VI. Anemone and Corallimorpharian Density

Background

Commercial marine-life fisheries and aquarium hobbyists remove an incredible diversity and number of invertebrates and fishes in the Florida Keys (Bohnsack et al. 1994). Otherwise known as the marine ornamental fishery, aquarium fisheries from West Palm Beach to Key West target a diversity of fish, invertebrate, and algal species, in addition to sand and live rock (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 2010, 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, including no-take areas. 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. The ecological importance of these organisms is best exemplified by many anemones that 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 afford the 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 in the upper Florida Keys during June-August 2010 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 conducted in the study area during 1999-2001 (211 sites), 2005 (195 sites), 2008 (145 sites), and 2009 (160 sites), as well as in the Dry Tortugas region during 2000, 2006, and 2008. Five anemone species were recorded during 2010 (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, *Bunodosoma granulifera* (first record since study inception), and *Lebrunia danae*. Although we searched for specimens, no individuals of the knobby anemone (*Heteractis lucida*) or the sun anemone *Stichodactyla* (=*Stoichactis*) *helianthus* were found. Two corallimorpharians were encountered: *Discosoma* (=*Paradiscosoma*) *carlgreni* in the Family Actinodiscidae and *Ricordea florida* in the Family Corallimorpharidae. No *D. sanctithomae* were encountered during 2010, a reflection of the fact that this species is more abundant in the lower Keys region (see 2009 Quick Look Report at http://people.uncw.edu/millers). Corallimorpharians, sometimes called false corals, differ from anemones in the arrangement of the tentacles, and may be solitary, but are typically found in clusters.

2010 Survey Results

Five anemone species representing 297 individuals were recorded from 7,200 m^2 of benthic habitat across the 120 upper Florida Keys survey sites in 2010 (Figure 6-1). Tables 6-1 and 6-2 provide transect frequency of occurrence and site-level densities for four of the five anemone species. The five anemone species were represented by: *Bartholomea annulata* (259 individuals, 87% of all anemones), *Bunodosoma granulifera* (2 individuals, 0.7%), *Condylactis gigantea* (24 individuals, 8%), *Epicystes crucifera* (1 individual, 0.3%), and *Lebrunia danae* (11 individuals, 4%). Only two individuals of *B. granulifera* were found from one mid-channel patch reef inshore of Molasses Reef (site B25); this is the first time we have encountered this anemone. One individual of *E. crucifera* was found on an offshore patch reef in the White Bank area (site 643) (Table 6-2). As in previous years, *B. annulata* was the most abundant and wide-ranging anemone, with individuals documented within belt transects at 91 out of 120 sites (76%). *B. annulata* was distributed among all of the cross-shelf habitats sampled in the upper Florida Keys during 2010 (Table 6-1). Site-level densities were as high as 0.183 ± 0.032 individuals per m^2, with the greatest density recorded from a mid-channel patch reef in Basin Hill Shoals (site 634). Figures 6-2 to 6-4 show the spatial distribution of *B. annulata* densities across the upper Florida Keys. Deeper fore-reef (6-15 m)

habitats yielded the greatest transect mean frequency of occurrence (51% ± 5%) and density (0.050 ± 0.060 per m^2), followed by mid-channel patch reefs (42% ± 7% of transects, 0.048 ± 0.010 per m^2) (Figures 6-5 and 6-6).

Similar to previous surveys dating back to 1999, frequency of occurrence and densities of *Condylactis gigantea* were relatively low in 2010 for the habitats surveyed (Table 6-1). A total of 24 individuals were found among the 120 upper Keys sites, with individuals present at 18 of the 120 sites (15%). Most *C. gigantea* (71%) were observed on mid-channel (46%) and offshore patch reefs (25%). A maximum density of 0.050 ± 0.032 individuals per m^2 was recorded from an offshore patch reef east of Basin Hill Shoals (site 648). Mean transect frequency of occurrence (13% ± 4%) and density (0.009 ± 0.002 per m^2) were greatest on mid-channel patch reefs, followed by offshore patch reefs (7% ± 4% transect occurrence, 0.006 ± 0.003 per m^2) (Table 6-1). *Lebrunia danae*, the third most common anemone (11 individuals) encountered in the upper Keys, was only observed on mid-channel patch reefs, offshore patch reefs, and the deeper (6-15 m) fore reef (Table 6-2). This anemone was most abundant on mid-channel patch reefs (6% ± 3% transect occurrence, 0.006 ± 0.003 per m^2) (Table 6-2).

A total of 311 corallimorpharians representing two species were recorded during 2010: *Discosoma carlgreni* (20 individuals, 6%) and *Ricordea florida* (291 individuals, 94%) (Figure 6-7). Table 6-3 provides site-level transect frequency of occurrence and density values for the two corallimorpharians. *D. carlgreni* occurred within three habitat types, with 50% of all individuals found on high-relief spur and groove reefs, followed by offshore patch reefs (40%) and deeper (6-15) fore-reef habitats (10%) (Table 6-3). A maximum site-level density of 0.150 ± 0.150 individuals per m^2 was recorded from the high-relief spur and groove reef at Little Grecian Rocks (site B42) (Table 6-3). Similar to previous years, the most abundant corallimorpharian encountered during 2010 in the upper Keys was *Ricordea florida* (Table 6-3). The greatest site-level mean density (1.550 ± 0.615 per m^2) occurred at an offshore patch reef at Watson's Reef (site 645). Just over 87% of *R. florida* were found on mid-channel (39%) and offshore patch reefs (48%). Figures 6-8 to 6-10 show the spatial distribution of *R. florida* throughout the upper Florida Keys study area. Mean transect frequency of occurrence (18% ± 7%) and density (0.137 ± 0.091 per m^2) were greatest on offshore patch reefs, followed by mid-channel patch reefs (8% ± 4%, 0.090 ± 0.056 per m^2) (Figures 6-11 and 6-12).

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 Florida Keys 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 Florida Keys ocean-side habitats. Levy et al. (1996) reviewed Florida Keys invertebrate inventories as of 1995 and found only three publications (e.g. Voss and Voss 1955; Voss et al. 1969) that discussed abundance and habitat distribution as of the mid-1990s.

The 2010 upper Florida Keys survey results indicate that, with the exception of the corallimorpharian *Ricordea florida* on some mid-channel and offshore patch reefs, mean densities of the anemones and corallimorpharians sampled were usually below one individual per 100 m^2 for the habitats sampled. All but one of the five actinians and one of the two corallimorpharians species were rare and/or exhibited limited habitat distribution. The more commonly encountered species exhibited different density and distribution patterns. *B. annulata* was the most frequently encountered anemone and generally had similar densities among most habitats, while *Condylactis gigantea* and *Lebrunia danae* were more common on patch reefs. The most abundant corallimorpharian, *R. florida*, was most abundant on mid-channel and offshore patch reefs.

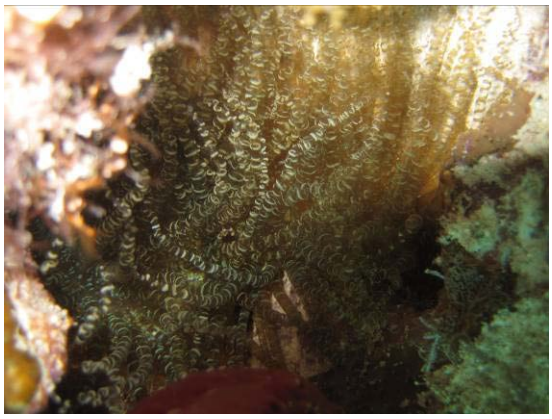
Conclusions from the 2010 surveys are confined because of poor life history knowledge and the paucity of historical abundance data for anemones and corallimorpharians. Interpretation of density patterns is further complicated because of the possibility that large numbers of these organisms are removed from the Florida Keys by commercial and private collectors. However, surveys dating back to 1999 confirm, at least for a 10-year period, consistent patterns in habitat-based patterns of abundance. 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 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.

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).

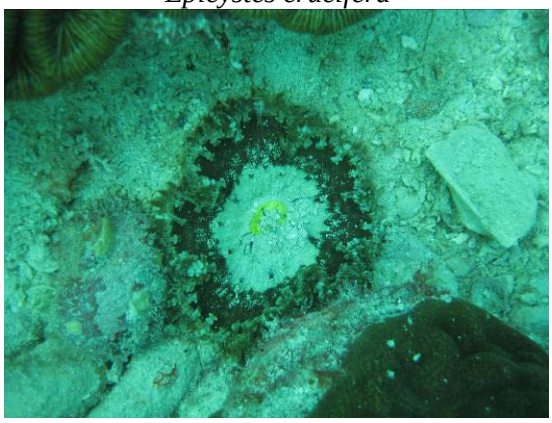
Although spatially explicit (e.g. at the scale of individual reefs) landings and fishing effort data are not available for Florida Keys anemones and corallimorpharians, the possibility that the observed density patterns are influenced by fishing should not be dismissed. For example, anecdotal observations, 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). 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. 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. 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 6-1. Anemones (Cnidaria, Anthozoa) surveyed for presence-absence, density, and habitat distribution in the Florida Keys during June-August 2010. Not pictured is *Stichodactyla helianthus*, which was not observed in the upper Florida Keys during 2010.

Bartholomea annulata

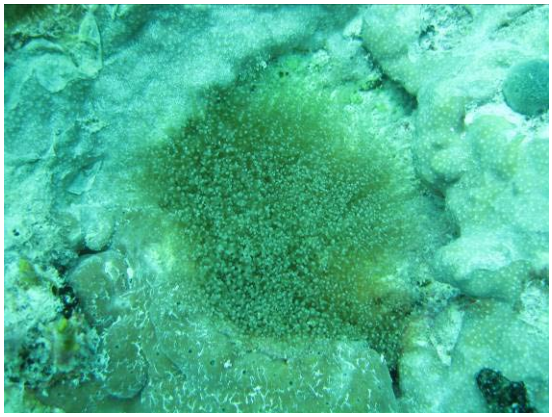


Epicystes crucifera



Bunodosoma granulifera

Heteractis lucida



Condylactis gigantea

Lebrunia danae

Figure 6-2. Densities (no. per m^2) of corkscrew anemones (*Bartholomea annulata*) in the upper Florida Keys National Marine Sanctuary from the southern BNP boundary to Carysfort/S. Carysfort SPA surveyed during June-August 2010.

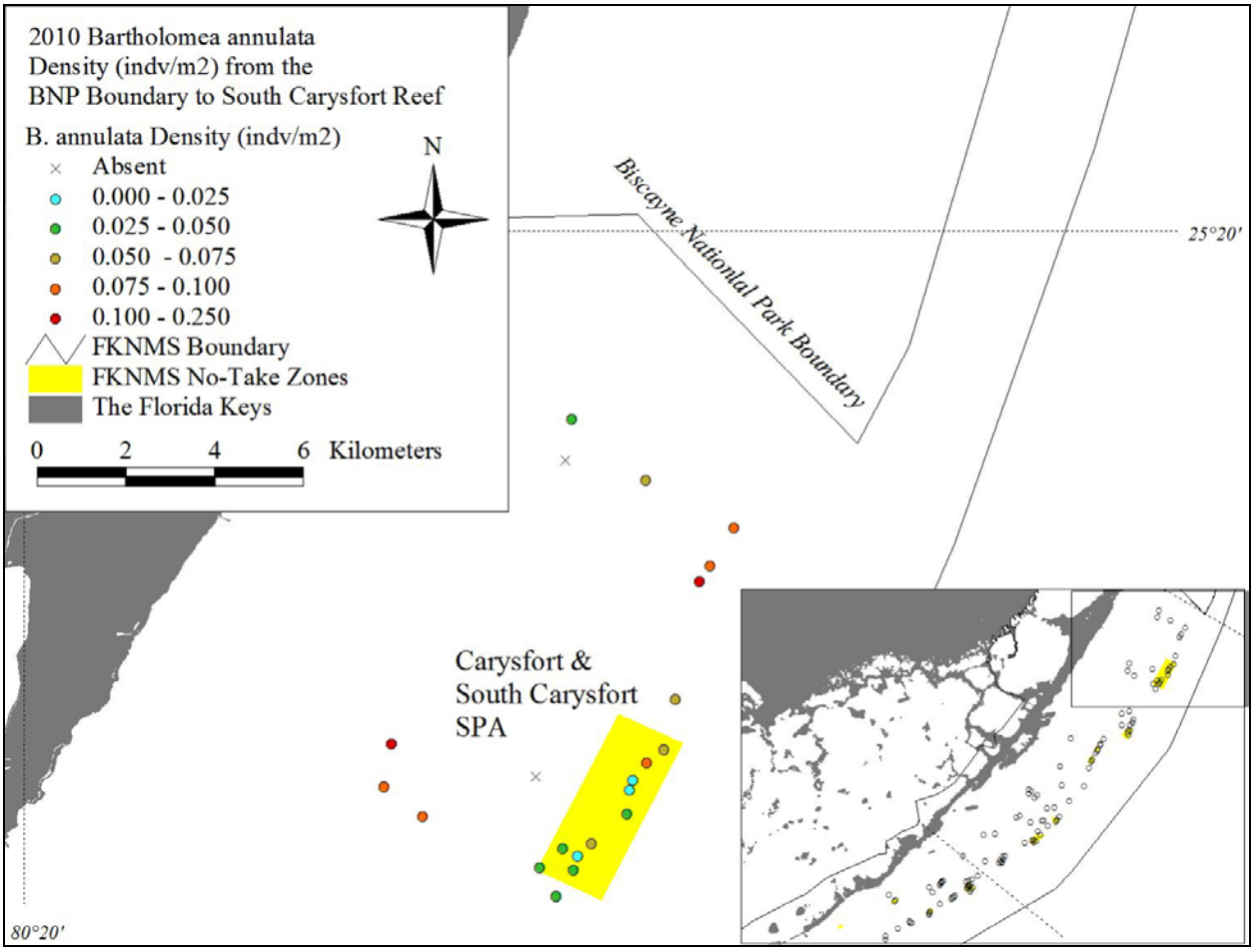


Figure 6-3. Densities (no. per m^2) of corkscrew anemones (*Bartholomea annulata*) in the upper Florida Keys National Marine Sanctuary from Elbow Reef to Pickles Reef surveyed during June-August 2010.

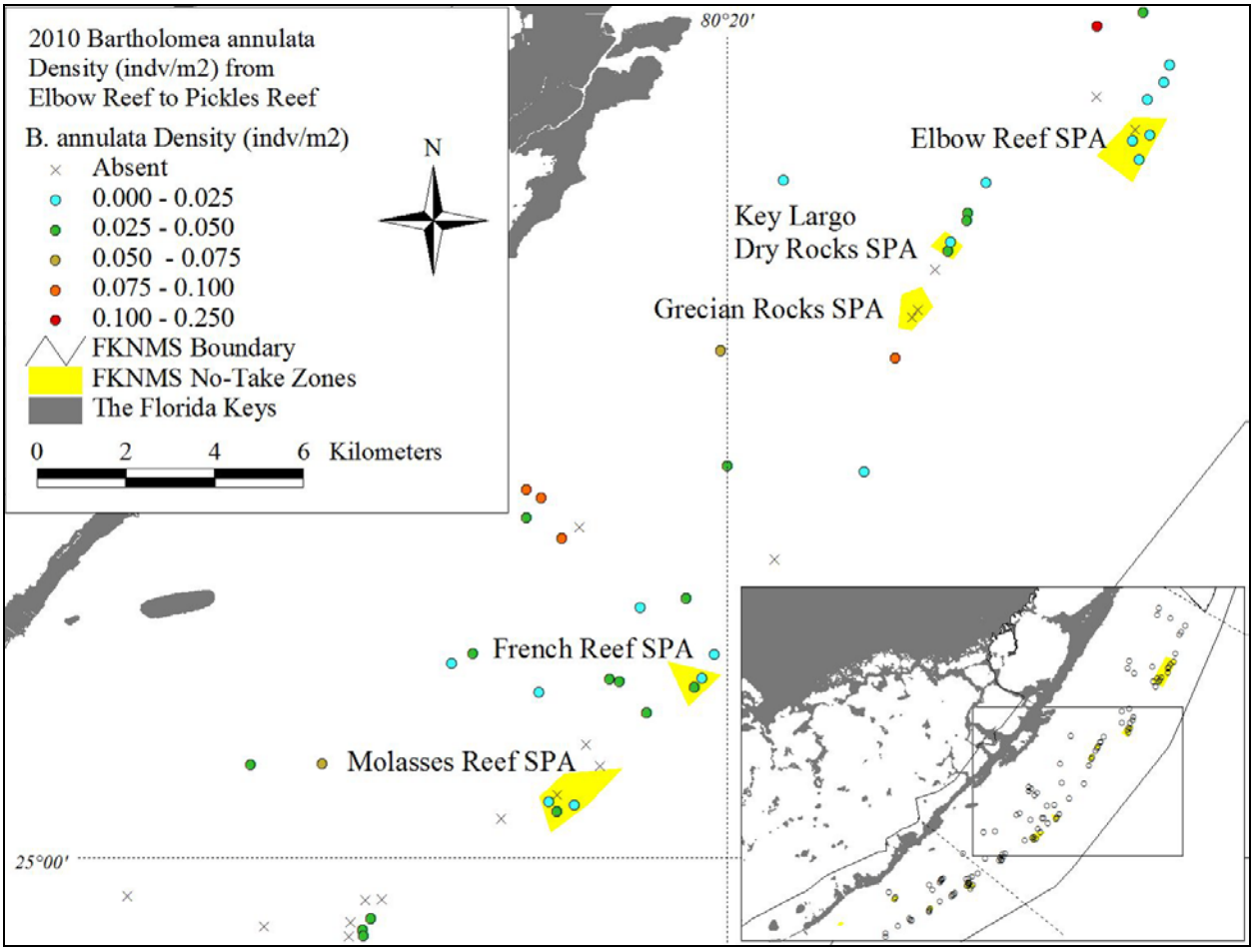


Figure 6-4. Densities (no. per m^2) of corkscrew anemones (*Bartholomea annulata*) in the upper Florida Keys National Marine Sanctuary from Conch Reef SPA to Crocker Reef surveyed during June-August 2010.

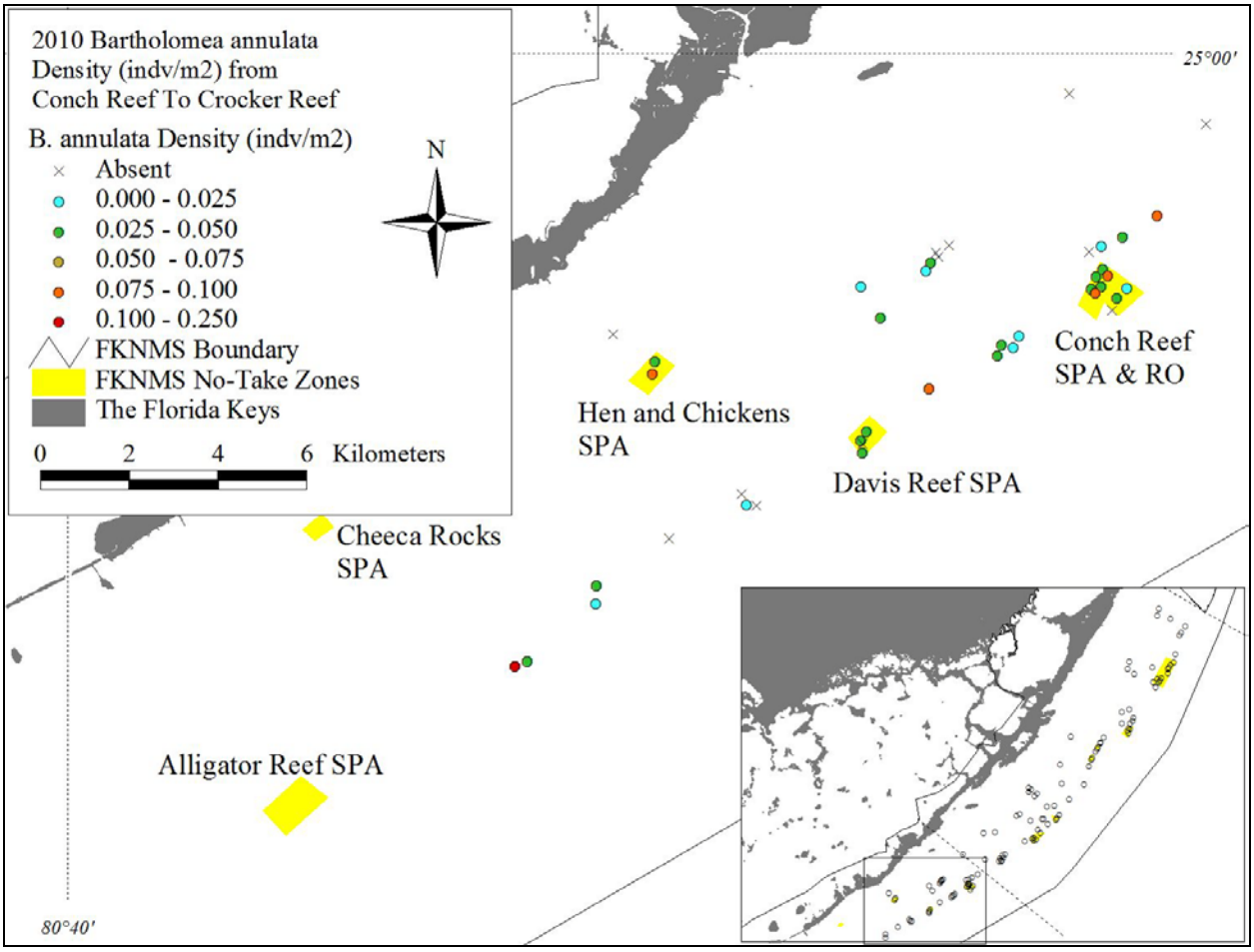
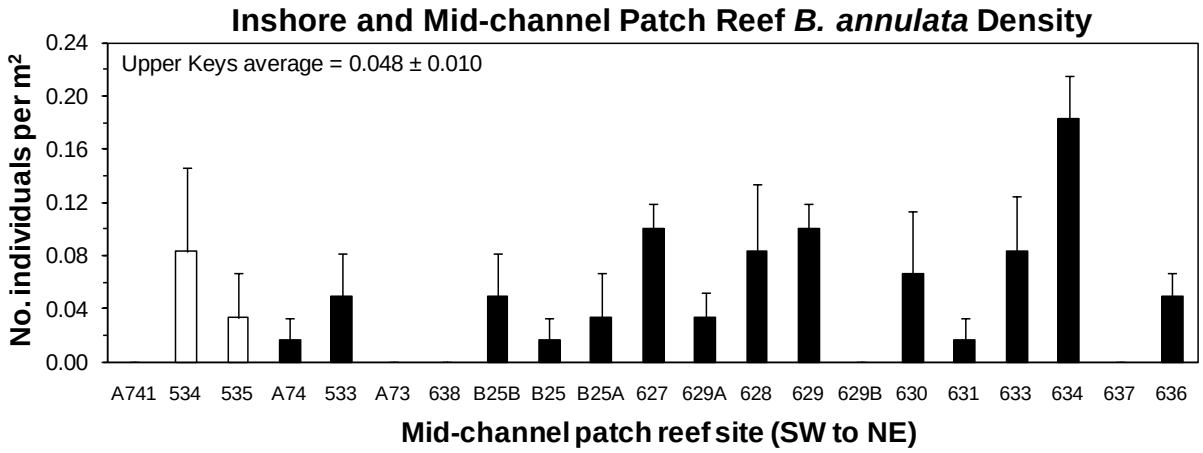
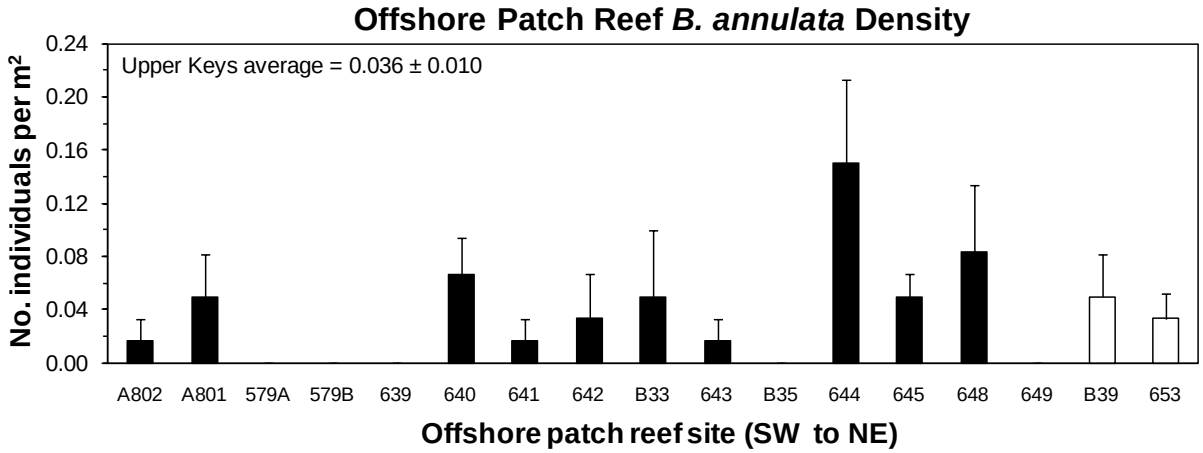


Figure 6-5. Mean (+ 1 SE) densities (no. per m^2) of corkscrew anemones (*Bartholomea annulata*) on inshore and mid-channel patch reefs (top), offshore patch reefs (middle, and back reef rubble habitats in the upper Florida Keys during June-August 2010. Open bars = FKNMS no-take zones; filled bars = reference areas.





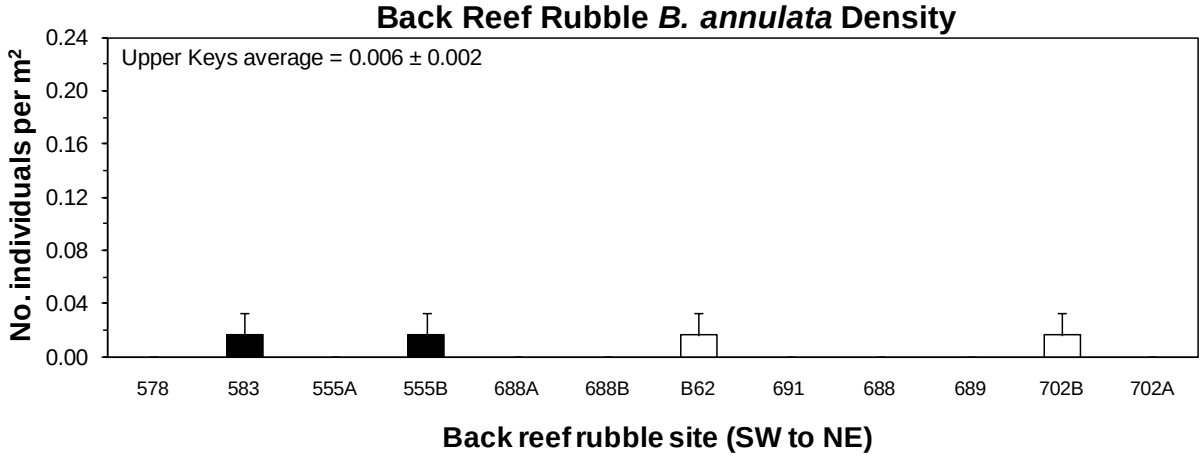


Figure 6-6. Mean (+ 1 SE) densities (no. per m^2) of corkscrew anemones (*Bartholomea annulata*) on shallow (< 6 m) hard-bottom (top), high-relief spur and groove reefs (middle) and deeper (6-15 m) fore reef habitats (bottom) in the upper Florida Keys during June-August 2010. Open bars = FKNMS no-take zones; filled bars = reference areas.

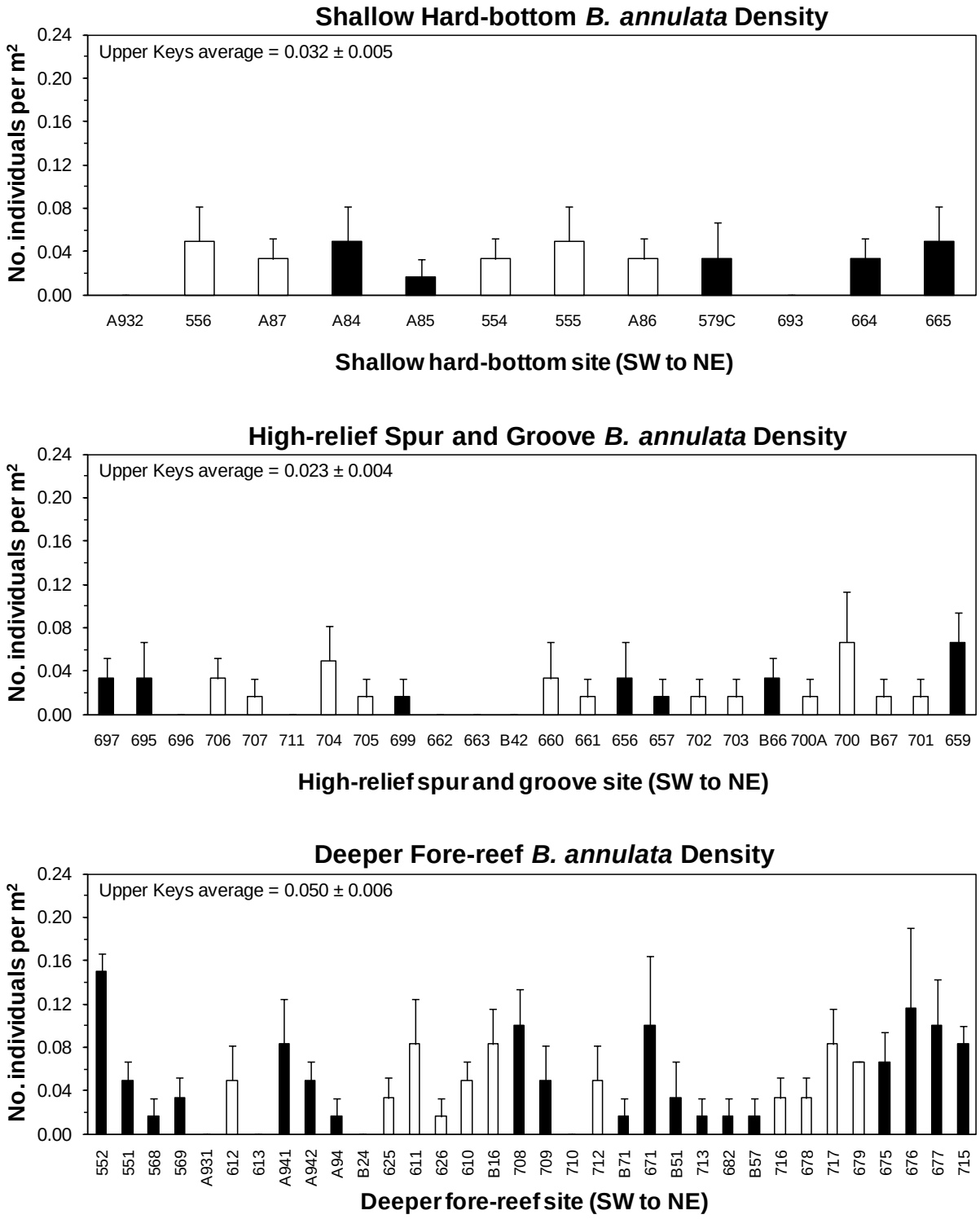
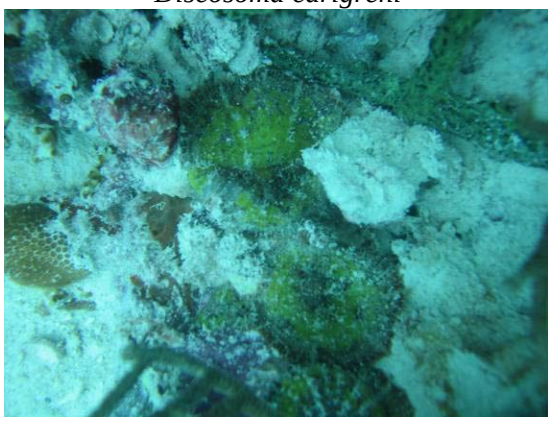


Figure 6-7. Corallimorpharians (Cnidaria, Anthozoa, Corallimorpharia) surveyed for presence-absence, density and habitat distribution in the upper Florida Keys National Marine Sanctuary during June-August 2010. Note that *Discosoma sanctithomae* was not encountered in the upper Keys during 2010.

Discosoma carlgreni

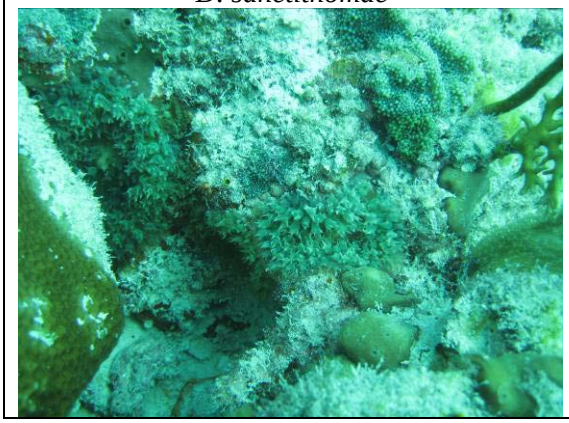


Ricordea florida

D. sanctithomae

R. florida

D. sanctithomae



R. florida

Figure 6-8. Densities (no. per m^2) of the Florida corallimorph (*Ricordea florida*) in the upper Florida Keys National Marine Sanctuary from the southern BNP boundary to Carysfort/S. Carysfort SPA surveyed during June-August 2010.

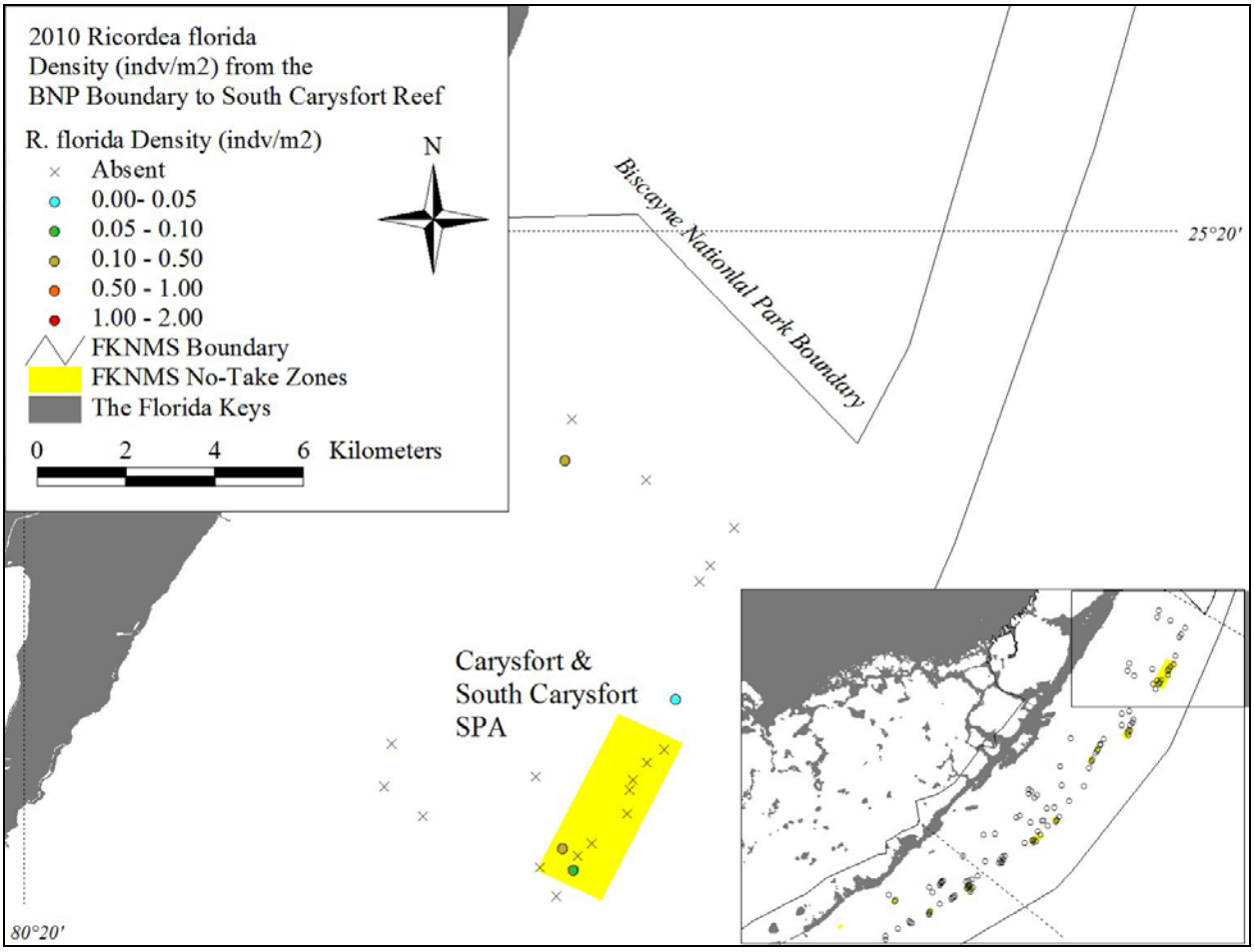


Figure 6-9. Densities (no. per m^2) of the Florida corallimorph (*Ricordea florida*) in the upper Florida Keys National Marine Sanctuary from Elbow Reef to Pickles Reef surveyed during June-August 2010.

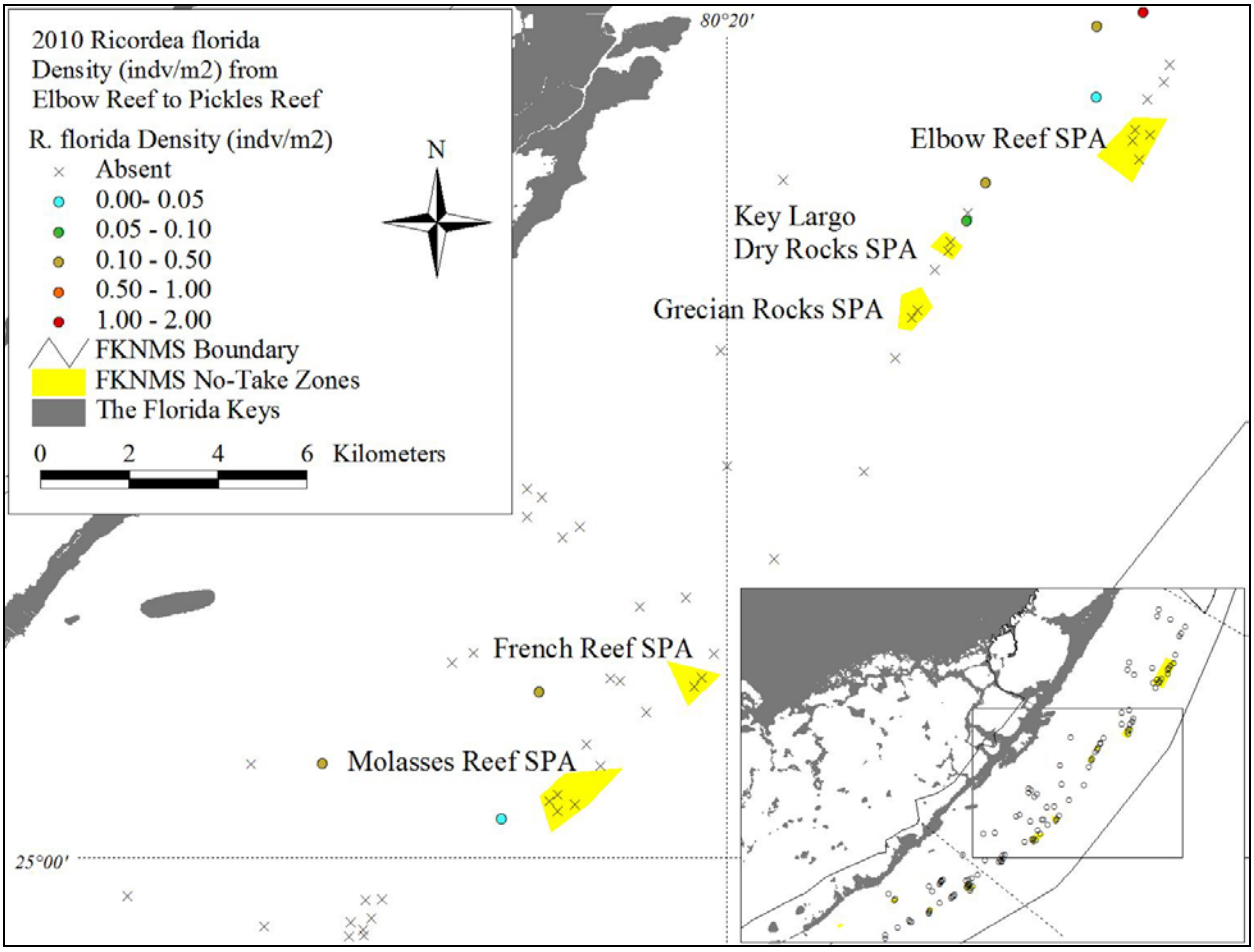


Figure 6-10. Densities (no. per m^2) of the Florida corallimorph (*Ricordea florida*) in the upper Florida Keys National Marine Sanctuary from Conch Reef SPA to Crocker Reef surveyed during June-August 2010.

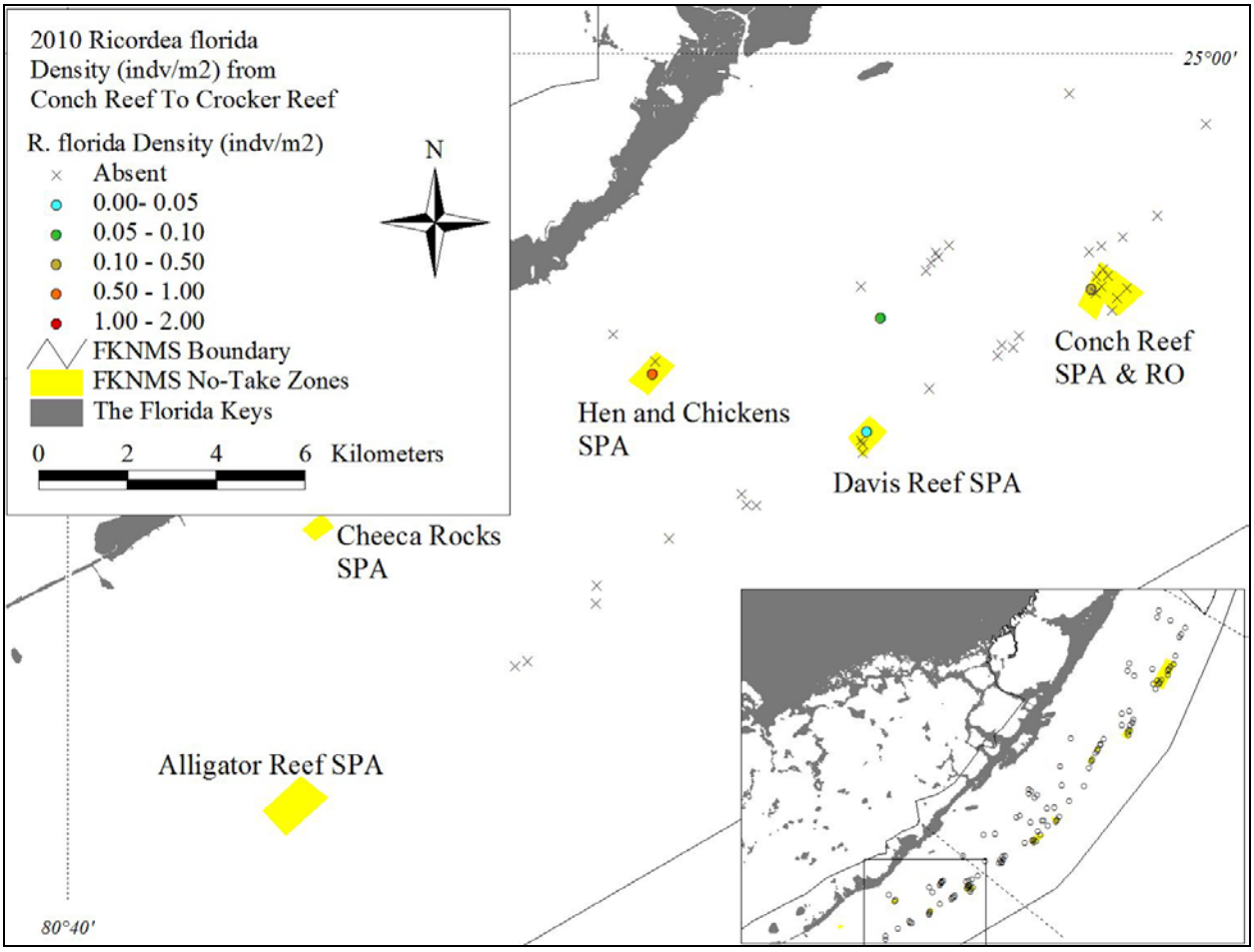
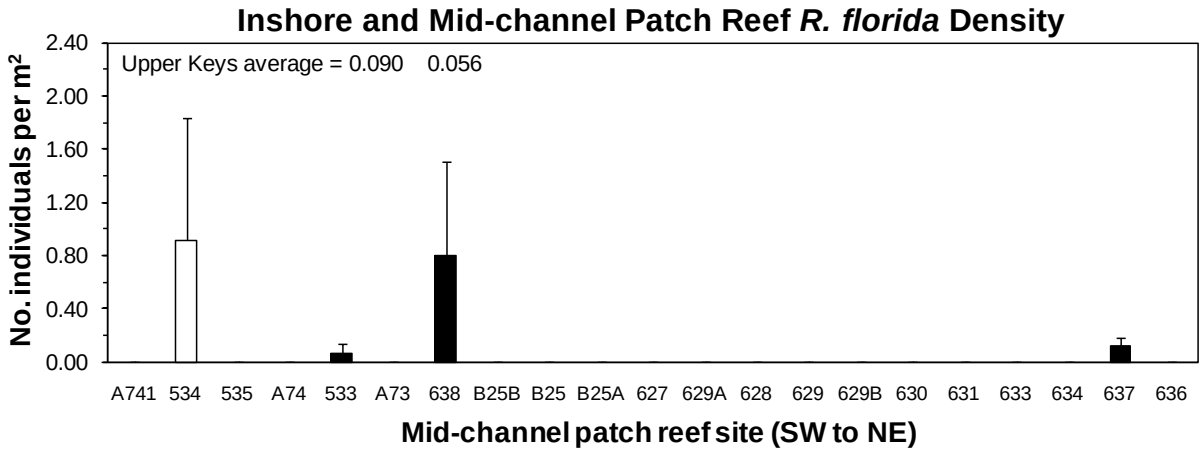
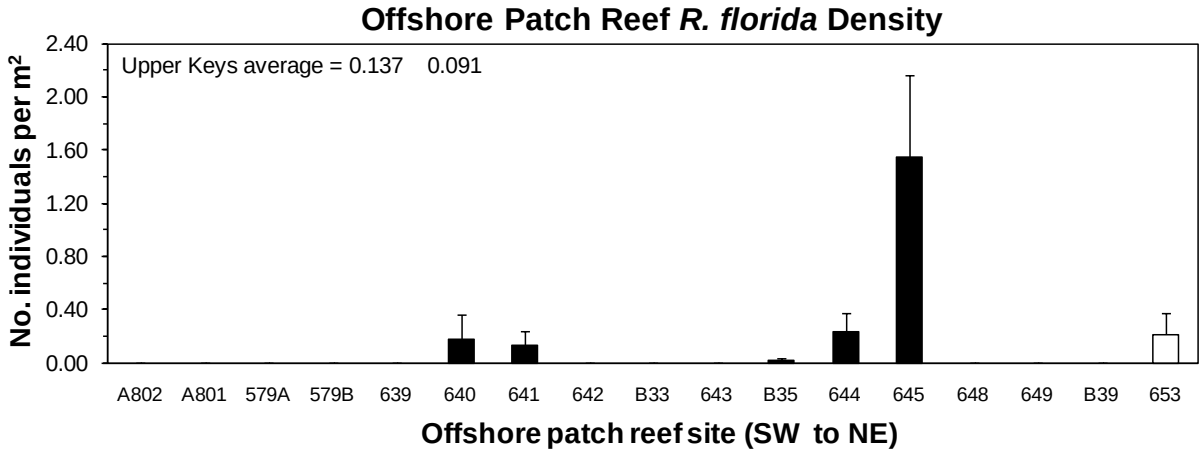


Figure 6-11. Mean (+ 1 SE) densities (no. per m^2) of the Florida corallimorph (*Ricordea florida*) on inshore and mid-channel patch reefs (top), offshore patch reefs (middle, and back reef rubble habitats in the upper Florida Keys during June-August 2010. Open bars = FKNMS no-take zones; filled bars = reference areas.





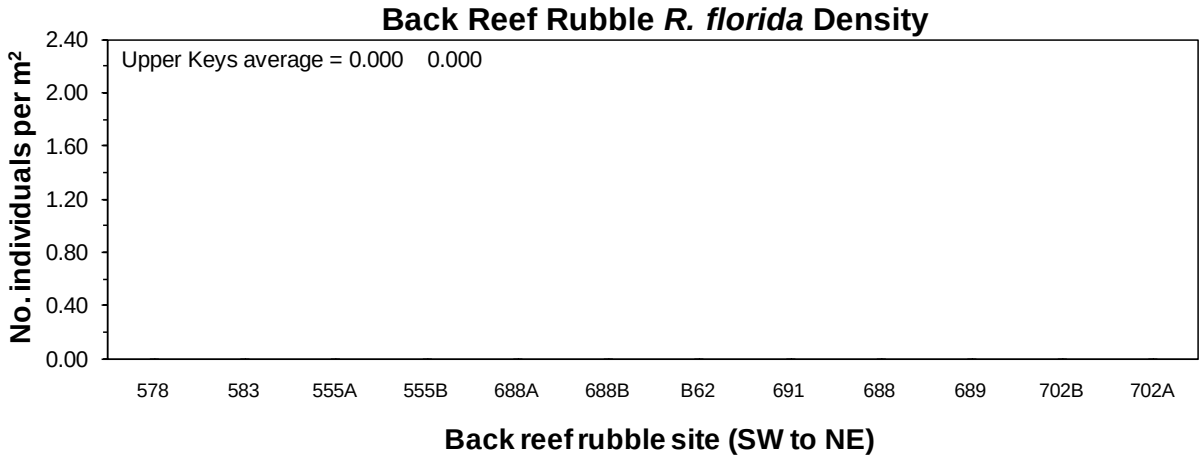


Figure 6-12. Mean (+ 1 SE) densities (no. per m^2) of the Florida corallimorph (*Ricordea florida*) on shallow (< 6 m) hard-bottom (top), high-relief spur and groove reefs (middle) and deeper (6-15 m) fore reef habitats (bottom) in the upper Florida Keys during June-August 2010. Open bars = FKNMS no-take zones; filled bars = reference areas.

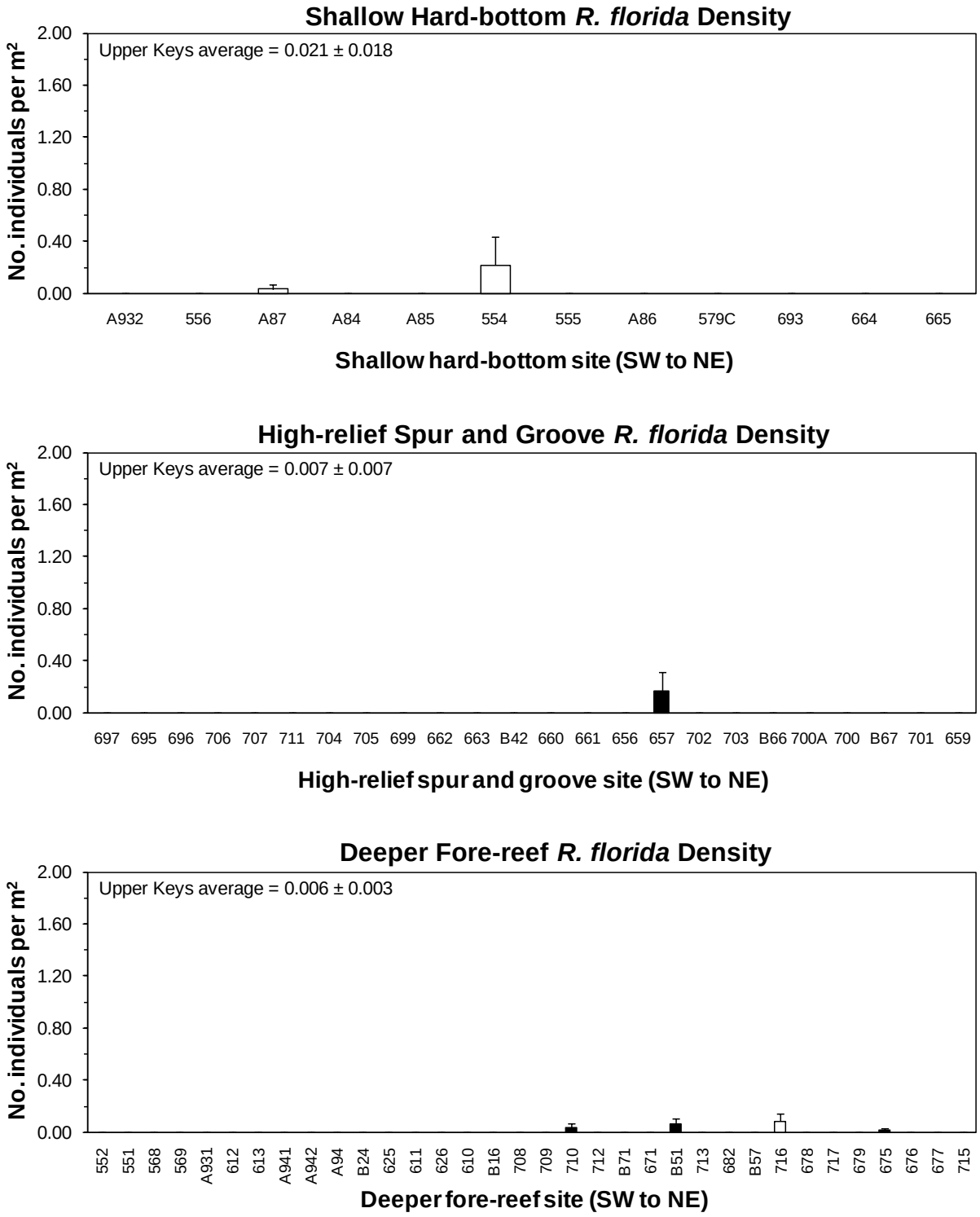


Table 6-1. Mean ± 1 SE proportional station frequencies, densities (no. individuals per m^2) and numbers of individuals recorded (N) for the anemones *Bartholomea annulata* and *Condylactis gigantea* in the upper Florida Keys National Marine Sanctuary, as determined from surveys of four 15-m x 1-m belt transects per site at 120 sites during June-August 2010. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	***Bartholomea annulata***			***Condylactis gigantea***		
	Frequency	**N**	**No./m^2**	**Frequency**	**N**	**No./m^2**
Inshore and mid-channel patch reefs						
Middle Florida Keys						
A741 – Tavernier Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
534 – Hen and Chickens SPA**	50 ± 29	5	0.083 ± 0.063	0 ± 0	0	0 ± 0
535 – Hen and Chickens SPA**	25 ± 25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
A74 – West of Conch Reef	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
533 – West of Conch Reef	50 ± 29	3	0.050 ± 0.032	25 ± 25	1	0.017 ± 0.017
A73 – West of Conch Reef	0 ± 0	0	0 ± 0	25 ± 25	1	0.017 ± 0.017
Middle Florida Keys Total (6)	25 ± 9	11	0.031 ± 0.013	8 ± 5	2	0.006 ± 0.004
Upper Florida Keys						
638 – Inshore of Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B25B – Inshore of Molasses Reef	50 ± 29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
B25 – Inshore of Molasses Reef	25 ± 25	1	0.017 ± 0.017	25 ± 25	1	0.017 ± 0.017
B25A – Inshore of Molasses Reef	25 ± 25	2	0.033 ± 0.033	25 ± 25	1	0.017 ± 0.017
627 – Mosquito Bank	100 ± 0	6	0.100 ± 0.019	25 ± 25	1	0.017 ± 0.017
629A – Mosquito Bank	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
628 – Mosquito Bank	50 ± 29	5	0.083 ± 0.050	25 ± 25	1	0.017 ± 0.017
629 – Mosquito Bank	100 ± 0	6	0.100 ± 0.019	0 ± 0	0	0 ± 0
629B – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
630 – SE of Cannon Patch Reef	50 ± 29	4	0.067 ± 0.047	0 ± 0	0	0 ± 0
631 – Marker 33	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
633 – Basin Hill Shoals	75 ± 25	5	0.083 ± 0.042	50 ± 29	2	0.033 ± 0.019
634 – Basin Hill Shoals	100 ± 0	11	0.183 ± 0.032	50 ± 29	2	0.033 ± 0.019
637 – West of Turtle Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
636 – West of Turtle Rocks	75 ± 25	3	0.050 ± 0.017	25 ± 25	1	0.017 ± 0.017
Upper Florida Keys Total (15)	48 ± 9	49	0.054 ± 0.013	0 ± 0	9	0.010 ± 0.003
Mid-channel Patch Reef Total (21)	**42 ± 7**	**60**	**0.048 ± 0.010**	**0 ± 0**	**11**	**0.009 ± 0.002**
Offshore patch reefs						
Middle Florida Keys						
A802 – Inshore of Conch Reef	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
A801 – Inshore of Conch Reef	50 ± 29	3	0.050 ± 0.032	25 ± 25	1	0.017 ± 0.017
579A – Inshore of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
579B – Inshore of Conch Reef	0 ± 0	0	0 ± 0	25 ± 25	1	0.017 ± 0.017
Middle Florida Keys Total (4)	19 ± 12	4	0.017 ± 0.012	13 ± 7	2	0.008 ± 0.005
Upper Florida Keys						
639 – Inshore of Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
640 – White Bank (West of Molasses)	75 ± 25	4	0.067 ± 0.027	0 ± 0	0	0 ± 0
641 – White Bank (West of Molasses)	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
642 – SE of White Bank Dry Rocks	25 ± 25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
B33 – East of White Bank Dry Rocks	25 ± 25	3	0.050 ± 0.050	0 ± 0	0	0 ± 0
643 – White Bank (NW of French)	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
B35 – West of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
644 – Watson's Reef	100 ± 0	9	0.150 ± 0.063	0 ± 0	0	0 ± 0
645 – Watson's Reef	75 ± 25	3	0.050 ± 0.017	0 ± 0	0	0 ± 0
648 – East of Basin Hill Shoals	50 ± 29	5	0.083 ± 0.050	50 ± 29	3	0.050 ± 0.032
649 – West of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B39 – Carysfort Reef SPA**	50 ± 29	3	0.050 ± 0.032	25 ± 25	1	0.017 ± 0.017

Site number/site location	*Bartholomea annulata*			*Condylactis gigantea*		
	Frequency	**N**	**No./m^2**	**Frequency**	**N**	**No./m^2**
653 – Carysfort Reef SPA**	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
Upper Florida Keys Total (13)	38 ± 9	33	0.042 ± 0.012	6 ± 4	4	0.005 ± 0.004
Offshore Patch Reef Total (17)	**34 ± 7**	**37**	**0.036 ± 0.010**	**7 ± 4**	**6**	**0.006 ± 0.003**
Back reef rubble						
Middle Florida Keys						
578 – Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
583 – Crocker Reef	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
555A – Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
555B – Conch Reef	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	13 ± 7	2	0.008 ± 0.005	0 ± 0	0	0 ± 0
Upper Florida Keys						
688A – Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
688B – Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B62 – Molasses Reef SPA**	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
691 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
688 – Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
689 – Inshore of Dixie Shoal	0 ± 0	0	0 ± 0	25 ± 25	1	0.017 ± 0.017
702B – Elbow Reef SPA**	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
702A – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (8)	6 ± 4	2	0.004 ± 0.003	3 ± 3	1	0.002 ± 0.002
Back Reef Rubble Total (12)	**8 ± 4**	**4**	**0.006 ± 0.002**	**2 ± 2**	**1**	**0.001 ± 0.001**
Low-relief hard-bottom (< 6 m)						
Middle Florida Keys						
A932 – Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
556 – Davis Reef SPA**	50 ± 29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
A87 – Davis Reef SPA**	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
A84 – Little Conch Reef	50 ± 29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
A85 – Little Conch Reef	25 ± 25	1	0.017 ± 0.017	25 ± 25	1	0.017 ± 0.017
554 – Conch Reef C1**	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
555 – Conch Reef C2**	50 ± 29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
A86 – Conch Reef C3**	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
579C – NE of Conch Reef	25 ± 25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
Middle Florida Keys Total (9)	39 ± 6	18	0.033 ± 0.006	3 ± 3	1	0.002 ± 0.002
Upper Florida Keys						
693 – Little Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
664 – North of French Reef	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
665 – Inshore of Dixie Shoal	50 ± 29	3	0.050 ± 0.032	50 ± 29	2	0.033 ± 0.019
Upper Florida Keys Total (3)	0 ± 0	5	0.028 ± 0.015	17 ± 17	2	0.011 ± 0.011
Shallow Hard-bottom Total (17)	**0 ± 0**	**23**	**0.032 ± 0.005**	**6 ± 4**	**3**	**0.004 ± 0.003**
High-relief spur and groove						
Upper Florida Keys						
697 – Pickles Reef P1	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
695 – Pickles Reef P3	25 ± 25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
696 – NE Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
706 – Molasses Reef SPA**	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
707 – Molasses Reef SPA**	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
711 – Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
704 – French Reef SPA**	50 ± 29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
705 – French Reef SPA**	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
699 – North of French Reef	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
662 – Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	*Bartholomea annulata*			*Condylactis gigantea*		
	Frequency	**N**	**No./m^2**	**Frequency**	**N**	**No./m^2**
663 – Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B42 – Little Grecian Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
660 – Key Largo Dry Rocks**	25 ± 25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
661 – Key Largo Dry Rocks**	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
656 – North Dry Rocks	25 ± 25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
657 – North-North Dry Rocks	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
702 – Elbow Reef SPA**	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
703 – Elbow Reef SPA**	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
B66 – South of S. Carysfort	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
700A – South Carysfort Reef**	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
700 – South Carysfort Reef**	50 ± 29	4	0.067 ± 0.047	0 ± 0	0	0 ± 0
B67 – Carysfort Reef C2**	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
701 – Carysfort Reef C5**	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
659 – Turtle Reef	75 ± 25	4	0.067 ± 0.027	0 ± 0	0	0 ± 0
Upper Florida Keys Total (24)	27 ± 4	33	0.023 ± 0.004	0 ± 0	0	0 ± 0
High-relief Spur & Groove Total (42)	**27 ± 4**	**33**	**0.023 ± 0.004**	**0 ± 0**	**0**	**0 ± 0**
Deeper Fore-reef (6-15 m)						
Middle Florida Keys						
552 – SW of Crocker Reef	75 ± 25	9	0.150 ± 0.017	0 ± 0	0	0 ± 0
551 – SW of Crocker Reef	75 ± 25	3	0.050 ± 0.017	0 ± 0	0	0 ± 0
568 – SW of Crocker Reef	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
569 – SW of Crocker Reef	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
A931 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
612 – Davis Reef SPA**	50 ± 29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
613 – Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A941 – North of Davis Reef	75 ± 25	5	0.083 ± 0.042	0 ± 0	0	0 ± 0
A942 – Little Conch Reef	75 ± 25	3	0.050 ± 0.017	0 ± 0	0	0 ± 0
A94 – Little Conch Reef	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
B24 – Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
625 – Conch Reef RO**	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
611 – Conch Reef SPA**	75 ± 25	5	0.083 ± 0.042	0 ± 0	0	0 ± 0
626 – Conch Reef RO**	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
610 – Conch Reef SPA**	75 ± 25	3	0.050 ± 0.017	0 ± 0	0	0 ± 0
B16 – Conch Reef SPA**	75 ± 25	5	0.083 ± 0.032	0 ± 0	0	0 ± 0
Middle Florida Keys Total (16)	47 ± 8	43	0.045 ± 0.010	0 ± 0	0	0 ± 0
Upper Florida Keys						
708 – NE of Conch Reef	100 ± 0	6	0.100 ± 0.033	0 ± 0	0	0 ± 0
709 – Pickles Reef	50 ± 29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
710 – SW of Molasses Reef SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
712 – SW of French Reef	50 ± 29	3	0.050 ± 0.032	0 ± 0	0	0 ± 0
B71 – Dixie Shoal	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
671 – South of Grecian Rocks	50 ± 29	6	0.100 ± 0.064	0 ± 0	0	0 ± 0
B51 – East of Dry Rocks	25 ± 25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
713 – North of Elbow Reef	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
682 – North of Elbow Reef	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
B57 – SE of Watson's Reef	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
716 – South Carysfort Reef**	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
678 – North Carysfort Reef**	50 ± 29	2	0.033 ± 0.019	0 ± 0	0	0 ± 0
717 – North Carysfort Reef**	75 ± 25	5	0.083 ± 0.032	0 ± 0	0	0 ± 0
679 – North Carysfort Reef**	100 ± 0	4	0.067 ± 0.000	0 ± 0	0	0 ± 0
675 – North of Carysfort Reef	75 ± 25	4	0.067 ± 0.027	0 ± 0	0	0 ± 0
676 – North of Carysfort Reef	75 ± 25	7	0.117 ± 0.074	0 ± 0	0	0 ± 0
677 – North of Carysfort Reef	75 ± 25	6	0.100 ± 0.043	25 ± 25	1	0.017 ± 0.017
715 – North of Carysfort Reef	100 ± 0	5	0.083 ± 0.017	50 ± 29	2	0.033 ± 0.019
Upper Florida Keys Total (18)	54 ± 7	59	0.055 ± 0.009	4 ± 3	3	0.003 ± 0.002
Deeper Fore-reef Total (34)	**51 ± 5**	**102**	**0.050 ± 0.006**	**2 ± 2**	**3**	**0.001 ± 0.001**

Table 6-2. Mean ± 1 SE proportional station frequencies, densities (no. individuals per m^2) and numbers of individuals recorded (N) for the anemones *Epicystes crucifera* and *Lebrunia danae* in the upper Florida Keys National Marine Sanctuary, as determined from surveys of four 15-m x 1-m belt transects per site at 120 sites during June-August 2010. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	***Epicystes crucifera***			***Lebrunia danae***		
	Frequency	**N**	**No./m^2**	**Frequency**	**N**	**No./m^2**
Inshore and mid-channel patch reefs						
Middle Florida Keys						
A741 – Tavernier Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
534 – Hen and Chickens SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
535 – Hen and Chickens SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A74 – West of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
533 – West of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A73 – West of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (6)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
638 – Inshore of Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B25B – Inshore of Molasses Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B25 – Inshore of Molasses Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B25A – Inshore of Molasses Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
627 – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
629A – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
628 – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
629 – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
629B – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
630 – SE of Cannon Patch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
631 – Marker 33	0 ± 0	0	0 ± 0	50 ± 29	4	0.067 ± 0.047
633 – Basin Hill Shoals	0 ± 0	0	0 ± 0	25 ± 25	1	0.017 ± 0.017
634 – Basin Hill Shoals	0 ± 0	0	0 ± 0	25 ± 25	1	0.017 ± 0.017
637 – West of Turtle Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
636 – West of Turtle Rocks	0 ± 0	0	0 ± 0	25 ± 25	1	0.017 ± 0.017
Upper Florida Keys Total (15)	0 ± 0	0	0 ± 0	8 ± 4	7	0.008 ± 0.005
Mid-channel Patch Reef Total (21)	**0 ± 0**	**0**	**0 ± 0**	**6 ± 3**	**7**	**0.006 ± 0.003**
Offshore patch reefs						
Middle Florida Keys						
A802 – Inshore of Conch Reef	0 ± 0	0	0 ± 0	25 ± 25	1	0.017 ± 0.017
A801 – Inshore of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
579A – Inshore of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
579B – Inshore of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (4)	0 ± 0	0	0 ± 0	6 ± 6	1	0.004 ± 0.004
Upper Florida Keys						
639 – Inshore of Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
640 – White Bank (West of Molasses)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
641 – White Bank (West of Molasses)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
642 – SE of White Bank Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B33 – East of White Bank Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
643 – White Bank (NW of French)	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
B35 – West of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
644 – Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
645 – Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
648 – East of Basin Hill Shoals	0 ± 0	0	0 ± 0	25 ± 25	1	0.017 ± 0.017
649 – West of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B39 – Carysfort Reef SPA**	0 ± 0	0	0 ± 0	25 ± 25	1	0.017 ± 0.017

Site number/site location	*Epicystes crucifera*			*Lebrunia danae*		
	Frequency	**N**	**No./m^2**	**Frequency**	**N**	**No./m^2**
653 – Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (13)	2 ± 2	1	0.001 ± 0.001	4 ± 3	2	0.003 ± 0.002
Offshore Patch Reef Total (17)	**1 ± 1**	**1**	**0.001 ± 0.001**	**4 ± 2**	**3**	**0.003 ± 0.002**
Back reef rubble						
Middle Florida Keys						
578 – Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
583 – Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
555A – Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
555B – Conch Reef	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						
688A – Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
688B – Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B62 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
691 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
688 – Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
689 – Inshore of Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
702B – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
702A – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (8)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Back Reef Rubble Total (12)	**0 ± 0**	**0**	**0 ± 0**	**0 ± 0**	**0**	**0 ± 0**
Low-relief hard-bottom (< 6 m)						
Middle Florida Keys						
A932 – Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
556 – Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A87 – Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A84 – Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A85 – Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
554 – Conch Reef C1**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
555 – Conch Reef C2**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A86 – Conch Reef C3**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
579C – NE of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (9)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys						
693 – Little Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
664 – North of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
665 – Inshore of Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (3)	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**
High-relief spur and groove						
Upper Florida Keys						
697 – Pickles Reef P1	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
695 – Pickles Reef P3	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
696 – NE Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
706 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
707 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
711 – Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
704 – French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
705 – French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
699 – North of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
662 – Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	*Epicystes crucifera*			*Lebrunia danae*		
	Frequency	**N**	**No./m^2**	**Frequency**	**N**	**No./m^2**
663 – Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B42 – Little Grecian Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
660 – Key Largo Dry Rocks**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
661 – Key Largo Dry Rocks**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
656 – North Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
657 – North-North Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
702 – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
703 – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B66 – South of S. Carysfort	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
700A – South Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
700 – South Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B67 – Carysfort Reef C2**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
701 – Carysfort Reef C5**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
659 – Turtle Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (24)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
High-relief Spur & Groove Total (42)	**0 ± 0**	**0**	**0 ± 0**	**0 ± 0**	**0**	**0 ± 0**
Deeper Fore-reef (6-15 m)						
Middle Florida Keys						
552 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
551 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
568 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
569 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A931 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
612 – Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
613 – Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A941 – North of Davis Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A942 – Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A94 – Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B24 – Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
625 – Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
611 – Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
626 – Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
610 – Conch Reef SPA**	0 ± 0	0	0 ± 0	25 ± 25	1	0.017 ± 0.017
B16 – Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (16)	0 ± 0	0	0 ± 0	2 ± 2	1	0.001 ± 0.001
Upper Florida Keys						
708 – NE of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
709 – Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
710 – SW of Molasses Reef SPA	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
712 – SW of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B71 – Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
671 – South of Grecian Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B51 – East of Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
713 – North of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
682 – North of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B57 – SE of Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
716 – South Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
678 – North Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
717 – North Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
679 – North Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
675 – North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
676 – North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
677 – North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
715 – North of Carysfort 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
Deeper Fore-reef Total (34)	**0 ± 0**	**0**	**0 ± 0**	**0 ± 0**	**0**	**0 ± 0**

Table 6-3. Mean ± 1 SE proportional station frequencies, densities (no. individuals per m^2) and numbers of individuals recorded (N) for the corallimorpharians *Discosoma carlgreni* and *Ricordea florida* in the upper Florida Keys National Marine Sanctuary, as determined from surveys of four 15-m x 1-m belt transects per site at 120 sites during June-August 2010. Sites are arranged by habitat from SW to NE and asterisked locations (**) are no-take zones.

Site number/site location	*Discosoma carlgreni*			*Ricordea florida*		
	Frequency	**N**	**No./m^2**	**Frequency**	**N**	**No./m^2**
Inshore and mid-channel patch reefs						
Middle Florida Keys						
A741 – Tavernier Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
534 – Hen and Chickens SPA**	0 ± 0	0	0 ± 0	25 ± 25	55	0.917 ± 0.917
535 – Hen and Chickens SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A74 – West of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
533 – West of Conch Reef	0 ± 0	0	0 ± 0	25 ± 25	4	0.067 ± 0.067
A73 – West of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (6)	0 ± 0	0	0 ± 0	8 ± 5	59	0.164 ± 0.151
Upper Florida Keys						
638 – Inshore of Pickles Reef	0 ± 0	0	0 ± 0	75 ± 25	48	0.800 ± 0.712
B25B – Inshore of Molasses Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B25 – Inshore of Molasses Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B25A – Inshore of Molasses Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
627 – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
629A – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
628 – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
629 – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
629B – Mosquito Bank	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
630 – SE of Cannon Patch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
631 – Marker 33	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
633 – Basin Hill Shoals	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
634 – Basin Hill Shoals	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
637 – West of Turtle Rocks	0 ± 0	0	0 ± 0	50 ± 29	7	0.117 ± 0.069
636 – West of Turtle Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (15)	0 ± 0	0	0 ± 0	8 ± 6	55	0.061 ± 0.053
Mid-channel Patch Reef Total (21)	**0 ± 0**	**0**	**0 ± 0**	**8 ± 4**	**114**	**0.090 ± 0.056**
Offshore patch reefs						
Middle Florida Keys						
A802 – Inshore of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A801 – Inshore of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
579A – Inshore of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
579B – Inshore of Conch Reef	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						
639 – Inshore of Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
640 – White Bank (West of Molasses)	0 ± 0	0	0 ± 0	50 ± 29	7	0.117 ± 0.069
641 – White Bank (West of Molasses)	0 ± 0	0	0 ± 0	50 ± 29	7	0.117 ± 0.069
642 – SE of White Bank Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B33 – East of White Bank Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
643 – White Bank (NW of French)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B35 – West of Elbow Reef	0 ± 0	0	0 ± 0	50 ± 29	7	0.117 ± 0.069
644 – Watson's Reef	25 ± 25	8	0.133 ± 0.133	50 ± 29	7	0.117 ± 0.069
645 – Watson's Reef	0 ± 0	0	0 ± 0	50 ± 29	7	0.117 ± 0.069
648 – East of Basin Hill Shoals	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
649 – West of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B39 – Carysfort Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	*Discosoma carlgreni*			*Ricordea florida*		
	Frequency	**N**	**No./m^2**	**Frequency**	**N**	**No./m^2**
653 – Carysfort Reef SPA**	0 ± 0	0	0 ± 0	50 ± 29	7	0.117 ± 0.069
Upper Florida Keys Total (13)	2 ± 2	8	0.010 ± 0.010	23 ± 9	140	0.179 ± 0.117
Offshore Patch Reef Total (17)	**1 ± 1**	**8**	**0.008 ± 0.008**	**18 ± 7**	**140**	**0.137 ± 0.091**
Back reef rubble						
Middle Florida Keys						
578 – Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
583 – Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
555A – Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
555B – Conch Reef	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						
688A – Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
688B – Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B62 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
691 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
688 – Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
689 – Inshore of Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
702B – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
702A – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (8)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Back Reef Rubble Total (12)						
Low-relief hard-bottom (< 6 m)						
Middle Florida Keys						
A932 – Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
556 – Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A87 – Davis Reef SPA**	0 ± 0	0	0 ± 0	25 ± 25	2	0.033 ± 0.033
A84 – Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A85 – Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
554 – Conch Reef C1**	0 ± 0	0	0 ± 0	25 ± 25	13	0.217 ± 0.217
555 – Conch Reef C2**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A86 – Conch Reef C3**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
579C – NE of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (9)	0 ± 0	0	0 ± 0	6 ± 4	15	0.028 ± 0.024
Upper Florida Keys						
693 – Little Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
664 – North of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
665 – Inshore of Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (3)	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Shallow Hard-bottom Total (17)	**0 ± 0**	**0**	**0 ± 0**	**4 ± 3**	**15**	**0.021 ± 0.018**
High-relief spur and groove						
Upper Florida Keys						
697 – Pickles Reef P1	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
695 – Pickles Reef P3	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
696 – NE Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
706 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
707 – Molasses Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
711 – Sand Island	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
704 – French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
705 – French Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
699 – North of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
662 – Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0

Site number/site location	*Discosoma carlgreni*			*Ricordea florida*		
	Frequency	**N**	**No./m^2**	**Frequency**	**N**	**No./m^2**
663 – Grecian Rocks SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B42 – Little Grecian Rocks	25 ± 25	9	0.150 ± 0.150	0 ± 0	0	0 ± 0
660 – Key Largo Dry Rocks**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
661 – Key Largo Dry Rocks**	25 ± 25	1	0.017 ± 0.017	0 ± 0	0	0 ± 0
656 – North Dry Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
657 – North-North Dry Rocks	0 ± 0	0	0 ± 0	50 ± 29	10	0.167 ± 0.145
702 – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
703 – Elbow Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B66 – South of S. Carysfort	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
700A – South Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
700 – South Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B67 – Carysfort Reef C2**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
701 – Carysfort Reef C5**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
659 – Turtle Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (24)	2 ± 1	10	0.007 ± 0.006	2 ± 2	10	0.007 ± 0.007
High-relief Spur & Groove Total (42)	**2 ± 1**	**10**	**0.007 ± 0.006**	**2 ± 2**	**10**	**0.007 ± 0.007**
Deeper Fore-reef (6-15 m)						
Middle Florida Keys						
552 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
551 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
568 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
569 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A931 – SW of Crocker Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
612 – Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
613 – Davis Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A941 – North of Davis Reef	25 ± 25	2	0.033 ± 0.033	0 ± 0	0	0 ± 0
A942 – Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
A94 – Little Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B24 – Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
625 – Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
611 – Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
626 – Conch Reef RO**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
610 – Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B16 – Conch Reef SPA**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Middle Florida Keys Total (16)	2 ± 2	2	0.002 ± 0.002	0 ± 0	0	0 ± 0
Upper Florida Keys						
708 – NE of Conch Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
709 – Pickles Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
710 – SW of Molasses Reef SPA	0 ± 0	0	0 ± 0	25 ± 25	2	0.033 ± 0.033
712 – SW of French Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B71 – Dixie Shoal	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
671 – South of Grecian Rocks	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B51 – East of Dry Rocks	0 ± 0	0	0 ± 0	75 ± 25	4	0.067 ± 0.038
713 – North of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
682 – North of Elbow Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
B57 – SE of Watson's Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
716 – South Carysfort Reef**	0 ± 0	0	0 ± 0	50 ± 29	5	0.083 ± 0.063
678 – North Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
717 – North Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
679 – North Carysfort Reef**	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
675 – North of Carysfort Reef	0 ± 0	0	0 ± 0	25 ± 25	1	0.017 ± 0.017
676 – North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
677 – North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
715 – North of Carysfort Reef	0 ± 0	0	0 ± 0	0 ± 0	0	0 ± 0
Upper Florida Keys Total (18)	0 ± 0	0	0 ± 0	10 ± 5	12	0.011 ± 0.006
Deeper Fore-reef Total (34)	**1 ± 1**	**2**	**0.001 ± 0.001**	**5 ± 3**	**12**	**0.006 ± 0.003**