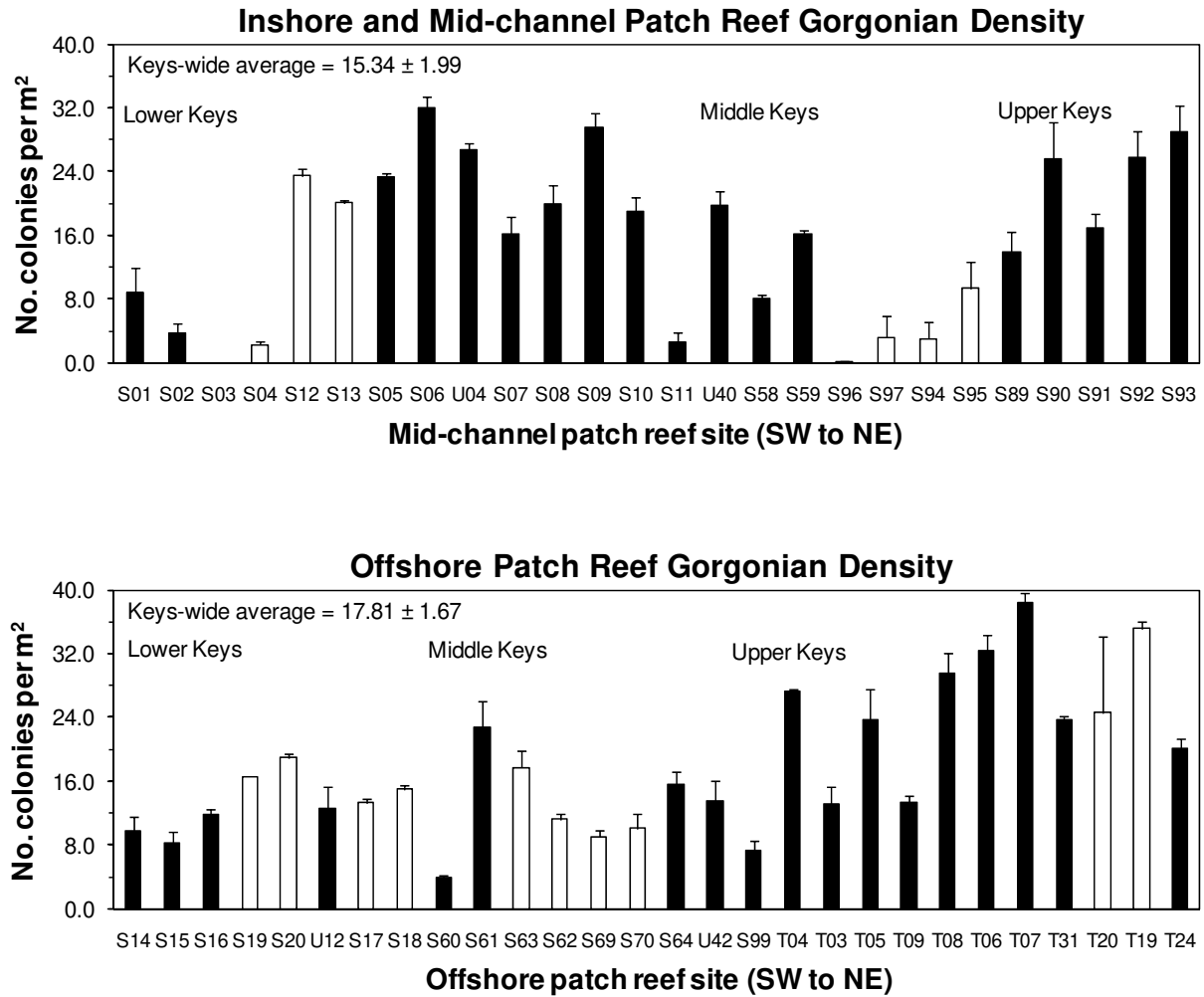


Figure 5-9. Mean (± 1 SE) densities (no. colonies per m^2) of all gorgonians on shallow, high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

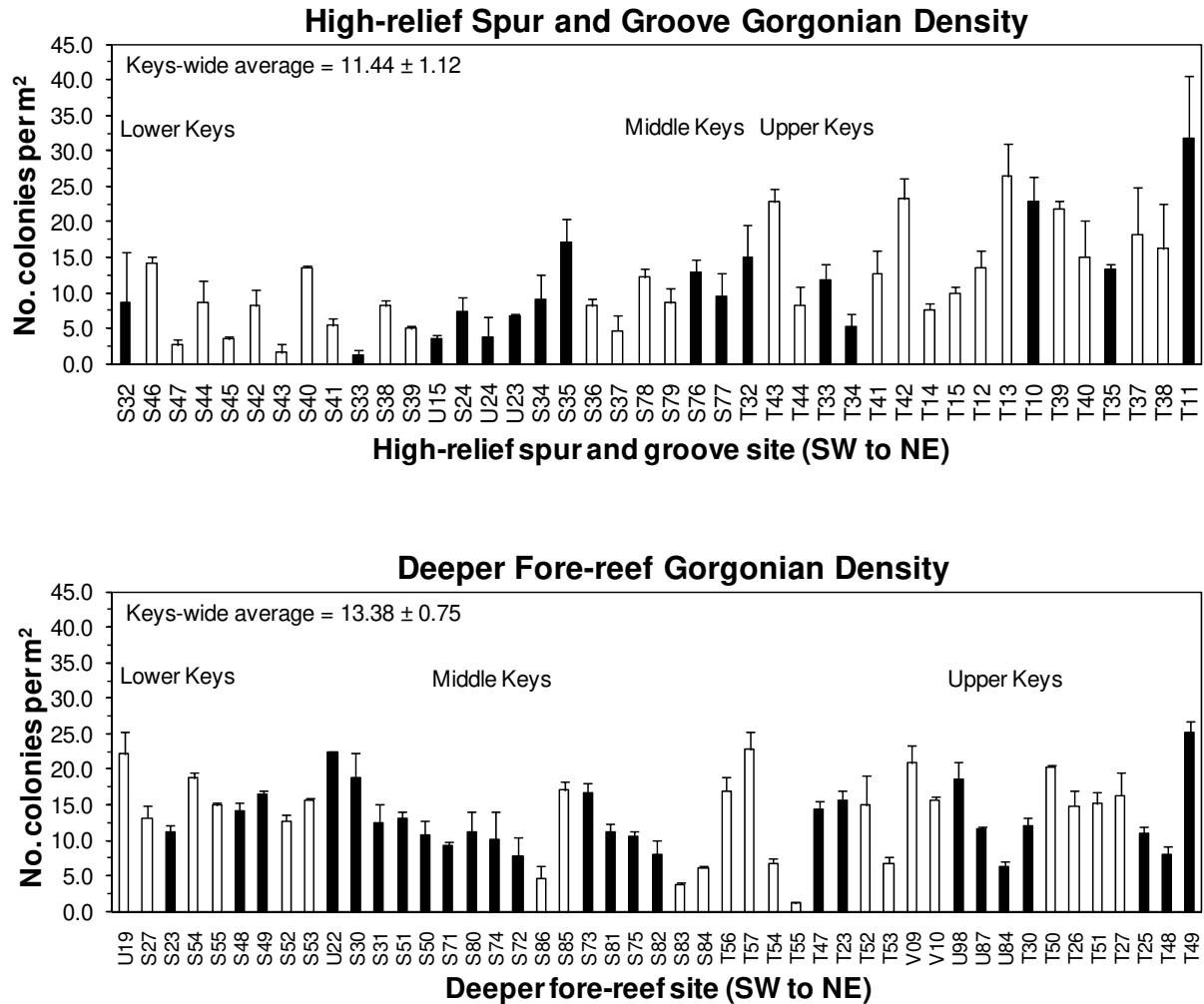


Table 5-1. Mean $\pm$ 1 SE densities (no. individuals/m²) and total shell lengths (SL, cm) of flamingo-tongue snails (*Cyphoma gibbosum*) and total gorgonian densities in the Florida Keys, as determined from surveys of two 8-m x 1-m belt transects per site for gorgonians and four 15-m x 1-m belt transects for snails during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>C. gibbosum</i>				Total gorgonians	
	Frequency	N	No./m ²	SL (cm)	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0 $\pm$ 0	0	0 $\pm$ 0		142	8.88 $\pm$ 3.13
S02 – South of Sugarloaf Creek	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	2.7	61	3.81 $\pm$ 1.19
S03 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0		0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0		37	2.31 $\pm$ 0.31
Lower Florida Keys Total (4)	0.06 $\pm$ 0.06	1	0.004 $\pm$ 0.004	2.7	240	3.75 $\pm$ 1.88
Inshore Patch Reef Total (4)	0.06 $\pm$ 0.06	1	0.004 $\pm$ 0.004	2.7	240	3.75 $\pm$ 1.88
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	2.8	375	23.44 $\pm$ 0.94
S13 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0		322	20.13 $\pm$ 0.38
S05 - North of Middle Sambo Reef	0 $\pm$ 0	0	0 $\pm$ 0		372	23.25 $\pm$ 0.50
S06 - North of Pelican Shoal	0.25 $\pm$ 0.25	12	0.200 $\pm$ 0.098	2.8 $\pm$ 0.1	512	32.00 $\pm$ 1.50
U04 - North of Pelican Shoal	0.75 $\pm$ 0.25	1	0.017 $\pm$ 0.017	3.3	429	26.81 $\pm$ 0.69
S07 - West Washerwoman Shoal	0 $\pm$ 0	0	0 $\pm$ 0		260	16.25 $\pm$ 2.00
S08 - West Washerwoman Shoal	0 $\pm$ 0	0	0 $\pm$ 0		318	19.88 $\pm$ 2.38
S09 - North of Maryland Shoal	0.25 $\pm$ 0.25	4	0.067 $\pm$ 0.067	2.8 $\pm$ 0.1	474	29.63 $\pm$ 1.75
S10 - North of American Shoal	0.75 $\pm$ 0.25	5	0.083 $\pm$ 0.032	3.1 $\pm$ 0.1	304	19.00 $\pm$ 1.75
S11 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0		42	2.63 $\pm$ 1.13
Lower Florida Keys Total (10)	0.23 $\pm$ 0.09	23	0.038 $\pm$ 0.020	2.9 $\pm$ 0.0	3,408	21.30 $\pm$ 2.59
Middle Florida Keys						
U40 - Marker 49A	0 $\pm$ 0	0	0 $\pm$ 0		315	19.69 $\pm$ 1.81
S58 - Marker 48	0 $\pm$ 0	0	0 $\pm$ 0		130	8.13 $\pm$ 0.38
S59 - East Turtle Shoal	0 $\pm$ 0	0	0 $\pm$ 0		259	16.19 $\pm$ 0.44
S96 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0		2	0.13 $\pm$ 0.13
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0		51	3.19 $\pm$ 2.69
S94 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0		49	3.06 $\pm$ 2.06
S95 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0		150	9.38 $\pm$ 3.38
Middle Florida Keys Total (7)	0 $\pm$ 0	0	0 $\pm$ 0		956	8.54 $\pm$ 2.73
Upper Florida Keys						
S89 - Mosquito Bank	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	3.5	221	13.81 $\pm$ 2.56
S90 - Mosquito Bank	0	0	0		410	25.63 $\pm$ 4.50
S91 - Basin Hill Shoals	0	0	0		271	16.94 $\pm$ 1.81
S92 - Basin Hill Shoals	0	0	0		412	25.75 $\pm$ 3.25
S93 - Turtle Rocks	0.50 $\pm$ 0.29	7	0.117 $\pm$ 0.069	2.7 $\pm$ 0.1	465	29.06 $\pm$ 3.19
Upper Florida Keys Total (5)	0.15 $\pm$ 0.10	8	0.027 $\pm$ 0.023	2.8 $\pm$ 0.1	1,779	22.24 $\pm$ 2.91
Mid-channel Patch Reef Total (22)	0.14 $\pm$ 0.05	31	0.023 $\pm$ 0.011	2.9 $\pm$ 0.1	6,143	17.45 $\pm$ 2.03
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0		156	9.75 $\pm$ 1.75
S15 - North of Sand Key	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	2.8 $\pm$ 0.0	131	8.19 $\pm$ 1.56
S16 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0		190	11.88 $\pm$ 0.63
S19 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0		265	16.56 $\pm$ 0.06
S20 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0		303	18.94 $\pm$ 0.56
U12 - West of Looe Key RO	0 $\pm$ 0	0	0 $\pm$ 0		200	12.50 $\pm$ 2.75
S17 - Looe Key RO**	0 $\pm$ 0	0	0 $\pm$ 0		213	13.31 $\pm$ 0.56
S18 - Looe Key RO**	0 $\pm$ 0	0	0 $\pm$ 0		240	15.00 $\pm$ 0.50
Lower Florida Keys Total (8)	0.06 $\pm$ 0.06	2	0.004 $\pm$ 0.004	2.8 $\pm$ 0.0	1,698	13.27 $\pm$ 1.14
Middle Florida Keys						
S60 - NE of Delta Shoal	0.50 $\pm$ 0.29	3	0.050 $\pm$ 0.032	2.8 $\pm$ 0.1	62	3.88 $\pm$ 0.25

Site number/site location	<i>C. gibbosum</i>				Total gorgonians	
	Frequency	N	No./m ²	SL (cm)	N	No./m ²
S61 - West Turtle Shoal	1.00 ± 0.00	4	0.067 ± 0.000	2.9 ± 0.1	363	22.69 ± 3.44
S63 - Coffins Patch SPA**	0.50 ± 0.29	2	0.033 ± 0.019	2.5 ± 0.1	283	17.69 ± 2.06
S62 - Coffins Patch SPA**	0.50 ± 0.29	3	0.050 ± 0.032	3.0 ± 0.2	180	11.25 ± 0.75
S69 - Coffins Patch SPA**	0 ± 0	0	0 ± 0		145	9.06 ± 0.81
S70 - Coffins Patch SPA**	0 ± 0	0	0 ± 0		161	10.06 ± 1.81
S64 - South of Coffins Patch	0 ± 0	0	0 ± 0		250	15.63 ± 1.63
U42 - East of Coffins Patch	0 ± 0	0	0 ± 0		215	13.44 ± 2.56
Middle Florida Keys Total (8)	0.31 ± 0.13	12	0.025 ± 0.010	2.8 ± 0.1	1,659	12.96 ± 2.04
Upper Florida Keys						
S99 - Wolf Reef	0 ± 0	0	0 ± 0		117	7.31 ± 1.31
T04 - Inshore of Sand Island	0 ± 0	0	0 ± 0		438	27.38 ± 0.13
T03 - White Bank	0 ± 0	0	0 ± 0		210	13.13 ± 2.25
T05 - White Bank	0.25 ± 0.25	4	0.067 ± 0.067	2.8 ± 0.1	380	23.75 ± 3.88
T09 - South of Key Largo Dry Rocks	0 ± 0	0	0 ± 0		213	13.31 ± 0.94
T08 - West of Key Largo Dry Rocks	0 ± 0	0	0 ± 0		474	29.63 ± 2.50
T06 - West of Elbow Reef	0 ± 0	0	0 ± 0		517	32.31 ± 2.06
T07 - SW of Watson's Reef	0 ± 0	0	0 ± 0		614	38.38 ± 1.25
T31 - South of Watson's Reef	0 ± 0	0	0 ± 0		380	23.75 ± 0.38
T20 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0		394	24.63 ± 9.63
T19 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0		562	35.13 ± 0.88
T24 - North of Carysfort Reef	0 ± 0	0	0 ± 0		321	20.06 ± 1.31
Upper Florida Keys Total (12)	0.02 ± 0.02	4	0.006 ± 0.006	2.8 ± 0.1	4,620	24.06 ± 2.71
Offshore Patch Reef Total (28)	0.12 ± 0.05	18	0.011 ± 0.004	2.8 ± 0.1	7,977	17.81 ± 1.67
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0 ± 0	0	0 ± 0		33	2.06 ± 0.44
S22 - West of Looe Key SPA	0 ± 0	0	0 ± 0		305	19.06 ± 1.69
Lower Florida Keys Total (2)	0 ± 0	0	0 ± 0		338	10.56 ± 8.50
Middle Florida Keys						
S65 - SE of Coffins Patch	0 ± 0	0	0 ± 0		155	9.69 ± 1.31
S66 - Tennessee Reef	0 ± 0	0	0 ± 0		185	11.56 ± 4.06
S68 - Tennessee Reef RO**	0 ± 0	0	0 ± 0		128	8.00 ± 0.38
S67 - Tennessee Reef RO**	0 ± 0	0	0 ± 0		143	8.94 ± 1.31
T16 - West of Alligator Reef	0 ± 0	0	0 ± 0		66	4.13 ± 0.13
T45 - Alligator Reef SPA**	0 ± 0	0	0 ± 0		316	19.75 ± 0.38
T46 - Alligator Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	3.0	304	19.00 ± 2.25
V03 - Davis Reef SPA**	0.25 ± 0.25	2	0.033 ± 0.033	2.9 ± 0.1	173	10.81 ± 4.44
T36 - Davis Reef SPA**	0 ± 0	0	0 ± 0		181	11.31 ± 0.06
T21 - Conch Reef SPA**	0.25 ± 0.25	2	0.033 ± 0.033	3.0 ± 0.1	124	7.75 ± 3.13
T22 - Conch Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	2.4	104	6.50 ± 4.50
Middle Florida Keys Total (11)	0.09 ± 0.04	6	0.009 ± 0.004	2.9 ± 0.1	1,879	10.68 ± 1.46
Upper Florida Keys						
T28 - Molasses Reef SPA**	0 ± 0	0	0 ± 0		55	3.44 ± 0.31
T29 - Molasses Reef SPA**	0.25 ± 0.25	2	0.033 ± 0.033	2.0 ± 0.4	39	2.44 ± 0.31
T17 - North of French Reef	0.25 ± 0.25	1	0.017 ± 0.017	2.7	191	11.94 ± 0.81
T18 - Watson's Reef	0 ± 0	0	0 ± 0		353	22.06 ± 0.19
Upper Florida Keys Total (4)	0.13 ± 0.07	3	0.013 ± 0.008	2.2 ± 0.3	638	9.97 ± 4.56
Shallow Hard-bottom Total (17)	0.09 ± 0.03	9	0.009 ± 0.003	2.6 ± 0.2	2,855	10.50 ± 1.52
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0.50 ± 0.29	6	0.100 ± 0.064	2.5 ± 0.1	137	8.56 ± 7.19
S46 - Sand Key SPA**	0.25 ± 0.25	2	0.033 ± 0.033	2.7 ± 0.0	228	14.25 ± 0.88
S47 - Sand Key SPA**	0 ± 0	0	0 ± 0		43	2.69 ± 0.69
S44 - Rock Key SPA**	0 ± 0	0	0 ± 0		139	8.69 ± 3.06
S45 - Rock Key SPA**	0 ± 0	0	0 ± 0		56	3.50 ± 0.38
S42 - Eastern Dry Rocks SPA**	0.25 ± 0.25	1	0.017 ± 0.017	2.9	130	8.13 ± 2.25
S43 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0		26	1.63 ± 1.25

Site number/site location	<i>C. gibbosum</i>				Total gorgonians	
	Frequency	N	No./m ²	SL (cm)	N	No./m ²
S40 - Western Sambo ER**	0 ± 0	0	0 ± 0		218	13.63 ± 0.25
S41 - Western Sambo ER**	0 ± 0	0	0 ± 0		86	5.38 ± 1.13
S33 - Middle Sambo Reef	0 ± 0	0	0 ± 0		21	1.31 ± 0.56
S38 - Eastern Sambo RO**	0 ± 0	0	0 ± 0		130	8.13 ± 0.88
S39 - Eastern Sambo RO**	0 ± 0	0	0 ± 0		79	4.94 ± 0.44
U15 - No Name Reef	0 ± 0	0	0 ± 0		56	3.50 ± 0.50
S24 - East of Eastern Sambo RO	0.50 ± 0.29	3	0.050 ± 0.032	2.9 ± 0.1	117	7.31 ± 2.06
U24 - Pelican Shoal	0.50 ± 0.29	5	0.083 ± 0.050	2.8 ± 0.1	61	3.81 ± 2.81
U23 - Maryland Shoal	0.75 ± 0.25	5	0.083 ± 0.042	2.7 ± 0.0	109	6.81 ± 0.19
S34 - Maryland Shoal	0 ± 0	0	0 ± 0		146	9.13 ± 3.38
S35 - American Shoal	0.25 ± 0.25	5	0.083 ± 0.083	2.7 ± 0.1	274	17.13 ± 3.38
S36 - Looe Key SPA**	0 ± 0	0	0 ± 0		130	8.13 ± 1.00
S37 - Looe Key SPA**	0 ± 0	0	0 ± 0		75	4.69 ± 2.06
Lower Florida Keys Total (20)	0.15 ± 0.05	27	0.023 ± 0.008	2.7 ± 0.0	2,261	7.07 ± 0.95
Middle Florida Keys						
S78 - Sombrero Key SPA**	0 ± 0	0	0 ± 0		195	12.19 ± 1.31
S79 - Sombrero Key SPA**	0 ± 0	0	0 ± 0		138	8.63 ± 2.00
S76 - Delta Shoal	0.25 ± 0.25	1	0.017 ± 0.017	2.8	205	12.81 ± 1.81
S77 - Delta Shoal	0.50 ± 0.29	8	0.133 ± 0.094	2.8 ± 0.1	153	9.56 ± 3.31
Middle Florida Keys Total (4)	0.19 ± 0.12	9	0.038 ± 0.032	2.8 ± 0.1	691	10.80 ± 1.01
Upper Florida Keys						
T32 - Pickles Reef	0.25 ± 0.25	3	0.050 ± 0.050	2.8 ± 0.1	239	14.94 ± 4.56
T43 - Molasses Reef SPA**	0 ± 0	0	0 ± 0		365	22.81 ± 1.81
T44 - Molasses Reef SPA**	0 ± 0	0	0 ± 0		132	8.25 ± 2.63
T33 - Sand Island	0.25 ± 0.25	1	0.017 ± 0.017	2.9	190	11.88 ± 2.25
T34 - Sand Island	0.75 ± 0.25	6	0.100 ± 0.043	2.9 ± 0.1	85	5.31 ± 1.81
T41 - French Reef SPA**	0 ± 0	0	0 ± 0		204	12.75 ± 3.25
T42 - French Reef SPA**	0 ± 0	0	0 ± 0		372	23.25 ± 2.88
T14 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0		123	7.69 ± 0.81
T15 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0		160	10.00 ± 0.88
T12 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0		217	13.56 ± 2.44
T13 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0		422	26.38 ± 4.63
T10 - North-North Dry Rocks	0 ± 0	0	0 ± 0		364	22.75 ± 3.50
T39 - Elbow Reef SPA**	0 ± 0	0	0 ± 0		350	21.88 ± 1.13
T40 - Elbow Reef SPA**	0 ± 0	0	0 ± 0		241	15.06 ± 5.06
T35 - South of South Carysfort	0.25 ± 0.25	1	0.017 ± 0.017	2.7	212	13.25 ± 0.75
T37 - South Carysfort Reef SPA**	0 ± 0	0	0 ± 0		292	18.25 ± 6.63
T38 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0		259	16.19 ± 6.31
T11 - North of Turtle Reef	0 ± 0	0	0 ± 0		507	31.69 ± 8.81
Upper Florida Keys Total (18)	0.08 ± 0.05	11	0.010 ± 0.006	2.9 ± 0.0	4,734	16.44 ± 1.67
Spur and Groove Total (44)	0.13 ± 0.03	47	0.019 ± 0.005	2.7 ± 0.0	7,686	11.44 ± 1.09
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0 ± 0	0	0 ± 0		354	22.13 ± 3.13
S27 - Sand Key SPA**	0 ± 0	0	0 ± 0		210	13.13 ± 1.88
S23 - East of Rock Key SPA	0 ± 0	0	0 ± 0		180	11.25 ± 0.88
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0		301	18.81 ± 0.69
S55 - Western Sambo ER**	0 ± 0	0	0 ± 0		240	15.00 ± 0.25
S48 - East of Western Sambo ER	0.25 ± 0.25	1	0.017 ± 0.017	2.6	226	14.13 ± 1.13
S49 - Middle Sambo Reef	0.25 ± 0.25	1	0.017 ± 0.017	2.6	265	16.56 ± 0.44
S52 - Eastern Sambo RO**	0 ± 0	0	0 ± 0		203	12.69 ± 0.94
S53 - Eastern Sambo RO**	0 ± 0	0	0 ± 0		251	15.69 ± 0.19
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0		358	22.38 ± 0.25
S30 - East of Pelican Shoal	0 ± 0	0	0 ± 0		301	18.81 ± 3.56
S31 - East of Maryland Shoal	0 ± 0	0	0 ± 0		198	12.38 ± 2.75
S51 - American Shoal	0 ± 0	0	0 ± 0		209	13.06 ± 0.94
S50 - American Shoal	0 ± 0	0	0 ± 0		172	10.75 ± 2.13
Lower Florida Keys Total (14)	0.04 ± 0.02	2	0.002 ± 0.002	2.6 ± 0.0	3,468	15.48 ± 1.01

Site number/site location	<i>C. gibbosum</i>				Total gorgonians	
	Frequency	N	No./m ²	SL (cm)	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0 ± 0	0	0 ± 0		147	9.19 ± 0.56
S80 - West of Sombrero Key	0 ± 0	0	0 ± 0		180	11.25 ± 2.75
S74 - West of Sombrero Key	0 ± 0	0	0 ± 0		162	10.13 ± 3.88
S72 - West of Sombrero Key	0 ± 0	0	0 ± 0		126	7.88 ± 2.50
S86 - Sombrero Key SPA	0 ± 0	0	0 ± 0		74	4.63 ± 1.75
S85 - Sombrero Key SPA	0 ± 0	0	0 ± 0		274	17.13 ± 1.13
S73 - East of Delta Shoal	0 ± 0	0	0 ± 0		268	16.75 ± 1.25
S81 - SW of Coffins Patch	0.25 ± 0.25	1	0.017 ± 0.017	2.6	180	11.25 ± 1.13
S75 - Marker 20	0.25 ± 0.25	1	0.017 ± 0.017	2.9	168	10.50 ± 0.88
S82 - Tennessee Reef	0 ± 0	0	0 ± 0		129	8.06 ± 2.06
S83 - Tennessee Reef RO**	0 ± 0	0	0 ± 0		62	3.88 ± 0.13
S84 - Tennessee Reef RO**	0 ± 0	0	0 ± 0		98	6.13 ± 0.38
T56 - Alligator Reef SPA**	0 ± 0	0	0 ± 0		272	17.00 ± 1.88
T57 - Alligator Reef SPA**	0 ± 0	0	0 ± 0		365	22.81 ± 2.56
T54 - Davis Reef SPA**	0 ± 0	0	0 ± 0		109	6.81 ± 0.56
T55 - Davis Reef SPA**	0 ± 0	0	0 ± 0		18	1.13 ± 0.25
T47 - Little Conch Reef	0 ± 0	0	0 ± 0		229	14.31 ± 1.19
T23 - Little Conch Reef	0 ± 0	0	0 ± 0		249	15.56 ± 1.56
T52 - Conch Reef SPA**	0 ± 0	0	0 ± 0		240	15.00 ± 4.13
T53 - Conch Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	2.8	109	6.81 ± 0.94
V09 - Conch Reef RO**	0 ± 0	0	0 ± 0		335	20.94 ± 2.44
V10 - Conch Reef RO**	0 ± 0	0	0 ± 0		252	15.75 ± 0.38
Middle Florida Keys Total (22)	0.03 ± 0.02	3	0.002 ± 0.001	2.8 ± 0.1	4,046	11.49 ± 1.21
Upper Florida Keys						
U98 - Pickles Reef	0 ± 0	0	0 ± 0		299	18.69 ± 2.44
U87 - Dixie Shoal	0 ± 0	0	0 ± 0		187	11.69 ± 0.31
U84 - North of Dixie Shoal	0 ± 0	0	0 ± 0		102	6.38 ± 0.63
T30 - South of Elbow Reef	0 ± 0	0	0 ± 0		192	12.00 ± 1.25
T50 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0		325	20.31 ± 0.31
T26 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0		237	14.81 ± 2.19
T51 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0		242	15.13 ± 1.63
T27 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0		261	16.31 ± 3.19
T25 - North of Carysfort Reef	0 ± 0	0	0 ± 0		174	10.88 ± 1.00
T48 - North of Carysfort Reef	0 ± 0	0	0 ± 0		129	8.06 ± 1.06
T49 - SE of Turtle Rocks	0 ± 0	0	0 ± 0		402	25.13 ± 1.75
Upper Florida Keys Total (11)	0 ± 0	0	0 ± 0		2,550	14.49 ± 1.66
Deeper Fore-reef Total (47)	0.03 ± 0.01	5	0.002 ± 0.001	2.7 ± 0.1	10,064	13.38 ± 0.78

Table 5-2. Size frequency distributions (top) and gorgonian host occupation patterns (bottom) of flamingo-tongue snails in the Florida Keys National Marine Sanctuary, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during May-September 2009.

Shell Length Frequency

Total Shell Length (cm)	<i>Cyphoma gibbosum</i>		<i>C. signatum</i>	
	Frequency	% Total	Frequency	% Total
< 1.0	0	0	0	0
1-1.9	1	0.9	0	0
2-2.9	86	77.5	0	0
3-3.9	24	21.6	0	0
4-4.9	0	0	0	0
5-5.9	0	0	0	0
6-6.9	0	0	0	0
Total	111	100.0	0	0

Substratum Occupancy

Gorgonian host genera	<i>Cyphoma gibbosum</i>		Total gorgonians	
	Frequency	% Total	Frequency	% Total
<i>Eunicea</i>	24	21.6	3,045	9.9
<i>Gorgonia</i>	17	15.3	4,724	15.3
<i>Muricea</i>	13	11.7	2,145	6.9
<i>Muriceopsis</i>	0	0	745	2.4
<i>Plexaura</i>	18	16.2	2,012	6.5
<i>Plexaurella</i>	12	10.8	871	2.8
<i>Pseudoplexaura</i>	8	7.2	1,435	4.6
<i>Pseudopterogorgia</i>	18	16.2	15,450	50.0
Other (algal turf)	1	0.9	444	1.4
Total	111	100.0	30,871	100.0

Table 5-3. Numbers of colonies (N) and mean $\pm$ 1 SE colony densities (no. per m²) for the gorgonians *Briareum asbestinum*, *Erythropodium caribaeorum*, and *Eunicea calyculata* in the Florida Keys, as determined from surveys of two 8-m x 1-m transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>B. asbestinum</i>		<i>E. caribaeorum</i>		<i>E. calyculata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	94	5.88 $\pm$ 4.63	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	1	0.06 $\pm$ 0.06	23	1.44 $\pm$ 0.94	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	13	0.81 $\pm$ 0.81	0	0 $\pm$ 0
Lower Florida Keys Total (4)	1	0.02 $\pm$ 0.02	130	2.03 $\pm$ 1.31	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	1	0.02 $\pm$ 0.02	130	2.03 $\pm$ 1.31	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	3	0.19 $\pm$ 0.06	15	0.94 $\pm$ 0.56	3	0.19 $\pm$ 0.19
S13 - Western Sambo ER**	4	0.25 $\pm$ 0.25	39	2.44 $\pm$ 0.94	1	0.06 $\pm$ 0.06
S05 - North of Middle Sambo Reef	57	3.56 $\pm$ 1.44	31	1.94 $\pm$ 0.31	3	0.19 $\pm$ 0.06
S06 - North of Pelican Shoal	31	1.94 $\pm$ 0.31	5	0.31 $\pm$ 0.19	15	0.94 $\pm$ 0.19
U04 - North of Pelican Shoal	29	1.81 $\pm$ 0.31	75	4.69 $\pm$ 0.19	6	0.38 $\pm$ 0.00
S07 - West Washerwoman Shoal	67	4.19 $\pm$ 0.31	23	1.44 $\pm$ 1.06	0	0
S08 - West Washerwoman Shoal	40	2.50 $\pm$ 0.13	60	3.75 $\pm$ 0.63	1	0.06 $\pm$ 0.06
S09 - North of Maryland Shoal	100	6.25 $\pm$ 0.75	46	2.88 $\pm$ 0.38	1	0.06 $\pm$ 0.06
S10 - North of American Shoal	31	1.94 $\pm$ 0.81	4	0.25 $\pm$ 0.13	0	0 $\pm$ 0
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	362	2.26 $\pm$ 0.63	298	1.86 $\pm$ 0.50	30	0.19 $\pm$ 0.09
Middle Florida Keys						
U40 - Marker 49A	40	2.50 $\pm$ 0.38	56	3.50 $\pm$ 1.63	0	0 $\pm$ 0
S58 - Marker 48	5	0.31 $\pm$ 0.06	30	1.88 $\pm$ 0.75	0	0 $\pm$ 0
S59 - East Turtle Shoal	33	2.06 $\pm$ 0.06	18	1.13 $\pm$ 0.63	3	0.19 $\pm$ 0.06
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	34	2.13 $\pm$ 2.00	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	3	0.19 $\pm$ 0.06	27	1.69 $\pm$ 1.69	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	19	1.19 $\pm$ 0.19	77	4.81 $\pm$ 1.31	0	0 $\pm$ 0
Middle Florida Keys Total (7)	100	0.89 $\pm$ 0.39	242	2.16 $\pm$ 0.60	3	0.03 $\pm$ 0.03
Upper Florida Keys						
S89 - Mosquito Bank	45	2.81 $\pm$ 0.19	16	1.00 $\pm$ 0.13	1	0.06 $\pm$ 0.06
S90 - Mosquito Bank	81	5.06 $\pm$ 0.19	36	2.25 $\pm$ 1.25	5	0.31 $\pm$ 0.06
S91 - Basin Hill Shoals	70	4.38 $\pm$ 0.75	18	1.13 $\pm$ 0.38	2	0.13 $\pm$ 0.13
S92 - Basin Hill Shoals	72	4.50 $\pm$ 0.50	47	2.94 $\pm$ 1.31	1	0.06 $\pm$ 0.06
S93 - Turtle Rocks	1	0.06 $\pm$ 0.06	1	0.06 $\pm$ 0.06	32	2.00 $\pm$ 0.13
Upper Florida Keys Total (5)	269	3.36 $\pm$ 0.91	118	1.48 $\pm$ 0.50	41	0.51 $\pm$ 0.37
Mid-channel Patch Reef Total (22)	371	2.08 $\pm$ 0.41	658	1.87 $\pm$ 0.31	74	0.21 $\pm$ 0.10
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0	0 $\pm$ 0	29	1.81 $\pm$ 0.69	0	0 $\pm$ 0
S15 - North of Sand Key	0	0 $\pm$ 0	67	4.19 $\pm$ 1.19	0	0 $\pm$ 0
S16 - North of Sand Key	2	0.13 $\pm$ 0.00	23	1.44 $\pm$ 0.44	3	0.19 $\pm$ 0.06
S19 - Western Sambo ER**	9	0.56 $\pm$ 0.44	102	6.38 $\pm$ 1.00	2	0.13 $\pm$ 0.13
S20 - Western Sambo ER**	10	0.63 $\pm$ 0.38	53	3.31 $\pm$ 1.19	1	0.06 $\pm$ 0.06
U12 - West of Looe Key RO	0	0 $\pm$ 0	17	1.06 $\pm$ 0.31	3	0.19 $\pm$ 0.19
S17 - Looe Key RO**	1	0.06 $\pm$ 0.06	9	0.56 $\pm$ 0.19	4	0.25 $\pm$ 0.00
S18 - Looe Key RO**	0	0 $\pm$ 0	56	3.50 $\pm$ 1.13	1	0.06 $\pm$ 0.06
Lower Florida Keys Total (8)	22	0.17 $\pm$ 0.09	356	2.78 $\pm$ 0.69	14	0.11 $\pm$ 0.03
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>B. asbestinum</i>		<i>E. caribaeorum</i>		<i>E. calyculata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	35	2.19 ± 1.31	59	3.69 ± 0.69	2	0.13 ± 0.00
S63 - Coffins Patch SPA**	0	0 ± 0	6	0.38 ± 0.38	0	0 ± 0
S62 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
S69 - Coffins Patch SPA**	0	0 ± 0	14	0.88 ± 0.63	0	0 ± 0
S70 - Coffins Patch SPA**	0	0 ± 0	63	3.94 ± 1.94	0	0 ± 0
S64 - South of Coffins Patch	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
U42 - East of Coffins Patch	1	0.06 ± 0.06	58	3.63 ± 1.88	2	0.13 ± 0.13
Middle Florida Keys Total (8)	36	0.28 ± 0.27	200	1.56 ± 0.65	8	0.06 ± 0.02
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	4	0.25 ± 0.13	4	0.25 ± 0.13
T04 - Inshore of Sand Island	71	4.44 ± 0.31	97	6.06 ± 1.81	0	0 ± 0
T03 - White Bank	5	0.31 ± 0.19	2	0.13 ± 0.13	5	0.31 ± 0.06
T05 - White Bank	1	0.06 ± 0.06	18	1.13 ± 1.00	2	0.13 ± 0.00
T09 - South of Key Largo Dry Rocks	9	0.56 ± 0.44	23	1.44 ± 1.06	1	0.06 ± 0.06
T08 - West of Key Largo Dry Rocks	1	0.06 ± 0.06	43	2.69 ± 1.81	4	0.25 ± 0.00
T06 - West of Elbow Reef	1	0.06 ± 0.06	28	1.75 ± 0.00	0	0 ± 0
T07 - SW of Watson's Reef	2	0.13 ± 0.00	34	2.13 ± 0.63	0	0 ± 0
T31 - South of Watson's Reef	22	1.38 ± 0.13	52	3.25 ± 0.50	2	0.13 ± 0.13
T20 - Carysfort Reef SPA**	4	0.25 ± 0.25	7	0.44 ± 0.44	4	0.25 ± 0.00
T19 - Carysfort Reef SPA**	27	1.69 ± 0.19	33	2.06 ± 0.44	5	0.31 ± 0.19
T24 - North of Carysfort Reef	44	2.75 ± 1.38	28	1.75 ± 1.38	0	0 ± 0
Upper Florida Keys Total (12)	187	0.97 ± 0.40	369	1.92 ± 0.47	27	0.14 ± 0.04
Offshore Patch Reef Total (28)	245	0.55 ± 0.20	925	2.06 ± 0.34	49	0.11 ± 0.02
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0	0 ± 0	2	0.13 ± 0.00	8	0.50 ± 0.13
Lower Florida Keys Total (2)	0	0 ± 0	2	0.06 ± 0.06	0	0.25 ± 0.25
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S66 - Tennessee Reef	0	0 ± 0	32	2.00 ± 1.25	6	0.38 ± 0.13
S68 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S67 - Tennessee Reef RO**	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
T16 - West of Alligator Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0	0 ± 0	8	0.50 ± 0.50	5	0.31 ± 0.06
T46 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.13
V03 - Davis Reef SPA**	0	0 ± 0	48	3.00 ± 2.25	0	0 ± 0
T36 - Davis Reef SPA**	0	0 ± 0	4	0.25 ± 0.25	0	0 ± 0
T21 - Conch Reef SPA**	1	0.06 ± 0.06	3	0.19 ± 0.06	0	0 ± 0
T22 - Conch Reef SPA**	1	0.06 ± 0.06	9	0.56 ± 0.56	0	0 ± 0
Middle Florida Keys Total (11)	2	0.01 ± 0.01	105	0.60 ± 0.30	17	0.10 ± 0.04
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T18 - Watson's Reef	6	0.38 ± 0.13	16	1.00 ± 1.00	10	0.63 ± 0.38
Upper Florida Keys Total (4)	6	0.09 ± 0.09	16	0.25 ± 0.25	11	0.17 ± 0.15
Shallow Hard-bottom Total (17)	8	0.03 ± 0.02	123	0.45 ± 0.20	36	0.13 ± 0.05
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	1	0.06 ± 0.06	37	2.31 ± 0.81	2	0.13 ± 0.00
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0	0 ± 0	7	0.44 ± 0.44	1	0.06 ± 0.06
S45 - Rock Key SPA**	0	0 ± 0	2	0.13 ± 0.13	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	40	2.50 ± 1.38	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0

Site number/site location	<i>B. asbestinum</i>		<i>E. caribaeorum</i>		<i>E. calyculata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	3	0.19 ± 0.19	2	0.13 ± 0.13
S41 - Western Sambo ER**	0	0 ± 0	2	0.13 ± 0.13	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	11	0.69 ± 0.69	0	0 ± 0
S24 - East of Eastern Sambo RO	0	0 ± 0	0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0	0 ± 0	3	0.19 ± 0.19	0	0 ± 0
U23 - Maryland Shoal	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
S34 - Maryland Shoal	0	0 ± 0	17	1.06 ± 1.06	0	0 ± 0
S35 - American Shoal	0	0 ± 0	7	0.44 ± 0.31	0	0 ± 0
S36 - Looe Key SPA**	0	0 ± 0	18	1.13 ± 0.13	0	0 ± 0
S37 - Looe Key SPA**	4	0.25 ± 0.25	25	1.56 ± 0.94	0	0 ± 0
Lower Florida Keys Total (20)	5	0.02 ± 0.01	175	0.55 ± 0.17	5	0.02 ± 0.01
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	6	0.38 ± 0.00	0	0 ± 0
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0	0 ± 0	3	0.19 ± 0.06	1	0.06 ± 0.06
S77 - Delta Shoal	0	0 ± 0	0	0 ± 0	5	0.31 ± 0.19
Middle Florida Keys Total (4)	0	0 ± 0	9	0.14 ± 0.09	6	0.09 ± 0.07
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T33 - Sand Island	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
T34 - Sand Island	0	0 ± 0	0	0	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	25	1.56 ± 1.44	0	0 ± 0
T42 - French Reef SPA**	5	0.31 ± 0.06	30	1.88 ± 0.25	2	0.13 ± 0.00
T14 - Grecian Rocks SPA**	0	0 ± 0	0	0	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	0	0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	4	0.25 ± 0.13	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	2	0.13 ± 0.13	4	0.25 ± 0.25	1	0.06 ± 0.06
T10 - North-North Dry Rocks	0	0 ± 0	11	0.69 ± 0.06	0	0 ± 0
T39 - Elbow Reef SPA**	11	0.69 ± 0.69	0	0	1	0.06 ± 0.06
T40 - Elbow Reef SPA**	0	0 ± 0	8	0.50 ± 0.50	0	0 ± 0
T35 - South of South Carysfort	0	0 ± 0	0	0	0	0 ± 0
T37 - South Carysfort Reef SPA**	3	0.19 ± 0.19	1	0.06 ± 0.06	0	0 ± 0
T38 - Carysfort Reef SPA**	8	0.50 ± 0.50	1	0.06 ± 0.06	0	0 ± 0
T11 - North of Turtle Reef	12	0.75 ± 0.38	37	2.31 ± 0.81	1	0.06 ± 0.06
Upper Florida Keys Total (18)	41	0.14 ± 0.06	122	0.42 ± 0.17	5	0.02 ± 0.01
Spur and Groove Total (44)	46	0.07 ± 0.03	306	0.46 ± 0.11	16	0.02 ± 0.01
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	11	0.69 ± 0.06	19	1.19 ± 0.81	9	0.56 ± 0.06
S27 - Sand Key SPA**	6	0.38 ± 0.13	30	1.88 ± 1.63	0	0 ± 0
S23 - East of Rock Key SPA	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
S54 - Western Sambo ER**	11	0.69 ± 0.06	37	2.31 ± 0.56	0	0 ± 0
S55 - Western Sambo ER**	4	0.25 ± 0.25	8	0.50 ± 0.25	2	0.13 ± 0.00
S48 - East of Western Sambo ER	1	0.06 ± 0.06	1	0.06 ± 0.06	2	0.13 ± 0.00
S49 - Middle Sambo Reef	13	0.81 ± 0.44	39	2.44 ± 0.94	2	0.13 ± 0.13
S52 - Eastern Sambo RO**	2	0.13 ± 0.13	12	0.75 ± 0.00	1	0.06 ± 0.06
S53 - Eastern Sambo RO**	31	1.94 ± 0.19	15	0.94 ± 0.81	1	0.06 ± 0.06
U22 - West of Pelican Shoal	0	0 ± 0	9	0.56 ± 0.06	13	0.81 ± 0.31
S30 - East of Pelican Shoal	2	0.13 ± 0.00	20	1.25 ± 1.13	3	0.19 ± 0.06
S31 - East of Maryland Shoal	1	0.06 ± 0.06	22	1.38 ± 1.13	2	0.13 ± 0.13
S51 - American Shoal	0	0 ± 0	4	0.25 ± 0.25	0	0 ± 0
S50 - American Shoal	0	0 ± 0	32	2.00 ± 1.63	1	0.06 ± 0.06
Lower Florida Keys Total (14)	82	0.37 ± 0.14	248	1.11 ± 0.22	38	0.17 ± 0.06

Site number/site location	<i>B. asbestinum</i>		<i>E. caribaeorum</i>		<i>E. calyculata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0	0 ± 0	9	0.56 ± 0.19	1	0.06 ± 0.06
S80 - West of Sombrero Key	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
S72 - West of Sombrero Key	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
S86 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S85 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	3	0.19 ± 0.19
S73 - East of Delta Shoal	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.00
S81 - SW of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
S75 - Marker 20	0	0 ± 0	20	1.25 ± 0.25	0	0 ± 0
S82 - Tennessee Reef	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
S83 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S84 - Tennessee Reef RO**	0	0 ± 0	6	0.38 ± 0.38	1	0.06 ± 0.06
T56 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	13	0.81 ± 0.06
T57 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	6	0.38 ± 0.00
T54 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
T55 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	9	0.56 ± 0.19	64	4.00 ± 1.63	1	0.06 ± 0.06
T23 - Little Conch Reef	5	0.31 ± 0.19	31	1.94 ± 1.31	0	0 ± 0
T52 - Conch Reef SPA**	2	0.13 ± 0.13	9	0.56 ± 0.56	1	0.06 ± 0.06
T53 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	3	0.19 ± 0.06
V09 - Conch Reef RO**	0	0 ± 0	16	1.00 ± 0.25	0	0 ± 0
V10 - Conch Reef RO**	0	0 ± 0	40	2.50 ± 1.25	2	0.13 ± 0.00
Middle Florida Keys Total (22)	18	0.05 ± 0.03	195	0.54 ± 0.22	42	0.12 ± 0.04
Upper Florida Keys						
U98 - Pickles Reef	14	0.88 ± 0.00	63	3.94 ± 0.31	1	0.06 ± 0.06
U97 - Dixie Shoal	1	0.06 ± 0.06	3	0.19 ± 0.19	2	0.13 ± 0.00
U94 - North of Dixie Shoal	0	0 ± 0	5	0.31 ± 0.31	1	0.06 ± 0.06
T30 - South of Elbow Reef	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
T50 - Carysfort Reef SPA**	153	9.56 ± 2.69	11	0.69 ± 0.56	4	0.25 ± 0.00
T26 - Carysfort Reef SPA**	4	0.25 ± 0.13	3	0.19 ± 0.06	9	0.56 ± 0.19
T51 - Carysfort Reef SPA**	32	2.00 ± 0.13	27	1.69 ± 1.44	0	0 ± 0
T27 - Carysfort Reef SPA**	3	0.19 ± 0.19	20	1.25 ± 0.38	6	0.38 ± 0.13
T25 - North of Carysfort Reef	17	1.06 ± 0.44	4	0.25 ± 0.25	1	0.06 ± 0.06
T48 - North of Carysfort Reef	11	0.69 ± 0.06	1	0.06 ± 0.06	3	0.19 ± 0.06
T49 - SE of Turtle Rocks	2	0.13 ± 0.13	4	0.25 ± 0.13	3	0.19 ± 0.19
Upper Florida Keys Total (11)	237	1.35 ± 0.84	141	0.80 ± 0.35	32	0.18 ± 0.05
Deeper Fore-reef Total (47)	337	0.45 ± 0.21	584	0.78 ± 0.15	112	0.15 ± 0.03

Table 5-4. Numbers of colonies (N) and mean ± 1 SE colony densities (no. per m²) for the gorgonians *Eunicea fusca*, *E. knighti*, and *E. laciniata* in the Florida Keys, as determined from surveys of two 8-m x 1-m transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>E. fusca</i>		<i>E. knighti</i>		<i>E. laciniata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	2	0.13 $\pm$ 0.0	0	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	17	1.06 $\pm$ 0.56	0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	5	0.31 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	6	0.38 $\pm$ 0.25	0	0 $\pm$ 0	0	0 $\pm$ 0
U04 - North of Pelican Shoal	3	0.19 $\pm$ 0.19	0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	16	1.00 $\pm$ 0.00	0	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	10	0.63 $\pm$ 0.63	0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	2	0.13 $\pm$ 0.00	0	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	61	0.38 $\pm$ 0.12	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys						
U40 - Marker 49A	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S58 - Marker 48	2	0.13 $\pm$ 0.00	0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	4	0.25 $\pm$ 0.13	0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	8	0.50 $\pm$ 0.50	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	15	0.13 $\pm$ 0.07	0	0 $\pm$ 0	1	0.01 $\pm$ 0.01
Upper Florida Keys						
S89 - Mosquito Bank	3	0.19 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	5	0.31 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	4	0.25 $\pm$ 0.25	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S92 - Basin Hill Shoals	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S93 - Turtle Rocks	8	0.50 $\pm$ 0.13	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	21	0.26 $\pm$ 0.07	0	0 $\pm$ 0	2	0.03 $\pm$ 0.02
Mid-channel Patch Reef Total (22)	97	0.28 $\pm$ 0.06	0	0 $\pm$ 0	3	0.01 $\pm$ 0.00
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	3	0.19 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	20	1.25 $\pm$ 0.13	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S20 - Western Sambo ER**	3	0.19 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S17 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S18 - Looe Key RO**	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0
Lower Florida Keys Total (8)	27	0.21 $\pm$ 0.15	1	0.01 $\pm$ 0.01	1	0.01 $\pm$ 0.01
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>E. fusca</i>		<i>E. knighti</i>		<i>E. laciniata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	10	0.63 ± 0.13	0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	3	0.19 ± 0.06	0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
Middle Florida Keys Total (8)	16	0.13 ± 0.08	0	0 ± 0	1	0.01 ± 0.01
Upper Florida Keys						
S99 - Wolf Reef	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T03 - White Bank	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T05 - White Bank	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	2	0.13 ± 0.00	0	0 ± 0	1	0.06 ± 0.06
T08 - West of Key Largo Dry Rocks	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	2	0.13 ± 0.00	0	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	3	0.19 ± 0.19	0	0 ± 0	1	0.13 ± 0.00
T20 - Carysfort Reef SPA**	4	0.25 ± 0.13	0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T24 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
Upper Florida Keys Total (12)	17	0.09 ± 0.02	0	0 ± 0	5	0.03 ± 0.01
Offshore Patch Reef Total (28)	60	0.13 ± 0.05	1	0.01 ± 0.01	7	0.02 ± 0.01
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	4	0.25 ± 0.13	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	4	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S66 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	2	0.13 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
S67 - Tennessee Reef RO**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	20	1.25 ± 0.13	0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	8	0.50 ± 0.38	0	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	4	0.25 ± 0.13	0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	4	0.25 ± 0.25	0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	5	0.31 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T22 - Conch Reef SPA**	3	0.19 ± 0.06	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	47	0.27 ± 0.11	0	0 ± 0	3	0.02 ± 0.01
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	6	0.38 ± 0.13	0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	4	0.25 ± 0.25	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (4)	10	0.16 ± 0.09	0	0 ± 0	0	0 ± 0
Shallow Hard-bottom Total (17)	61	0.22 ± 0.07	0	0 ± 0	3	0.01 ± 0.01
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	7	0.44 ± 0.44	0	0 ± 0	1	0.06 ± 0.06
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	2	0.13 ± 0.00	0	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	3	0.19 ± 0.19	0	0 ± 0	0	0 ± 0

Site number/site location	<i>E. fusca</i>		<i>E. knighti</i>		<i>E. laciniata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	19	1.19 ± 1.19	0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	11	0.69 ± 0.06	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0	0 ± 0	0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	12	0.75 ± 0.75	0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	5	0.31 ± 0.06	0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	2	0.13 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
S35 - American Shoal	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S36 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	61	0.19 ± 0.07	0	0 ± 0	3	0.01 ± 0.01
Middle Florida Keys						
S78 - Sombrero Key SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	9	0.56 ± 0.31	0	0 ± 0	1	0.06 ± 0.06
S77 - Delta Shoal	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	12	0.19 ± 0.13	0	0 ± 0	1	0.02 ± 0.02
Upper Florida Keys						
T32 - Pickles Reef	12	0.75 ± 0.50	0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T33 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T34 - Sand Island	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T14 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0	0 ± 0	0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	15	0.05 ± 0.04	0	0 ± 0	1	0.01 ± 0.01
Spur and Groove Total (44)	88	0.13 ± 0.04	0	0 ± 0	5	0.01 ± 0.00
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	30	1.88 ± 0.75	0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	8	0.50 ± 0.00	0	0 ± 0	1	0.06 ± 0.06
S23 - East of Rock Key SPA	4	0.25 ± 0.13	0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	6	0.38 ± 0.38	0	0 ± 0	1	0.06 ± 0.06
S55 - Western Sambo ER**	10	0.63 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
S48 - East of Western Sambo ER	5	0.31 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
S49 - Middle Sambo Reef	9	0.56 ± 0.06	0	0 ± 0	2	0.13 ± 0.00
S52 - Eastern Sambo RO**	14	0.88 ± 0.25	0	0 ± 0	0	0 ± 0
S53 - Eastern Sambo RO**	16	1.00 ± 0.25	0	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	10	0.63 ± 0.38	0	0 ± 0	1	0.06 ± 0.06
S30 - East of Pelican Shoal	6	0.38 ± 0.13	0	0 ± 0	2	0.13 ± 0.13
S31 - East of Maryland Shoal	5	0.31 ± 0.06	0	0 ± 0	0	0 ± 0
S51 - American Shoal	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
S50 - American Shoal	5	0.31 ± 0.19	0	0 ± 0	1	0.06 ± 0.06
Lower Florida Keys Total (14)	130	0.58 ± 0.12	0	0 ± 0	10	0.04 ± 0.01

Site number/site location	<i>E. fusca</i>		<i>E. knighti</i>		<i>E. laciniata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	8	0.50 ± 0.38	0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	5	0.31 ± 0.19	0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	4	0.25 ± 0.13	0	0 ± 0	2	0.13 ± 0.13
S73 - East of Delta Shoal	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
S81 - SW of Coffins Patch	2	0.13 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
S75 - Marker 20	5	0.31 ± 0.19	0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T56 - Alligator Reef SPA**	33	2.06 ± 0.94	0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	10	0.63 ± 0.38	0	0 ± 0	1	0.06 ± 0.06
T54 - Davis Reef SPA**	4	0.25 ± 0.00	0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	2	0.13 ± 0.00	0	0 ± 0	1	0.06 ± 0.06
T23 - Little Conch Reef	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T52 - Conch Reef SPA**	18	1.13 ± 0.38	0	0 ± 0	1	0.06 ± 0.06
T53 - Conch Reef SPA**	48	3.00 ± 0.25	0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	30	1.88 ± 0.38	0	0 ± 0	2	0.13 ± 0.13
V10 - Conch Reef RO**	26	1.63 ± 0.63	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	200	0.57 ± 0.18	0	0 ± 0	11	0.03 ± 0.11
Upper Florida Keys						
U98 - Pickles Reef	8	0.50 ± 0.50	0	0 ± 0	1	0.06 ± 0.06
U87 - Dixie Shoal	3	0.19 ± 0.06	0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
T30 - South of Elbow Reef	2	0.13 ± 0.13	0	0 ± 0	3	0.19 ± 0.06
T50 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.25
T26 - Carysfort Reef SPA**	6	0.38 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
T51 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	6	0.38 ± 0.00
T27 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
T25 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T48 - North of Carysfort Reef	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	17	1.06 ± 0.31	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	37	0.21 ± 0.10	0	0 ± 0	20	0.11 ± 0.04
Deeper Fore-reef Total (47)	367	0.49 ± 0.09	0	0 ± 0	41	0.05 ± 0.01

Table 5-5. Numbers of colonies (N) and mean $\pm$ 1 SE colony densities (no. per m²) for the gorgonians *Eunicea mammosa*, *E. palmeri*, and *E. succinea* in the Florida Keys, as determined from surveys of two 8-m x 1-m transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>E. mammosa</i>		<i>E. palmeri</i>		<i>E. succinea</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	0	0 $\pm$ 0	4	0.25 $\pm$ 0.25
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	4	0.06 $\pm$ 0.06
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	4	0.06 $\pm$ 0.06
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	7	0.44 $\pm$ 0.31
S13 - Western Sambo ER**	3	0.19 $\pm$ 0.19	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S05 - North of Middle Sambo Reef	0	0 $\pm$ 0	0	0 $\pm$ 0	8	0.50 $\pm$ 0.00
S06 - North of Pelican Shoal	2	0.13 $\pm$ 0.00	0	0 $\pm$ 0	3	0.19 $\pm$ 0.19
U04 - North of Pelican Shoal	6	0.38 $\pm$ 0.00	0	0 $\pm$ 0	6	0.38 $\pm$ 0.00
S07 - West Washerwoman Shoal	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	2	0.13 $\pm$ 0.00
S08 - West Washerwoman Shoal	4	0.25 $\pm$ 0.13	0	0 $\pm$ 0	3	0.19 $\pm$ 0.19
S09 - North of Maryland Shoal	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	4	0.25 $\pm$ 0.13
S10 - North of American Shoal	4	0.25 $\pm$ 0.13	0	0 $\pm$ 0	2	0.13 $\pm$ 0.00
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	22	0.14 $\pm$ 0.04	0	0 $\pm$ 0	36	0.23 $\pm$ 0.05
Middle Florida Keys						
U40 - Marker 49A	4	0.25 $\pm$ 0.13	0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	6	0.38 $\pm$ 0.25	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
Middle Florida Keys Total (7)	11	0.10 $\pm$ 0.06	0	0 $\pm$ 0	2	0.02 $\pm$ 0.01
Upper Florida Keys						
S89 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	3	0.19 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	2	0.13 $\pm$ 0.13	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S92 - Basin Hill Shoals	2	0.13 $\pm$ 0.13	0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	40	2.50 $\pm$ 0.38	0	0 $\pm$ 0	3	0.19 $\pm$ 0.06
Upper Florida Keys Total (5)	47	0.59 $\pm$ 0.48	0	0 $\pm$ 0	4	0.05 $\pm$ 0.04
Mid-channel Patch Reef Total (22)	80	0.23 $\pm$ 0.11	0	0 $\pm$ 0	42	0.12 $\pm$ 0.03
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	5	0.31 $\pm$ 0.19	0	0 $\pm$ 0	13	0.81 $\pm$ 0.56
S15 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	2	0.13 $\pm$ 0.13
S16 - North of Sand Key	16	1.00 $\pm$ 0.00	0	0 $\pm$ 0	17	1.06 $\pm$ 0.19
S19 - Western Sambo ER**	5	0.31 $\pm$ 0.19	0	0 $\pm$ 0	12	0.75 $\pm$ 0.00
S20 - Western Sambo ER**	4	0.25 $\pm$ 0.00	0	0 $\pm$ 0	8	0.50 $\pm$ 0.25
U12 - West of Looe Key RO	8	0.50 $\pm$ 0.38	0	0 $\pm$ 0	6	0.38 $\pm$ 0.13
S17 - Looe Key RO**	10	0.63 $\pm$ 0.38	0	0 $\pm$ 0	6	0.38 $\pm$ 0.00
S18 - Looe Key RO**	3	0.19 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (8)	51	0.40 $\pm$ 0.11	0	0 $\pm$ 0	64	0.50 $\pm$ 0.13
Middle Florida Keys						
S60 - NE of Delta Shoal	2	0.13 $\pm$ 0.13	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>E. mammosa</i>		<i>E. palmeri</i>		<i>E. succinea</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	6	0.38 ± 0.25	0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	61	3.81 ± 0.69	0	0 ± 0	2	0.13 ± 0.00
S62 - Coffins Patch SPA**	2	0.13 ± 0.13	0	0 ± 0	2	0.13 ± 0.13
S69 - Coffins Patch SPA**	21	1.31 ± 0.06	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	1	0.06 ± 0.06	0	0 ± 0	2	0.13 ± 0.00
S64 - South of Coffins Patch	3	0.19 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
U42 - East of Coffins Patch	7	0.44 ± 0.19	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	103	0.80 ± 0.45	0	0 ± 0	7	0.05 ± 0.02
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T04 - Inshore of Sand Island	3	0.19 ± 0.06	0	0 ± 0	2	0.13 ± 0.13
T03 - White Bank	3	0.19 ± 0.06	0	0 ± 0	0	0 ± 0
T05 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	1	0.06 ± 0.06	0	0 ± 0	3	0.19 ± 0.06
T08 - West of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
T06 - West of Elbow Reef	9	0.56 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T07 - SW of Watson's Reef	12	0.75 ± 0.25	0	0 ± 0	6	0.38 ± 0.00
T31 - South of Watson's Reef	0	0 ± 0	0	0 ± 0	14	0.88 ± 0.38
T20 - Carysfort Reef SPA**	6	0.38 ± 0.25	0	0 ± 0	3	0.19 ± 0.06
T19 - Carysfort Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	8	0.50 ± 0.25
T24 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	13	0.81 ± 0.31
Upper Florida Keys Total (12)	35	0.18 ± 0.07	0	0 ± 0	53	0.28 ± 0.09
Offshore Patch Reef Total (28)	189	0.42 ± 0.14	0	0 ± 0	124	0.28 ± 0.06
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	12	0.75 ± 0.25	0	0 ± 0	9	0.56 ± 0.31
Lower Florida Keys Total (2)	13	0.41 ± 0.34	0	0 ± 0	9	0.28 ± 0.28
Middle Florida Keys						
S65 - SE of Coffins Patch	21	1.31 ± 0.19	0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	5	0.31 ± 0.06	0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	4	0.25 ± 0.13	0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	1	0.06 ± 0.06	0	0 ± 0	3	0.19 ± 0.19
T16 - West of Alligator Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	15	0.94 ± 0.19	0	0 ± 0	4	0.25 ± 0.00
T46 - Alligator Reef SPA**	32	2.00 ± 0.13	0	0 ± 0	2	0.13 ± 0.00
V03 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
T36 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	7	0.44 ± 0.06	0	0 ± 0	2	0.13 ± 0.00
T22 - Conch Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	86	0.49 ± 0.20	0	0 ± 0	13	0.07 ± 0.03
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	23	1.44 ± 0.19	0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	10	0.63 ± 0.13	0	0 ± 0	7	0.44 ± 0.19
Upper Florida Keys Total (4)	33	0.52 ± 0.34	0	0 ± 0	8	0.13 ± 0.11
Shallow Hard-bottom Total (17)	132	0.49 ± 0.15	0	0 ± 0	30	0.11 ± 0.04
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	2	0.13 ± 0.13	0	0 ± 0	1	0.06 ± 0.6
S46 - Sand Key SPA**	1	0.06 ± 0.06	0	0 ± 0	5	0.31 ± 0.06
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	20	1.25 ± 0.38	0	0 ± 0	2	0.13 ± 0.13
S45 - Rock Key SPA**	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0

Site number/site location	<i>E. mammosa</i>		<i>E. palmeri</i>		<i>E. succinea</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	17	1.06 ± 0.19	0	0 ± 0	1	0.06 ± 0.06
S41 - Western Sambo ER**	6	0.38 ± 0.13	0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	7	0.44 ± 0.19	0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	3	0.19 ± 0.19	0	0 ± 0	1	0.06 ± 0.06
U24 - Pelican Shoal	3	0.19 ± 0.19	0	0 ± 0	1	0.06 ± 0.06
U23 - Maryland Shoal	4	0.25 ± 0.13	0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	2	0.13 ± 0.13	0	0 ± 0	2	0.13 ± 0.13
S35 - American Shoal	13	0.81 ± 0.19	0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	85	0.27 ± 0.08	0	0 ± 0	13	0.04 ± 0.02
Middle Florida Keys						
S78 - Sombrero Key SPA**	2	0.13 ± 0.00	0	0 ± 0	1	0.06 ± 0.06
S79 - Sombrero Key SPA**	4	0.25 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
S76 - Delta Shoal	8	0.50 ± 0.38	0	0 ± 0	1	0.06 ± 0.06
S77 - Delta Shoal	7	0.44 ± 0.44	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	21	0.33 ± 0.09	0	0 ± 0	3	0.05 ± 0.02
Upper Florida Keys						
T32 - Pickles Reef	3	0.19 ± 0.19	0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	3	0.19 ± 0.06	0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	8	0.50 ± 0.38	0	0 ± 0	0	0 ± 0
T33 - Sand Island	4	0.25 ± 0.00	0	0 ± 0	0	0 ± 0
T34 - Sand Island	5	0.31 ± 0.31	0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	2	0.13 ± 0.00	0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	4	0.25 ± 0.00	0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	15	0.94 ± 0.06	0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	7	0.44 ± 0.31	0	0 ± 0	1	0.06 ± 0.06
T39 - Elbow Reef SPA**	7	0.44 ± 0.31	0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	9	0.56 ± 0.56	0	0 ± 0	2	0.13 ± 0.00
T37 - South Carysfort Reef SPA**	19	1.19 ± 0.69	0	0 ± 0	3	0.19 ± 0.19
T38 - Carysfort Reef SPA**	6	0.38 ± 0.13	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	1	0.06 ± 0.06	0	0 ± 0	2	0.13 ± 0.00
Upper Florida Keys Total (18)	94	0.33 ± 0.08	0	0 ± 0	8	0.03 ± 0.01
Spur and Groove Total (44)	200	0.30 ± 0.05	0	0 ± 0	24	0.04 ± 0.01
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	7	0.44 ± 0.31	0	0 ± 0	13	0.81 ± 0.31
S27 - Sand Key SPA**	4	0.25 ± 0.13	0	0 ± 0	6	0.38 ± 0.00
S23 - East of Rock Key SPA	13	0.81 ± 0.31	0	0 ± 0	1	0.06 ± 0.06
S54 - Western Sambo ER**	1	0.06 ± 0.06	0	0 ± 0	9	0.56 ± 0.31
S55 - Western Sambo ER**	2	0.13 ± 0.13	0	0 ± 0	8	0.50 ± 0.00
S48 - East of Western Sambo ER	15	0.94 ± 0.19	0	0 ± 0	2	0.13 ± 0.13
S49 - Middle Sambo Reef	2	0.13 ± 0.13	0	0 ± 0	4	0.25 ± 0.00
S52 - Eastern Sambo RO**	1	0.06 ± 0.06	0	0 ± 0	6	0.38 ± 0.25
S53 - Eastern Sambo RO**	3	0.19 ± 0.19	0	0 ± 0	14	0.88 ± 0.50
U22 - West of Pelican Shoal	15	0.94 ± 0.44	0	0 ± 0	13	0.81 ± 0.06
S30 - East of Pelican Shoal	6	0.38 ± 0.13	0	0 ± 0	16	1.00 ± 0.38
S31 - East of Maryland Shoal	4	0.25 ± 0.13	0	0 ± 0	11	0.69 ± 0.19
S51 - American Shoal	0	0	0	0 ± 0	1	0.06 ± 0.06
S50 - American Shoal	5	0.31 ± 0.06	0	0 ± 0	5	0.31 ± 0.06
Lower Florida Keys Total (14)	78	0.35 ± 0.09	0	0 ± 0	109	0.49 ± 0.08

Site number/site location	<i>E. mammosa</i>		<i>E. palmeri</i>		<i>E. succinea</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	8	0.50 ± 0.13	0	0 ± 0	0	0
S80 - West of Sombrero Key	0	0	0	0 ± 0	0	0
S74 - West of Sombrero Key	4	0.25 ± 0.00	0	0 ± 0	1	0.06 ± 0.06
S72 - West of Sombrero Key	3	0.19 ± 0.06	0	0 ± 0	0	0
S86 - Sombrero Key SPA	3	0.19 ± 0.19	0	0 ± 0	0	0
S85 - Sombrero Key SPA	2	0.13 ± 0.00	0	0 ± 0	2	0.13 ± 0.00
S73 - East of Delta Shoal	59	3.69 ± 0.81	0	0 ± 0	0	0
S81 - SW of Coffins Patch	0	0	1	0.06 ± 0.06	0	0
S75 - Marker 20	0	0	0	0 ± 0	0	0
S82 - Tennessee Reef	5	0.31 ± 0.19	0	0 ± 0	0	0
S83 - Tennessee Reef RO**	5	0.31 ± 0.06	0	0 ± 0	0	0
S84 - Tennessee Reef RO**	1	0.06 ± 0.06	0	0 ± 0	0	0
T56 - Alligator Reef SPA**	34	2.13 ± 0.13	0	0 ± 0	5	0.31 ± 0.06
T57 - Alligator Reef SPA**	43	2.69 ± 0.19	0	0 ± 0	12	0.75 ± 0.50
T54 - Davis Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0
T55 - Davis Reef SPA**	0	0	0	0 ± 0	0	0
T47 - Little Conch Reef	0	0	0	0 ± 0	0	0
T23 - Little Conch Reef	2	0.13 ± 0.13	0	0 ± 0	0	0
T52 - Conch Reef SPA**	3	0.19 ± 0.06	0	0 ± 0	2	0.13 ± 0.00
T53 - Conch Reef SPA**	3	0.19 ± 0.06	0	0 ± 0	0	0
V09 - Conch Reef RO**	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
V10 - Conch Reef RO**	0	0	0	0 ± 0	3	0.19 ± 0.06
Middle Florida Keys Total (22)	177	0.50 ± 0.21	1	<0.01 ± <0.01	26	0.07 ± 0.04
Upper Florida Keys						
U98 - Pickles Reef	1	0.06 ± 0.06	0	0 ± 0	0	0
U87 - Dixie Shoal	4	0.25 ± 0.00	0	0 ± 0	0	0
U84 - North of Dixie Shoal	0	0	0	0 ± 0	0	0
T30 - South of Elbow Reef	37	2.31 ± 0.56	0	0 ± 0	4	0.25 ± 0.13
T50 - Carysfort Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T26 - Carysfort Reef SPA**	3	0.19 ± 0.06	0	0 ± 0	2	0.13 ± 0.13
T51 - Carysfort Reef SPA**	14	0.88 ± 0.25	0	0 ± 0	5	0.31 ± 0.19
T27 - Carysfort Reef SPA**	2	0.13 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
T25 - North of Carysfort Reef	2	0.13 ± 0.00	0	0 ± 0	4	0.25 ± 0.13
T48 - North of Carysfort Reef	7	0.44 ± 0.06	0	0 ± 0	8	0.50 ± 0.13
T49 - SE of Turtle Rocks	139	8.69 ± 1.94	0	0 ± 0	2	0.13 ± 0.13
Upper Florida Keys Total (11)	210	1.19 ± 0.78	0	0 ± 0	27	0.15 ± 0.05
Deeper Fore-reef Total (47)	465	0.62 ± 0.21	1	<0.01 ± <0.01	162	0.22 ± 0.04

Table 5-6. Numbers of colonies (N) and mean $\pm$ 1 SE colony densities (no. per m²) for the gorgonians *Eunicea tourneforti*, *Gorgonia ventalina*, and *Muricea elongata* in the Florida Keys, as determined from surveys of two 8-m x 1-m transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>E. tourneforti</i>		<i>G. ventalina</i>		<i>M. elongata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	4	0.25 $\pm$ 0.13	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	4	0.25 $\pm$ 0.13	4	0.25 $\pm$ 0.25
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	21	1.31 $\pm$ 0.44	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	29	0.45 $\pm$ 0.29	4	0.06 $\pm$ 0.06
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	29	0.45 $\pm$ 0.29	4	0.06 $\pm$ 0.06
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	11	0.69 $\pm$ 0.31	35	2.19 $\pm$ 0.31	45	2.81 $\pm$ 0.44
S13 - Western Sambo ER**	8	0.50 $\pm$ 0.13	10	0.63 $\pm$ 0.25	24	1.50 $\pm$ 0.38
S05 - North of Middle Sambo Reef	14	0.88 $\pm$ 0.25	19	1.19 $\pm$ 0.06	30	1.88 $\pm$ 0.13
S06 - North of Pelican Shoal	13	0.81 $\pm$ 0.44	13	0.81 $\pm$ 0.44	36	2.25 $\pm$ 0.25
U04 - North of Pelican Shoal	5	0.31 $\pm$ 0.19	29	1.81 $\pm$ 0.19	24	1.50 $\pm$ 0.25
S07 - West Washerwoman Shoal	2	0.13 $\pm$ 0.00	16	1.00 $\pm$ 0.63	27	1.69 $\pm$ 0.81
S08 - West Washerwoman Shoal	4	0.25 $\pm$ 0.13	26	1.63 $\pm$ 0.50	9	0.56 $\pm$ 0.06
S09 - North of Maryland Shoal	9	0.56 $\pm$ 0.06	30	1.88 $\pm$ 0.63	24	1.50 $\pm$ 0.13
S10 - North of American Shoal	3	0.19 $\pm$ 0.06	28	1.75 $\pm$ 1.00	26	1.63 $\pm$ 0.25
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
Lower Florida Keys Total (10)	69	0.43 $\pm$ 0.10	206	1.29 $\pm$ 0.22	246	1.54 $\pm$ 0.25
Middle Florida Keys						
U40 - Marker 49A	4	0.25 $\pm$ 0.13	47	2.94 $\pm$ 0.19	13	0.81 $\pm$ 0.19
S58 - Marker 48	2	0.13 $\pm$ 0.13	31	1.94 $\pm$ 0.19	0	0 $\pm$ 0
S59 - East Turtle Shoal	0	0 $\pm$ 0	36	2.25 $\pm$ 0.25	26	1.63 $\pm$ 0.25
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	4	0.25 $\pm$ 0.13	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	6	0.38 $\pm$ 0.25	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	2	0.13 $\pm$ 0.00	0	0 $\pm$ 0
Middle Florida Keys Total (7)	6	0.05 $\pm$ 0.04	127	1.13 $\pm$ 0.45	39	0.35 $\pm$ 0.24
Upper Florida Keys						
S89 - Mosquito Bank	2	0.13 $\pm$ 0.13	9	0.56 $\pm$ 0.19	4	0.25 $\pm$ 0.00
S90 - Mosquito Bank	8	0.50 $\pm$ 0.13	45	2.81 $\pm$ 1.06	0	0 $\pm$ 0
S91 - Basin Hill Shoals	1	0.06 $\pm$ 0.06	51	3.19 $\pm$ 0.19	0	0 $\pm$ 0
S92 - Basin Hill Shoals	3	0.19 $\pm$ 0.06	27	1.69 $\pm$ 0.56	2	0.13 $\pm$ 0.13
S93 - Turtle Rocks	38	2.38 $\pm$ 0.50	18	1.13 $\pm$ 0.50	30	1.88 $\pm$ 0.25
Upper Florida Keys Total (5)	52	0.65 $\pm$ 0.44	150	1.88 $\pm$ 0.50	36	0.45 $\pm$ 0.36
Mid-channel Patch Reef Total (22)	127	0.36 $\pm$ 0.11	483	1.37 $\pm$ 0.21	321	0.91 $\pm$ 0.20
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	1	0.06 $\pm$ 0.06	11	0.69 $\pm$ 0.31	17	1.06 $\pm$ 0.44
S15 - North of Sand Key	0	0 $\pm$ 0	4	0.25 $\pm$ 0.13	0	0
S16 - North of Sand Key	7	0.44 $\pm$ 0.06	13	0.81 $\pm$ 0.06	30	1.88 $\pm$ 0.00
S19 - Western Sambo ER**	1	0.06 $\pm$ 0.06	13	0.81 $\pm$ 0.44	13	0.81 $\pm$ 0.31
S20 - Western Sambo ER**	6	0.38 $\pm$ 0.13	10	0.63 $\pm$ 0.00	16	1.00 $\pm$ 0.13
U12 - West of Looe Key RO	0	0 $\pm$ 0	8	0.50 $\pm$ 0.00	47	2.94 $\pm$ 1.69
S17 - Looe Key RO**	0	0 $\pm$ 0	43	2.69 $\pm$ 0.69	27	1.69 $\pm$ 0.69
S18 - Looe Key RO**	2	0.13 $\pm$ 0.00	49	3.06 $\pm$ 1.31	18	1.13 $\pm$ 0.25
Lower Florida Keys Total (8)	17	0.13 $\pm$ 0.06	151	1.18 $\pm$ 0.38	168	1.31 $\pm$ 0.31
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06

Site number/site location	<i>E. tourneforti</i>		<i>G. ventalina</i>		<i>M. elongata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	6	0.38 ± 0.13	64	4.00 ± 1.75	14	0.88 ± 0.13
S63 - Coffins Patch SPA**	9	0.56 ± 0.06	56	3.50 ± 0.50	13	0.81 ± 0.06
S62 - Coffins Patch SPA**	1	0.06 ± 0.06	30	1.88 ± 0.63	3	0.19 ± 0.06
S69 - Coffins Patch SPA**	1	0.06 ± 0.06	28	1.75 ± 0.00	0	0 ± 0
S70 - Coffins Patch SPA**	0	0 ± 0	40	2.50 ± 0.00	0	0 ± 0
S64 - South of Coffins Patch	6	0.38 ± 0.25	39	2.44 ± 0.44	3	0.19 ± 0.06
U42 - East of Coffins Patch	11	0.69 ± 0.06	38	2.38 ± 0.00	7	0.44 ± 0.06
Middle Florida Keys Total (8)	34	0.27 ± 0.10	295	2.30 ± 0.43	41	0.32 ± 0.12
Upper Florida Keys						
S99 - Wolf Reef	5	0.31 ± 0.31	10	0.63 ± 0.25	2	0.13 ± 0.13
T04 - Inshore of Sand Island	3	0.19 ± 0.06	11	0.69 ± 0.44	0	0 ± 0
T03 - White Bank	13	0.81 ± 0.31	8	0.50 ± 0.13	14	0.88 ± 0.50
T05 - White Bank	6	0.38 ± 0.25	19	1.19 ± 0.19	0	0 ± 0
T09 - South of Key Largo Dry Rocks	13	0.81 ± 0.31	5	0.31 ± 0.06	1	0.06 ± 0.06
T08 - West of Key Largo Dry Rocks	12	0.75 ± 0.13	19	1.19 ± 0.19	3	0.19 ± 0.06
T06 - West of Elbow Reef	4	0.25 ± 0.13	89	5.56 ± 1.06	0	0 ± 0
T07 - SW of Watson's Reef	14	0.88 ± 0.13	47	2.94 ± 0.56	1	0.06 ± 0.06
T31 - South of Watson's Reef	6	0.38 ± 0.13	8	0.50 ± 0.13	3	0.19 ± 0.19
T20 - Carysfort Reef SPA**	17	1.06 ± 0.06	33	2.06 ± 0.81	2	0.13 ± 0.13
T19 - Carysfort Reef SPA**	9	0.56 ± 0.06	34	2.13 ± 0.50	3	0.19 ± 0.19
T24 - North of Carysfort Reef	3	0.19 ± 0.19	6	0.38 ± 0.25	0	0 ± 0
Upper Florida Keys Total (12)	105	0.55 ± 0.09	289	1.51 ± 0.44	29	0.15 ± 0.07
Offshore Patch Reef Total (28)	156	0.35 ± 0.06	735	1.64 ± 0.25	238	0.53 ± 0.13
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	3	0.19 ± 0.06
S22 - West of Looe Key SPA	14	0.88 ± 0.25	14	0.88 ± 0.25	53	3.31 ± 0.19
Lower Florida Keys Total (2)	14	0.44 ± 0.44	14	0.44 ± 0.444	56	1.75 ± 1.56
Middle Florida Keys						
S65 - SE of Coffins Patch	4	0.25 ± 0.13	13	0.81 ± 0.19	6	0.38 ± 0.13
S66 - Tennessee Reef	12	0.75 ± 0.25	30	1.88 ± 0.63	4	0.25 ± 0.25
S68 - Tennessee Reef RO**	1	0.06 ± 0.06	46	2.88 ± 1.00	7	0.44 ± 0.06
S67 - Tennessee Reef RO**	2	0.13 ± 0.13	50	3.13 ± 1.00	5	0.31 ± 0.19
T16 - West of Alligator Reef	5	0.31 ± 0.06	2	0.13 ± 0.00	1	0.06 ± 0.06
T45 - Alligator Reef SPA**	15	0.94 ± 0.31	49	3.06 ± 1.31	11	0.69 ± 0.44
T46 - Alligator Reef SPA**	10	0.63 ± 0.13	64	4.00 ± 0.75	8	0.50 ± 0.38
V03 - Davis Reef SPA**	3	0.19 ± 0.19	26	1.63 ± 1.00	0	0 ± 0
T36 - Davis Reef SPA**	3	0.19 ± 0.06	33	2.06 ± 0.19	1	0.06 ± 0.06
T21 - Conch Reef SPA**	4	0.25 ± 0.25	44	2.75 ± 0.38	1	0.06 ± 0.06
T22 - Conch Reef SPA**	2	0.13 ± 0.13	25	1.56 ± 1.06	0	0 ± 0
Middle Florida Keys Total (11)	61	0.35 ± 0.09	382	2.17 ± 0.34	44	0.25 ± 0.07
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	9	0.56 ± 0.44	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	32	2.00 ± 0.25	0	0 ± 0
T17 - North of French Reef	2	0.13 ± 0.00	68	4.25 ± 0.63	0	0 ± 0
T18 - Watson's Reef	30	1.88 ± 0.38	21	1.31 ± 0.31	3	0.19 ± 0.06
Upper Florida Keys Total (4)	32	0.50 ± 0.46	130	2.03 ± 0.80	3	0.05 ± 0.05
Shallow Hard-bottom Total (17)	107	0.39 ± 0.12	526	1.93 ± 0.31	103	0.38 ± 0.19
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	1	0.06 ± 0.06	93	5.81 ± 4.44	0	0 ± 0
S46 - Sand Key SPA**	3	0.19 ± 0.06	56	3.50 ± 1.63	0	0 ± 0
S47 - Sand Key SPA**	0	0 ± 0	27	1.69 ± 0.19	0	0 ± 0
S44 - Rock Key SPA**	2	0.13 ± 0.13	43	2.69 ± 0.19	1	0.06 ± 0.06
S45 - Rock Key SPA**	0	0 ± 0	31	1.94 ± 0.06	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	26	1.63 ± 0.88	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	13	0.81 ± 0.44	0	0 ± 0

Site number/site location	<i>E. tourneforti</i>		<i>G. ventalina</i>		<i>M. elongata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	52	3.25 ± 1.13	0	0 ± 0
S41 - Western Sambo ER**	0	0 ± 0	44	2.75 ± 0.13	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	12	0.75 ± 0.63	0	0 ± 0
S38 - Eastern Sambo RO**	1	0.06 ± 0.06	60	3.75 ± 1.25	0	0 ± 0
S39 - Eastern Sambo RO**	0	0 ± 0	30	1.88 ± 0.63	1	0.06 ± 0.06
U15 - No Name Reef	0	0 ± 0	19	1.19 ± 0.81	0	0 ± 0
S24 - East of Eastern Sambo RO	0	0 ± 0	25	1.56 ± 0.31	8	0.50 ± 0.25
U24 - Pelican Shoal	0	0 ± 0	36	2.25 ± 1.50	0	0 ± 0
U23 - Maryland Shoal	7	0.44 ± 0.06	10	0.63 ± 0.13	3	0.19 ± 0.19
S34 - Maryland Shoal	1	0.06 ± 0.06	6	0.38 ± 0.25	9	0.56 ± 0.44
S35 - American Shoal	1	0.06 ± 0.06	86	5.38 ± 2.63	14	0.88 ± 0.38
S36 - Looe Key SPA**	0	0 ± 0	13	0.81 ± 0.19	0	0 ± 0
S37 - Looe Key SPA**	0	0 ± 0	11	0.69 ± 0.19	0	0 ± 0
Lower Florida Keys Total (20)	16	0.05 ± 0.02	693	2.17 ± 0.34	36	0.11 ± 0.05
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	86	5.38 ± 1.00	0	0 ± 0
S79 - Sombrero Key SPA**	0	0 ± 0	79	4.94 ± 1.31	0	0 ± 0
S76 - Delta Shoal	5	0.31 ± 0.31	40	2.50 ± 0.88	3	0.19 ± 0.06
S77 - Delta Shoal	8	0.50 ± 0.13	34	2.13 ± 0.13	6	0.38 ± 0.13
Middle Florida Keys Total (4)	13	0.20 ± 0.12	239	3.73 ± 0.83	9	0.14 ± 0.09
Upper Florida Keys						
T32 - Pickles Reef	2	0.13 ± 0.13	151	9.44 ± 3.69	3.69	0 ± 0
T43 - Molasses Reef SPA**	0	0 ± 0	139	8.69 ± 0.19	0.19	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	71	4.44 ± 1.56	1.56	0 ± 0
T33 - Sand Island	1	0.06 ± 0.06	110	6.88 ± 1.38	1.38	0 ± 0
T34 - Sand Island	2	0.13 ± 0.13	47	2.94 ± 0.06	0.06	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	19	1.19 ± 0.31	0.31	0 ± 0
T42 - French Reef SPA**	0	0 ± 0	5	0.31 ± 0.19	0.19	0 ± 0
T14 - Grecian Rocks SPA**	0	0 ± 0	105	6.56 ± 1.06	1.06	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	86	5.38 ± 1.63	1.63	0 ± 0
T12 - Key Largo Dry Rocks SPA**	1	0.06 ± 0.06	112	7.00 ± 0.63	0.63	0 ± 0
T13 - Key Largo Dry Rocks SPA**	1	0.06 ± 0.06	137	8.56 ± 1.31	1.31	0 ± 0
T10 - North-North Dry Rocks	4	0.25 ± 0.25	135	8.44 ± 2.06	2.06	0 ± 0
T39 - Elbow Reef SPA**	1	0.06 ± 0.06	97	6.06 ± 1.06	1.06	0 ± 0
T40 - Elbow Reef SPA**	1	0.06 ± 0.06	66	4.13 ± 0.00	0.00	0 ± 0
T35 - South of South Carysfort	5	0.31 ± 0.19	135	8.44 ± 0.19	0.19	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	98	6.13 ± 1.13	1.13	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	72	4.50 ± 2.00	2.00	0 ± 0
T11 - North of Turtle Reef	3	0.19 ± 0.19	56	3.50 ± 0.50	0.50	0 ± 0
Upper Florida Keys Total (18)	21	0.07 ± 0.02	1,641	5.70 ± 0.62	0	0 ± 0
Spur and Groove Total (44)	50	0.07 ± 0.02	2,573	3.83 ± 0.41	45	0.07 ± 0.03
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	6	0.38 ± 0.13	4	0.25 ± 0.13	35	2.19 ± 0.44
S27 - Sand Key SPA**	3	0.19 ± 0.06	3	0.19 ± 0.06	5	0.31 ± 0.31
S23 - East of Rock Key SPA	4	0.25 ± 0.00	8	0.50 ± 0.38	7	0.44 ± 0.31
S54 - Western Sambo ER**	0	0 ± 0	5	0.31 ± 0.19	12	0.75 ± 0.13
S55 - Western Sambo ER**	0	0 ± 0	10	0.63 ± 0.25	16	1.00 ± 0.38
S48 - East of Western Sambo ER	10	0.63 ± 0.50	8	0.50 ± 0.00	24	1.50 ± 1.00
S49 - Middle Sambo Reef	3	0.19 ± 0.06	13	0.81 ± 0.31	11	0.69 ± 0.31
S52 - Eastern Sambo RO**	1	0.06 ± 0.06	15	0.94 ± 0.19	11	0.69 ± 0.19
S53 - Eastern Sambo RO**	1	0.06 ± 0.06	11	0.69 ± 0.06	16	1.00 ± 0.13
U22 - West of Pelican Shoal	12	0.75 ± 0.00	7	0.44 ± 0.19	33	2.06 ± 0.31
S30 - East of Pelican Shoal	5	0.31 ± 0.06	22	1.38 ± 0.25	30	1.88 ± 0.38
S31 - East of Maryland Shoal	1	0.06 ± 0.06	15	0.94 ± 0.81	15	0.94 ± 0.19
S51 - American Shoal	1	0.06 ± 0.06	21	1.31 ± 1.31	12	0.75 ± 0.75
S50 - American Shoal	0	0 ± 0	23	1.44 ± 0.44	13	0.81 ± 0.19
Lower Florida Keys Total (14)	47	0.21 ± 0.06	165	0.74 ± 0.11	240	1.07 ± 0.16

Site number/site location	<i>E. tourneforti</i>		<i>G. ventalina</i>		<i>M. elongata</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	2	0.13 ± 0.00	17	1.06 ± 0.81	5	0.31 ± 0.19
S80 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	5	0.31 ± 0.19
S74 - West of Sombrero Key	0	0 ± 0	6	0.38 ± 0.25	9	0.56 ± 0.31
S72 - West of Sombrero Key	0	0 ± 0	2	0.13 ± 0.13	1	0.06 ± 0.06
S86 - Sombrero Key SPA	1	0.06 ± 0.06	0	0 ± 0	8	0.50 ± 0.00
S85 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	17	1.06 ± 0.06
S73 - East of Delta Shoal	6	0.38 ± 0.38	3	0.19 ± 0.06	38	2.38 ± 1.13
S81 - SW of Coffins Patch	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
S75 - Marker 20	6	0.38 ± 0.00	15	0.94 ± 0.44	3	0.19 ± 0.06
S82 - Tennessee Reef	2	0.13 ± 0.13	4	0.25 ± 0.25	15	0.94 ± 0.69
S83 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	3	0.19 ± 0.19
S84 - Tennessee Reef RO**	3	0.19 ± 0.19	14	0.88 ± 0.38	4	0.25 ± 0.00
T56 - Alligator Reef SPA**	12	0.75 ± 0.25	1	0.06 ± 0.06	26	1.63 ± 0.25
T57 - Alligator Reef SPA**	6	0.38 ± 0.13	9	0.56 ± 0.44	24	1.50 ± 1.00
T54 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
T55 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	4	0.25 ± 0.13	10	0.63 ± 0.13	0	0 ± 0
T23 - Little Conch Reef	3	0.19 ± 0.19	26	1.63 ± 0.63	3	0.19 ± 0.06
T52 - Conch Reef SPA**	2	0.13 ± 0.00	2	0.13 ± 0.00	15	0.94 ± 0.56
T53 - Conch Reef SPA**	1	0.06 ± 0.06	2	0.13 ± 0.13	8	0.50 ± 0.13
V09 - Conch Reef RO**	3	0.19 ± 0.19	7	0.44 ± 0.06	7	0.44 ± 0.06
V10 - Conch Reef RO**	3	0.19 ± 0.06	8	0.50 ± 0.13	13	0.81 ± 0.31
Middle Florida Keys Total (22)	54	0.15 ± 0.04	127	0.36 ± 0.09	206	0.59 ± 0.13
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	7	0.44 ± 0.19	0	0 ± 0
U87 - Dixie Shoal	0	0 ± 0	14	0.88 ± 0.13	1	0.06 ± 0.06
U84 - North of Dixie Shoal	4	0.25 ± 0.13	3	0.19 ± 0.19	2	0.13 ± 0.13
T30 - South of Elbow Reef	2	0.13 ± 0.00	9	0.56 ± 0.06	8	0.50 ± 0.13
T50 - Carysfort Reef SPA**	1	0.06 ± 0.06	2	0.13 ± 0.00	1	0.06 ± 0.06
T26 - Carysfort Reef SPA**	9	0.56 ± 0.06	20	1.25 ± 0.025	0	0 ± 0
T51 - Carysfort Reef SPA**	2	0.13 ± 0.13	3	0.19 ± 0.06	7	0.44 ± 0.31
T27 - Carysfort Reef SPA**	5	0.31 ± 0.06	22	1.38 ± 0.13	0	0 ± 0
T25 - North of Carysfort Reef	4	0.25 ± 0.00	3	0.19 ± 0.06	4	0.25 ± 0.13
T48 - North of Carysfort Reef	3	0.19 ± 0.06	3	0.19 ± 0.06	6	0.38 ± 0.13
T49 - SE of Turtle Rocks	1	0.06 ± 0.06	0	0 ± 0	8	0.50 ± 0.00
Upper Florida Keys Total (11)	31	0.18 ± 0.05	86	0.49 ± 0.14	37	0.21 ± 0.06
Deeper Fore-reef Total (47)	132	0.18 ± 0.03	378	0.50 ± 0.07	483	0.64 ± 0.09

Table 5-7. Numbers of colonies (N) and mean $\pm$ 1 SE colony densities (no. per m²) for the gorgonians *Muricea muricata*, *Muriceopsis flavida*, and *Plexaura flexuosa* in the Florida Keys, as determined from surveys of two 8-m x 1-m transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>M. muricata</i>		<i>M. flavida</i>		<i>P. flexuosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	3	0.19 $\pm$ 0.06
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	4	0.06 $\pm$ 0.04
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	4	0.06 $\pm$ 0.04
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	16	1.00 $\pm$ 0.25	1	0.06 $\pm$ 0.06	34	2.13 $\pm$ 0.13
S13 - Western Sambo ER**	8	0.50 $\pm$ 0.13	8	0.50 $\pm$ 0.38	58	3.63 $\pm$ 0.25
S05 - North of Middle Sambo Reef	8	0.50 $\pm$ 0.25	3	0.19 $\pm$ 0.06	52	3.25 $\pm$ 0.25
S06 - North of Pelican Shoal	62	3.88 $\pm$ 0.63	0	0 $\pm$ 0	51	3.19 $\pm$ 0.06
U04 - North of Pelican Shoal	14	0.88 $\pm$ 0.13	2	0.13 $\pm$ 0.13	56	3.50 $\pm$ 0.25
S07 - West Washerwoman Shoal	4	0.25 $\pm$ 0.13	0	0 $\pm$ 0	16	1.00 $\pm$ 0.38
S08 - West Washerwoman Shoal	4	0.25 $\pm$ 0.13	0	0 $\pm$ 0	40	2.50 $\pm$ 0.25
S09 - North of Maryland Shoal	18	1.13 $\pm$ 0.00	2	0.13 $\pm$ 0.00	39	2.44 $\pm$ 0.06
S10 - North of American Shoal	10	0.63 $\pm$ 0.00	6	0.38 $\pm$ 0.00	25	1.56 $\pm$ 0.19
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	144	0.90 $\pm$ 0.35	22	0.14 $\pm$ 0.05	371	2.32 $\pm$ 0.37
Middle Florida Keys						
U40 - Marker 49A	10	0.63 $\pm$ 0.13	0	0 $\pm$ 0	9	0.56 $\pm$ 0.31
S58 - Marker 48	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	11	0.69 $\pm$ 0.06
S59 - East Turtle Shoal	34	2.13 $\pm$ 0.13	0	0 $\pm$ 0	11	0.69 $\pm$ 0.31
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	2	0.13 $\pm$ 0.13	2	0.13 $\pm$ 0.13
Middle Florida Keys Total (7)	46	0.41 $\pm$ 0.30	2	0.02 $\pm$ 0.02	34	0.30 $\pm$ 0.12
Upper Florida Keys						
S89 - Mosquito Bank	1	0.06 $\pm$ 0.06	3	0.19 $\pm$ 0.06	10	0.63 $\pm$ 0.38
S90 - Mosquito Bank	3	0.19 $\pm$ 0.06	4	0.25 $\pm$ 0.00	11	0.69 $\pm$ 0.06
S91 - Basin Hill Shoals	1	0.06 $\pm$ 0.06	1	0.06 $\pm$ 0.06	12	0.75 $\pm$ 0.13
S92 - Basin Hill Shoals	6	0.38 $\pm$ 0.00	25	1.56 $\pm$ 0.56	12	0.75 $\pm$ 0.25
S93 - Turtle Rocks	18	1.13 $\pm$ 0.25	0	0 $\pm$ 0	38	2.38 $\pm$ 0.75
Upper Florida Keys Total (5)	29	0.36 $\pm$ 0.20	33	0.41 $\pm$ 0.29	83	1.04 $\pm$ 0.34
Mid-channel Patch Reef Total (22)	219	0.62 $\pm$ 0.19	57	0.16 $\pm$ 0.07	488	1.39 $\pm$ 0.27
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0	0 $\pm$ 0	18	1.13 $\pm$ 0.25	22	1.38 $\pm$ 0.50
S15 - North of Sand Key	0	0 $\pm$ 0	0	0	11	0.69 $\pm$ 0.19
S16 - North of Sand Key	10	0.63 $\pm$ 0.00	2	0.13 $\pm$ 0.13	32	2.00 $\pm$ 0.13
S19 - Western Sambo ER**	5	0.31 $\pm$ 0.06	7	0.44 $\pm$ 0.06	20	1.25 $\pm$ 0.25
S20 - Western Sambo ER**	4	0.25 $\pm$ 0.25	8	0.50 $\pm$ 0.25	53	3.31 $\pm$ 0.56
U12 - West of Looe Key RO	19	1.19 $\pm$ 0.31	3	0.19 $\pm$ 0.06	20	1.25 $\pm$ 0.25
S17 - Looe Key RO**	17	1.06 $\pm$ 0.19	28	1.75 $\pm$ 0.25	21	1.31 $\pm$ 0.19
S18 - Looe Key RO**	6	0.38 $\pm$ 0.13	0	0	20	1.25 $\pm$ 0.13
Lower Florida Keys Total (8)	61	0.48 $\pm$ 0.16	66	0.52 $\pm$ 0.22	199	1.55 $\pm$ 0.28
Middle Florida Keys						
S60 - NE of Delta Shoal	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>M. muricata</i>		<i>M. flavida</i>		<i>P. flexuosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	14	0.88 ± 0.25	3	0.19 ± 0.19	11	0.69 ± 0.06
S63 - Coffins Patch SPA**	24	1.50 ± 0.25	0	0 ± 0	9	0.56 ± 0.19
S62 - Coffins Patch SPA**	9	0.56 ± 0.06	1	0.06 ± 0.06	15	0.94 ± 0.56
S69 - Coffins Patch SPA**	12	0.75 ± 0.38	0	0 ± 0	5	0.31 ± 0.06
S70 - Coffins Patch SPA**	3	0.19 ± 0.19	0	0 ± 0	5	0.31 ± 0.31
S64 - South of Coffins Patch	11	0.69 ± 0.06	1	0.06 ± 0.06	15	0.94 ± 0.06
U42 - East of Coffins Patch	5	0.31 ± 0.06	3	0.19 ± 0.19	5	0.31 ± 0.06
Middle Florida Keys Total (8)	79	0.62 ± 0.16	82	0.06 ± 0.03	65	0.51 ± 0.12
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	12	0.75 ± 0.00	7	0.44 ± 0.19
T04 - Inshore of Sand Island	1	0.06 ± 0.06	7	0.44 ± 0.19	3	0.19 ± 0.06
T03 - White Bank	10	0.63 ± 0.13	43	2.69 ± 0.81	12	0.75 ± 0.13
T05 - White Bank	1	0.06 ± 0.06	28	1.75 ± 0.00	6	0.38 ± 0.00
T09 - South of Key Largo Dry Rocks	0	0 ± 0	7	0.44 ± 0.31	6	0.38 ± 0.13
T08 - West of Key Largo Dry Rocks	1	0.06 ± 0.06	2	0.13 ± 0.00	4	0.25 ± 0.13
T06 - West of Elbow Reef	2	0.13 ± 0.00	28	1.75 ± 0.25	6	0.38 ± 0.13
T07 - SW of Watson's Reef	2	0.13 ± 0.00	12	0.75 ± 0.00	6	0.38 ± 0.00
T31 - South of Watson's Reef	1	0.06 ± 0.06	5	0.31 ± 0.31	3	0.19 ± 0.19
T20 - Carysfort Reef SPA**	8	0.50 ± 0.13	5	0.31 ± 0.06	12	0.75 ± 0.00
T19 - Carysfort Reef SPA**	4	0.25 ± 0.25	20	1.25 ± 0.88	5	0.31 ± 0.19
T24 - North of Carysfort Reef	0	0 ± 0	3	0.19 ± 0.19	8	0.50 ± 0.38
Upper Florida Keys Total (12)	30	0.16 ± 0.06	172	0.90 ± 0.23	78	0.41 ± 0.05
Offshore Patch Reef Total (28)	170	0.38 ± 0.08	246	0.55 ± 0.13	342	0.76 ± 0.13
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	23	1.44 ± 0.44	13	0.81 ± 0.31	28	1.75 ± 0.63
Lower Florida Keys Total (2)	25	0.78 ± 0.66	13	0.41 ± 0.41	28	0.88 ± 0.88
Middle Florida Keys						
S65 - SE of Coffins Patch	3	0.19 ± 0.06	1	0.06 ± 0.06	6	0.38 ± 0.13
S66 - Tennessee Reef	3	0.19 ± 0.06	0	0 ± 0	5	0.31 ± 0.06
S68 - Tennessee Reef RO**	2	0.13 ± 0.13	1	0.06 ± 0.06	8	0.50 ± 0.00
S67 - Tennessee Reef RO**	10	0.63 ± 0.13	2	0.13 ± 0.13	15	0.94 ± 0.44
T16 - West of Alligator Reef	3	0.19 ± 0.06	1	0.06 ± 0.06	7	0.44 ± 0.19
T45 - Alligator Reef SPA**	19	1.19 ± 0.56	9	0.56 ± 0.06	18	1.13 ± 0.75
T46 - Alligator Reef SPA**	20	1.25 ± 0.25	4	0.25 ± 0.00	16	1.00 ± 0.38
V03 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.00
T36 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
T21 - Conch Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T22 - Conch Reef SPA**	2	0.13 ± 0.13	4	0.25 ± 0.25	1	0.06 ± 0.06
Middle Florida Keys Total (11)	63	0.36 ± 0.14	22	0.13 ± 0.05	81	0.46 ± 0.12
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	7	0.44 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T18 - Watson's Reef	5	0.31 ± 0.06	12	0.75 ± 0.38	27	1.69 ± 0.19
Upper Florida Keys Total (4)	12	0.19 ± 0.11	13	0.20 ± 0.18	28	0.44 ± 0.42
Shallow Hard-bottom Total (17)	100	0.37 ± 0.11	48	0.18 ± 0.07	137	0.50 ± 0.14
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	6	0.38 ± 0.38	0	0 ± 0	5	0.31 ± 0.31
S46 - Sand Key SPA**	4	0.25 ± 0.00	1	0.06 ± 0.06	6	0.38 ± 0.13
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.00
S44 - Rock Key SPA**	8	0.50 ± 0.50	0	0 ± 0	8	0.50 ± 0.13
S45 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
S42 - Eastern Dry Rocks SPA**	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
S43 - Eastern Dry Rocks SPA**	2	0.13 ± 0.13	0	0 ± 0	1	0.06 ± 0.06

Site number/site location	<i>M. muricata</i>		<i>M. flavida</i>		<i>P. flexuosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	7	0.44 ± 0.06	0	0 ± 0	2	0.13 ± 0.13
S41 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	3	0.19 ± 0.19
S33 - Middle Sambo Reef	2	0.13 ± 0.13	0	0 ± 0	2	0.13 ± 0.13
S38 - Eastern Sambo RO**	8	0.50 ± 0.25	0	0 ± 0	3	0.19 ± 0.19
S39 - Eastern Sambo RO**	3	0.19 ± 0.06	0	0 ± 0	13	0.81 ± 0.06
U15 - No Name Reef	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
S24 - East of Eastern Sambo RO	9	0.56 ± 0.44	1	0.06 ± 0.06	14	0.88 ± 0.38
U24 - Pelican Shoal	2	0.13 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
U23 - Maryland Shoal	9	0.56 ± 0.19	0	0 ± 0	6	0.38 ± 0.13
S34 - Maryland Shoal	9	0.56 ± 0.56	0	0 ± 0	4	0.25 ± 0.13
S35 - American Shoal	14	0.88 ± 0.00	5	0.31 ± 0.06	14	0.88 ± 0.13
S36 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.25
S37 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.13
Lower Florida Keys Total (20)	84	0.26 ± 0.06	7	0.02 ± 0.02	97	0.30 ± 0.06
Middle Florida Keys						
S78 - Sombrero Key SPA**	6	0.38 ± 0.00	5	0.31 ± 0.06	3	0.19 ± 0.06
S79 - Sombrero Key SPA**	6	0.38 ± 0.13	5	0.31 ± 0.06	1	0.06 ± 0.06
S76 - Delta Shoal	11	0.69 ± 0.44	1	0.06 ± 0.06	22	1.38 ± 1.00
S77 - Delta Shoal	8	0.50 ± 0.13	0	0 ± 0	6	0.38 ± 0.25
Middle Florida Keys Total (4)	31	0.48 ± 0.07	11	0.17 ± 0.08	32	0.50 ± 0.30
Upper Florida Keys						
T32 - Pickles Reef	5	0.31 ± 0.19	0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	3	0.19 ± 0.06	2	0.13 ± 0.13	3	0.19 ± 0.06
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
T33 - Sand Island	0	0 ± 0	0	0 ± 0	3	0.19 ± 0.06
T34 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0	0 ± 0	3	0.19 ± 0.19	3	0.19 ± 0.06
T14 - Grecian Rocks SPA**	1	0.06 ± 0.06	0	0 ± 0	3	0.19 ± 0.19
T15 - Grecian Rocks SPA**	1	0.06 ± 0.06	27	1.69 ± 1.31	3	0.19 ± 0.06
T12 - Key Largo Dry Rocks SPA**	2	0.13 ± 0.00	22	1.38 ± 0.63	5	0.31 ± 0.06
T13 - Key Largo Dry Rocks SPA**	6	0.38 ± 0.00	56	3.50 ± 0.63	9	0.56 ± 0.19
T10 - North-North Dry Rocks	3	0.19 ± 0.06	23	1.44 ± 0.69	8	0.50 ± 0.00
T39 - Elbow Reef SPA**	1	0.06 ± 0.06	3	0.19 ± 0.06	1	0.06 ± 0.06
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	5	0.31 ± 0.06	1	0.06 ± 0.06	1	0.06 ± 0.06
T37 - South Carysfort Reef SPA**	4	0.25 ± 0.13	3	0.19 ± 0.19	3	0.19 ± 0.19
T38 - Carysfort Reef SPA**	4	0.25 ± 0.25	0	0 ± 0	3	0.19 ± 0.06
T11 - North of Turtle Reef	0	0 ± 0	10	0.63 ± 0.13	8	0.50 ± 0.25
Upper Florida Keys Total (18)	35	0.12 ± 0.03	150	0.52 ± 0.22	55	0.19 ± 0.04
Spur and Groove Total (44)	150	0.22 ± 0.04	168	0.25 ± 0.10	184	0.27 ± 0.04
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	28	1.75 ± 0.13	5	0.31 ± 0.06	18	1.13 ± 0.13
S27 - Sand Key SPA**	10	0.63 ± 0.38	0	0 ± 0	8	0.50 ± 0.25
S23 - East of Rock Key SPA	18	1.13 ± 0.00	1	0.06 ± 0.06	11	0.69 ± 0.44
S54 - Western Sambo ER**	2	0.13 ± 0.13	4	0.25 ± 0.13	8	0.50 ± 0.13
S55 - Western Sambo ER**	9	0.56 ± 0.06	0	0 ± 0	2	0.13 ± 0.13
S48 - East of Western Sambo ER	20	1.25 ± 0.00	0	0 ± 0	15	0.94 ± 0.81
S49 - Middle Sambo Reef	7	0.44 ± 0.19	3	0.19 ± 0.06	2	0.13 ± 0.13
S52 - Eastern Sambo RO**	12	0.75 ± 0.38	0	0 ± 0	5	0.31 ± 0.31
S53 - Eastern Sambo RO**	8	0.50 ± 0.38	2	0.13 ± 0.13	10	0.63 ± 0.25
U22 - West of Pelican Shoal	38	2.38 ± 0.25	33	2.06 ± 0.06	33	2.06 ± 0.06
S30 - East of Pelican Shoal	11	0.69 ± 0.19	4	0.25 ± 0.00	64	4.00 ± 0.25
S31 - East of Maryland Shoal	10	0.63 ± 0.25	4	0.25 ± 0.00	11	0.69 ± 0.06
S51 - American Shoal	6	0.38 ± 0.38	13	0.81 ± 0.81	3	0.19 ± 0.19
S50 - American Shoal	8	0.50 ± 0.38	1	0.06 ± 0.06	11	0.69 ± 0.19
Lower Florida Keys Total (14)	187	0.83 ± 0.16	70	0.31 ± 0.15	201	0.90 ± 0.27

Site number/site location	<i>M. muricata</i>		<i>M. flavida</i>		<i>P. flexuosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	4	0.25 ± 0.25	12	0.75 ± 0.13	7	0.44 ± 0.06
S80 - West of Sombrero Key	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	10	0.63 ± 0.25	0	0 ± 0	2	0.13 ± 0.13
S72 - West of Sombrero Key	1	0.06 ± 0.06	0	0 ± 0	4	0.25 ± 0.25
S86 - Sombrero Key SPA	0	0 ± 0	2	0.13 ± 0.13	3	0.19 ± 0.19
S85 - Sombrero Key SPA	2	0.13 ± 0.00	4	0.25 ± 0.13	1	0.06 ± 0.06
S73 - East of Delta Shoal	28	1.75 ± 0.88	0	0 ± 0	3	0.19 ± 0.19
S81 - SW of Coffins Patch	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S75 - Marker 20	4	0.25 ± 0.13	10	0.63 ± 0.00	7	0.44 ± 0.19
S82 - Tennessee Reef	6	0.38 ± 0.00	0	0 ± 0	5	0.31 ± 0.06
S83 - Tennessee Reef RO**	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
S84 - Tennessee Reef RO**	1	0.06 ± 0.06	0	0 ± 0	3	0.19 ± 0.06
T56 - Alligator Reef SPA**	17	1.06 ± 0.19	7	0.44 ± 0.44	14	0.88 ± 0.63
T57 - Alligator Reef SPA**	16	1.00 ± 0.13	27	1.69 ± 0.19	9	0.56 ± 0.06
T54 - Davis Reef SPA**	1	0.06 ± 0.06	2	0.13 ± 0.13	2	0.13 ± 0.00
T55 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T47 - Little Conch Reef	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	3	0.19 ± 0.06	0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	5	0.31 ± 0.06	26	1.63 ± 0.88	3	0.19 ± 0.19
T53 - Conch Reef SPA**	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
V09 - Conch Reef RO**	2	0.13 ± 0.00	6	0.38 ± 0.13	4	0.25 ± 0.00
V10 - Conch Reef RO**	3	0.19 ± 0.06	6	0.38 ± 0.00	2	0.13 ± 0.00
Middle Florida Keys Total (22)	105	0.30 ± 0.09	104	0.30 ± 0.11	71	0.20 ± 0.05
Upper Florida Keys						
U98 - Pickles Reef	1	0.06 ± 0.06	1	0.06 ± 0.06	0	0 ± 0
U87 - Dixie Shoal	2	0.13 ± 0.00	4	0.25 ± 0.13	3	0.19 ± 0.06
U84 - North of Dixie Shoal	0	0 ± 0	9	0.56 ± 0.06	2	0.13 ± 0.00
T30 - South of Elbow Reef	6	0.38 ± 0.00	1	0.06 ± 0.06	2	0.13 ± 0.13
T50 - Carysfort Reef SPA**	0	0 ± 0	7	0.44 ± 0.19	3	0.19 ± 0.06
T26 - Carysfort Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	7	0.44 ± 0.19
T51 - Carysfort Reef SPA**	2	0.13 ± 0.13	1	0.06 ± 0.06	1	0.06 ± 0.06
T27 - Carysfort Reef SPA**	2	0.13 ± 0.13	0	0 ± 0	2	0.13 ± 0.13
T25 - North of Carysfort Reef	3	0.19 ± 0.19	1	0.06 ± 0.06	6	0.38 ± 0.13
T48 - North of Carysfort Reef	1	0.06 ± 0.06	4	0.25 ± 0.00	4	0.25 ± 0.13
T49 - SE of Turtle Rocks	2	0.13 ± 0.13	24	1.50 ± 0.63	3	0.19 ± 0.06
Upper Florida Keys Total (11)	20	0.11 ± 0.03	52	0.30 ± 0.13	33	0.19 ± 0.04
Deeper Fore-reef Total (47)	312	0.41 ± 0.08	226	0.30 ± 0.07	305	0.41 ± 0.10

Table 5-8. Numbers of colonies (N) and mean $\pm$ 1 SE colony densities (no. per m²) for the gorgonians *Plexaura homomalla*, *Plexaura kuna*, and *Plexaurella dichotoma* in the Florida Keys, as determined from surveys of two 8-m x 1-m transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>P. homomalla</i>		<i>P. kuna</i>		<i>P. dichotoma</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	16	1.00 $\pm$ 0.38	0	0 $\pm$ 0	8	0.50 $\pm$ 0.00
S13 - Western Sambo ER**	23	1.44 $\pm$ 0.06	2	0.13 $\pm$ 0.13	7	0.44 $\pm$ 0.19
S05 - North of Middle Sambo Reef	23	1.44 $\pm$ 0.06	0	0 $\pm$ 0	9	0.56 $\pm$ 0.06
S06 - North of Pelican Shoal	17	1.06 $\pm$ 0.06	0	0 $\pm$ 0	13	0.81 $\pm$ 0.06
U04 - North of Pelican Shoal	34	2.13 $\pm$ 0.25	0	0 $\pm$ 0	8	0.50 $\pm$ 0.00
S07 - West Washerwoman Shoal	11	0.69 $\pm$ 0.31	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S08 - West Washerwoman Shoal	30	1.88 $\pm$ 0.50	0	0 $\pm$ 0	7	0.44 $\pm$ 0.19
S09 - North of Maryland Shoal	35	2.19 $\pm$ 0.06	0	0 $\pm$ 0	8	0.50 $\pm$ 0.13
S10 - North of American Shoal	18	1.13 $\pm$ 0.13	0	0 $\pm$ 0	13	0.81 $\pm$ 0.31
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	207	1.29 $\pm$ 0.21	2	0.01 $\pm$ 0.01	74	0.46 $\pm$ 0.08
Middle Florida Keys						
U40 - Marker 49A	15	0.94 $\pm$ 0.06	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S58 - Marker 48	2	0.13 $\pm$ 0.00	0	0 $\pm$ 0	2	0.13 $\pm$ 0.13
S59 - East Turtle Shoal	3	0.19 $\pm$ 0.19	0	0 $\pm$ 0	5	0.31 $\pm$ 0.19
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	3	0.19 $\pm$ 0.06	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
Middle Florida Keys Total (7)	23	0.21 $\pm$ 0.13	0	0 $\pm$ 0	9	0.08 $\pm$ 0.04
Upper Florida Keys						
S89 - Mosquito Bank	28	1.75 $\pm$ 1.13	0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	31	1.94 $\pm$ 0.19	0	0 $\pm$ 0	7	0.44 $\pm$ 0.19
S91 - Basin Hill Shoals	19	1.19 $\pm$ 0.06	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0
S92 - Basin Hill Shoals	8	0.50 $\pm$ 0.13	0	0 $\pm$ 0	6	0.38 $\pm$ 0.25
S93 - Turtle Rocks	13	0.81 $\pm$ 0.06	0	0 $\pm$ 0	27	1.69 $\pm$ 0.44
Upper Florida Keys Total (5)	99	1.24 $\pm$ 0.27	1	0.01 $\pm$ 0.01	40	0.50 $\pm$ 0.31
Mid-channel Patch Reef Total (22)	329	0.93 $\pm$ 0.16	3	0.01 $\pm$ 0.01	123	0.35 $\pm$ 0.09
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	2	0.13 $\pm$ 0.00	0	0 $\pm$ 0	2	0.13 $\pm$ 0.00
S19 - Western Sambo ER**	2	0.13 $\pm$ 0.13	0	0 $\pm$ 0	3	0.19 $\pm$ 0.06
S20 - Western Sambo ER**	31	1.94 $\pm$ 0.19	0	0 $\pm$ 0	4	0.25 $\pm$ 0.00
U12 - West of Looe Key RO	5	0.31 $\pm$ 0.19	0	0 $\pm$ 0	3	0.19 $\pm$ 0.06
S17 - Looe Key RO**	6	0.38 $\pm$ 0.13	0	0 $\pm$ 0	6	0.38 $\pm$ 0.13
S18 - Looe Key RO**	4	0.25 $\pm$ 0.13	0	0 $\pm$ 0	6	0.38 $\pm$ 0.38
Lower Florida Keys Total (8)	51	0.40 $\pm$ 0.22	0	0 $\pm$ 0	24	0.19 $\pm$ 0.05
Middle Florida Keys						
S60 - NE of Delta Shoal	0	0 $\pm$ 0	2	0.13	0.13	0 $\pm$ 0

Site number/site location	<i>P. homomalla</i>		<i>P. kuna</i>		<i>P. dichotoma</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	1	0.06 ± 0.06	0	0 ± 0	17	1.06 ± 0.69
S63 - Coffins Patch SPA**	4	0.25 ± 0.00	0	0 ± 0	5	0.31 ± 0.06
S62 - Coffins Patch SPA**	1	0.06 ± 0.06	1	0.06 ± 0.06	5	0.31 ± 0.06
S69 - Coffins Patch SPA**	7	0.44 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
S70 - Coffins Patch SPA**	8	0.50 ± 0.50	0	0 ± 0	0	0
S64 - South of Coffins Patch	0	0 ± 0	0	0 ± 0	8	0.50 ± 0.13
U42 - East of Coffins Patch	2	0.13 ± 0.13	0	0 ± 0	5	0.31 ± 0.19
Middle Florida Keys Total (8)	23	0.18 ± 0.07	1	0.01 ± 0.01	43	0.34 ± 0.12
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.13
T04 - Inshore of Sand Island	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.13
T03 - White Bank	1	0.06 ± 0.06	0	0 ± 0	41	2.56 ± 0.94
T05 - White Bank	6	0.38 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
T09 - South of Key Largo Dry Rocks	1	0.06 ± 0.06	1	0.06 ± 0.06	5	0.31 ± 0.06
T08 - West of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
T06 - West of Elbow Reef	2	0.13 ± 0.00	0	0 ± 0	1	0.06 ± 0.06
T07 - SW of Watson's Reef	1	0.06 ± 0.06	1	0.06 ± 0.06	10	0.63 ± 0.00
T31 - South of Watson's Reef	0	0 ± 0	0	0 ± 0	10	0.63 ± 0.50
T20 - Carysfort Reef SPA**	2	0.13 ± 0.00	0	0 ± 0	7	0.44 ± 0.44
T19 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.00
T24 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.00
Upper Florida Keys Total (12)	13	0.07 ± 0.03	2	0.01 ± 0.01	89	0.46 ± 0.20
Offshore Patch Reef Total (28)	87	0.19 ± 0.07	3	0.01 ± 0.00	156	0.35 ± 0.09
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.00
S22 - West of Looe Key SPA	4	0.25 ± 0.13	0	0 ± 0	19	1.19 ± 0.44
Lower Florida Keys Total (2)	4	0.13 ± 0.13	0	0 ± 0	21	0.66 ± 0.53
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	0	0 ± 0	20	1.25 ± 0.38
S66 - Tennessee Reef	2	0.13 ± 0.00	0	0 ± 0	9	0.56 ± 0.06
S68 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
S67 - Tennessee Reef RO**	0	0 ± 0	1	0.06 ± 0.06	1	0.06 ± 0.06
T16 - West of Alligator Reef	0	0 ± 0	0	0 ± 0	12	0.75 ± 0.00
T45 - Alligator Reef SPA**	3	0.19 ± 0.06	0	0 ± 0	2	0.13 ± 0.00
T46 - Alligator Reef SPA**	3	0.19 ± 0.19	0	0 ± 0	2	0.13 ± 0.00
V03 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
Middle Florida Keys Total (11)	8	0.05 ± 0.02	1	0.01 ± 0.01	49	0.28 ± 0.12
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	6	0.38 ± 0.00	0	0 ± 0	20	1.25 ± 0.25
Upper Florida Keys Total (4)	6	0.09 ± 0.09	0	<0.01 ± <0.01	20	0.31 ± 0.31
Shallow Hard-bottom Total (17)	18	0.07 ± 0.03	1	<0.01 ± <0.01	90	0.33 ± 0.12
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	2	0.13 ± 0.00	0	0 ± 0	1	0.06 ± 0.06
S45 - Rock Key SPA**	1	0.06 ± 0.06	0	0 ± 0	2	0.13 ± 0.13
S42 - Eastern Dry Rocks SPA**	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0

Site number/site location	<i>P. homomalla</i>		<i>P. kuna</i>		<i>P. dichotoma</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	5	0.31 ± 0.06	0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	10	0.63 ± 0.25	0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	4	0.25 ± 0.00	0	0 ± 0	1	0.06 ± 0.06
S34 - Maryland Shoal	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S35 - American Shoal	7	0.44 ± 0.19	0	0 ± 0	1	0.06 ± 0.06
S36 - Looe Key SPA**	3	0.19 ± 0.19	0	0 ± 0	1	0.06 ± 0.06
S37 - Looe Key SPA**	4	0.25 ± 0.13	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	42	0.13 ± 0.04	0	0 ± 0	6	0.02 ± 0.01
Middle Florida Keys						
S78 - Sombrero Key SPA**	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0
S76 - Delta Shoal	1	0.06 ± 0.06	0	0 ± 0	0	0
S77 - Delta Shoal	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
Middle Florida Keys Total (4)	2	0.03 ± 0.02	0	0 ± 0	2	0.03 ± 0.02
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
T44 - Molasses Reef SPA**	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
T33 - Sand Island	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T34 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.00
T14 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	2	0.13 ± 0.13	0	0 ± 0	2	0.13 ± 0.00
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	2	0.13 ± 0.13	0	0 ± 0	5	0.31 ± 0.06
T10 - North-North Dry Rocks	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
T39 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	3	0.19 ± 0.19
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T35 - South of South Carysfort	0	0 ± 0	0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	1	0.06 ± 0.06	3	0.19 ± 0.19	0	0 ± 0
T38 - Carysfort Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
Upper Florida Keys Total (18)	10	0.03 ± 0.01	4	0.01 ± 0.01	17	0.06 ± 0.02
Spur and Groove Total (44)	54	0.08 ± 0.02	4	0.01 ± 0.00	25	0.04 ± 0.01
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	4	0.25 ± 0.25	0	0 ± 0	3	0.19 ± 0.06
S27 - Sand Key SPA**	2	0.13 ± 0.00	0	0 ± 0	3	0.19 ± 0.19
S23 - East of Rock Key SPA	2	0.13 ± 0.00	0	0 ± 0	29	1.81 ± 0.31
S54 - Western Sambo ER**	1	0.06 ± 0.06	0	0 ± 0	2	0.13 ± 0.13
S55 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
S48 - East of Western Sambo ER	1	0.06 ± 0.06	0	0 ± 0	0	0
S49 - Middle Sambo Reef	1	0.06 ± 0.06	0	0 ± 0	3	0.19 ± 0.06
S52 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0
S53 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.13
U22 - West of Pelican Shoal	8	0.50 ± 0.00	0	0 ± 0	15	0.94 ± 0.56
S30 - East of Pelican Shoal	18	1.13 ± 0.50	0	0 ± 0	0	0
S31 - East of Maryland Shoal	6	0.38 ± 0.25	0	0 ± 0	1	0.06 ± 0.06
S51 - American Shoal	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
S50 - American Shoal	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
Lower Florida Keys Total (14)	45	0.20 ± 0.08	0	0 ± 0	64	0.29 ± 0.13

Site number/site location	<i>P. homomalla</i>		<i>P. kuna</i>		<i>P. dichotoma</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
S80 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	15	0.94 ± 0.31
S74 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	5	0.31 ± 0.31
S72 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	6	0.38 ± 0.38
S86 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	12	0.75 ± 0.75
S85 - Sombrero Key SPA	0	0 ± 0	0	0 ± 0	8	0.50 ± 0.00
S73 - East of Delta Shoal	0	0 ± 0	0	0 ± 0	28	1.75 ± 0.13
S81 - SW of Coffins Patch	0	0 ± 0	0	0 ± 0	3	0.19 ± 0.06
S75 - Marker 20	0	0 ± 0	1	0.06 ± 0.06	4	0.25 ± 0.00
S82 - Tennessee Reef	0	0 ± 0	0	0 ± 0	6	0.38 ± 0.13
S83 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.25
S84 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	11	0.69 ± 0.06
T56 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	26	1.63 ± 0.25
T57 - Alligator Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	12	0.75 ± 0.13
T54 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	10	0.63 ± 0.25
T55 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.13
T47 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.25
T53 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	19	1.19 ± 0.31
V09 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.13
V10 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	2	0.01 ± 0.00	1	<0.01 ± <0.01	182	0.52 ± 0.10
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.13
U87 - Dixie Shoal	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
U84 - North of Dixie Shoal	0	0 ± 0	0	0 ± 0	21	1.31 ± 0.31
T30 - South of Elbow Reef	0	0 ± 0	0	0 ± 0	7	0.44 ± 0.06
T50 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	5	0.31 ± 0.31
T26 - Carysfort Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T51 - Carysfort Reef SPA**	0	0 ± 0	3	0.19 ± 0.06	8	0.50 ± 0.38
T27 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	8	0.50 ± 0.13
T48 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	6	0.38 ± 0.13
T49 - SE of Turtle Rocks	0	0 ± 0	1	0.06 ± 0.06	5	0.31 ± 0.06
Upper Florida Keys Total (11)	1	0.01 ± 0.01	4	0.02 ± 0.02	66	0.38 ± 0.11
Deeper Fore-reef Total (47)	48	0.06 ± 0.03	5	0.01 ± 0.00	312	0.41 ± 0.07

Table 5-9. Numbers of colonies (N) and mean $\pm$ 1 SE colony densities (no. per m²) for the gorgonians *Plexaurella grisea*, *Plexaurella nutans*, and *Pseudoplexaura flagellosa* in the Florida Keys, as determined from surveys of two 8-m x 1-m transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>P. grisea</i>		<i>P. nutans</i>		<i>P. flagellosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	1	0.02 $\pm$ 0.02	0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	1	0.02 $\pm$ 0.02	0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	1	0.06 $\pm$ 0.06	2	0.13 $\pm$ 0.00	8	0.50 $\pm$ 0.13
S13 - Western Sambo ER**	2	0.13 $\pm$ 0.00	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S05 - North of Middle Sambo Reef	3	0.19 $\pm$ 0.19	1	0.06 $\pm$ 0.06	3	0.19 $\pm$ 0.19
S06 - North of Pelican Shoal	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	16	1.00 $\pm$ 0.50
U04 - North of Pelican Shoal	2	0.13 $\pm$ 0.00	0	0 $\pm$ 0	6	0.38 $\pm$ 0.13
S07 - West Washerwoman Shoal	2	0.13 $\pm$ 0.13	2	0.13 $\pm$ 0.13	4	0.25 $\pm$ 0.25
S08 - West Washerwoman Shoal	3	0.19 $\pm$ 0.06	0	0 $\pm$ 0	4	0.25 $\pm$ 0.00
S09 - North of Maryland Shoal	3	0.19 $\pm$ 0.06	0	0 $\pm$ 0	5	0.31 $\pm$ 0.06
S10 - North of American Shoal	7	0.44 $\pm$ 0.31	1	0.06 $\pm$ 0.06	4	0.25 $\pm$ 0.13
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	24	0.15 $\pm$ 0.04	6	0.04 $\pm$ 0.02	51	0.32 $\pm$ 0.09
Middle Florida Keys						
U40 - Marker 49A	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S58 - Marker 48	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
Middle Florida Keys Total (7)	1	0.01 $\pm$ 0.01	0	0 $\pm$ 0	2	0.02 $\pm$ 0.01
Upper Florida Keys						
S89 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	4	0.25 $\pm$ 0.00
S90 - Mosquito Bank	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	3	0.19 $\pm$ 0.06
S91 - Basin Hill Shoals	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	2	0.13 $\pm$ 0.13
S92 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	27	1.69 $\pm$ 0.19
S93 - Turtle Rocks	17	1.06 $\pm$ 0.06	0	0 $\pm$ 0	17	1.06 $\pm$ 0.06
Upper Florida Keys Total (5)	19	0.24 $\pm$ 0.21	0	0 $\pm$ 0	53	0.66 $\pm$ 0.31
Mid-channel Patch Reef Total (22)	44	0.13 $\pm$ 0.05	6	0.02 $\pm$ 0.01	106	0.30 $\pm$ 0.09
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	4	0.25 $\pm$ 0.25	1	0.06 $\pm$ 0.06	1	0.06 $\pm$ 0.06
S15 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	2	0.13 $\pm$ 0.00	0	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	3	0.19 $\pm$ 0.19	0	0 $\pm$ 0	0	0 $\pm$ 0
S20 - Western Sambo ER**	2	0.13 $\pm$ 0.13	1	0.06 $\pm$ 0.06	5	0.31 $\pm$ 0.06
U12 - West of Looe Key RO	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	2	0.13 $\pm$ 0.00
S17 - Looe Key RO**	1	0.06 $\pm$ 0.06	1	0.06 $\pm$ 0.06	3	0.19 $\pm$ 0.06
S18 - Looe Key RO**	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	3	0.19 $\pm$ 0.19
Lower Florida Keys Total (8)	14	0.11 $\pm$ 0.03	3	0.02 $\pm$ 0.01	14	0.11 $\pm$ 0.04
Middle Florida Keys						
S60 - NE of Delta Shoal	4	0.25 $\pm$ 0.25	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>P. grisea</i>		<i>P. nutans</i>		<i>P. flagellosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	7	0.44 ± 0.06	0	0 ± 0	2	0.13 ± 0.00
S63 - Coffins Patch SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S70 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S64 - South of Coffins Patch	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	14	0.11 ± 0.06	0	0 ± 0	4	0.03 ± 0.02
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T04 - Inshore of Sand Island	3	0.19 ± 0.06	0	0 ± 0	0	0 ± 0
T03 - White Bank	8	0.50 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
T05 - White Bank	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	2	0.13 ± 0.13	0	0 ± 0	2	0.13 ± 0.00
T08 - West of Key Largo Dry Rocks	2	0.13 ± 0.00	0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T31 - South of Watson's Reef	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T20 - Carysfort Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T24 - North of Carysfort Reef	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	20	0.10 ± 0.04	0	0 ± 0	5	0.03 ± 0.01
Offshore Patch Reef Total (28)	48	0.11 ± 0.02	3	0.01 ± 0.00	23	0.05 ± 0.01
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	5	0.31 ± 0.06	0	0 ± 0	3	0.19 ± 0.06
Lower Florida Keys Total (2)	6	0.19 ± 0.13	0	0 ± 0	3	0.09 ± 0.09
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S66 - Tennessee Reef	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.00
T46 - Alligator Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
V03 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	2	0.01 ± 0.01	0	0 ± 0	5	0.03 ± 0.02
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	0	0 ± 0	3	0.19 ± 0.06
T18 - Watson's Reef	3	0.19 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
Upper Florida Keys Total (4)	3	0.05 ± 0.05	0	0 ± 0	4	0.06 ± 0.04
Shallow Hard-bottom Total (17)	11	0.04 ± 0.02	0	0 ± 0	12	0.04 ± 0.02
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S46 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0
S44 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0
S45 - Rock Key SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0

Site number/site location	<i>P. grisea</i>		<i>P. nutans</i>		<i>P. flagellosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	8	0.50 ± 0.25
S41 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
S39 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0
U15 - No Name Reef	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S24 - East of Eastern Sambo RO	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
U24 - Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0
U23 - Maryland Shoal	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S34 - Maryland Shoal	0	0 ± 0	0	0 ± 0	0	0
S35 - American Shoal	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
S36 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.00
S37 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0
Lower Florida Keys Total (20)	1	<0.01 ± <0.01	0	0 ± 0	22	0.07 ± 0.03
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	2	0.13 ± 0.13	0	0 ± 0	5	0.31 ± 0.06
S77 - Delta Shoal	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
Middle Florida Keys Total (4)	3	0.05 ± 0.03	0	0 ± 0	8	0.13 ± 0.07
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T43 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T33 - Sand Island	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T34 - Sand Island	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T10 - North-North Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0	0 ± 0	1	0.06 ± 0.06	1	0.06 ± 0.06
T37 - South Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	1	<0.01 ± <0.01	1	<0.01 ± <0.01	5	0.02 ± 0.01
Spur and Groove Total (44)	5	0.01 ± 0.00	1	<0.01 ± <0.01	35	0.05 ± 0.02
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
S27 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0
S23 - East of Rock Key SPA	3	0.19 ± 0.19	0	0 ± 0	9	0.56 ± 0.19
S54 - Western Sambo ER**	2	0.13 ± 0.00	0	0 ± 0	0	0
S55 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S48 - East of Western Sambo ER	1	0.06 ± 0.06	0	0 ± 0	4	0.25 ± 0.13
S49 - Middle Sambo Reef	1	0.06 ± 0.06	0	0 ± 0	0	0
S52 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.00
S53 - Eastern Sambo RO**	1	0.06 ± 0.06	0	0 ± 0	3	0.19 ± 0.06
U22 - West of Pelican Shoal	4	0.25 ± 0.00	0	0 ± 0	3	0.19 ± 0.06
S30 - East of Pelican Shoal	0	0 ± 0	1	0.06 ± 0.06	1	0.06 ± 0.06
S31 - East of Maryland Shoal	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.13
S51 - American Shoal	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S50 - American Shoal	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.00
Lower Florida Keys Total (14)	13	0.06 ± 0.02	1	<0.01 ± <0.01	29	0.13 ± 0.04

Site number/site location	<i>P. grisea</i>		<i>P. nutans</i>		<i>P. flagellosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0	0 ± 0	0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	1	0.06 ± 0.06	0	0 ± 0	12	0.75 ± 0.13
S74 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S72 - West of Sombrero Key	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	1	0.06 ± 0.06	2	0.13 ± 0.00	0	0 ± 0
S85 - Sombrero Key SPA	4	0.25 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
S73 - East of Delta Shoal	2	0.13 ± 0.00	0	0 ± 0	3	0.19 ± 0.06
S81 - SW of Coffins Patch	0	0 ± 0	0	0 ± 0	0	0 ± 0
S75 - Marker 20	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	3	0.19 ± 0.19	1	0.06 ± 0.06	0	0 ± 0
T57 - Alligator Reef SPA**	0	0 ± 0	1	0.06 ± 0.06	1	0.06 ± 0.06
T54 - Davis Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
V10 - Conch Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	17	0.05 ± 0.01	4	0.01 ± 0.01	18	0.05 ± 0.03
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
U87 - Dixie Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.00
T51 - Carysfort Reef SPA**	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	2	0.13 ± 0.00	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	11	0.06 ± 0.02	0	0 ± 0	3	0.02 ± 0.01
Deeper Fore-reef Total (47)	41	0.05 ± 0.01	5	0.01 ± 0.00	50	0.07 ± 0.02

Table 5-10. Numbers of colonies (N) and mean $\pm$ 1 SE colony densities (no. per m²) for the gorgonians *Pseudoplexaura porosa*, *Pseudoplexaura wagnaari*, and *Pseudopterogorgia acerosa* in the Florida Keys, as determined from surveys of two 8-m x 1-m transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>P. porosa</i>		<i>P. wagnaari</i>		<i>P. acerosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	16	1.00 $\pm$ 1.00
S02 – South of Sugarloaf Creek	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	8	0.50 $\pm$ 0.50
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	1	0.02 $\pm$ 0.02	0	0 $\pm$ 0	24	0.38 $\pm$ 0.24
Inshore Patch Reef Total (4)	1	0.02 $\pm$ 0.02	0	0 $\pm$ 0	24	0.38 $\pm$ 0.24
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	82	5.13 $\pm$ 1.00	1	0.06 $\pm$ 0.06	13	0.81 $\pm$ 0.06
S13 - Western Sambo ER**	57	3.56 $\pm$ 0.44	0	0 $\pm$ 0	3	0.19 $\pm$ 0.06
S05 - North of Middle Sambo Reef	44	2.75 $\pm$ 0.38	1	0.06 $\pm$ 0.06	15	0.94 $\pm$ 0.19
S06 - North of Pelican Shoal	66	4.13 $\pm$ 0.38	0	0 $\pm$ 0	31	1.94 $\pm$ 0.31
U04 - North of Pelican Shoal	63	3.94 $\pm$ 0.56	0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	29	1.81 $\pm$ 0.56	0	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	32	2.00 $\pm$ 0.38	0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	71	4.44 $\pm$ 0.81	0	0 $\pm$ 0	7	0.44 $\pm$ 0.19
S10 - North of American Shoal	30	1.88 $\pm$ 0.25	0	0 $\pm$ 0	11	0.69 $\pm$ 0.56
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	2	0.13 $\pm$ 0.00
Lower Florida Keys Total (10)	474	2.96 $\pm$ 0.49	2	0.01 $\pm$ 0.01	82	0.51 $\pm$ 0.19
Middle Florida Keys						
U40 - Marker 49A	25	1.56 $\pm$ 0.19	0	0 $\pm$ 0	10	0.63 $\pm$ 0.00
S58 - Marker 48	12	0.75 $\pm$ 0.50	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S59 - East Turtle Shoal	6	0.38 $\pm$ 0.13	0	0 $\pm$ 0	16	1.00 $\pm$ 0.13
S96 - Cheeca Rocks SPA**	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	0	0
S97 - Cheeca Rocks SPA**	11	0.69 $\pm$ 0.56	0	0 $\pm$ 0	0	0
S94 - Hen and Chickens Reef SPA**	6	0.38 $\pm$ 0.13	0	0 $\pm$ 0	0	0
S95 - Hen and Chickens Reef SPA**	19	1.19 $\pm$ 0.81	0	0 $\pm$ 0	0	0
Middle Florida Keys Total (7)	80	0.71 $\pm$ 0.20	0	0 $\pm$ 0	27	0.24 $\pm$ 0.15
Upper Florida Keys						
S89 - Mosquito Bank	42	2.63 $\pm$ 0.38	0	0 $\pm$ 0	7	0.44 $\pm$ 0.44
S90 - Mosquito Bank	81	5.06 $\pm$ 0.56	0	0 $\pm$ 0	14	0.88 $\pm$ 0.38
S91 - Basin Hill Shoals	28	1.75 $\pm$ 0.75	0	0 $\pm$ 0	8	0.50 $\pm$ 0.38
S92 - Basin Hill Shoals	12	0.75 $\pm$ 0.13	0	0 $\pm$ 0	78	4.88 $\pm$ 1.38
S93 - Turtle Rocks	48	3.00 $\pm$ 0.63	0	0 $\pm$ 0	19	1.19 $\pm$ 0.19
Upper Florida Keys Total (5)	211	2.64 $\pm$ 0.72	0	0 $\pm$ 0	126	1.58 $\pm$ 0.84
Mid-channel Patch Reef Total (22)	765	2.17 $\pm$ 0.35	2	0.01 $\pm$ 0.00	235	0.67 $\pm$ 0.23
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	5	0.31 $\pm$ 0.06	2	0.13 $\pm$ 0.13	6	0.38 $\pm$ 0.25
S15 - North of Sand Key	7	0.44 $\pm$ 0.19	3	0.19 $\pm$ 0.06	1	0.06 $\pm$ 0.06
S16 - North of Sand Key	13	0.81 $\pm$ 0.06	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0
S19 - Western Sambo ER**	9	0.56 $\pm$ 0.06	2	0.13 $\pm$ 0.13	2	0.13 $\pm$ 0.00
S20 - Western Sambo ER**	51	3.19 $\pm$ 0.69	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0
U12 - West of Looe Key RO	13	0.81 $\pm$ 0.56	0	0 $\pm$ 0	4	0.25 $\pm$ 0.13
S17 - Looe Key RO**	6	0.38 $\pm$ 0.13	0	0 $\pm$ 0	3	0.19 $\pm$ 0.19
S18 - Looe Key RO**	14	0.88 $\pm$ 0.00	1	0.06 $\pm$ 0.06	2	0.13 $\pm$ 0.00
Lower Florida Keys Total (8)	118	0.92 $\pm$ 0.33	10	0.08 $\pm$ 0.02	18	0.14 $\pm$ 0.05
Middle Florida Keys						
S60 - NE of Delta Shoal	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>P. porosa</i>		<i>P. wagnaari</i>		<i>P. acerosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	10	0.63 ± 0.25	0	0 ± 0	25	1.56 ± 0.44
S63 - Coffins Patch SPA**	4	0.25 ± 0.13	0	0 ± 0	2	0.13 ± 0.13
S62 - Coffins Patch SPA**	0	0	0	0 ± 0	10	0.63 ± 0.13
S69 - Coffins Patch SPA**	33	2.06 ± 0.06	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	15	0.94 ± 0.31	0	0 ± 0	3	0.19 ± 0.19
S64 - South of Coffins Patch	0	0	0	0 ± 0	17	1.06 ± 0.06
U42 - East of Coffins Patch	10	0.63 ± 0.25	0	0 ± 0	21	1.31 ± 0.69
Middle Florida Keys Total (8)	73	0.57 ± 0.25	0	0 ± 0	78	0.61 ± 0.22
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	0	0 ± 0	10	0.63 ± 0.00
T04 - Inshore of Sand Island	0	0 ± 0	0	0 ± 0	12	0.75 ± 0.13
T03 - White Bank	5	0.31 ± 0.19	0	0 ± 0	5	0.31 ± 0.06
T05 - White Bank	6	0.38 ± 0.13	0	0 ± 0	13	0.81 ± 0.19
T09 - South of Key Largo Dry Rocks	3	0.19 ± 0.06	0	0 ± 0	14	0.88 ± 0.13
T08 - West of Key Largo Dry Rocks	1	0.06 ± 0.06	0	0 ± 0	8	0.50 ± 0.25
T06 - West of Elbow Reef	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.25
T07 - SW of Watson's Reef	3	0.19 ± 0.06	1	0.06 ± 0.06	6	0.38 ± 0.25
T31 - South of Watson's Reef	0	0 ± 0	0	0 ± 0	25	1.56 ± 0.19
T20 - Carysfort Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	12	0.75 ± 0.13
T19 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	5	0.31 ± 0.31
T24 - North of Carysfort Reef	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	20	0.10 ± 0.04	1	0.01 ± 0.01	114	0.59 ± 0.12
Offshore Patch Reef Total (28)	211	0.47 ± 0.13	11	0.02 ± 0.01	210	0.47 ± 0.09
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	2	0.13 ± 0.00	0	0 ± 0	5	0.31 ± 0.19
S22 - West of Looe Key SPA	3	0.19 ± 0.19	0	0 ± 0	13	0.81 ± 0.31
Lower Florida Keys Total (2)	5	0.16 ± 0.03	0	0 ± 0	18	0.56 ± 0.25
Middle Florida Keys						
S65 - SE of Coffins Patch	5	0.31 ± 0.06	0	0 ± 0	11	0.69 ± 0.56
S66 - Tennessee Reef	1	0.06 ± 0.06	0	0 ± 0	19	1.19 ± 0.19
S68 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	13	0.81 ± 0.31
S67 - Tennessee Reef RO**	1	0.06 ± 0.06	0	0 ± 0	11	0.69 ± 0.31
T16 - West of Alligator Reef	0	0 ± 0	0	0 ± 0	3	0.19 ± 0.06
T45 - Alligator Reef SPA**	4	0.25 ± 0.13	0	0 ± 0	14	0.88 ± 0.13
T46 - Alligator Reef SPA**	4	0.25 ± 0.13	0	0 ± 0	19	1.19 ± 0.19
V03 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	5	0.31 ± 0.19
T36 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	12	0.75 ± 0.13
T21 - Conch Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	4	0.25 ± 0.13
T22 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	9	0.56 ± 0.31
Middle Florida Keys Total (11)	16	0.09 ± 0.04	0	0 ± 0	120	0.68 ± 0.10
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0	0	0 ± 0	2	0.13 ± 0.13
T29 - Molasses Reef SPA**	0	0	0	0 ± 0	2	0.13 ± 0.13
T17 - North of French Reef	1	0.06 ± 0.06	0	0 ± 0	12	0.75 ± 0.50
T18 - Watson's Reef	5	0.31 ± 0.06	0	0 ± 0	23	1.44 ± 0.06
Upper Florida Keys Total (4)	6	0.09 ± 0.07	0	0 ± 0	39	0.61 ± 0.31
Shallow Hard-bottom Total (17)	27	0.10 ± 0.03	0	0 ± 0	177	0.65 ± 0.10
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	3	0.19 ± 0.06	0	0 ± 0	7	0.44 ± 0.19
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	1	0.06 ± 0.06	0	0 ± 0	3	0.19 ± 0.06
S45 - Rock Key SPA**	2	0.13 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0

Site number/site location	<i>P. porosa</i>		<i>P. wagnaari</i>		<i>P. acerosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	4	0.25 ± 0.00
S41 - Western Sambo ER**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S39 - Eastern Sambo RO**	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	2	0.13 ± 0.00	0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	8	0.50 ± 0.25	1	0.06 ± 0.06	0	0 ± 0
U24 - Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	4	0.25 ± 0.00	0	0 ± 0	7	0.44 ± 0.44
S34 - Maryland Shoal	0	0 ± 0	0	0 ± 0	5	0.31 ± 0.31
S35 - American Shoal	9	0.56 ± 0.19	0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	1	0.06 ± 0.06	2	0.13 ± 0.13	1	0.06 ± 0.06
S37 - Looe Key SPA**	0	0 ± 0	7	0.44 ± 0.19	1	0.06 ± 0.06
Lower Florida Keys Total (20)	33	0.10 ± 0.04	10	0.03 ± 0.02	30	0.09 ± 0.03
Middle Florida Keys						
S78 - Sombrero Key SPA**	11	0.69 ± 0.06	0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	5	0.31 ± 0.06	0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	7	0.44 ± 0.06	0	0 ± 0	13	0.81 ± 0.56
S77 - Delta Shoal	0	0 ± 0	0	0 ± 0	3	0.19 ± 0.06
Middle Florida Keys Total (4)	23	0.36 ± 0.14	0	0 ± 0	16	0.25 ± 0.19
Upper Florida Keys						
T32 - Pickles Reef	2	0.13 ± 0.13	0	0 ± 0	2	0.13 ± 0.13
T43 - Molasses Reef SPA**	2	0.13 ± 0.00	0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T33 - Sand Island	0	0 ± 0	0	0 ± 0	2	0.13 ± 0.00
T34 - Sand Island	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	6	0.38 ± 0.38
T42 - French Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	26	1.63 ± 0.75
T14 - Grecian Rocks SPA**	1	0.06 ± 0.06	4	0.25 ± 0.00	0	0 ± 0
T15 - Grecian Rocks SPA**	1	0.06 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	2	0.13 ± 0.13	0	0 ± 0	5	0.31 ± 0.06
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T35 - South of South Carysfort	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T37 - South Carysfort Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0	0 ± 0	2	0.13 ± 0.13	11	0.69 ± 0.44
Upper Florida Keys Total (18)	12	0.04 ± 0.01	6	0.02 ± 0.02	55	0.19 ± 0.09
Spur and Groove Total (44)	68	0.10 ± 0.03	16	0.02 ± 0.01	101	0.15 ± 0.05
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	2	0.13 ± 0.00	0	0 ± 0	30	1.88 ± 0.88
S27 - Sand Key SPA**	2	0.13 ± 0.00	0	0 ± 0	24	1.50 ± 0.50
S23 - East of Rock Key SPA	0	0	0	0 ± 0	9	0.56 ± 0.31
S54 - Western Sambo ER**	3	0.19 ± 0.06	0	0 ± 0	93	5.81 ± 0.56
S55 - Western Sambo ER**	1	0.06 ± 0.06	0	0 ± 0	16	1.00 ± 0.25
S48 - East of Western Sambo ER	6	0.38 ± 0.13	0	0 ± 0	19	1.19 ± 0.31
S49 - Middle Sambo Reef	2	0.13 ± 0.00	0	0 ± 0	9	0.56 ± 0.19
S52 - Eastern Sambo RO**	7	0.44 ± 0.06	0	0 ± 0	9	0.56 ± 0.19
S53 - Eastern Sambo RO**	0	0	0	0 ± 0	14	0.88 ± 0.00
U22 - West of Pelican Shoal	7	0.44 ± 0.31	0	0 ± 0	11	0.69 ± 0.31
S30 - East of Pelican Shoal	7	0.44 ± 0.06	1	0.06 ± 0.06	3	0.19 ± 0.19
S31 - East of Maryland Shoal	1	0.06 ± 0.06	0	0 ± 0	6	0.38 ± 0.00
S51 - American Shoal	1	0.06 ± 0.06	0	0 ± 0	7	0.44 ± 0.19
S50 - American Shoal	1	0.06 ± 0.06	0	0 ± 0	5	0.31 ± 0.06
Lower Florida Keys Total (14)	40	0.18 ± 0.04	1	<0.01 ± <0.01	255	1.14 ± 0.38

Site number/site location	<i>P. porosa</i>		<i>P. wagnaari</i>		<i>P. acerosa</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	4	0.25 ± 0.00	0	0 ± 0	5	0.31 ± 0.19
S80 - West of Sombrero Key	3	0.19 ± 0.19	0	0 ± 0	11	0.69 ± 0.44
S74 - West of Sombrero Key	0	0	0	0 ± 0	8	0.50 ± 0.13
S72 - West of Sombrero Key	3	0.19 ± 0.06	0	0 ± 0	3	0.19 ± 0.19
S86 - Sombrero Key SPA	2	0.13 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
S85 - Sombrero Key SPA	1	0.06 ± 0.06	0	0 ± 0	29	1.81 ± 0.19
S73 - East of Delta Shoal	5	0.31 ± 0.06	0	0 ± 0	18	1.13 ± 0.00
S81 - SW of Coffins Patch	1	0.06 ± 0.06	0	0 ± 0	46	2.88 ± 0.63
S75 - Marker 20	5	0.31 ± 0.19	0	0 ± 0	24	1.50 ± 0.75
S82 - Tennessee Reef	4	0.25 ± 0.25	0	0 ± 0	23	1.44 ± 0.06
S83 - Tennessee Reef RO**	0	0	0	0 ± 0	19	1.19 ± 0.19
S84 - Tennessee Reef RO**	3	0.19 ± 0.19	0	0 ± 0	14	0.88 ± 0.13
T56 - Alligator Reef SPA**	0	0	0	0 ± 0	23	1.44 ± 0.44
T57 - Alligator Reef SPA**	8	0.50 ± 0.00	0	0 ± 0	54	3.38 ± 0.75
T54 - Davis Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	17	1.06 ± 0.31
T55 - Davis Reef SPA**	0	0	0	0 ± 0	6	0.38 ± 0.00
T47 - Little Conch Reef	1	0.06 ± 0.06	0	0 ± 0	27	1.69 ± 0.06
T23 - Little Conch Reef	1	0.06 ± 0.06	0	0 ± 0	38	2.38 ± 0.75
T52 - Conch Reef SPA**	2	0.13 ± 0.13	0	0 ± 0	27	1.69 ± 0.06
T53 - Conch Reef SPA**	0	0	0	0 ± 0	3	0.19 ± 0.06
V09 - Conch Reef RO**	6	0.38 ± 0.13	0	0 ± 0	52	3.25 ± 0.75
V10 - Conch Reef RO**	0	0	0	0 ± 0	40	2.50 ± 0.50
Middle Florida Keys Total (22)	50	0.14 ± 0.03	0	0 ± 0	488	1.39 ± 0.21
Upper Florida Keys						
U98 - Pickles Reef	2	0.13 ± 0.13	0	0 ± 0	55	3.44 ± 0.31
U87 - Dixie Shoal	2	0.13 ± 0.00	0	0 ± 0	20	1.25 ± 0.00
U84 - North of Dixie Shoal	1	0.06 ± 0.06	0	0 ± 0	12	0.75 ± 0.38
T30 - South of Elbow Reef	4	0.25 ± 0.13	0	0 ± 0	23	1.44 ± 0.56
T50 - Carysfort Reef SPA**	0	0	0	0 ± 0	37	2.31 ± 0.19
T26 - Carysfort Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	23	1.44 ± 0.06
T51 - Carysfort Reef SPA**	2	0.13 ± 0.13	0	0 ± 0	21	1.31 ± 0.31
T27 - Carysfort Reef SPA**	1	0.06 ± 0.06	0	0 ± 0	26	1.63 ± 0.50
T25 - North of Carysfort Reef	0	0	1	0.06 ± 0.06	12	0.75 ± 0.13
T48 - North of Carysfort Reef	0	0	0	0 ± 0	9	0.56 ± 0.19
T49 - SE of Turtle Rocks	3	0.19 ± 0.19	0	0 ± 0	19	1.19 ± 0.44
Upper Florida Keys Total (11)	16	0.09 ± 0.02	1	0.01 ± 0.01	257	1.46 ± 0.25
Deeper Fore-reef Total (47)	106	0.14 ± 0.02	2	<0.01 ± <0.01	1,000	1.33 ± 0.16

Table 5-11. Numbers of colonies (N) and mean $\pm$ 1 SE colony densities (no. per m²) for the gorgonians *Pseudopterogorgia americana*, *P. bipinnata*, and *P. rigida* in the Florida Keys, as determined from surveys of two 8-m x 1-m transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>P. americana</i>		<i>P. bipinnata</i>		<i>P. rigida</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	25	1.56 $\pm$ 0.31	0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	14	0.88 $\pm$ 0.75	0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	3	0.19 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	42	0.66 $\pm$ 0.36	0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	42	0.66 $\pm$ 0.36	0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	71	4.44 $\pm$ 0.44	0	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	46	2.88 $\pm$ 0.50	0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	43	2.69 $\pm$ 0.31	0	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	131	8.19 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
U04 - North of Pelican Shoal	61	3.81 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	37	2.31 $\pm$ 0.94	0	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	41	2.56 $\pm$ 1.44	0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	69	4.31 $\pm$ 0.56	0	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	80	5.00 $\pm$ 0.00	0	0 $\pm$ 0	0	0 $\pm$ 0
S11 - North of American Shoal	39	2.44 $\pm$ 1.19	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	618	3.86 $\pm$ 0.57	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys						
U40 - Marker 49A	77	4.81 $\pm$ 0.44	0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	30	1.88 $\pm$ 0.38	0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	50	3.13 $\pm$ 0.25	0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0	0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	2	0.13 $\pm$ 0.00	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	5	0.31 $\pm$ 0.19	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	15	0.94 $\pm$ 0.69	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	179	1.60 $\pm$ 0.68	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	46	2.88 $\pm$ 0.00	0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	72	4.50 $\pm$ 1.75	0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	48	3.00 $\pm$ 0.38	0	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	82	5.13 $\pm$ 0.63	0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	96	6.00 $\pm$ 1.38	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	344	4.30 $\pm$ 0.61	0	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	1,141	3.24 $\pm$ 0.43	0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	17	1.06 $\pm$ 0.69	0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	36	2.25 $\pm$ 0.50	0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	14	0.88 $\pm$ 0.13	0	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	34	2.13 $\pm$ 0.00	0	0 $\pm$ 0	0	0 $\pm$ 0
S20 - Western Sambo ER**	32	2.00 $\pm$ 0.13	0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	41	2.56 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
S17 - Looe Key RO**	21	1.31 $\pm$ 0.19	0	0 $\pm$ 0	0	0 $\pm$ 0
S18 - Looe Key RO**	53	3.31 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (8)	248	1.94 $\pm$ 0.29	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys						
S60 - NE of Delta Shoal	37	2.31 $\pm$ 0.56	0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>P. americana</i>		<i>P. bipinnata</i>		<i>P. rigida</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	77	4.81 ± 0.56	0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	80	5.00 ± 0.88	0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	96	6.00 ± 0.88	0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	22	1.38 ± 0.38	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	20	1.25 ± 0.38	0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	135	8.44 ± 1.44	0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	34	2.13 ± 0.50	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	501	3.91 ± 0.91	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	56	3.50 ± 0.75	0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	31	1.94 ± 0.06	189	11.81 ± 1.44	0	0 ± 0
T03 - White Bank	33	2.06 ± 0.19	0	0 ± 0	0	0 ± 0
T05 - White Bank	150	9.38 ± 0.50	120	7.50 ± 4.50	0	0 ± 0
T09 - South of Key Largo Dry Rocks	89	5.56 ± 1.19	22	1.38 ± 1.13	2	0.13 ± 0.13
T08 - West of Key Largo Dry Rocks	86	5.38 ± 0.50	282	17.63 ± 3.00	1	0.06 ± 0.06
T06 - West of Elbow Reef	91	5.69 ± 1.31	245	15.31 ± 2.06	0	0 ± 0
T07 - SW of Watson's Reef	159	9.94 ± 0.31	262	16.38 ± 3.25	0	0 ± 0
T31 - South of Watson's Reef	119	7.44 ± 0.06	93	5.81 ± 1.69	6	0.38 ± 0.25
T20 - Carysfort Reef SPA**	107	6.69 ± 1.69	150	9.38 ± 7.75	0	0 ± 0
T19 - Carysfort Reef SPA**	91	5.69 ± 0.81	313	19.56 ± 1.19	0	0 ± 0
T24 - North of Carysfort Reef	79	4.94 ± 1.06	132	8.25 ± 3.50	0	0 ± 0
Upper Florida Keys Total (12)	1,091	5.68 ± 0.72	1,808	9.42 ± 1.98	9	0.05 ± 0.03
Offshore Patch Reef Total (28)	1,840	4.11 ± 0.50	1,808	4.04 ± 1.22	9	0.02 ± 0.01
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	16	1.00 ± 0.00	0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	68	4.25 ± 0.63	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	84	2.63 ± 1.63	0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	57	3.56 ± 0.31	0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	55	3.44 ± 1.81	0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	34	2.13 ± 0.25	0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	39	2.44 ± 0.06	0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	10	0.63 ± 0.13	0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	116	7.25 ± 0.25	0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	104	6.50 ± 2.63	0	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	83	5.19 ± 1.44	0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	122	7.63 ± 0.13	0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	49	3.06 ± 2.56	0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	46	2.88 ± 2.13	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	715	4.06 ± 0.68	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	5	0.31 ± 0.19	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	3	0.19 ± 0.06	0	0 ± 0
T17 - North of French Reef	0	0 ± 0	2	0.13 ± 0.13	0	0 ± 0
T18 - Watson's Reef	0	0 ± 0	2	0.13 ± 0.00	1	0.06 ± 0.06
Upper Florida Keys Total (4)	236	3.69 ± 1.87	12	0.19 ± 0.04	1	0.02 ± 0.02
Shallow Hard-bottom Total (17)	1,035	3.81 ± 0.61	12	0.04 ± 0.02	1	<0.01 ± <0.01
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	28	1.75 ± 1.75	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	93	5.81 ± 1.19	0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	14	0.88 ± 0.50	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	34	2.13 ± 1.88	0	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	12	0.75 ± 0.13	0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	60	3.75 ± 1.50	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	3	0.19 ± 0.19	0	0 ± 0	0	0 ± 0

Site number/site location	<i>P. americana</i>		<i>P. bipinnata</i>		<i>P. rigida</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	102	6.38 ± 0.13	0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	29	1.81 ± 0.94	0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	3	0.19 ± 0.06	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	47	2.94 ± 1.19	0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	13	0.81 ± 0.06	0	0 ± 0	0	0 ± 0
U15 - No Name Reef	15	0.94 ± 0.19	0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	28	1.75 ± 0.00	0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	3	0.19 ± 0.06	0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	44	2.75 ± 0.13	0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	63	3.94 ± 1.06	0	0 ± 0	0	0 ± 0
S35 - American Shoal	96	6.00 ± 0.63	0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	82	5.13 ± 0.63	0	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	18	1.13 ± 0.75	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	787	2.46 ± 0.46	0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S78 - Sombrero Key SPA**	70	4.38 ± 0.25	0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	36	2.25 ± 1.00	0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	71	4.44 ± 1.44	0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	68	4.25 ± 2.63	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	245	3.83 ± 0.53	0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T32 - Pickles Reef	33	2.06 ± 0.81	1	0.06 ± 0.06	0	0 ± 0
T43 - Molasses Reef SPA**	19	1.19 ± 0.19	160	10.00 ± 0.63	0	0 ± 0
T44 - Molasses Reef SPA**	1	0.06 ± 0.06	44	2.75 ± 0.13	0	0 ± 0
T33 - Sand Island	60	3.75 ± 0.50	6	0.38 ± 0.00	0	0 ± 0
T34 - Sand Island	27	1.69 ± 1.19	0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	70	4.38 ± 0.88	83	5.19 ± 3.06	0	0 ± 0
T42 - French Reef SPA**	224	14.00 ± 2.63	68	4.25 ± 0.50	0	0 ± 0
T14 - Grecian Rocks SPA**	2	0.13 ± 0.13	0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	23	1.44 ± 0.06	8	0.50 ± 0.25	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	18	1.13 ± 0.63	38	2.38 ± 2.00	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	63	3.94 ± 0.06	135	8.44 ± 6.19	0	0 ± 0
T10 - North-North Dry Rocks	13	0.81 ± 0.19	156	9.75 ± 4.88	0	0 ± 0
T39 - Elbow Reef SPA**	36	2.25 ± 0.00	182	11.38 ± 1.38	0	0 ± 0
T40 - Elbow Reef SPA**	16	1.00 ± 0.88	147	9.19 ± 3.56	0	0 ± 0
T35 - South of South Carysfort	24	1.50 ± 0.75	2	0.13 ± 0.13	0	0 ± 0
T37 - South Carysfort Reef SPA**	8	0.50 ± 0.25	145	9.06 ± 3.56	0	0 ± 0
T38 - Carysfort Reef SPA**	12	0.75 ± 0.38	152	9.50 ± 3.25	0	0 ± 0
T11 - North of Turtle Reef	100	6.25 ± 2.00	262	16.38 ± 5.63	0	0 ± 0
Upper Florida Keys Total (18)	749	2.60 ± 0.77	1,589	5.52 ± 1.19	0	0 ± 0
Spur & Groove Total (44)	1,781	2.65 ± 0.40	1,589	2.36 ± 0.66	0	0 ± 0
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	128	8.00 ± 0.13	0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	95	5.94 ± 0.44	0	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	59	3.69 ± 0.69	0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	104	6.50 ± 1.00	0	0 ± 0	0	0 ± 0
S55 - Western Sambo ER**	148	9.25 ± 0.25	0	0 ± 0	0	0 ± 0
S48 - East of Western Sambo ER	87	5.44 ± 0.56	0	0 ± 0	2	0.13 ± 0.13
S49 - Middle Sambo Reef	139	8.69 ± 0.81	0	0 ± 0	0	0 ± 0
S52 - Eastern Sambo RO**	105	6.56 ± 0.44	0	0 ± 0	0	0 ± 0
S53 - Eastern Sambo RO**	101	6.31 ± 0.06	0	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	93	5.81 ± 0.44	0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	79	4.94 ± 2.06	0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	80	5.00 ± 0.25	0	0 ± 0	0	0 ± 0
S51 - American Shoal	135	8.44 ± 2.94	0	0 ± 0	0	0 ± 0
S50 - American Shoal	56	3.50 ± 0.13	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (14)	1,409	6.29 ± 0.48	0	0 ± 0	2	0.01 ± 0.01

Site number/site location	<i>P. americana</i>		<i>P. bipinnata</i>		<i>P. rigida</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	63	3.94 ± 1.06	0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	124	7.75 ± 2.00	0	0 ± 0	7	0.44 ± 0.19
S74 - West of Sombrero Key	107	6.69 ± 2.81	0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	98	6.13 ± 1.63	0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	19	1.19 ± 0.06	0	0 ± 0	16	1.00 ± 0.13
S85 - Sombrero Key SPA	164	10.25 ± 1.25	0	0 ± 0	29	1.81 ± 0.31
S73 - East of Delta Shoal	71	4.44 ± 0.06	0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	115	7.19 ± 0.31	0	0 ± 0	7	0.44 ± 0.44
S75 - Marker 20	62	3.88 ± 1.13	0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	56	3.50 ± 0.50	0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	28	1.75 ± 0.25	0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	34	2.13 ± 0.25	0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	55	3.44 ± 1.19	0	0 ± 0	1	0.06 ± 0.06
T57 - Alligator Reef SPA**	118	7.38 ± 0.38	2	0.13 ± 0.00	0	0 ± 0
T54 - Davis Reef SPA**	59	3.69 ± 1.19	0	0 ± 0	5	0.31 ± 0.06
T55 - Davis Reef SPA**	3	0.19 ± 0.06	0	0 ± 0	1	0.06 ± 0.06
T47 - Little Conch Reef	109	6.81 ± 0.19	0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	135	8.44 ± 1.44	0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	81	5.06 ± 1.06	0	0 ± 0	6	0.38 ± 0.13
T53 - Conch Reef SPA**	13	0.81 ± 0.31	0	0 ± 0	6	0.38 ± 0.13
V09 - Conch Reef RO**	181	11.31 ± 1.06	4	0.25 ± 0.25	1	0.06 ± 0.06
V10 - Conch Reef RO**	94	5.88 ± 0.25	3	0.19 ± 0.19	0	0 ± 0
Middle Florida Keys Total (22)	1,789	5.08 ± 0.64	9	0.03 ± 0.01	79	0.22 ± 0.09
Upper Florida Keys						
U98 - Pickles Reef	131	8.19 ± 1.19	5	0.31 ± 0.31	0	0 ± 0
U87 - Dixie Shoal	123	7.69 ± 0.06	4	0.25 ± 0.25	0	0 ± 0
U84 - North of Dixie Shoal	31	1.94 ± 0.19	0	0 ± 0	3	0.19 ± 0.06
T30 - South of Elbow Reef	69	4.31 ± 0.19	0	0 ± 0	11	0.69 ± 0.44
T50 - Carysfort Reef SPA**	85	5.31 ± 1.06	2	0.13 ± 0.13	5	0.31 ± 0.31
T26 - Carysfort Reef SPA**	143	8.94 ± 2.06	1	0.06 ± 0.06	0	0 ± 0
T51 - Carysfort Reef SPA**	99	6.19 ± 0.81	6	0.38 ± 0.25	1	0.06 ± 0.06
T27 - Carysfort Reef SPA**	169	10.56 ± 1.56	0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	102	6.38 ± 1.13	0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	59	3.69 ± 0.94	2	0.13 ± 0.13	0	0 ± 0
T49 - SE of Turtle Rocks	105	6.56 ± 1.56	0	0 ± 0	1	0.06 ± 0.06
Upper Florida Keys Total (11)	1,116	6.34 ± 0.75	20	0.11 ± 0.04	21	0.12 ± 0.06
Deeper Fore-reef Total (47)	4,314	5.74 ± 0.38	29	0.04 ± 0.01	102	0.14 ± 0.05

Table 5-12. Numbers of colonies (N) and mean $\pm$ 1 SE colony densities (no. per m²) for the gorgonians *Pterogorgia anceps*, *P. citrina*, and *P. guadalupensis* in the Florida Keys, as determined from surveys of two 8-m x 1-m transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>P. anceps</i>		<i>P. citrina</i>		<i>P. guadalupensis</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
U04 - North of Pelican Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.06 $\pm$ 0.06
S11 - North of American Shoal	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	0	0 $\pm$ 0	0	0 $\pm$ 0	1	0.01 $\pm$ 0.01
Middle Florida Keys						
U40 - Marker 49A	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0	0 $\pm$ 0	7	0.44 $\pm$ 0.06	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0	0 $\pm$ 0	7	0.06 $\pm$ 0.06	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	1	0.06 $\pm$ 0.06	0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	1	0.01 $\pm$ 0.01	0	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	1	<0.01 $\pm$ <0.01	7	0.02 $\pm$ 0.02	1	<0.01 $\pm$ <0.01
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S20 - Western Sambo ER**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S17 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
S18 - Looe Key RO**	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (8)	0	0 $\pm$ 0	0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys						
S60 - NE of Delta Shoal	2	0.13 $\pm$ 0.00	11	0.69 $\pm$ 0.19	1	0.06 $\pm$ 0.06

Site number/site location	<i>P. anceps</i>		<i>P. citrina</i>		<i>P. guadalupensis</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S61 - West Turtle Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0	0 ± 0	7	0.44 ± 0.06	0	0 ± 0
S62 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	0	0 ± 0	5	0.31 ± 0.06	0	0 ± 0
U42 - East of Coffins Patch	0	0 ± 0	3	0.19 ± 0.06	0	0 ± 0
Middle Florida Keys Total (8)	2	0.02 ± 0.02	26	0.20 ± 0.09	1	0.01 ± 0.01
Upper Florida Keys						
S99 - Wolf Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T03 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T05 - White Bank	0	0 ± 0	0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T08 - West of Key Largo Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	1	0.06 ± 0.06	5	0.31 ± 0.19	0	0 ± 0
T07 - SW of Watson's Reef	0	0 ± 0	31	1.94 ± 0.56	0	0 ± 0
T31 - South of Watson's Reef	0	0 ± 0	5	0.31 ± 0.19	0	0 ± 0
T20 - Carysfort Reef SPA**	1	0.06 ± 0.06	8	0.50 ± 0.50	0	0 ± 0
T19 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
T24 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	2	0.01 ± 0.01	49	0.26 ± 0.16	1	0.01 ± 0.01
Offshore Patch Reef Total (28)	4	0.01 ± 0.01	75	0.17 ± 0.07	2	<0.01 ± <0.01
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
S22 - West of Looe Key SPA	0	0 ± 0	9	0.56 ± 0.56	1	0.06 ± 0.06
Lower Florida Keys Total (2)	0	0 ± 0	10	0.31 ± 0.25	1	0.03 ± 0.03
Middle Florida Keys						
S65 - SE of Coffins Patch	0	0 ± 0	5	0.31 ± 0.31	0	0 ± 0
S66 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0	0 ± 0	5	0.31 ± 0.31	1	0.06 ± 0.06
S67 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0	0 ± 0	22	1.38 ± 0.00	0	0 ± 0
T45 - Alligator Reef SPA**	0	0 ± 0	2	0.13 ± 0.13	0	0 ± 0
T46 - Alligator Reef SPA**	0	0 ± 0	2	0.13 ± 0.13	0	0 ± 0
V03 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	0	0 ± 0	36	0.20 ± 0.12	1	0.01 ± 0.01
Upper Florida Keys						
T28 - Molasses Reef SPA**	0	0 ± 0	6	0.38 ± 0.38	0	0 ± 0
T29 - Molasses Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T17 - North of French Reef	1	0.06 ± 0.06	2	0.13 ± 0.13	0	0 ± 0
T18 - Watson's Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (4)	1	0.02 ± 0.02	8	0.13 ± 0.09	0	0 ± 0
Shallow Hard-bottom Total (17)	1	<0.01 ± <0.01	54	0.20 ± 0.08	2	0.01 ± 0.01
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0	0 ± 0	4	0.25 ± 0.25	0	0 ± 0
S45 - Rock Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0

Site number/site location	<i>P. anceps</i>		<i>P. citrina</i>		<i>P. guadalupensis</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
S40 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
S39 - Eastern Sambo RO**	0	0 ± 0	4	0.25 ± 0.25	0	0 ± 0
U15 - No Name Reef	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
S24 - East of Eastern Sambo RO	0	0 ± 0	8	0.50 ± 0.38	0	0 ± 0
U24 - Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	0	0 ± 0	3	0.19 ± 0.19	0	0 ± 0
S34 - Maryland Shoal	0	0 ± 0	24	1.50 ± 1.50	0	0 ± 0
S35 - American Shoal	0	0 ± 0	4	0.25 ± 0.13	0	0 ± 0
S36 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	1	0.06 ± 0.06
S37 - Looe Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	0	0 ± 0	49	0.15 ± 0.08	1	<0.01 ± <0.01
Middle Florida Keys						
S78 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
S77 - Delta Shoal	0	0 ± 0	4	0.25 ± 0.25	0	0 ± 0
Middle Florida Keys Total (4)	0	0 ± 0	5	0.08 ± 0.06	0	0 ± 0
Upper Florida Keys						
T32 - Pickles Reef	0	0 ± 0	27	1.69 ± 0.81	0	0 ± 0
T43 - Molasses Reef SPA**	0	0 ± 0	33	2.06 ± 2.06	0	0 ± 0
T44 - Molasses Reef SPA**	0	0 ± 0	4	0.25 ± 0.25	0	0 ± 0
T33 - Sand Island	0	0 ± 0	0	0 ± 0	0	0 ± 0
T34 - Sand Island	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
T41 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0	0 ± 0	5	0.31 ± 0.31	0	0 ± 0
T15 - Grecian Rocks SPA**	0	0 ± 0	2	0.13 ± 0.00	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0	0 ± 0	0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0	0 ± 0	25	1.56 ± 0.81	0	0 ± 0
T37 - South Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	0	0 ± 0	97	0.34 ± 0.16	0	0 ± 0
Spur and Groove Total (44)	0	0 ± 0	151	0.22 ± 0.08	1	<0.01 ± <0.01
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	0	0 ± 0	0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S55 - Western Sambo ER**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S48 - East of Western Sambo ER	0	0 ± 0	2	0.13 ± 0.00	0	0 ± 0
S49 - Middle Sambo Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S52 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S53 - Eastern Sambo RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
S51 - American Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S50 - American Shoal	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
Lower Florida Keys Total (14)	0	0 ± 0	4	0.02 ± 0.01	0	0 ± 0

Site number/site location	<i>P. anceps</i>		<i>P. citrina</i>		<i>P. guadalupensis</i>	
	N	No./m ²	N	No./m ²	N	No./m ²
Middle Florida Keys						
S71 - South of Bahia Honda	0	0 ± 0	0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	0	0 ± 0	0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	0	0 ± 0	2	0.13 ± 0.13	0	0 ± 0
S72 - West of Sombrero Key	1	0.06 ± 0.06	1	0.06 ± 0.06	0	0 ± 0
S86 - Sombrero Key SPA	2	0.13 ± 0.13	0	0 ± 0	1	0.06 ± 0.06
S85 - Sombrero Key SPA	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
S73 - East of Delta Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	0	0 ± 0	2	0.13 ± 0.13	0	0 ± 0
S75 - Marker 20	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
S82 - Tennessee Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0	0 ± 0	0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
T57 - Alligator Reef SPA**	0	0 ± 0	5	0.31 ± 0.06	0	0 ± 0
T54 - Davis Reef SPA**	0	0 ± 0	1	0.06 ± 0.06	1	0.06 ± 0.06
T55 - Davis Reef SPA**	0	0 ± 0	1	0.06 ± 0.06	0	0 ± 0
T47 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	1	0.06 ± 0.06	27	1.69 ± 0.56	2	0.13 ± 0.00
T53 - Conch Reef SPA**	1	0.06 ± 0.06	1	0.06 ± 0.06	0	0 ± 0
V09 - Conch Reef RO**	0	0 ± 0	8	0.50 ± 0.25	0	0 ± 0
V10 - Conch Reef RO**	0	0 ± 0	9	0.56 ± 0.19	0	0 ± 0
Middle Florida Keys Total (22)	6	0.02 ± 0.01	60	0.17 ± 0.08	4	0.01 ± 0.01
Upper Florida Keys						
U98 - Pickles Reef	0	0 ± 0	4	0.25 ± 0.25	0	0 ± 0
U87 - Dixie Shoal	0	0 ± 0	0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	1	0.06 ± 0.06	3	0.19 ± 0.06	0	0 ± 0
T30 - South of Elbow Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0	0 ± 0	2	0.13 ± 0.13	0	0 ± 0
T26 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	0	0 ± 0	0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0	0 ± 0	0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	1	0.06 ± 0.06	0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	2	0.01 ± 0.01	69	0.39 ± 0.34	0	0 ± 0
Deeper Fore-reef Total (47)	8	0.01 ± 0.00	133	0.18 ± 0.09	4	<0.01 ± <0.01

VI. Urchin Density and Size

Background

The 1983-84 Caribbean-wide mass mortality of the long-spined sea urchin *Diadema antillarum* represents one of the most spatially expansive and prolonged disturbances to coral reef ecosystems in the region (Carpenter 1988; Lessios 1988, 2005). Prior to the mass mortality event, *D. antillarum* attained high (>20 per m^2) densities on many Caribbean reefs (Lessios 1988), but after the disease epidemic, abundances declined by several orders of magnitude and have largely remained in this state for over two decades (Lessios 2005; Weil et al. 2005; Debrot and Nagelkerken 2006). Together with physical impacts from storms, coral disease outbreaks, and severe bleaching episodes (Gardner et al. 2003), the reduction in urchin densities has had severe consequences in terms of coral-algal dominance patterns (Carpenter 1988; Lessios 1988). In the Florida Keys, the few historical data available prior to 1983-84 indicate that *D. antillarum* densities were perhaps lower (up to 4 to 5 per m^2) (Kier and Grant 1965; Bauer 1976, 1980) than reported from the Caribbean. Still, a general trend of greater algal cover was reported after the urchin mortality at several Florida Keys offshore reefs in the late 1980s and early 1990s (Jaap et al. 1988; Porter and Meier 1992). However, identifying clear relationships between grazing and algae – and ultimately coral recovery – remains problematic for at least two reasons: 1) few (if any) specifically designed before-and-after studies were conducted in the Florida Keys related to urchin decline, and 2) the regional die-off of *Acropora* corals from white-band disease occurred at the same time, which opened up large amounts of dead coral substrate for algal recruitment. Also, seven years after the 1983-84 event, a second disease event in the Florida Keys, after initially modest recovery to 0.30-0.58 individuals per m^2 , once again depressed *D. antillarum* densities to < 0.01 individuals per m^2 (Forcucci 1994). With the exception of a few shallow-water areas in the Dry Tortugas (Chiappone et al. 2001), large-scale surveys of urchin densities across the south Florida during 1999-2001 confirm this pattern of poor recovery (Chiappone et al. 2002a,b).

Since the mass mortality, limited to moderate recovery in *Diadema antillarum* populations has been reported in some Caribbean reef areas (Lessios 2005; Carpenter and Edmunds 2006; Debrot and Nagelkerken 2006), but recovery in the Florida Keys appears to be occurring slower (Chiappone et al. 2002a, in press; Lazar et al. 2005). Still, beginning in 2005 up to and including 2009, we have documented a small increase in the frequency of occurrence, density, and the sizes of *D. antillarum* from surveys of hundreds of sites across the south Florida shelf. While some have suggested that *D. antillarum* recovery will help to promote coral recruitment and a return to pre-mortality baseline reef conditions (Carpenter and Edmunds 2006; Macia et al. 2007; Myhre and Acevedo-Gutierrez 2007), disease, bleaching, and overfishing may counteract any positive influences of increased urchin grazing. Despite these

uncertainties, and because of these certainties, there is keen interest in the spatial and temporal patterns of *D. antillarum* recovery in the Florida Keys. In addition, the slow and incomplete recovery of this urchin raises the question of what factors currently limit population recovery (Miller et al. in press).

Beginning in 1999, we have conducted intermittent, large-scale surveys of urchin density and size structure in a diversity of habitats across the south Florida shelf encompassing hundreds of sites (Chiappone et al. 2001, 2002a, b). We have recently described the population status of *Diadema antillarum* based upon surveys of 235 sites along ~200 km of the Florida reef tract during 2007 (Chiappone et al. in press) and additionally sampled 145 sites for urchin abundance and size in 2008. Below is a summary of the 2009 results for density and sizes of all urchins encountered during the surveys of 160 sites in the Florida Keys. To our knowledge, these are the only large-scale, repeated, surveys being conducted for urchins in the region.

2009 Survey Results

During May-September, a total of 9,600 m² of benthic habitat among 160 sites was surveyed in the Florida Keys for urchin abundance and test sizes. Five species were encountered within transects: *Diadema antillarum*, *Echinometra lucunter*, *E. viridis*, *Eucidaris tribuloides*, and *Tripneustes ventricosus* (Figure 6-1). Tables 6-1 to 6-5 summarize site-level densities for each species and Table 6-6 provides the mean and ranges in test diameters (TD) by habitat and for the entire sampling domain. Of the five urchin species and 1,768 individuals encountered, the most abundant species were *E. viridis* (1,092 individuals, 61.8% of all individuals) and *E. tribuloides* (497 individuals, 28.1%), followed by *D. antillarum* (146 individuals, 8.3%), *E. lucunter* (28 individuals, 1.6%), and *T. ventricosus* (5 individuals, 0.3%).

A total of 146 individuals of *Diadema antillarum* were recorded, with individuals distributed among all of the habitats sampled, albeit at different densities and sizes (Table 6-1). The maximum site-level density of 0.30 individuals/m² occurred at an offshore patch reef east of Coffins Patch SPA (site U42). We have noticed since 2001 an increase in the number of sites where *D. antillarum* is found and a trend towards larger test sizes, especially on patch reefs. Figures 6-2 to 6-7 illustrate the spatial distribution of *D. antillarum* densities throughout the Florida Keys study area. Proportional station frequencies and habitat-level mean (± 1 SE) densities were greatest on offshore patch reefs (21% $\pm$ 5% of transects, 0.027 ± 0.011 individuals per m²), followed by mid-channel patch reefs (17% $\pm$ 6% of transects, 0.022 ± 0.008 per m²) (Table 6-1). Among all habitats sampled, densities tended to either similar or lower in no-take zones compared to reference areas (Figures 6-8 and 6-9). In high-relief spur and groove, densities were relatively similar to previous years, and on the deeper fore-reef, lower densities (< 0.01 individuals per

m²) persist (Figure 6-9). *D. antillarum* test sizes ranged from 0.4 to 9.3 cm and averaged 5.0 ± 0.2 cm; this is slightly larger than that reported in 2008, nearly 1 cm larger on average than the 3.6 ± 0.1 cm documented in 2007 (Table 6-6), and nearly 3 cm greater than that reported in 1999-2001 (Chiappone et al. 2002a,b). The test sizes of the individuals in 2009 indicated a mixed distribution, with not only abundant recruits (18% of individuals), but also 60% of individuals greater than 5.0 cm TD (Figure 6-10). Patch reefs and shallow hard-bottom sites yielded the largest average size, while the deeper fore-reef had the lowest average size (Table 6-6).

Two species of *Echinometra* were encountered during the 2008 surveys. *E. lucunter* was the less abundant of the two species, with only 28 individuals recorded, and was found among all habitats except the deeper fore-reef (Table 6-2). Half of all individuals were encountered on patch reefs, with the balance recorded from shallow hard-bottom and high-relief spur and groove. Similar to its congener, *E. viridis* was widely distributed among the habitats sampled, but exhibited habitat-specific patterns of abundance (Table 6-3). As documented in previous years, *E. viridis* was especially abundant on mid-channel patch reefs, with 965 (88%) of the 1,092 individuals recorded from this habitat. Figures 6-11 to 6-16 illustrate the spatial distribution of *E. viridis* densities throughout the Florida Keys study area. A mean (± 1 SE) habitat-level density of 0.73 ± 0.27 individuals per m² was recorded from mid-channel patch reefs, a density at least one order of magnitude greater than the other habitats. Site-level densities of *E. viridis* were as high as 3.9 individuals per m² and the greatest densities were recorded on mid-channel patch reefs, especially in the lower Keys (Table 6-3 and Figure 6-17). The test diameter (TD) of individuals ranged from 0.5 cm to 4.6 cm and averaged 2.7 cm (Figure 6-10) among the 160 sites, with inshore and mid-channel patch reefs yielding the largest average sizes and the largest maximum sizes compared to other habitats (Table 6-6).

Eucidaris tribuloides was recorded from all habitats sampled and exhibited a habitat distribution pattern similar to historical surveys during 1999-2008. A total of 497 individuals were counted in 2009 and the highest site-level density estimate of 0.57 ± 0.24 individuals/m² recorded from a high-relief spur and groove reef east of Eastern Sambo RO (site S24) (Table 6-4). Figures 6-19 to 6-24 illustrate the spatial distribution of *E. tribuloides* densities throughout the Florida Keys study area. Densities tended to be greatest on inshore and offshore patch reefs, as well as high-relief spur and groove, with apparent regional density variations for some habitats (Figures 6-25 and 6-26). Of the 497 individuals encountered, test diameters ranged from 0.7 cm to 4.7 cm, averaged 2.2 cm (Table 6-6), and showed a modal size class between 3.0 and 3.9 cm (Figure 6-10). A slightly larger average size was recorded from inshore patch reefs compared to other habitat types (Table 6-6).

Discussion

Large-scale surveys encompassing hundreds of sites across the south Florida shelf since 1999 indicate that the *Diadema antillarum* population exists at densities well below values reported before the two mortality events in 1983-84 and 1991 (Kier and Grant 1965; Bauer 1980; Forcucci 1994). For the Florida Keys there has been an increase in the proportion of sites with *D. antillarum* present, as well an increase in mean test size, with a greater proportion of larger individuals in the population. Earlier reports and recent observations indicate that other urchin species show density and habitat distribution patterns similar to pre-1983 observations, indicating that other urchin species have not compensated for the loss of *D. antillarum* (Chiappone et al. 2002a). In areas with relatively high (> 0.1 individuals/m²) and larger (> 5 cm TD) *D. antillarum*, there are obvious effects of grazing on the substratum, particularly the removal of turf and macroalgae and exposure of the substratum (Chiappone et al. 2001). It remains unclear whether or not increasing urchin densities and sizes will lead to other changes to the benthos; for example, increased coral or urchin recruitment.

The slow and prolonged recovery in the Florida Keys, especially compared to several recent studies in other Caribbean reef areas, raises several questions pertaining to factors that may inhibit recovery (Lessios 1988). Possible causes of slow recovery include poor larval survivorship, lack of adult conspecifics and hence protection from predators, suitable recruitment sites, and inter-specific competition. The sources of urchin larvae to the south Florida shelf are not known, but may include both local and regional sources (Lee et al. 1994). Nonetheless, it is apparent that *D. antillarum* have continually recruited to benthic habitats, even after the 1991 mortality event (Chiappone et al. 2002a). A recent study of *D. antillarum* larval settlement rates in the Florida Keys, however, indicate that low larval supply may be one factor limiting recovery (Miller et al. in press). The predominance of relatively small test sizes from 1999-2005 indicated that post-settlement recruits have poor survivorship into larger size classes, perhaps due to predation or physical disturbance from storms. However, since 2005, there has been a notable shift in the size distribution towards larger individuals in the population. Because *D. antillarum* was historically significant as a grazer, it is anticipated that continued recovery will influence patterns in benthic community structure throughout the Florida Keys.

Figure 6-1. Urchin species surveyed for density and size (test diameter) in the Florida Keys during 2009. Not shown is *Echinometra lucunter* (rock boring urchin).

Diadema antillarum



Juvenile *Diadema antillarum*



Echinometra viridis



Echinometra viridis



Eucidaris tribuloides



Tripneustes ventricosus



Figure 6-2. Densities (no. per m²) of long-spined sea urchins (*Diadema antillarum*) in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

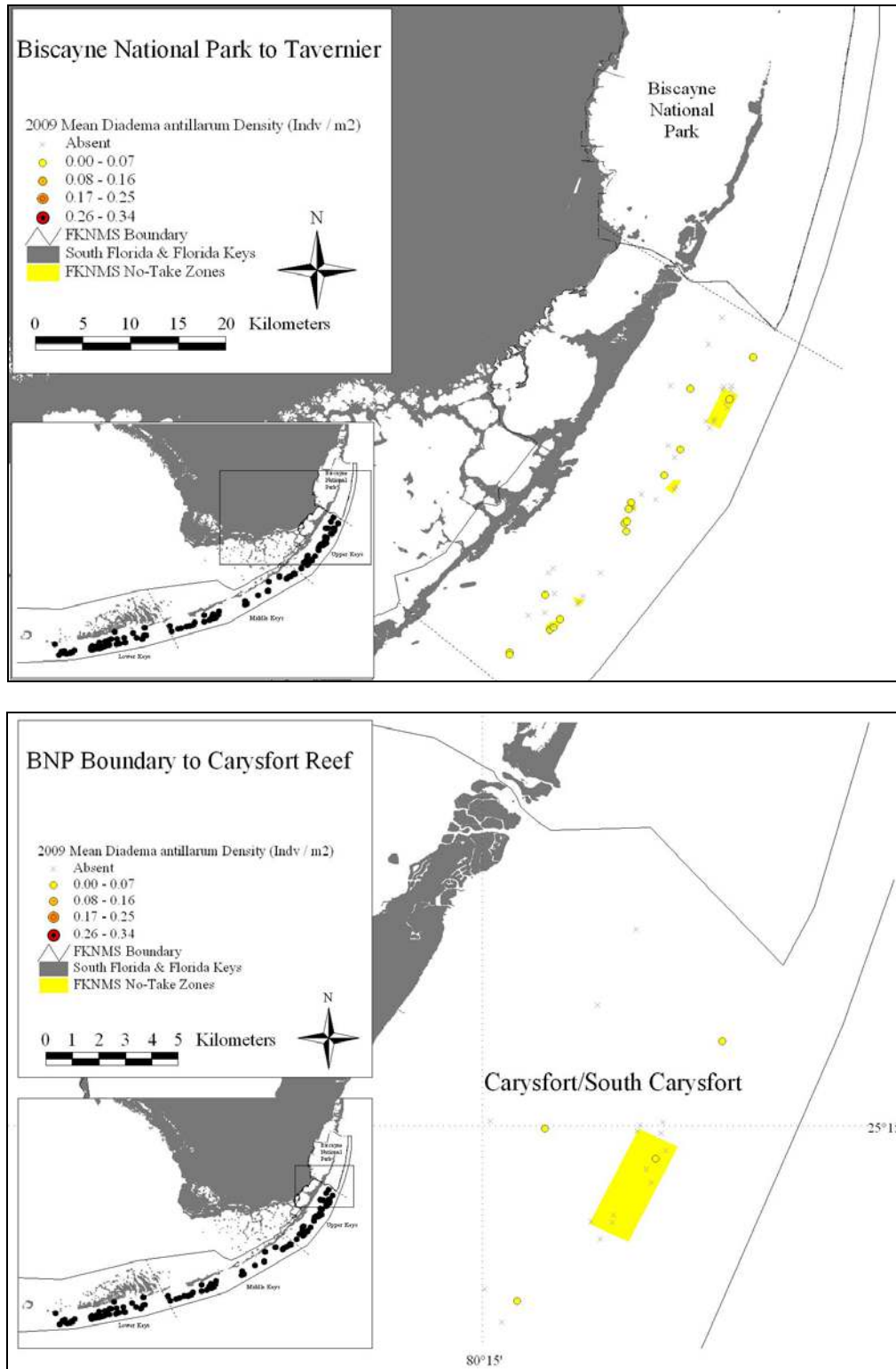


Figure 6-3. Densities (no. per m²) of long-spined sea urchins (*Diadema antillarum*) in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region during May-September 2009.

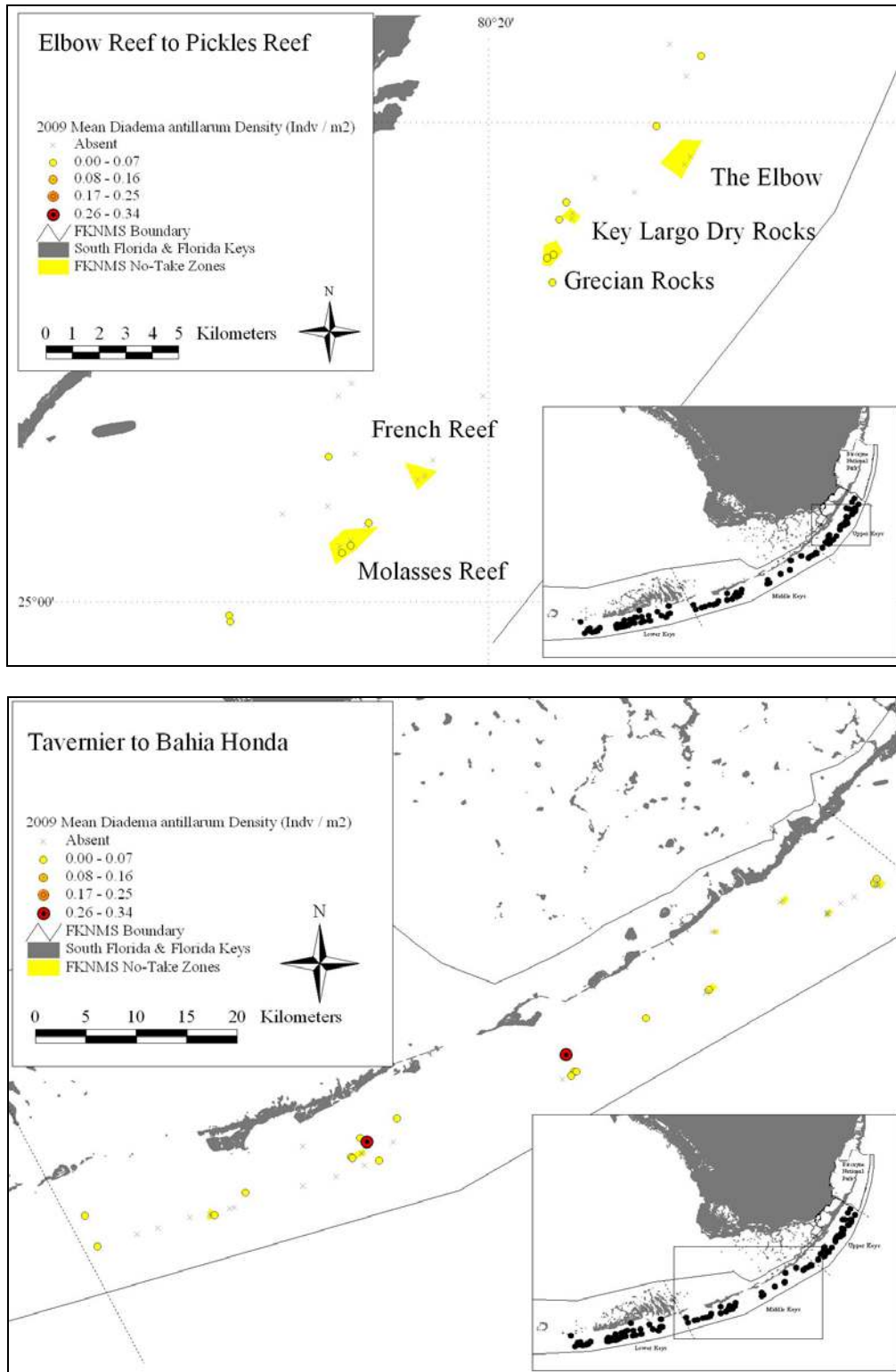


Figure 6-4. Densities (no. per m²) of long-spined sea urchins (*Diadema antillarum*) in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

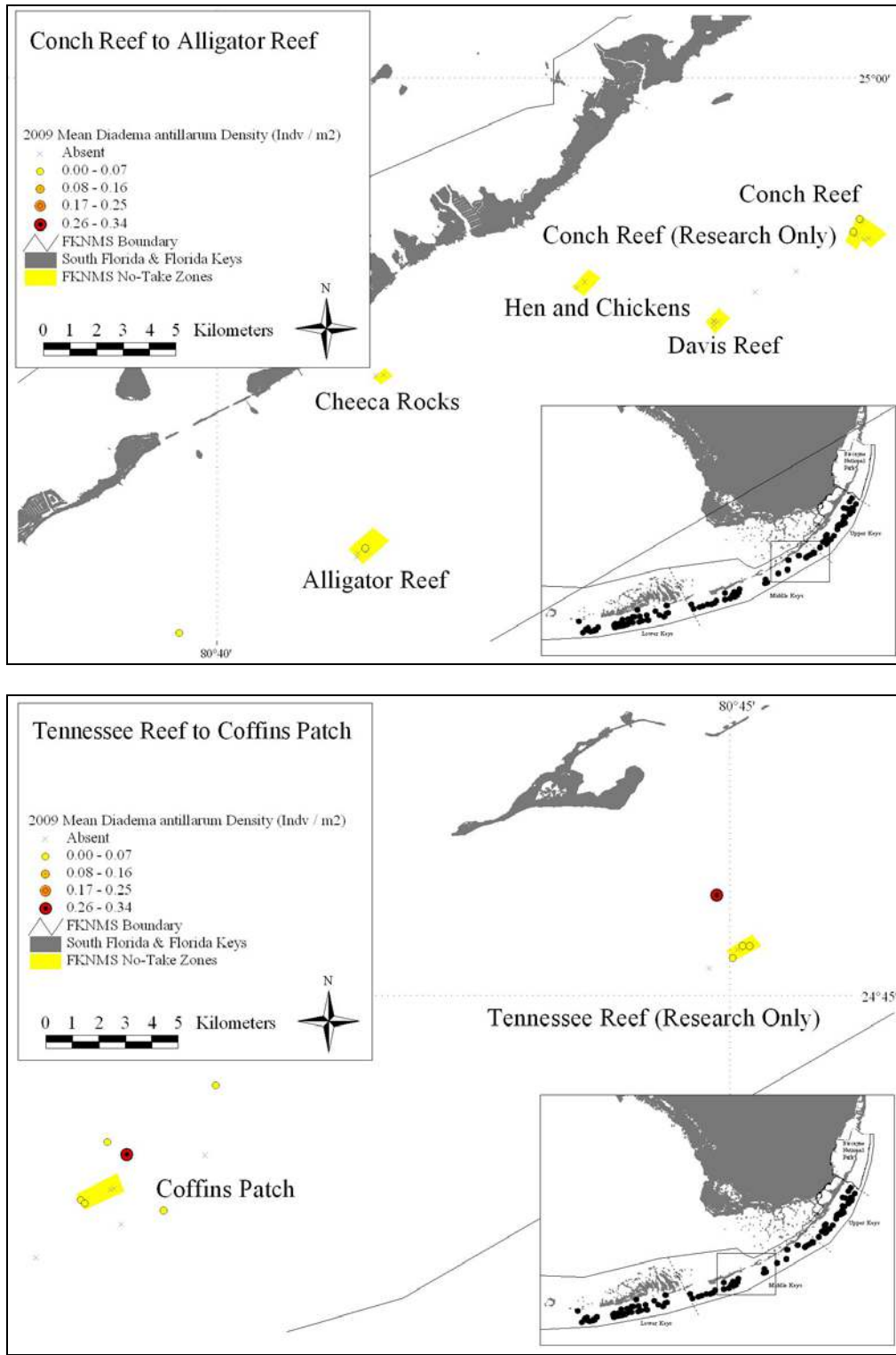


Figure 6-5. Densities (no. per m²) of long-spined sea urchins (*Diadema antillarum*) in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

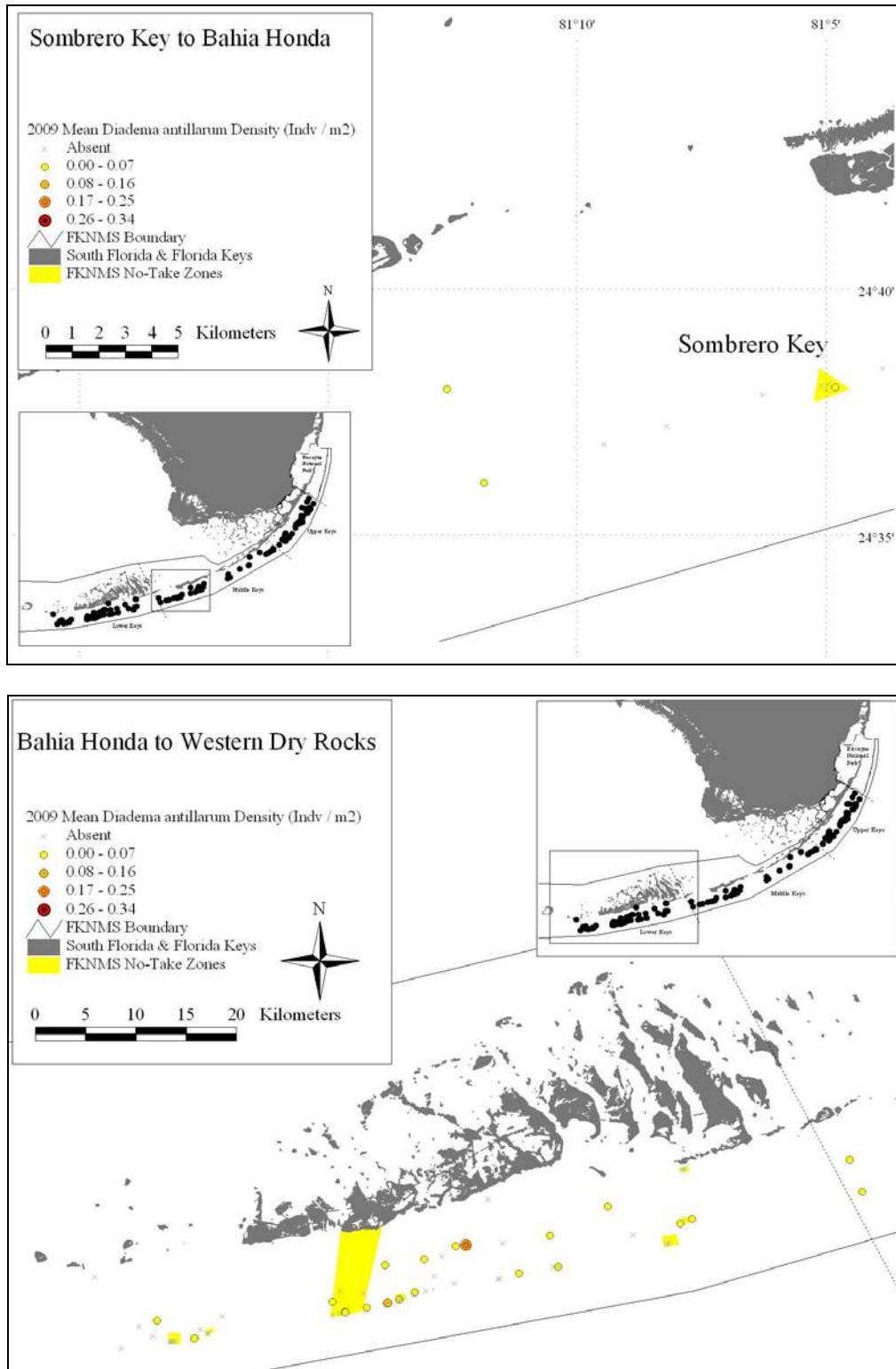


Figure 6-6. Densities (no. per m²) of long-spined sea urchins (*Diadema antillarum*) in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

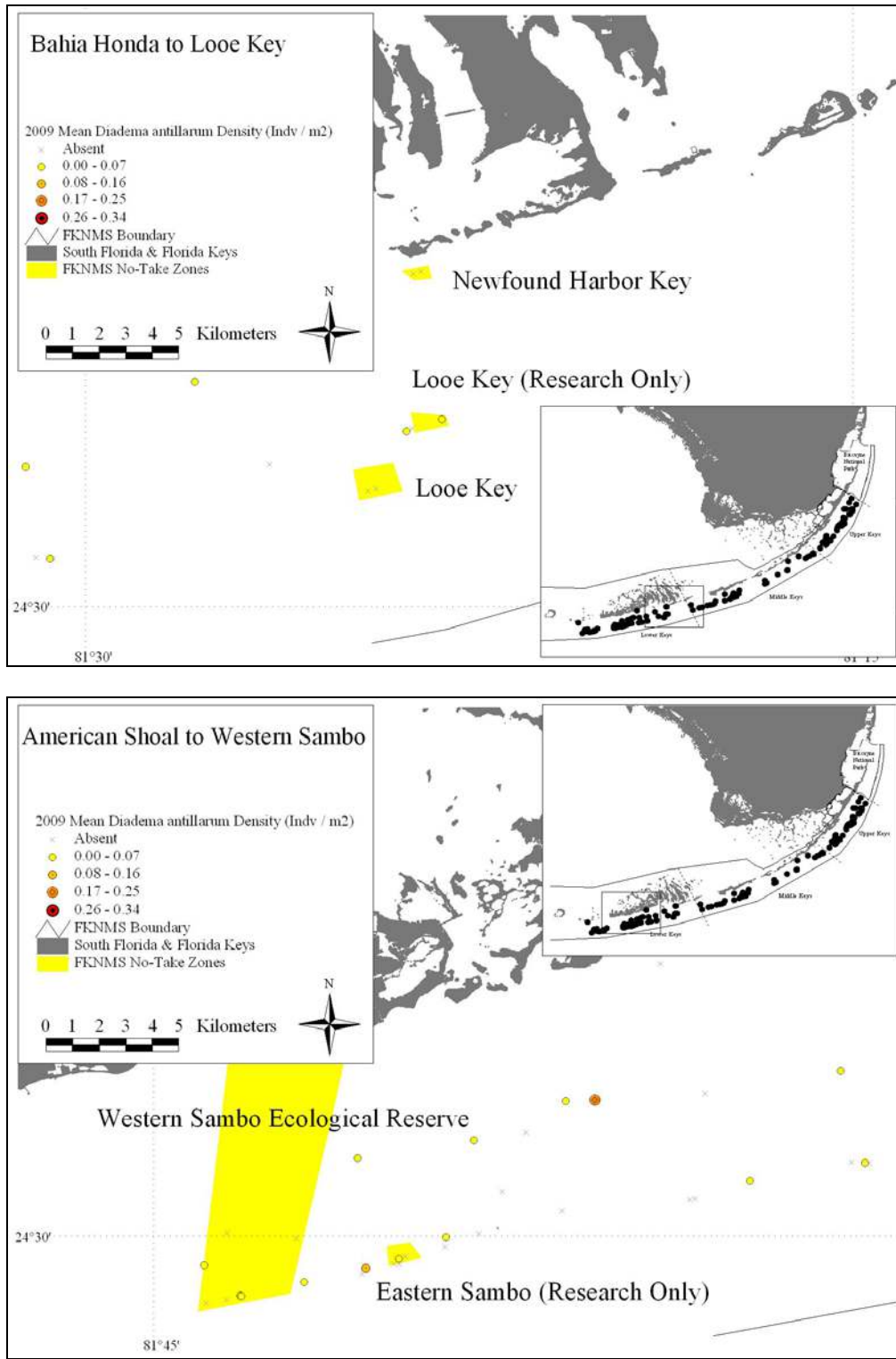


Figure 6-7. Densities (no. per m²) of long-spined sea urchins (*Diadema antillarum*) in the lower Florida Keys region from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

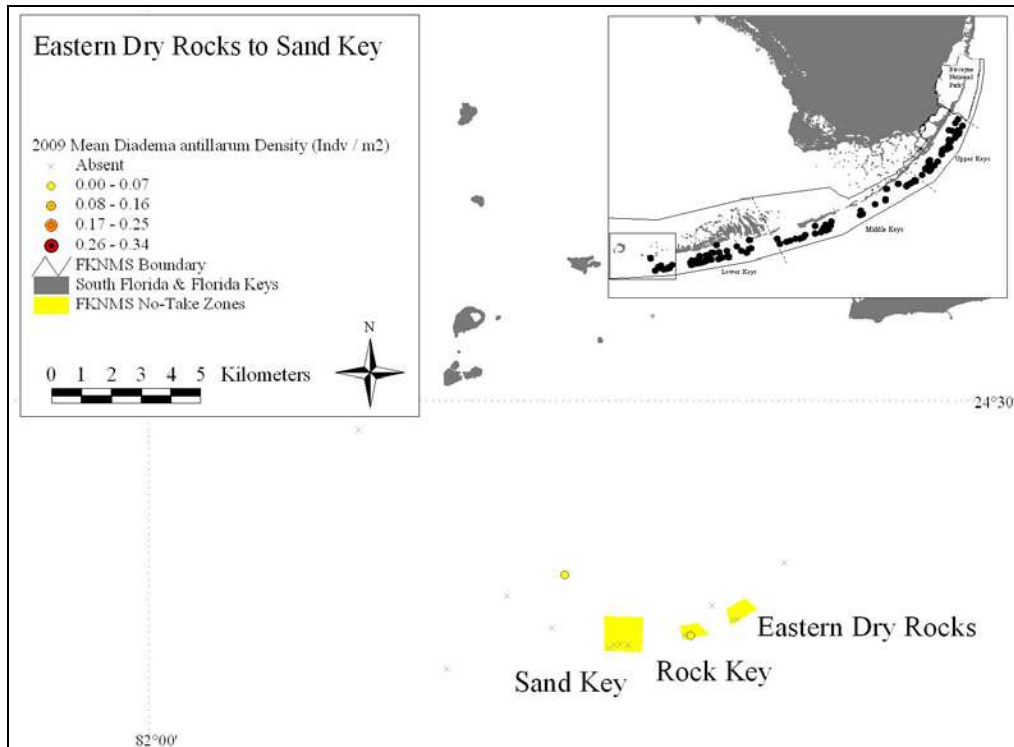


Figure 6-8. Mean (+ 1 SE) densities (no. per m²) of long-spined sea urchins (*Diadema antillarum*) on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

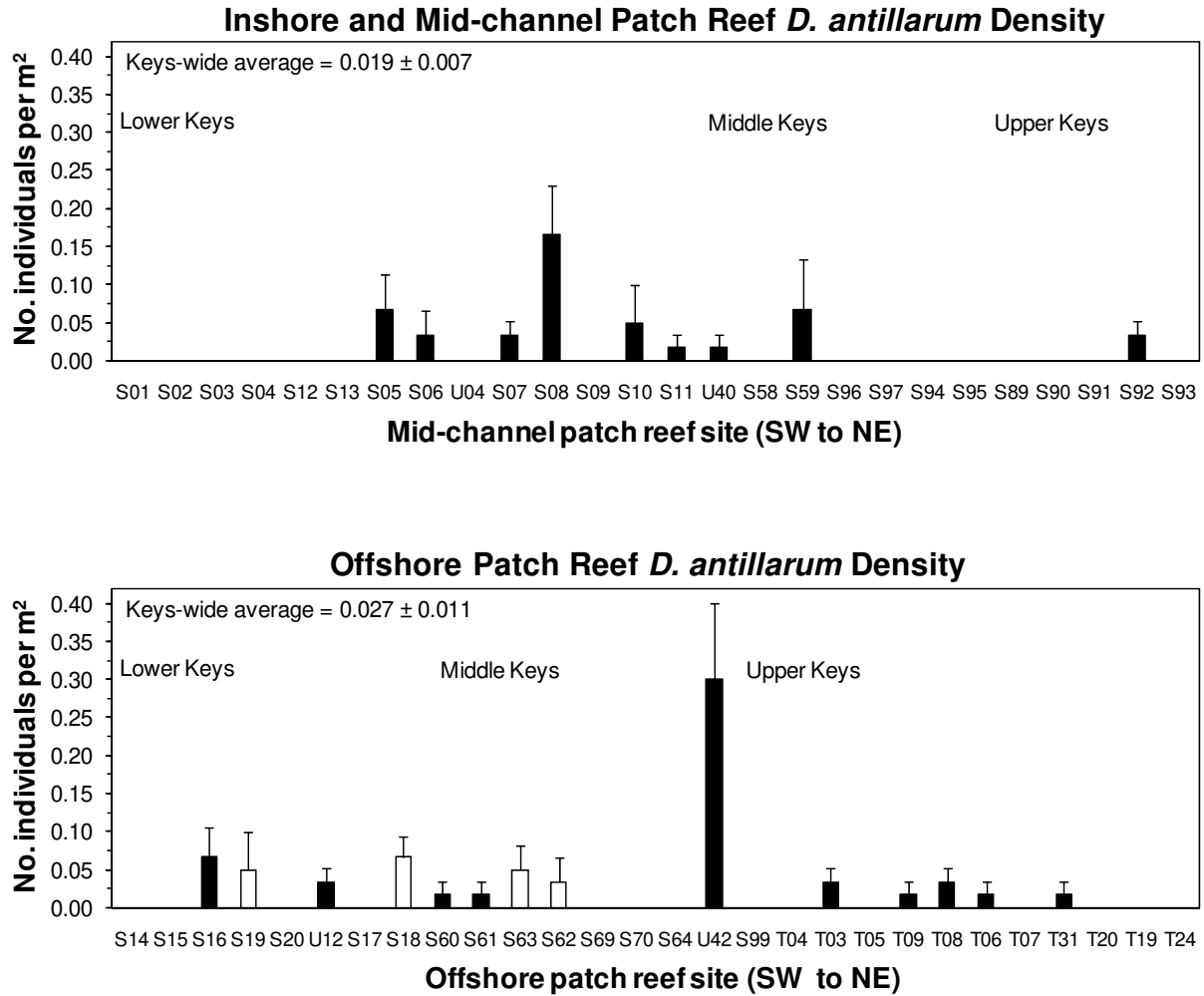


Figure 6-9. Mean (+ 1 SE) densities (no. per m²) of long-spined sea urchins (*Diadema antillarum*) on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

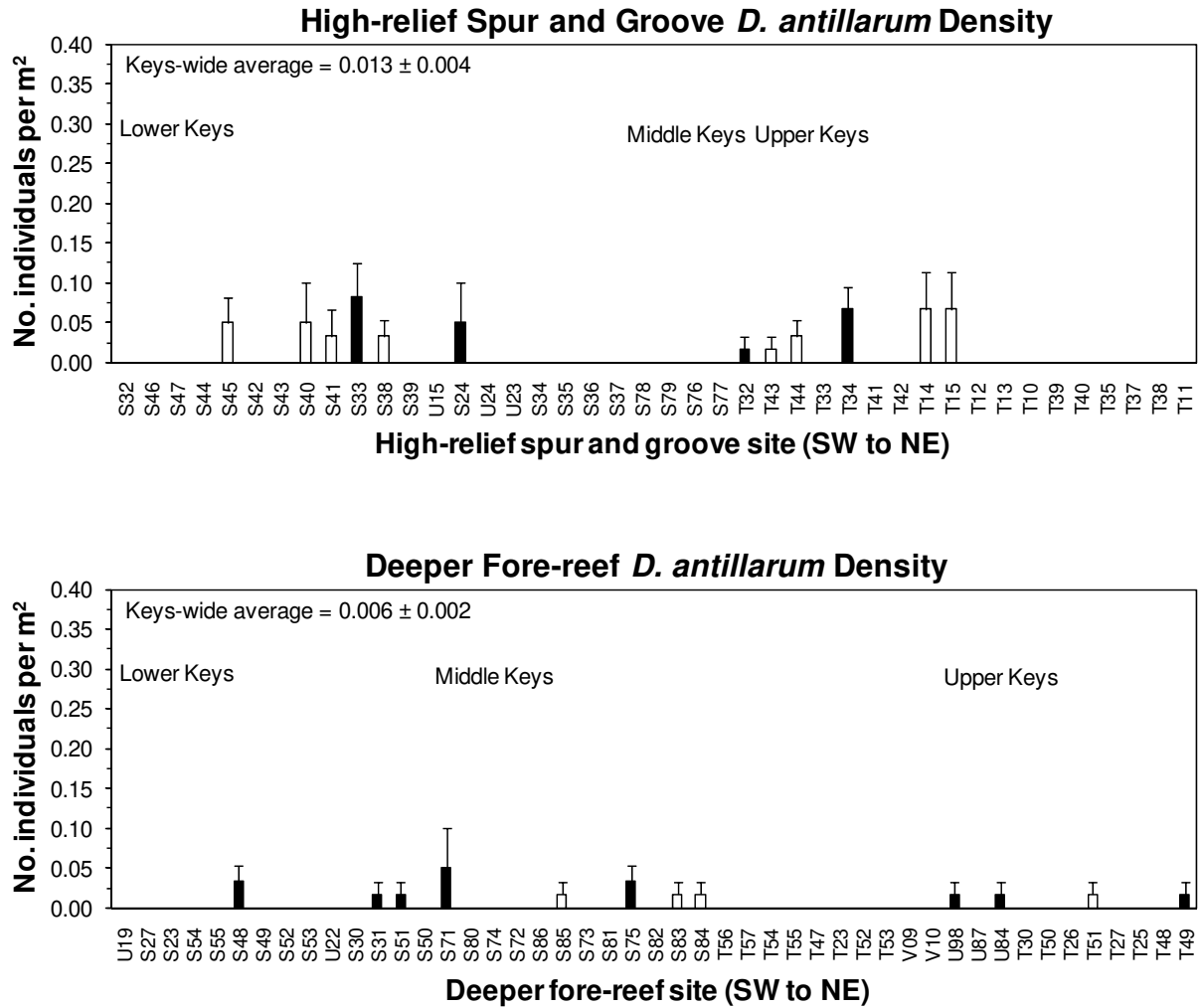


Figure 6-10. Distribution of urchin test diameter sizes for *Diadema antillarum*, *Echinometra viridis*, and *Eucidaris tribuloides* in the Florida Keys National Marine Sanctuary during May-September 2009 at 160 hard-bottom and coral reef sites.

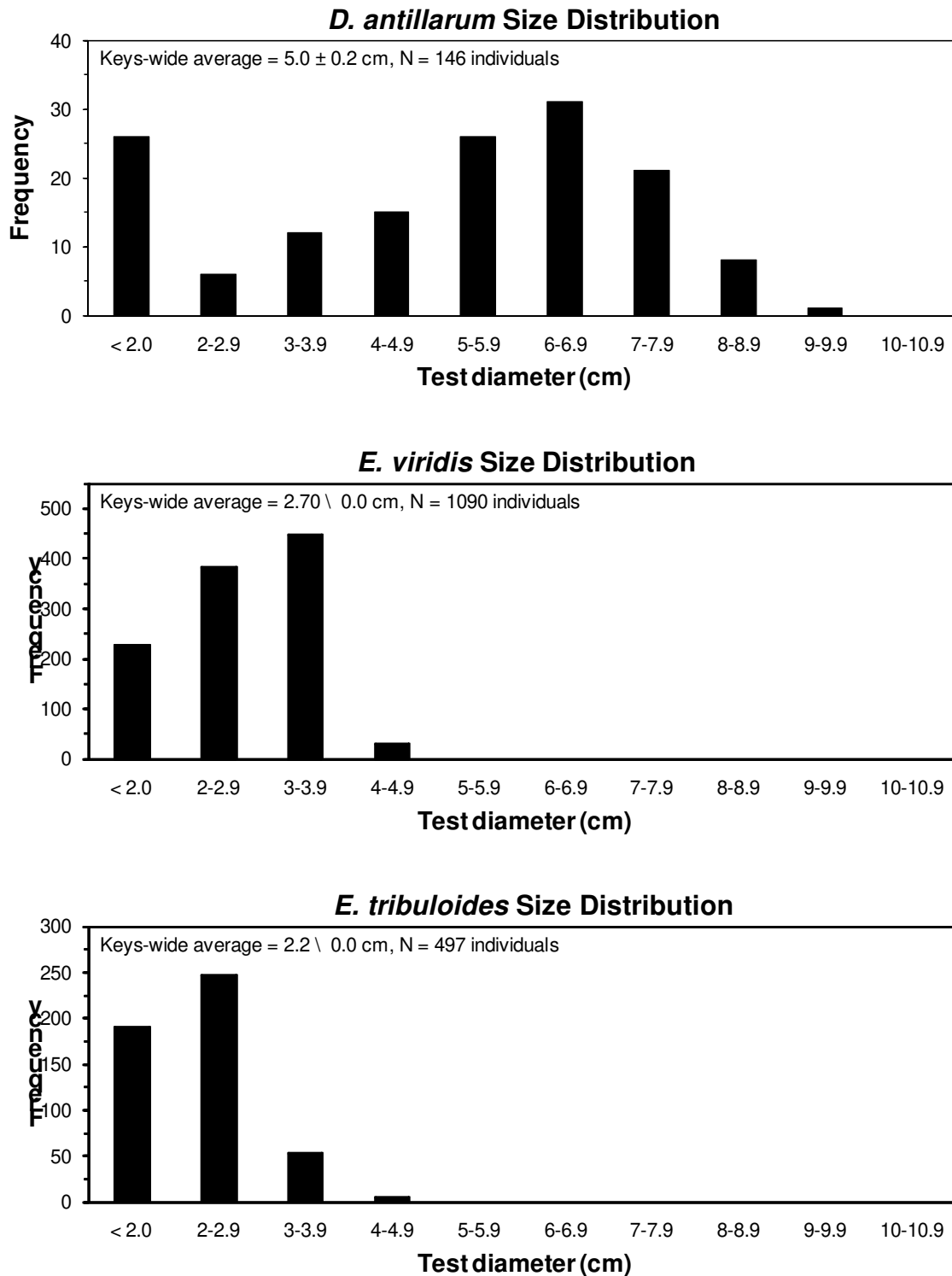


Figure 6-11. Densities (no. per m²) of green rock-boring urchins (*Echinometra viridis*) in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

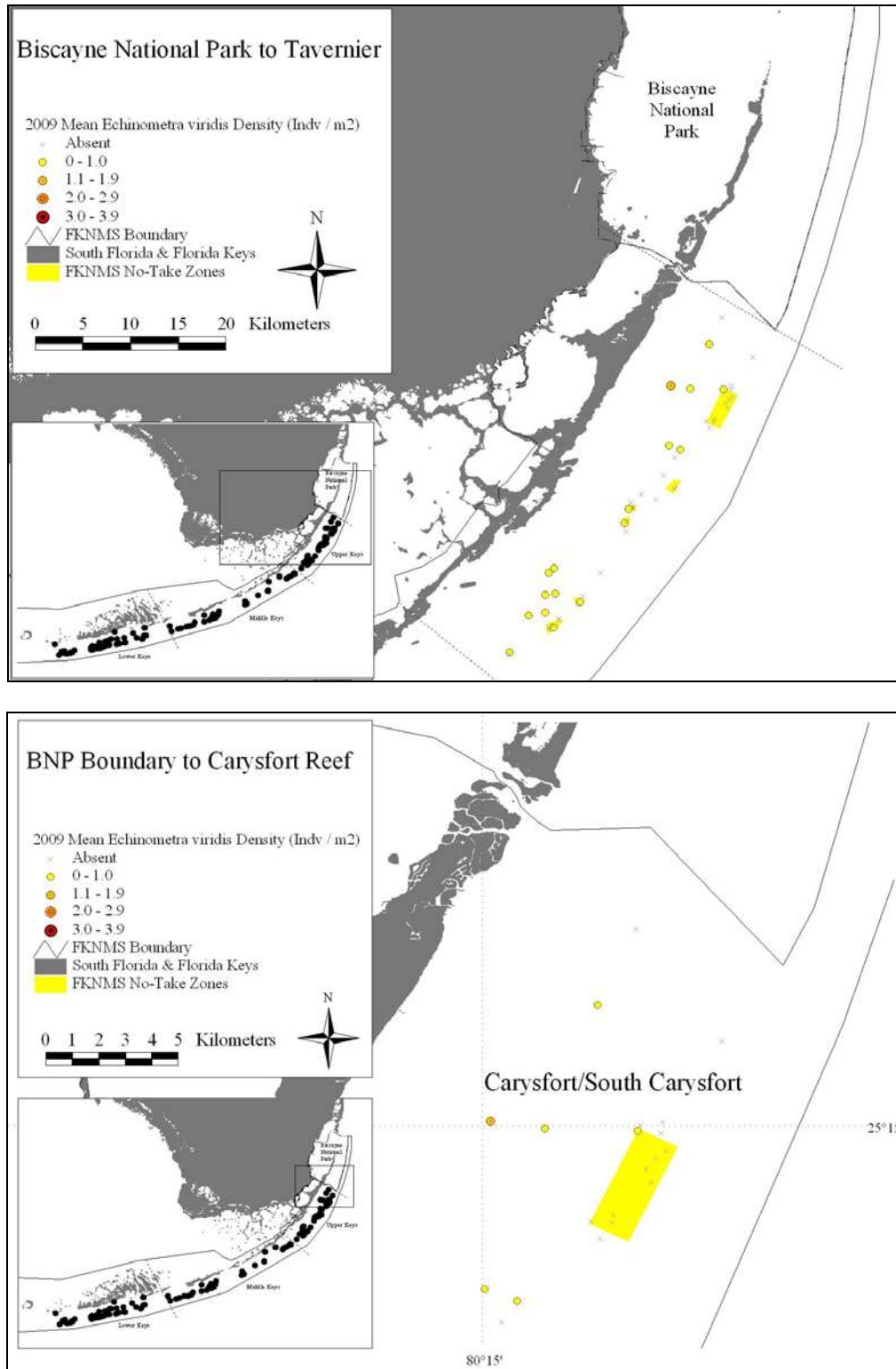


Figure 6-12. Densities (no. per m²) of green rock-boring urchins (*Echinometra viridis*) in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region (bottom) during May-September 2009.

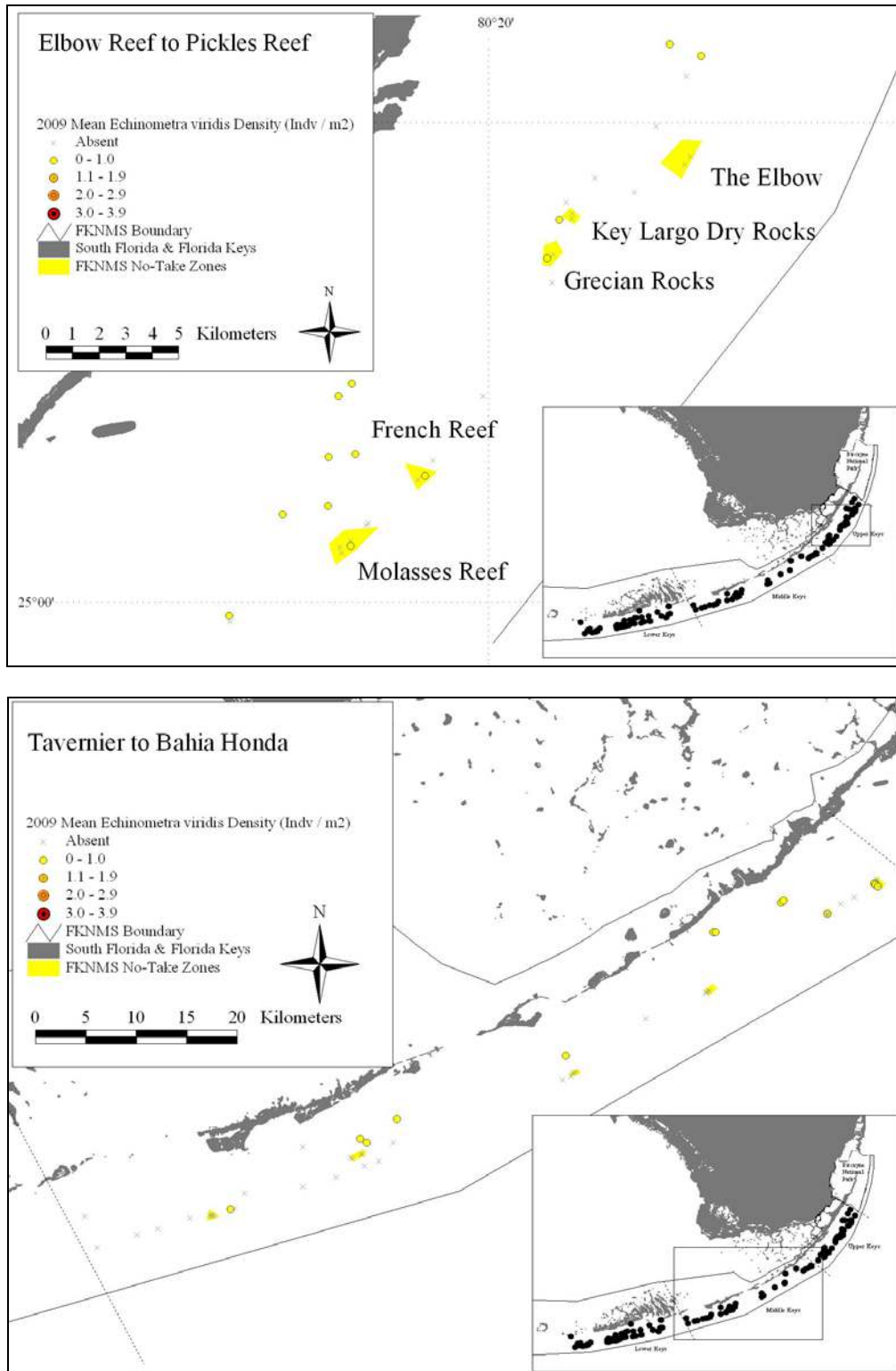


Figure 6-13. Densities (no. per m²) of green rock-boring urchins (*Echinometra viridis*) in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

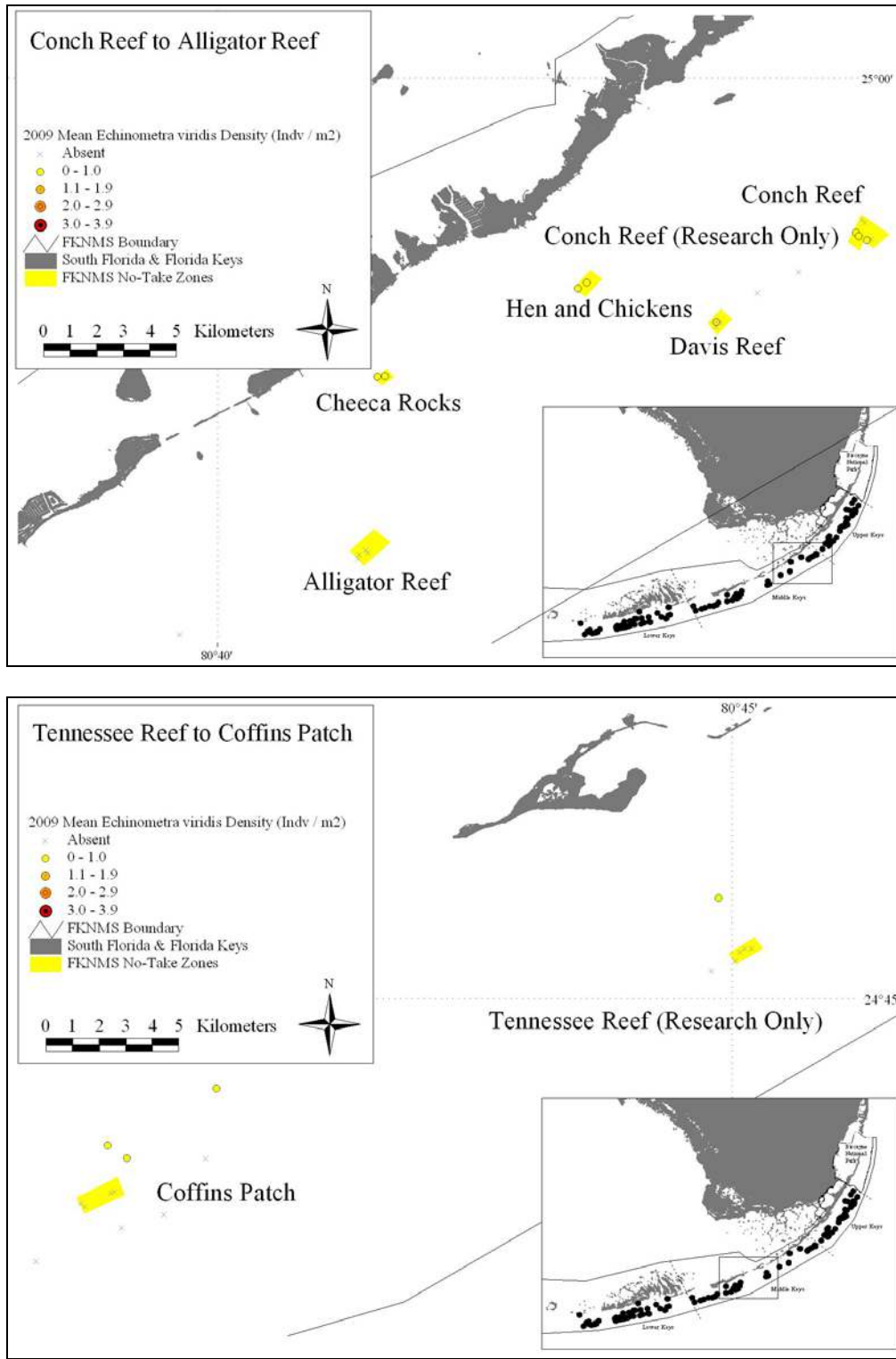


Figure 6-14. Densities (no. per m²) of green rock-boring urchins (*Echinometra viridis*) in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

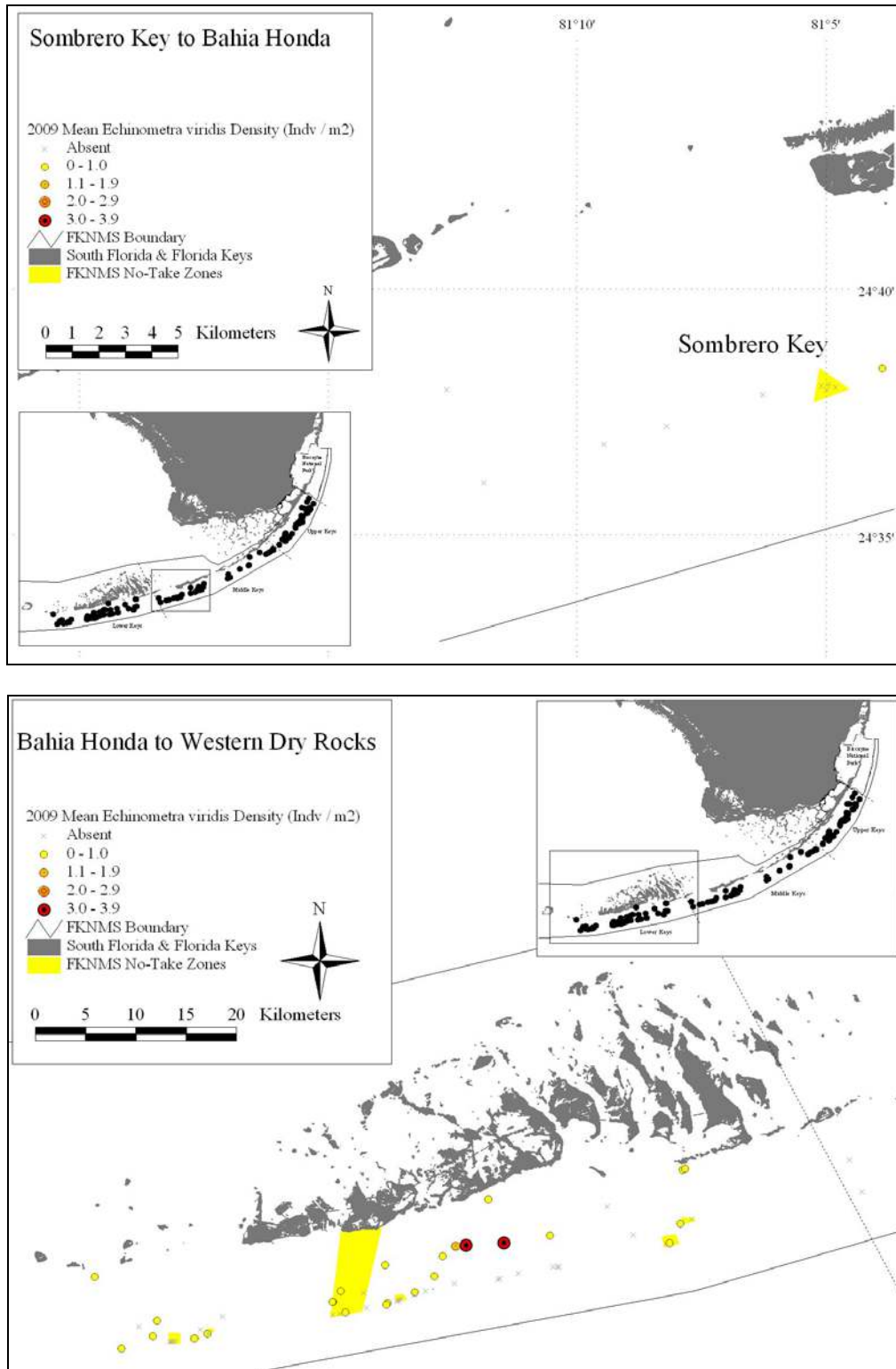


Figure 6-15. Densities (no. per m²) of green rock-boring urchins (*Echinometra viridis*) in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

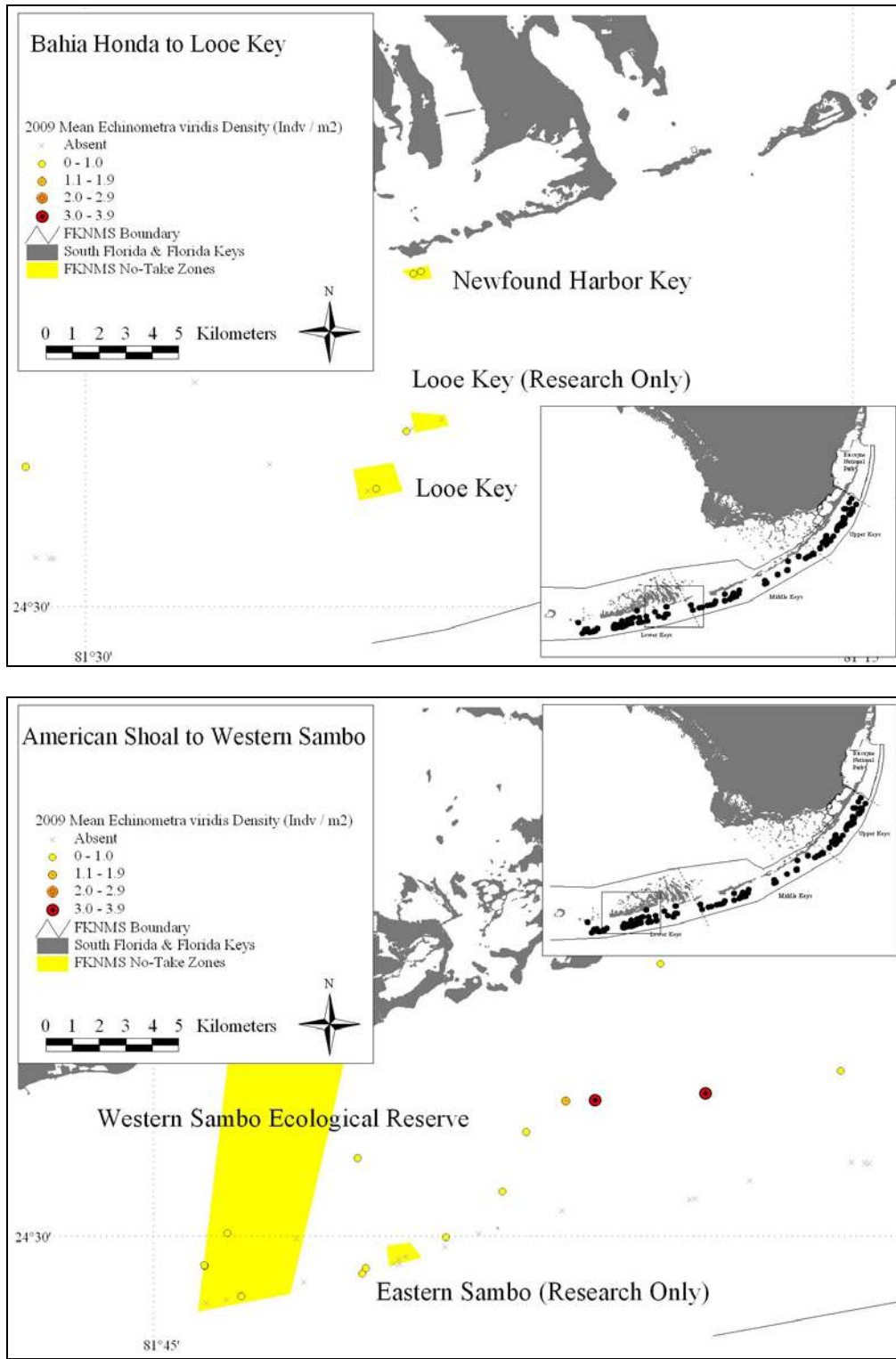


Figure 6-16. Densities (no. per m²) of green rock-boring urchins (*Echinometra viridis*) in the lower Florida Keys region from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

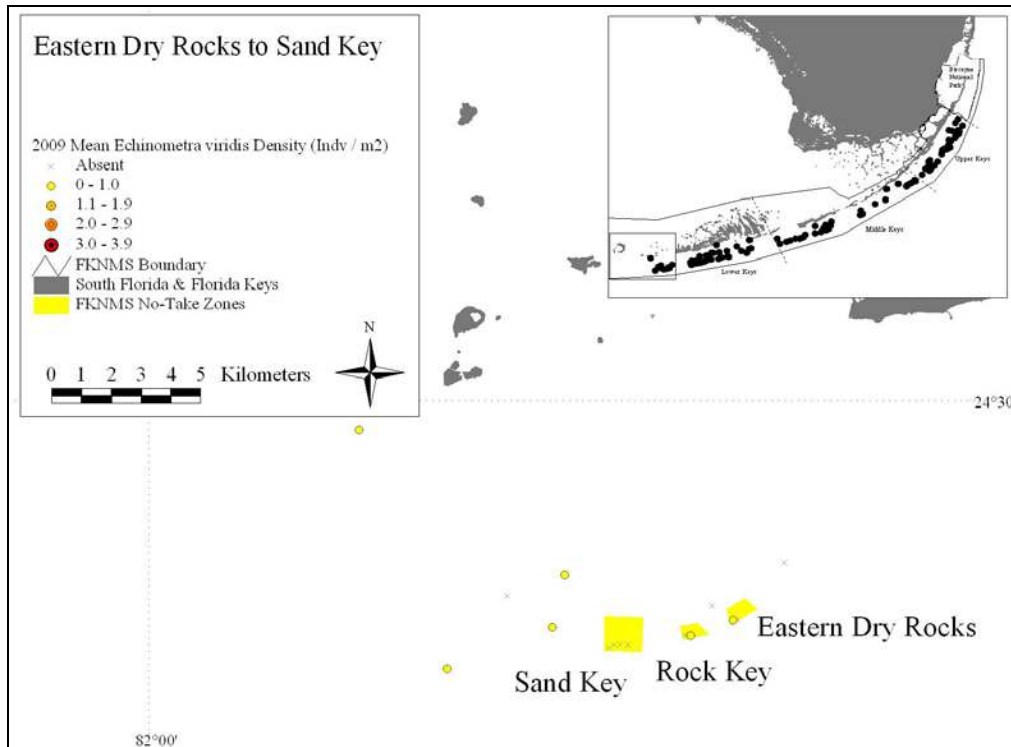


Figure 6-17. Mean (+ 1 SE) densities (no. per m²) of green rock-boring urchins (*Echinometra viridis*) on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

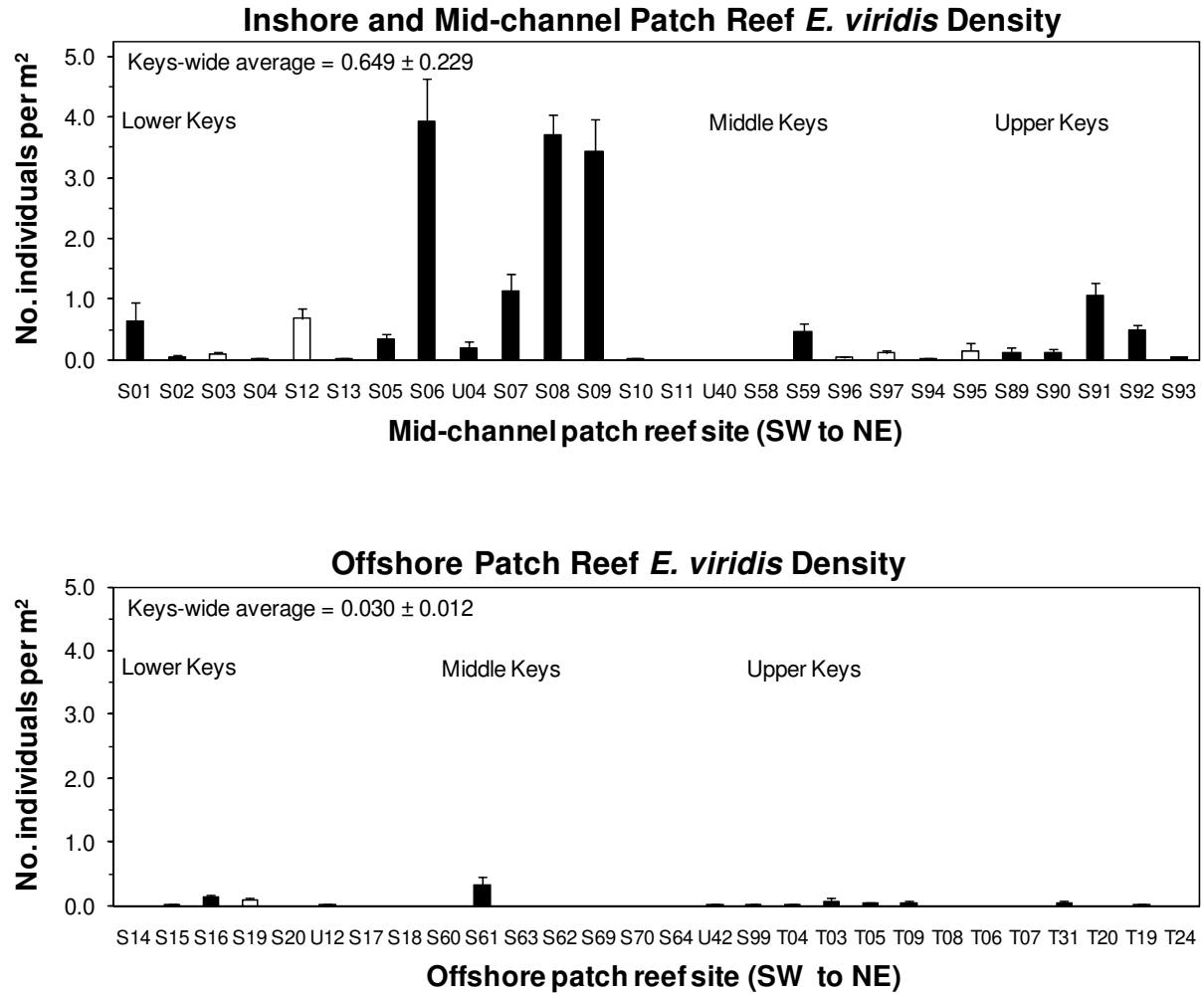


Figure 6-18. Mean (+ 1 SE) densities (no. per m²) of green rock-boring urchins (*Echinometra viridis*) on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

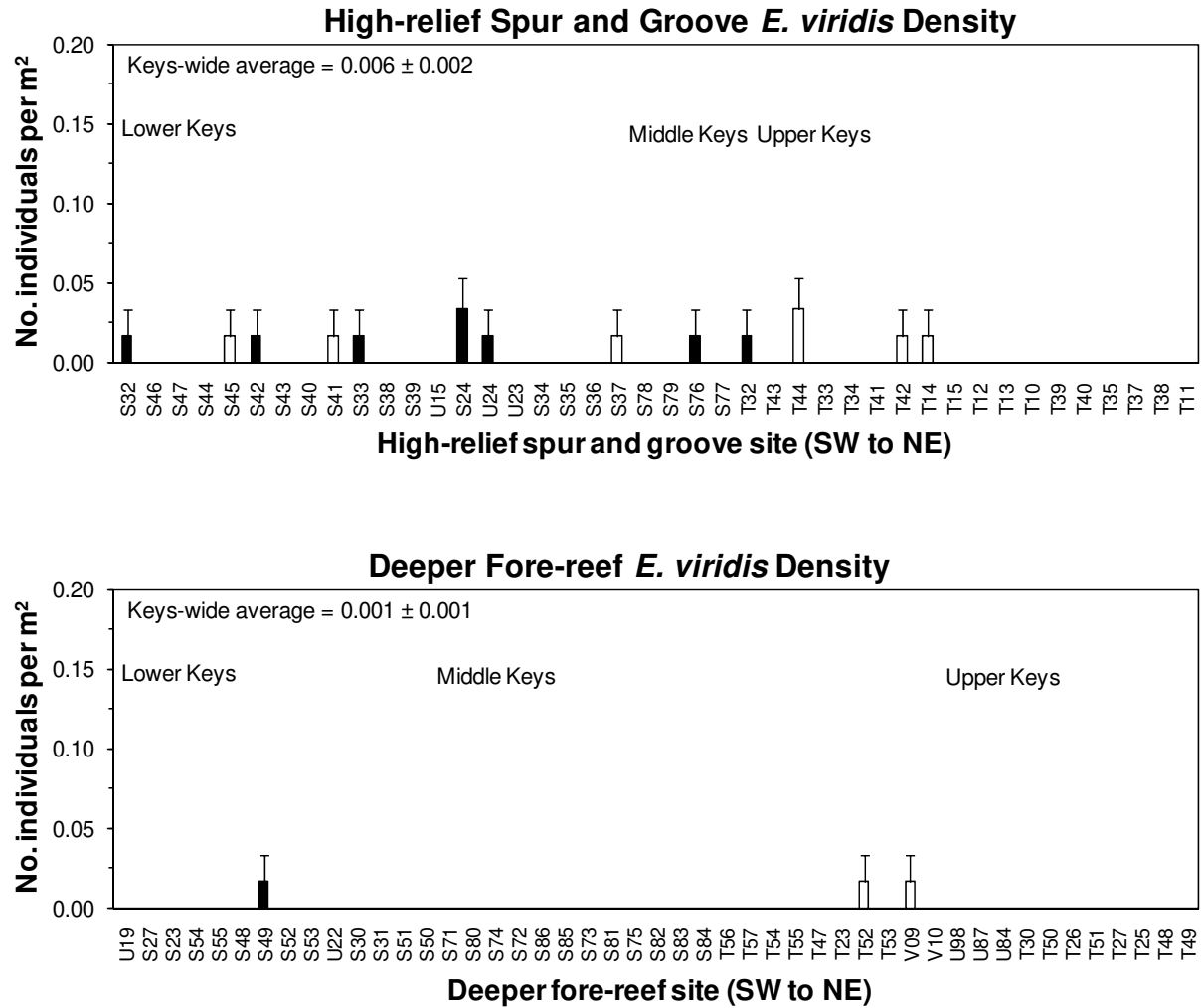


Figure 6-19. Densities (no. per m²) of slate pencil urchins (*Eucidaris tribuloides*) in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

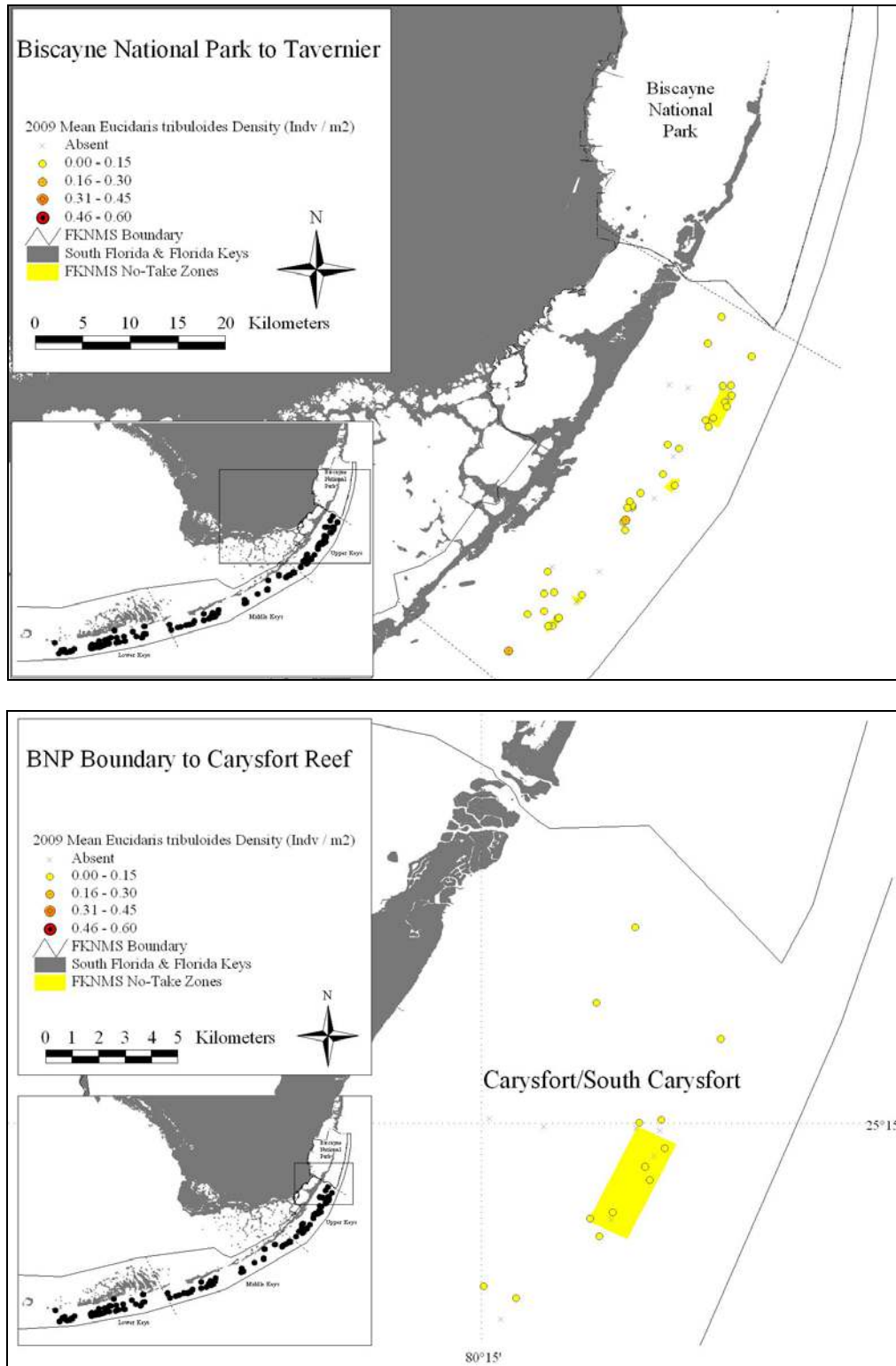


Figure 6-20. Densities (no. per m²) of slate pencil urchins (*Eucidaris tribuloides*) in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region (bottom) during May-September 2009.

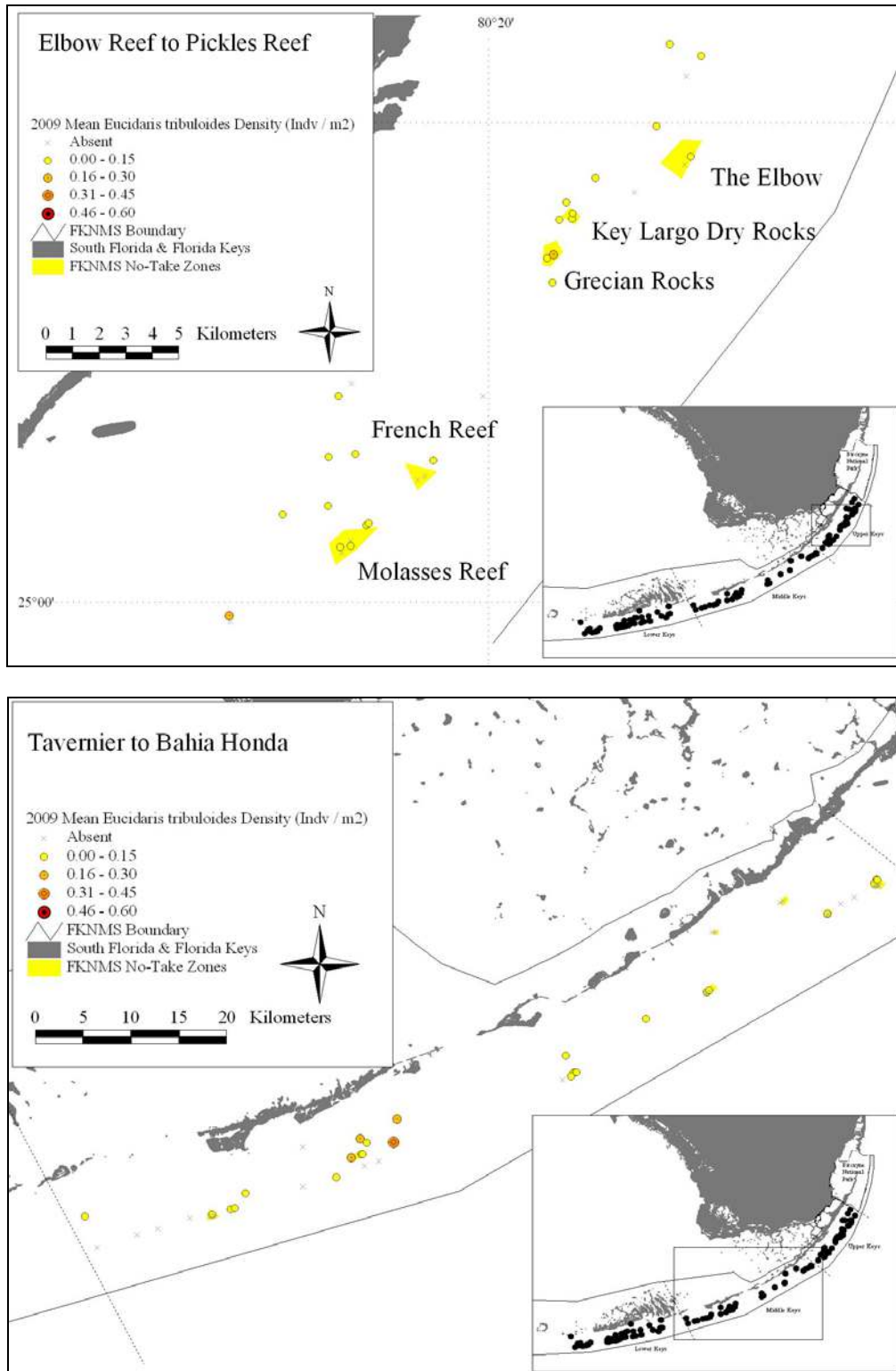


Figure 6-21. Densities (no. per m²) of slate pencil urchins (*Eucidaris tribuloides*) in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

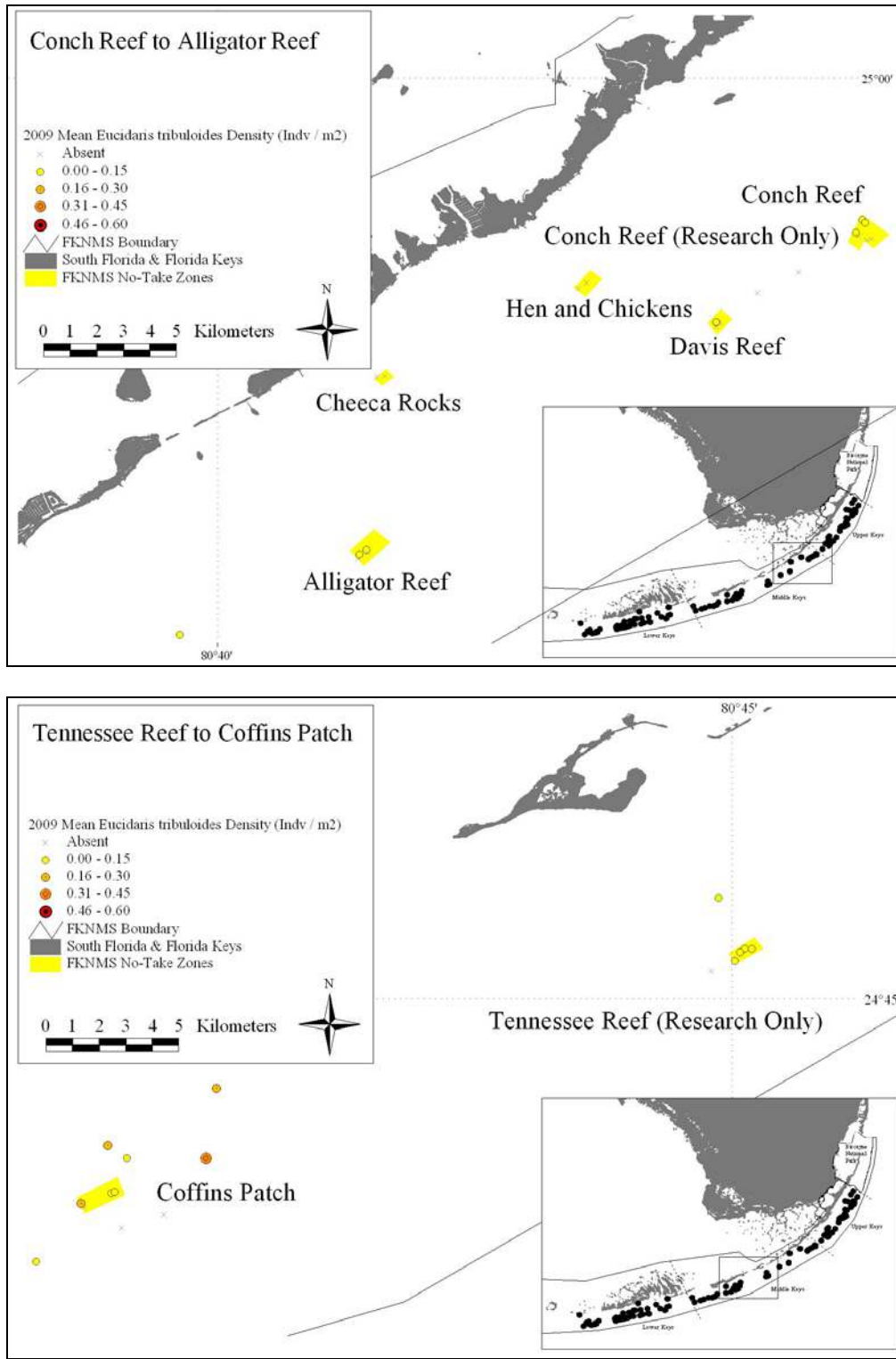


Figure 6-22. Densities (no. per m²) of slate pencil urchins (*Eucidaris tribuloides*) in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

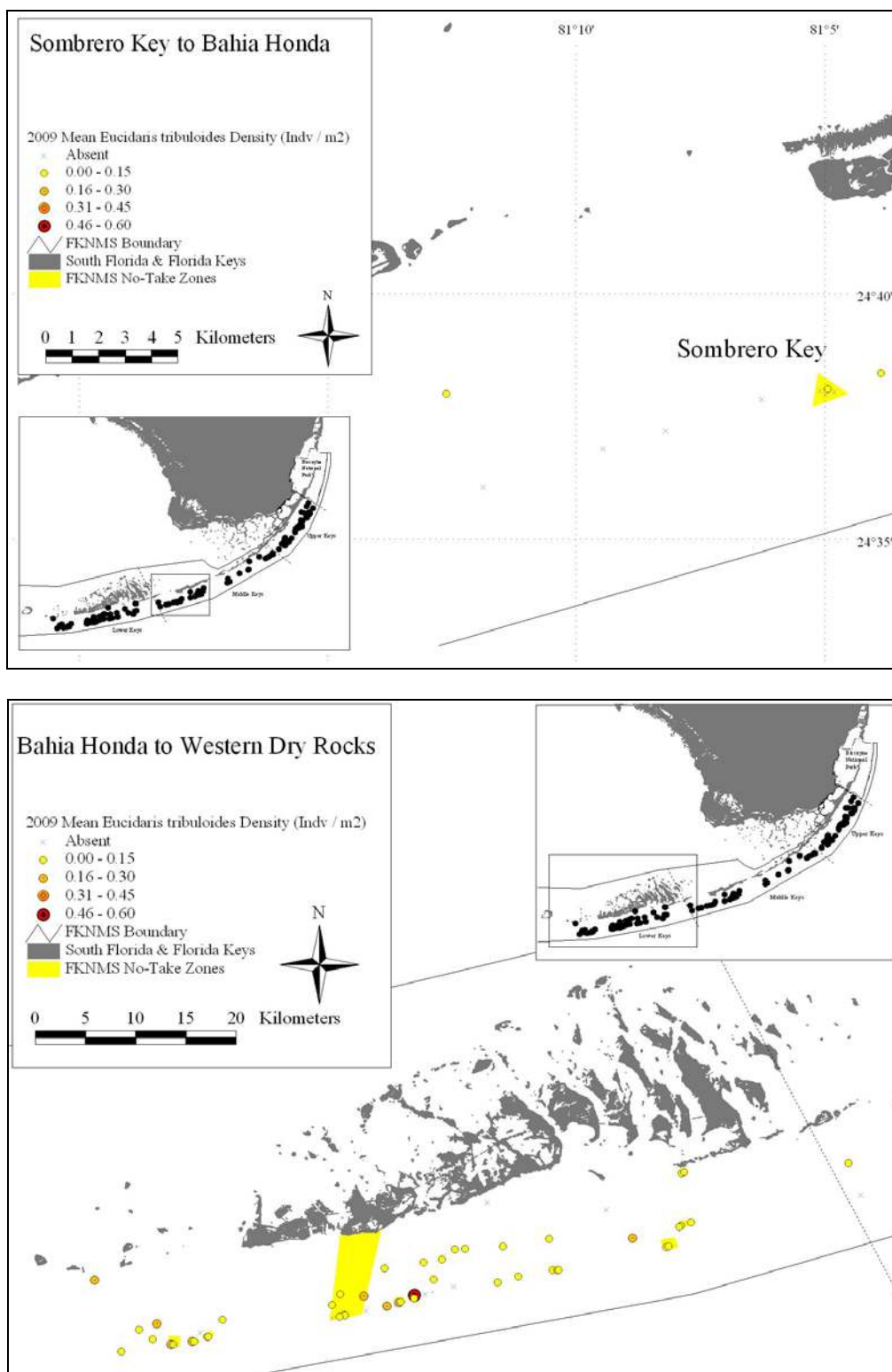


Figure 6-23. Densities (no. per m²) of slate pencil urchins (*Eucidaris tribuloides*) in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

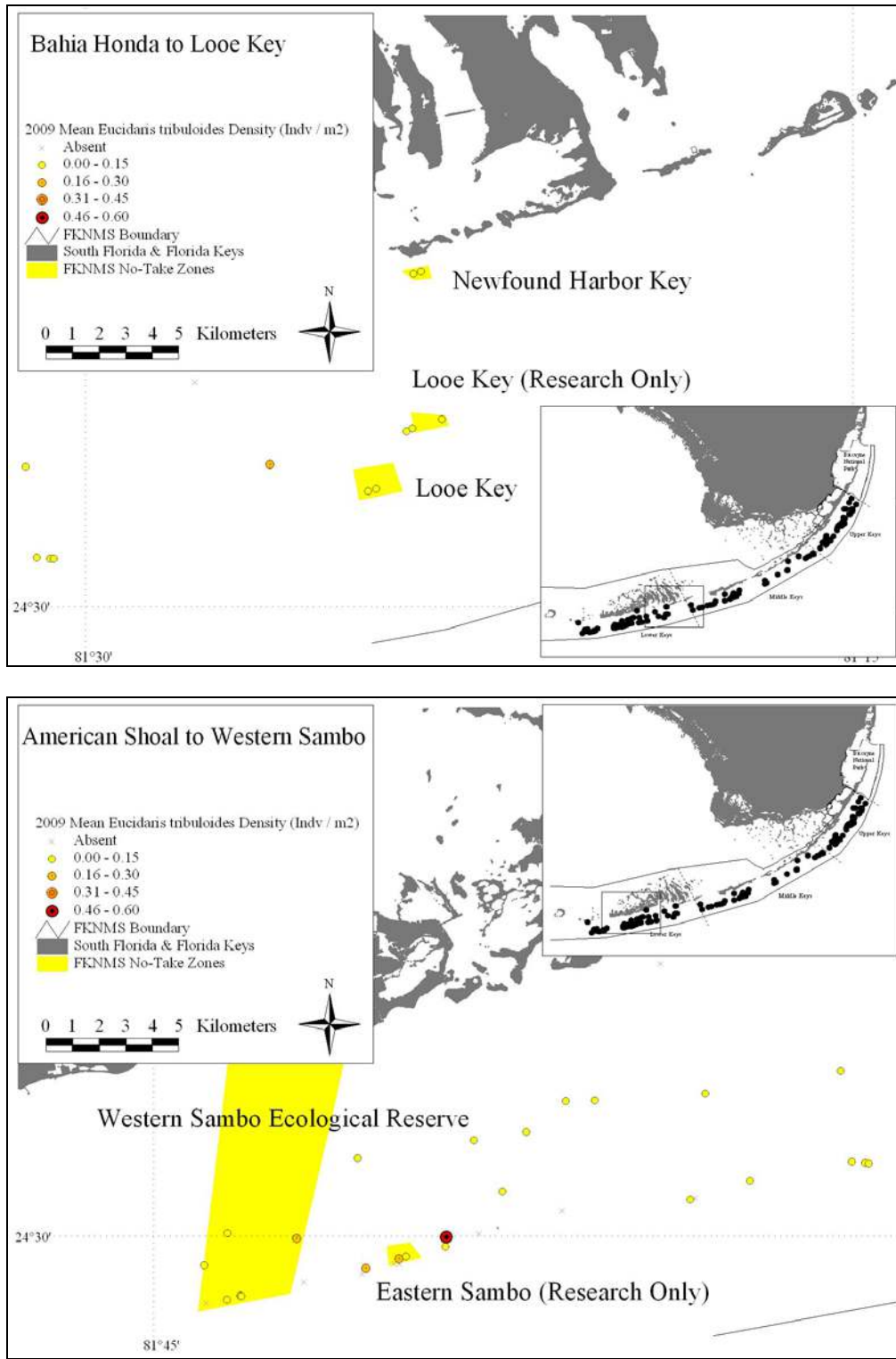


Figure 6-24. Densities (no. per m²) of slate pencil urchins (*Eucidaris tribuloides*) in the lower Florida Keys region from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

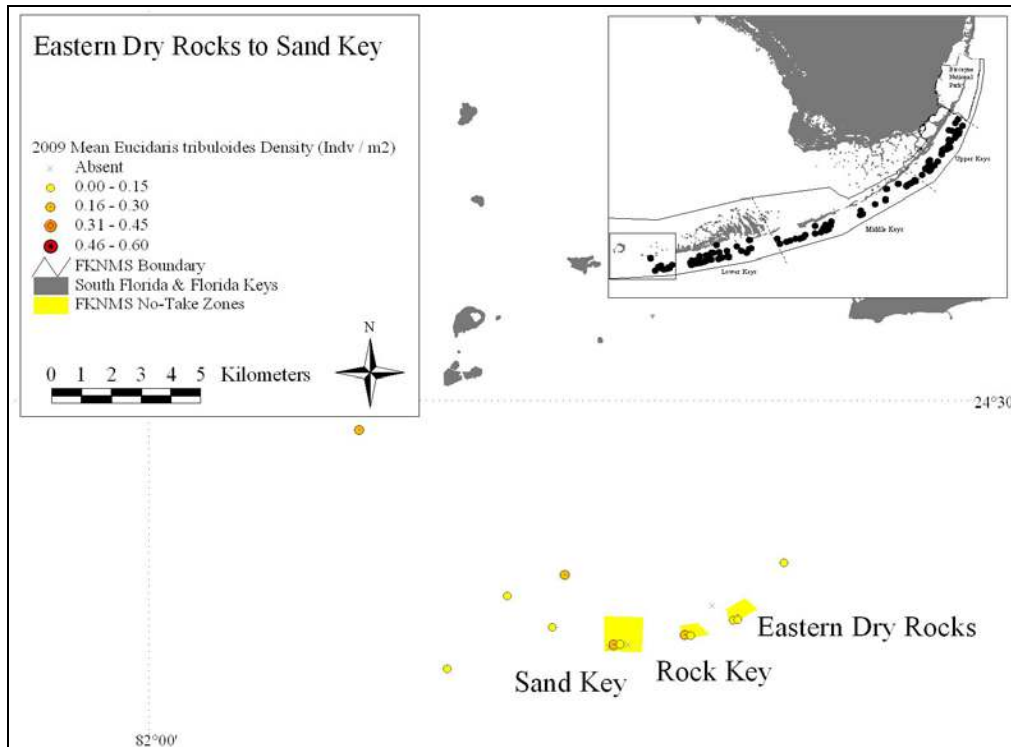


Figure 6-25. Mean (+ 1 SE) densities (no. per m²) of slate pencil urchins (*Eucidaris tribuloides*) on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

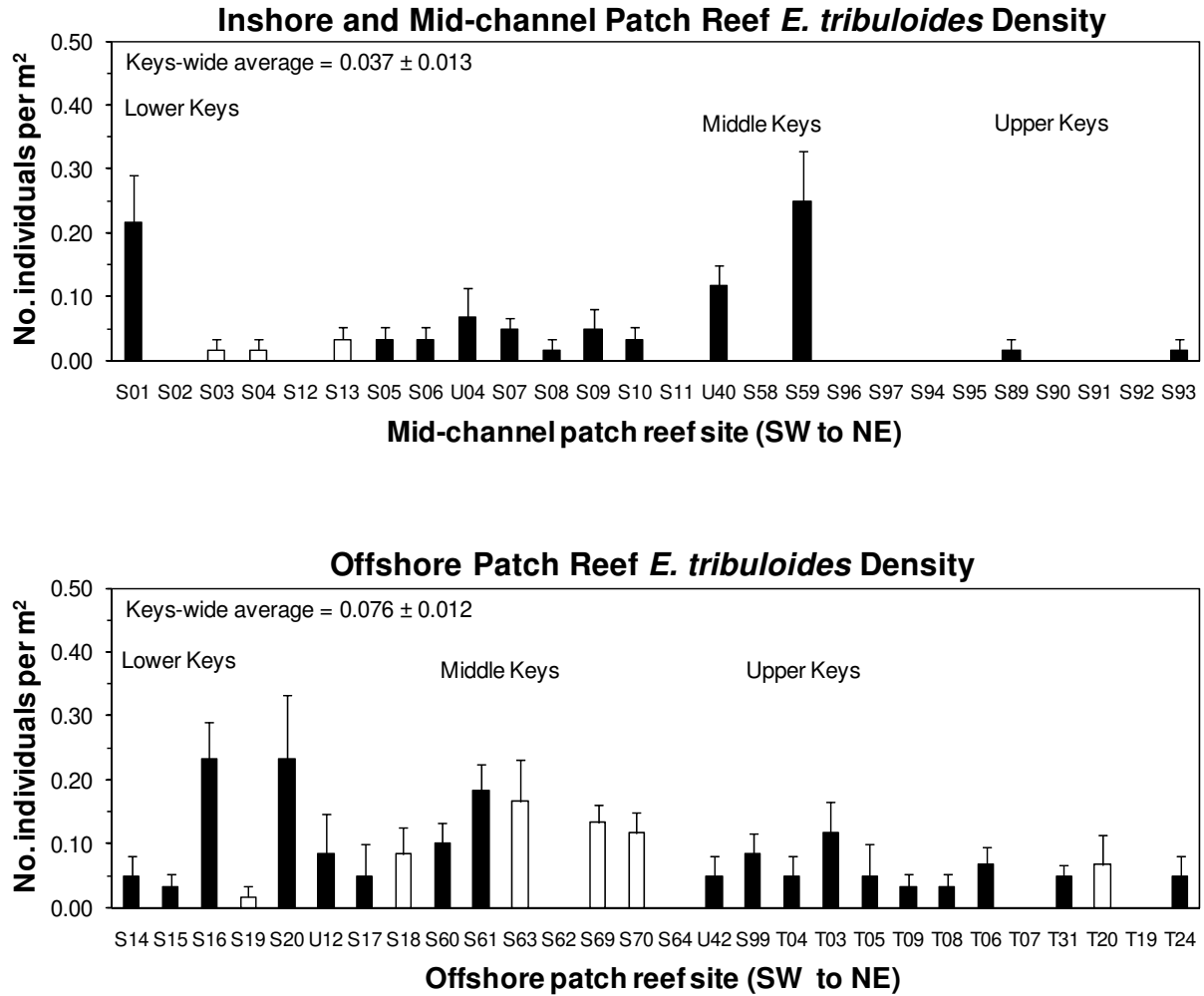


Figure 6-26. Mean (+ 1 SE) densities (no. per m²) of slate pencil urchins (*Eucidaris tribuloides*) on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

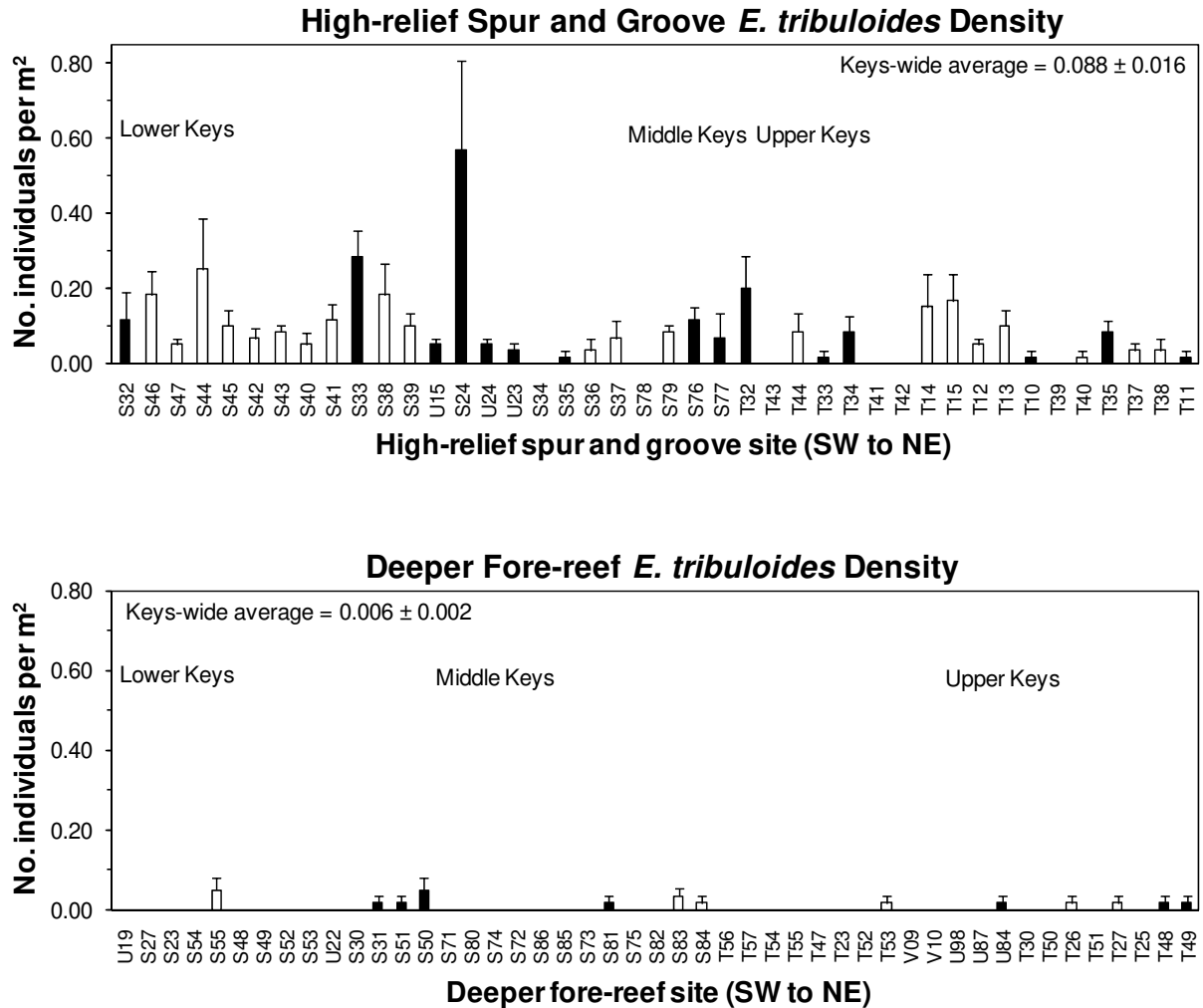


Table 6-1. Mean $\pm$ 1 SE proportional station frequencies and densities (no. individuals per m²), urchin test diameter, and numbers of individuals (N) sampled for the urchin *Diadema antillarum* in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
<i>Inshore patch reefs</i>				
Lower Florida Keys				
S01 – SE of Ballast Key	0 $\pm$ 0	0	0 $\pm$ 0	
S02 – South of Sugarloaf Creek	0 $\pm$ 0	0	0 $\pm$ 0	
S03 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
S04 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
Lower Florida Keys Total (4)	0 $\pm$ 0	0	0 $\pm$ 0	
Inshore Patch Reef Total (4)	0 $\pm$ 0	0	0 $\pm$ 0	
<i>Mid-channel patch reefs</i>				
Lower Florida Keys				
S12 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
S13 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
S05 - North of Middle Sambo Reef	0.50 $\pm$ 0.29	4	0.067 $\pm$ 0.047	5.3 $\pm$ 0.4
S06 - North of Pelican Shoal	0.25 $\pm$ 0.25	2	0.033 $\pm$ 0.044	6.6 $\pm$ 1.6
U04 - North of Pelican Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
S07 - West Washerwoman Shoal	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	6.1 $\pm$ 0.3
S08 - West Washerwoman Shoal	1.00 $\pm$ 0.00	10	0.167 $\pm$ 0.064	6.1 $\pm$ 1.5
S09 - North of Maryland Shoal	0.00 $\pm$ 0.00	0	0 $\pm$ 0	
S10 - North of American Shoal	0.25 $\pm$ 0.25	3	0.050 $\pm$ 0.050	7.3 $\pm$ 0.4
S11 - North of American Shoal	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	6.8
Lower Florida Keys Total (10)	0.28 $\pm$ 0.10	22	0.037 $\pm$ 0.016	6.4 $\pm$ 0.3
Middle Florida Keys				
U40 - Marker 49A	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	1.1
S58 - Marker 48	0 $\pm$ 0	0	0 $\pm$ 0	0
S59 - East Turtle Shoal	0.25 $\pm$ 0.25	4	0.067 $\pm$ 0.067	4.5 $\pm$ 0.5
S96 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0
S94 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0
S95 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0
Middle Florida Keys Total (7)	0.07 $\pm$ 0.05	5	0.012 $\pm$ 0.009	2.8 $\pm$ 1.7
Upper Florida Keys				
S89 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0
S90 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0
S91 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	0
S92 - Basin Hill Shoals	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	2.8 $\pm$ 1.7
S93 - Turtle Rocks	0 $\pm$ 0	0	0 $\pm$ 0	0
Upper Florida Keys Total (5)	0.10 $\pm$ 0.10	2	0.007 $\pm$ 0.007	2.8
Mid-channel Patch Reef Total (22)	0.17 $\pm$ 0.06	29	0.022 $\pm$ 0.008	5.2 $\pm$ 0.7
<i>Offshore patch reefs</i>				
Lower Florida Keys				
S14 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	
S15 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	
S16 - North of Sand Key	0.50 $\pm$ 0.29	4	0.067 $\pm$ 0.038	6.9 $\pm$ 0.3
S19 - Western Sambo ER**	0.25 $\pm$ 0.25	3	0.050 $\pm$ 0.050	5.7 $\pm$ 0.3
S20 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
U12 - West of Looe Key RO	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	1.6 $\pm$ 0.2
S17 - Looe Key RO**	0 $\pm$ 0	0	0 $\pm$ 0	
S18 - Looe Key RO**	0.75 $\pm$ 0.25	4	0.067 $\pm$ 0.027	6.6 $\pm$ 0.9

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
Lower Florida Keys Total (8)	0.25 ± 0.11	13	0.027 ± 0.011	5.2 ± 1.2
Middle Florida Keys				
S60 - NE of Delta Shoal	0.25 ± 0.25	1	0.017 ± 0.017	5.1
S61 - West Turtle Shoal	0.25 ± 0.25	1	0.017 ± 0.017	5.2
S63 - Coffins Patch SPA**	0.50 ± 0.29	3	0.050 ± 0.032	5.3 ± 0.2
S62 - Coffins Patch SPA**	0.25 ± 0.25	2	0.033 ± 0.033	1.1 ± 0.2
S69 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S70 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S64 - South of Coffins Patch	0 ± 0	0	0 ± 0	
U42 - East of Coffins Patch	0.75 ± 0.25	18	0.300 ± 0.100	5.7 ± 0.6
Middle Florida Keys Total (8)	0.25 ± 0.09	25	0.052 ± 0.036	4.5 ± 0.9
Upper Florida Keys				
S99 - Wolf Reef	0 ± 0	0	0 ± 0	
T04 - Inshore of Sand Island	0 ± 0	0	0 ± 0	
T03 - White Bank	0.50 ± 0.29	2	0.033 ± 0.019	2.7 ± 1.2
T05 - White Bank	0 ± 0	0	0 ± 0	
T09 - South of Key Largo Dry Rocks	0.25 ± 0.25	1	0.017 ± 0.017	6.8
T08 - West of Key Largo Dry Rocks	0.50 ± 0.29	2	0.033 ± 0.019	6.9 ± 1.4
T06 - West of Elbow Reef	0.25 ± 0.25	1	0.017 ± 0.017	7.1
T07 - SW of Watson's Reef	0 ± 0	0	0 ± 0	
T31 - South of Watson's Reef	0.25 ± 0.25	1	0.017 ± 0.017	1.1
T20 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T19 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T24 - North of Carysfort Reef	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (12)	0.15 ± 0.06	7	0.010 ± 0.004	4.9 ± 1.3
Offshore Patch Reef Total (28)	0.21 ± 0.05	45	0.027 ± 0.011	4.8 ± 0.6
<i>Low-relief hard-bottom (< 6 m)</i>				
Lower Florida Keys				
S21 - East of Eastern Dry Rocks SPA	0 ± 0	0	0 ± 0	
S22 - West of Looe Key SPA	0 ± 0	0	0 ± 0	
Lower Florida Keys Total (2)	0 ± 0	0	0 ± 0	
Middle Florida Keys				
S65 - SE of Coffins Patch	0 ± 0	0	0 ± 0	
S66 - Tennessee Reef	0.75 ± 0.25	16	0.267 ± 0.098	5.5 ± 0.4
S68 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
S67 - Tennessee Reef RO**	0.25 ± 0.25	2	0.033 ± 0.033	5.0 ± 2.2
T16 - West of Alligator Reef	0.25 ± 0.25	1	0.017 ± 0.017	1.3
T45 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
T46 - Alligator Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	1.4
V03 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T36 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T21 - Conch Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	7.1
T22 - Conch Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	8.3
Middle Florida Keys Total (11)	0.18 ± 0.07	22	0.033 ± 0.024	4.8 ± 1.2
Upper Florida Keys				
T28 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T29 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T17 - North of French Reef	0 ± 0	0	0 ± 0	
T18 - Watson's Reef	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (4)	0 ± 0	0	0 ± 0	
Shallow Hard-bottom Total (17)	0.12 ± 0.05	22	0.022 ± 0.016	4.8 ± 1.2
<i>High-relief spur and groove</i>				
Lower Florida Keys				
S32 - Western Dry Rocks	0 ± 0	0	0 ± 0	

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
S46 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S47 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S44 - Rock Key SPA**	0 ± 0	0	0 ± 0	
S45 - Rock Key SPA**	0.50 ± 0.29	3	0.050 ± 0.032	5.2 ± 0.7
S42 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	
S43 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	
S40 - Western Sambo ER**	0.25 ± 0.25	3	0.050 ± 0.050	4.1 ± 0.3
S41 - Western Sambo ER**	0.25 ± 0.25	2	0.033 ± 0.033	5.4 ± 0.2
S33 - Middle Sambo Reef	0.75 ± 0.25	5	0.083 ± 0.042	6.8 ± 0.8
S38 - Eastern Sambo RO**	0.50 ± 0.29	2	0.033 ± 0.019	3.2 ± 0.4
S39 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
U15 - No Name Reef	0 ± 0	0	0 ± 0	
S24 - East of Eastern Sambo RO	0.25 ± 0.25	3	0.050 ± 0.050	2.7 ± 1.9
U24 - Pelican Shoal	0 ± 0	0	0 ± 0	
U23 - Maryland Shoal	0 ± 0	0	0 ± 0	
S34 - Maryland Shoal	0 ± 0	0	0 ± 0	
S35 - American Shoal	0 ± 0	0	0 ± 0	
S36 - Looe Key SPA**	0 ± 0	0	0 ± 0	
S37 - Looe Key SPA**	0 ± 0	0	0 ± 0	
Lower Florida Keys Total (20)	0.13 ± 0.05	22	0.015 ± 0.006	4.6 ± 0.6
Middle Florida Keys				
S78 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	
S79 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	
S76 - Delta Shoal	0 ± 0	0	0 ± 0	
S77 - Delta Shoal	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (4)	0 ± 0	0	0 ± 0	
Upper Florida Keys				
T32 - Pickles Reef	0.25 ± 0.25	1	0.017 ± 0.017	1.2
T43 - Molasses Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	3.1
T44 - Molasses Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	1.7 ± 0.3
T33 - Sand Island	0 ± 0	0	0 ± 0	
T34 - Sand Island	0.75 ± 0.25	4	0.067 ± 0.027	1.2 ± 0.1
T41 - French Reef SPA**	0 ± 0	0	0 ± 0	
T42 - French Reef SPA**	0 ± 0	0	0 ± 0	
T14 - Grecian Rocks SPA**	0.50 ± 0.29	4	0.067 ± 0.047	6.6 ± 0.3
T15 - Grecian Rocks SPA**	0.50 ± 0.29	4	0.067 ± 0.047	5.7 ± 1.1
T12 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	
T13 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	
T10 - North-North Dry Rocks	0 ± 0	0	0 ± 0	
T39 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	
T40 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	
T35 - South of South Carysfort	0 ± 0	0	0 ± 0	
T37 - South Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T38 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T11 - North of Turtle Reef	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (18)	0.15 ± 0.06	16	0.015 ± 0.006	3.2 ± 1.0
Spur and Groove Total (44)	0.13 ± 0.03	34	0.013 ± 0.004	3.9 ± 0.6
<i>Deeper Fore-reef (6-15 m)</i>				
Lower Florida Keys				
U19 - Sand Key SPA**	0 ± 0	0	0 ± 0	0
S27 - Sand Key SPA**	0 ± 0	0	0 ± 0	0
S23 - East of Rock Key SPA	0 ± 0	0	0 ± 0	0
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0	0
S55 - Western Sambo ER**	0 ± 0	0	0 ± 0	0
S48 - East of Western Sambo ER	0.50 ± 0.29	2	0.033 ± 0.019	5.3 ± 0.8
S49 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0
S52 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0
S53 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0	0

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
S30 - East of Pelican Shoal	0 ± 0	0	0 ± 0	0
S31 - East of Maryland Shoal	0.25 ± 0.25	1	0.017 ± 0.017	1.5
S51 - American Shoal	0.25 ± 0.25	1	0.017 ± 0.017	3.8
S50 - American Shoal	0 ± 0	0	0 ± 0	
Lower Florida Keys Total (14)	0.07 ± 0.04	4	0.005 ± 0.003	3.5 ± 1.1
Middle Florida Keys				
S71 - South of Bahia Honda	0.25 ± 0.25	3	0.050 ± 0.050	7.0 ± 0.9
S80 - West of Sombrero Key	0 ± 0	0	0 ± 0	
S74 - West of Sombrero Key	0 ± 0	0	0 ± 0	
S72 - West of Sombrero Key	0 ± 0	0	0 ± 0	
S86 - Sombrero Key SPA	0 ± 0	0	0 ± 0	
S85 - Sombrero Key SPA	0.25 ± 0.25	1	0.017 ± 0.017	1.5
S73 - East of Delta Shoal	0 ± 0	0	0 ± 0	
S81 - SW of Coffins Patch	0 ± 0	0	0 ± 0	
S75 - Marker 20	0.50 ± 0.29	2	0.033 ± 0.019	5.6 ± 0.8
S82 - Tennessee Reef	0 ± 0	0	0 ± 0	
S83 - Tennessee Reef RO**	0.25 ± 0.25	1	0.017 ± 0.017	4.7
S84 - Tennessee Reef RO**	0.25 ± 0.25	1	0.017 ± 0.017	4.1
T56 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
T57 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
T54 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T55 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T47 - Little Conch Reef	0 ± 0	0	0 ± 0	
T23 - Little Conch Reef	0 ± 0	0	0 ± 0	
T52 - Conch Reef SPA**	0 ± 0	0	0 ± 0	
T53 - Conch Reef SPA**	0 ± 0	0	0 ± 0	
V09 - Conch Reef RO**	0 ± 0	0	0 ± 0	
V10 - Conch Reef RO**	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (22)	0.07 ± 0.03	8	0.006 ± 0.003	4.9 ± 0.6
Upper Florida Keys				
U98 - Pickles Reef	0.25 ± 0.25	1	0.017 ± 0.017	0.8
U87 - Dixie Shoal	0 ± 0	0	0 ± 0	
U84 - North of Dixie Shoal	0.25 ± 0.25	1	0.017 ± 0.017	2.2
T30 - South of Elbow Reef	0 ± 0	0	0 ± 0	
T50 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T26 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T51 - Carysfort Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	1.4
T27 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T25 - North of Carysfort Reef	0 ± 0	0	0 ± 0	
T48 - North of Carysfort Reef	0 ± 0	0	0 ± 0	
T49 - SE of Turtle Rocks	0.25 ± 0.25	1	0.017 ± 0.017	1.1
Upper Florida Keys Total (11)	0.09 ± 0.04	4	0.006 ± 0.003	1.4 ± 0.3
Deeper Fore-reef Total (47)	0.07 ± 0.02	16	0.006 ± 0.002	3.2 ± 0.6

Table 6-2. Mean $\pm$ 1 SE proportional station frequencies and densities (no. individuals/m²), test diameter, and numbers of individuals (N) sampled for the urchin *Echinometra lucunter* in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
<i>Inshore patch reefs</i>				
Lower Florida Keys				
S01 – SE of Ballast Key	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	1.2
S02 – South of Sugarloaf Creek	0 $\pm$ 0	0	0 $\pm$ 0	
S03 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
S04 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
Lower Florida Keys Total (4)	0.06 $\pm$ 0.06	1	0.004 $\pm$ 0.004	1.2
Inshore Patch Reef Total (4)	0.06 $\pm$ 0.06	1	0.004 $\pm$ 0.004	1.2
<i>Mid-channel patch reefs</i>				
Lower Florida Keys				
S12 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
S13 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
S05 - North of Middle Sambo Reef	0 $\pm$ 0	0	0 $\pm$ 0	
S06 - North of Pelican Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
U04 - North of Pelican Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
S07 - West Washerwoman Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
S08 - West Washerwoman Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
S09 - North of Maryland Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
S10 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
S11 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
Lower Florida Keys Total (10)	0 $\pm$ 0	0	0 $\pm$ 0	
Middle Florida Keys				
U40 - Marker 49A	0 $\pm$ 0	0	0 $\pm$ 0	
S58 - Marker 48	0 $\pm$ 0	0	0 $\pm$ 0	
S59 - East Turtle Shoal	0.75 $\pm$ 0.25	6	0.100 $\pm$ 0.043	1.3 $\pm$ 0.2
S96 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
S94 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
S95 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
Middle Florida Keys Total (7)	0.11 $\pm$ 0.11	6	0.014 $\pm$ 0.014	1.3 $\pm$ 0.2
Upper Florida Keys				
S89 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	
S90 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	
S91 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	
S92 - Basin Hill Shoals	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	3.2
S93 - Turtle Rocks	0.75 $\pm$ 0.25	4	0.067 $\pm$ 0.027	1.7 $\pm$ 0.2
Upper Florida Keys Total (5)	0.20 $\pm$ 0.15	5	0.017 $\pm$ 0.013	2.4 $\pm$ 0.8
Mid-channel Patch Reef Total (22)	0.08 $\pm$ 0.05	11	0.008 $\pm$ 0.005	2.1 $\pm$ 0.6
<i>Offshore patch reefs</i>				
Lower Florida Keys				
S14 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	
S15 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	
S16 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	
S19 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
S20 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
U12 - West of Looe Key RO	0 $\pm$ 0	0	0 $\pm$ 0	
S17 - Looe Key RO**	0 $\pm$ 0	0	0 $\pm$ 0	
S18 - Looe Key RO**	0 $\pm$ 0	0	0 $\pm$ 0	

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
Lower Florida Keys Total (8)	0 ± 0	0	0 ± 0	
Middle Florida Keys				
S60 - NE of Delta Shoal	0 ± 0	0	0 ± 0	
S61 - West Turtle Shoal	0 ± 0	0	0 ± 0	
S63 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S62 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S69 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S70 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S64 - South of Coffins Patch	0 ± 0	0	0 ± 0	
U42 - East of Coffins Patch	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (8)	0 ± 0	0	0 ± 0	
Upper Florida Keys				
S99 - Wolf Reef	0.25 ± 0.25	1	0.017 ± 0.017	1.9
T04 - Inshore of Sand Island	0 ± 0	0	0 ± 0	
T03 - White Bank	0.25 ± 0.25	1	0.017 ± 0.017	3.9
T05 - White Bank	0 ± 0	0	0 ± 0	
T09 - South of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	
T08 - West of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	
T06 - West of Elbow Reef	0 ± 0	0	0 ± 0	
T07 - SW of Watson's Reef	0 ± 0	0	0 ± 0	
T31 - South of Watson's Reef	0 ± 0	0	0 ± 0	
T20 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T19 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T24 - North of Carysfort Reef	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (12)	0.04 ± 0.03	2	0.003 ± 0.002	2.9 ± 1.0
Offshore Patch Reef Total (28)	0.02 ± 0.01	2	0.001 ± 0.001	2.9 ± 1.0
<i>Low-relief hard-bottom (< 6 m)</i>				
Lower Florida Keys				
S21 - East of Eastern Dry Rocks SPA	0 ± 0	0	0 ± 0	
S22 - West of Looe Key SPA	0 ± 0	0	0 ± 0	
Lower Florida Keys Total (2)	0 ± 0	0	0 ± 0	
Middle Florida Keys				
S65 - SE of Coffins Patch	0 ± 0	0	0 ± 0	
S66 - Tennessee Reef	0 ± 0	0	0 ± 0	
S68 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
S67 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
T16 - West of Alligator Reef	0 ± 0	0	0 ± 0	
T45 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
T46 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
V03 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T36 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T21 - Conch Reef SPA**	0 ± 0	0	0 ± 0	
T22 - Conch Reef SPA**	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (11)	0 ± 0	0	0 ± 0	
Upper Florida Keys				
T28 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T29 - Molasses Reef SPA**	0.50 ± 0.29	3	0.003 ± 0.002	1.3 ± 0.0
T17 - North of French Reef	0 ± 0	0	0 ± 0	
T18 - Watson's Reef	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (4)	0.13 ± 0.13	3	0.013 ± 0.013	1.3
Shallow Hard-bottom Total (17)	0.03 ± 0.03	3	0.003 ± 0.003	1.3
<i>High-relief spur and groove</i>				
Lower Florida Keys				
S32 - Western Dry Rocks	0 ± 0	0	0 ± 0	

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
S46 - Sand Key SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0.6 ± 0.2
S47 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S44 - Rock Key SPA**	0 ± 0	0	0 ± 0	
S45 - Rock Key SPA**	0.25 ± 0.25	1	0.017 ± 0.017	2.1
S42 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	
S43 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	
S40 - Western Sambo ER**	0 ± 0	0	0 ± 0	
S41 - Western Sambo ER**	0.25 ± 0.25	1	0.017 ± 0.017	1.9
S33 - Middle Sambo Reef	0.25 ± 0.25	1	0.017 ± 0.017	1.4
S38 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
S39 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
U15 - No Name Reef	0 ± 0	0	0 ± 0	
S24 - East of Eastern Sambo RO	0 ± 0	0	0 ± 0	
U24 - Pelican Shoal	0 ± 0	0	0 ± 0	
U23 - Maryland Shoal	0 ± 0	0	0 ± 0	
S34 - Maryland Shoal	0 ± 0	0	0 ± 0	
S35 - American Shoal	0 ± 0	0	0 ± 0	
S36 - Looe Key SPA**	0 ± 0	0	0 ± 0	
S37 - Looe Key SPA**	0 ± 0	0	0 ± 0	
Lower Florida Keys Total (20)	0.06 ± 0.03	5	0.004 ± 0.002	1.5 ± 0.3
Middle Florida Keys				
S78 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	
S79 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	
S76 - Delta Shoal	0 ± 0	0	0 ± 0	
S77 - Delta Shoal	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (4)	0 ± 0	0	0 ± 0	
Upper Florida Keys				
T32 - Pickles Reef	0.75 ± 0.25	3	0.050 ± 0.017	1.4 ± 0.2
T43 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T44 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T33 - Sand Island	0 ± 0	0	0 ± 0	
T34 - Sand Island	0 ± 0	0	0 ± 0	
T41 - French Reef SPA**	0 ± 0	0	0 ± 0	
T42 - French Reef SPA**	0 ± 0	0	0 ± 0	
T14 - Grecian Rocks SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0.9 ± 0.0
T15 - Grecian Rocks SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0.9
T12 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	
T13 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	
T10 - North-North Dry Rocks	0 ± 0	0	0 ± 0	
T39 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	
T40 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	
T35 - South of South Carysfort	0 ± 0	0	0 ± 0	
T37 - South Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T38 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T11 - North of Turtle Reef	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (18)	0.08 ± 0.05	6	0.006 ± 0.003	1.1 ± 0.2
Spur and Groove Total (42)	0.07 ± 0.03	11	0.004 ± 0.002	1.3 ± 0.2
<i>Deeper Fore-reef (6-15 m)</i>				
Lower Florida Keys				
U19 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S27 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S23 - East of Rock Key SPA	0 ± 0	0	0 ± 0	
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0	
S55 - Western Sambo ER**	0 ± 0	0	0 ± 0	
S48 - East of Western Sambo ER	0 ± 0	0	0 ± 0	
S49 - Middle Sambo Reef	0 ± 0	0	0 ± 0	
S52 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
S53 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0	

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
S30 - East of Pelican Shoal	0 ± 0	0	0 ± 0	
S31 - East of Maryland Shoal	0 ± 0	0	0 ± 0	
S51 - American Shoal	0 ± 0	0	0 ± 0	
S50 - American Shoal	0 ± 0	0	0 ± 0	
Lower Florida Keys Total (14)	0 ± 0	0	0 ± 0	
Middle Florida Keys				
S71 - South of Bahia Honda	0 ± 0	0	0 ± 0	
S80 - West of Sombrero Key	0 ± 0	0	0 ± 0	
S74 - West of Sombrero Key	0 ± 0	0	0 ± 0	
S72 - West of Sombrero Key	0 ± 0	0	0 ± 0	
S86 - Sombrero Key SPA	0 ± 0	0	0 ± 0	
S85 - Sombrero Key SPA	0 ± 0	0	0 ± 0	
S73 - East of Delta Shoal	0 ± 0	0	0 ± 0	
S81 - SW of Coffins Patch	0 ± 0	0	0 ± 0	
S75 - Marker 20	0 ± 0	0	0 ± 0	
S82 - Tennessee Reef	0 ± 0	0	0 ± 0	
S83 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
S84 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
T56 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
T57 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
T54 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T55 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T47 - Little Conch Reef	0 ± 0	0	0 ± 0	
T23 - Little Conch Reef	0 ± 0	0	0 ± 0	
T52 - Conch Reef SPA**	0 ± 0	0	0 ± 0	
T53 - Conch Reef SPA**	0 ± 0	0	0 ± 0	
V09 - Conch Reef RO**	0 ± 0	0	0 ± 0	
V10 - Conch Reef RO**	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (22)	0 ± 0	0	0 ± 0	
Upper Florida Keys				
U98 - Pickles Reef	0 ± 0	0	0 ± 0	
U87 - Dixie Shoal	0 ± 0	0	0 ± 0	
U84 - North of Dixie Shoal	0 ± 0	0	0 ± 0	
T30 - South of Elbow Reef	0 ± 0	0	0 ± 0	
T50 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T26 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T51 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T27 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T25 - North of Carysfort Reef	0 ± 0	0	0 ± 0	
T48 - North of Carysfort Reef	0 ± 0	0	0 ± 0	
T49 - SE of Turtle Rocks	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (11)	0 ± 0	0	0 ± 0	
Deeper Fore-reef Total (47)	0 ± 0	0	0 ± 0	

Table 6-3. Mean $\pm$ 1 SE proportional station frequencies and densities (no. individuals per m²), urchin test diameter, and numbers of individuals (N) sampled for the urchin *Echinometra viridis* in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
<i>Inshore patch reefs</i>				
Lower Florida Keys				
S01 – SE of Ballast Key	1.00 $\pm$ 0.00	38	0.633 $\pm$ 0.309	2.4 $\pm$ 0.1
S02 – South of Sugarloaf Creek	0.50 $\pm$ 0.29	3	0.050 $\pm$ 0.032	1.8 $\pm$ 0.1
S03 – Newfound Harbor SPA**	0.75 $\pm$ 0.25	6	0.100 $\pm$ 0.033	1.8 $\pm$ 0.3
S04 – Newfound Harbor SPA**	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	2.4
Lower Florida Keys Total (4)	0.63 $\pm$ 0.16	48	0.200 $\pm$ 0.145	2.1 $\pm$ 0.2
Inshore Patch Reef Total (4)	0.63 $\pm$ 0.16	48	0.200 $\pm$ 0.145	2.1 $\pm$ 0.2
<i>Mid-channel patch reefs</i>				
Lower Florida Keys				
S12 - Western Sambo ER**	1.00 $\pm$ 0.00	41	0.683 $\pm$ 0.160	2.6 $\pm$ 0.1
S13 - Western Sambo ER**	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	1.5
S05 - North of Middle Sambo Reef	1.00 $\pm$ 0.00	21	0.350 $\pm$ 0.069	2.5 $\pm$ 0.1
S06 - North of Pelican Shoal	1.00 $\pm$ 0.00	236	3.933 $\pm$ 0.069	2.9 $\pm$ 0.0
U04 - North of Pelican Shoal	0.75 $\pm$ 0.25	12	0.200 $\pm$ 0.105	2.5 $\pm$ 0.2
S07 - West Washerwoman Shoal	1.00 $\pm$ 0.00	68	1.133 $\pm$ 0.274	2.5 $\pm$ 0.1
S08 - West Washerwoman Shoal	1.00 $\pm$ 0.00	223	3.717 $\pm$ 0.332	3.1 $\pm$ 0.7
S09 - North of Maryland Shoal	1.00 $\pm$ 0.00	206	3.433 $\pm$ 0.520	2.8 $\pm$ 0.7
S10 - North of American Shoal	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	2.4
S11 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
Lower Florida Keys Total (10)	0.73 $\pm$ 0.13	809	1.348 $\pm$ 0.525	2.5 $\pm$ 0.2
Middle Florida Keys				
U40 - Marker 49A	0 $\pm$ 0	0	0 $\pm$ 0	
S58 - Marker 48	0 $\pm$ 0	0	0 $\pm$ 0	
S59 - East Turtle Shoal	1.00 $\pm$ 0.00	28	0.467 $\pm$ 0.144	2.2 $\pm$ 0.1
S96 - Cheeca Rocks SPA**	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	2.5 $\pm$ 0.3
S97 - Cheeca Rocks SPA**	1.00 $\pm$ 0.00	7	0.117 $\pm$ 0.032	1.7 $\pm$ 0.2
S94 - Hen and Chickens Reef SPA**	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	1.5
S95 - Hen and Chickens Reef SPA**	0.50 $\pm$ 0.29	9	0.150 $\pm$ 0.129	1.6 $\pm$ 0.2
Middle Florida Keys Total (7)	0.46 $\pm$ 0.16	47	0.112 $\pm$ 0.063	1.9 $\pm$ 0.2
Upper Florida Keys				
S89 - Mosquito Bank	0.50 $\pm$ 0.29	7	0.117 $\pm$ 0.079	2.2 $\pm$ 0.2
S90 - Mosquito Bank	0.75 $\pm$ 0.25	7	0.117 $\pm$ 0.057	1.6 $\pm$ 0.2
S91 - Basin Hill Shoals	1.00 $\pm$ 0.00	64	1.067 $\pm$ 0.207	2.5 $\pm$ 0.1
S92 - Basin Hill Shoals	1.00 $\pm$ 0.00	29	0.483 $\pm$ 0.100	2.4 $\pm$ 0.2
S93 - Turtle Rocks	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	2.3 $\pm$ 0.5
Upper Florida Keys Total (5)	0.75 $\pm$ 0.11	109	0.363 $\pm$ 0.192	2.2 $\pm$ 0.2
Mid-channel Patch Reef Total (22)	0.65 $\pm$ 0.08	965	0.731 $\pm$ 0.267	2.3 $\pm$ 0.1
<i>Offshore patch reefs</i>				
Lower Florida Keys				
S14 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	
S15 - North of Sand Key	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	1.4
S16 - North of Sand Key	1.00 $\pm$ 0.00	8	0.133 $\pm$ 0.027	2.3 $\pm$ 0.2
S19 - Western Sambo ER**	0.75 $\pm$ 0.25	6	0.100 $\pm$ 0.033	2.1 $\pm$ 0.2
S20 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
U12 - West of Looe Key RO	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0.5
S17 - Looe Key RO**	0 $\pm$ 0	0	0 $\pm$ 0	
S18 - Looe Key RO**	0 $\pm$ 0	0	0 $\pm$ 0	

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
Lower Florida Keys Total (8)	0.28 ± 0.14	16	0.033 ± 0.019	1.6 ± 0.4
Middle Florida Keys				
S60 - NE of Delta Shoal	0 ± 0	0	0 ± 0	
S61 - West Turtle Shoal	1.00 ± 0.00	19	0.317 ± 0.137	1.8 ± 0.1
S63 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S62 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S69 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S70 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S64 - South of Coffins Patch	0 ± 0	0	0 ± 0	
U42 - East of Coffins Patch	0.25 ± 0.25	1	0.017 ± 0.017	0.6
Middle Florida Keys Total (8)	0.16 ± 0.12	20	0.042 ± 0.039	1.2 ± 0.6
Upper Florida Keys				
S99 - Wolf Reef	0.25 ± 0.25	1	0.017 ± 0.017	2.5
T04 - Inshore of Sand Island	0.25 ± 0.25	1	0.017 ± 0.017	1.6
T03 - White Bank	0.50 ± 0.29	4	0.067 ± 0.047	3.0 ± 0.3
T05 - White Bank	0.50 ± 0.29	2	0.033 ± 0.019	1.3 ± 0.2
T09 - South of Key Largo Dry Rocks	0.25 ± 0.25	2	0.033 ± 0.033	1.3 ± 0.4
T08 - West of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	
T06 - West of Elbow Reef	0 ± 0	0	0 ± 0	
T07 - SW of Watson's Reef	0 ± 0	0	0 ± 0	
T31 - South of Watson's Reef	0.50 ± 0.29	3	0.050 ± 0.032	1.4 ± 0.1
T20 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T19 - Carysfort Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	1.8
T24 - North of Carysfort Reef	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (12)	0.21 ± 0.06	14	0.019 ± 0.006	1.8 ± 0.3
Offshore Patch Reef Total (28)	0.21 ± 0.06	50	0.030 ± 0.012	1.7 ± 0.2
<i>Low-relief hard-bottom (< 6 m)</i>				
Lower Florida Keys				
S21 - East of Eastern Dry Rocks SPA	0 ± 0	0	0 ± 0	
S22 - West of Looe Key SPA	0 ± 0	0	0 ± 0	
Lower Florida Keys Total (2)	0 ± 0	0	0 ± 0	
Middle Florida Keys				
S65 - SE of Coffins Patch	0 ± 0	0	0 ± 0	
S66 - Tennessee Reef	0.75 ± 0.25	4	0.067 ± 0.027	1.7 ± 0.2
S68 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
S67 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
T16 - West of Alligator Reef	0 ± 0	0	0 ± 0	
T45 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
T46 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
V03 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T36 - Davis Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	1.0
T21 - Conch Reef SPA**	0.25 ± 0.25	5	0.083 ± 0.063	1.6 ± 0.3
T22 - Conch Reef SPA**	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (11)	0.11 ± 0.07	10	0.015 ± 0.009	1.4 ± 0.2
Upper Florida Keys				
T28 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T29 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T17 - North of French Reef	0 ± 0	0	0 ± 0	
T18 - Watson's Reef	0.25 ± 0.25	1	0.017 ± 0.017	1.7
Upper Florida Keys Total (4)	0.06 ± 0.06	1	0.004 ± 0.004	1.7
Shallow Hard-bottom Total (17)	0.09 ± 0.05	11	0.011 ± 0.006	1.5 ± 0.2
<i>High-relief spur and groove</i>				
Lower Florida Keys				
S32 - Western Dry Rocks	0.25 ± 0.25	1	0.017 ± 0.017	2.9

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
S46 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S47 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S44 - Rock Key SPA**	0 ± 0	0	0 ± 0	
S45 - Rock Key SPA**	0.25 ± 0.25	1	0.017 ± 0.017	1.1
S42 - Eastern Dry Rocks SPA**	0.25 ± 0.25	1	0.017 ± 0.017	1.2
S43 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	
S40 - Western Sambo ER**	0 ± 0	0	0 ± 0	
S41 - Western Sambo ER**	0.25 ± 0.25	1	0.017 ± 0.017	1.9
S33 - Middle Sambo Reef	0.25 ± 0.25	1	0.017 ± 0.017	1.6
S38 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
S39 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
U15 - No Name Reef	0 ± 0	0	0 ± 0	
S24 - East of Eastern Sambo RO	0.50 ± 0.29	2	0.033 ± 0.019	1.7 ± 0.1
U24 - Pelican Shoal	0.25 ± 0.25	1	0.017 ± 0.017	1.4
U23 - Maryland Shoal	0 ± 0	0	0 ± 0	
S34 - Maryland Shoal	0 ± 0	0	0 ± 0	
S35 - American Shoal	0 ± 0	0	0 ± 0	
S36 - Looe Key SPA**	0 ± 0	0	0 ± 0	
S37 - Looe Key SPA**	0.25 ± 0.25	1	0.017 ± 0.017	
Lower Florida Keys Total (20)	0.11 ± 0.03	9	0.008 ± 0.002	1.6 ± 0.2
Middle Florida Keys				
S78 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	
S79 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	
S76 - Delta Shoal	0.25 ± 0.25	1	0.017 ± 0.017	2.6
S77 - Delta Shoal	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (4)	0.06 ± 0.06	1	0.004 ± 0.004	2.6
Upper Florida Keys				
T32 - Pickles Reef	0.25 ± 0.25	1	0.017 ± 0.017	3.0
T43 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T44 - Molasses Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	1.3 ± 0.1
T33 - Sand Island	0 ± 0	0	0 ± 0	
T34 - Sand Island	0 ± 0	0	0 ± 0	
T41 - French Reef SPA**	0 ± 0	0	0 ± 0	
T42 - French Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	1.3
T14 - Grecian Rocks SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0.8
T15 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	
T12 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	
T13 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	
T10 - North-North Dry Rocks	0 ± 0	0	0 ± 0	
T39 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	
T40 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	
T35 - South of South Carysfort	0 ± 0	0	0 ± 0	
T37 - South Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T38 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T11 - North of Turtle Reef	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (18)	0.07 ± 0.03	5	0.005 ± 0.002	1.6 ± 0.5
Spur and Groove Total (42)	0.09 ± 0.02	15	0.006 ± 0.001	1.7 ± 0.2
<i>Deeper Fore-reef (6-15 m)</i>				
Lower Florida Keys				
U19 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S27 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S23 - East of Rock Key SPA	0 ± 0	0	0 ± 0	
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0	
S55 - Western Sambo ER**	0 ± 0	0	0 ± 0	
S48 - East of Western Sambo ER	0 ± 0	0	0 ± 0	
S49 - Middle Sambo Reef	0.25 ± 0.25	1	0.017 ± 0.017	0.9
S52 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
S53 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0	

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
S30 - East of Pelican Shoal	0 ± 0	0	0 ± 0	
S31 - East of Maryland Shoal	0 ± 0	0	0 ± 0	
S51 - American Shoal	0 ± 0	0	0 ± 0	
S50 - American Shoal	0 ± 0	0	0 ± 0	
Lower Florida Keys Total (14)	0.02 ± 0.02	1	0.001 ± 0.001	0.9
Middle Florida Keys				
S71 - South of Bahia Honda	0 ± 0	0	0 ± 0	
S80 - West of Sombrero Key	0 ± 0	0	0 ± 0	
S74 - West of Sombrero Key	0 ± 0	0	0 ± 0	
S72 - West of Sombrero Key	0 ± 0	0	0 ± 0	
S86 - Sombrero Key SPA	0 ± 0	0	0 ± 0	
S85 - Sombrero Key SPA	0 ± 0	0	0 ± 0	
S73 - East of Delta Shoal	0 ± 0	0	0 ± 0	
S81 - SW of Coffins Patch	0 ± 0	0	0 ± 0	
S75 - Marker 20	0 ± 0	0	0 ± 0	
S82 - Tennessee Reef	0 ± 0	0	0 ± 0	
S83 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
S84 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
T56 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
T57 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
T54 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T55 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T47 - Little Conch Reef	0 ± 0	0	0 ± 0	
T23 - Little Conch Reef	0 ± 0	0	0 ± 0	
T52 - Conch Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	1.1
T53 - Conch Reef SPA**	0 ± 0	0	0 ± 0	
V09 - Conch Reef RO**	0.25 ± 0.25	1	0.017 ± 0.017	1.2
V10 - Conch Reef RO**	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (22)	0.02 ± 0.02	2	0.002 ± 0.001	1.2 ± 0.1
Upper Florida Keys				
U98 - Pickles Reef	0 ± 0	0	0 ± 0	
U87 - Dixie Shoal	0 ± 0	0	0 ± 0	
U84 - North of Dixie Shoal	0 ± 0	0	0 ± 0	
T30 - South of Elbow Reef	0 ± 0	0	0 ± 0	
T50 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T26 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T51 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T27 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T25 - North of Carysfort Reef	0 ± 0	0	0 ± 0	
T48 - North of Carysfort Reef	0 ± 0	0	0 ± 0	
T49 - SE of Turtle Rocks	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (11)	0 ± 0	0	0 ± 0	
Deeper Fore-reef Total (47)	0.02 ± 0.01	3	0.001 ± 0.001	1.1 ± 0.1

Table 6-4. Mean $\pm$ 1 SE proportional station frequencies and densities (no. individuals per m²), test diameter, and number of individuals (N) sampled for the urchin *Eucidaris tribuloides* in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
<i>Inshore patch reefs</i>				
Lower Florida Keys				
S01 – SE of Ballast Key	1.00 $\pm$ 0.00	13	0.217 $\pm$ 0.074	3.6 $\pm$ 0.3
S02 – South of Sugarloaf Creek	0 $\pm$ 0	0	0 $\pm$ 0	
S03 – Newfound Harbor SPA**	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	2.0
S04 – Newfound Harbor SPA**	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	1.8
Lower Florida Keys Total (4)	0.38 $\pm$ 0.22	15	0.063 $\pm$ 0.052	2.5 $\pm$ 0.6
Inshore Patch Reef Total (4)	0.38 $\pm$ 0.22	15	0.063 $\pm$ 0.052	2.5 $\pm$ 0.6
<i>Mid-channel patch reefs</i>				
Lower Florida Keys				
S12 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
S13 - Western Sambo ER**	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	2.1 $\pm$ 0.3
S05 - North of Middle Sambo Reef	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	2.1 $\pm$ 0.0
S06 - North of Pelican Shoal	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	3.4 $\pm$ 0.6
U04 - North of Pelican Shoal	0.50 $\pm$ 0.29	4	0.067 $\pm$ 0.047	2.5 $\pm$ 0.3
S07 - West Washerwoman Shoal	0.75 $\pm$ 0.25	3	0.050 $\pm$ 0.017	3.2 $\pm$ 0.1
S08 - West Washerwoman Shoal	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	2.9
S09 - North of Maryland Shoal	0.50 $\pm$ 0.29	3	0.050 $\pm$ 0.032	2.7 $\pm$ 0.5
S10 - North of American Shoal	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	1.8 $\pm$ 0.2
S11 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
Lower Florida Keys Total (10)	0.40 $\pm$ 0.08	19	0.032 $\pm$ 0.007	2.6 $\pm$ 0.2
Middle Florida Keys				
U40 - Marker 49A	1.00 $\pm$ 0.00	7	0.117 $\pm$ 0.032	1.8 $\pm$ 0.3
S58 - Marker 48	0 $\pm$ 0	0	0 $\pm$ 0	
S59 - East Turtle Shoal	1.00 $\pm$ 0.00	15	0.250 $\pm$ 0.079	2.2 $\pm$ 0.1
S96 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
S94 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
S95 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
Middle Florida Keys Total (7)	0.29 $\pm$ 0.18	22	0.052 $\pm$ 0.037	2.0 $\pm$ 0.2
Upper Florida Keys				
S89 - Mosquito Bank	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	2.9
S90 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	
S91 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	
S92 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	
S93 - Turtle Rocks	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	2.3
Upper Florida Keys Total (5)	0.10 $\pm$ 0.06	2	0.007 $\pm$ 0.004	2.6 $\pm$ 0.3
Mid-channel Patch Reef Total (22)	0.30 $\pm$ 0.07	43	0.033 $\pm$ 0.012	2.5 $\pm$ 0.2
<i>Offshore patch reefs</i>				
Lower Florida Keys				
S14 - North of Sand Key	0.50 $\pm$ 0.29	3	0.050 $\pm$ 0.032	2.5 $\pm$ 0.1
S15 - North of Sand Key	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	2.3 $\pm$ 0.1
S16 - North of Sand Key	1.00 $\pm$ 0.00	14	0.233 $\pm$ 0.058	2.4 $\pm$ 0.1
S19 - Western Sambo ER**	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	2.8
S20 - Western Sambo ER**	0.75 $\pm$ 0.25	14	0.233 $\pm$ 0.100	2.7 $\pm$ 0.5
U12 - West of Looe Key RO	0.50 $\pm$ 0.29	5	0.083 $\pm$ 0.063	1.7 $\pm$ 0.1
S17 - Looe Key RO**	0.25 $\pm$ 0.25	3	0.050 $\pm$ 0.050	2.3 $\pm$ 0.6
S18 - Looe Key RO**	0.75 $\pm$ 0.25	5	0.083 $\pm$ 0.042	2.0 $\pm$ 0.1

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
Lower Florida Keys Total (8)	0.56 ± 0.09	47	0.098 ± 0.031	2.3 ± 0.1
Middle Florida Keys				
S60 - NE of Delta Shoal	0.75 ± 0.25	6	0.100 ± 0.033	3.5 ± 0.2
S61 - West Turtle Shoal	1.00 ± 0.00	11	0.183 ± 0.042	2.3 ± 0.1
S63 - Coffins Patch SPA**	1.00 ± 0.00	10	0.167 ± 0.064	2.4 ± 0.2
S62 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S69 - Coffins Patch SPA**	1.00 ± 0.00	8	0.133 ± 0.027	2.5 ± 0.1
S70 - Coffins Patch SPA**	1.00 ± 0.00	7	0.117 ± 0.032	2.2 ± 0.2
S64 - South of Coffins Patch	0 ± 0	0	0 ± 0	
U42 - East of Coffins Patch	0.50 ± 0.29	3	0.050 ± 0.032	2.7 ± 0.2
Middle Florida Keys Total (8)	0.66 ± 0.16	45	0.094 ± 0.025	2.6 ± 0.2
Upper Florida Keys				
S99 - Wolf Reef	0.75 ± 0.25	5	0.083 ± 0.032	2.6 ± 0.2
T04 - Inshore of Sand Island	0.50 ± 0.29	3	0.050 ± 0.032	2.8 ± 0.0
T03 - White Bank	0.75 ± 0.25	7	0.117 ± 0.050	2.8 ± 0.2
T05 - White Bank	0.25 ± 0.25	3	0.050 ± 0.050	2.5 ± 0.5
T09 - South of Key Largo Dry Rocks	0.50 ± 0.29	2	0.033 ± 0.019	2.3 ± 0.4
T08 - West of Key Largo Dry Rocks	0.50 ± 0.29	2	0.033 ± 0.019	2.5 ± 0.0
T06 - West of Elbow Reef	0.75 ± 0.25	4	0.067 ± 0.027	1.8 ± 0.2
T07 - SW of Watson's Reef	0 ± 0	0	0 ± 0	
T31 - South of Watson's Reef	0.75 ± 0.25	3	0.050 ± 0.017	1.7 ± 0.2
T20 - Carysfort Reef SPA**	0.50 ± 0.29	4	0.067 ± 0.047	2.0 ± 0.1
T19 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T24 - North of Carysfort Reef	0.50 ± 0.29	3	0.050 ± 0.032	2.4 ± 0.2
Upper Florida Keys Total (12)	0.48 ± 0.08	36	0.050 ± 0.009	2.3 ± 0.1
Offshore Patch Reef Total (28)	0.55 ± 0.06	128	0.076 ± 0.012	2.4 ± 0.1
<i>Low-relief hard-bottom (< 6 m)</i>				
Lower Florida Keys				
S21 - East of Eastern Dry Rocks SPA	0.50 ± 0.29	2	0.033 ± 0.019	3.1 ± 0.2
S22 - West of Looe Key SPA	1.00 ± 0.00	16	0.267 ± 0.098	2.8 ± 0.2
Lower Florida Keys Total (2)	0.75 ± 0.25	18	0.150 ± 0.117	2.9 ± 0.1
Middle Florida Keys				
S65 - SE of Coffins Patch	0.75 ± 0.25	22	0.367 ± 0.199	2.4 ± 0.1
S66 - Tennessee Reef	0.75 ± 0.25	4	0.067 ± 0.027	3.1 ± 0.3
S68 - Tennessee Reef RO**	0.50 ± 0.29	3	0.050 ± 0.032	1.3 ± 0.2
S67 - Tennessee Reef RO**	0.25 ± 0.25	2	0.033 ± 0.033	1.5 ± 0.1
T16 - West of Alligator Reef	0.25 ± 0.25	1	0.017 ± 0.017	3.6
T45 - Alligator Reef SPA**	0.25 ± 0.25	3	0.050 ± 0.050	2.4 ± 0.5
T46 - Alligator Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	2.8
V03 - Davis Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	1.5 ± 0.5
T36 - Davis Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	1.1
T21 - Conch Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.033	2.0 ± 0.0
T22 - Conch Reef SPA**	0.25 ± 0.45	3	0.050 ± 0.050	1.9 ± 0.2
Middle Florida Keys Total (11)	0.41 ± 0.06	44	0.067 ± 0.030	2.1 ± 0.2
Upper Florida Keys				
T28 - Molasses Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	1.6 ± 0.2
T29 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T17 - North of French Reef	0.25 ± 0.25	3	0.050 ± 0.050	2.2 ± 0.3
T18 - Watson's Reef	0.50 ± 0.29	3	0.050 ± 0.032	2.3 ± 0.2
Upper Florida Keys Total (4)	0.31 ± 0.12	8	0.033 ± 0.012	2.0 ± 0.2
Shallow Hard-bottom Total (17)	0.43 ± 0.06	70	0.069 ± 0.023	2.2 ± 0.2
<i>High-relief spur and groove</i>				
Lower Florida Keys				
S32 - Western Dry Rocks	0.75 ± 0.25	7	0.117 ± 0.074	1.7 ± 0.2

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
S46 - Sand Key SPA**	0.75 ± 0.25	11	0.183 ± 0.063	0.063
S47 - Sand Key SPA**	0.75 ± 0.25	3	0.050 ± 0.017	0.017
S44 - Rock Key SPA**	0.75 ± 0.25	15	0.250 ± 0.137	0.137
S45 - Rock Key SPA**	0.75 ± 0.25	6	0.100 ± 0.043	0.043
S42 - Eastern Dry Rocks SPA**	0.75 ± 0.25	4	0.067 ± 0.027	0.027
S43 - Eastern Dry Rocks SPA**	1.00 ± 0.00	5	0.083 ± 0.017	0.017
S40 - Western Sambo ER**	0.50 ± 0.29	3	0.050 ± 0.032	0.032
S41 - Western Sambo ER**	0.75 ± 0.25	7	0.117 ± 0.042	0.042
S33 - Middle Sambo Reef	1.00 ± 0.00	17	0.283 ± 0.069	0
S38 - Eastern Sambo RO**	0.75 ± 0.25	11	0.183 ± 0.083	0
S39 - Eastern Sambo RO**	0.75 ± 0.25	6	0.100 ± 0.033	0.033
U15 - No Name Reef	0.75 ± 0.25	3	0.050 ± 0.017	0.017
S24 - East of Eastern Sambo RO	0.75 ± 0.25	34	0.567 ± 0.241	0.241
U24 - Pelican Shoal	0.75 ± 0.25	3	0.050 ± 0.017	0.017
U23 - Maryland Shoal	0.50 ± 0.29	2	0.033 ± 0.019	0.019
S34 - Maryland Shoal	0 ± 0	0	0	0
S35 - American Shoal	0.25 ± 0.25	1	0.017 ± 0.017	0.017
S36 - Looe Key SPA**	0.25 ± 0.25	2	0.033 ± 0.033	0.033
S37 - Looe Key SPA**	0.50 ± 0.29	4	0.067 ± 0.047	0.047
Lower Florida Keys Total (20)	0.65 ± 0.06	144	0.120 ± 0.029	1.8 ± 0.1
Middle Florida Keys				
S78 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	
S79 - Sombrero Key SPA**	1.00	5	0.083	2.0 ± 0.1
S76 - Delta Shoal	1.00	7	0.117	1.9 ± 0.1
S77 - Delta Shoal	0.25	4	0.067	1.8 ± 0.0
Middle Florida Keys Total (4)	0.56 ± 0.26	16	0.067 ± 0.025	1.9 ± 0.0
Upper Florida Keys				
T32 - Pickles Reef	0.75 ± 0.25	12	0.200 ± 0.086	2.2 ± 0.1
T43 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T44 - Molasses Reef SPA**	0.50 ± 0.29	5	0.083 ± 0.050	2.1 ± 0.2
T33 - Sand Island	0.25 ± 0.25	1	0.017 ± 0.017	1.8
T34 - Sand Island	0.75 ± 0.25	5	0.083 ± 0.042	1.8 ± 0.1
T41 - French Reef SPA**	0 ± 0	0	0 ± 0	
T42 - French Reef SPA**	0 ± 0	0	0 ± 0	
T14 - Grecian Rocks SPA**	0.75 ± 0.25	9	0.150 ± 0.088	2.5 ± 0.0
T15 - Grecian Rocks SPA**	0.75 ± 0.25	10	0.167 ± 0.069	2.3 ± 0.2
T12 - Key Largo Dry Rocks SPA**	0.75 ± 0.25	3	0.050 ± 0.017	2.0 ± 0.1
T13 - Key Largo Dry Rocks SPA**	0.75 ± 0.25	6	0.100 ± 0.043	2.1 ± 0.2
T10 - North-North Dry Rocks	0.25 ± 0.25	1	0.017 ± 0.017	1.9
T39 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	
T40 - Elbow Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	2.4
T35 - South of South Carysfort	0.75 ± 0.25	5	0.083 ± 0.032	1.7 ± 0.1
T37 - South Carysfort Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	2.0 ± 0.0
T38 - Carysfort Reef SPA**	0.25 ± 0.25	2	0.033 ± 0.033	1.9 ± 0.1
T11 - North of Turtle Reef	0.25 ± 0.25	1	0.017 ± 0.017	1.8
Upper Florida Keys Total (18)	0.42 ± 0.07	63	0.058 ± 0.015	2.0 ± 0.1
Spur and Groove Total (42)	0.54 ± 0.05	223	0.088 ± 0.016	1.9 ± 0.0
<i>Deeper Fore-reef (6-15 m)</i>				
Lower Florida Keys				
U19 - Sand Key SPA**	0 ± 0	0	0 ± 0	0
S27 - Sand Key SPA**	0 ± 0	0	0 ± 0	0
S23 - East of Rock Key SPA	0 ± 0	0	0 ± 0	0
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0	0
S55 - Western Sambo ER**	0.50 ± 0.29	3	0.050 ± 0.032	2.2 ± 0.2
S48 - East of Western Sambo ER	0 ± 0	0	0 ± 0	0
S49 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0
S52 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0
S53 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0	0

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
S30 - East of Pelican Shoal	0 ± 0	0	0 ± 0	0
S31 - East of Maryland Shoal	0.25 ± 0.25	1	0.017 ± 0.017	0.017
S51 - American Shoal	0.25 ± 0.25	1	0.017 ± 0.017	0.017
S50 - American Shoal	0.50 ± 0.29	3	0.050 ± 0.032	0.032
Lower Florida Keys Total (14)	0.11 ± 0.05	8	0.010 ± 0.005	2.2 ± 0.3
Middle Florida Keys				
S71 - South of Bahia Honda	0	0	0	
S80 - West of Sombrero Key	0	0	0	
S74 - West of Sombrero Key	0	0	0	
S72 - West of Sombrero Key	0	0	0	
S86 - Sombrero Key SPA	0	0	0	
S85 - Sombrero Key SPA	0	0	0	
S73 - East of Delta Shoal	0	0	0	
S81 - SW of Coffins Patch	0.25 ± 0.25	1	0.017 ± 0.017	2.0
S75 - Marker 20	0	0	0	
S82 - Tennessee Reef	0	0	0	
S83 - Tennessee Reef RO**	0.50 ± 0.29	2	0.033 ± 0.019	1.9 ± 0.5
S84 - Tennessee Reef RO**	0.25 ± 0.25	1	0.017 ± 0.017	2.9
T56 - Alligator Reef SPA**	0	0	0	
T57 - Alligator Reef SPA**	0	0	0	
T54 - Davis Reef SPA**	0	0	0	
T55 - Davis Reef SPA**	0	0	0	
T47 - Little Conch Reef	0	0	0	
T23 - Little Conch Reef	0	0	0	
T52 - Conch Reef SPA**	0	0	0	
T53 - Conch Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	1.2
V09 - Conch Reef RO**	0	0	0	
V10 - Conch Reef RO**	0	0	0	
Middle Florida Keys Total (22)	0.06 ± 0.03	5	0.004 ± 0.002	2.0 ± 0.3
Upper Florida Keys				
U98 - Pickles Reef	0	0	0	
U87 - Dixie Shoal	0	0	0	
U84 - North of Dixie Shoal	0.25 ± 0.25	1	0.017 ± 0.017	1.4
T30 - South of Elbow Reef	0	0	0	
T50 - Carysfort Reef SPA**	0	0	0	
T26 - Carysfort Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	1.5
T51 - Carysfort Reef SPA**	0	0	0	
T27 - Carysfort Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	2.9
T25 - North of Carysfort Reef	0	0	0	
T48 - North of Carysfort Reef	0.25 ± 0.25	1	0.017 ± 0.017	2.8
T49 - SE of Turtle Rocks	0.25 ± 0.25	1	0.017 ± 0.017	1.9
Upper Florida Keys Total (11)	0.11 ± 0.04	5	0.008 ± 0.003	2.1 ± 0.3
Deeper Fore-reef Total (47)	0.09 ± 0.02	18	0.006 ± 0.002	2.1 ± 0.2

Table 6-5. Mean $\pm$ 1 SE proportional station frequencies and densities (no. individuals/m²), test diameter, and number of individuals (N) sampled for the urchin *Tripneustes ventricosus* in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
<i>Inshore patch reefs</i>				
Lower Florida Keys				
S01 – SE of Ballast Key	0 $\pm$ 0	0	0 $\pm$ 0	
S02 – South of Sugarloaf Creek	0 $\pm$ 0	0	0 $\pm$ 0	
S03 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
S04 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
Lower Florida Keys Total (4)	0 $\pm$ 0	0	0 $\pm$ 0	
Inshore Patch Reef Total (4)	0 $\pm$ 0	0	0 $\pm$ 0	
<i>Mid-channel patch reefs</i>				
Lower Florida Keys				
S12 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
S13 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
S05 - North of Middle Sambo Reef	0 $\pm$ 0	0	0 $\pm$ 0	
S06 - North of Pelican Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
U04 - North of Pelican Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
S07 - West Washerwoman Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
S08 - West Washerwoman Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
S09 - North of Maryland Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
S10 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
S11 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	
Lower Florida Keys Total (10)	0 $\pm$ 0	0	0 $\pm$ 0	
Middle Florida Keys				
U40 - Marker 49A	0 $\pm$ 0	0	0 $\pm$ 0	
S58 - Marker 48	0 $\pm$ 0	0	0 $\pm$ 0	
S59 - East Turtle Shoal	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	9.1
S96 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
S94 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
S95 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	
Middle Florida Keys Total (7)	0.04 $\pm$ 0.04	1	0.002 $\pm$ 0.002	9.1
Upper Florida Keys				
S89 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	
S90 - Mosquito Bank	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	5.2
S91 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	
S92 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	
S93 - Turtle Rocks	0 $\pm$ 0	0	0 $\pm$ 0	
Upper Florida Keys Total (5)	0.05 $\pm$ 0.05	1	0.003 $\pm$ 0.003	5.2
Mid-channel Patch Reef Total (22)	0.02 $\pm$ 0.02	2	0.002 $\pm$ 0.001	7.2 $\pm$ 2.0
<i>Offshore patch reefs</i>				
Lower Florida Keys				
S14 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	
S15 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	
S16 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	
S19 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
S20 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	
U12 - West of Looe Key RO	0 $\pm$ 0	0	0 $\pm$ 0	
S17 - Looe Key RO**	0 $\pm$ 0	0	0 $\pm$ 0	
S18 - Looe Key RO**	0 $\pm$ 0	0	0 $\pm$ 0	

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
Lower Florida Keys Total (8)	0 ± 0	0	0 ± 0	
Middle Florida Keys				
S60 - NE of Delta Shoal	0 ± 0	0	0 ± 0	
S61 - West Turtle Shoal	0 ± 0	0	0 ± 0	
S63 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S62 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S69 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	
S70 - Coffins Patch SPA**	0.25 ± 0.25	1	0.017 ± 0.017	10.2
S64 - South of Coffins Patch	0 ± 0	0	0 ± 0	
U42 - East of Coffins Patch	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (8)	0.03 ± 0.03	1	0.002 ± 0.002	10.2
Upper Florida Keys				
S99 - Wolf Reef	0 ± 0	0	0 ± 0	
T04 - Inshore of Sand Island	0 ± 0	0	0 ± 0	
T03 - White Bank	0 ± 0	0	0 ± 0	
T05 - White Bank	0.25 ± 0.25	1	0.017 ± 0.017	10.3
T09 - South of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	
T08 - West of Key Largo Dry Rocks	0.25 ± 0.25	1	0.017 ± 0.017	5.1
T06 - West of Elbow Reef	0 ± 0	0	0 ± 0	
T07 - SW of Watson's Reef	0 ± 0	0	0 ± 0	
T31 - South of Watson's Reef	0 ± 0	0	0 ± 0	
T20 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T19 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T24 - North of Carysfort Reef	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (12)	0.04 ± 0.03	2	0.003 ± 0.002	7.7 ± 2.6
Offshore Patch Reef Total (28)	0.03 ± 0.01	3	0.002 ± 0.001	8.5 ± 1.7
<i>Low-relief hard-bottom (< 6 m)</i>				
Lower Florida Keys				
S21 - East of Eastern Dry Rocks SPA	0 ± 0	0	0 ± 0	
S22 - West of Looe Key SPA	0 ± 0	0	0 ± 0	
Lower Florida Keys Total (2)	0 ± 0	0	0 ± 0	
Middle Florida Keys				
S65 - SE of Coffins Patch	0 ± 0	0	0 ± 0	
S66 - Tennessee Reef	0 ± 0	0	0 ± 0	
S68 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
S67 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
T16 - West of Alligator Reef	0 ± 0	0	0 ± 0	
T45 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
T46 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
V03 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T36 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T21 - Conch Reef SPA**	0 ± 0	0	0 ± 0	
T22 - Conch Reef SPA**	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (11)	0 ± 0	0	0 ± 0	
Upper Florida Keys				
T28 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T29 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T17 - North of French Reef	0 ± 0	0	0 ± 0	
T18 - Watson's Reef	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (4)	0 ± 0	0	0 ± 0	
Shallow Hard-bottom Total (17)	0 ± 0	0	0 ± 0	
<i>High-relief spur and groove</i>				
Lower Florida Keys				
S32 - Western Dry Rocks	0 ± 0	0	0 ± 0	

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
S46 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S47 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S44 - Rock Key SPA**	0 ± 0	0	0 ± 0	
S45 - Rock Key SPA**	0 ± 0	0	0 ± 0	
S42 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	
S43 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	
S40 - Western Sambo ER**	0 ± 0	0	0 ± 0	
S41 - Western Sambo ER**	0 ± 0	0	0 ± 0	
S33 - Middle Sambo Reef	0 ± 0	0	0 ± 0	
S38 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
S39 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
U15 - No Name Reef	0 ± 0	0	0 ± 0	
S24 - East of Eastern Sambo RO	0 ± 0	0	0 ± 0	
U24 - Pelican Shoal	0 ± 0	0	0 ± 0	
U23 - Maryland Shoal	0 ± 0	0	0 ± 0	
S34 - Maryland Shoal	0 ± 0	0	0 ± 0	
S35 - American Shoal	0 ± 0	0	0 ± 0	
S36 - Looe Key SPA**	0 ± 0	0	0 ± 0	
S37 - Looe Key SPA**	0 ± 0	0	0 ± 0	
Lower Florida Keys Total (20)	0 ± 0	0	0 ± 0	
Middle Florida Keys				
S78 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	
S79 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	
S76 - Delta Shoal	0 ± 0	0	0 ± 0	
S77 - Delta Shoal	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (4)	0 ± 0	0	0 ± 0	
Upper Florida Keys				
T32 - Pickles Reef	0 ± 0	0	0 ± 0	
T43 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T44 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	
T33 - Sand Island	0 ± 0	0	0 ± 0	
T34 - Sand Island	0 ± 0	0	0 ± 0	
T41 - French Reef SPA**	0 ± 0	0	0 ± 0	
T42 - French Reef SPA**	0 ± 0	0	0 ± 0	
T14 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	
T15 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	
T12 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	
T13 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	
T10 - North-North Dry Rocks	0 ± 0	0	0 ± 0	
T39 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	
T40 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	
T35 - South of South Carysfort	0 ± 0	0	0 ± 0	
T37 - South Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T38 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T11 - North of Turtle Reef	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (18)	0 ± 0	0	0 ± 0	
Spur and Groove Total (42)	0 ± 0	0	0 ± 0	
<i>Deeper Fore-reef (6-15 m)</i>				
Lower Florida Keys				
U19 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S27 - Sand Key SPA**	0 ± 0	0	0 ± 0	
S23 - East of Rock Key SPA	0 ± 0	0	0 ± 0	
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0	
S55 - Western Sambo ER**	0 ± 0	0	0 ± 0	
S48 - East of Western Sambo ER	0 ± 0	0	0 ± 0	
S49 - Middle Sambo Reef	0 ± 0	0	0 ± 0	
S52 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
S53 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0	

Site number/site location	Station frequency	N	Mean no. per m ²	Mean size (cm)
S30 - East of Pelican Shoal	0 ± 0	0	0 ± 0	
S31 - East of Maryland Shoal	0 ± 0	0	0 ± 0	
S51 - American Shoal	0 ± 0	0	0 ± 0	
S50 - American Shoal	0 ± 0	0	0 ± 0	
Lower Florida Keys Total (14)	0 ± 0	0	0 ± 0	
Middle Florida Keys				
S71 - South of Bahia Honda	0 ± 0	0	0 ± 0	
S80 - West of Sombrero Key	0 ± 0	0	0 ± 0	
S74 - West of Sombrero Key	0 ± 0	0	0 ± 0	
S72 - West of Sombrero Key	0 ± 0	0	0 ± 0	
S86 - Sombrero Key SPA	0 ± 0	0	0 ± 0	
S85 - Sombrero Key SPA	0 ± 0	0	0 ± 0	
S73 - East of Delta Shoal	0 ± 0	0	0 ± 0	
S81 - SW of Coffins Patch	0 ± 0	0	0 ± 0	
S75 - Marker 20	0 ± 0	0	0 ± 0	
S82 - Tennessee Reef	0 ± 0	0	0 ± 0	
S83 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
S84 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	
T56 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
T57 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	
T54 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T55 - Davis Reef SPA**	0 ± 0	0	0 ± 0	
T47 - Little Conch Reef	0 ± 0	0	0 ± 0	
T23 - Little Conch Reef	0 ± 0	0	0 ± 0	
T52 - Conch Reef SPA**	0 ± 0	0	0 ± 0	
T53 - Conch Reef SPA**	0 ± 0	0	0 ± 0	
V09 - Conch Reef RO**	0 ± 0	0	0 ± 0	
V10 - Conch Reef RO**	0 ± 0	0	0 ± 0	
Middle Florida Keys Total (22)	0 ± 0	0	0 ± 0	
Upper Florida Keys				
U98 - Pickles Reef	0 ± 0	0	0 ± 0	
U87 - Dixie Shoal	0 ± 0	0	0 ± 0	
U84 - North of Dixie Shoal	0 ± 0	0	0 ± 0	
T30 - South of Elbow Reef	0 ± 0	0	0 ± 0	
T50 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T26 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T51 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T27 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	
T25 - North of Carysfort Reef	0 ± 0	0	0 ± 0	
T48 - North of Carysfort Reef	0 ± 0	0	0 ± 0	
T49 - SE of Turtle Rocks	0 ± 0	0	0 ± 0	
Upper Florida Keys Total (11)	0 ± 0	0	0 ± 0	
Deeper Fore-reef Total (47)	0 ± 0	0	0 ± 0	

Table 6-6. Number of individuals (N), mean, standard error (SE), and range in sea urchin test diameters by species and habitat type in the Florida Keys National Marine Sanctuary, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during May-September 2009.

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>						
Inshore patch reef (4)	1.5-4.6 m	0				
Mid-channel patch reef (22)	0.9-9.4 m	29	5.5	0.3	1.1	8.4
Offshore patch reef (28)	2.7-12.5 m	45	5.3	0.4	0.4	8.4
Shallow (< 6 m) hard-bottom (17)	1.8-8.5 m	22	5.3	0.4	1.3	8.3
High-relief spur and groove (42)	1.2-8.2 m	34	4.4	0.4	0.8	9.3
Deeper (6-15 m) fore-reef (47)	6.1-13.1 m	16	4.0	0.6	0.8	8.3
All habitats combined (160 sites)	0.9-13.1 m	146	5.0	0.2	0.4	9.3
<i>Echinometra lucunter</i>						
Inshore patch reef (4)	1.5-4.6 m	1	1.2		1.2	1.2
Mid-channel patch reef (22)	0.9-9.4 m	11	1.6	0.2	0.6	3.2
Offshore patch reef (28)	2.7-12.5 m	2	2.9	1.0	1.9	3.9
Shallow (< 6 m) hard-bottom (17)	1.8-8.5 m	3	1.3	0.0	1.2	1.3
High-relief spur and groove (42)	1.2-8.2 m	11	1.2	0.2	0.4	2.1
Deeper (6-15 m) fore-reef (47)	6.1-13.1 m	0				
All habitats combined (160 sites)	0.9-13.1 m	28	1.5	0.1	0.4	3.9
<i>Echinometra viridis</i>						
Inshore patch reef (4)	1.5-4.6 m	48	2.2	0.1	0.5	4.0
Mid-channel patch reef (22)	0.9-9.4 m	965	2.8	0.0	0.9	4.6
Offshore patch reef (28)	2.7-12.5 m	50	1.9	0.1	0.5	3.6
Shallow (< 6 m) hard-bottom (17)	1.8-8.5 m	11	1.6	0.2	0.6	2.7
High-relief spur and groove (42)	1.2-8.2 m	15	1.6	0.2	0.8	3.0
Deeper (6-15 m) fore-reef (47)	6.1-13.1 m	3	1.1	0.1	0.9	1.2
All habitats combined (160 sites)	0.9-13.1 m	1,092	2.7	0.0	0.5	4.6
<i>Eucidaris tribuloides</i>						
Inshore patch reef (4)	1.5-4.6 m	15	3.3	0.3	1.3	4.7
Mid-channel patch reef (22)	0.9-9.4 m	43	2.3	0.1	0.8	3.9
Offshore patch reef (28)	2.7-12.5 m	128	2.4	0.1	1.2	4.1
Shallow (< 6 m) hard-bottom (17)	1.8-8.5 m	70	2.4	0.1	1.0	3.7
High-relief spur and groove (42)	1.2-8.2 m	223	1.9	0.0	0.7	3.4
Deeper (6-15 m) fore-reef (47)	6.1-13.1 m	18	2.1	0.1	1.2	2.9
All habitats combined (160 sites)	0.9-13.1 m	497	2.2	0.0	0.7	4.7
<i>Tripneustes ventricosus</i>						
Inshore patch reef (4)	1.5-4.6 m	0				
Mid-channel patch reef (22)	0.9-9.4 m	2	7.2	2.0	5.2	9.1
Offshore patch reef (28)	2.7-12.5 m	3	8.5	1.7	5.1	10.3
Shallow (< 6 m) hard-bottom (17)	1.8-8.5 m	0				
High-relief spur and groove (42)	1.2-8.2 m	0				
Deeper (6-15 m) fore-reef (47)	6.1-13.1 m	0				
All habitats combined (160 sites)	0.9-13.1 m	5	8.0	1.2	5.1	10.3

VII. Anemone and Corallimorpharian Density

Background

Most historical and recent studies of Caribbean reef fauna, including those in the Florida Keys, have generally focused on either stony corals or fishes. This is not surprising, given that corals are primary framework builders, while fishes, along with certain shellfish species (e.g. queen conch and spiny lobster) are generally the most economically important fishery targets. In the Florida Keys, however, commercial marine-life fisheries and aquarium hobbyists remove an incredible diversity and number of invertebrates and fishes (Bohnsack et al. 1994). Otherwise known as the marine ornamental fishery, aquarium fisheries target a diversity of fish, invertebrate, and algal species, in addition to sand and live rock from West Palm Beach to Key West (FWCC 2001). State and Federal waters near Key West and Marathon in the Florida Keys constitute 94% of the total fishes and invertebrates removed in southeast Florida for the marine aquarium trade. Commercial data do not include an undocumented effort from recreational fishers, nor are data available concerning species abundance patterns and population trends relative to fishing effort (NOAA 1996). Key Largo has been protected from marine aquarium trade species collection since 1960 in John Pennekamp Coral Reef State Park, followed by the protection in federal waters in 1975 with the establishment of Key Largo National Marine Sanctuary. The Looe Key area has been protected since 1981, as well as Everglades National Park (Florida Bay), portions of the Dry Tortugas area, Biscayne National Park, and Fish and Wildlife Service management areas.

There is a paucity of basic ecological information for most Florida Keys anemone and corallimorpharian (Cnidaria, Anthozoa) species, and even fewer studies have explored the population effects of exploitation. During 2009, we continued a time series dating back to 1999 that quantifies the habitat distribution and abundance patterns of selected actinians (O. Actiniaria) and corallimorpharians (O. Corallimorpharia) in the Florida Keys in relation to cross-shelf habitat type, along-shelf regional variation, and management zones. With the exception of general Caribbean field guides (e.g. Sefton and Webster 1986; Kaplan 1988; Humann 1992) and isolated distribution studies (Voss and Voss 1955; Wheaton and Jaap 1988; reviewed in Levy et al. 1996), there are few density estimates we are aware of that consider multiple sites and benthic habitat types in the Florida Keys. Many of these species, most notably certain anemones, form associations with several invertebrates such as cleaner shrimps (Limbaugh et al. 1961; Shick 1991) and provide refuge for smaller reef fishes (Hanlon and Kaufman 1976; Colin and Heiser 1973). Some of these associations, such as cleaning stations, provide a valuable function to reef fishes (Herrnkind et al. 1976; Sluka et al. 1999) and the large-scale removal of certain species may have important, but as of yet, undocumented effects on other biota. The establishment of the Florida Keys National Marine Sanctuary (FKNMS) in 1990 and the subsequent designation of 23 no-fishing zones in 1997 presents an opportunity

to evaluate the effects of exploitation for a variety of species, including those targeted by the marine aquarium fishery (Bohnsack 1997). These data provide a means from which to measure the responses of organisms to protection from exploitation.

Quantitative surveys for the 2009 surveys targeted anemones (O. Actiniaria) and corallimorpharians (O. Corallimorpharia) known or suspected to occur in the Florida Keys, and focused on the larger and conspicuous or field-identifiable members of both orders. Similar surveys were carried out in the study area during 1999-2001 (211 sites), 2005 (195 sites) and 2008 (145 sites), as well as in the Tortugas region during 2000, 2006, and 2008. Five anemone species were recorded during 2009 (classification according to Cairns et al. 1991), all of which tend to have solitary and larger polyps compared to other cnidarians: the giant Caribbean or pink-tipped anemone *Condylactis gigantea* in the Family Actiniidae, the ringed or corkscrew anemone *Bartholomea annulata* in the Family Aiptasiidae, the speckled anemone *Epicystes* (=Phymanthus) *crucifera* in the Family Phymanthidae, *Heteractis lucida*, and *Lebrunia danae*. Although we searched for specimens, no individuals of the sun anemone *Stichodactyla* (=Stoichactis) *helianthus* were found. Three corallimorpharians were encountered: *Discosoma* (=Paradiscosoma) *carlgreni* and *D.* (=Rhodactis) *sanctithomae* in the Family Actinodiscidae and *Ricordea florida* in the Family Corallimorpharidae. Corallimorpharians, sometimes called false corals, differ from anemones in the arrangement of the tentacles, and may be solitary, but are typically found in clusters. We are collaborating with Nancy Sheridan, from the Florida Fish and Wildlife Institute, on these surveys and have a joint proposal submitted to continue and expand this work in nearshore habitats during 2010.

2009 Survey Results

Five anemone species were recorded from the 160 survey sites in 2009 (Figure 7-1) and a total of 461 individuals were enumerated from surveys of 9,600 m² of benthic habitat. Tables 7-1 to 7-3 provide transect frequency of occurrence and site-level densities for the five species. The anemones found were represented by: *Bartholomea annulata* (282 individuals, 61% of the total), *Condylactis gigantea* (14 individuals, 3%), *Epicystes crucifera* (23 individuals, 5%), *Heteractis lucida* (3 individuals, 0.7%), and *Lebrunia danae* (139 individuals, 30%). The five species exhibited markedly different habitat and regional distribution and abundance patterns in the Florida Keys, similar to our previous assessments. *B. annulata* was the most abundant and wide-ranging anemone, similar to results from 1999-2001, 2005, and 2008. *B. annulata* was recorded at 123 out of the 160 sites (77%) and was found in all habitat types sampled during 2009. Mean habitat-level densities for this species were somewhat similar among some of the habitats, ranging from 0.004 ± 0.004 per m² on inshore patch reefs to 0.042 ± 0.008 per m² on mid-channel patch reefs (Figures 7-2 and 7-3). Transect frequencies among habitats ranged from $6\% \pm 6\%$ on

inshore patch reefs to $41 \pm 6\%$ on mid-channel patch reefs (Table 7-1). The greatest site-level density was 0.22 individuals per m^2 (13 individuals from four 15-m x 1-m transects) recorded from an offshore patch reef near Sand Island in the upper Keys. On mid-channel patch reefs, frequency of occurrence was about 10% higher, on average, in the lower and upper Keys compared to the middle Keys. Densities tended to be greater in the lower Keys in both no-take zones and reference areas (Figure 7-2). A somewhat similar pattern was noted on offshore patch reefs, where frequency of occurrence and density tended to be greater in the lower Keys.

Similar to surveys in 1999-2001, 2005, and 2008, densities of *Condylactis gigantea* were relatively low in 2009 (Table 7-1). Fourteen individuals were found among the 160 sites and this species was present at only 13 sites (8%). Most *C. gigantea* were found on patch reefs, shallow hard-bottom, and one deeper fore reef site. A maximum density of 0.05 ± 0.02 individuals per m^2 was recorded from an offshore patch reef in the Carysfort/S. Carysfort SPA. Densities on mid-channel patch reefs were greater in the upper Keys compared to other regions, while densities on offshore patch reefs were greater in the middle Keys. Distribution and abundance patterns of *Epicystes crucifera* were similar to *C. gigantea*, but with greater habitat specificity on mid-channel patch reefs, especially in the lower Keys (Table 7-2). *E. crucifera* was present at 11 out of 160 sites (7%), with a maximum site-level density of 0.12 ± 0.03 individuals per m^2 recorded from a mid-channel patch reef in the Western Sambo ER. On mid-channel patch reefs, this species was present on $18\% \pm 6\%$ of all transects. Over 95% of all individuals were recorded from mid-channel patch reefs, and of those individuals, 91% were from lower Keys sites. Frequency of occurrence ($38\% \pm 10$) and density (0.033 ± 0.012 per m^2) were substantially higher in the lower Keys. Only three individuals of the knobby anemone (*Heteractis lucida*) were encountered, all of which were found on mid-channel and offshore patch reefs only in the lower Keys (Table 7-2). Although sighted in previous years, we did not encounter any sun anemones (*Stichodactyla helianthus*) during 2009. *Lebrunia danae*, the second most abundant anemone surveyed during 2009, was most abundant on mid-channel patch reefs and offshore patch reefs, particularly in the lower Keys. Individuals were recorded from all habitats except shallow hard-bottom and a maximum site-level density of 0.30 ± 0.04 individuals per m^2 was recorded from an offshore patch reef north of Sand Key SPA (Table 7-3). Transect frequency of occurrence ($44\% \pm 9\%$) and density (0.069 ± 0.018 per m^2) were greatest on mid-channel patch reefs, especially in the lower Keys, where $80\% \pm 10\%$ of all belt transect areas contained one or more individuals (Table 7-3).

A total of 5,418 corallimorpharians representing three species were sampled during 2009 (Figure 7-4): *Discosoma carlgreni* (35 individuals, 0.6%), *D. sanctithomae* (1,086 individuals, 20%), and *Ricordea*

florida (4,297 individuals, 79%). Tables 7-3 and 7-4 provide site-level transect frequency of occurrence and density values for the three corallimorpharians. *D. carlgreni* was only recorded from just two habitat types and 97% of all individuals were found on mid-channel patch reefs in the lower Keys. A maximum site-level density of 0.13 individuals per m² was recorded from several patch reef sites (Table 7-3). Similar to its congener, *D. sanctithomae* was most abundant on mid-channel patch reefs (92% of all individuals), especially in the lower Keys region, and only a few individuals were found on offshore patch reefs and high-relief spur and groove (Table 7-4). Site-level densities were as high as 3.6 individuals per m².

Similar to previous years, the most abundant corallimorpharian encountered during 2009 was *Ricordea florida* (Table 7-4). Like *D. sanctithomae*, the greatest densities of *R. florida* were recorded from mid-channel and offshore patch reefs, especially in the lower Keys (Figures 7-5 and 7-6). *R. florida* was recorded from all habitats sampled except inshore patch reefs, with 69% and 26% of all individuals recorded from mid-channel and offshore patch reefs, respectively. Site-level densities were as high as 31.6 ± 2.9 individuals per m² recorded from a mid-channel patch reef in the Western Sambo ER. Mean frequency of occurrence and density on mid-channel ($34\% \pm 8\%$, 2.24 ± 1.44 per m²) and offshore patch reefs ($47\% \pm 8\%$, 0.66 ± 0.19 per m²) were substantially higher than for other habitats. On mid-channel patch reefs in the lower Keys, transect frequency ($58\% \pm 12\%$) was 3-5 times greater and mean density (4.75 ± 3.05 per m²) was 15+ times greater than for the middle and upper Keys. A similar pattern was evident for offshore patch reefs, where frequency of occurrence ($72\% \pm 16\%$) was 2-3 times greater and mean density (1.58 ± 0.44 per m²) was 3-18 times greater than for other regions.

Discussion

While numerous studies address the life history characteristics of anemones and corallimorpharians, including feeding behavior (Bursey and Guanciale 1977; Bursey and Harmer 1979; Elliot and Cook 1989), reproduction (Jennison 1981), and associations with other fauna (Limbaugh et al. 1961; Colin and Heiser 1973; Hanlon and Kaufman 1976), studies that describe or quantify habitat distribution and abundance in the wider Caribbean are limited. Nine actinian species are common in the Caribbean; of these, seven are planktivores, while the two larger species (*Condylactis gigantea* and *Stichodactyla helianthus*) can eat macroscopic prey such as gastropods and echinoids (Van-Praët 1985). Several field guidebooks provide qualitative descriptions of habitat occurrence, biogeographic distribution, and taxonomic characters (Voss 1976; Kaplan 1988; Humann 1992), but with the exception of one quantitative study of benthic cnidarians at Looe Key, in which *Ricordea florida* was included (Wheaton and Jaap 1988), the data collected by our program represent the only large-scale assessments of habitat

distribution and abundance of actinians and corallimorpharians on ocean-side habitats in the Florida Keys. Levy et al. (1996) reviewed Florida Keys invertebrate inventories up to 1995 and found only three publications that discussed abundance and habitat distribution (e.g. Voss and Voss 1955; Voss et al. 1969).

The 2009 survey results indicate that, with the exception of some corallimorpharians on mid-channel and offshore patch reefs, mean density estimates were usually low (usually < 1 individual per 100 m^2) at the spatial scales investigated and habitat types investigated for the five anemones and three corallimorpharians encountered. Three of the five actinians and two of the three corallimorpharians were rare and/or exhibited limited habitat distribution. The three more commonly encountered species exhibited different density and distribution patterns. *B. annulata* was frequently encountered and similarly abundant on most habitats, while *L. danae* was more common on patch reefs, especially in the lower Keys. The most abundant corallimorpharian, *R. florida*, was significantly more abundant on mid-channel and offshore patch reefs, especially in the lower Keys.

Conclusions from the 2009 surveys are confined because of poor life history knowledge and the paucity of historical abundance data for anemones and corallimorpharians. Interpretation of density patterns is further complicated because of the possibility that large numbers of these organisms are removed from the study area by commercial and private collectors. However, surveys dating back to 1999 confirm, at least for a 10-year period, consistent patterns in habitat-based and regional patterns of abundance. One interesting and consistent pattern is the relatively high abundances of several species in the lower Keys, especially on patch reefs, compared to similarly structured habitats in the middle and upper Keys. It is also possible that locations not sampled by our program, including nearshore hard-bottom and seagrass beds (ocean-side and bay-side), mangrove channels, and tidal channels into Florida Bay, comprise important habitat types for various anemones and corallimorpharians. We have a proposal submitted in partnership with the Florida Fish and Wildlife Institute to sample some of these areas in 2010.

Few differences in abundance were obvious between the no-fishing zones and reference areas sampled. The ability to detect density differences between the no-fishing zones and reference areas presumes that: 1) fishing pressure for these organisms is concentrated in the habitat types surveyed, 2) fishing pressure is detectable at the scale of sampling, and 3) fishing pressure is the predominant factor affecting abundance, compared to say differential recruitment patterns, habitat-based limitations, or predation from fish populations that are different to what is found in reference areas. Because spatially explicit fishing effort for the marine aquarium trade is not available, it is difficult to ascertain where organisms are being

harvested. We did not sample any soft-sediment communities such as seagrass beds, and it is well known that some of the actinians (e.g. *Bartholomea annulata* and *Condylactis gigantea*) form relatively large aggregations in these habitats. As mentioned above, it is possible that overlooked soft-sediment and nearshore hard-bottom habitats contain greater densities of these organisms, perhaps due to differences in wave energy, competition for space, or other unexplored hypotheses. However, certain aspects of cnidarian life history have implications for fisheries management. For example, recruitment of sexually produced planula into natural populations of sea anemones seems rare, and it appears that most anemones studied (see review in Shick 1991) have great longevity of adults, low and sporadic larval recruitment, and high juvenile mortality. Asexual reproduction, especially for corallimorpharians, appears to be very important for maintenance of local aggregations if recruitment is successful (Elliot and Cook 1989), and probably explains the very high, but localized densities or clusters of *Discosoma sanctithomae* and *Ricordea florida*. Without basic information on life history, it will remain difficult to ascertain the ability of these organisms to maintain populations, especially considering the apparent level of exploitation in the Florida Keys (Bohnsack et al. 1994).

Although spatially explicit (e.g. at the scale of individual reefs) landings and fishing effort data are not available for Florida Keys anemones and corallimorpharians, the possibility that the observed density patterns are influenced by fishing should not be dismissed. For example, anecdotal observations, acquired from interviews with Florida Keys residents in 1993, indicated that *Condylactis gigantea* declined by the early 1990s, possibly due to collection, disease, or other causes (DeMaria 1996). Commercial marine life collectors and aquarium hobbyists potentially collect all of the cnidarians surveyed in this study (Bohnsack et al. 1994). Only a saltwater license is needed for recreational fishing, and a saltwater products license and commercial vessel registration is required to fish commercial quantities of unregulated species (NOAA 1996; FWCC 2000). The daily quota for fishes and invertebrates is 20 organisms per person per day, with no more than five angelfishes (Pomacanthidae) and no more than six gorgonian (Octocorallia) colonies, with live landing and live well requirements. In addition to a prohibition on collection in 23 of the no-take zones within the FKNMS (not including Tortugas North and South), fishing for these “unregulated” species is also prohibited in Biscayne National Park, John Pennekamp Coral Reef State Park/Key Largo National Marine Sanctuary (since 1960), the Florida Bay area within Everglades National Park, and Dry Tortugas National Park. With a saltwater products license, marine life fishery endorsement, and restricted species endorsement issued by the State of Florida, a limit of 400 *Condylactis gigantea* per vessel per day is currently permitted (FWCC 2000). Recreational regulations allow for a daily quota of 20 individuals of “unregulated” species per day (fished, possessed or landed), but data on recreational landings and effort are not available (NOAA 1996).

Management of exploited species obviously requires information on fishing effort, population trends, and life history parameters. Density estimates for anemones and corallimorpharians provide a baseline from which to measure the effects of protection within no-fishing zones. Because density data for shallow-water actinians and corallimorpharians were not available prior to our surveys, these initial samples were a first attempt at exploring spatial variability relative to sampling effort (e.g. number of transects per site, number of sites per stratum). Usage and modification of a stratified random sampling design, in which future optimization is achieved based upon both stratum-specific covariates (e.g. habitat type) and variance estimates (Ault et al. 1999), can provide fishery-independent density and total abundance estimates for cnidarians and other taxa. When coupled with important and much needed information on the marine life fishery, the outputs of this sampling approach can furnish state and federal resource managers with improved guidelines on population estimates and trends relative to fishing intensity. Moreover, the implementation of no-fishing zones in the Florida Keys National Marine Sanctuary presents a unique opportunity to evaluate the effects of fishing (Bohnsack 1997), not only on the most economically important species (Bohnsack et al. 1994), but also on a diversity of targeted, but relatively understudied taxa.

Figure 7-1. Anemones (Cnidaria, Anthozoa) surveyed for presence-absence, density, and habitat distribution in the Florida Keys during 2009.

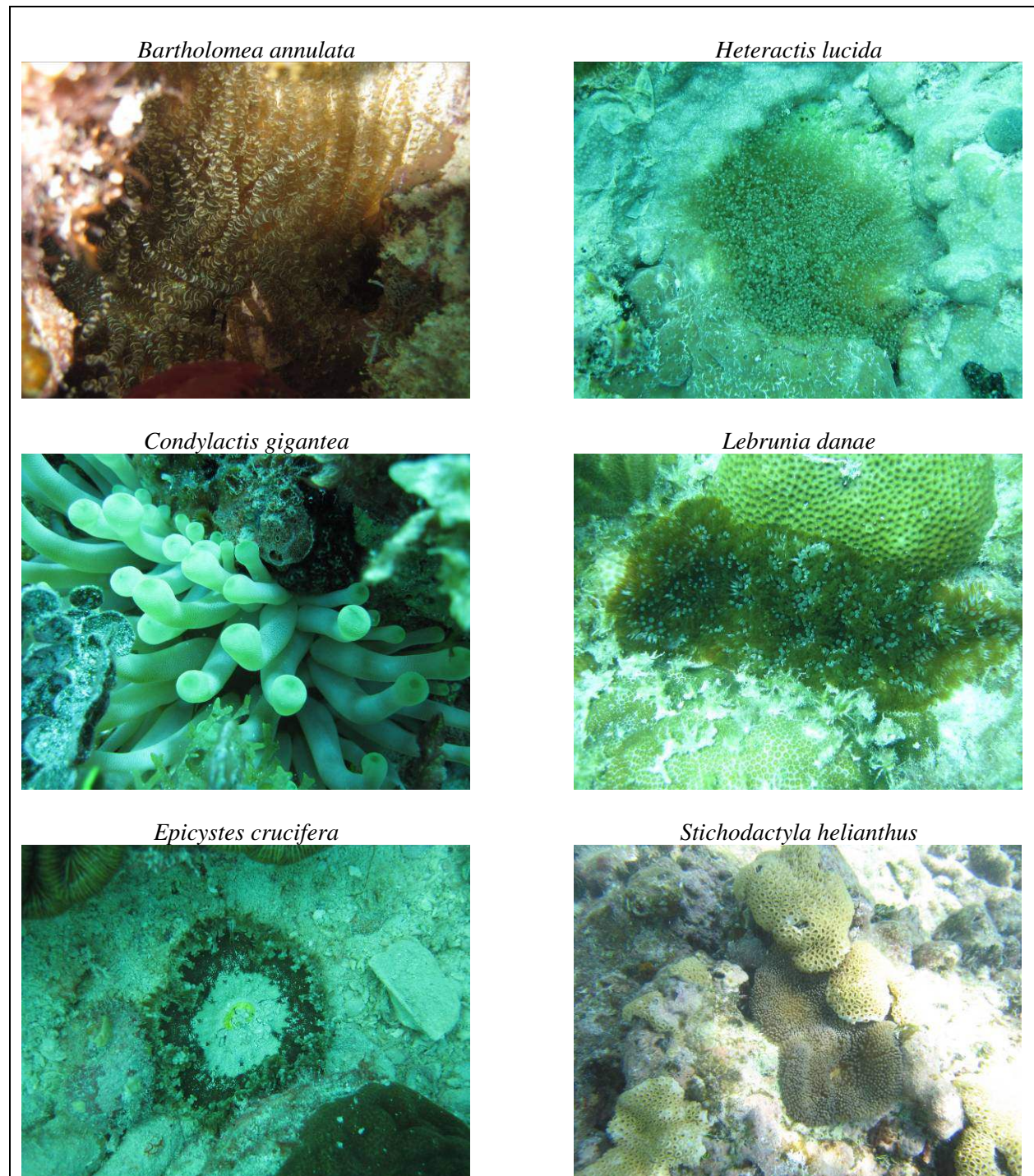


Figure 7-2. Mean (+ 1 SE) densities (no. per m²) of the corkscrew anemone (*Bartholomea annulata*) on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

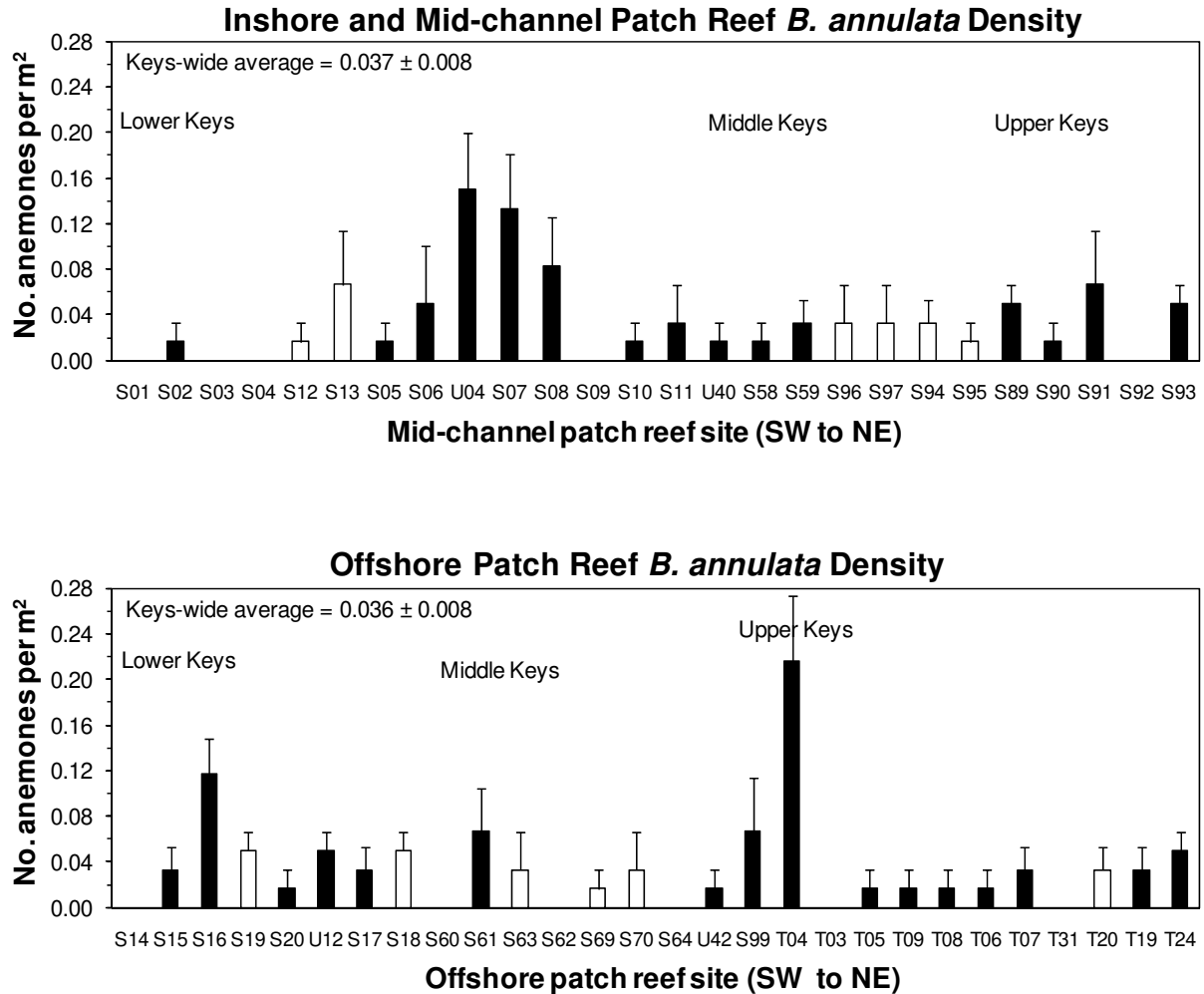


Figure 7-3. Mean (± 1 SE) densities (no. per m^2) of the corkscrew anemone (*Bartholomea annulata*) on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper fore reef (6-15 m) habitats (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

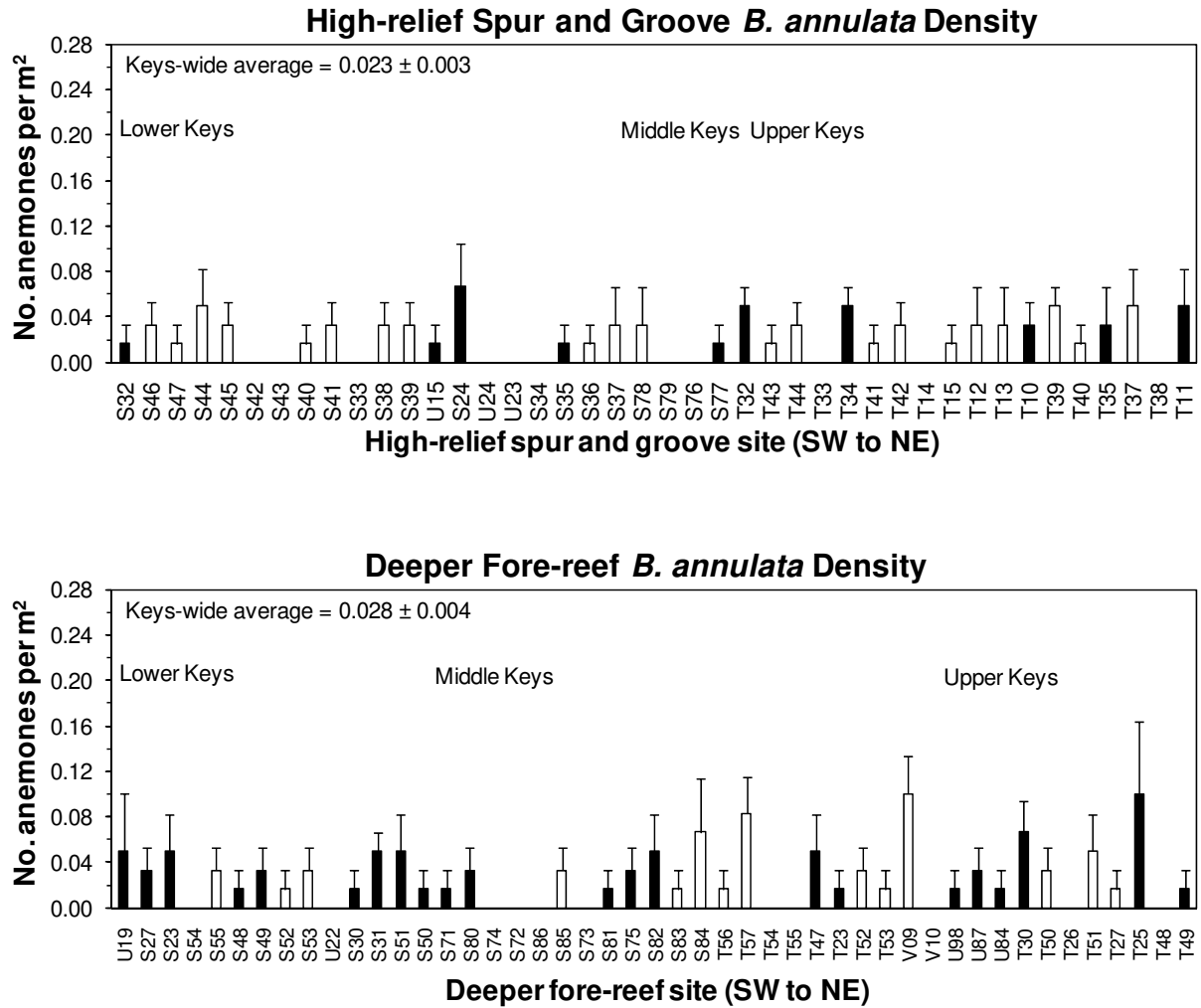


Figure 7-4. Corallimorpharians (Cnidaria, Anthozoa, Corallimorpharia) surveyed for presence-absence, density and habitat distribution in the Florida Keys during 2009.

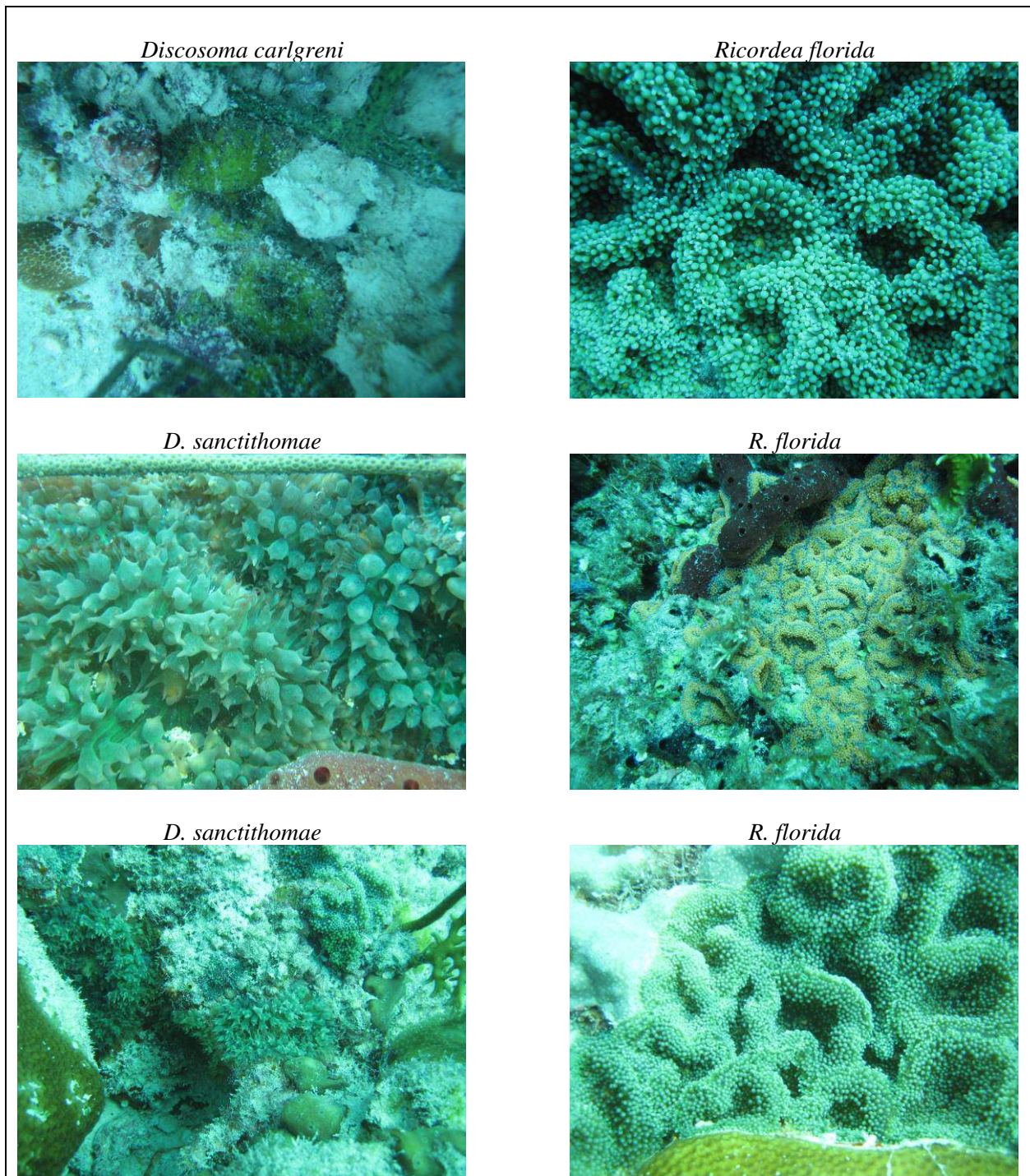


Figure 7-5. Mean (+ 1 SE) densities (no. per m²) of the Florida corallimorph (*Ricordea florida*) on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

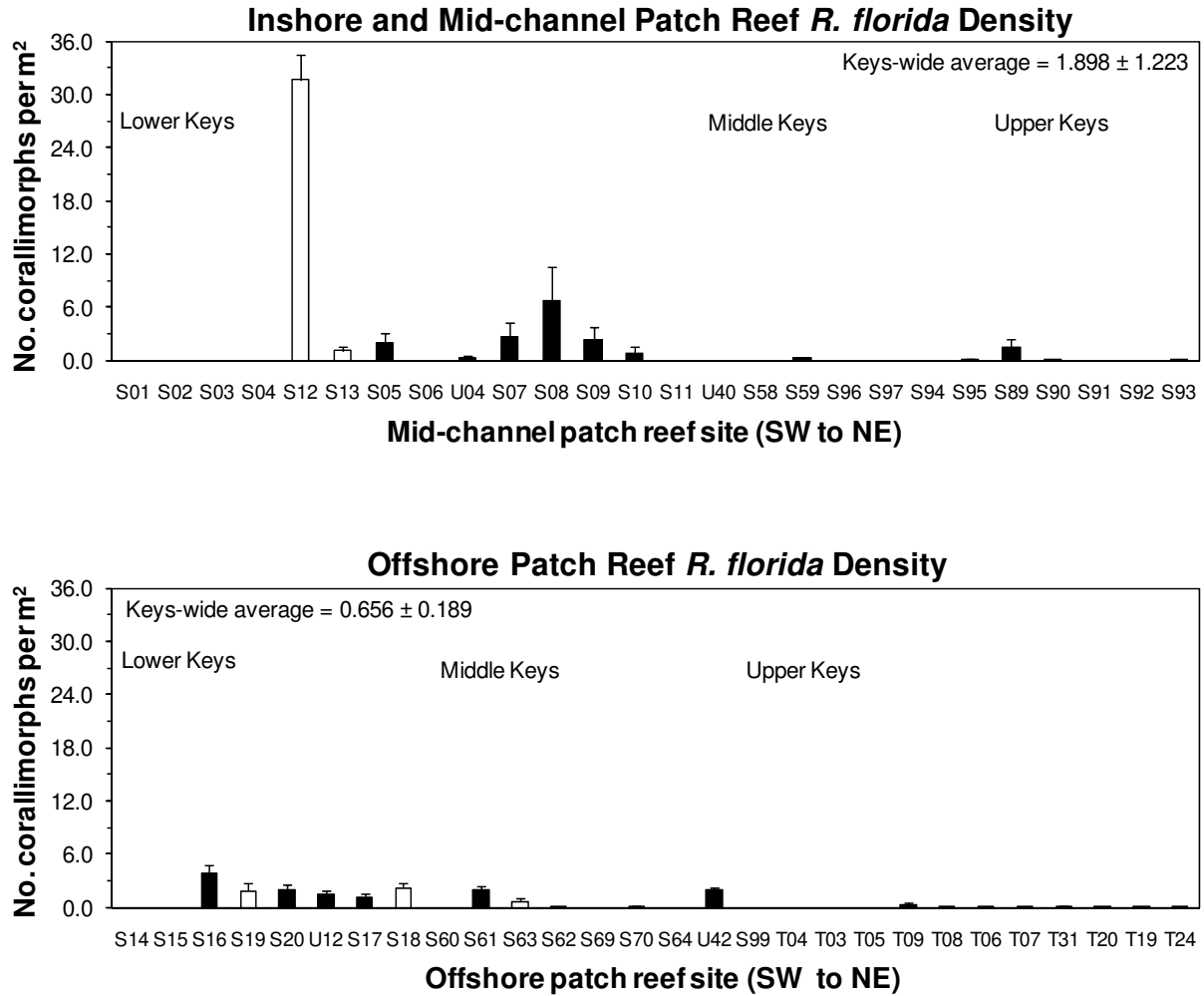


Figure 7-6. Mean (± 1 SE) densities (no. per m^2) of the Florida corallimorph (*Ricordea florida*) on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

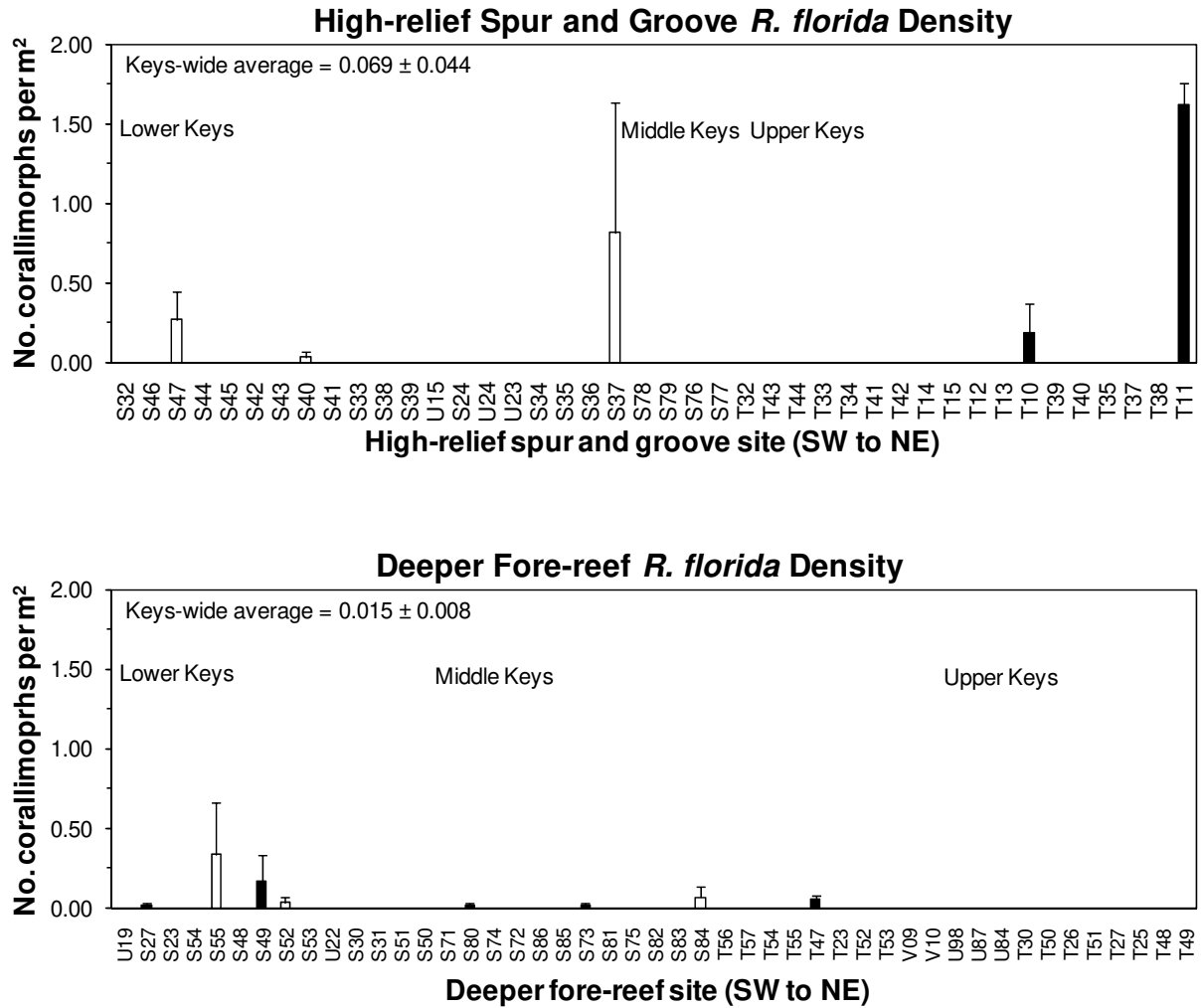


Table 7-1. Mean $\pm$ 1 SE proportional station frequencies, densities (no. individuals per m²) and numbers of individuals recorded (N) for the anemones *Bartholomea annulata* and *Condylactis gigantea* in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>Bartholomea annulata</i>			<i>Condylactis gigantea</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0.06 $\pm$ 0.06	1	0.004 $\pm$ 0.004	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0.06 $\pm$ 0.06	1	0.004 $\pm$ 0.004	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	0.50 $\pm$ 0.29	4	0.067 $\pm$ 0.047	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0.25 $\pm$ 0.25	3	0.050 $\pm$ 0.050	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017
U04 - North of Pelican Shoal	1.00 $\pm$ 0.00	9	0.150 $\pm$ 0.050	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	1.00 $\pm$ 0.00	8	0.133 $\pm$ 0.047	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	0.75 $\pm$ 0.25	5	0.083 $\pm$ 0.042	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S11 - North of American Shoal	0.25 $\pm$ 0.25	2	0.033 $\pm$ 0.033	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	0.45 $\pm$ 0.11	34	0.057 $\pm$ 0.016	0.03 $\pm$ 0.03	1	0.002 $\pm$ 0.002
Middle Florida Keys						
U40 - Marker 49A	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0.25 $\pm$ 0.25	2	0.033 $\pm$ 0.033	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0.25 $\pm$ 0.25	2	0.033 $\pm$ 0.033	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0.32 $\pm$ 0.05	11	0.026 $\pm$ 0.003	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	0.75 $\pm$ 0.25	3	0.050 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	0.50 $\pm$ 0.29	4	0.067 $\pm$ 0.047	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	0.75 $\pm$ 0.25	3	0.050 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	0.45 $\pm$ 0.15	11	0.037 $\pm$ 0.012	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	0.41 $\pm$ 0.06	56	0.042 $\pm$ 0.008	0.01 $\pm$ 0.01	1	0.001 $\pm$ 0.001
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	1.00 $\pm$ 0.00	7	0.117 $\pm$ 0.032	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017
S19 - Western Sambo ER**	0.75 $\pm$ 0.25	3	0.050 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S20 - Western Sambo ER**	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0.75 $\pm$ 0.25	3	0.050 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>Bartholomea annulata</i>			<i>Condylactis gigantea</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S17 - Looe Key RO**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
S18 - Looe Key RO**	0.75 ± 0.25	3	0.050 ± 0.017	0 ± 0	0	0 ± 0
Lower Florida Keys Total (8)	0.56 ± 0.11	21	0.044 ± 0.012	0.03 ± 0.03	1	0.002 ± 0.002
Middle Florida Keys						
S60 - NE of Delta Shoal	0 ± 0	0	0	0 ± 0	0	0 ± 0
S61 - West Turtle Shoal	0.50 ± 0.29	4	0.067 ± 0.038	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0.25 ± 0.25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	0 ± 0	0	0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0.25 ± 0.25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	0 ± 0	0	0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	0.19 ± 0.06	10	0.021 ± 0.008	0 ± 0	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	0.50 ± 0.29	4	0.067 ± 0.047	0.25 ± 0.25	1	0.017 ± 0.017
T04 - Inshore of Sand Island	1.00 ± 0.00	13	0.217 ± 0.057	0 ± 0	0	0 ± 0
T03 - White Bank	0 ± 0	0	0	0 ± 0	0	0 ± 0
T05 - White Bank	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T08 - West of Key Largo Dry Rocks	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	0 ± 0	0	0	0.25 ± 0.25	1	0.017 ± 0.017
T20 - Carysfort Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0.75 ± 0.25	3	0.050 ± 0.017
T19 - Carysfort Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
T24 - North of Carysfort Reef	0.75 ± 0.25	3	0.050 ± 0.017	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	0.40 ± 0.08	30	0.042 ± 0.017	0.10 ± 0.06	5	0.007 ± 0.004
Offshore Patch Reef Total (28)	0.38 ± 0.06	61	0.036 ± 0.008	0.05 ± 0.03	6	0.004 ± 0.002
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	0.25 ± 0.00	2	0.017 ± 0.000	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0.25 ± 0.25	1	0.017 ± 0.017	0.25 ± 0.25	1	0.017 ± 0.017
S66 - Tennessee Reef	0.25 ± 0.25	1	0.017 ± 0.017	0.25 ± 0.25	1	0.017 ± 0.017
S68 - Tennessee Reef RO**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0.75 ± 0.25	5	0.083 ± 0.032	0.25 ± 0.25	1	0.017 ± 0.017
T16 - West of Alligator Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0.75 ± 0.25	4	0.067 ± 0.027	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0.25 ± 0.25	1	0.017 ± 0.017
T36 - Davis Reef SPA**	0.50 ± 0.29	3	0.050 ± 0.032	0.25 ± 0.25	1	0.017 ± 0.017
T21 - Conch Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	0.34 ± 0.08	19	0.029 ± 0.008	0.11 ± 0.04	5	0.008 ± 0.003
Upper Florida Keys						
T28 - Molasses Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	0.50 ± 0.29	2	0.033 ± 0.019	0.25 ± 0.25	1	0.017 ± 0.017
Upper Florida Keys Total (4)	0.25 ± 0.14	4	0.017 ± 0.010	0.06 ± 0.06	1	0.004 ± 0.004
Shallow Hard-bottom Total (17)	0.31 ± 0.06	25	0.025 ± 0.006	0.09 ± 0.03	0	0.006 ± 0.002

Site number/site location	<i>Bartholomea annulata</i>			<i>Condylactis gigantea</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0.50 ± 0.29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0	0	0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0	0	0	0 ± 0	0	0 ± 0
S40 - Western Sambo ER**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0	0	0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
U15 - No Name Reef	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0.50 ± 0.29	4	0.067 ± 0.038	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0	0	0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	0	0	0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	0	0	0	0 ± 0	0	0 ± 0
S35 - American Shoal	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	0.25 ± 0.25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	0.26 ± 0.05	25	0.021 ± 0.004	0 ± 0	0	0 ± 0
Middle Florida Keys						
S78 - Sombrero Key SPA**	0.25 ± 0.25	0	0.033 ± 0.033	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	0.25 ± 0.25	0	0.017 ± 0.017	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	0.13 ± 0.07	3	0.013 ± 0.008	0 ± 0	0	0 ± 0
Upper Florida Keys						
T32 - Pickles Reef	0.75 ± 0.25	3	0.050 ± 0.017	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
T33 - Sand Island	0	0	0	0 ± 0	0	0 ± 0
T34 - Sand Island	0.75 ± 0.25	3	0.050 ± 0.017	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0	0	0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0.25 ± 0.25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0.25 ± 0.25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0.75 ± 0.25	3	0.050 ± 0.017	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0.25 ± 0.25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0.50 ± 0.29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0	0	0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0.50 ± 0.29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	0.36 ± 0.06	31	0.029 ± 0.004	0 ± 0	0	0 ± 0
Spur and Groove Total (44)	0.29 ± 0.04	59	0.023 ± 0.003	0 ± 0	0	0 ± 0
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0.25 ± 0.25	3	0.050 ± 0.050	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	0.50 ± 0.29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S55 - Western Sambo ER**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0

Site number/site location	<i>Bartholomea annulata</i>			<i>Condylactis gigantea</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S48 - East of Western Sambo ER	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
S52 - Eastern Sambo RO**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S53 - Eastern Sambo RO**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	0.75 ± 0.25	3	0.050 ± 0.017	0 ± 0	0	0 ± 0
S51 - American Shoal	0.50 ± 0.29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
S50 - American Shoal	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
Lower Florida Keys Total (14)	0.36 ± 0.06	24	0.029 ± 0.005	0 ± 0	0	0 ± 0
Middle Florida Keys						
S71 - South of Bahia Honda	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	0 ± 0	0	0 ± 0	0.25 ± 0.25	1	0.017 ± 0.017
S81 - SW of Coffins Patch	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S75 - Marker 20	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0.50 ± 0.29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	0.50 ± 0.29	4	0.067 ± 0.047	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	0.75 ± 0.25	5	0.083 ± 0.032	0 ± 0	0	0 ± 0
T54 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0.50 ± 0.29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0.75 ± 0.25	6	0.100 ± 0.033	0 ± 0	0	0 ± 0
V10 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	0.30 ± 0.05	35	0.027 ± 0.006	0.01 ± 0.01	1	0.001 ± 0.001
Upper Florida Keys						
U98 - Pickles Reef	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
U87 - Dixie Shoal	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	0.75 ± 0.25	4	0.067 ± 0.027	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	0	0	0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0.50 ± 0.29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0.50 ± 0.29	6	0.100 ± 0.064	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0	0	0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	0.34 ± 0.07	21	0.032 ± 0.009	0 ± 0	0	0 ± 0
Deeper Fore-reef Total (47)	0.32 ± 0.03	80	0.028 ± 0.004	0.01 ± 0.01	1	0.001 ± 0.000

Table 7-2. Mean $\pm$ 1 SE proportional station frequencies, densities (no. individuals per m²) and numbers of individuals (N) for the anemones *Epicystes crucifera* and *Heteractis lucida* in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during May-September 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>Epicystes crucifera</i>			<i>Heteractis lucida</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	1.00 $\pm$ 0.00	7	0.117 $\pm$ 0.032	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	0.75 $\pm$ 0.25	5	0.083 $\pm$ 0.032	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
U04 - North of Pelican Shoal	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017
S07 - West Washerwoman Shoal	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S11 - North of American Shoal	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	0.38 $\pm$ 0.10	20	0.033 $\pm$ 0.012	0.03 $\pm$ 0.03	1	0.002 $\pm$ 0.002
Middle Florida Keys						
U40 - Marker 49A	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	0.05 $\pm$ 0.05	1	0.003 $\pm$ 0.003	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	0.18 $\pm$ 0.06	21	0.016 $\pm$ 0.006	0.01 $\pm$ 0.01	0	0.001 $\pm$ 0.001
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017
S19 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017
S20 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>Epicystes crucifera</i>			<i>Heteractis lucida</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S17 - Looe Key RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S18 - Looe Key RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (8)	0.03 ± 0.03	1	0.002 ± 0.002	0.06 ± 0.04	2	0.004 ± 0.003
Middle Florida Keys						
S60 - NE of Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S61 - West Turtle Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T03 - White Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T05 - White Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T08 - West of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T20 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T24 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Offshore Patch Reef Total (28)	0.01 ± 0.01	1	0.001 ± 0.001	0.02 ± 0.01	2	0.001 ± 0.001
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T28 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	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
Shallow Hard-bottom Total (17)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	<i>Epicystes crucifera</i>			<i>Heteractis lucida</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S40 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S35 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	0.01 ± 0.01	1	0.001 ± 0.001	0 ± 0	0	0 ± 0
Middle Florida Keys						
S78 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	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
Upper Florida Keys						
T32 - Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T33 - Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T34 - Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Spur and Groove Total (44)	0.01 ± 0.01	1	0.001 ± 0.001	0 ± 0	0	0 ± 0
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S55 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	<i>Epicystes crucifera</i>			<i>Heteractis lucida</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S48 - East of Western Sambo ER	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S52 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S53 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S51 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S50 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (14)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S71 - South of Bahia Honda	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S75 - Marker 20	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T54 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V10 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
U98 - Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U87 - Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Deeper Fore-reef Total (47)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Table 7-3. Mean $\pm$ 1 SE proportional station frequencies, densities (no. individuals/m²) and numbers of individuals (N) for the anemone *Lebrunia danae* and the corallimorpharians *Discosoma carlgreni* in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>Lebrunia danae</i>			<i>Discosoma carlgreni</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0.75 $\pm$ 0.25	3	0.050 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0.31 $\pm$ 0.19	5	0.021 $\pm$ 0.013	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0.31 $\pm$ 0.19	5	0.021 $\pm$ 0.013	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	1.00 $\pm$ 0.00	6	0.100 $\pm$ 0.019	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017
S13 - Western Sambo ER**	1.00 $\pm$ 0.00	13	0.217 $\pm$ 0.063	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017
S05 - North of Middle Sambo Reef	0.50 $\pm$ 0.29	3	0.050 $\pm$ 0.017	1.00 $\pm$ 0.00	6	0.100 $\pm$ 0.033
S06 - North of Pelican Shoal	1.00 $\pm$ 0.00	9	0.150 $\pm$ 0.017	0.50 $\pm$ 0.29	8	0.133 $\pm$ 0.112
U04 - North of Pelican Shoal	1.00 $\pm$ 0.00	12	0.200 $\pm$ 0.027	0.50 $\pm$ 0.29	8	0.133 $\pm$ 0.082
S07 - West Washerwoman Shoal	0.75 $\pm$ 0.25	10	0.167 $\pm$ 0.043	0	0	0
S08 - West Washerwoman Shoal	1.00 $\pm$ 0.00	14	0.233 $\pm$ 0.019	0.25 $\pm$ 0.25	8	0.133 $\pm$ 0.133
S09 - North of Maryland Shoal	1.00 $\pm$ 0.00	11	0.183 $\pm$ 0.057	0.25 $\pm$ 0.25	2	0.033 $\pm$ 0.033
S10 - North of American Shoal	0.75 $\pm$ 0.25	5	0.083 $\pm$ 0.032	0	0	0
S11 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0	0	0
Lower Florida Keys Total (10)	0.80 $\pm$ 0.10	83	0.138 $\pm$ 0.024	0.30 $\pm$ 0.10	34	0.057 $\pm$ 0.019
Middle Florida Keys						
U40 - Marker 49A	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0.14 $\pm$ 0.07	4	0.010 $\pm$ 0.005	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	0.50 $\pm$ 0.29	0	0.050 $\pm$ 0.032	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0.25 $\pm$ 0.25	0	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	0.15 $\pm$ 0.10	4	0.013 $\pm$ 0.010	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	0.44 $\pm$ 0.09	91	0.069 $\pm$ 0.018	0.14 $\pm$ 0.05	34	0.026 $\pm$ 0.010
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	1.00 $\pm$ 0.00	18	0.300 $\pm$ 0.043	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019	0 $\pm$ 0	0	0 $\pm$ 0
S20 - Western Sambo ER**	1.00 $\pm$ 0.00	4	0.067 $\pm$ 0.000	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>Lebrunia danae</i>			<i>Discosoma carlgreni</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S17 - Looe Key RO**	0.25 ± 0.25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
S18 - Looe Key RO**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
Lower Florida Keys Total (8)	0.41 ± 0.14	28	0.058 ± 0.035	0 ± 0	0	0 ± 0
Middle Florida Keys						
S60 - NE of Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S61 - West Turtle Shoal	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	0.06 ± 0.04	2	0.004 ± 0.003	0 ± 0	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0.50 ± 0.29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
T03 - White Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T05 - White Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T08 - West of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T20 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T24 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	0.04 ± 0.04	3	0.004 ± 0.004	0 ± 0	0	0 ± 0
Offshore Patch Reef Total (28)	0.15 ± 0.05	33	0.020 ± 0.011	0 ± 0	0	0 ± 0
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T28 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	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
Shallow Hard-bottom Total (17)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	<i>Lebrunia danae</i>			<i>Discosoma carlgreni</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0.25 ± 0.25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S40 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0.50 ± 0.29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S35 - American Shoal	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	0.08 ± 0.03	8	0.007 ± 0.003	0 ± 0	0	0 ± 0
Middle Florida Keys						
S78 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	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
Upper Florida Keys						
T32 - Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T33 - Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T34 - Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Spur and Groove Total (44)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S55 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	<i>Lebrunia danae</i>			<i>Discosoma carlgreni</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S48 - East of Western Sambo ER	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S52 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S53 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S51 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S50 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (14)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S71 - South of Bahia Honda	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	0.25 ± 0.25	1	0.017 ± 0.017	0.25 ± 0.25	1	0.017 ± 0.017
S74 - West of Sombrero Key	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S75 - Marker 20	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T54 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V10 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	0.02 ± 0.02	2	0.002 ± 0.001	0.01 ± 0.01	1	0.001 ± 0.001
Upper Florida Keys						
U98 - Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U87 - Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Deeper Fore-reef Total (47)	0.01 ± 0.01	2	0.001 ± 0.001	0.01 ± 0.01	1	0.001 ± 0.001

Table 7-4. Mean $\pm$ 1 SE proportional station frequencies, densities (no. individuals per m²) and numbers of individuals (N) for the corallimorpharians *Discosoma sanctithomae* and *Ricordea florida* in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>Discosoma sanctithomae</i>			<i>Ricordea florida</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	1.00 $\pm$ 0.00	57	0.950 $\pm$ 0.344	1.00 $\pm$ 0.00	1,898	31.633 $\pm$ 2.89
S13 - Western Sambo ER**	0.50 $\pm$ 0.29	3	0.050 $\pm$ 0.032	1.00 $\pm$ 0.00	64	1.067 $\pm$ 0.453
S05 - North of Middle Sambo Reef	1.00 $\pm$ 0.00	92	1.533 $\pm$ 0.482	0.75 $\pm$ 0.25	117	1.950 $\pm$ 1.110
S06 - North of Pelican Shoal	1.00 $\pm$ 0.00	41	0.683 $\pm$ 0.484	0 $\pm$ 0	0	0 $\pm$ 0
U04 - North of Pelican Shoal	1.00 $\pm$ 0.00	210	3.500 $\pm$ 1.788	0.25 $\pm$ 0.25	18	0.300 $\pm$ 0.300
S07 - West Washerwoman Shoal	1.00 $\pm$ 0.00	215	3.583 $\pm$ 1.529	0.75 $\pm$ 0.25	158	2.633 $\pm$ 1.600
S08 - West Washerwoman Shoal	1.00 $\pm$ 0.00	209	3.483 $\pm$ 1.193	0.75 $\pm$ 0.25	404	6.733 $\pm$ 3.816
S09 - North of Maryland Shoal	1.00 $\pm$ 0.00	173	2.883 $\pm$ 0.572	0.75 $\pm$ 0.25	144	2.400 $\pm$ 1.354
S10 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0.50 $\pm$ 0.25	48	0.800 $\pm$ 0.693
S11 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	0.75 $\pm$ 0.13	1,000	1.667 $\pm$ 0.489	0.58 $\pm$ 0.12	2,851	4.752 $\pm$ 3.052
Middle Florida Keys						
U40 - Marker 49A	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0.50 $\pm$ 0.29	14	0.233 $\pm$ 0.158
S96 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0.25 $\pm$ 0.25	6	0.100 $\pm$ 0.100
Middle Florida Keys Total (7)	0 $\pm$ 0	0	0 $\pm$ 0	0.11 $\pm$ 0.07	20	0.048 $\pm$ 0.034
Upper Florida Keys						
S89 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0.50 $\pm$ 0.29	88	1.467 $\pm$ 0.978
S90 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017
S91 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	0 $\pm$ 0	0	0 $\pm$ 0	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017
Upper Florida Keys Total (5)	0 $\pm$ 0	0	0 $\pm$ 0	0.20 $\pm$ 0.09	90	0.300 $\pm$ 0.292
Mid-channel Patch Reef Total (22)	0.34 $\pm$ 0.10	1,000	0.758 $\pm$ 0.282	0.34 $\pm$ 0.08	2,961	2.243 $\pm$ 1.438
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	1.00 $\pm$ 0.00	45	0.750 $\pm$ 0.326	1.00 $\pm$ 0.00	227	3.783 $\pm$ 1.081
S19 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0.75 $\pm$ 0.25	110	1.833 $\pm$ 0.856
S20 - Western Sambo ER**	1.00 $\pm$ 0.00	40	0.667 $\pm$ 0.174	1.00 $\pm$ 0.00	123	2.050 $\pm$ 0.606
U12 - West of Looe Key RO	0 $\pm$ 0	0	0 $\pm$ 0	1.00 $\pm$ 0.00	90	1.500 $\pm$ 0.382

Site number/site location	<i>Discosoma sanctithomae</i>			<i>Ricordea florida</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S17 - Looe Key RO**	0 ± 0	0	0 ± 0	1.00 ± 0.00	74	1.233 ± 0.399
S18 - Looe Key RO**	0 ± 0	0	0 ± 0	1.00 ± 0.00	135	2.250 ± 0.465
Lower Florida Keys Total (8)	0.25 ± 0.16	85	0.177 ± 0.116	0.72 ± 0.16	759	1.581 ± 0.437
Middle Florida Keys						
S60 - NE of Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S61 - West Turtle Shoal	0 ± 0	0	0 ± 0	1.00 ± 0.00	118	1.967 ± 0.520
S63 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	1.00 ± 0.00	43	0.717 ± 0.274
S62 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0.25 ± 0.25	1	0.017 ± 0.017
S69 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0.25 ± 0.25	4	0.067 ± 0.067
S64 - South of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	0 ± 0	0	0 ± 0	1.00 ± 0.00	116	1.933 ± 0.234
Middle Florida Keys Total (8)	0 ± 0	0	0 ± 0	0.44 ± 0.17	282	0.588 ± 0.309
Upper Florida Keys						
S99 - Wolf Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T03 - White Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T05 - White Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	0.50 ± 0.29	23	0.383 ± 0.225
T08 - West of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	0.25 ± 0.25	3	0.050 ± 0.050
T06 - West of Elbow Reef	0 ± 0	0	0 ± 0	0.25 ± 0.25	3	0.050 ± 0.050
T07 - SW of Watson's Reef	0 ± 0	0	0 ± 0	1.00 ± 0.00	10	0.167 ± 0.043
T31 - South of Watson's Reef	0 ± 0	0	0 ± 0	0.50 ± 0.29	7	0.117 ± 0.069
T20 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0.50 ± 0.29	3	0.050 ± 0.032
T19 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0.75 ± 0.25	9	0.150 ± 0.088
T24 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0.25 ± 0.25	3	0.050 ± 0.050
Upper Florida Keys Total (12)	0 ± 0	0	0 ± 0	0.33 ± 0.09	61	0.085 ± 0.032
Offshore Patch Reef Total (28)	0.07 ± 0.05	85	0.051 ± 0.035	0.47 ± 0.08	1,102	0.656 ± 0.189
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0 ± 0	0	0 ± 0	1.00 ± 0.00	16	0.267 ± 0.086
Lower Florida Keys Total (2)	0 ± 0	0	0 ± 0	0.50 ± 0.50	16	0.133 ± 0.133
Middle Florida Keys						
S65 - SE of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T28 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	0 ± 0	0	0 ± 0	0.25 ± 0.25	1	0.017 ± 0.017
Upper Florida Keys Total (4)	0 ± 0	0	0 ± 0	0.06 ± 0.06	1	0.004 ± 0.004
Shallow Hard-bottom Total (17)	0 ± 0	0	0 ± 0	0.07 ± 0.06	17	0.017 ± 0.016

Site number/site location	<i>Discosoma sanctithomae</i>			<i>Ricordea florida</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0 ± 0	0	0 ± 0	0.50 ± 0.29	16	0.267 ± 0.174
S44 - Rock Key SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S40 - Western Sambo ER**	0 ± 0	0	0 ± 0	0.25 ± 0.25	2	0.033 ± 0.033
S41 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S35 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	0 ± 0	0	0 ± 0	0.25 ± 0.25	49	0.817 ± 0.817
Lower Florida Keys Total (20)	0.01 ± 0.01	1	0.001 ± 0.001	0.05 ± 0.03	67	0.056 ± 0.042
Middle Florida Keys						
S78 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	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
Upper Florida Keys						
T32 - Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T33 - Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T34 - Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0 ± 0	0	0 ± 0	0.25 ± 0.25	11	0.183 ± 0.183
T39 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0 ± 0	0	0 ± 0	1.00 ± 0.00	97	1.617 ± 0.134
Upper Florida Keys Total (18)	0 ± 0	0	0 ± 0	0.07 ± 0.06	108	0.100 ± 0.090
Spur and Groove Total (44)	0.01 ± 0.01	1	0.001 ± 0.001	0.05 ± 0.03	175	0.069 ± 0.043
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	0 ± 0	0	0 ± 0	0.25 ± 0.25	1	0.017 ± 0.017
S23 - East of Rock Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S55 - Western Sambo ER**	0 ± 0	0	0 ± 0	0.25 ± 0.25	20	0.333 ± 0.333

Site number/site location	<i>Discosoma sanctithomae</i>			<i>Ricordea florida</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S48 - East of Western Sambo ER	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0.25 ± 0.25	10	0.167 ± 0.167
S52 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0.25 ± 0.25	2	0.033 ± 0.033
S53 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S51 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S50 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (14)	0 ± 0	0	0 ± 0	0 ± 0	33	0.039 ± 0.026
Middle Florida Keys						
S71 - South of Bahia Honda	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	0 ± 0	0	0 ± 0	0.25 ± 0.25	1	0.017 ± 0.017
S74 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	0 ± 0	0	0 ± 0	0.25 ± 0.25	1	0.017 ± 0.017
S81 - SW of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S75 - Marker 20	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0.25 ± 0.25	4	0.067 ± 0.067
T56 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T54 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0 ± 0	0	0 ± 0	0.25 ± 0.25	3	0.050 ± 0.032
T23 - Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V10 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	0 ± 0	0	0 ± 0	0.06 ± 0.03	9	0.007 ± 0.004
Upper Florida Keys						
U98 - Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U87 - Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Deeper Fore-reef Total (47)	0 ± 0	0	0 ± 0	0.05 ± 0.02	42	0.015 ± 0.008

VIII. Mollusk Density

Background

The Florida Keys marine ecosystem supports a diverse fauna of gastropod mollusks belonging to several orders. Opisthobranch mollusks, for example, are represented by at least 30 species of sea slugs (Sacoglossa) and 23 species of nudibranchs (Nudibranchia) (Clark and DeFreese 1987; Levy et al. 1996), including at least three endemic species (Clark 1994). Data on the status and trends of mollusk populations and habitat utilization patterns in the Florida Keys, with the exception of queen conch (*Strombus gigas*), are limited (Marcus 1960; Jensen and Clark 1983; Clark and DeFreese 1987), as most previous studies have been qualitative in nature (Clark 1994; Trowbridge 2002). Most recently, Clark (1994) noted a declining population trend of the lettuce sea slug, *Elysia (Tridachia) crispata* Mörch (see cladistic analyses in Gosliner 1995; Jensen 1996) in southern Florida, based upon qualitative comparisons of occurrence and population densities between 1969-80 and 1987-93. About 50% of the nearshore populations assessed by Clark (1994) over a decade ago were declining due to habitat destruction, siltation, eutrophication, and over-collection, particularly in nearshore habitats.

Since 2001, we have conducted intermittent surveys of various gastropod mollusk species in conjunction with other benthic assessments. For example, we encountered unusually high densities of lettuce sea slugs among 63 shallow fore reef sites during June-September 2001. While sacoglossans are not particularly rare in many shallow-water marine habitats where densities correlate with algal biomass (Clarke and DeFreese 1987), our observations offshore were unusual because fleshy algal cover tends to be relatively low (Chiappone et al. 1997; Miller et al. 2002). In 2007 we surveyed *Coralliophila* snail predation on *Acropora* corals and also quantified the density two other Neogastropoda species that were especially abundant in high-relief spur and groove habitats. During 2001 and 2008-2009, we surveyed *Cyphoma* abundance, size, and gorgonian host occupation patterns (see Chapter V). During 2009, four 15-m x 1-m belt transects per site at all 160 sites (9,600 m²) were surveyed for the following sacoglossan, nudibranch, and neogastropoda mollusks:

- The lettuce sea slug, *Elysia (Tradachia) crispata* (Mörch), Class Gastropoda, Subclass Opisthobranchia, Order Sacoglossa, Family Elysiidae;
- The nudibranchs *Hypselodoris edenticulata* (Florida regal sea goddess), *H. bayeri* (black-spotted sea goddess), *Chromodoris kempfi* (purple-crowned sea goddess), *C. nyalia* (red-line blue sea goddess), and *Glossodoris sedna* (red-tipped sea goddess) of the Class Gastropoda, Subclass Opisthobranchia, Order Nudibranchia; and

- The Neogastropoda mollusks *Thais deltoidea* (Lamarck) of the Family Thaididae, *Coralliophila* sp. of the Family Coralliophilidae, and *Leucozonia nassa* (Gmelin) of the Family Fasciolaridae.

Of these targeted species, all except three nudibranch species were recorded during 2009 (Figure 8-1).

2009 Survey Results

A total of 9,600 m² of benthic habitat was surveyed during 2009 for the aforementioned gastropod mollusks. Data on the density, size, and gorgonian host occupation patterns of flamingo-tongue snails (*Cyphoma*) are presented in Chapter V. The 2009 surveys yielded two nudibranch species, one of which (*Chromodoris kempfi*) we have not previously recorded, one sacoglossan sea slug, and three Neogastropoda snails. Tables 8-1 to 8-3 provide site-level density and transect frequency of occurrence data. Nudibranch species observed in previous years, but not recorded during 2009, included *Hypselodoris edenticulata* (Florida regal sea goddess), *H. bayeri* (black-spotted sea goddess), and *Glossodoris sedna* (red-tipped sea goddess). Four individuals of *C. kempfi* were recorded from just two sites, and at both locations (Conch Reef SPA, Carysfort/S. Carysfort SPA), pairs of individuals were found intertwined together on algal turf substrate. Only one individual of *C. nyalya* (red-line blue sea goddess) was found at a low-relief spur and groove site SE of Turtle Rocks (Table 8-1).

A total of 170 individuals of the lettuce sea slug (*Elysia crispata*) were recorded and individuals were only found in high-relief spur and groove habitat (Table 8-2). This distribution pattern matches historical surveys of this species conducted in 2001, 2005, and 2007. A maximum site-level density of 0.55 ± 0.12 individuals per m² was recorded from a high-relief spur and groove site at Western Dry Rocks. In the high-relief spur and groove habitat, *E. crispata* was found on $32\% \pm 6\%$ of all transects, with an overall mean habitat density of 0.067 ± 0.019 individuals per m². In this same habitat, individuals were only found in the lower Keys ($35\% \pm 9\%$ of all transects, 0.072 ± 0.031 per m²) and upper Keys ($35\% \pm 10\%$ of all transects, 0.078 ± 0.029 per m²). In the lower Keys, transect frequency of occurrence was two times greater in no-take zones, while mean densities were roughly similar between no-take zones and reference sites. In the upper Keys, transect frequency of occurrence was nearly six times greater and mean density 10 times greater in no-take zones compared to reference sites.

Three Neogastropoda mollusks were surveyed during 2009 and observations were similar to those from 2007 (Tables 8-2 and 8-3). A total of 28 *Coralliophila* sp. individuals were found and these snails were only recorded from an offshore patch reef (29% of individuals) and several high-relief spur and groove sites (71%). The maximum site-level density was 0.283 ± 0.283 individuals per m² recorded from high-

relief spur and groove at Western Sambo ER (Table 8-2). *Coralliophila* sp. exhibited a highly aggregated distribution and was always found in clusters of individuals on the edges of live coral colonies. Similar results were obtained in 2007, where most individuals were found in high-relief spur and groove habitat on live coral.

Similar to 2007, the most abundant neogastropoda mollusk surveyed in 2009 was the deltoid rock shell (*Thais deltoidea*). A total of 1,162 individuals were found, with 96% recorded from high-relief spur and groove habitat (Table 8-3). Transect frequency of occurrence ($79\% \pm 5\%$) and mean density (0.442 ± 0.073) were substantially higher in high-relief spur and groove compared to all other habitats sampled. This is similar to 2007, where nearly 90% of all individuals were recorded in this habitat type. The maximum site-level density of 1.87 ± 0.30 individuals per m^2 was recorded from a high-relief spur and groove site at Western Dry Rocks. In the high-relief spur and groove habitat, there was a slightly higher frequency of occurrence ($88\% \pm 6\%$), but substantially greater mean density in the lower Keys (0.703 ± 0.120 per m^2) compared to the middle ($75\% \pm 10\%$, 0.342 ± 0.221) and upper Keys ($69\% \pm 9\%$, 0.174 ± 0.036 per m^2) regions. In addition, there was a slightly higher frequency of occurrence (92% vs. 81%) and density (0.794 vs. 0.567 per m^2) between no-take zones and reference areas, respectively, in the lower Keys. A similar pattern was evident in the upper Keys region. Similar to observations in 2007, *T. deltoidea* was found nearly exclusively on algal turf or crustose coralline algae.

The third gastropod mollusk sampled during 2009 was the common lesser tulip shell (*Leucozonia nassa*) (Figure 8-1), a species that exhibited the widest habitat distribution of the three neogastropod mollusks sampled. A total of 202 individuals were found, and similar to *T. deltoidea*, more than 90% were recorded from high-relief spur and groove habitat. Transect frequency of occurrence ($40\% \pm 6\%$) and mean density (0.073 ± 0.015) were substantially higher in high-relief spur and groove compared to all other habitats sampled (Table 8-3). The maximum site-level density of 0.317 ± 0.050 per m^2 was recorded from a high-relief spur and groove site within Molasses Reef SPA. In this same habitat, there was a substantially higher frequency of occurrence ($55\% \pm 9\%$) and mean density (0.103 ± 0.022 per m^2) in the lower Keys compared to the middle ($25\% \pm 25\%$, 0.063 ± 0.063 per m^2) and upper Keys ($26\% \pm 8\%$, 0.041 ± 0.018 per m^2). However, there were no obvious differences in frequency of occurrence (58% vs. 50%) or mean density (0.107 vs. 0.098 per m^2) between no-take zones and reference areas, respectively, in the lower Keys. Similar to *T. deltoidea*, most *L. nassa* snails were found on either crustose coralline algae or algal turf.

Figure 8-1. Selected mollusks surveyed for habitat distribution and density in the Florida Keys during 2009.

Coralliophila sp.



Coralliophila sp.



Thais deltoidea



Leucozonia nassa



Elysia (Tridachia) crispata



Chromodoris kempfi



Table 8-1. Mean $\pm$ 1 SE proportional station frequencies, numbers of individuals recorded (N), and densities (no. individuals per m²) of the nudibranchs *Chromodoris kempfi* and *C. nyalya* in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>C. kempfi</i>			<i>C. nyalya</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
U04 - North of Pelican Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S11 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys						
U40 - Marker 49A	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S20 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S17 - Looe Key RO**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>C. kempfi</i>			<i>C. nyalya</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S18 - Looe Key RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (8)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S60 - NE of Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S61 - West Turtle Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T03 - White Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T05 - White Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T08 - West of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T20 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T24 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Offshore Patch Reef Total (28)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0.25 ± 0.25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	0.02 ± 0.02	2	0.003 ± 0.003	0 ± 0	0	0 ± 0
Upper Florida Keys						
T28 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	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
Shallow Hard-bottom Total (17)	0.01 ± 0.01	2	0.002 ± 0.002	0 ± 0	0	0 ± 0

Site number/site location	<i>C. kempfi</i>			<i>C. nyalya</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S40 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S35 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S78 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	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
Upper Florida Keys						
T32 - Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T33 - Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T34 - Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Spur and Groove Total (44)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S55 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	<i>C. kempfi</i>			<i>C. nyalya</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S48 - East of Western Sambo ER	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S52 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S53 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S51 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S50 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (14)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S71 - South of Bahia Honda	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S75 - Marker 20	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T54 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V10 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
U98 - Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U87 - Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	0 ± 0	0	0 ± 0	0.25 ± 0.25	1	0.017 ± 0.017
Upper Florida Keys Total (11)	0 ± 0	0	0 ± 0	0.02 ± 0.02	1	0.002 ± 0.002
Deeper Fore-reef Total (47)	0 ± 0	0	0 ± 0	0.01 ± 0.01	1	0.001 ± 0.001

Table 8-2. Mean $\pm$ 1 SE proportional station frequencies, numbers of individuals recorded (N), and densities (no. individuals per m²) of the sacoglossan *Elysia crispata* and the gastropod *Coralliophila* sp. in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>E. crispata</i>			<i>Coralliophila</i> sp.		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S02 – South of Sugarloaf Creek	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S03 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S04 – Newfound Harbor SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (4)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Inshore Patch Reef Total (4)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
U04 - North of Pelican Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S11 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys						
U40 - Marker 49A	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S20 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S17 - Looe Key RO**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>E. crispata</i>			<i>Coralliophila</i> sp.		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S18 - Looe Key RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (8)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S60 - NE of Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S61 - West Turtle Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0 ± 0	0	0 ± 0	0.25 ± 0.25	8	0.133 ± 0.133
T03 - White Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T05 - White Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T08 - West of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T20 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T24 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	0 ± 0	0	0 ± 0	0.02 ± 0.02	8	0.011 ± 0.011
Offshore Patch Reef Total (28)	0 ± 0	0	0 ± 0	0.01 ± 0.01	8	0.005 ± 0.005
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T28 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	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
Shallow Hard-bottom Total (17)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	<i>E. crispata</i>			<i>Coralliophila</i> sp.		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	1.00 ± 0.00	33	0.550 ± 0.120	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0.50 ± 0.29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	1.00 ± 0.00	17	0.283 ± 0.42	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	1.00 ± 0.00	6	0.100 ± 0.33	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0.50 ± 0.29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	0.25 ± 0.25	1	0.017 ± 0.017
S43 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S40 - Western Sambo ER**	0 ± 0	0	0 ± 0	0.25 ± 0.25	17	0.283 ± 0.283
S41 - Western Sambo ER**	0.25 ± 0.25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0.50 ± 0.29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S35 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	1.00 ± 0.00	6	0.100 ± 0.019	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	1.00 ± 0.00	13	0.217 ± 0.088	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	0.35 ± 0.09	86	0.072 ± 0.031	0.03 ± 0.02	18	0.015 ± 0.014
Middle Florida Keys						
S78 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	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
Upper Florida Keys						
T32 - Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T33 - Sand Island	0.50 ± 0.29	4	0.067 ± 0.047	0.25 ± 0.25	2	0.033 ± 0.033
T34 - Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	1.00 ± 0.00	18	0.300 ± 0.148	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	1.00 ± 0.00	11	0.183 ± 0.057	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0.25 ± 0.25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0.75 ± 0.25	3	0.050 ± 0.017	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0.75 ± 0.25	8	0.133 ± 0.047	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	1.00 ± 0.00	25	0.417 ± 0.074	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0.75 ± 0.25	13	0.217 ± 0.074	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	0.35 ± 0.10	84	0.078 ± 0.029	0.01 ± 0.01	2	0.002 ± 0.002
Spur and Groove Total (44)	0.32 ± 0.06	170	0.067 ± 0.019	0.02 ± 0.01	20	0.008 ± 0.007
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S55 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	<i>E. crispata</i>			<i>Coralliophila</i> sp.		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S48 - East of Western Sambo ER	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S52 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S53 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S51 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S50 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (14)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S71 - South of Bahia Honda	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S75 - Marker 20	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T54 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V10 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
U98 - Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U87 - Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Deeper Fore-reef Total (47)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Table 8-3. Mean $\pm$ 1 SE proportional station frequencies, numbers of individuals recorded (N), and densities (no. individuals per m²) of the gastropods *Thais deltoidea* and *Leucozonia nassa* in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during 2009. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	<i>T. deltoidea</i>			<i>L. nassa</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>Inshore patch reefs</i>						
Lower Florida Keys						
S01 – SE of Ballast Key	0	0	0 $\pm$ 0	0.25 $\pm$ 0.25	1	0.017 $\pm$ 0.017
S02 – South of Sugarloaf Creek	0	0	0 $\pm$ 0	0.25 $\pm$ 0.25	2	0.033 $\pm$ 0.033
S03 – Newfound Harbor SPA**	0.25 $\pm$ 0.25	1	0.031 $\pm$ 0.031	0.50 $\pm$ 0.29	2	0.033 $\pm$ 0.019
S04 – Newfound Harbor SPA**	0.50 $\pm$ 0.29	9	0.150 $\pm$ 0.088	0 $\pm$ 0	0	0
Lower Florida Keys Total (4)	0.19 $\pm$ 0.12	10	0.042 $\pm$ 0.036	0.25 $\pm$ 0.10	5	0.021 $\pm$ 0.008
Inshore Patch Reef Total (4)	0.19 $\pm$ 0.12	10	0.042 $\pm$ 0.036	0.25 $\pm$ 0.10	5	0.021 $\pm$ 0.008
<i>Mid-channel patch reefs</i>						
Lower Florida Keys						
S12 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S13 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S05 - North of Middle Sambo Reef	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S06 - North of Pelican Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
U04 - North of Pelican Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S07 - West Washerwoman Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S08 - West Washerwoman Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S09 - North of Maryland Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S10 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S11 - North of American Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Lower Florida Keys Total (10)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys						
U40 - Marker 49A	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S58 - Marker 48	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S59 - East Turtle Shoal	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S96 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S97 - Cheeca Rocks SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S94 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S95 - Hen and Chickens Reef SPA**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Middle Florida Keys Total (7)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys						
S89 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S90 - Mosquito Bank	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S91 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S92 - Basin Hill Shoals	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S93 - Turtle Rocks	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Upper Florida Keys Total (5)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
Mid-channel Patch Reef Total (22)	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
<i>Offshore patch reefs</i>						
Lower Florida Keys						
S14 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S15 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S16 - North of Sand Key	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S19 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S20 - Western Sambo ER**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
U12 - West of Looe Key RO	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0
S17 - Looe Key RO**	0 $\pm$ 0	0	0 $\pm$ 0	0 $\pm$ 0	0	0 $\pm$ 0

Site number/site location	<i>T. deltoidea</i>			<i>L. nassa</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S18 - Looe Key RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (8)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S60 - NE of Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S61 - West Turtle Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S63 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S62 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S69 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S70 - Coffins Patch SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S64 - South of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U42 - East of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (8)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
S99 - Wolf Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T04 - Inshore of Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T03 - White Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T05 - White Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T09 - South of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T08 - West of Key Largo Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T06 - West of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T07 - SW of Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T31 - South of Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T20 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T19 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T24 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (12)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Offshore Patch Reef Total (28)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
<i>Low-relief hard-bottom (< 6 m)</i>						
Lower Florida Keys						
S21 - East of E. Dry Rocks SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S22 - West of Looe Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (2)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S65 - SE of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S66 - Tennessee Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S68 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S67 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T16 - West of Alligator Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T45 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T46 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V03 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T36 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T21 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T22 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (11)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
T28 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T29 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T17 - North of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T18 - Watson's Reef	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
Shallow Hard-bottom Total (17)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	<i>T. deltoidea</i>			<i>L. nassa</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
<i>High-relief spur and groove</i>						
Lower Florida Keys						
S32 - Western Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S46 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S47 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S44 - Rock Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S45 - Rock Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S42 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S43 - Eastern Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S40 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S41 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S33 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S38 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S39 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U15 - No Name Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S24 - East of Eastern Sambo RO	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U24 - Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U23 - Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S34 - Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S35 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S36 - Looe Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S37 - Looe Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (20)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S78 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S79 - Sombrero Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S76 - Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S77 - Delta Shoal	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
Upper Florida Keys						
T32 - Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T43 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T44 - Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T33 - Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T34 - Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T41 - French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T42 - French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T14 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T15 - Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T12 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T13 - Key Largo Dry Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T10 - North-North Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T39 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T40 - Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T35 - South of South Carysfort	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T37 - South Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T38 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T11 - North of Turtle Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Spur and Groove Total (44)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
<i>Deeper Fore-reef (6-15 m)</i>						
Lower Florida Keys						
U19 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S27 - Sand Key SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S23 - East of Rock Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S54 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S55 - Western Sambo ER**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	<i>T. deltoidea</i>			<i>L. nassa</i>		
	Frequency	N	No./m ²	Frequency	N	No./m ²
S48 - East of Western Sambo ER	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S49 - Middle Sambo Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S52 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S53 - Eastern Sambo RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U22 - West of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S30 - East of Pelican Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S31 - East of Maryland Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S51 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S50 - American Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Lower Florida Keys Total (14)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys						
S71 - South of Bahia Honda	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S80 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S74 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S72 - West of Sombrero Key	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S86 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S85 - Sombrero Key SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S73 - East of Delta Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S81 - SW of Coffins Patch	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S75 - Marker 20	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S82 - Tennessee Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S83 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
S84 - Tennessee Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T56 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T57 - Alligator Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T54 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T55 - Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T47 - Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T23 - Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T52 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T53 - Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V09 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
V10 - Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (22)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
U98 - Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U87 - Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
U84 - North of Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T30 - South of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T50 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T26 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T51 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T27 - Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T25 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T48 - North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
T49 - SE of Turtle Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (11)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Deeper Fore-reef Total (47)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

IX. Conclusions and future efforts

Survey results from 2009 add to a growing dataset on the distribution, abundance, size, and condition of benthic coral reef organisms in the Florida Keys National Marine Sanctuary. For many of the variables assessed, we have now developed a 10-year record dating back to 1999 to evaluate benthic community structure in no-take zones throughout the Sanctuary, within the context of larger-scale environmental variability on the south Florida shelf. Benthic surveys completed in 2009 included a follow-up effort to Keys-wide sampling for all of the included variables sampled during 1999-2001 and 2005. It is important to note that subsequent analyses will yield domain-wide abundance estimates for the benthic invertebrates sampled, and population estimates structured by habitat, regional sector, and for individual no-take marine reserves. In addition, we are in the process of evaluating temporal trends in benthic organisms and community structure throughout the Sanctuary and to evaluate the potential responses of the benthic community to protection from fishing the 23 no-take zones from Key Largo to Key West.

Species richness and cover

Patterns in the species richness of stony corals, sponges, and gorgonians, as well as coverage of major biotic components, during 2009 were relatively similar to previous surveys dating back to 1999. Stony coral species richness and cover continue to be greatest in the patch reef environment, reflecting the abundance of massive framework species. *Acropora cervicornis* continues to be more frequently encountered and occurs in greater densities on patch reefs. For the habitats surveyed, coral species richness tended to be similar between reference areas and no-take zones, although certain zones (e.g. Sombrero Key SPA and Looe Key SPA) continue to harbor greater numbers of species compared to reference sites and other no-take zones. Habitat-related patterns in gorgonian and sponge species richness were somewhat similar to stony corals, with greater species richness for both groups on offshore patch reefs and the deeper fore reef.

Benthic cover for most habitats continues to exhibit algal dominance, although coral cover is still relatively high (> 25%) on many patch reefs. Coral cover on patch reefs, on average, is about five times greater than on shallower and deeper sites along the platform margin or reef tract, again reflecting the predominance of large head corals. Regional patterns in coral cover did not vary consistently among habitats, and no-take zones either had similar or greater coverage, on average, than reference sites. Most habitats, particularly along the reef tract offshore of the patch reef environment, are dominated by algae. However, even in areas where total algal cover was high (> 50%), most of the coverage was comprised of diminutive turf species and crustose coralline algae. Macroalgal cover in most habitats is still relatively

low (< 25%) in most habitats surveyed. This pattern is significant, given that *Diadema antillarum* has not recovered to pre-1983 densities.

Juvenile and non-juvenile Corals

Non-juvenile (> 4 cm max. diameter) and juvenile (< 4 cm) coral assemblages paralleled each other in terms of overall relative abundance patterns among species. Relative to similar surveys during 1999-2001 and 2005, abundance patterns were similar in 2009 in terms of dominant species and habitat-related patterns in abundance. Patch reefs continue to yield the greatest densities of both juveniles and non-juveniles, especially mounding corals such as *Siderastrea siderea* and *Stephanocoenia michelini*. *Acropora cervicornis* continues to be most frequently encountered in the patch reef environment. Since region-wide disease events beginning in the late 1970s and localized coral bleaching events, *Acropora palmata*, and to a lesser extent *Millepora complanata*, continue to be minor framework elements on shallow spur and groove reefs. Extensive thickets of both species are relatively rare and are confined to a handful of shallow bank reefs such as Sand Island and Molasses Reef. The current coral assemblages in this habitat predominately consists of weedy, brooding corals such as *Porites astreoides* and *Agaricia agaricites*.

Gorgonians

Gorgonians continue to be a dominant sessile component for most of the habitats surveyed. Patch reefs support dense and diverse assemblages, while shallower platform margin hard-bottom and spur and groove are dominated by sea fans and sea plumes, especially in the upper Keys. *Cyphoma* snails were less frequently encountered compared to 2001, but not 2008, and exhibited gorgonian host occupation patterns similar to previous years. Fewer differences between no-take zones and reference sites were evident for most habitats compared to 2001.

Urchins

Urchin density and size estimates during 2009 continue a decade-long record of population status in the Florida Keys. Results indicate that since 1999, *Diadema antillarum* prevalence and average size have both increased, particularly when compared to the 1990s up until about 2005. However, maximum site-level densities are still at least one order of magnitude lower than before the Caribbean mass mortality event in 1983-84 and the second dieback in the Florida Keys in 1991. Increasing *D. antillarum* density and size are likely to affect benthic community structure and thus represents an important aspect of our monitoring effort. Other urchin species exhibited spatial distribution and abundance patterns similar to

historical observations, with high densities of *Echinometra* on some patch reefs and *Eucidaris tribuloides* abundant on the shallow fore-reef.

Anemones and corallimorpharians

Anemone and corallimorpharian surveys indicated similar patterns in species distribution and abundance compared to historical observations dating back to 1999. Most anemones were either broadly distributed, but occurred in low densities (e.g. *Bartholomea annulata*), or were relatively abundant in certain habitats and/or regions (e.g. *Lebrunia danae*). The three corallimorpharian species were particularly abundant in the patch reef environment, including Sanctuary no-take zones. The degree to which the distribution and abundance patterns of these organisms are affected by the marine aquarium trade is not well known. In 2010, we plan to collaborate further with the Florida Fish & Wildlife Research Institute to combine ocean-side and nearshore-Florida Bay-Biscayne Bay surveys, along with fishery-dependent data on landings and aggregation locations, to provide both fishery-dependent and independent population assessments of targeted species.

Future plans

The cumulative results of our program define baseline conditions for coral reef community structure throughout the FKNMS and Dry Tortugas, including marine protected areas. However, sampling only began in 1999 and thus represents an effort established after major declines had already occurred throughout the system, especially related to the loss of *Acropora* corals from white band disease, the demise of the urchin *Diadema antillarum*, coral bleaching, and various other stressors that impact the system. To address the lack of a longer temporal framework of our program, we have an unprecedented opportunity to integrate our work with results from an unpublished NSF-funded project conducted in the 1970s. Specifically, we plan to partner with the FKNMS, through B. Precht and his damage assessment team, to compare and extend work first started by Dr. Don Kissling in the early 1970s, when Dr. Kissling and his students completed over 190 days of underwater field studies from June 1970 to January 1974. Over 1,000 pages of field notes and data were compiled, reporting on the hydrological, sedimentological and ecological elements of nine reefs located from Looe Key to Sand Key. Kissling's data indicate diverse living coral assemblages. In addition, hundreds of black-and-white and color photographs were cataloged. In 1978, Dr. Kissling retired unexpectedly from academia and with his retirement the project came to a halt. This treasure trove of data has sat idle for over 30 years and none of these data were ever published nor are they available to the scientific community at large. Dr. Kissling, a long-time friend of B. Precht, has agreed to work with us to publish and resample the sites he visited over 30 years ago. The comparative work will be based on our on-going, long-term monitoring protocols, as well as additional

work to resample the parameters he measured that are not presently included in our sampling program (e.g. brittle stars and sediments). In general, publications from this work will be based on comparisons of these reefs after three decades of decline, including what was lost and why. Other elements of this data rescue element include preparation of database files for publication on our website and digitizing photographs for archival purposes.

In 2010, we plan to collaborate further with Nancy Sheridan of the Florida Fish & Wildlife Research Institute to sample ocean-side and nearshore-Florida Bay-Biscayne Bay hard-bottom and seagrass matrix habitats for benthic community structure, with a focus on several species targeted by the marine ornamental trade. Along with fishery-dependent data on landings and aggregation locations, these data will provide both fishery-dependent and independent population assessments of targeted species. This will also provide an unprecedented data set from nearshore to offshore habitats for evaluating population status of benthic organisms that provides a framework for monitoring trends over time.

In 2010, we will also continue to analyze data and prepare publications. Of particular note is work related to our ten-year record of surveys in the FKNMS and additional multivariate work related to the distribution and abundance of species and habitat types throughout the region. The data set provides unprecedented spatial coverage of organism habitat distribution, density, and size, as well as a means to evaluate temporal changes related to the FKNMS zoning action plan relative to larger-scale phenomena.

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