

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.

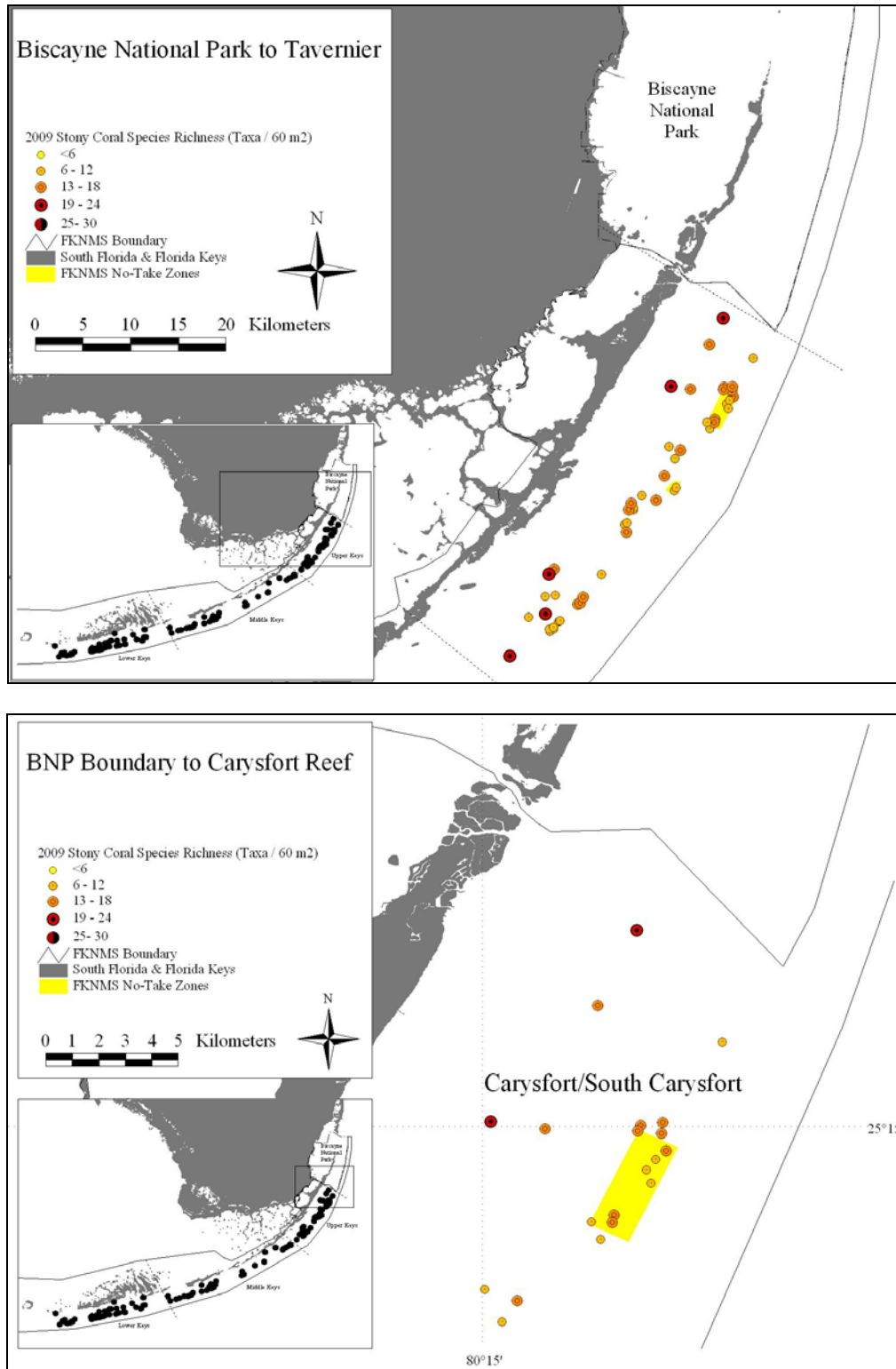


Figure 3-2. Species richness (no. taxa per 60 m²) of stony corals (Milleporina and Scleractinia) in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region during May-September 2009.

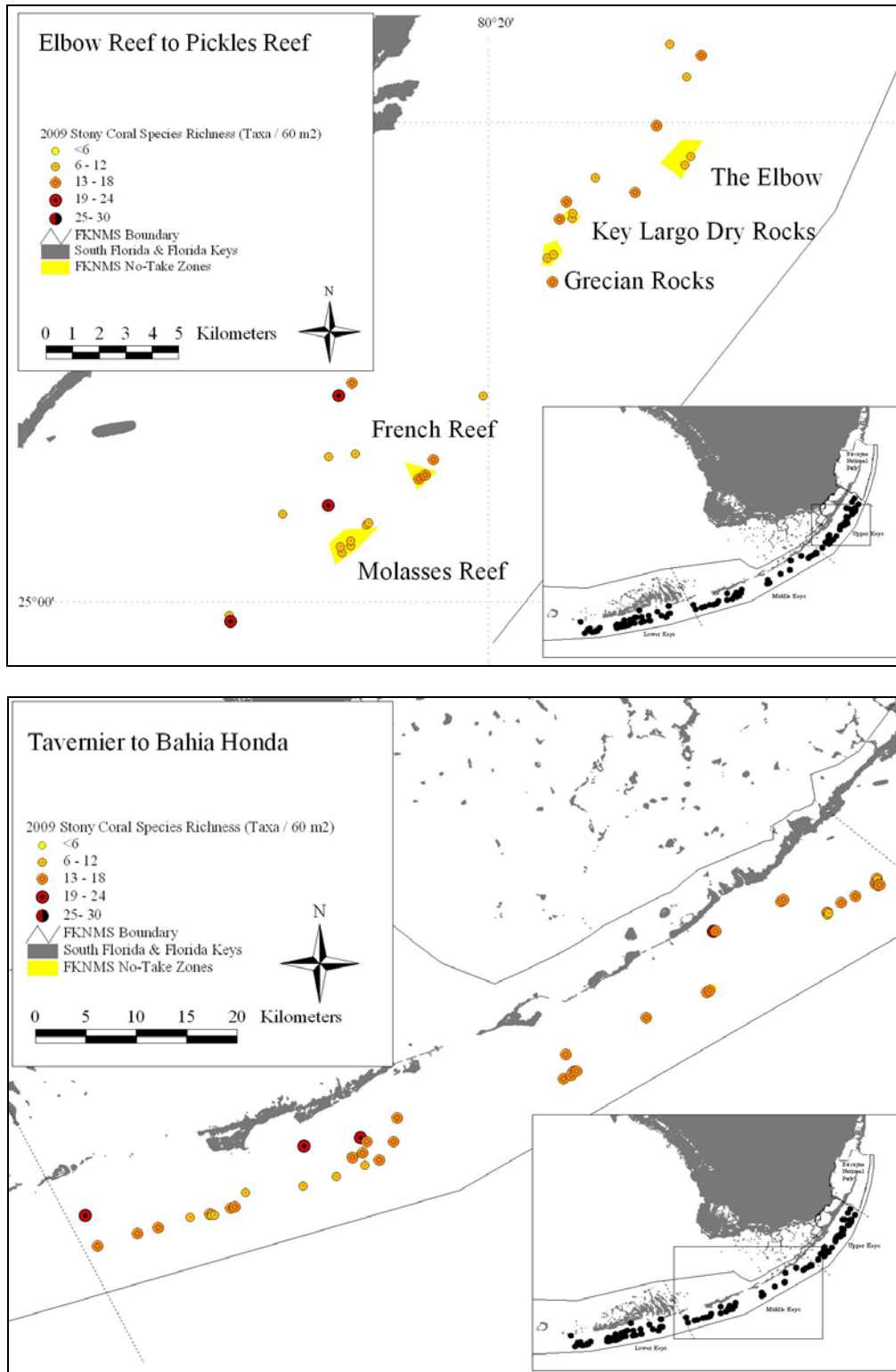


Figure 3-3. Species richness (no. taxa per 60 m²) of stony corals (Milleporina and Scleractinia) in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

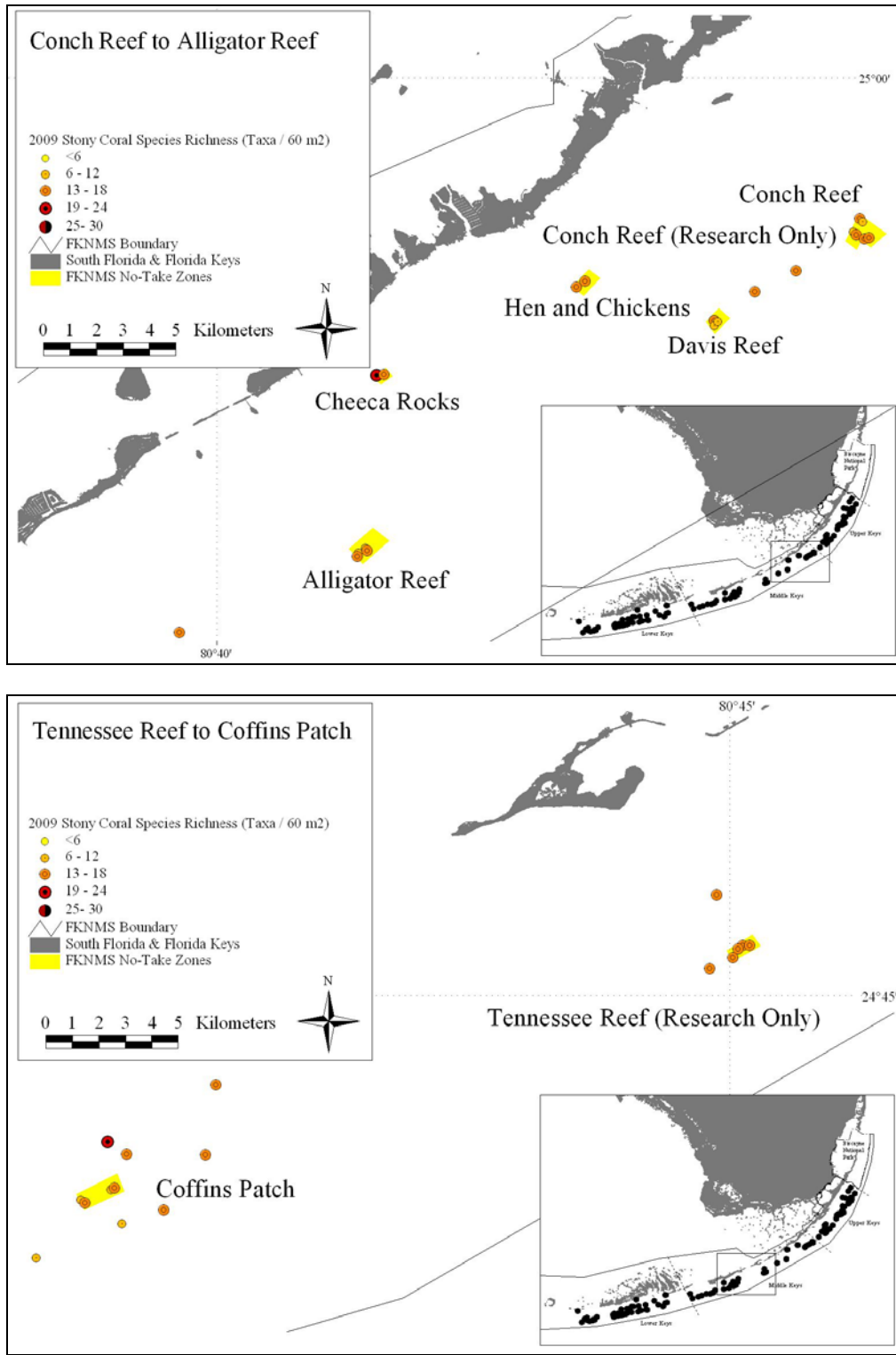


Figure 3-4. Species richness (no. taxa per 60 m²) of stony corals (*Milleporina* and *Scleractinia*) in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

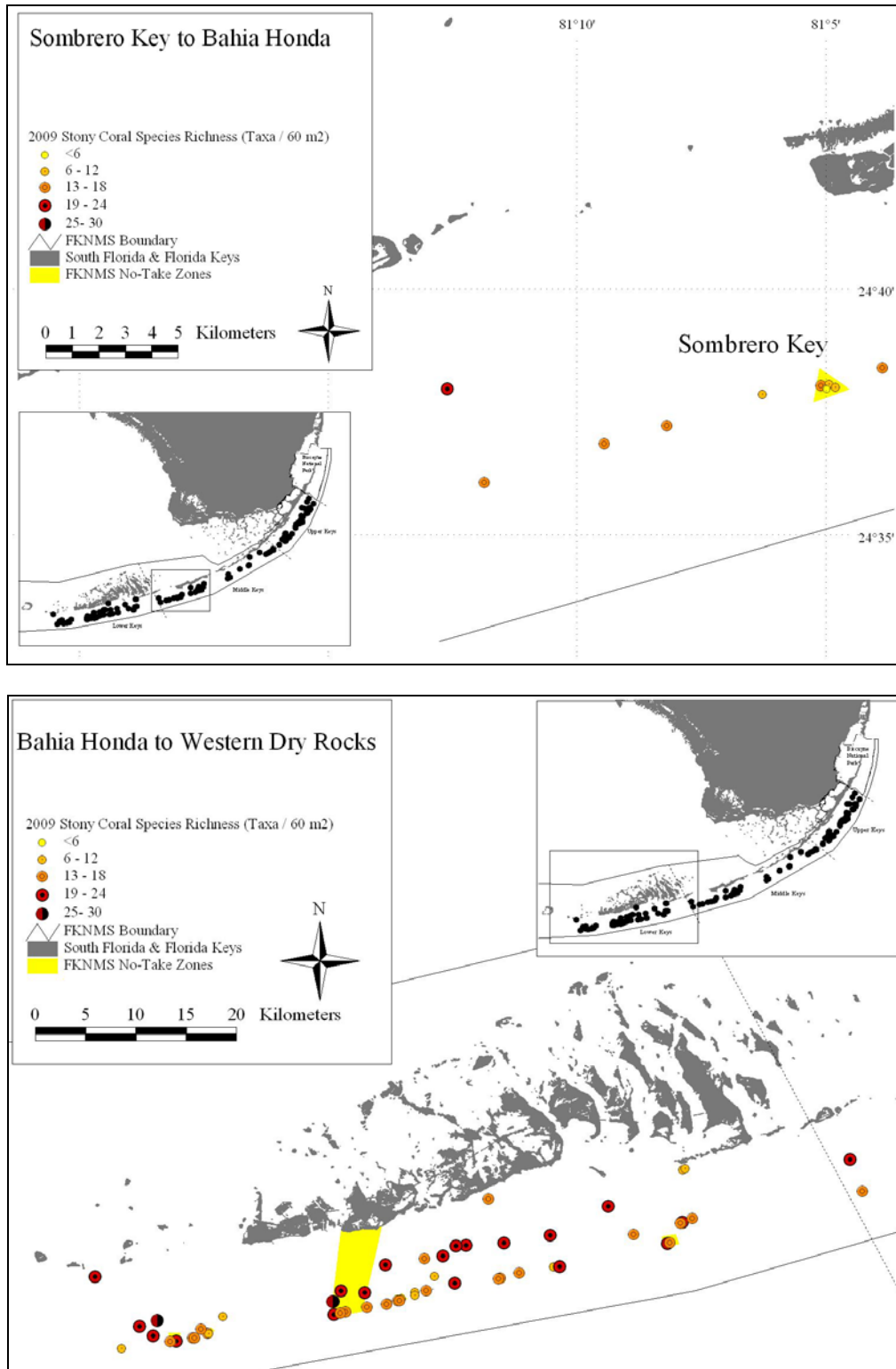


Figure 3-5. Species richness (no. taxa per 60 m²) of stony corals (*Milleporina* and *Scleractinia*) in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

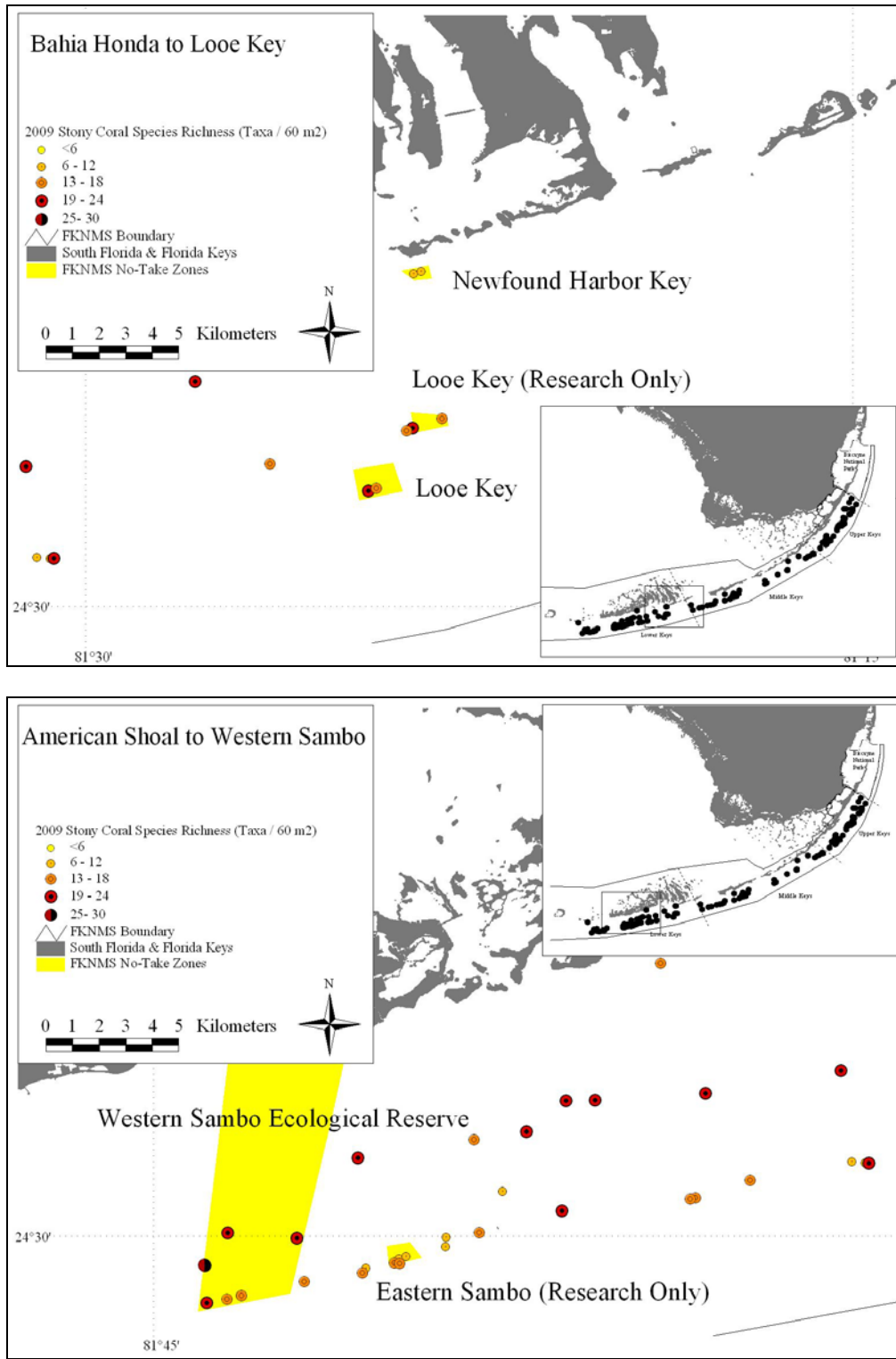


Figure 3-6. Species richness (no. taxa per 60 m²) of stony corals (*Milleporina* and *Scleractinia*) in the lower Florida Keys region from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

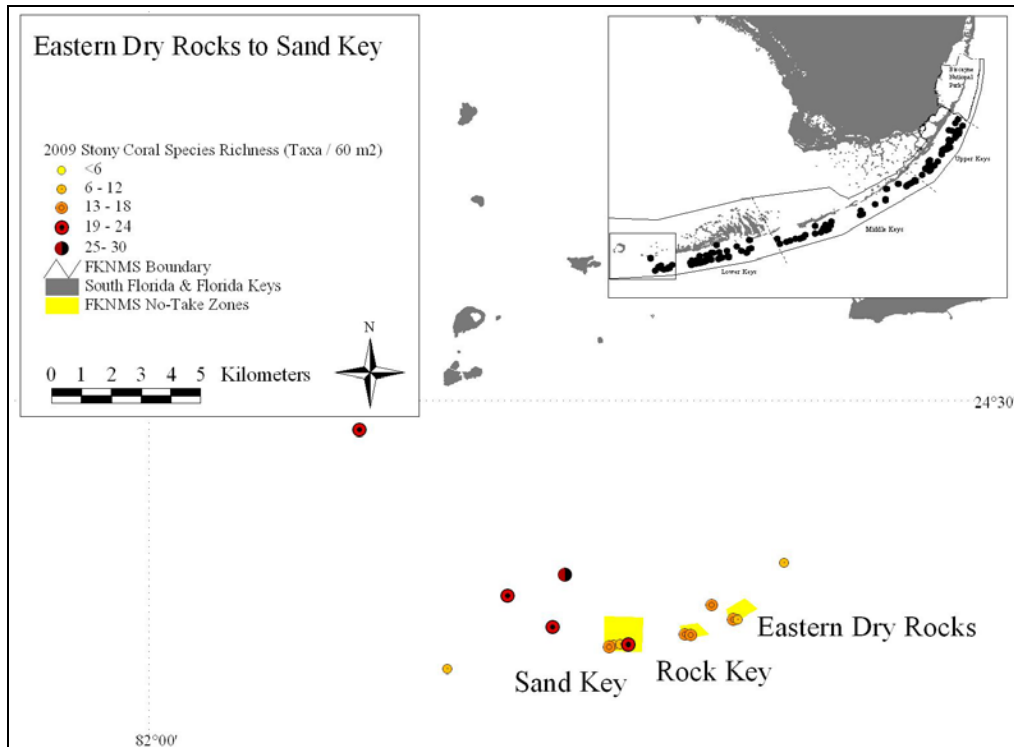


Figure 3-7. Site species richness of stony corals (Milleporina and Scleractinia) on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Data represent the total number of taxa recorded from a 60-m² sampling area. Open bars = FKNMS no-take zones;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

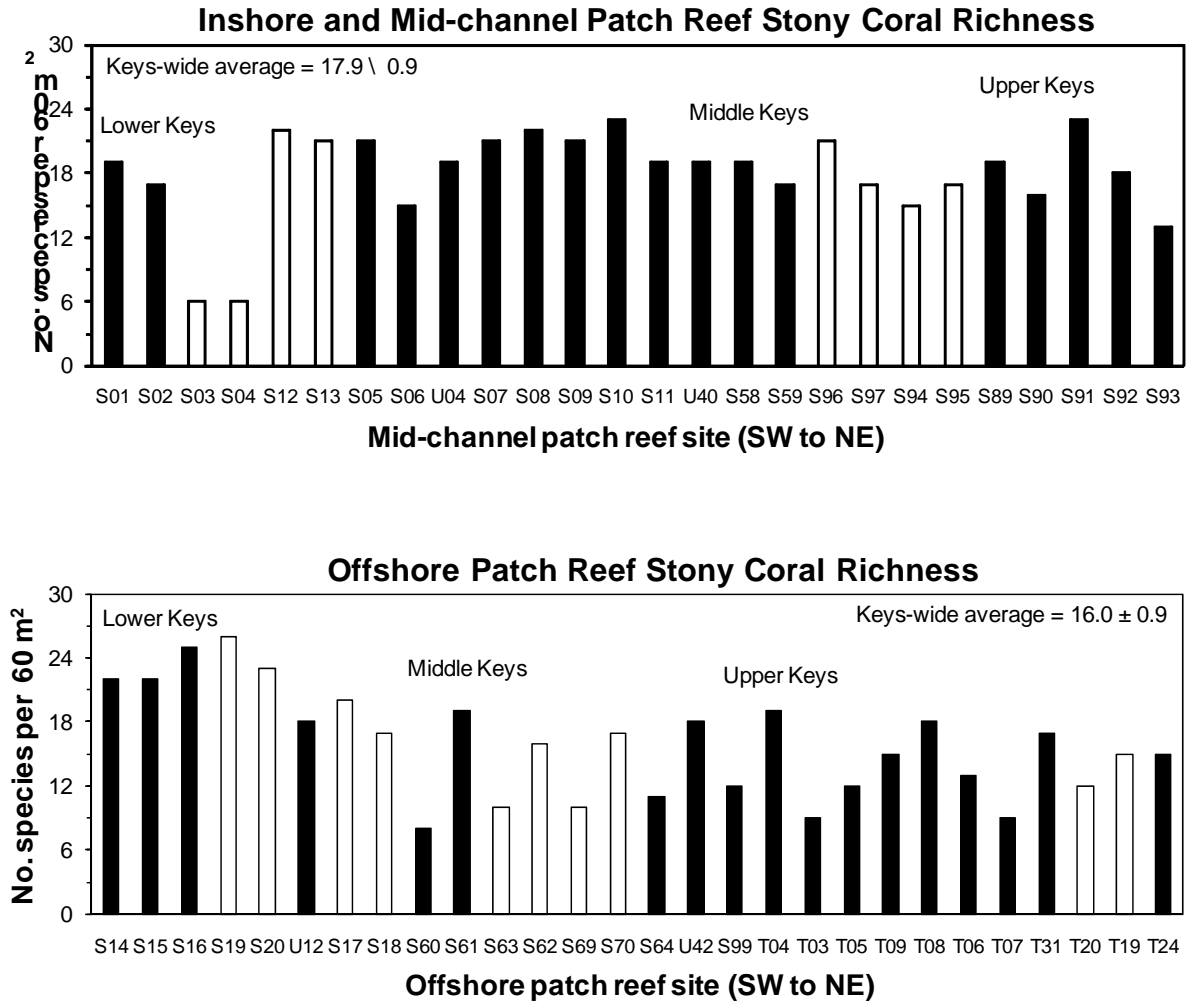


Figure 3-8. Site species richness of stony corals (Milleporina and Scleractinia) on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Data represent the total number of taxa recorded from a 60-m² sampling area. Open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

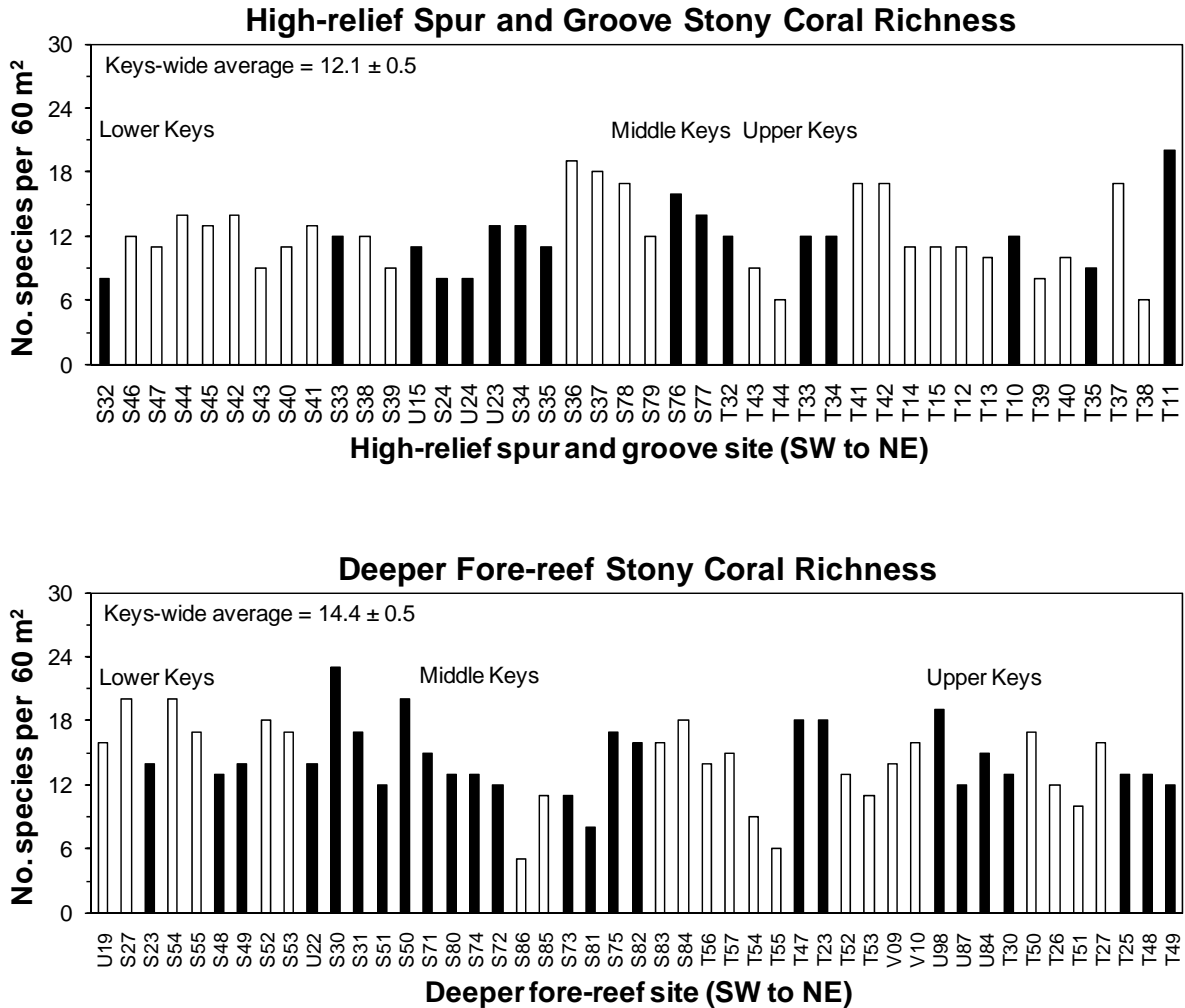


Figure 3-9. Species richness (no. taxa per 60 m²) of gorgonians (Octocorallia) in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

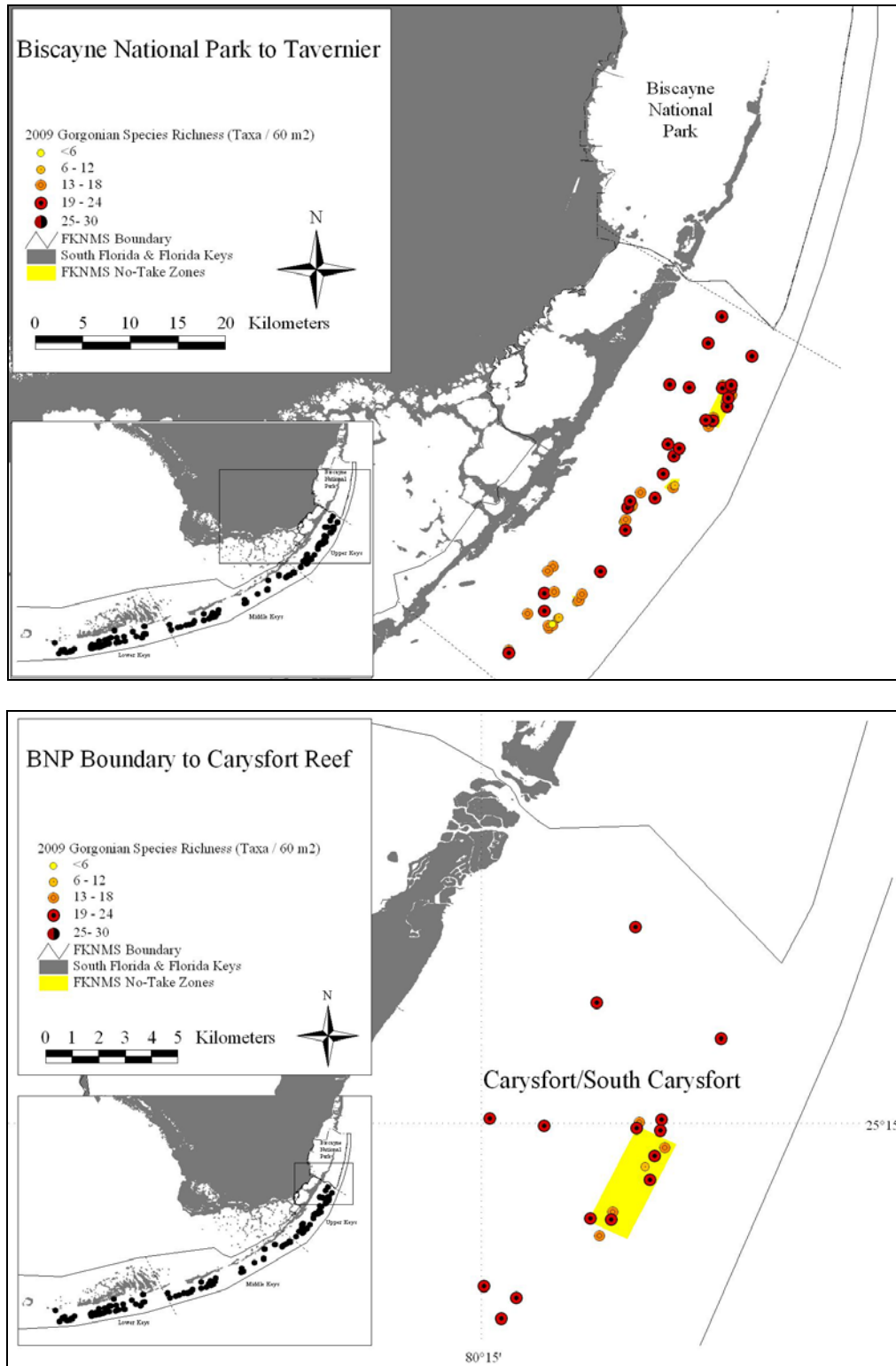


Figure 3-10. Species richness (no. taxa per 60 m²) of gorgonians (Octocorallia) in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region during May-September 2009.

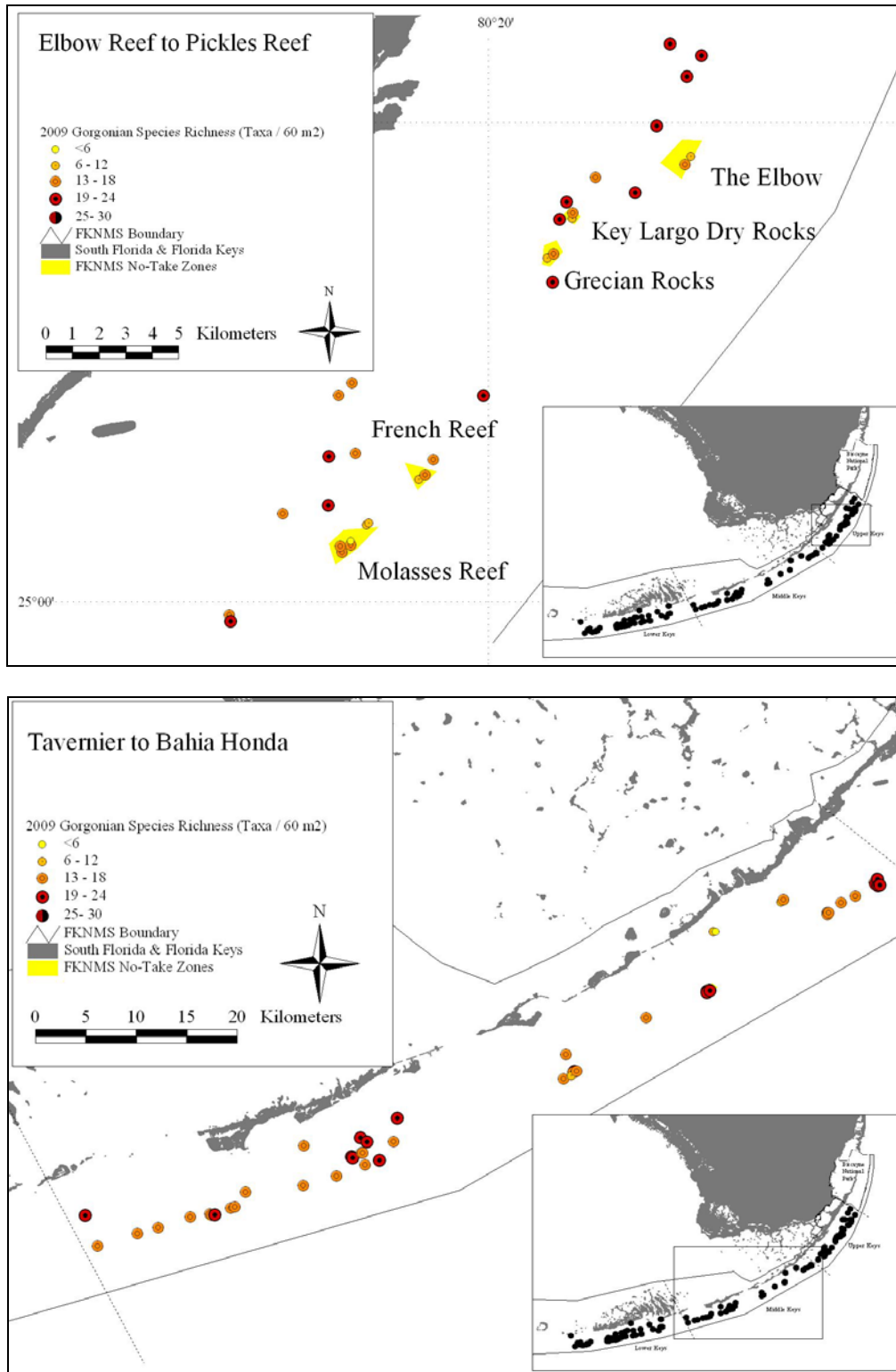


Figure 3-11. Species richness (no. taxa per 60 m²) of gorgonians (Octocorallia) in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

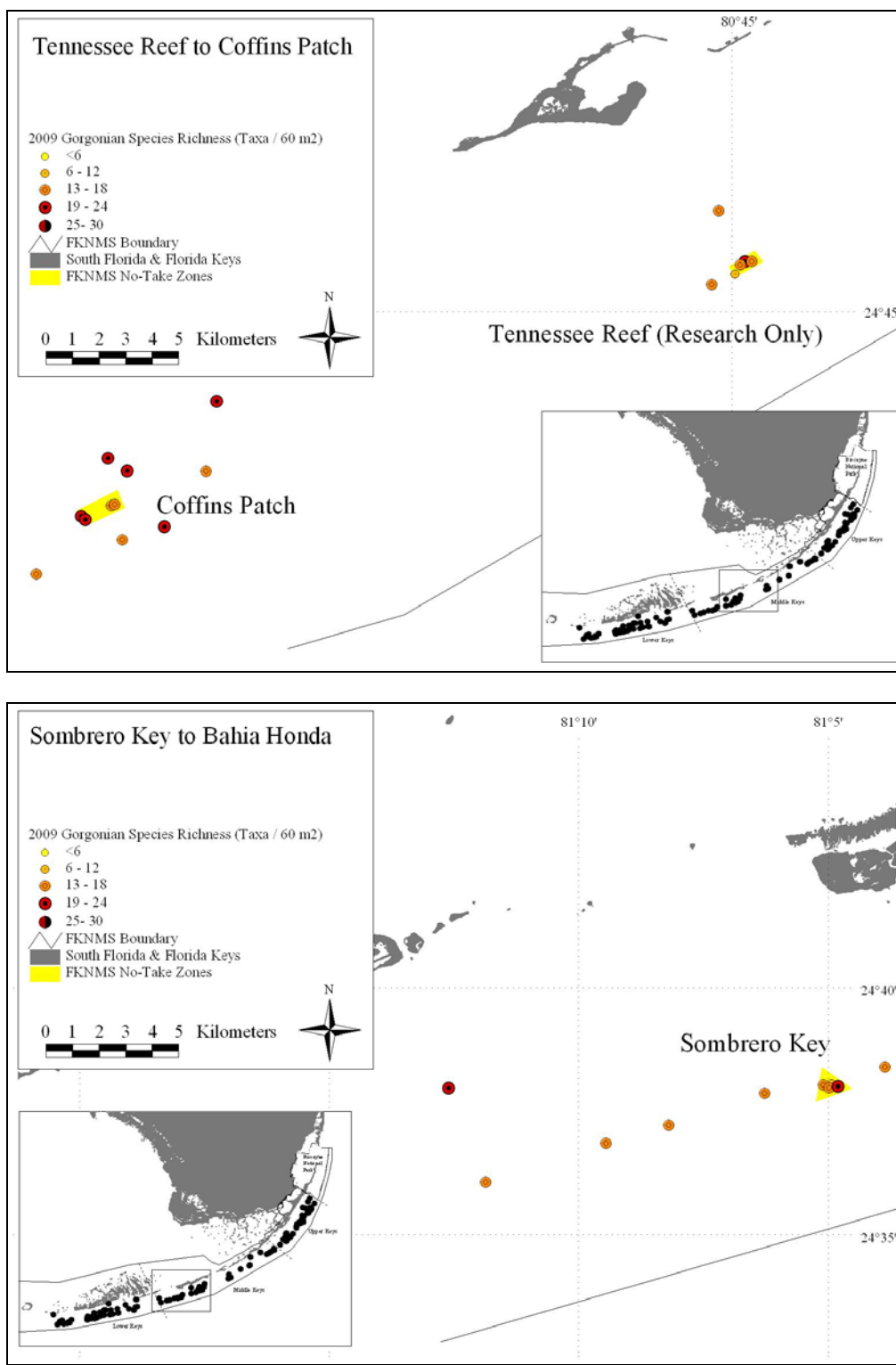


Figure 3-12. Species richness (no. taxa per 60 m²) of gorgonians (Octocorallia) in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

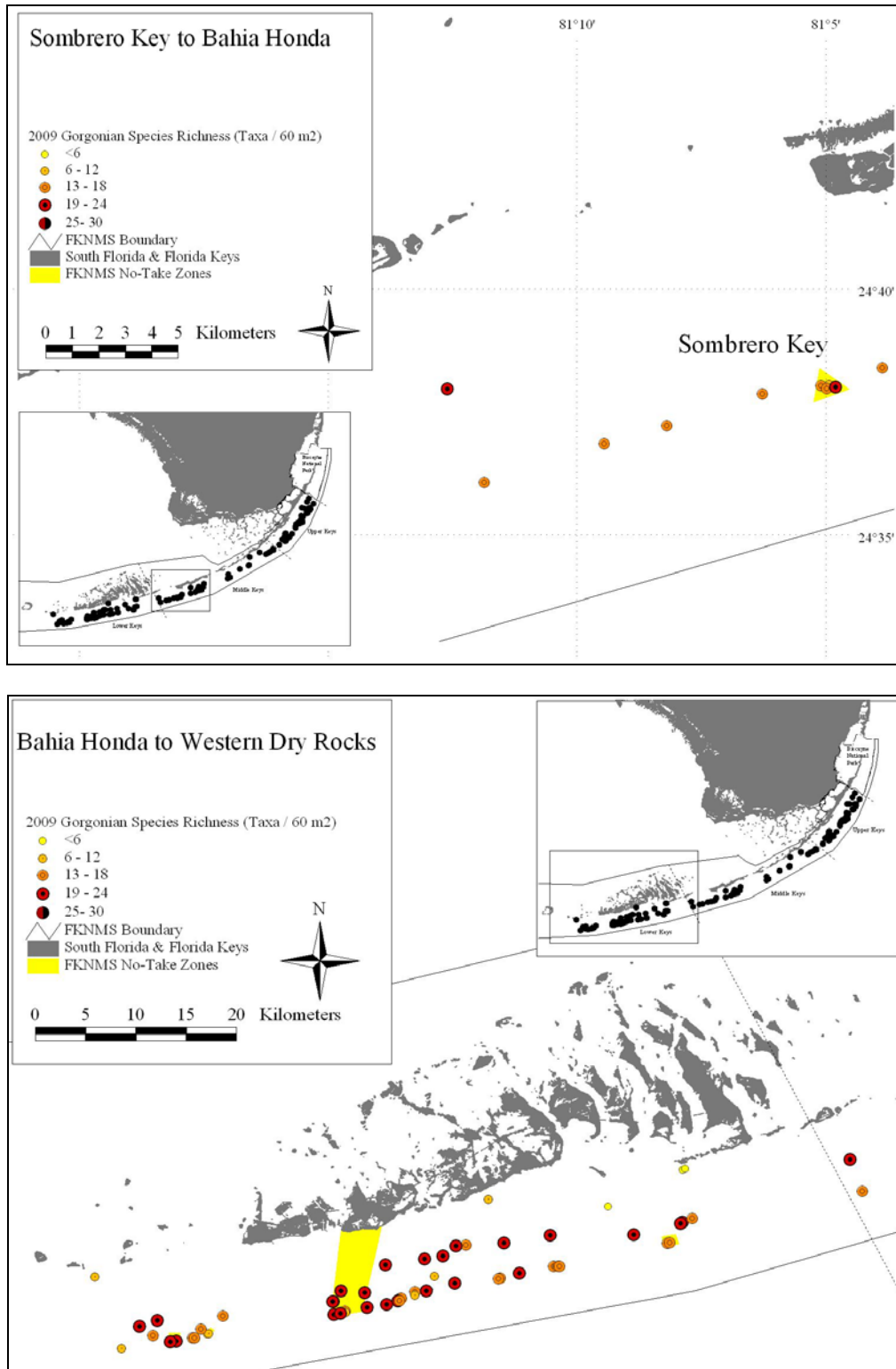


Figure 3-13. Species richness (no. taxa per 60 m²) of gorgonians (Octocorallia) in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

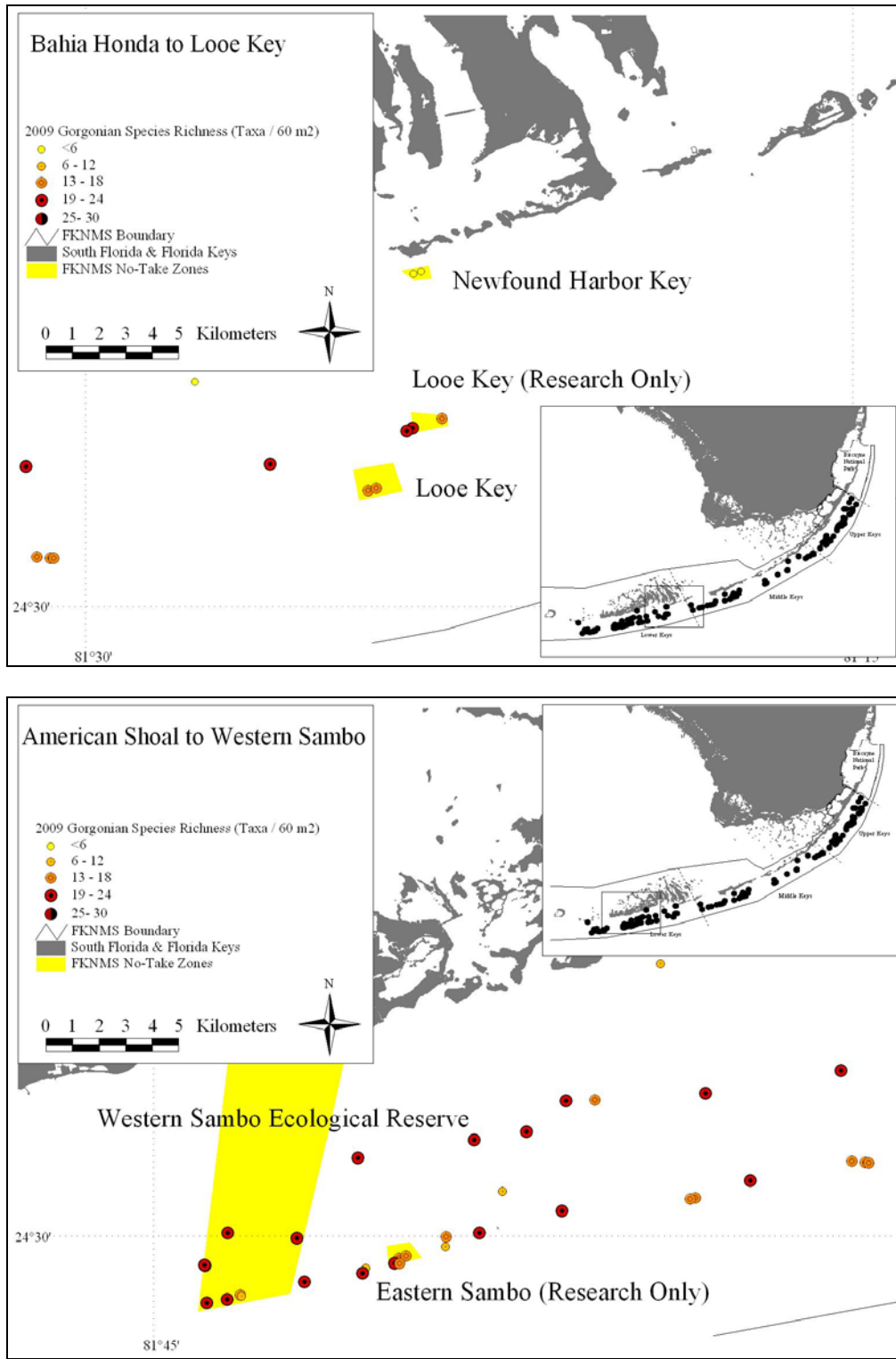


Figure 3-14. Species richness (no. taxa per 60 m²) of gorgonians (Octocorallia) in the lower Florida Keys from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

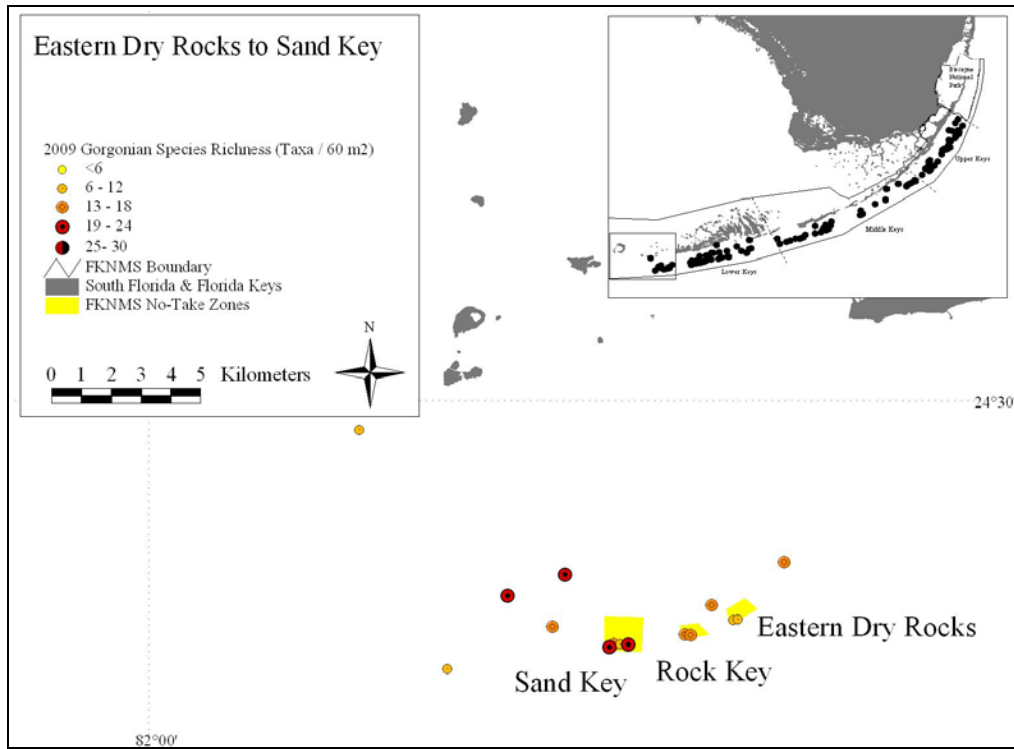


Figure 3-15. Site species richness of gorgonians (Octocorallia) on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Data represent the total number of taxa recorded from a 60-m² sampling area. Open bars = FKNMS no-take zones; filled bars = reference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

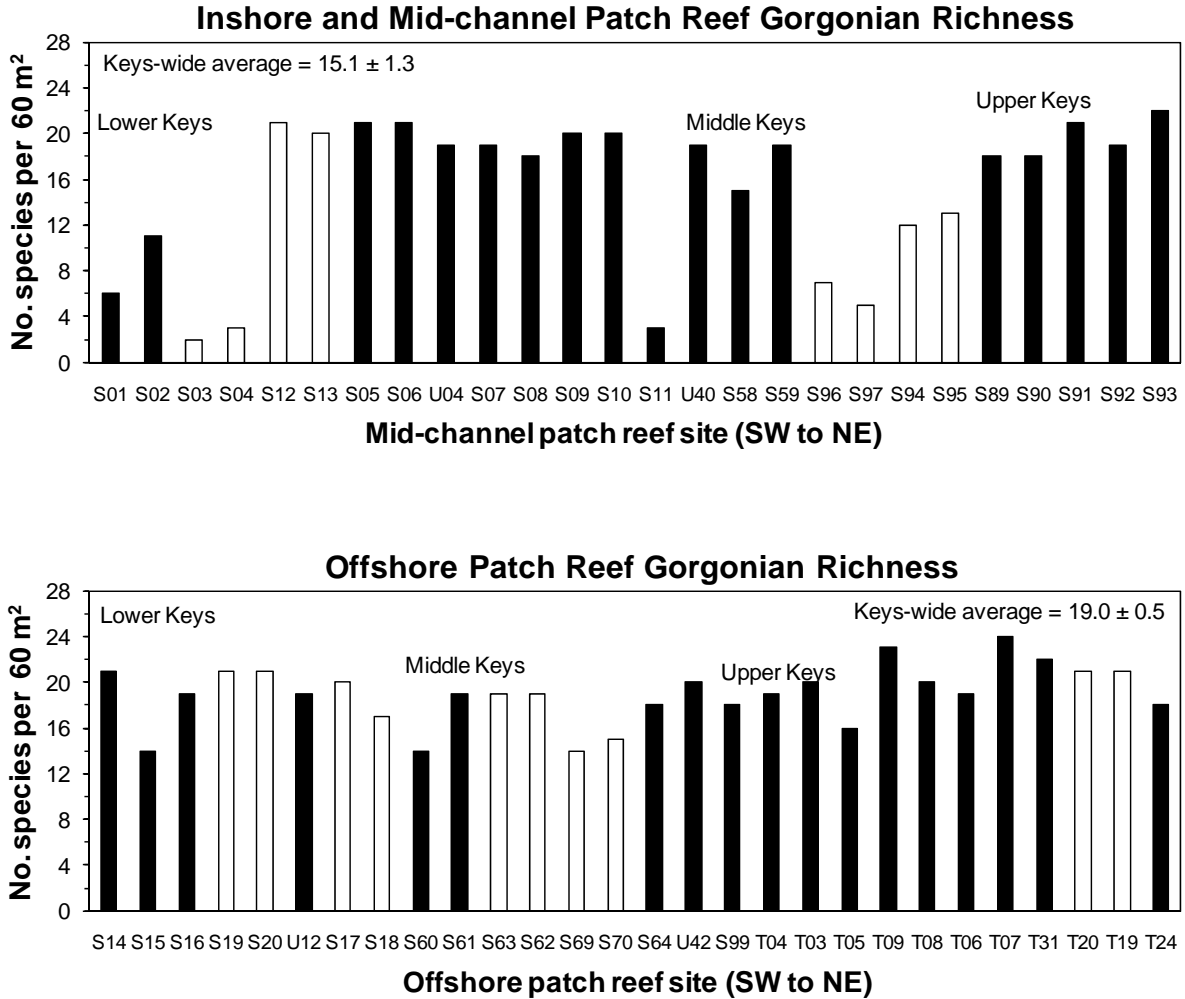


Figure 3-16. Site species richness of gorgonians (Octocorallia) on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Data represent the total number of taxa recorded from a 60-m² sampling area. Open bars = FKNMS no-take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

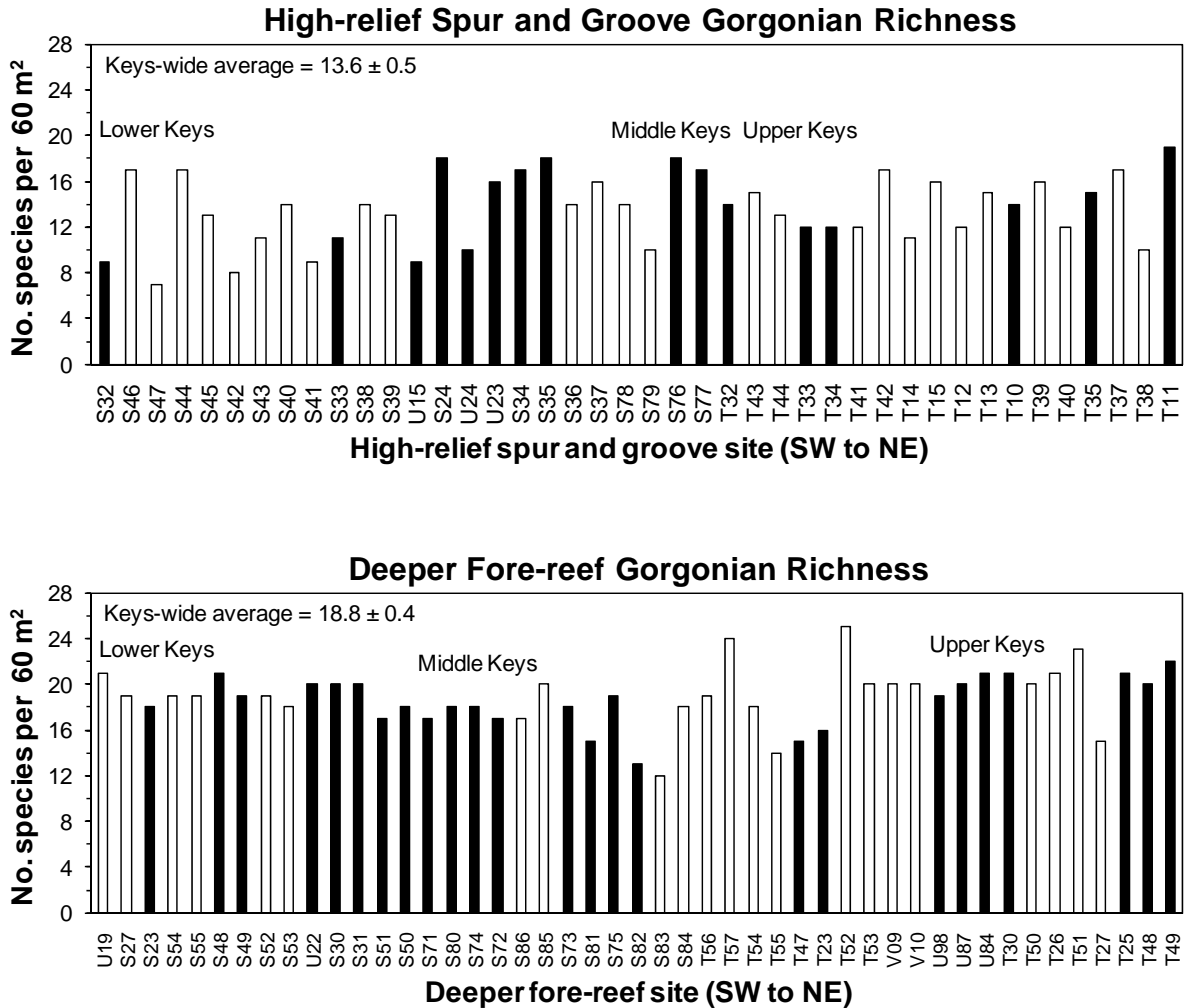


Figure 3-17. Species richness (no. taxa per 60 m²) of sponges in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

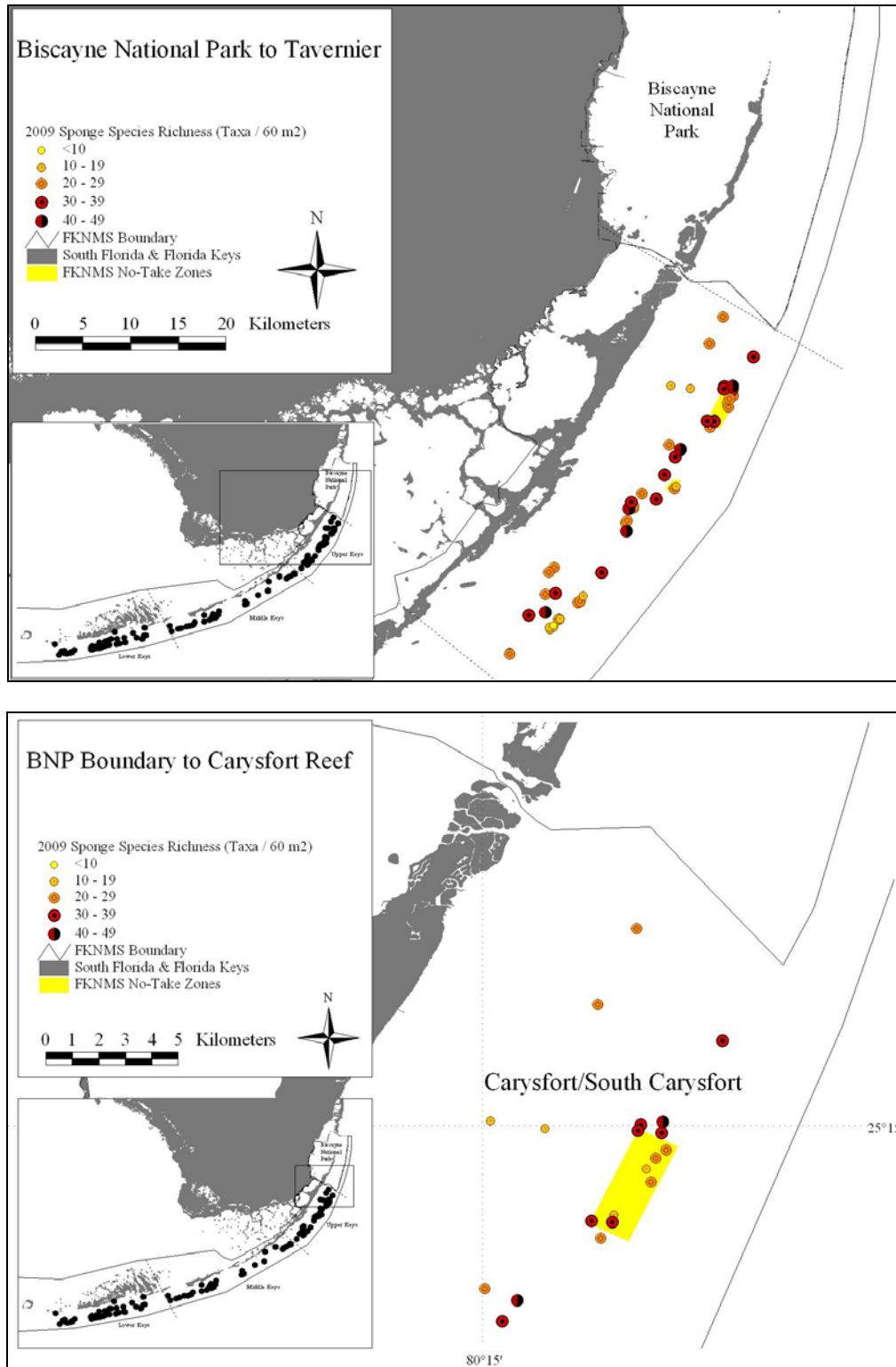


Figure 3-18. Species richness (no. taxa per 60 m²) of sponges in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region during May-September 2009.

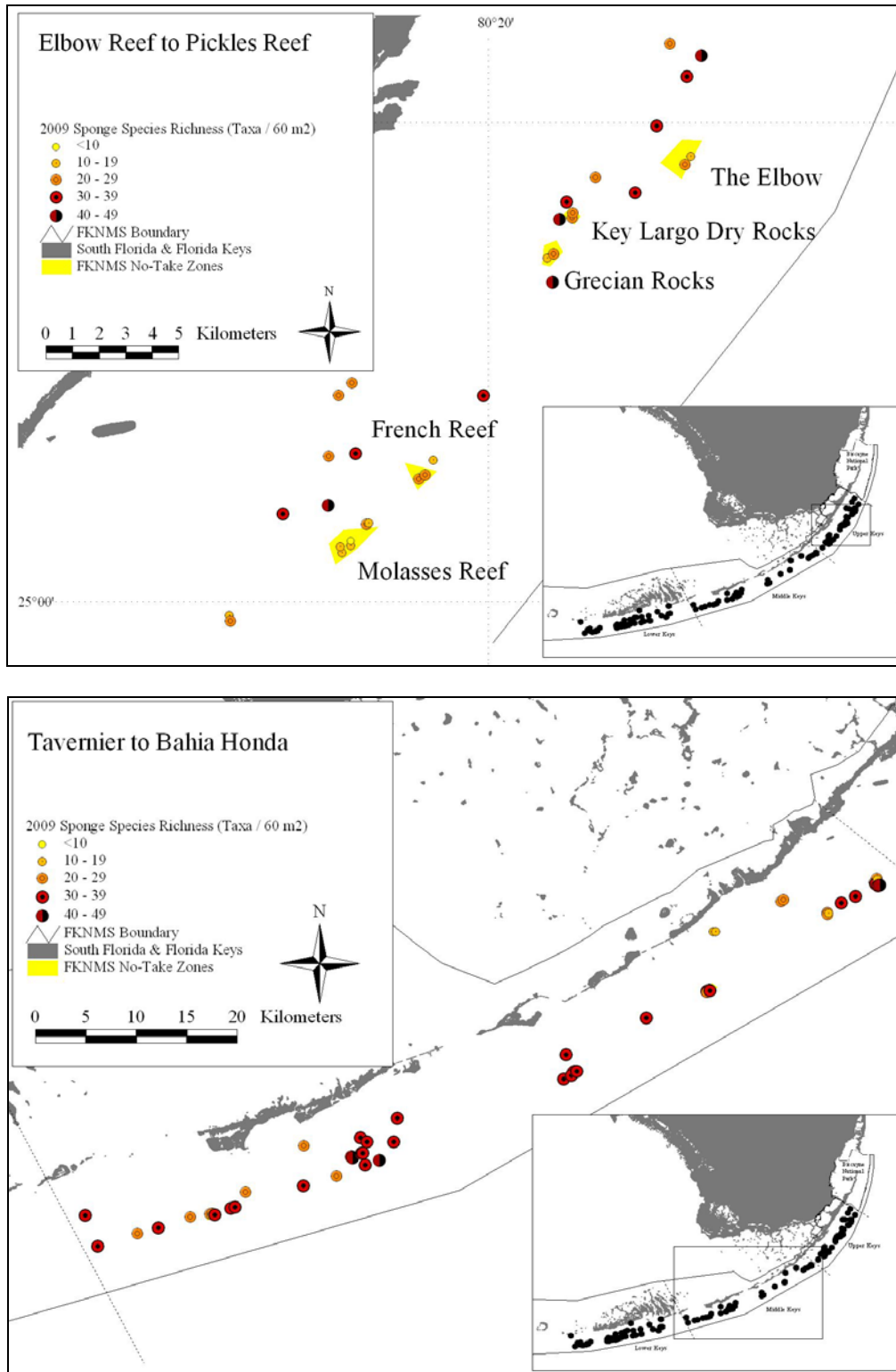


Figure 3-19. Species richness (no. taxa per 60 m²) of sponges in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

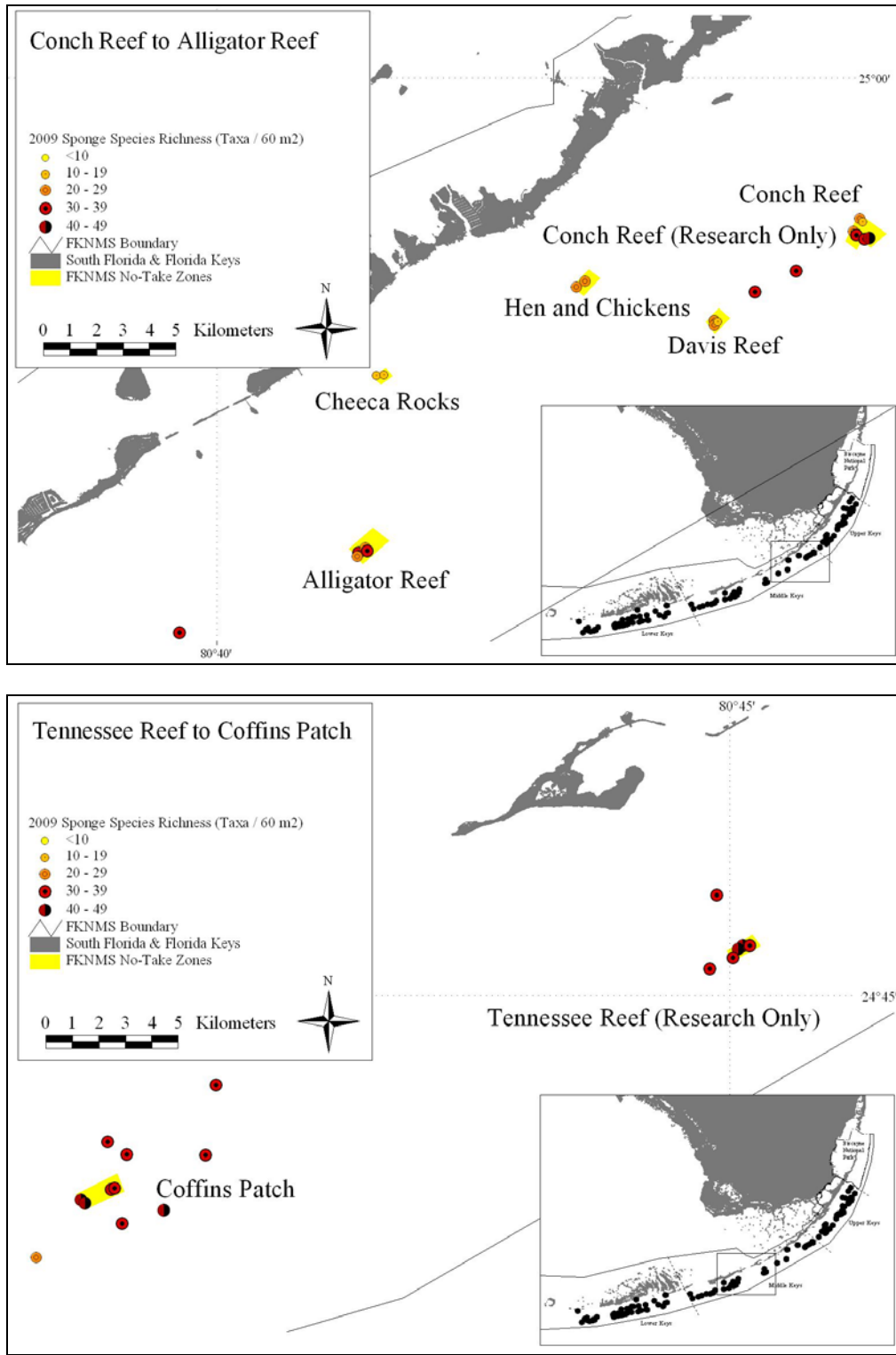


Figure 3-20. Species richness (no. taxa per 60 m²) of sponges in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

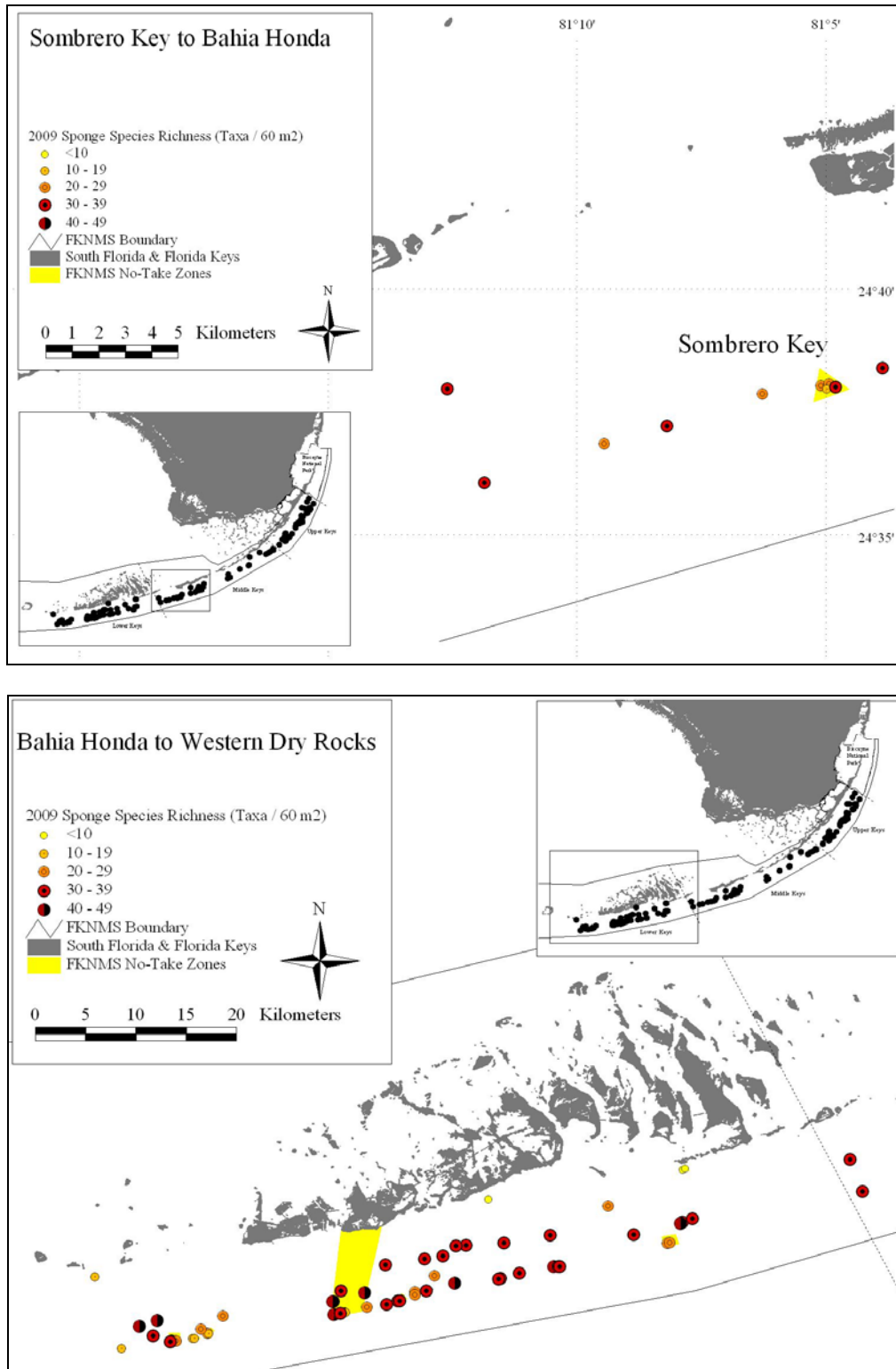


Figure 3-21. Species richness (no. taxa per 60 m²) of sponges in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

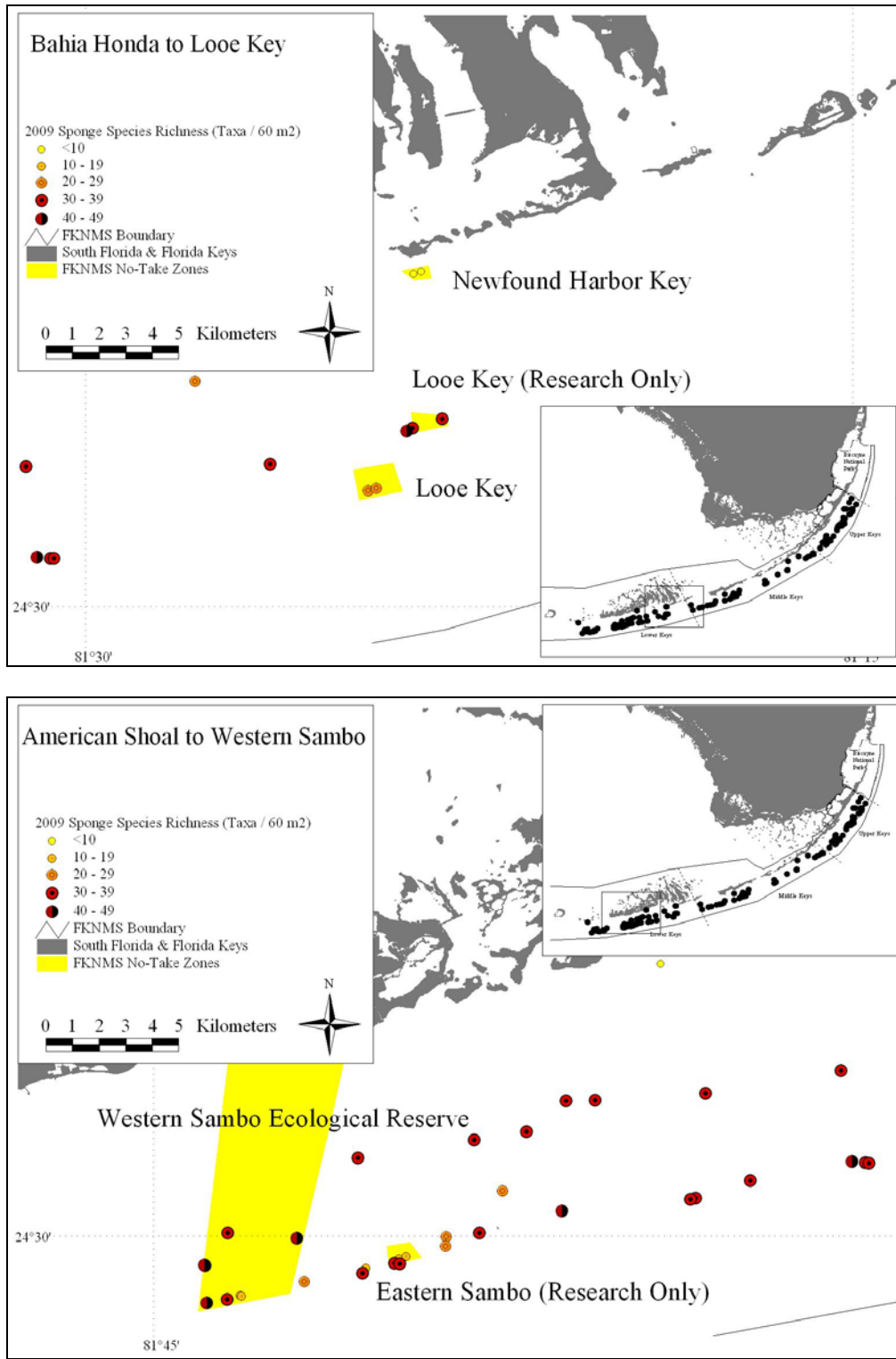


Figure 3-22. Species richness (no. taxa per 60 m²) of sponges in the lower Florida Keys region from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

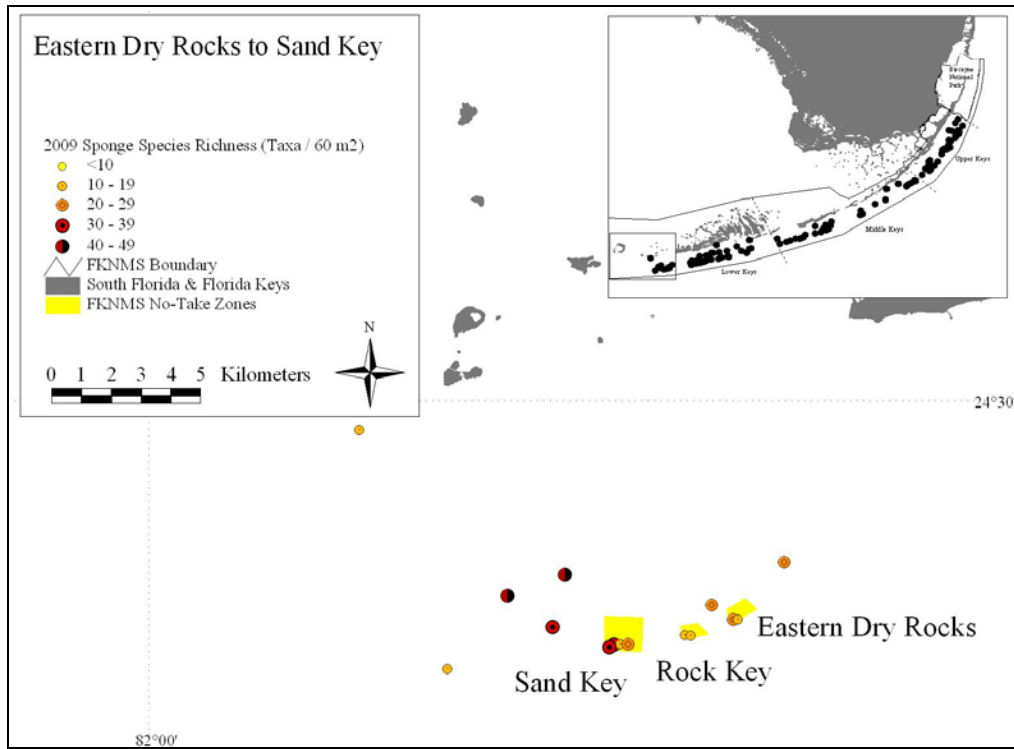


Figure 3-23. Site species richness of sponges on inshore and mid-channel patch reefs (top) and offshore patch reefs (bottom) in the Florida Keys during 2009. Data represent the total number of taxa recorded from a 60-m² sampling area. Open bars = FKNMS no-take zones; filled bars = reference areas.

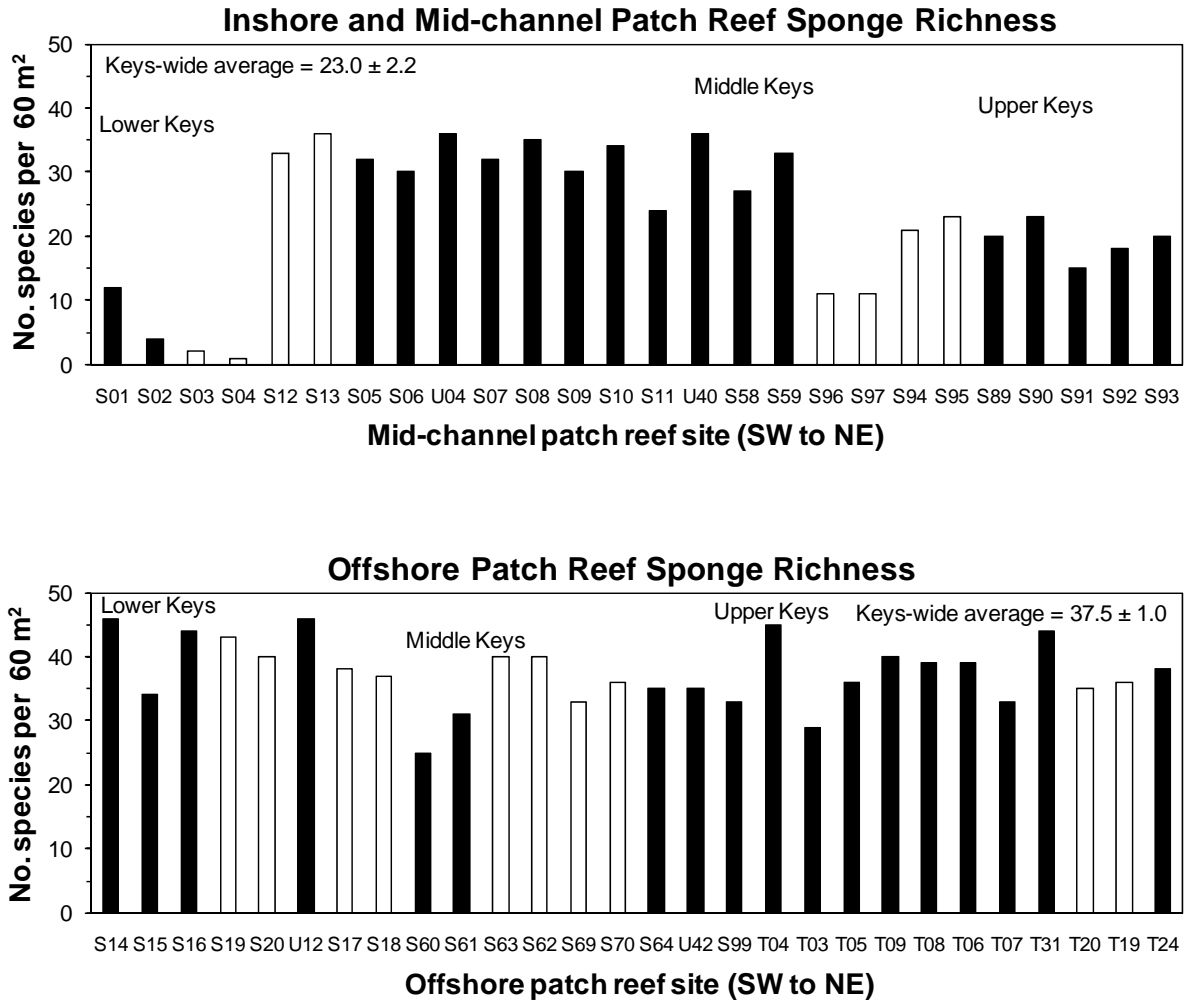


Figure 3-24. Site species richness of sponges on shallow (< 6 m), high-relief spur and groove reefs (top) and deeper (6-15 m) fore reef habitats (bottom) in the Florida Keys during 2009. Data represent the total number of taxa recorded from a 60-m² sampling area. Open bars = FKNMS no-take zones; filled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

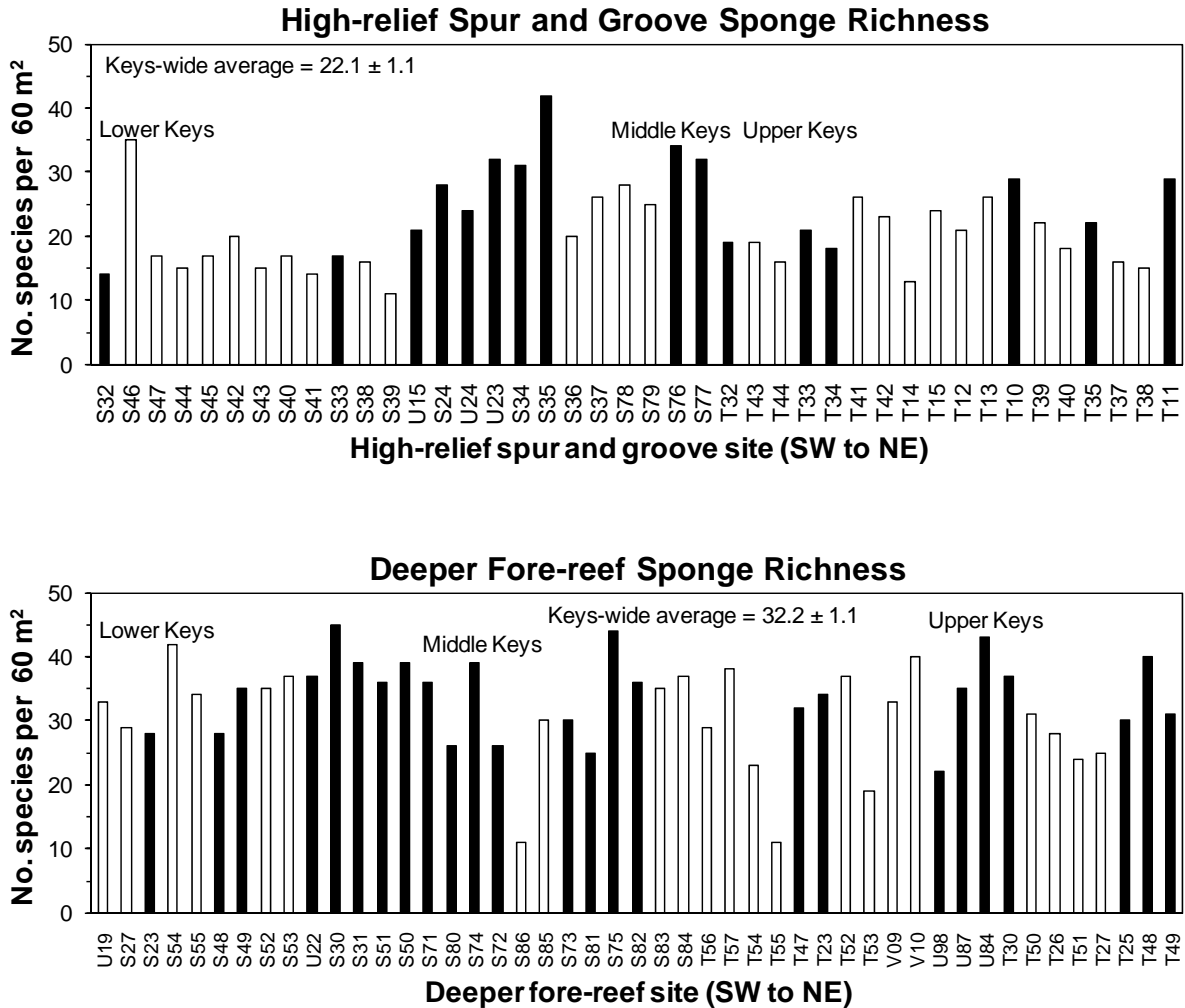


Figure 3-25. Mean total stony coral cover (%) in the entire upper Florida Keys region (top) and from the southern BNP boundary to Carysfort Reef (bottom) during May-September 2009.

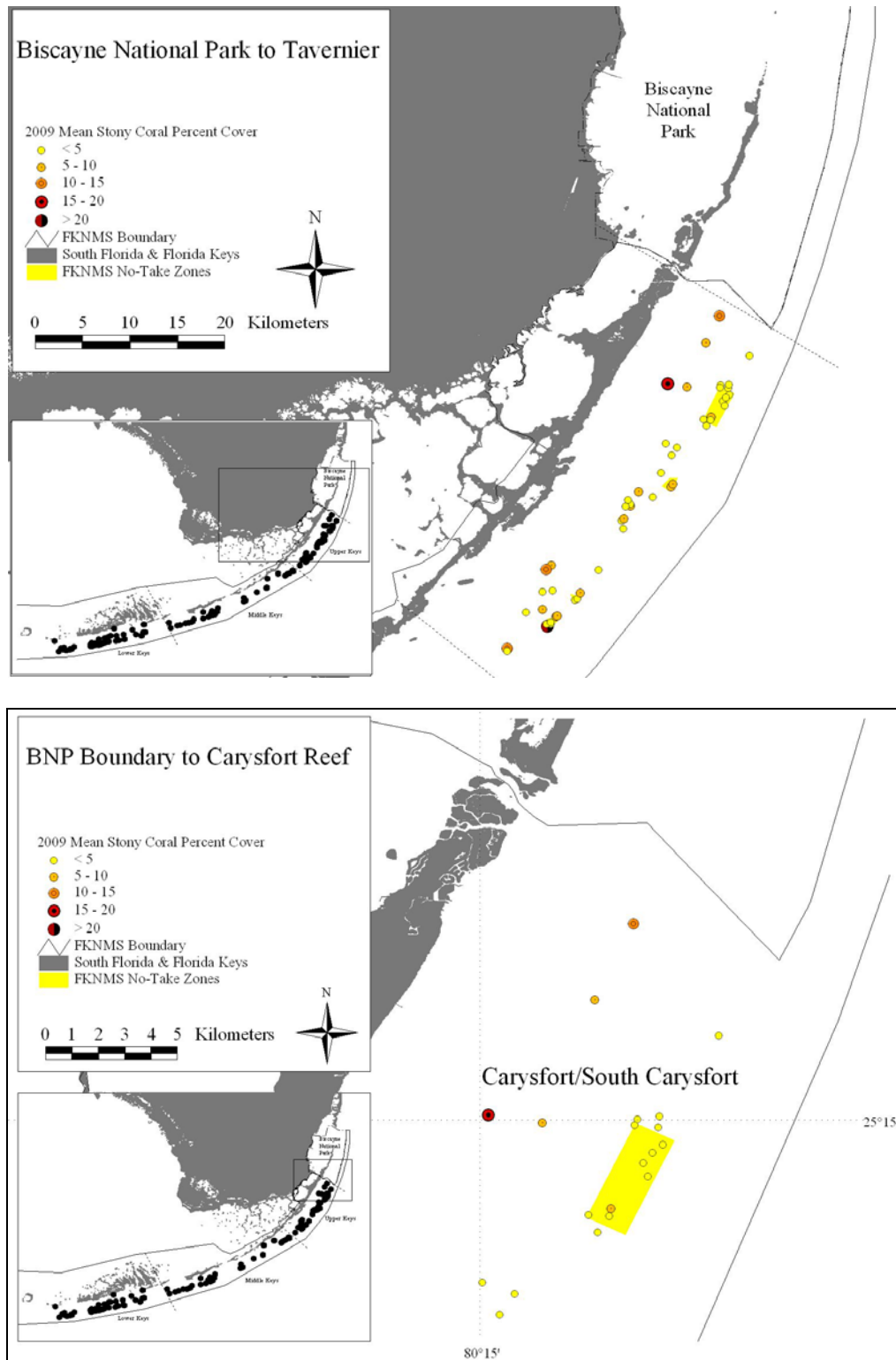


Figure 3-26. Mean total stony coral cover (%) in the upper Florida Keys region from Elbow Reef to Pickles Reef (top) and in the entire middle Florida Keys region during May-September 2009.

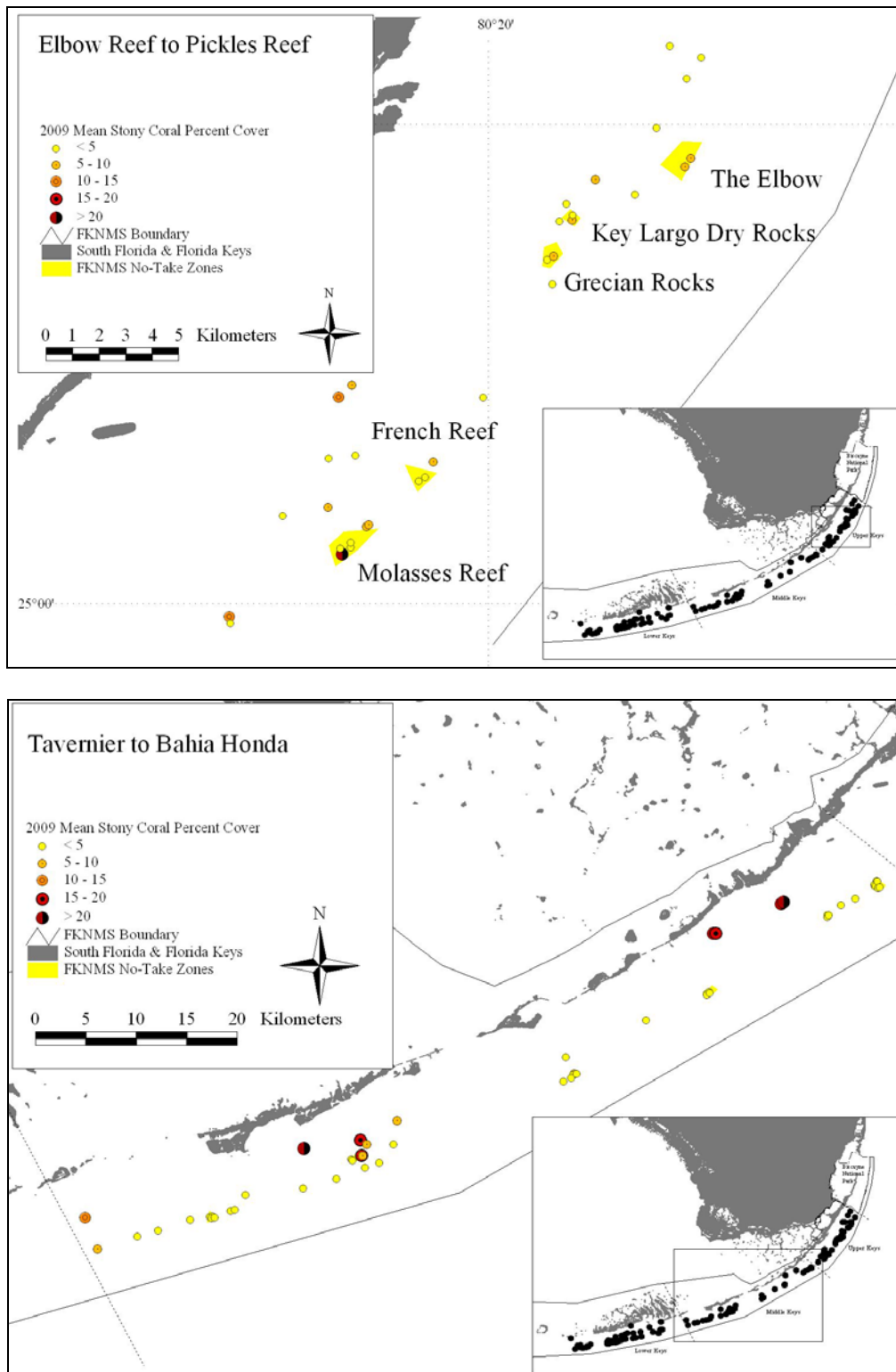


Figure 3-27. Mean total stony coral cover (%) in the middle Florida Keys region from Conch Reef to Alligator Reef (top) and from Tennessee Reef to Coffins Patch (bottom) during May-September 2009.

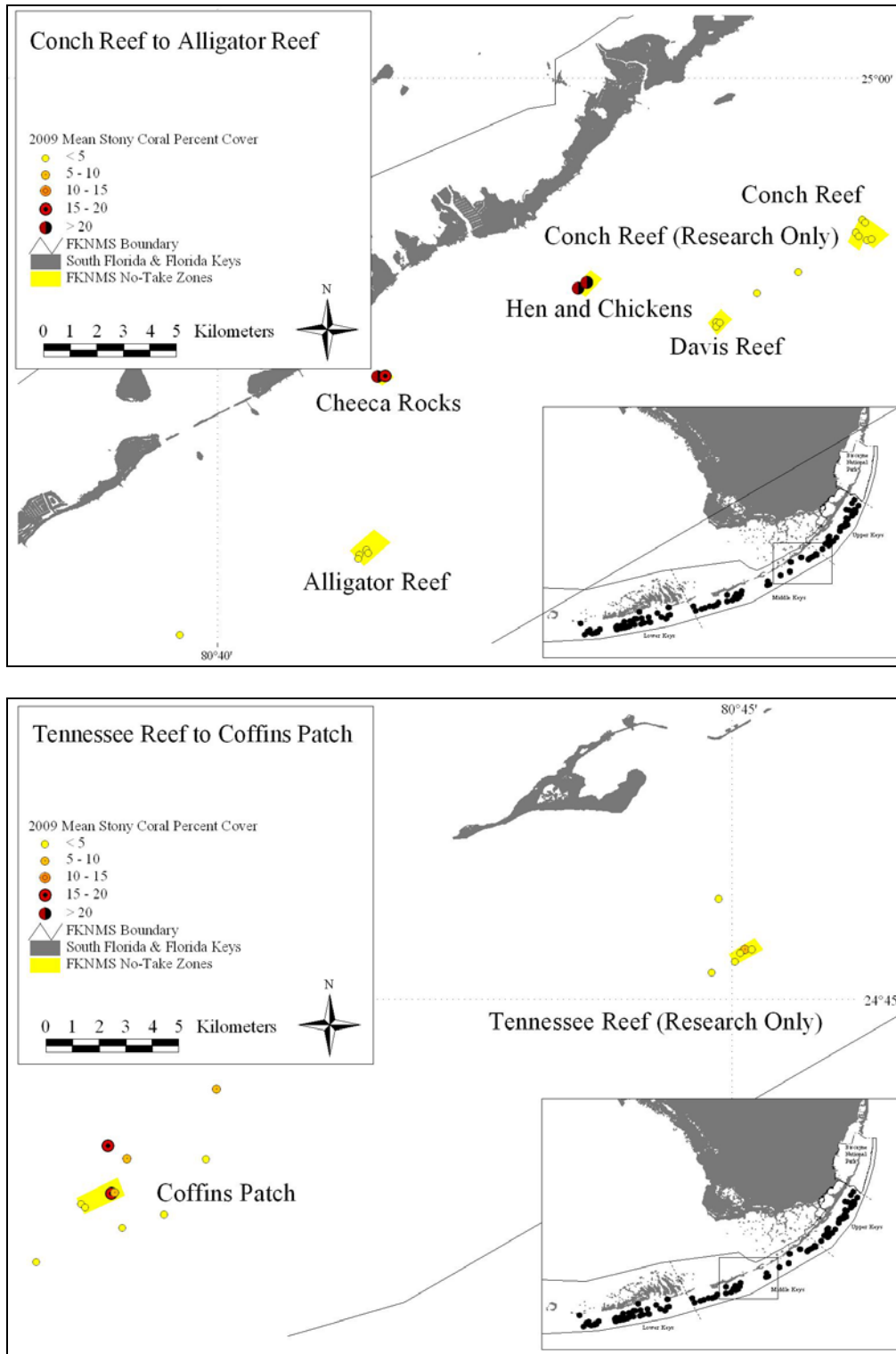


Figure 3-28. Mean total stony coral cover (%) in the middle Florida Keys region from Sombrero Reef to Bahia Honda (top) and in the entire lower Florida Keys region (bottom) during May-September 2009.

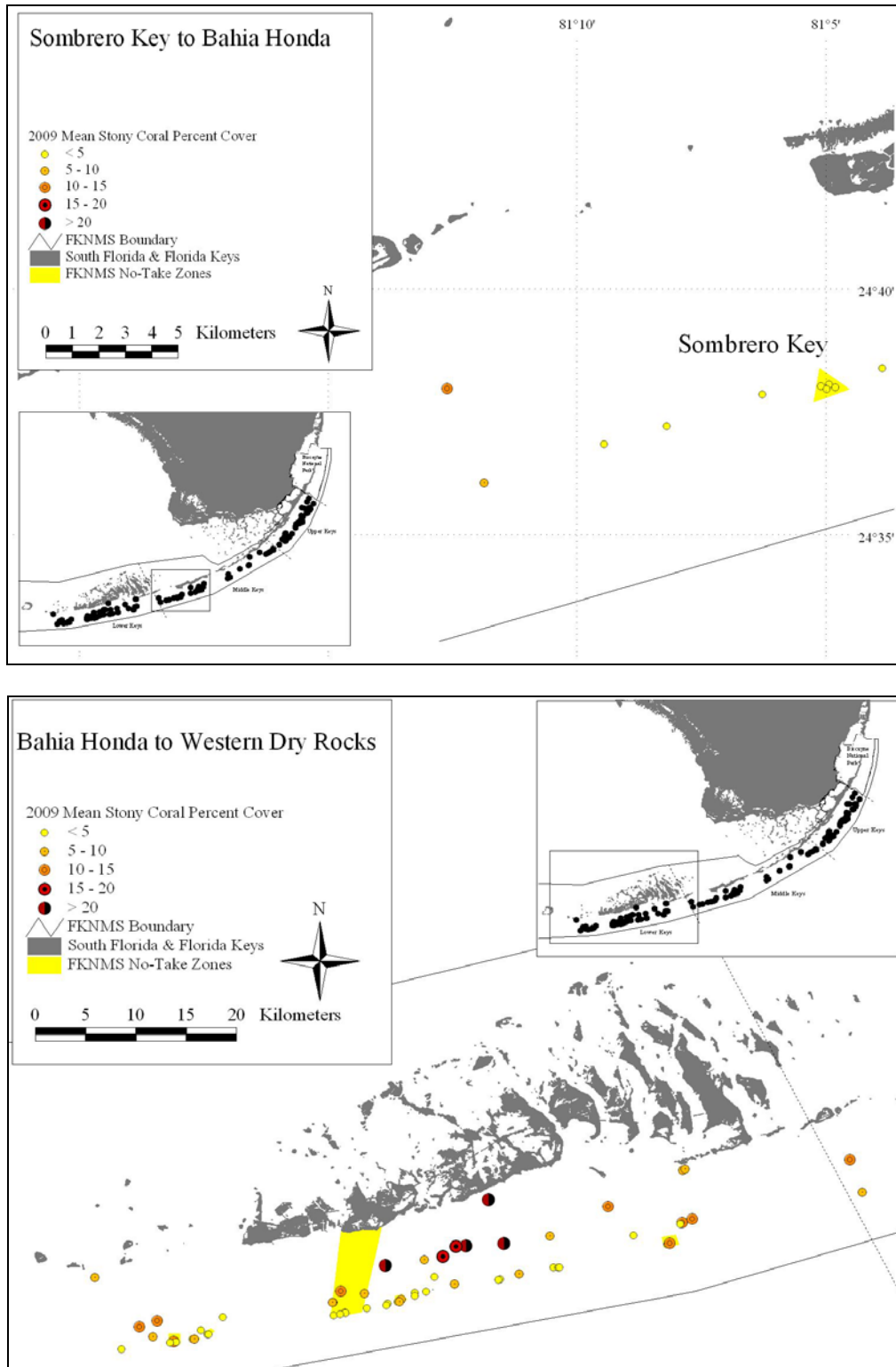


Figure 3-29. Mean total stony coral cover (%) in the lower Florida Keys region from Bahia Honda to Looe Key (top) and from American Shoal to Western Sambo (bottom) during May-September 2009.

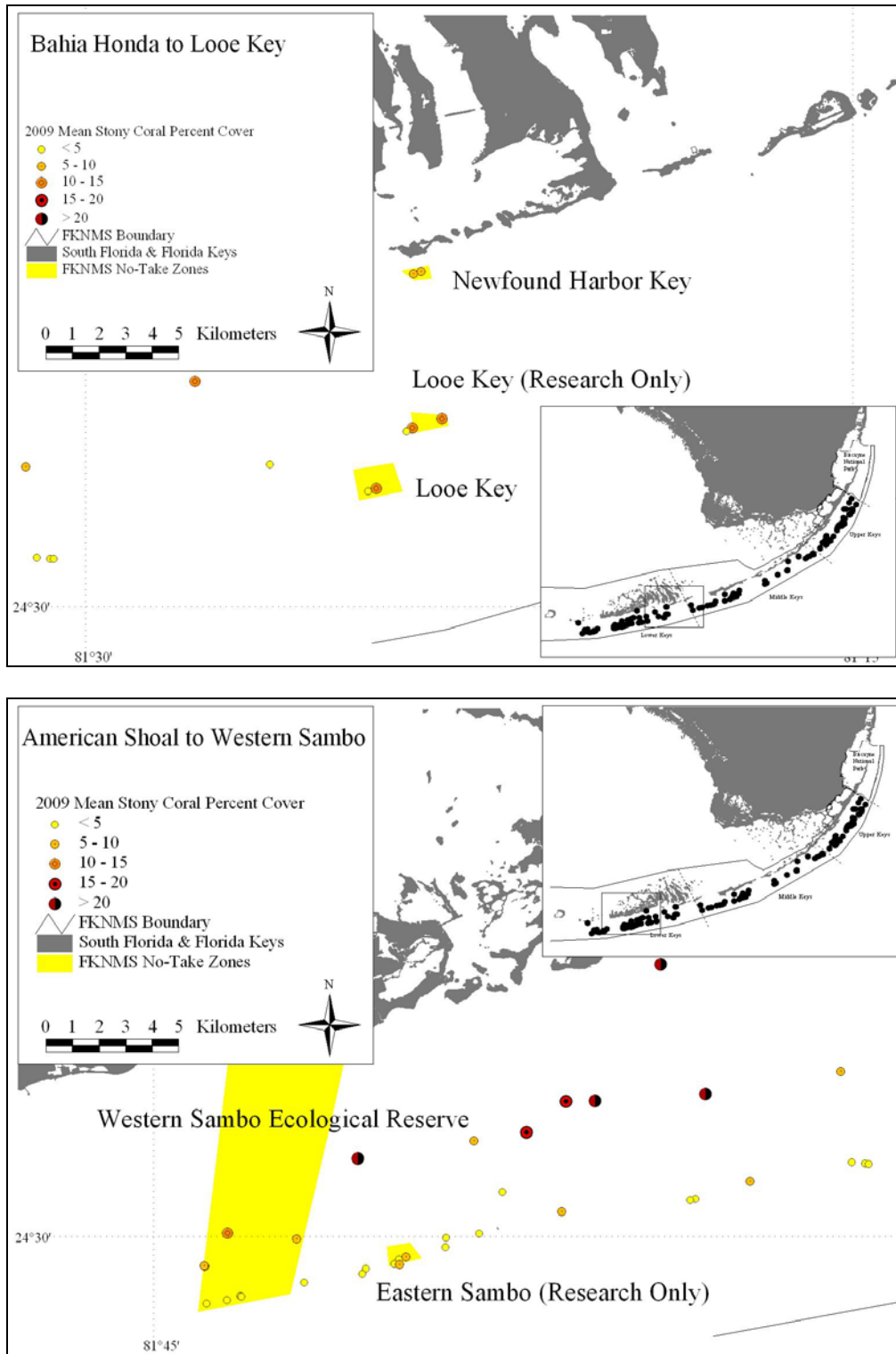


Figure 3-30. Mean total stony coral cover (%) in the lower Florida Keys from Eastern Dry Rocks to Western Dry Rocks during May-September 2009.

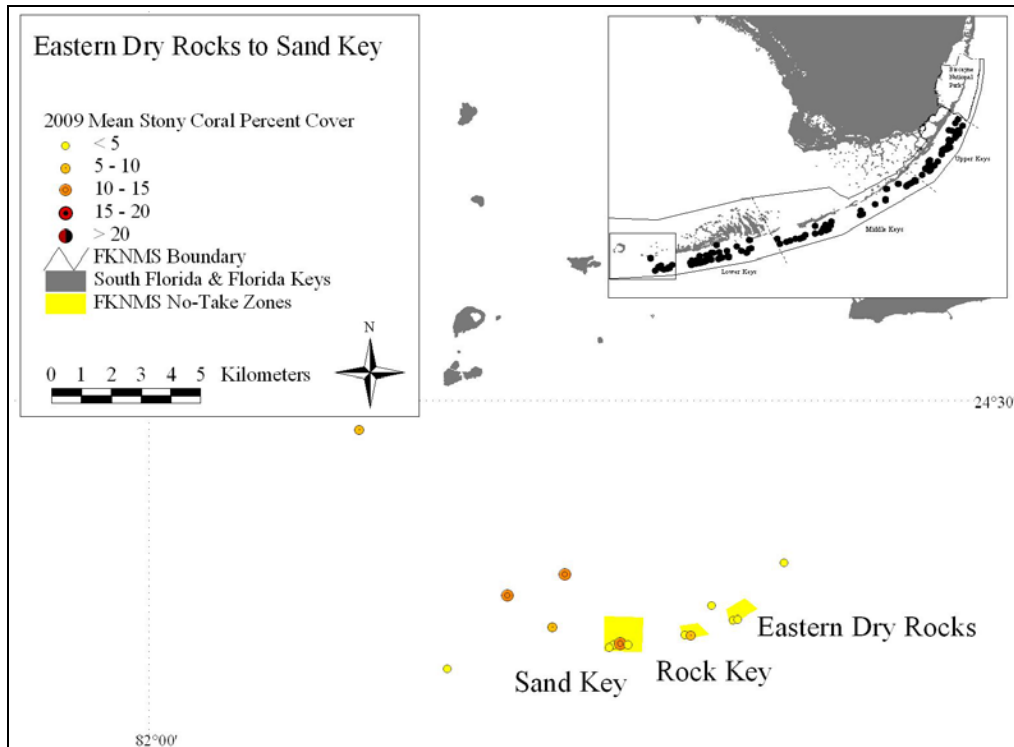


Figure 3-31. Examples of sites with relatively high (> 20%) total coral cover sampled in the Florida Keys during 2009. Note the predominance of massive, frame-building species on various types of patch reefs.

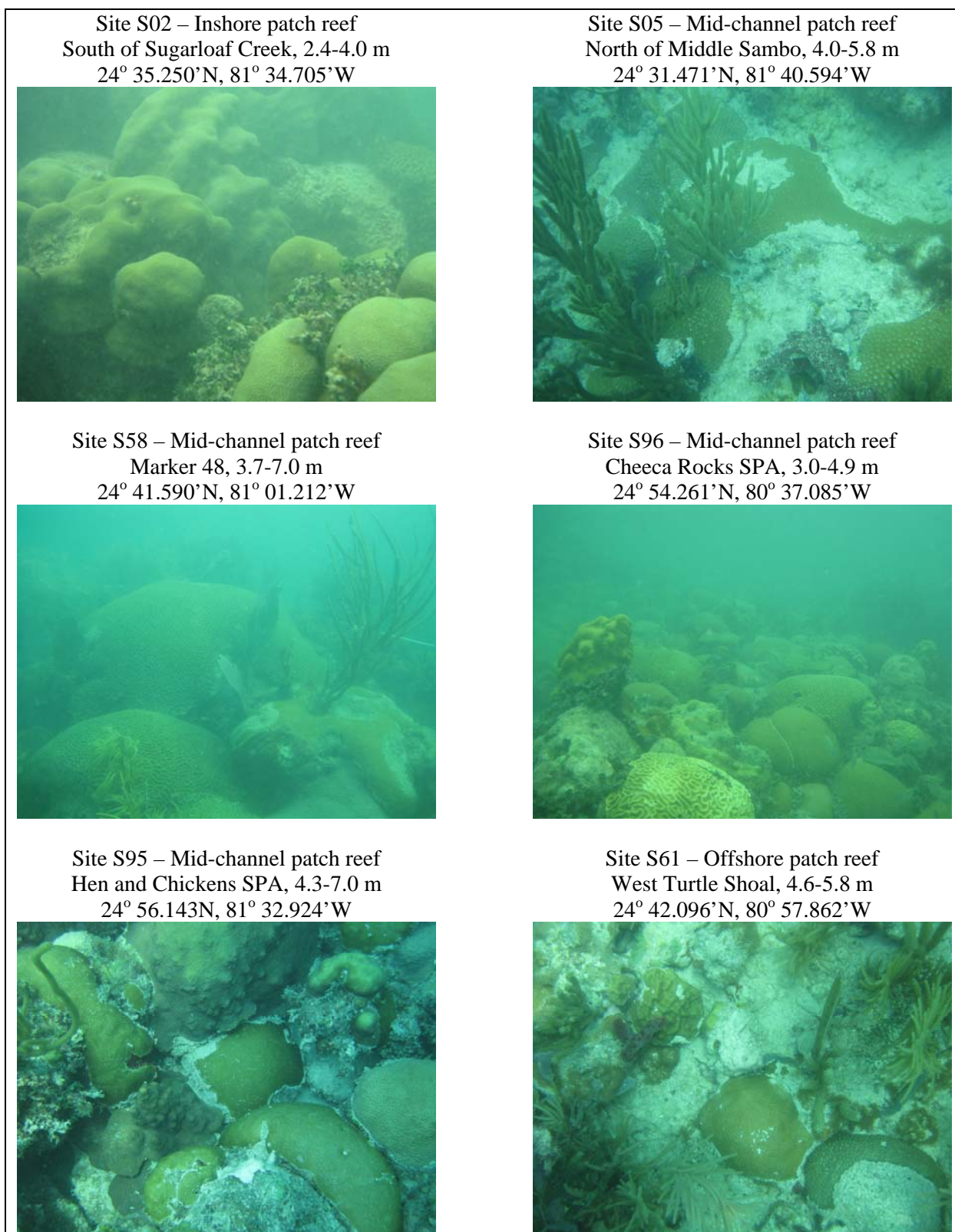


Figure 3-32. Mean (+ 1 SE) percent cover of stony corals, sponges, and the colonial zoanthid *Palythoa* on inshore and mid-channel patch reefs in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

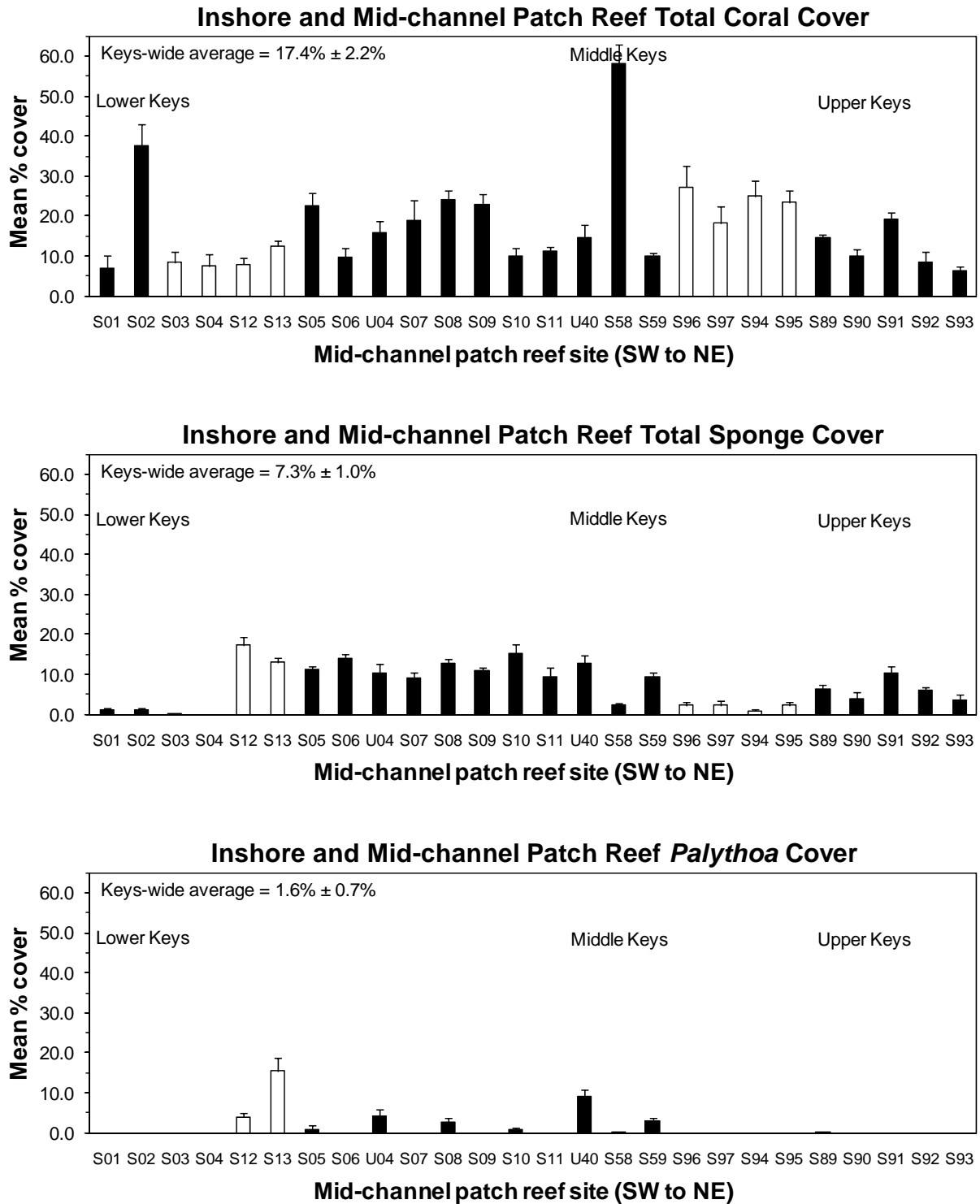


Figure 3-33. Mean (+ 1 SE) percent cover of stony corals, sponges, and the colonial zoanthid *Palythoa* on offshore patch reefs in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

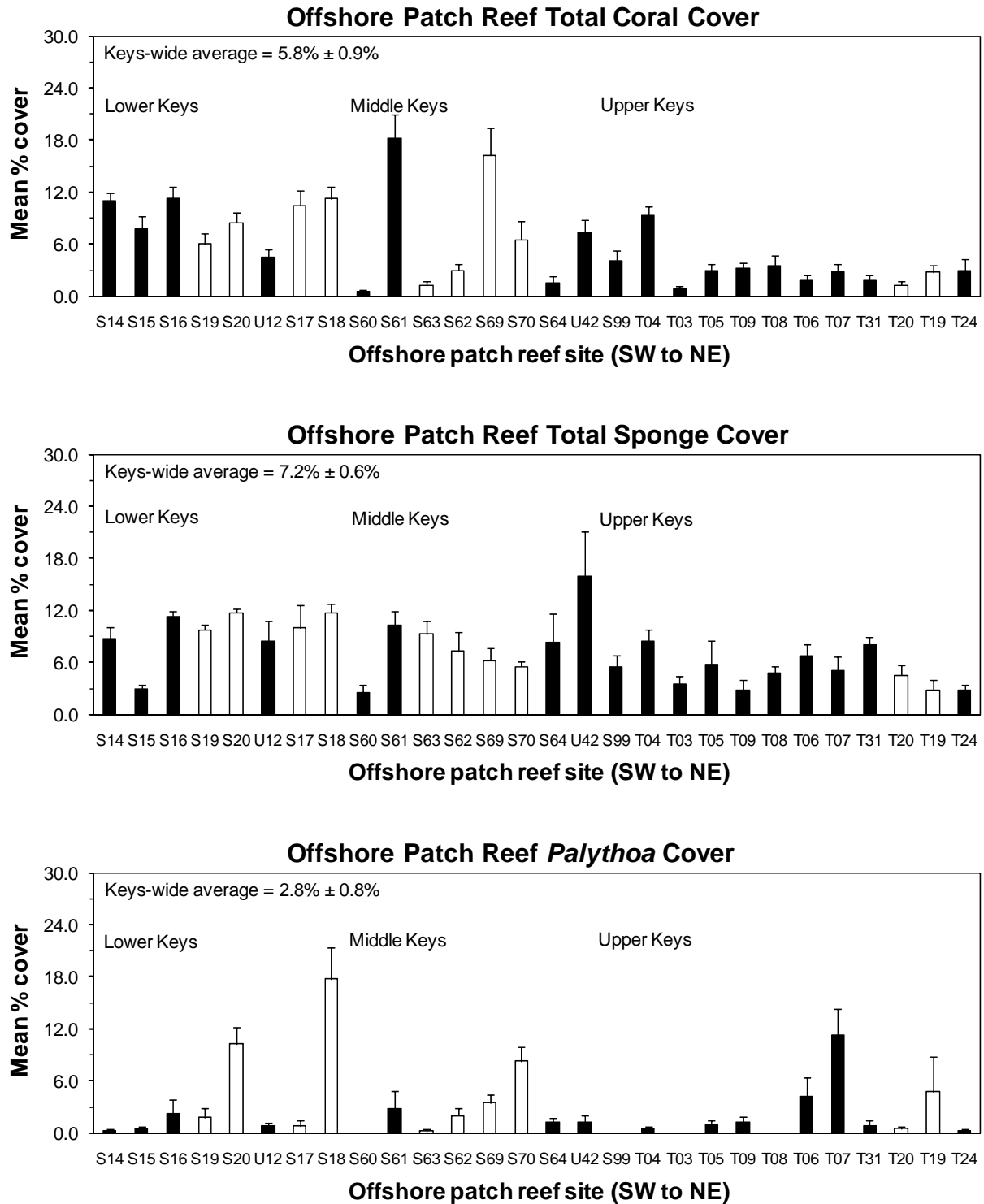


Figure 3-34. Mean (+ 1 SE) percent cover of stony corals, sponges, and the colonial zoanthid *Palythoa* on shallow (< 6 m), high-relief spur and groove reefs in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

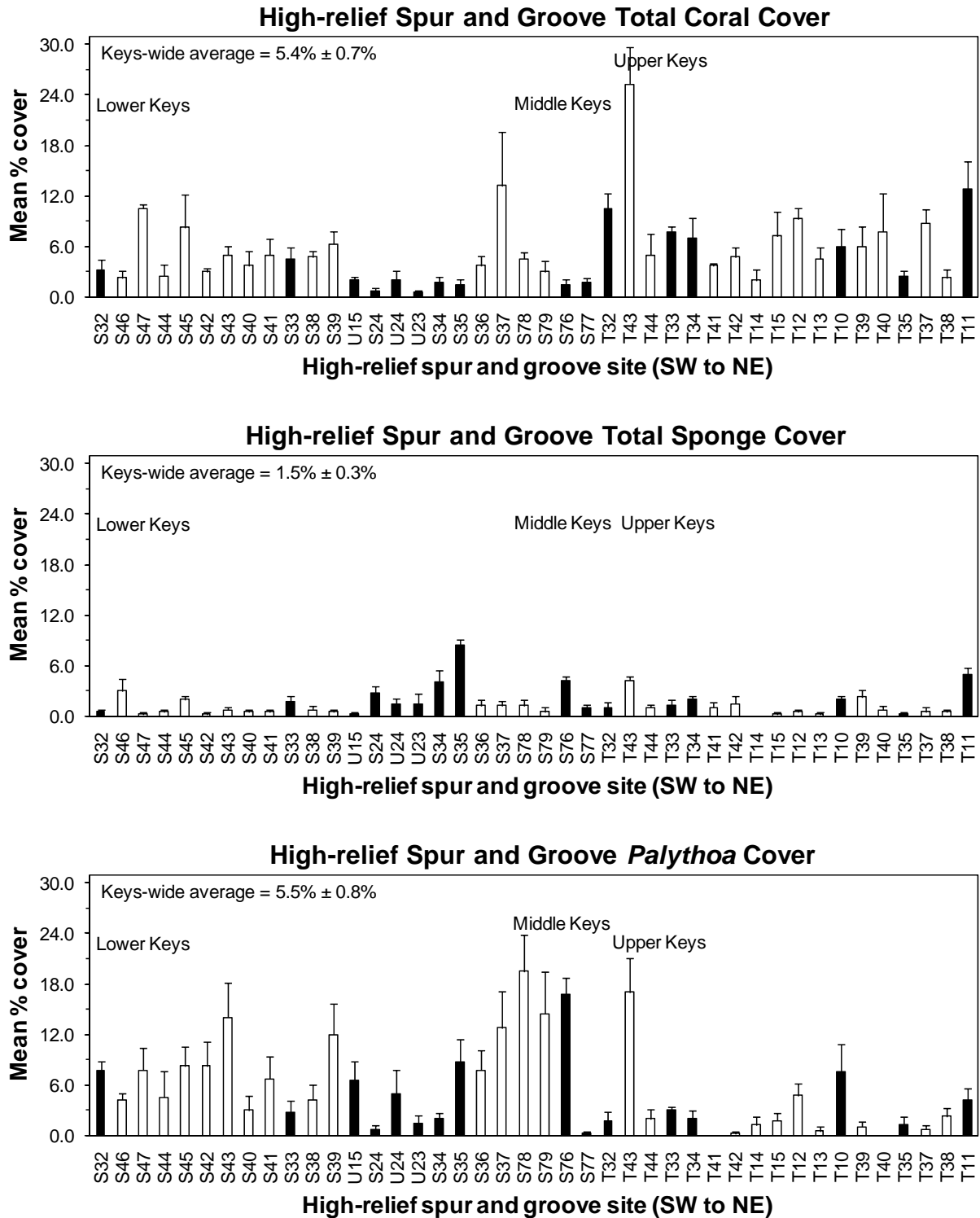


Figure 3-35. Mean (+ 1 SE) percent cover of stony corals, sponges, and the colonial zoanthid *Palythoa* on deeper (6-15 m) fore reef habitats in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

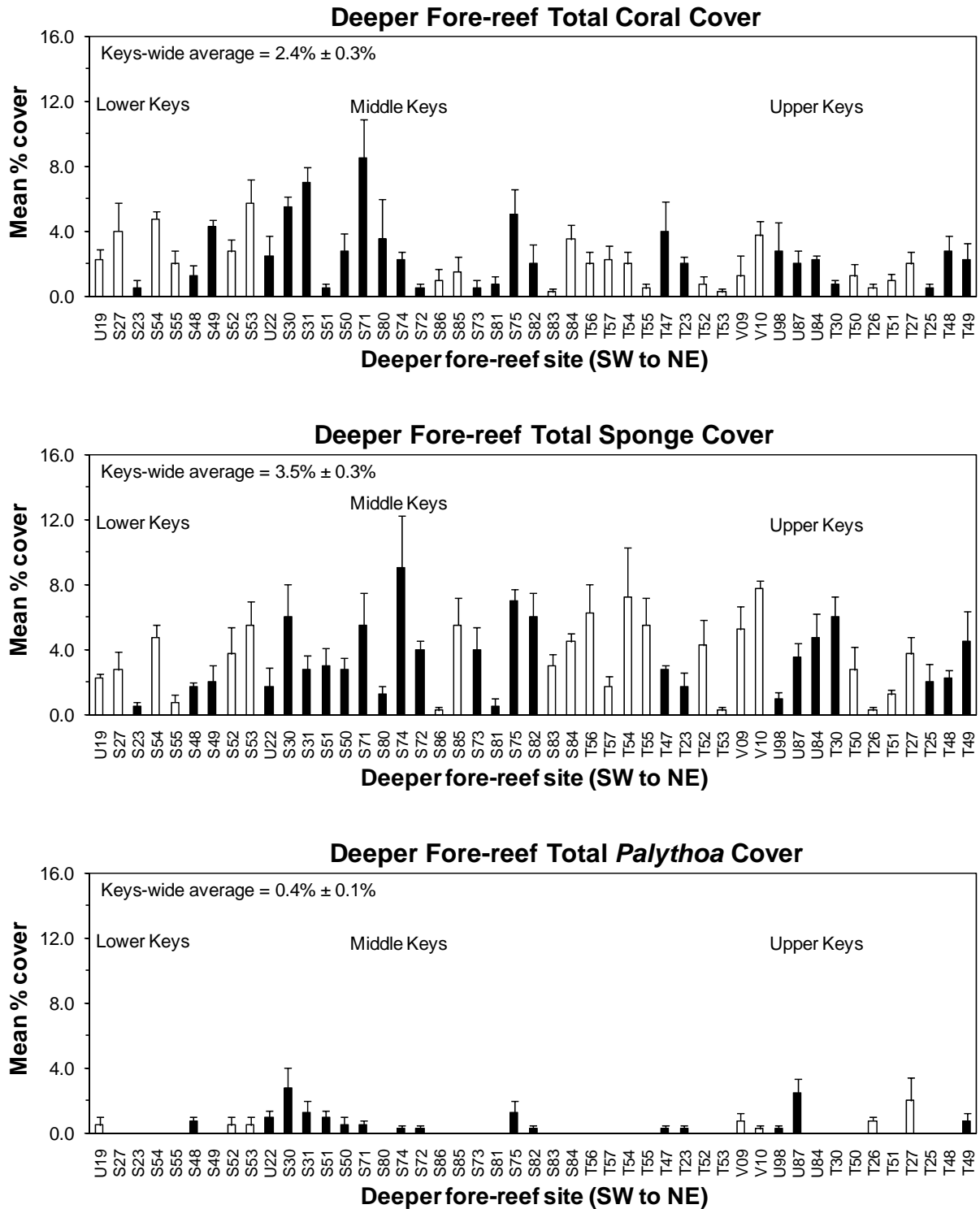


Figure 3-36. Mean (+ 1 SE) percent cover of algal turfs, crustose coralline algae, and macroalgae on inshore and mid-channel patch reefs in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

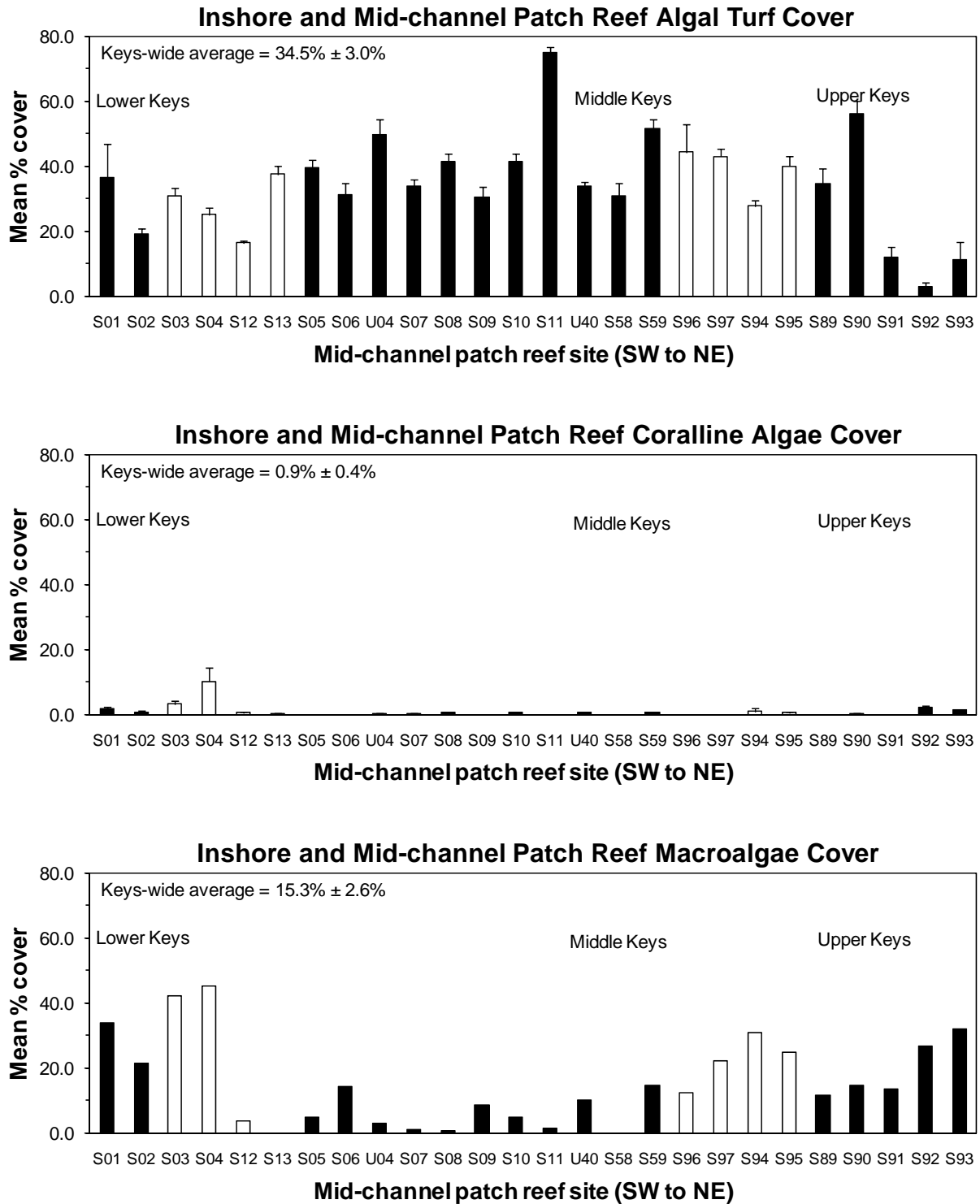


Figure 3-37. Mean (+ 1 SE) percent cover of algal turfs, crustose coralline algae, and macroalgae on offshore patch reefs in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

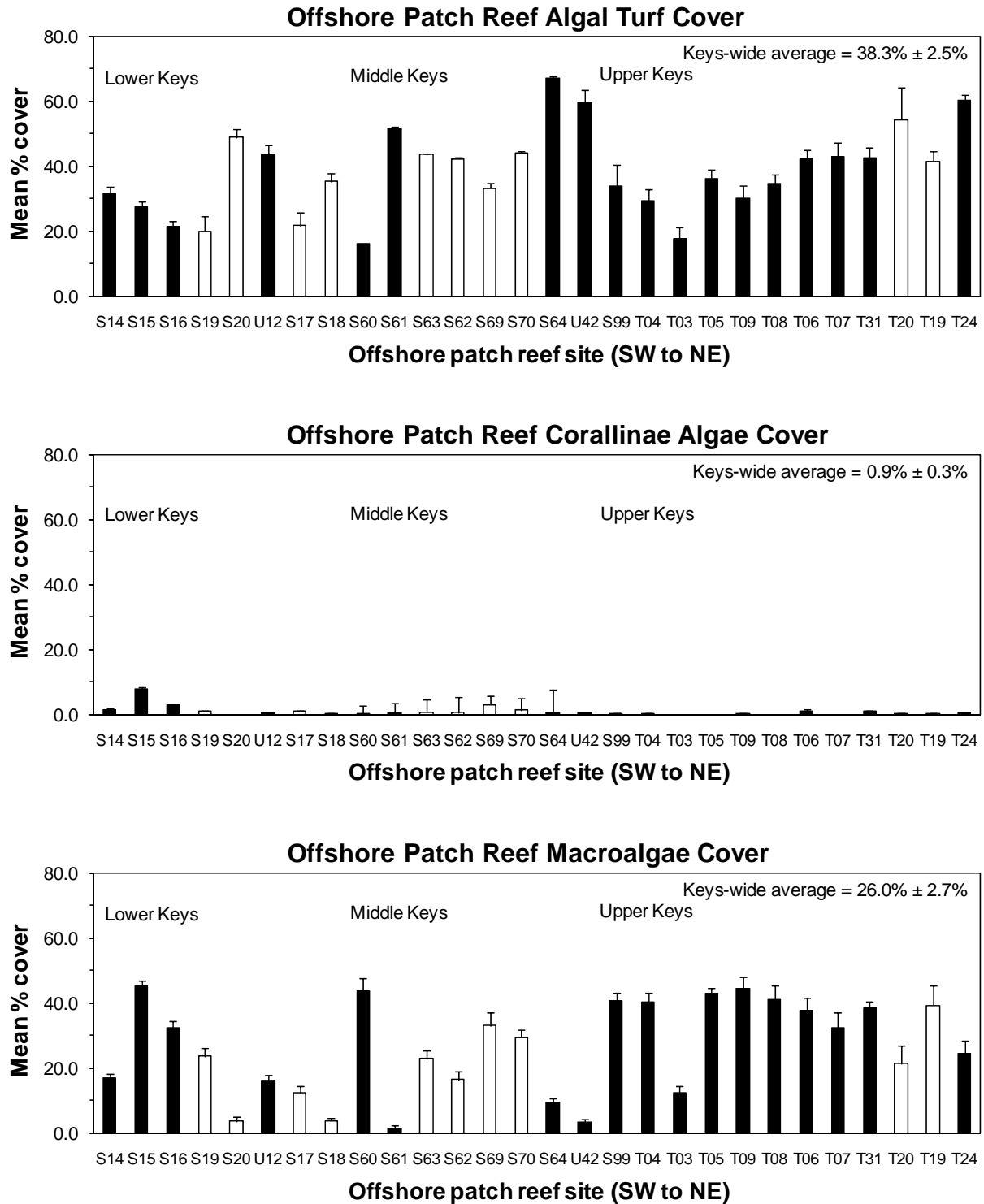


Figure 3-38. Mean (+ 1 SE) percent cover of algal turfs, crustose coralline algae, and macroalgae on shallow (< 6 m), high-relief spur and groove reefs in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

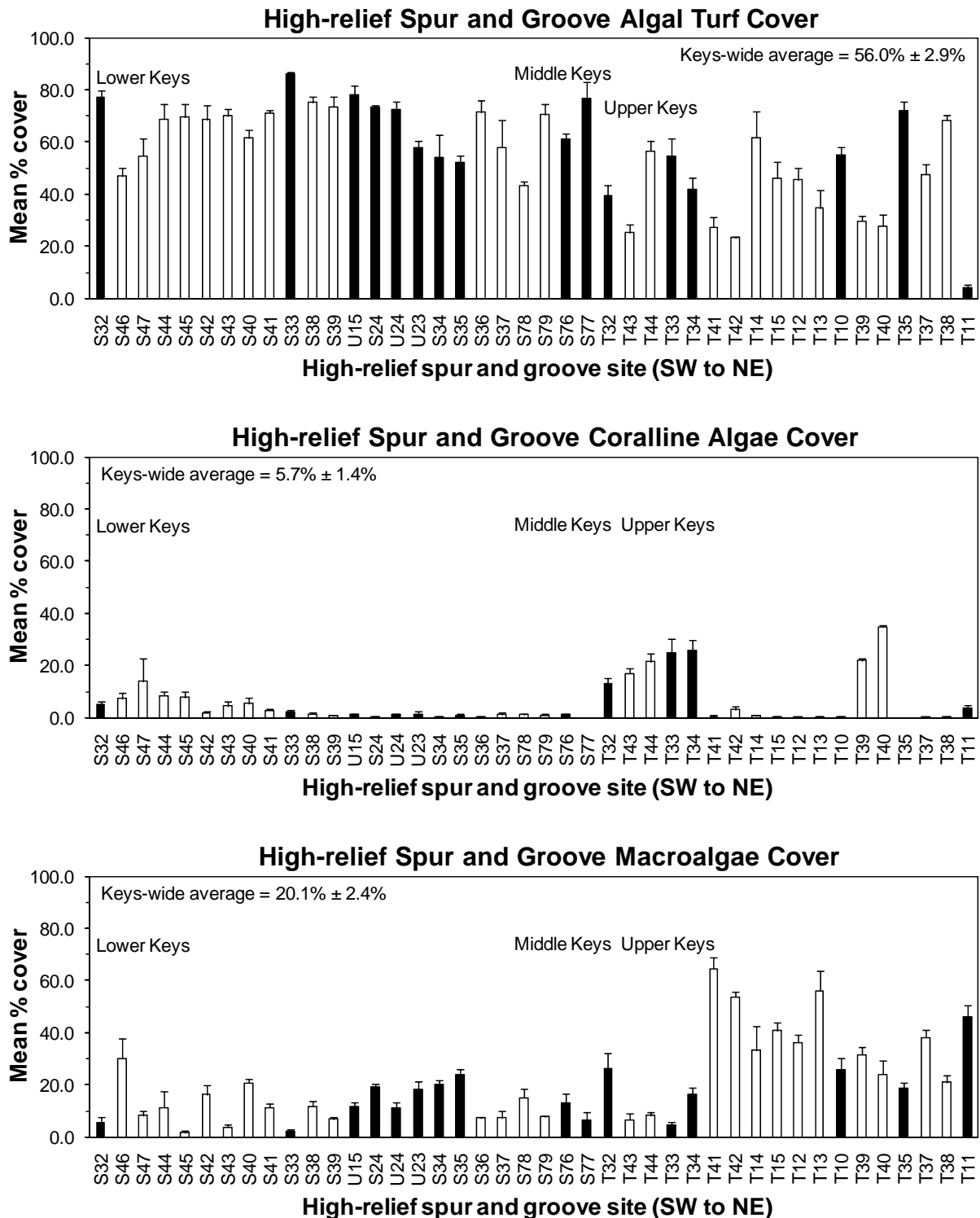


Figure 3-39. Mean (+ 1 SE) percent cover of algal turfs, crustose coralline algae, and macroalgae on deeper (6-15 m) fore reef habitats in the Florida Keys during 2009. Open bars = FKNMS no-take zones; filled bars = reference areas.

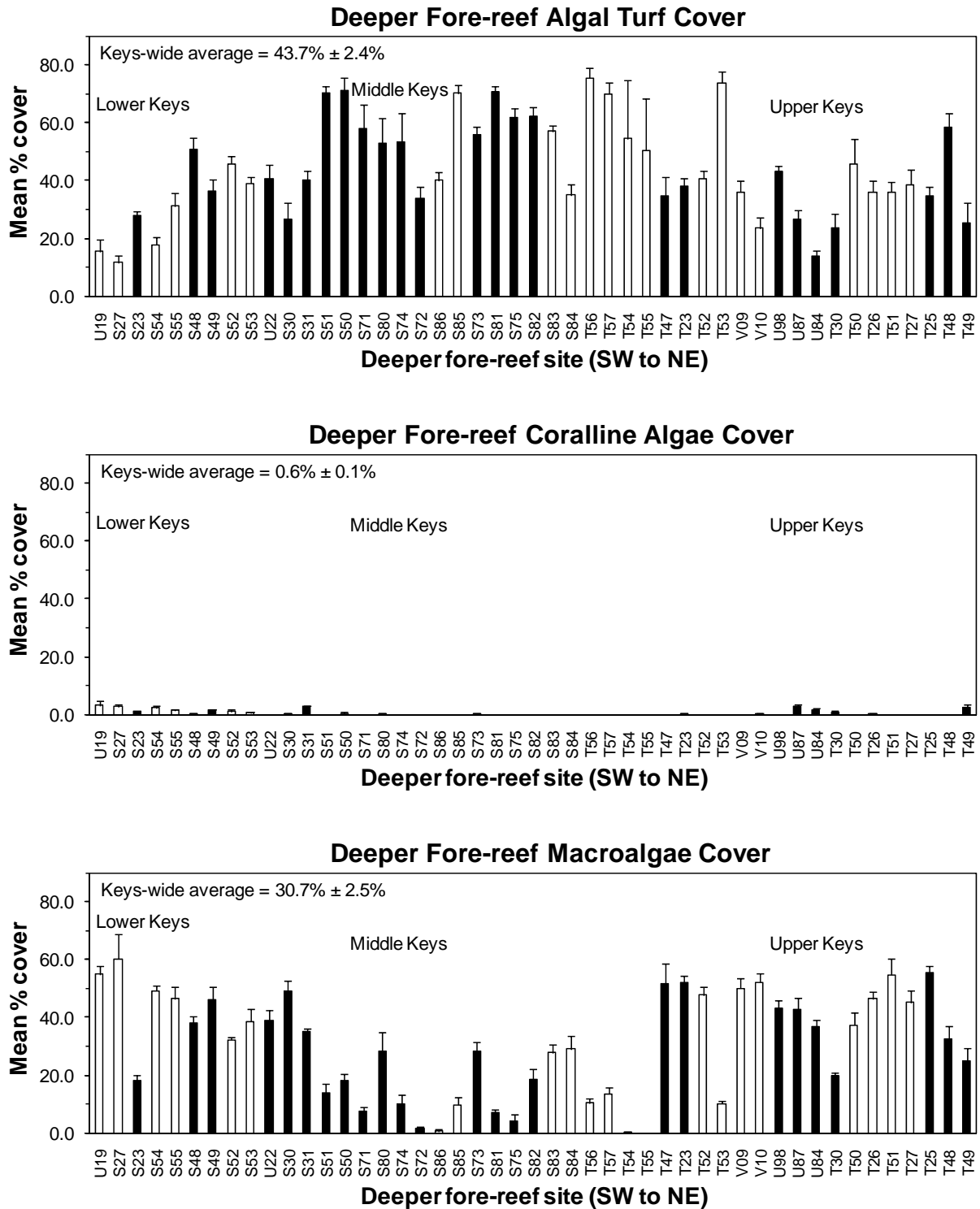


Table 3-1. Site species richness and mean \pm 1 SE numbers of species per 15 m² for stony corals (Milleporina and Scleractinia), gorgonians (Octocorallia), and sponges in the Florida Keys, as determined from surveys of four 15-m x 1-m belt transects per site at 160 sites during May-September 2009. Sites 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 - Sombbrero Key SPA**	0.50 ± 0.29	4.00 ± 0.91	4.50 ± 0.87	19.50 ± 4.29	1.25 ± 0.75
S79 - Sombbrero 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