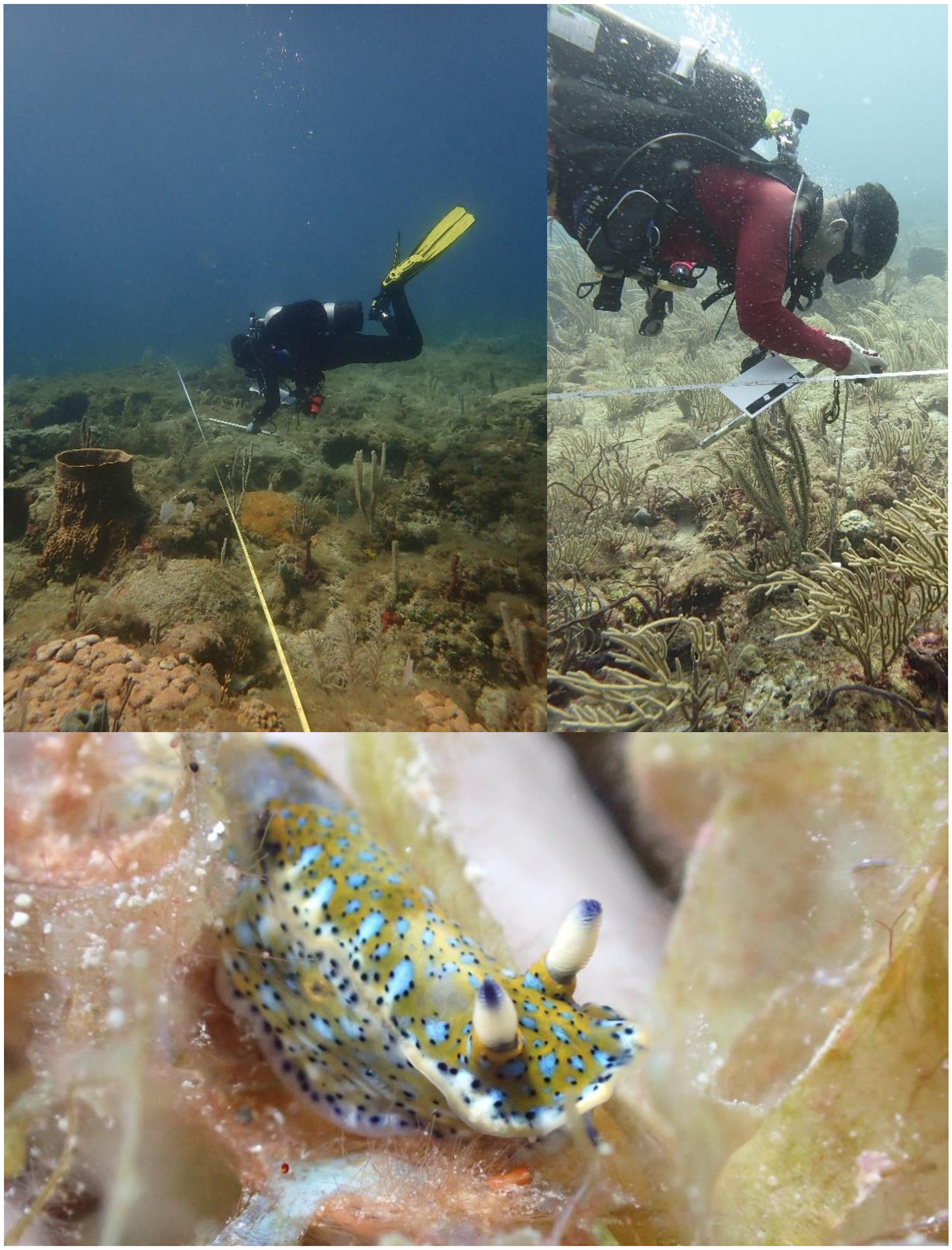
Southeast Florida Coral Reef Evaluation and Monitoring Project



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FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

FLORIDA'S CORAL REEF

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NOAA CORAL REEF CONSERVATION PROGRAM

Southeast Florida Coral Reef Evaluation and Monitoring Project

2024 Year 22 Draft Comprehensive Report

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LIST OF ACRONYMS

CRCP …………………………….………… (DEP) Coral Reef Conservation Program
CREMP …………………………..…... Coral Reef Evaluation and Monitoring Program
DEP …………………………..………Florida Department of Environmental Protection
FKNMS …………………………………….... Florida Keys National Marine Sanctuary
FWC ……………………………….. Florida Fish and Wildlife Conservation Commission
FWRI …………………………………………... Fish and Wildlife Research Institute
SECREMP …………………….. Southeast Coral Reef Evaluation and Monitoring Project
SCTLD …………………………………...……….. Stony Coral Tissue Loss Disease
FCR ……………………………………………………..…… Florida's Coral Reef
Coral AP …………….…………………………….. Kristin Jacobs Coral Aquatic Preserve
LTA…………………………………………….……………………Live Tissue Area

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Executive Summary

The Southeast Florida coral reef system is offshore a highly urbanized mainland (population ~6.2 million) influenced by numerous human activity-related local and global stressors. To document changes potentially related to increasing stressors, the Florida Department of Environmental Protection (DEP), in conjunction with Florida Fish and Wildlife Conservation Commission (FWC) and Nova Southeastern University (NSU), initiated an annual long-term coral reef monitoring program in 2003 along the Southeast Florida coast. To provide continuity in monitoring efforts along all of Florida's Coral Reef (FCR), the Southeast Florida Coral Reef Evaluation and Monitoring Project (SECREMP) was established as an expansion of the FWC-managed Coral Reef Evaluation and Monitoring Project (CREMP) in the Florida Keys. SECREMP provides local, state, and federal resource managers with annual reports on the status and condition of the Southeast Florida coral reef system (which spans Miami-Dade, Broward, Palm Beach, and Martin counties), as well as information on temporal changes in resource condition. Survey methods include photographic transects to quantify percent cover of major benthic taxa (stony corals, sponges, octocorals, macroalgae, etc.) and demographic surveys to quantify abundance, size distribution, and overall condition of stony corals, octocorals, and giant barrel sponges. SECREMP is also a partnership between DEP, FWC, and NSU that facilitates collaboration and knowledge sharing benefiting coral reef ecosystems nationwide.

The Kristin Jacobs Coral Aquatic Preserve (Coral AP), formerly known as the Kristin Jacobs Coral Reef Ecosystem Conservation Area, experienced significant stony coral assemblage declines across the study period, with significant losses observed for all stony coral metrics examined (cover, live tissue area (LTA), and density). These losses were predominately driven by a significant increase in stony coral tissue loss disease (SCTLD), which peaked in 2016 but has subsequently decreased in prevalence. As regional disease prevalence has remained below 1% since 2018, indicators of recovery can begin to be examined. No significant decline in stony coral LTA was identified from 2018 through 2024, and density in 2024 was significantly higher than density in all years from 2013-2019. However, this increase in density was predominantly driven by increases in non-SCTLD susceptible species, such as *Siderastrea siderea* and *Porites astreoides*. The juvenile assemblage was also dominated by these generalist, low-relief species, and juveniles of highly SCTLD-susceptible species were rare. This disease event does not appear to have had any significant impact on the octocoral community or barrel sponge, *Xestospongia muta*.

The chronic nature of disturbances to, and the significant economic value of, the coral reefs within the Kristin Jacobs Coral Aquatic Preserve requires comprehensive, long-term monitoring to define and quantify change and to help identify threats to the ecosystem. Both continual region-wide monitoring (i.e., SECREMP) and improved incident-specific monitoring are necessary for resource managers to develop sound management plans for coral reefs that allow continued use and realization of the economic value of these fragile marine ecosystems. The value for a long-term region-wide monitoring program is highlighted by the information in this report, which will be vital in planning and monitoring the potential future recovery of this resource.

Introduction

Florida's Coral Reef (FCR) is an important aesthetic and economic resource that extends approximately 577 km from the Dry Tortugas in the south to the St. Lucie Inlet in the north. The northern third of this reef system is contained within the Kristin Jacobs Coral Aquatic Preserve (Coral AP), which extends from the northern boundary of Biscayne National Park in Miami-Dade County to the St. Lucie Inlet in Martin County (approximately 170 km) and within 3 km off the mainland Atlantic coast of Florida. These reefs support diverse benthic and fish communities. Additionally, Coral AP reef habitats are an important economic asset for the region. They have been estimated to generate more than $6 billion in sales and income (adjusted for inflation) and support more than 35,000 jobs (Johns et al. 2001, 2004). The reef system has also been estimated to protect nearly 8,000 people, $500 million in infrastructure, and $440 million in economic activity from storm-related flooding (Storlazzi et al. 2019). The reefs within the Coral AP are clearly an important resource, but their adjacent location to a highly urbanized area (population ~6.2 million) drives ever-increasing human activity-related stress on the reefs.

Prior to 2003, long-term coral reef monitoring in Florida was primarily limited to the Florida Keys and Dry Tortugas in Monroe County. With the establishment of the Florida Keys National Marine Sanctuary (FKNMS) in 1990, coral reef monitoring efforts in the Keys grew. Since 1996, the Coral Reef Evaluation and Monitoring Project (CREMP) has documented changes in reef resources along the Keys portion of Florida's Coral Reef (FCR) from Key West to Carysfort Reef (Ruzicka et al 2010; Ruzicka et al. 2013). In 1999, the project was expanded to include sites in the Dry Tortugas. Conversely, in Southeast Florida, most coral reef monitoring efforts before 2003 were associated with impact and mitigation studies, and included investigating the impacts of dredging, ship groundings, pipeline and cable deployments, and beach renourishment. Because these efforts were defined by an activity permit and focused on monitoring for effects specific to a given impact, the temporal duration and spatial extent of these monitoring efforts were limited. In 2003, the Florida Department of Environmental Protection (DEP) was awarded funding for the inception of a long-term coral reef monitoring program along the Southeast Florida coast. To provide continuity in monitoring efforts along FCR from the Keys through Southeast Florida, DEP established the Southeast Florida Coral Reef Evaluation and Monitoring Project (SECREMP) as an expansion of CREMP. The goal of SECREMP has been to provide local, state, and federal resource managers an annual report on the status and condition of the Southeast Florida reef system (which spans Miami-Dade, Broward, Palm Beach, and Martin counties), as well as information on temporal changes in resource condition.

Survey Sites

Off the mainland coast of Southeast Florida from Miami-Dade County to central Palm Beach County, in particular offshore Broward County, the reef system within the Coral AP is composed of a series of linear reef complexes (also referred to as reefs, reef tracts, or reef terraces) running parallel to shore (Moyer et al. 2003; Banks et al. 2007; Walker et al. 2008) (Figure 1). The Inner Reef (also referred to as the "First Reef"), the terrace closest to the shoreline, crests in 3 to 7 m depths. The Middle Reef ("Second Reef") crests in 12 to 14 m depths. A large sand area separates the Outer and Middle Reef complexes. The Outer Reef ("Third Reef"), the terrace farthest from the shoreline, crests in 15 to 21 m depths. The Outer Reef is the most continuous reef complex, extending from Miami-Dade County to northern Palm Beach County, while the Inner and Middle Reefs are only intermittently exposed in Miami-Dade and Broward counties. Inshore of these reef complexes, there are extensive nearshore ridges and colonized pavement areas. From Palm Beach County to Martin County, the reef system is comprised of limestone ridges and terraces colonized by reef biota (Walker and Gilliam 2013). Since the inception of SECREMP, sites have been spread across all four of these reef habitats.

SECREMP began monitoring in 2003 at 10 sites, three each in Palm Beach and Miami-Dade counties and four in Broward County, including a nearshore monotypic stand of *Acropora cervicornis*. In 2006, two sites were added in Martin County, extending efforts to the northernmost area of FCR. Four additional sites were added in 2010, two each in Palm Beach County and Miami-Dade County. Finally, in 2013 six sites were added, three each in Broward and Miami-Dade counties. Currently SECREMP monitors 22 sites from Miami-Dade County to Martin County, distributed across all four described habitats. Figures 2 and 3 show the location of the 22 current sites along the Southeast Florida coast. Project sampling occurs annually from May through August. Table 1 provides reef type, depths, locations, and the 2024 monitoring date of each SECREMP site.

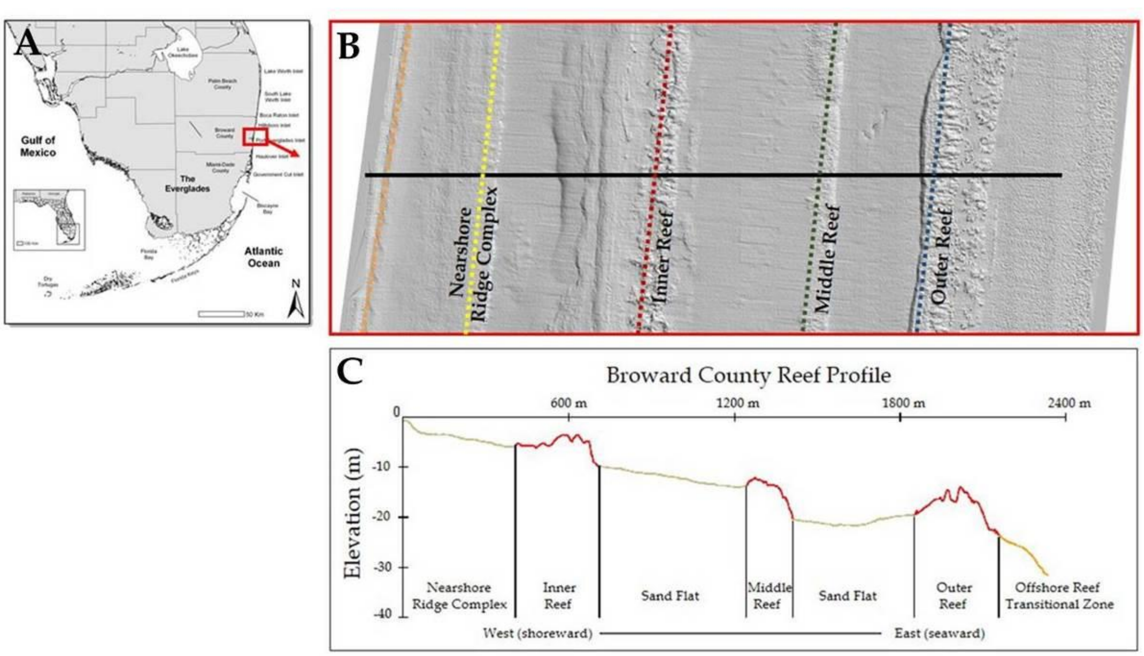


Figure 1. The Southeast Florida coastline. Panel A is a view of southern Florida showing an area off Broward County in red that corresponds to Panel B, which is a sea floor bathymetry map based on LIDAR (Light Detection and Ranging) data. The black line in Panel B shows the location of a bathymetric profile illustrated in Panel C.

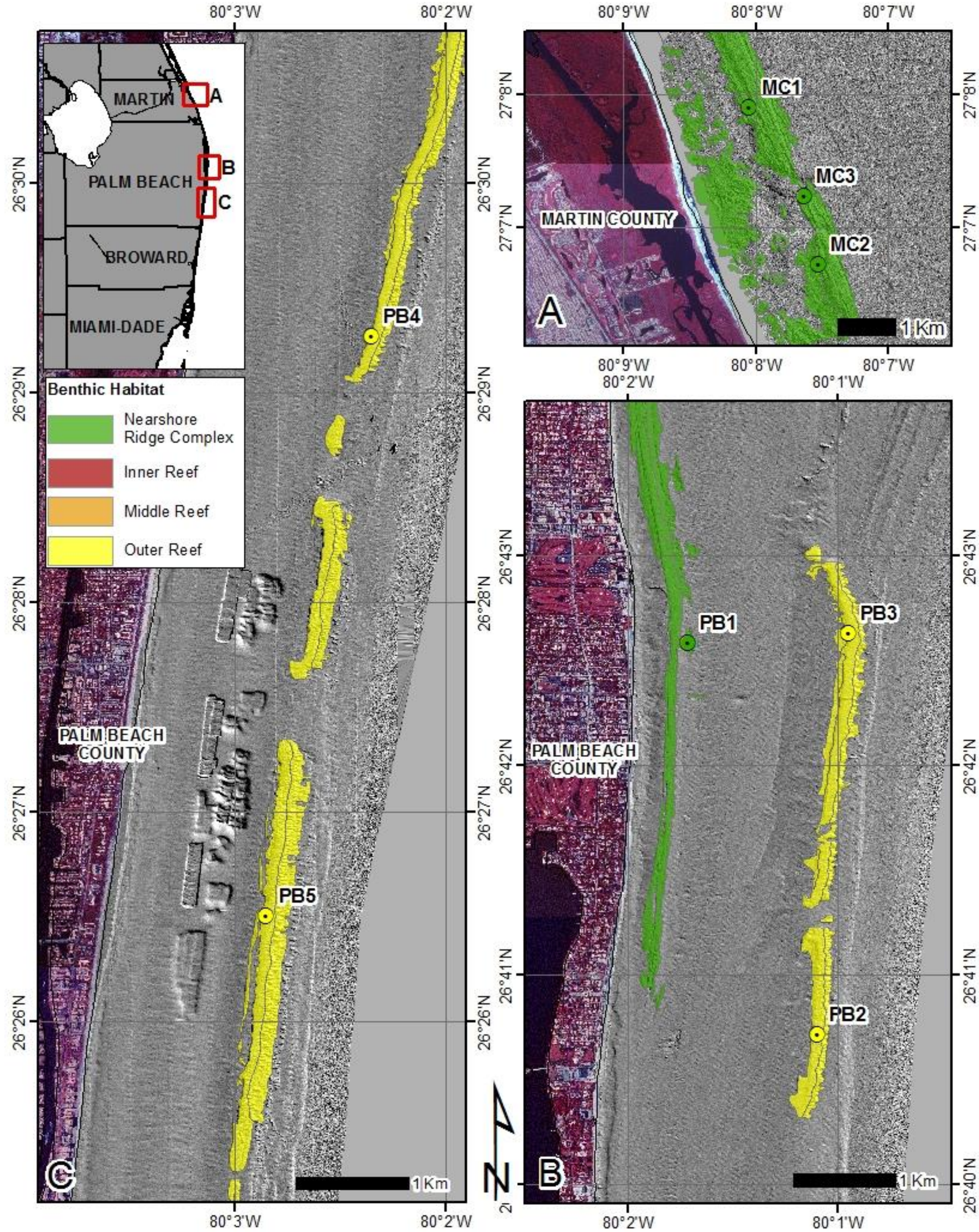


Figure 2. SECREMP sites. Location and habitat map of sites in Martin (Panel A) and Palm Beach (Panels B and C) counties.

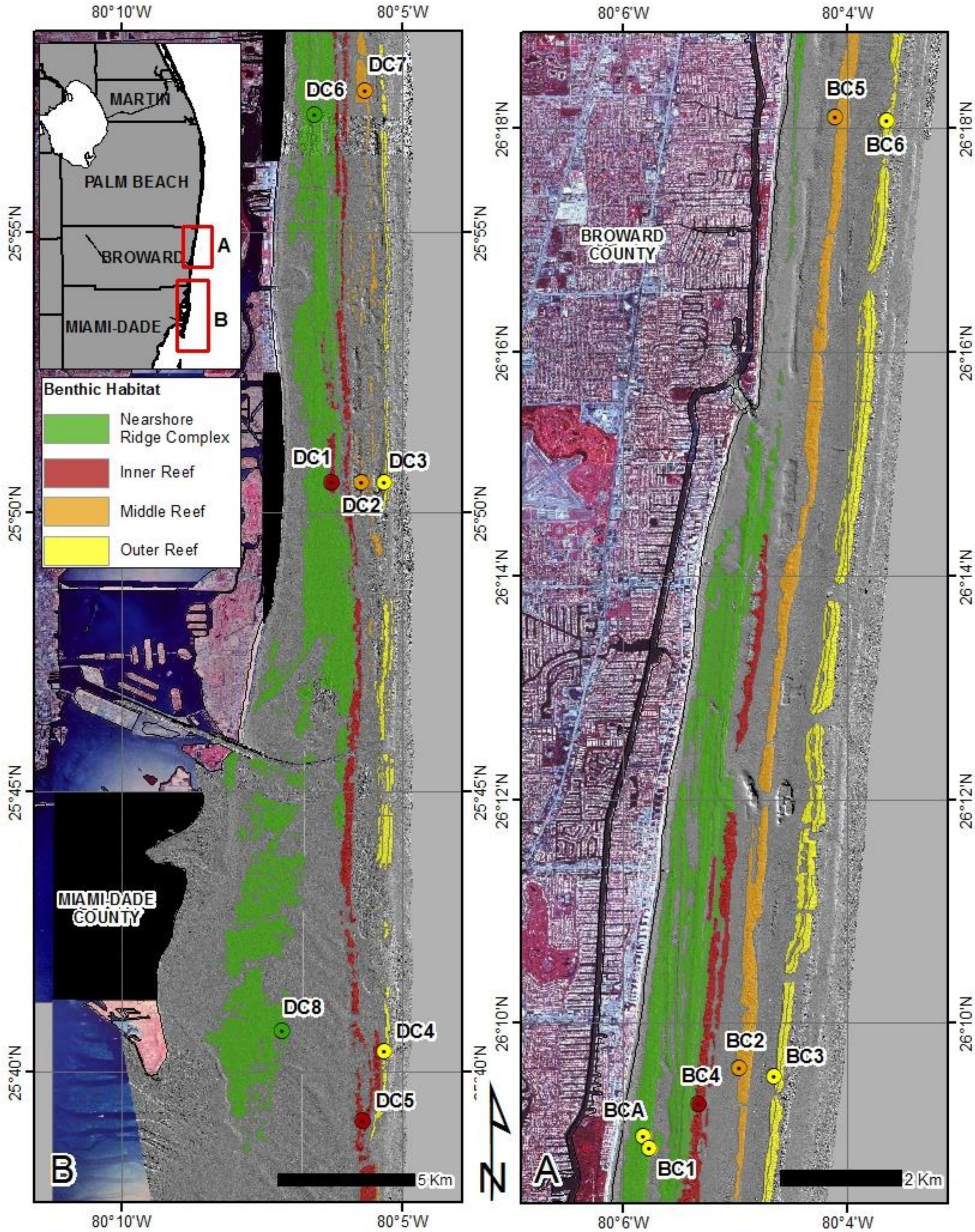


Figure 3. SECREMP sites. Location and habitat map of sites in Miami-Dade (Panel B) and Broward (Panel A) counties.

Table 1. Monitoring site reef types, depth (ft), location, and 2024 monitoring date. DC = Miami-Dade County, BC = Broward County, PB = Palm Beach County, MC = Martin County. NRC = Nearshore Ridge Complex.

Site Code	Reef Type	Depth	Latitude (N)	Longitude (W)	Monitoring Date
DC1	Inner	25	25° 50.530’	80° 06.242’	July 23
DC2	Middle	45	25° 50.520’	80° 05.704’	August 29
DC3	Outer	55	25° 50.526’	80° 05.286’	August 20
DC4	Outer	41	25° 40.357’	80° 05.301’	August 12
DC5	Inner	24	25° 39.112’	80° 05.676’	August 21
DC6	NRC	15	25° 57.099’	80° 06.534’	August 8
DC7	Middle	55	25° 57.530’	80° 05.639’	August 8
DC8	NRC	15	25° 40.707’	80° 07.111’	August 12
BCA	NRC	25	26° 08.985’	80° 05.810’	June 5
BC1	NRC	25	26° 08.872’	80° 05.758’	June 5
BC2	Middle	40	26° 09.597’	80° 04.950’	August 27
BC3	Outer	55	26° 09.518’	80° 04.641’	August 27
BC4	Inner	30	26° 08.963’	80° 05.364’	April 25
BC5	Middle	45	26° 18.100’	80° 04.095’	August 13
BC6	Outer	55	26° 18.067’	80° 03.634’	July 26
PB1	NRC	25	26° 42.583’	80° 01.714’	July 30
PB2	Outer	55	26° 40.710’	80° 01.095’	July 31
PB3	Outer	55	26° 42.626’	80° 00.949’	July 30
PB4	Outer	55	26° 29.268’	80° 02.345’	August 1
PB5	Outer	55	26° 26.504’	80° 02.854’	July 29
MC1	NRC	15	27° 07.900’	80° 08.042’	June 3
MC2	NRC	15	27° 06.722’	80° 07.525’	June 3

Methods

Each site consists of four monitoring stations demarcated by stainless steel stakes that are permanently placed in the substrate. Each station is 22 meters in length and has a north-south orientation, which is generally parallel to the reef tracts of Southeast Florida. Survey transect areas are delineated by a fiberglass tape stretched between the stainless-steel stakes at either end of a station. *In situ* monitoring included photo transects at all site stations sampled each year (2003-2024). Starting in 2013, a stony coral population survey, an octocoral population survey, and a *Xestospongia muta* population survey, were conducted along the same transect covering a similar area of the substrate (Figure 4).

Image Transects

Transect images were taken along all stations at all sites sampled each year (2003-2024). All transect images were taken to the east of the fiberglass tape delineating a transect. In 2024, the images were captured using an Olympus Tough TG-4 digital camera. Each image was captured at ~40 cm above the reef substrate to yield images approximately 40 cm wide by 30 cm in height. A constant distance above the substrate was maintained using an aluminum bar affixed to the base of the camera housing. Benthic features seen in the top border of the camera viewfinder and the fiberglass tape were used as visual reference points to take abutting images with minimal overlap. This results in an image transect consisting of about 60 photos covering an area of approximately 0.4 m x 22 m.

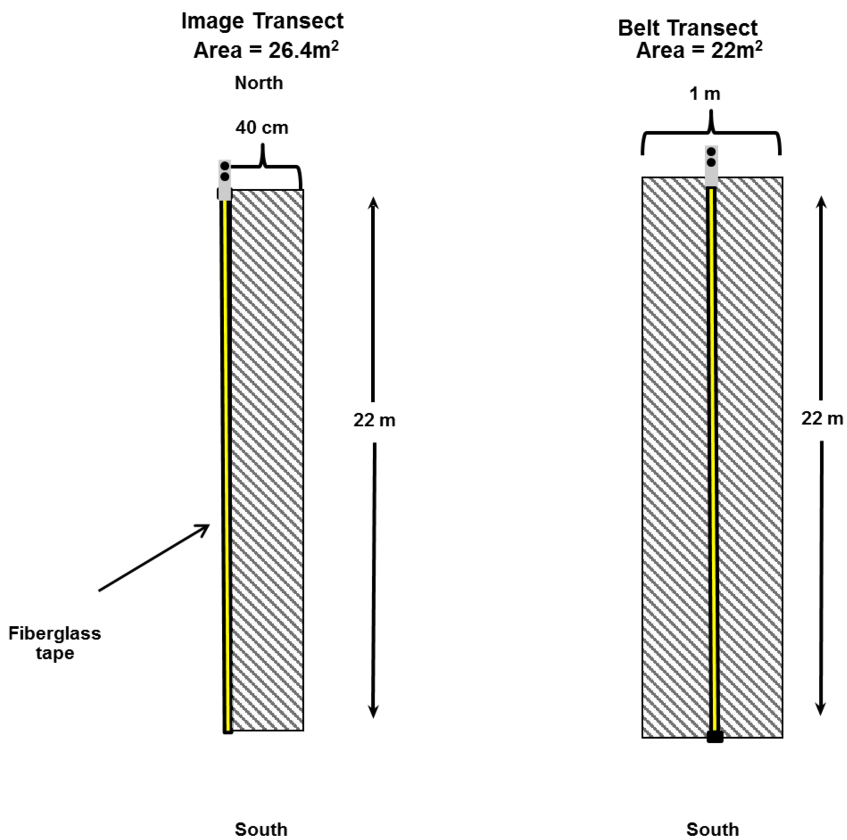


Figure 4. Layout of each SECREMP station. Hatching indicates the area within which the image and belt transect data were collected (note the gorgonian belt area is 1 m x 10 m).

In the lab, images were formatted for PointCount '99 image analysis software. Fifteen points were randomly overlaid on each image, which is consistent with CREMP protocol. Underneath each point, select benthic taxa were identified to species (i.e., stony corals, *Gorgonia ventalina*, *Xestospongia muta*), genus (e.g., *Dictyota* spp., *Halimeda* spp., and *Lobophora* spp), or higher taxonomic levels (e.g. encrusting or branching octocoral, crustose coralline algae, zoanthid, sponge, and macroalgae). Uncolonized substrate was identified as sand or substrate (consolidated pavement or rubble). After all images were analyzed, the data were checked for quality assurance and entered into the Microsoft Access database managed by FWC.

Stony Coral Demographic Survey

Stony coral surveys were performed at all site stations across 22 sites starting in 2013. Divers conducted a 1 m x 22 m belt transect from north to south along the transect tape and identified every stony coral colony to the species level (Figure 4). From 2013-2017, all colonies ≥4 cm in diameter were identified to species and the maximum diameter and the maximum height, perpendicular to the plane of growth, were measured. Each colony was then visually assessed for the presence of diseases, bleaching, and other conditions (e.g., predation, damselfish, Clionaids etc.). Where these conditions resulted in partial mortality, the percentage was visually estimated. Diseases include those with conditions that resulted in tissue mortality (e.g., stony coral tissue loss disease (SCTLD) or black band disease) as well as conditions that may not visually result in tissue mortality (e.g., dark spot syndrome and tissue growth anomalies). Mortality was considered "recent" if the corallite structure was clearly distinguishable and there was minimal overgrowth by algae or other fouling organisms. Otherwise, mortality was classified as "old." In 2018, the minimum colony size for demographic data was reduced to ≥2 cm in diameter. Also starting in 2018, colonies <2 cm in diameter were identified to lowest taxonomic level possible and tallied at each station. However, for this report, only colonies ≥4 cm in diameter were included in the demographic data analysis to facilitate comparisons between years. All corals <4 cm in diameter were presented as tallied data only. For *Millepora alcicornis* (fire coral) only colony presence or absence was recorded. Beginning in 2023, the stony coral transect survey length at two sites (Martin County (MC) 1 and 2) was modified to only include the first 10 meters of the transect, due to the difficulty in surveying the large abundance of small *Siderastrea siderea* and *Porites astreoides* colonies within the tidally influenced timing constraints.

Octocoral Demographic Survey

Starting in 2013, octocoral surveys were also conducted at all stations, but covered a reduced survey area. Divers conducted a 1 m x 10 m belt transect starting at the northernmost stake for each station. Octocoral surveys were completed in two parts. First, all octocoral colonies within the belt transect were counted, regardless of species, to provide a measurement of overall octocoral density. Second, for three target species, *Antillogorgia americana* (formerly *Pseudopterogorgia americana*)*, Eunicea flexuosa* (formerly *Plexaura flexuosa*)*,* and *Gorgonia ventalina*, all colonies within the belt transect were recorded, the maximum height was measured, and the colony was visually assessed for the presence of disease, bleaching, and various other conditions (e.g., predation, overgrowth, etc.). These species were selected because they are generally easily distinguishable in the field and are relatively abundant in their preferred reef habitat along Florida's Coral Reef. Although colony conditions were assessed, the condition data are not presented in this report, as they were relatively rare.

Barrel Sponge Demographic Survey

A barrel sponge (*Xestospongia muta*) survey, starting in 2013, was also conducted at each station. *Xestospongia muta* density was determined by counting all sponges within the 1 m x 22 m belt centered under the transect tape (Figure 4). For each sponge, the maximum diameter, maximum base diameter, and maximum height were measured, and the sponge was visually assessed for the presence of disease, bleaching, and other conditions (e.g., damage/injury, predation). The percent of the sponge affected by injury, disease, and/or bleaching was also recorded. Similar to octocorals, sponge conditions are not presented in this report.

Monitoring Site Temperature Record

The deployment of Onset (www.onsetcomp.com) temperature loggers has been part of the SECREMP sampling protocol since 2007. Temperature loggers were deployed at all existing sites annually and at new sites as they were established. Throughout the course of the project three models of temperature loggers have been deployed: the StowAway TidbiT™, HOBO Pendant Temperature Data Logger, and HOBO Water Temperature Pro v2. Currently, HOBO Water Temperature Pro v2 loggers are used at all sites. Two temperature loggers were deployed at each site and were replaced during each annual monitoring event. Two loggers were deployed at each site in order to provide redundancy in the event of logger failure or dislodgement. The loggers were programmed to record temperature at a sampling interval of two hours. The two loggers were attached approximately 10 cm off the substrate to the northern-end stakes identifying Stations 1 and 2 at each site. Data from both loggers were downloaded. If data from both loggers were successfully downloaded, the data from the logger attached to Station 1 was reported.

Analyses

All analyses of the stony coral community included only colonies ≥4 cm diameter because colonies 2-4 cm were only first included in monitoring efforts in 2018. To provide a metric to evaluate changes to the stony coral community, stony coral colony width, height, and percent mortality (sum of old and recent) for each colony were used to calculate total live tissue area (LTA) for each site for 2013-2024. Because the stony coral transect survey length at Martin County sites was modified due to the aforementioned constraints, site-level LTA for MC1 and MC2 beginning in 2023 was standardized to 22 meters by multiplying the site LTA sum across the first 10 meters of the survey by 2.2. Region-wide LTAs were also calculated for select stony coral species for 2013-2024. The LTA for each colony was calculated using the following equation:

$$SA = 2\pi\left(\frac{a^{p}\left(\frac{1}{2}b\right)^{p} + a^{p}\left(\frac{1}{2}b\right)^{p} + \left(\frac{1}{2}b\right)^{p}\left(\frac{1}{2}b\right)^{p}}{3}\right)^{\frac{1}{p}}$$

This equation was modified from Knud Thomsen's formula for the estimated surface area (SA) of an ellipsoid. The original SA equation was multiplied by ½ to estimate the surface area of a coral as the equivalent of the top half of an ellipsoid. In this modified version a = maximum height of the colony, b = the maximum diameter of the colony, and p ≈ 1.6075, a constant yielding a relative error of at most 1.061%. Following calculation of the SA, the value was converted to LTA via the following formula:

$$LTA = SA\left(1 - \left(\frac{\%\ Old\ Mortality + \%\ Recent\ Mortality}{100}\right)\right)$$

Mortality was divided by 100 to convert to a proportion. Additionally, LTA was calculated in cm^2 and then converted to m^2.

Region-wide stony coral (colonies ≥4 cm diameter only) density, LTA, and disease prevalence, octocoral density, and barrel sponge density were tested for differences between years 2013-2024. For Martin County sites beginning in 2023, stony coral density was calculated based on only the first 10 meters of the stony coral transect and was directly comparable to previous years' density measurements, as density controls for area surveyed. Additionally, stony coral species were grouped into SCTLD susceptibility groups, as defined in the SCTLD Case Definition (NOAA 2018). These groups included those species defined as "highly susceptible," "intermediately susceptible," "lowly susceptible," and "presumed susceptible" (NOAA 2018). These groups (high, intermediate, low, presumed) were then examined for changes in LTA between years. As with site-level LTA analyses, coral LTA by susceptibility group for MC1 and MC2 beginning in 2023 was standardized to 22 meters by multiplying the LTA sum for each susceptibility group within the first 10 meters of the survey by 2.2. Similar to stony corals, the three octocoral target species were tested for differences in density and mean height between years. For metrics meeting the assumptions of a repeated measures analysis of variance (ANOVA), the ANOVA was performed using the linear mixed-effects model (lme) and anova functions in the nlme (Pinheiro et al. 2017) and base R packages, respectively, in RStudio (version 4.3.1 (2023-06-16)) (R Core Team 2023). The lme equation was "metric" ~ year with site as the repeated measure within Year. Following the lme function, the anova function was used to perform the ANOVA on the lme model. Significant differences between years for all metrics were identified by $p \leq 0.05$. For metrics analyzed via the lme and anova test and identified as significant, a general linear hypothesis (glht) and multiple comparisons post-hoc were performed to determine which years were significantly different. The post-hoc test was performed using the glht function in the multcomp package (Hothorn et al. 2008). Significant differences between years were identified by multiple comparison adjusted (Tukey single-step method) *p*-values ($p \leq 0.05$).

Region-wide stony coral disease prevalence was calculated for 2013-2024 (colonies ≥4 cm diameter). Regional prevalence was calculated by taking the total number of diseased stony coral colonies for the region and dividing it by the total number of all stony coral colonies and multiplying by 100% to get prevalence as a percent. Site-level prevalence values were calculated by dividing the total number of diseased colonies within a site by the total number of colonies and multiplying by 100% to get prevalence as a percent. Disease was then grouped into SCTLD or Other, where Other consisted of all other diseases recorded within sample sites: black band disease, yellow band disease, dark spot disease, white band disease (for acroporids), and rapid tissue loss (for acroporids).

Temporal changes in percent cover were analyzed at the site level across multiple time periods. Because of high site-to-site variability in percent cover, statistical models that examine temporal changes by grouping data from multiple sites at various spatial scales (e.g., by region, subregion, or habitat) can become complicated and difficult to fit. By limiting comparisons to the site level, the confounding effects of spatial variability are reduced and model estimates and statistical inference are strengthened. Changes occurring at the regional, subregional, or habitat spatial levels can be drawn by evaluating the changes occurring at the sites within each spatial domain.

Three generalized linear mixed models were used to examine percent cover changes in the four major benthic taxa (stony corals, octocorals, macroalgae, and sponges) across multiple time periods. All models followed a similar structure but compared different time periods among different groups of sites. Three time periods were delineated: 2003-2005 (which represents benthic cover values at the inception of monitoring), 2013-2015 (which represents benthic cover values 10 years after the start of SECREMP and around the onset of SCTLD), and 2022-2024 (which represents more recent benthic cover values in a post-SCTLD time period). Because many benthic taxa groups fluctuate in cover over time, fitting linear trends over 20- or 10-year project periods can be less informative because the trend can be heavily influenced by starting or ending points in the time series. Blocking the data into time intervals, as described herein, allows for equally weighted comparisons that mark different points in time of the project. In addition, pooling survey data across multiple years lowers the influence of observer variability or ephemeral events and provides a more robust estimate on benthic condition during different snapshots in the 20 years of SECREMP monitoring. For short term analyses the same statistical approach was used but only single years were incorporated (2023 compared to 2024). In the first model, the 10 original SECREMP sites which were first surveyed in 2003 (BC1, BC2, BC3, BCA, DC1, DC2, DC3, PB1, PB2, PB3) were compared between 2003-2005 and 2013-2015 to provide a historical context for benthic cover changes across the SECREMP region since the project inception. In the second model, the full complement of all 22 SECREMP sites were compared across two grouped time periods, 2013-2015 and 2022-2024, providing a record of change in percent cover over the last decade. In the third model, all 22 SECREMP sites were compared between 2023 and 2024, providing a recent record of change in benthic percent cover over the last two years.

All analyses were conducted using logistic regression in R 4.3.2 using the glmmTMB and the emmeans packages (R Core Team 2023). For each model, year grouping (Models 1 and 2) or individual year (Model 3), sites, and the interaction of the two, were included as fixed effects and the survey stations within each site were included as a random effect to account for the nested, repeated measures survey design. All assigned random points identified in Point Count were included. Points were pooled for each year group in the two longer term analyses (Models 1 and 2), or for individual years in the short-term analysis (Model 3). Changes between year groups, or individual years, were examined at the regional level and for each site for each target taxon (i.e., corals, sponges, octocorals, and macroalgae). For regional comparisons across year groupings, α = 0.05 was used. To account for the multiple comparisons made when comparing the selected time periods for each site, a Bonferroni adjustment was applied to the α value of 0.05 to reduce the potential for Type I errors. For the 10 sites that were included in the analysis of 2003-2005 vs. 2013-2015, the α was adjusted to 0.005. For the 22 sites that were included in the analysis of 2013-2015 vs. 2020-2022, and for the short-term analysis comparing 2023 vs. 2024, the α was adjusted to 0.002273. For each model, the regional arithmetic mean for each time period across all sites is provided, and the number of sites significantly increasing, decreasing, or remaining unchanged.

Year 22 (2024) Results

Stony Coral

When averaged across the region, stony coral cover has generally decreased over time (Figure 5). However, for the 10 sites evaluated between the 2003-2005 and 2013-2015 time periods, coral cover significantly increased at three sites (BC3, DC1 and DC2), significantly decreased at two sites (BCA and PB1), and was unchanged at five sites (Table 2, see Appendix 3 for site values and statistical *p*-values). While overall coral cover, averaged for all 10 sites, decreased from 5.59 ± 3.65% in the 2003-2005 period to 3.51 ± 0.19% in the 2013-2015 period, this change was primarily driven by the loss of coral cover at BCA. Cover at BCA, which decreased from 36.86 ± 1.70% in 2003-2005 to 11.43% ± 0.74% in 2013-2015. At PB1, coral cover also significantly decreased, but was low to start, only averaging 0.50 ± 0.08% in 2003-2005. Excluding BCA, the mean coral cover at the remaining 9 sites actually increased from 2.09 ± 1.17% to 2.63 ± 1.32%. Beyond BCA and PB1, coral cover across the SECREMP region mostly increased from 2003-2005 to 2013-2015. Aside from the three sites with significant gains in coral cover between the time periods, the five sites with no significant differences showed modest but non-significant increases in coral cover (Table 2, see Appendix 3 for site values and statistical *p*-values). The largest increase was observed at DC1, where cover increased from 2.35 ± 0.53% in 2003-2005 to 4.72 ± 1.00% in 2013-2015.

With the onset of observable SCTLD in 2014, the increase of coral cover at three of the original sites ceased and cover declined at most sites during the next 10 years. Between the 2013-2015 and the 2022-2024 time periods, coral cover did not significantly increase at any site: it significantly declined at 15 of 22 sites and was unchanged at 7 sites (Table 2, see Appendix 3 for site values and statistical *p*-values). Mean stony coral cover decreased across these time periods from 2.63 ± 0.69% in 2013-2015 to 1.13 ± 0.24% in 2022-2024. Most sites that had a significant decrease lost more than half of their stony coral coverage, with the largest decrease observed at BCA, which declined from 11.43 ± 1.06% in 2013-2015 to 1.55 ± 0.12% in 2022-2024. BC1 also had a large decrease, from 12.43 ± 1.55% in 2013-2015 to 5.14 ± 0.74% in 2022-2024. Of the seven sites that did not have a significant change in cover, only two had cover above 1.00% in the 2013-2015 period, DC4 and DC8, and both decreased in cover, albeit not significantly.

Over the last two years, coral percent cover was stable. Although there was a slight increase, this was not significant. Mean coral cover, averaged for all sites, was similar in both years: 1.08 ± 0.25% in 2023 and 1.09 ± 0.21% in 2024. Short-term analyses comparing 2023 to 2024 indicated no significant changes at all 22 sites (see Appendix 1 for region-wide and site mean values and Appendix 2 for statistical *p*-values). The largest increase in coral cover, albeit non-significant, was observed at BC4, which increased from 2.03 ± 0.30% in 2023 to 2.43 ± 0.51% in 2024. The largest decrease in coral cover, also non-significant, was observed at MC1, which decreased from 2.28 ± 0.63% in 2023 to 1.60 ± 0.61% in 2024 (see Appendix 1 for region-wide and site mean values and Appendix 2 for statistical *p*-values).

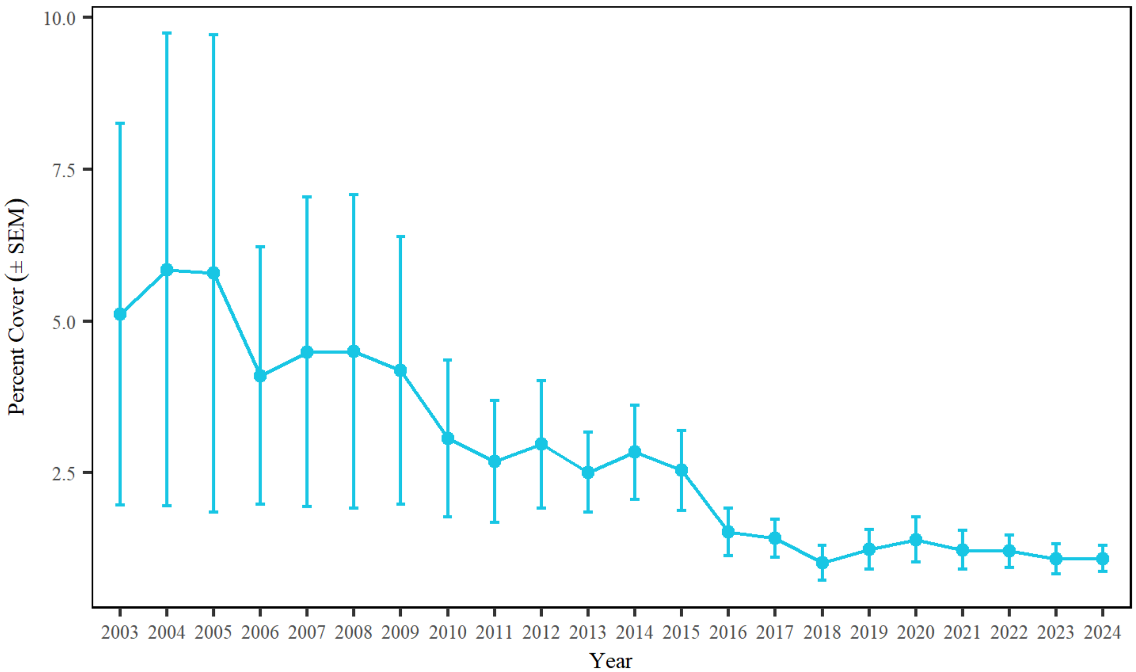


Figure 5. Mean stony coral percent cover (± SEM) for all sites combined.

Table 2. Stony coral long term percent cover change for the 10 original SECREMP sites and the 22 current SECREMP sites. Increasing denotes the number of sites with a significant increase in cover, decreasing denotes the number of sites with significant increase, and no change indicates sites that have not significantly changed between each time interval (2003-2005 vs. 2013-2015, 2013-2015 vs. 2022-2024).

N	Overall Mean 2003-2005	Overall Mean 2013-2015	Overall Mean 2022-2024	Increasing	Decreasing	No Change
10	5.59 ± 3.65%	3.51 ± 1.47%		3	2	5
22		2.63 ± 0.69%	1.13 ± 0.24%	0	15	7

Regional live tissue area in 2017 (3.53 ± 1.09 m^2), 2018 (2.72 ± 1.01 m^2), 2019 (3.08 ± 1.08 m^2), 2020 (3.11 ± 1.03 m^2), 2021 (2.95 ± 0.96 m^2), 2022 (3.16 ± 0.98 m^2), 2023 (3.18 ± 1.03 m^2), and 2024 (3.46 ± 1.08 m^2) was significantly lower than the LTA in 2013 (6.11 ± 1.87 m^2), 2014 (6.38 ± 2.16 m^2), and 2015 (6.48 ± 2.38 m^2) (Figure 6, $p < 0.05$; see Appendix 4 for region-wide, site mean values and Appendix 5 for regional p-values). Only one site (BC2) had its highest LTA recorded in 2024. Two sites (PB2 and PB1) had their lowest recorded LTA in 2023 and 2024, respectively (Appendix 4). Although there was no significant increase in LTA at any sites, 15 sites (BC1, BC3, BC5, BC6, BCA, DC1, DC2, DC4, DC5, DC6, DC7, PB2, PB3, PB4, PB5) experienced an increase in LTA of ≥5% between 2023 and 2024 (Appendix 4).

When comparing LTA between different groups of SCTLD susceptibility, only those species in the high and intermediate susceptibility groups had significant changes in regional LTA (linear mixed-effects model ANOVA: $p < 0.05$; see Appendix 5 for region-wide mean values and Appendix 6 for regional statistical *p*-values). Regional LTA for highly susceptible species was significantly lower in 2016 (0.59 ± 0.44 m^2), 2017 (0.57 ± 0.41 m^2), 2018 (0.03 ± 0.01 m^2), 2019 (0.04 ± 0.02 m^2), 2020 (0.04 ± 0.02 m^2), 2021 (0.04 ± 0.01 m^2), 2022 (0.06 ± 0.01 m^2), 2023 (0.06 ± 0.01 m^2), and 2024 (0.08 ± 0.01 m^2) than it was in 2013 (1.23 ± 0.35 m^2) and 2014 (1.14 ± 0.37 m^2). Regional LTA of highly susceptible species was also significantly lower from 2018-2024 than it was in 2015 (0.93 ± 0.34 m^2) (Figure 7, linear mixed-effects model ANOVA: $p < 0.05$; see Appendix 5 for region-wide mean values and Appendix 6 for regional statistical p-values). Regional LTA for intermediately susceptible species was significantly lower in 2018 (1.83 ± 0.98 m^2), 2019 (1.90 ± 1.02 m^2), 2020 (1.90 ± 0.99 m^2), 2021 (1.79 ± 0.90 m^2), and 2022 (1.89 ± 0.90 m^2) than it was in 2014 (4.28 ± 2.11 m^2). It was also significantly lower in 2017 (2.13 ± 0.99 m^2), 2018, 2019, 2020, 2021, 2022, 2023 (2.00 ± 0.96 m^2), and 2024 (2.14 ± 1.02 m^2) than it was in 2015 (4.73 ± 2.39 m^2) (Figure 8, linear mixed-effects model ANOVA: $p < 0.05$; see Appendix 5 for region-wide mean values and Appendix 6 for regional statistical *p*-values). For both the presumed susceptible and low susceptible species groups, no significant change in regional LTA was identified across the study years (Figure 9, Figure 10 linear mixed-effects model ANOVA: $p > 0.05$; see Appendix 5 for region-wide mean values and Appendix 6 for regional statistical *p*-values).

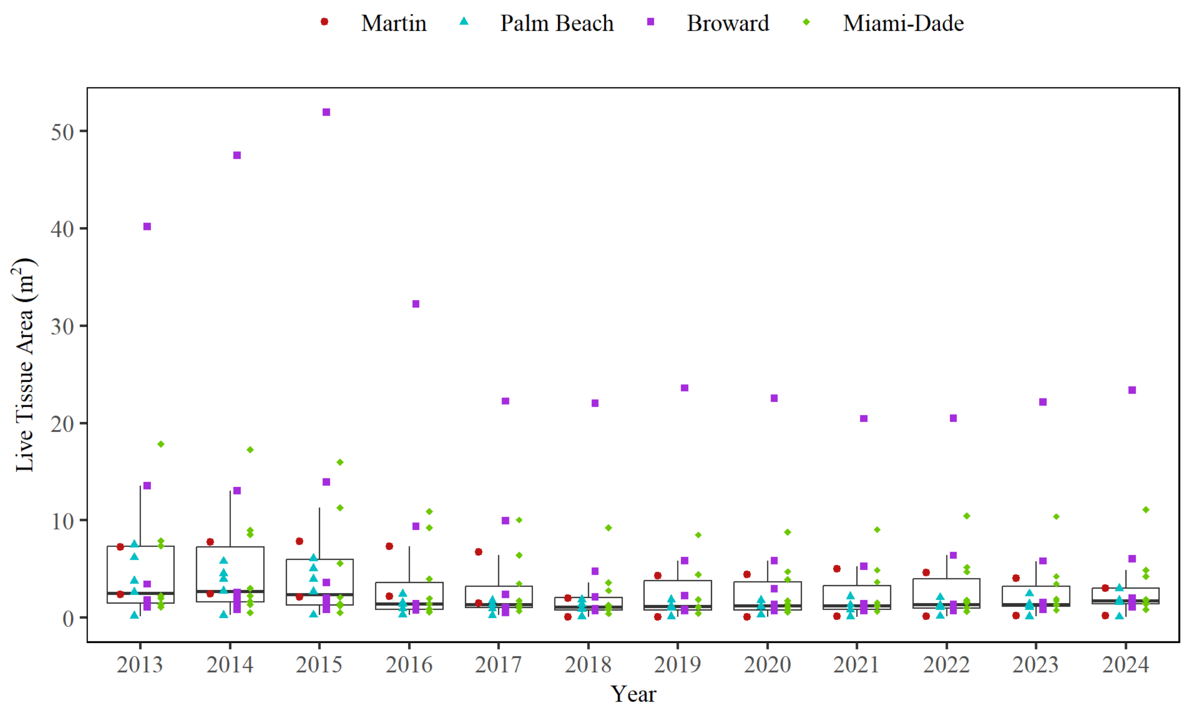


Figure 6. Live tissue area (LTA) for all stony corals summed by site (2013 to 2024). Each point is the LTA at a site, with both point shape and color representing county. The middle bar in the boxplot is the median LTA for the region. The areas above and below the median, hinges, represent the 1st and 3rd quartiles, respectively. The whiskers, upper and lower, extend from the hinge to the largest value no greater than 1.5*IQR, where IQR is the inter-quartile range (the distance between the 1st and 3rd quartiles). Points lying beyond the whiskers are considered outliers. There was a significant LTA decrease in 2017, 2018, 2019, 2020, 2021, 2022, 2023, and 2024 compared to 2013, 2014, and 2015 (Tukey post-hoc: $p < 0.05$; see Appendix 4 for region-wide and site mean values and Appendix 6 for regional statistical p-values).

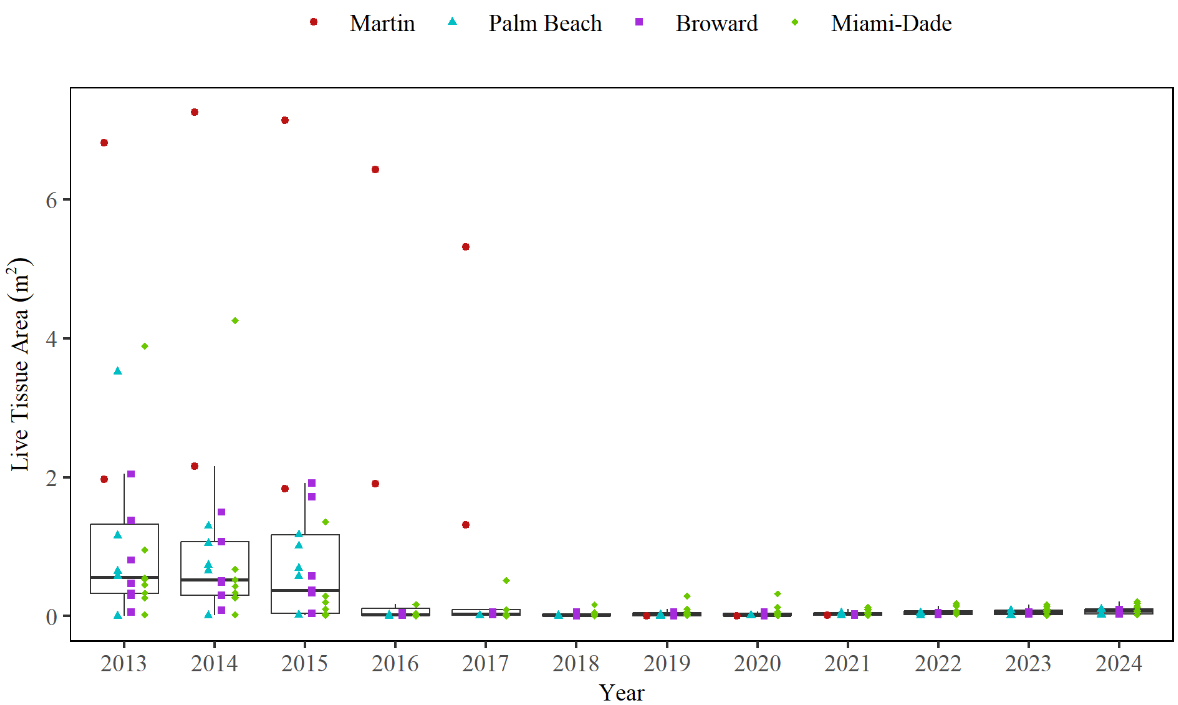


Figure 7. Highly SCTLD-susceptible species regional LTA (2013 to 2024). Each point is the sum of the LTA at a site, with both point shape and color representing county. For an explanation of the box and whisker components, see the caption for Figure 6. Only sites that contained highly SCTLD-susceptible species were included. There was a significant LTA decrease in 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, and 2024 compared to 2013 and 2014; additionally 2018-2024 LTA was significantly lower than in 2015 (Tukey post-hoc: $p < 0.05$; see Appendix 5 for species mean LTA values and Appendix 6 for statistical values).

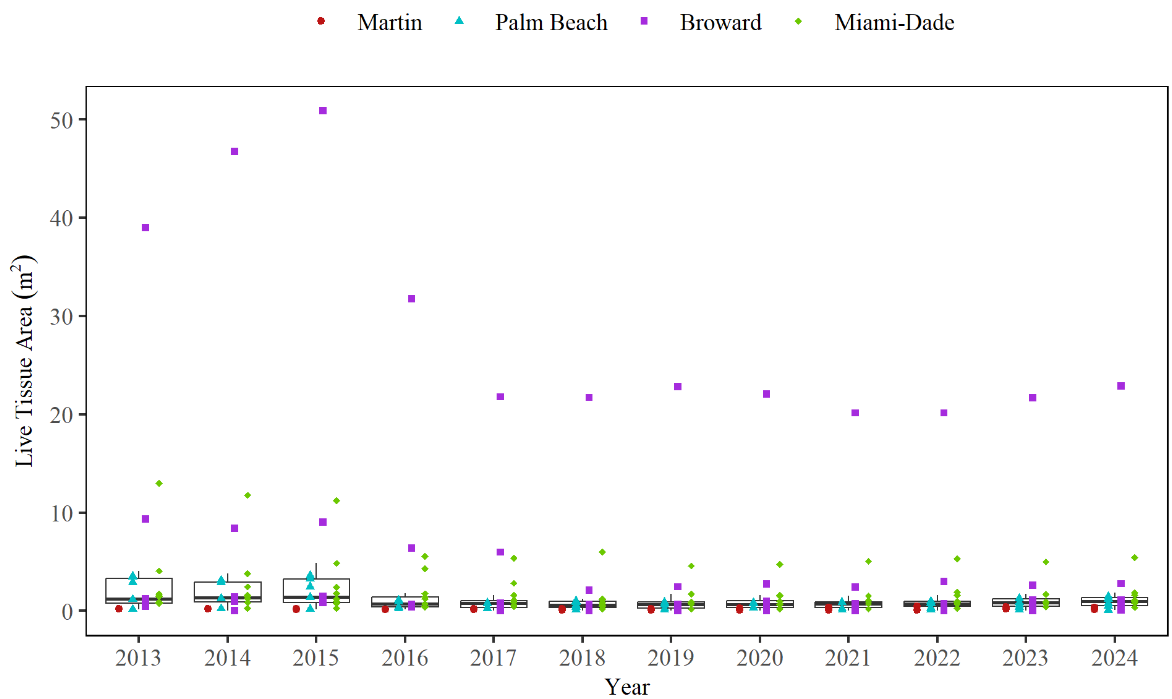


Figure 8. Intermediately SCTLD-susceptible species regional LTA (2013 to 2024). Each point is the sum of the LTA at a site, with both point shape and color representing county. For an explanation of the box and whisker components, see the caption for Figure 6. Only sites that contained intermediately SCTLD-susceptible species were included. There was a significant LTA decrease in 2018, 2019, 2020, 2021, and 2022 compared to 2014; LTA in 2017, 2018, 2019, 2020, 2021, 2022, 2023, and 2024 was also significantly lower than in 2015 (Tukey post-hoc: $p < 0.05$; see Appendix 5 for species mean LTA values and Appendix 6 for statistical values).

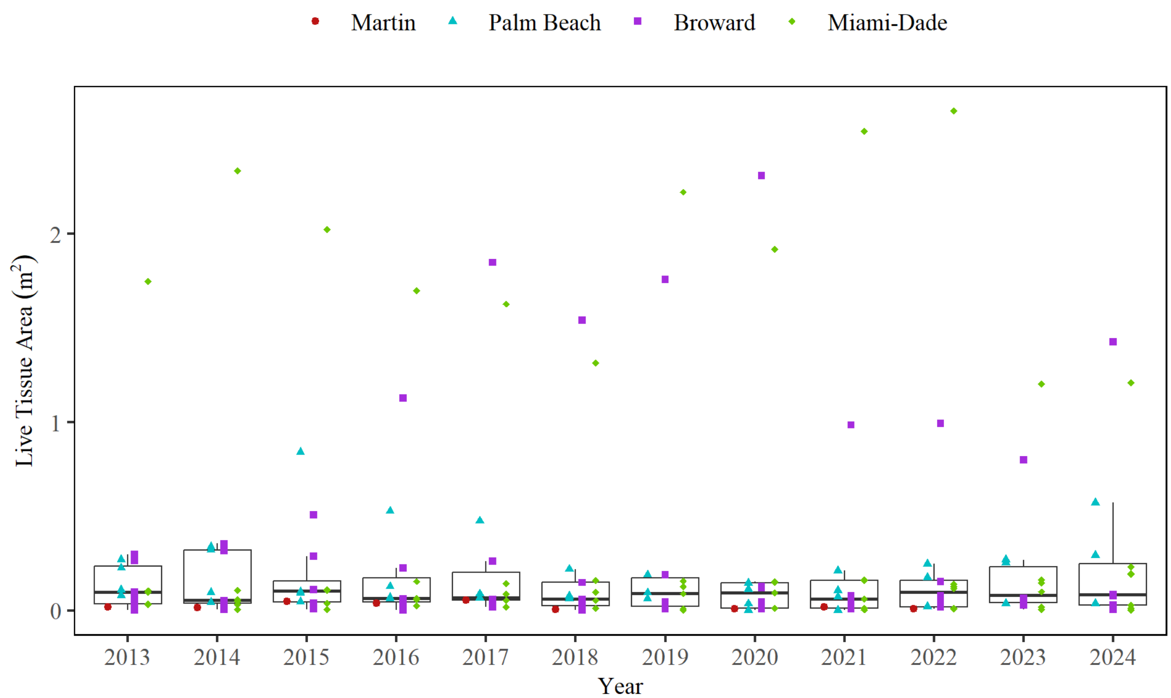


Figure 9. Presumed SCTLD-susceptible species regional LTA (2013 to 2024). Each point is the sum of the LTA at a site, with both point shape and color representing county. For an explanation of the box and whisker components, see the caption for Figure 6. Only sites that contained presumed SCTLD-susceptible species were included. No significant change in LTA occurred across the study years (Tukey post-hoc: $p > 0.05$; see Appendix 5 for species mean LTA values and Appendix 6 for statistical values).

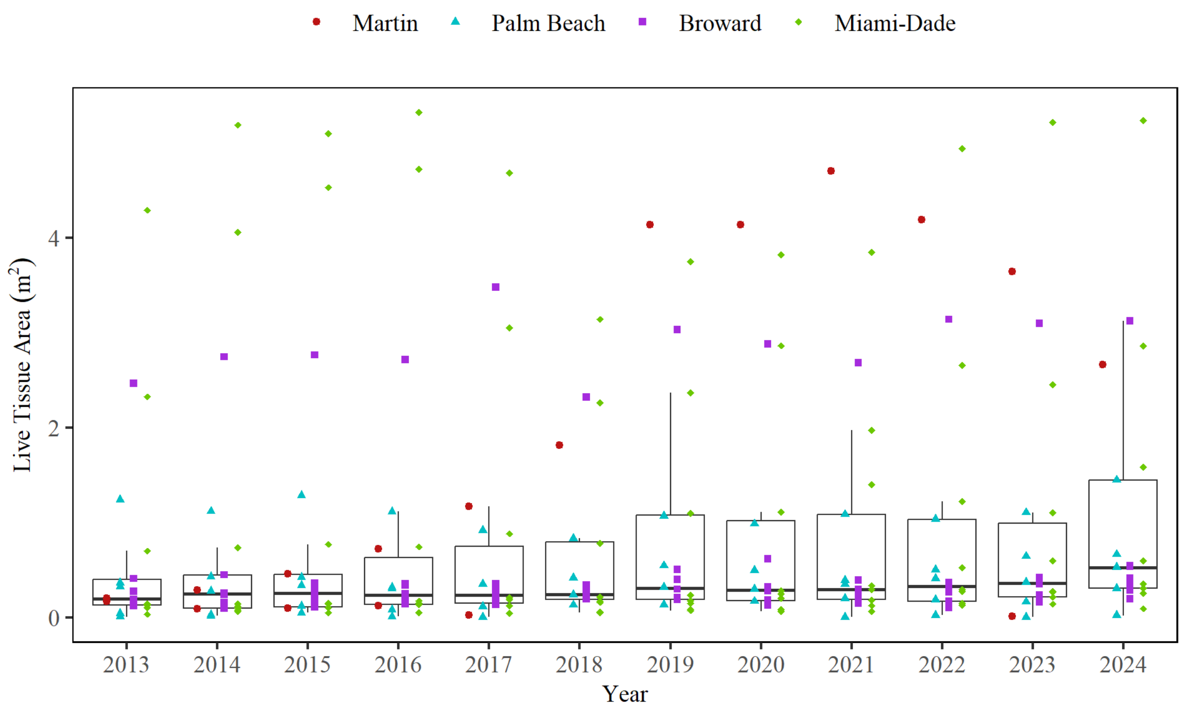


Figure 10. Lowly SCTLD-susceptible species regional LTA (2013 to 2024). Each point is the sum of the LTA at a site, with both point shape and color representing county. For an explanation of the box and whisker components, see the caption for Figure 6. Only sites that contained lowly SCTLD-susceptible species were included. No significant change in LTA occurred across the study years (Tukey post-hoc: $p > 0.05$; see Appendix 5 for species mean LTA values and Appendix 6 for statistical values).

Figure 11 illustrates the distribution of coral colony densities across the region for 2013-2024 (22 sites). The 2024 regional mean (± SE) stony colony density was 2.22 ± 0.36 colonies/m², the highest density recorded across study years, and was significantly higher than density in 2013 (1.21 ± 0.16 colonies/m²), 2014 (1.26 ± 0.18 colonies/m²), 2015 (1.29 ± 0.19 colonies/m²), 2016 (1.07 ± 0.17 colonies/m²), 2017 (1.35 ± 0.25 colonies/m²), 2018 (1.40 ± 0.23 colonies/m²), and 2019 (1.54 ± 0.28 colonies/m²) (repeated measure ANOVA: $p < 0.05$; see Appendix 7 for region and sites mean density values and Appendix 8 for statistical values). Density in 2024 ranged from a high of 5.86 ± 0.56 colonies/m² at site BC4 to a low of 0.27 ± 0.07 colonies/m² at site PB1 (see Appendix 7). While 14 sites had their lowest density in 2016, 2017 or 2018, 16 sites had their highest density recorded in 2023 or 2024 (Appendix 7).

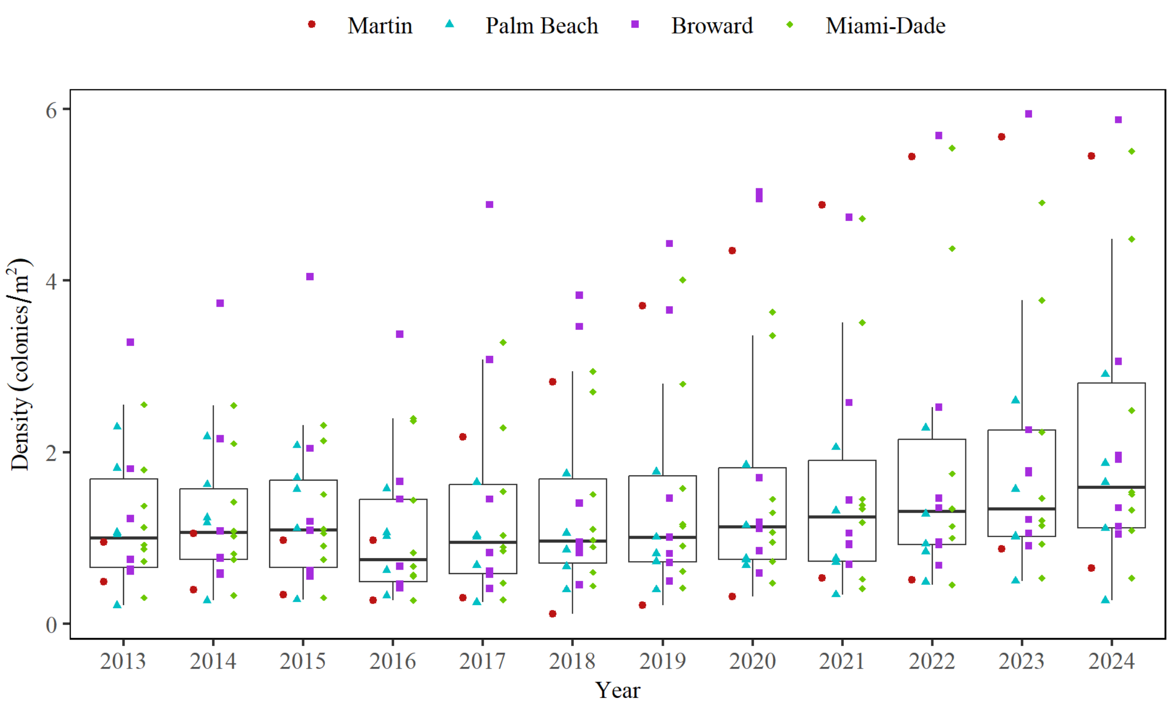


Figure 11. Region-wide stony coral density of colonies ≥4 cm summed by site (2013 – 2024). Each point is the stony coral density at a site, with both point shape and color representing county. See the caption for Figure 6 for explanation of the box and whisker components. Density in 2023 and 2024 was significantly greater than all years from 2013-2019 (Linear mixed-effects model: $p < 0.05$; see Appendix 7 for region and sites mean density values and Appendix 8 for statistical values).

Region-wide disease prevalence increased every year from 2013 to 2016 (Table 3). The greatest prevalence increase occurred between 2015 and 2016, where it more than doubled from 1.4% to 3.7%. Disease prevalence has remained below 1% every year from 2018-2024, and it reached the lowest prevalence in 2024 (0.2%) since 2020 (Table 3). At the site level, 12 sites had their highest recorded disease prevalence in 2016. By 2019, only three sites were recorded with active disease. In 2024, only three sites were recorded with disease, and prevalence at all sites was <4% (Table 3). Changes in disease prevalence have been driven primarily by changes in stony coral tissue loss disease (SCTLD) prevalence (Figure 12). Prevalence of SCTLD has varied across sites and counties, with the highest prevalences occurring in 2014-2016. Although SCTLD is still present, the prevalence has remained low since 2020; in 2024, it was present at only one site in Broward County (BC1) (Figure 12). Prevalence of SCTLD was significantly higher in 2016 than in all other years see (Figure 12).

Table 3. Stony coral disease prevalence (%). Values are the percentage of total colonies identified with disease at each site. Regional values are the total number of diseased colonies for all sites combined divided by the total number of coral colonies for all sites. Note that, beginning in 2023, only corals within the first 10 meters of the transect are considered for MC1 and MC2.

Site	2013 (%)	2014 (%)	2015 (%)	2016 (%)	2017 (%)	2018 (%)	2019 (%)	2020 (%)	2021 (%)	2022 (%)	2023 (%)	2024 (%)
BC1	1.3	0.5	0.6	13.7	10.2	6.5	6.2	0.7	0.8	1.6	1.3	2.4
BC2	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	1.2	0.0	0.0	0.0
BC3	1.5	1.5	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BC4	2.1	0.9	0.6	1.7	0.5	0.6	0.0	0.5	0.0	0.4	0.4	0.4
BC5	0.9	4.2	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.6	0.0
BC6	0.0	13.5	0.0	10.5	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0
BCA	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.5	0.0	0.5	0.0	0.0
DC1	0.0	1.6	4.8	8.7	3.0	1.7	0.0	0.7	1.0	0.3	0.5	0.4
DC2	0.0	0.0	1.1	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DC3	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DC4	0.0	3.0	4.5	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0
DC5	0.0	2.2	2.5	0.9	0.0	0.8	0.0	0.3	0.2	0.0	1.5	0.0
DC6	0.0	1.6	0.8	4.7	1.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0
DC7	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.8	0.0	0.0	0.0
DC8	1.2	0.0	8.8	0.0	0.0	0.0	0.0	0.0	13.0	1.1	0.0	0.0
MC1	0.0	0.0	4.7	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.0	0.0
MC2	4.7	0.0	3.3	0.0	0.0	0.0	0.0	0.0	2.1	2.2	0.0	3.8
PB1	0.0	0.0	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PB2	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PB3	0.0	0.0	1.0	1.8	1.7	0.0	0.0	0.0	0.0	0.0	1.1	0.0
PB4	0.0	0.0	0.7	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PB5	0.0	0.5	0.0	5.8	2.1	0.6	0.0	0.0	0.0	0.5	0.0	0.0
Region	0.6	1.2	1.4	3.7	1.1	0.8	0.4	0.2	0.5	0.3	0.4	0.2

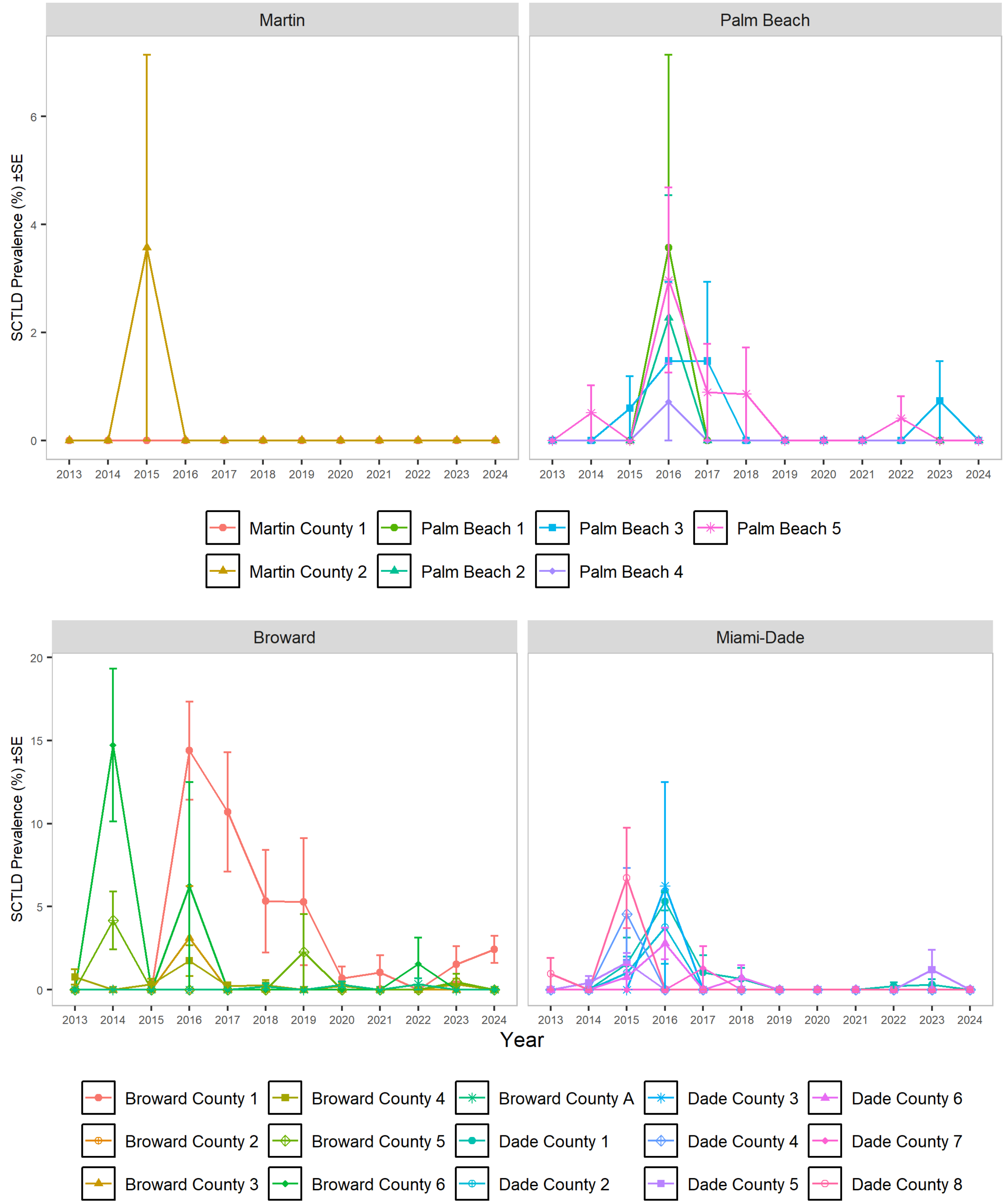


Figure 12. Mean (± SE) annual stony coral disease prevalence by site for SCTLD. Regional prevalence of SCTLD was higher in 2016 than in all other years. Note that, beginning in 2023, the stony coral transect survey length was reduced from 22 meters to 10 meters for MC1 and MC2.

A total of 3,395 stony coral colonies <4 cm in maximum diameter were recorded across the 22 sites in 2024, which was higher than the total number seen in all previous survey years (Table 4). This number likely underestimates the number of recruits and juveniles, as only the first 10 meters of MC1 and MC2 were surveyed for stony corals. Across all years, *Siderastrea siderea* was the most abundant species <4 cm, with 2,063 colonies recorded in 2024, the most of any previous year. The next two most abundant species identified in 2024 were *Porites astreoides* and *Montastraea cavernosa*. which had 517 colonies and 260 colonies, respectively (Table 4). In previous years, *Agaricia* spp. comprised a larger component of the juvenile abundance, with a maximum abundance of 375 colonies measured in 2020, but it has declined since then, with 147 seen in 2024. Very few colonies of species classified as highly susceptible to SCTLD were documented in 2024 (19 colonies), the fewest that have been recorded since recording colonies <4 cm in diameter began in 2018. *Montastraea cavernosa,* which is considered intermediately susceptible and was severely impacted by SCTLD, has shown an increasing number of colonies <4 cm (Table 4).

Table 4. Count of stony coral colonies <4 cm diameter by year. The coral colonies are totaled by species and year, where identification occurred to the lowest taxonomic level possible. Note that, beginning in 2023, only the first 10 meters of the transect were surveyed for stony corals at sites in Martin County, so these numbers likely underestimate the abundance of corals that are common at those sites, especially *Siderastrea siderea* and *Porites* spp.

	Colonies <4 cm						
Species or Genera	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Acropora cervicornis	0	0	0	1	0	0	0
Agaricia spp.	162	325	375	190	263	210	147
Colpophyllia natans	1	0	1	1	2	0	1
Cladocora arbuscula	0	0	0	0	0	0	2
Dichocoenia stokesii	33	21	27	24	23	11	8
Diploria labyrinthiformis	0	1	2	0	0	0	3
Eusmilia fastigiata	3	3	1	7	3	2	3
Helioseris cucullata	0	0	0	2	0	0	0
Isophyllia spp.	0	0	0	0	3	0	0
Madracis aurentenra	16	5	3	3	2	4	12
Madracis decactis	7	6	5	10	6	8	7
Meandrina meandrites	14	12	8	9	5	3	0
Montastraea cavernosa	158	170	192	209	202	215	260
Mycetophyllia spp.	3	5	7	8	2	3	4
Oculina spp.	0	1	1	1	1	0	0
Orbicella spp.	0	0	0	0	1	1	1
Phyllangia americana	12	2	1	3	2	3	1
Porites astreoides	309	232	416	554	633	540	517
Porites porites	52	87	129	113	163	166	218
Pseudodiploria spp.	7	4	6	5	4	4	4
Scolymia spp.	1	8	5	5	8	10	20
Siderastrea spp.	1170	885	1926	1881	1844	1923	2063
Solenastrea bournoni	1	1	3	3	3	5	3
Stephanocoenia intersepta	122	94	110	106	120	104	121
Tubastraea coccinea	0	0	0	0	2	1	0
Scleractinia spp.	1	0	0	2	0	0	0
Total	2071	1862	3218	3137	3292	3213	3395

Octocoral

When averaged across the region, octocoral cover generally decreased through time, but it has been far more variable than coral cover (Figure 13). For the 10 sites evaluated between the 2003-2005 and 2013-2015 time periods, octocoral cover significantly increased at two sites (DC1 and BCA), significantly decreased at seven sites (BC2, BC3, DC2, DC3, PB1, PB2 and PB3), and was unchanged at one site (BC1) (Table 5, see Appendix 3 for site values and statistical *p*-values). Mean octocoral cover, averaged for these 10 sites, decreased from 12.01 ± 2.94% in 2003-2005 to 8.63 ± 1.65% in 2013-2015. The largest increase in cover occurred at DC1, where octocoral cover increased from 6.24 ± 0.19% in the 2003-2005 time period to 9.96 ± 1.08% in the 2013-2015 time period. The largest decline in octocoral cover was seen at PB3, where cover changed from 28.09 ± 2.41% in 2003-2005 to 12.44 ± 1.37% in 2013-2015 (Table 5, see Appendix 3 for site values and statistical *p*-values). Similar decreases were observed at the other Palm Beach County sites, PB2 and PB1. Although PB1 had much lower octocoral cover in 2003-2005 than PB2 or PB3, cover was nearly zero in 2013-2015, the lowest of the ten sites analyzed across these time periods. All sites that decreased in cover did so by approximately 2.0% or more.

During the last 10 years octocoral cover has declined at most sites. Mean octocoral cover averaged for 20 sites decreased from 10.47 ± 1.19% in 2013-2015 to 9.22 ± 1.08% in 2022-2024. Between the 2013-2015 and 2022-2024 time periods, octocoral cover significantly increased at three sites, significantly decreased at 13 sites, and was unchanged at four of 20 sites (Table 5, see Appendix 3 for site values and statistical *p*-values). Octocoral cover was not analyzed for the two Martin County sites because octocorals are absent or extremely rare at these sites. For the ten sites that were first surveyed in 2003, three significantly increased, four significantly decreased, and three were unchanged between the 2013-2015 and 2022-2024 time periods. While all three sites that significantly increased from 2013-2015 to 2023-2024 were sites first surveyed in 2003, none of these sites continued to increase in cover between the 2003-2005 and 2013-2015 comparisons. For most of the 10 sites, there does not appear to be a correlation with changes observed in the earliest comparison (2003-2005 vs. 2013-2015) and the more recent comparison (2013-2015 vs. 2022-2024). Only two sites that decreased in octocoral cover in the first 10 years (DC2 and PB2) decreased again between the 2013-2015 and 2022-2024 time periods. The largest increase in octocoral cover occurred at PB3, where cover increased from 12.44 ± 1.37% in 2013-2015 to 17.29 ± 1.16% in 2022-2024. The magnitude of significant decreases varied, but at least one site in each county subregion declined by about 5.0% or more; the largest decline in octocoral cover was at BC6, which fell from 15.49 ± 0.28% in 2023-2025 to 8.50 ± 0.81% in 2022-2024.

Over the last two years (2023 and 2024), octocoral cover was mostly stable but significantly increased at four sites (BC2, DC6, PB3, PB5) and was unchanged at 15 sites (see Appendix 1 for region wide and site mean values and Appendix 2 for statistical *p*-values). PB1, in addition to the two Martin County sites, was excluded from the analysis because it had 0% cover for 2024, resulting in model errors. Mean octocoral cover averaged for all 19 sites between the two years was similar (8.02 ± 1.13% in 2023 and 8.69 ± 1.23% in 2024). Between years, the largest increase in octocoral cover was at PB3, where cover increased from 17.13 ± 0.91% in 2023 to 20.26 ± 2.04% in 2024. The largest, although non-significant, decrease in octocoral cover was observed at PB4, where it decreased from 16.26

± 2.03% in 2023 to 14.93 ± 1.517% in 2024 (see Appendix 1 for region-wide and site mean values and Appendix 2 for statistical *p*-values).

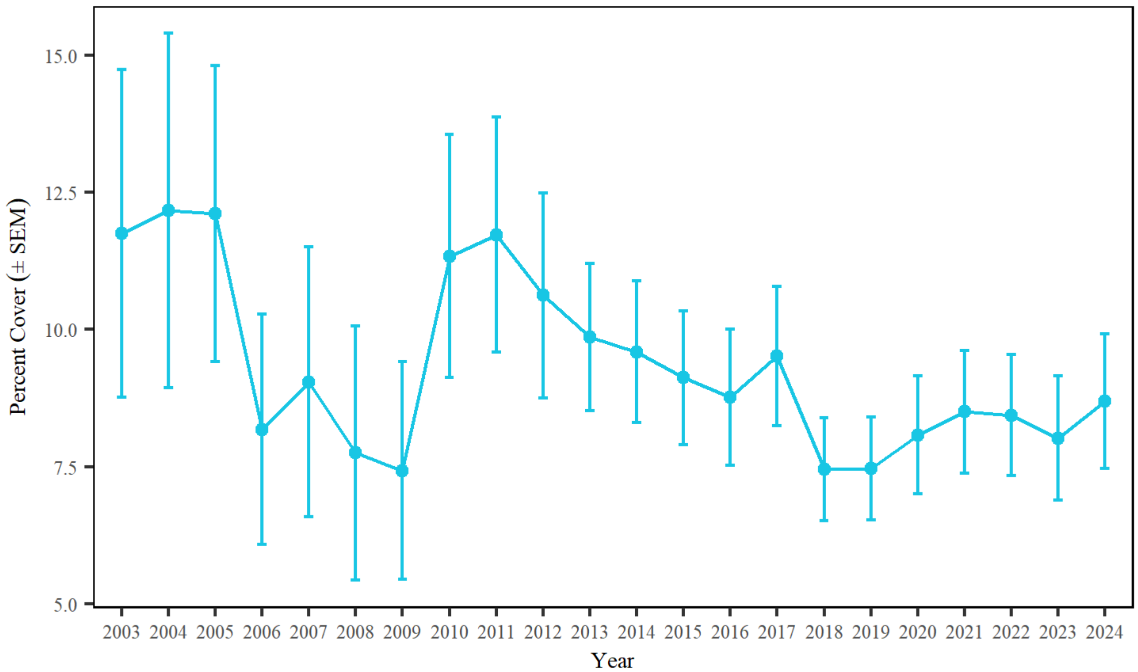


Figure 13. Mean octocoral percent cover (± SEM) for all sites combined.

Table 5. Octocoral long term percent cover change for the 10 original SECREMP sites (N=10) and the 20 of the 22 current SECREMP sites (N=20). Both Martin County sites (MC1 and MC2) were not included because all values were zero. Increasing denotes the number of sites with a significant increase in cover, decreasing denotes the number of sites with a significant increase, and no change indicates sites that have not significantly changed between each time interval (2003-2005 vs. 2013-2015, 2013-2015 vs. 2022-2024).

N	Overall Mean 2003-2005	Overall Mean 2013-2015	Overall Mean 2022-2024	Increasing	Decreasing	No Change
10	12.01 ± 2.94%	8.63 ± 1.65%		2	7	1
20		10.47 ± 1.19%	9.22 ± 1.08%	3	13	4

The 2024 regional mean (± SEM) octocoral colony density was 10.53 ± 1.47 colonies/m² (Figure 14). Density in 2024 ranged from a high of 25.37 ± 3.00 colonies/m² at site PB5 to a low of 0 colonies/m² at site MC1 and MC2. Regional octocoral colony density increased every year from 2013 to 2017, with the density in 2017 peaking at 12.58 ± 1.85 colonies/m². The first regional decrease in density was recorded in 2018, when density declined to 10.36 ± 1.50 colonies/m². Mean regional octocoral density then peaked at 14.05 ± 2.01 colonies/m² in 2020, and has declined further in every subsequent year. A region-wide significant change in octocoral colony density was identified between years (Linear mixed-effects model: $p > 0.05$; see Appendix 7 for region and site mean density values and Appendix 8 for statistical values). Following the linear mixed-effects model ANOVA, pairwise comparisons indicated that octocoral density in 2015 (11.52 ± 1.76 colonies/m²), 2016 (11.85 ± 1.83 colonies/m²), 2017, 2019 (11.57 ± 1.61 colonies/m²), 2020, 2021, 2022, and 2023 were significantly higher than in 2013 (8.68 ± 1.34 colonies/m²). Additionally, octocoral density in 2017, 2020, and 2021 were significantly higher than in 2014 (9.97 ± 1.55 colonies/m²), and density in 2018 (10.41 ± 1.50 colonies/m²) was significantly lower than in 2020 and 2021. Density in 2020 was significantly higher than in 2015, 2018, and 2019. Density in 2024 was significantly lower than in 2020 and 2021 (glht Tukey post-hoc: $p < 0.05$; see Appendix 8 for statistical *p*-values).

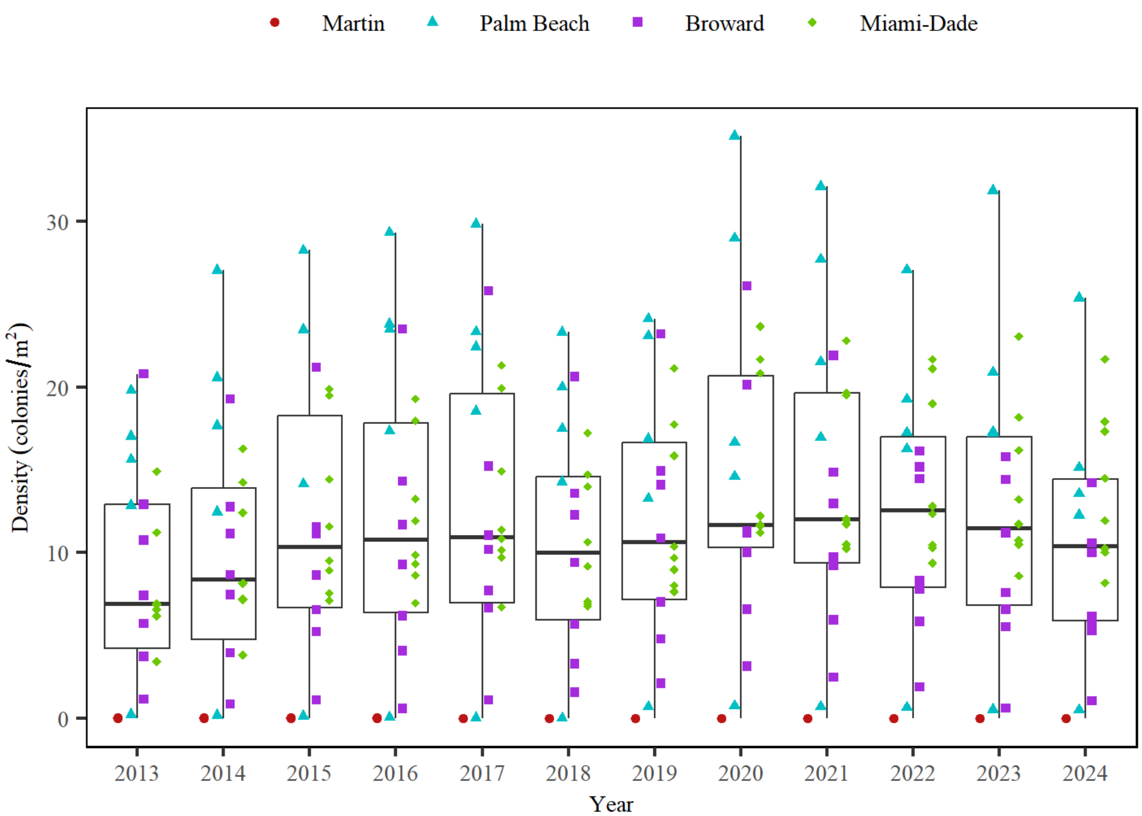


Figure 14. Region-wide octocoral density (colonies/m²) distribution from 2013 to 2024. Each point is the density at one site, with both point shape and color representing county. For an explanation of the box and whisker components, see the caption for Figure 6. Density in 2013 was significantly lower than 2015-2017 and 2019-2023; density in 2014 was significantly lower than in 2017, 2020, and 2022. Density in 2020 and 2021 was significantly higher than in 2018; density in 2020 was significantly higher than 2015, 2018, and 2019. Density in 2024 was significantly lower than in 2020 and 2021 (Tukey post-hoc: $p < 0.05$; see Appendix 8 for statistical *p*-values).

None of the three octocoral target species (*Antillogorigia americana, Eunicea flexuosa,* and *Gorgonia ventalina*) were identified at either of the Martin County sites (MC1 and MC2). In 2024, regional *A. americana* density was the greatest (1.96 ± 0.31 colonies/m^2) of the three species, followed by *E. flexuosa* (0.76 ± 0.23 colonies/m^2) and *G. ventalina* (0.44 ± 0.11 colonies/m^2) (Appendix 9). *Eunicea flexuosa* density peaked in 2015, with 0.84 ± 0.27 colonies/m^2, and has been variable across years (Figure 15); however, no years were found to be significantly different from each other (linear mixed-effects model ANOVA & glht Tukey post-hoc: $p > 0.05$). *Gorgonia ventalina* colony density was significantly higher in 2021 (0.41 ± 0.09 colonies/m^2), 2023 (0.42 ± 0.10 colonies/m^2), and 2024 than in 2013 (0.21 ± 0.05 colonies/m^2) and 2014 (0.24 ± 0.05 colonies/m^2). Density in 2024 was also significantly higher than in 2018 (0.28 ± 0.07 colonies/m^2) (Figure 16) (linear mixed-effects model ANOVA & glht Tukey post-hoc: $p < 0.05$). Trends in *Antillogorgia americana* colony density were complex (Figure 17): colony density was significantly higher in 2019 (1.98 ± 0.37 colonies/m^2), 2020 (2.54 ± 0.45 colonies/m^2), 2021 (2.64 ± 0.45 colonies/m^2), 2022 (2.61 ± 0.45 colonies/m^2), 2023 (2.04 ± 0.32 colonies/m^2), and 2024 than in 2013 (1.36 ± 0.24 colonies/m^2). Colony density in 2020, 2021, 2022 was significantly greater than in 2014 (1.39 ± 0.26 colonies/m^2), 2015 (1.71 ± 0.28 colonies/m^2), 2016 (1.79 ± 0.31 colonies/m^2), 2017 (1.80 ± 0.31 colonies/m^2), and 2018 (1.70 ± 0.30 colonies/m^2). Density in 2019 was significantly lower than in 2021 and 2022; density in 2023 was significantly greater than in 2014, but significantly lower than in 2021. Additionally, density in 2024 was significantly lower than in 2021 and 2022 (linear mixed-effects model ANOVA & glht Tukey post-hoc: $p < 0.05$). See Appendix 9 for octocoral mean density values and Appendix 10 statistical *p*-values.

Eunicea flexuosa colony height was significantly lower in 2015 (21.5 ± 0.6 cm), 2020 (20.3 ± 0.5 cm), 2021 (20.9 ± 0.5 cm), 2022 (20.6 ± 0.5 cm), 2023 (20.17 ± 0.53 cm), and 2024 (21.42 ± 0.55 cm) compared to 2013 (24.9 ± 0.6 cm) and 2014 (24.4 ± 0.7 cm); additionally, height in 2020 (20.3 ± 0.5 cm) was significantly lower than in 2017 (22.9 ± 0.5 cm) and 2018; colony height in 2018 was also significantly greater than colony height in 2023 (Figure 18; linear mixed-effects model ANOVA: $p < 0.05$). *Gorgonia ventalina* colony height in 2021 (13.0 ± 0.6 cm) and 2023 (13.0 ± 0.0.6 cm) was significantly lower than in 2013 (18.3 ± 1.1 cm), 2017 (16.4 ± 0.8 cm), and 2018 (17.6 ± 0.9 cm). Colony height was also significantly lower in 2022 (13.9 ± 0.7 cm) compared to 2018, and significantly higher in 2019 (16.7 ± 0.9 cm) than in 2023 (Figure 18; linear mixed-effects model ANOVA: $p < 0.05$). Trends in *Antillogorgia americana* colony height were complex: colony height was significantly higher in 2013 (27.1 ± 0.5 cm) compared to all other monitoring years. Height in 2014-2017 was significantly higher than in 2019-2022; height in 2014 (25.1 ± 0.5 cm) was also significantly greater than in 2018 (21.8 ± 0.5 cm) and 2023 (23.0 ± 0.4 cm), and height in 2016 (23.8 ± 0.4 cm) was significantly higher than 2018. Height in 2018 was significantly higher than in 2019 (19.1 ± 0.4 cm), 2020 (17.9 ± 0.3 cm), and 2021 (19.3 ± 0.3 cm), but significantly lower than 2024 (24.8 ± 0.4 cm). Height from 2019-2021 was significantly lower than height in 2022-2024. *Antillogorgia americana* height in 2024 was also significantly greater than height in 2022 (20.9 ± 0.3 cm) and 2023, the latter of which was also significantly greater than height in 2022 (Figure 18; linear mixed-effects model ANOVA: $p < 0.05$). See Appendix 11 for target species mean heights and Appendix 12 for statistical *p*-values.

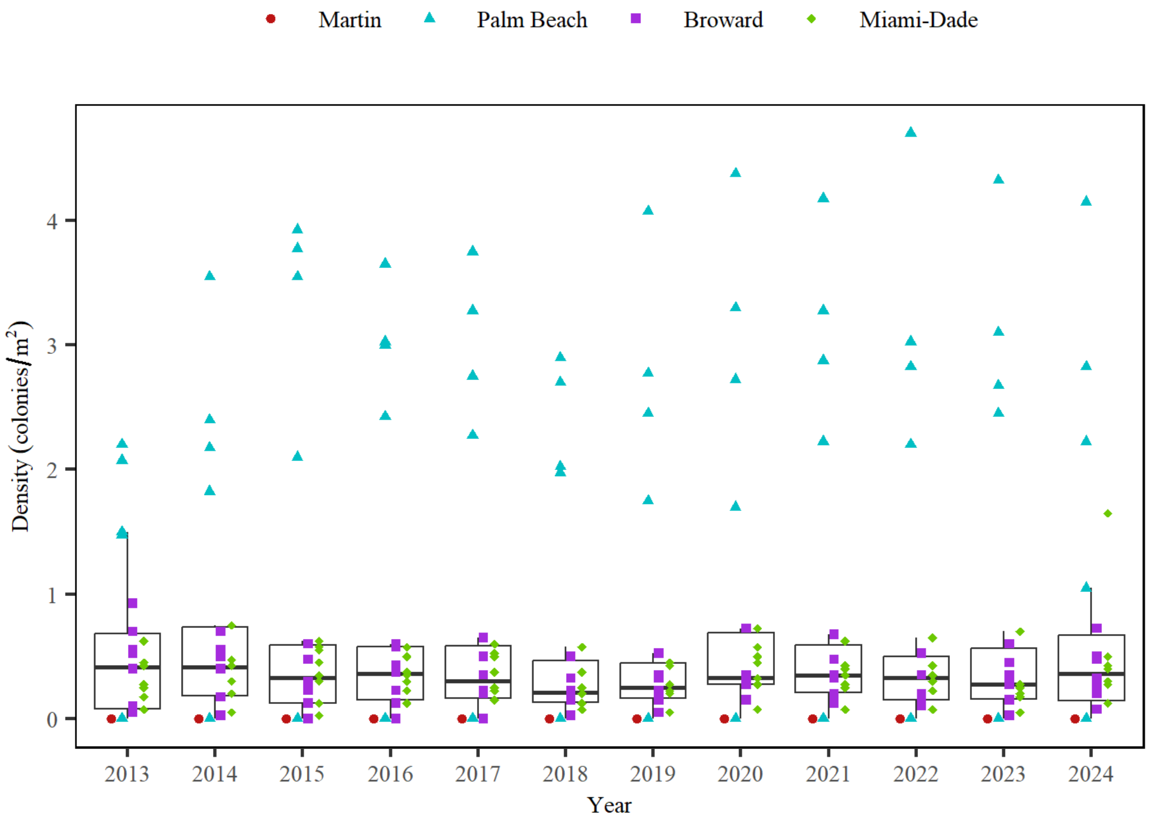


Figure 15. *Eunicea flexuosa* regional density (colonies/m^2) distribution from 2013 to 2024. Each point is the density at a site, with both point shape and color representing county. For an explanation of the box and whisker components, see the caption for Figure 6. There was no significant difference between years identified (Tukey post-hoc: $p > 0.05$; see Appendix 10 for statistical *p*-values).

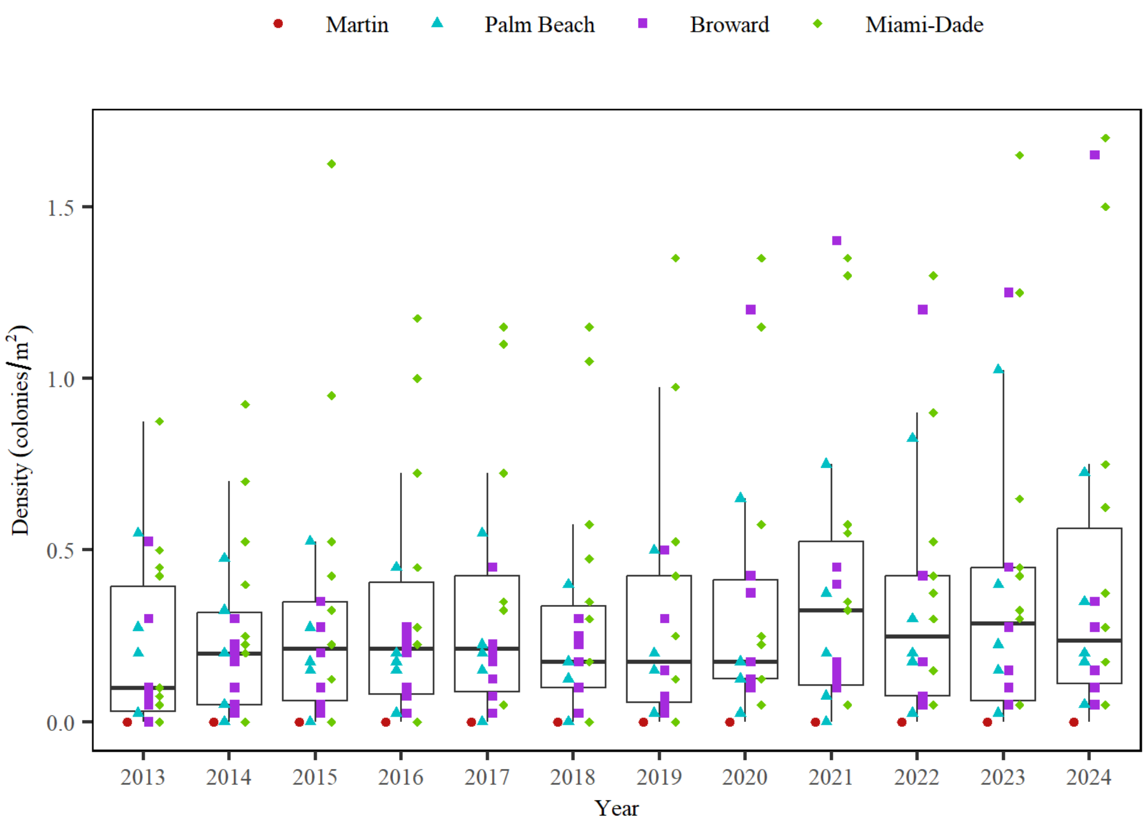


Figure 16. *Gorgonia ventalina* regional density (colonies/m^2) distribution from 2013 to 2024. Each point is the density at a site, with both point shape and color representing county. For an explanation of the box and whisker components, see the caption for Figure 6. Density in 2021-2024 was significantly higher than in 2013 and 2014; density in 2024 was also significantly higher than in 2018 (Tukey post-hoc: $p < 0.05$; see Appendix 10 for statistical p-values).

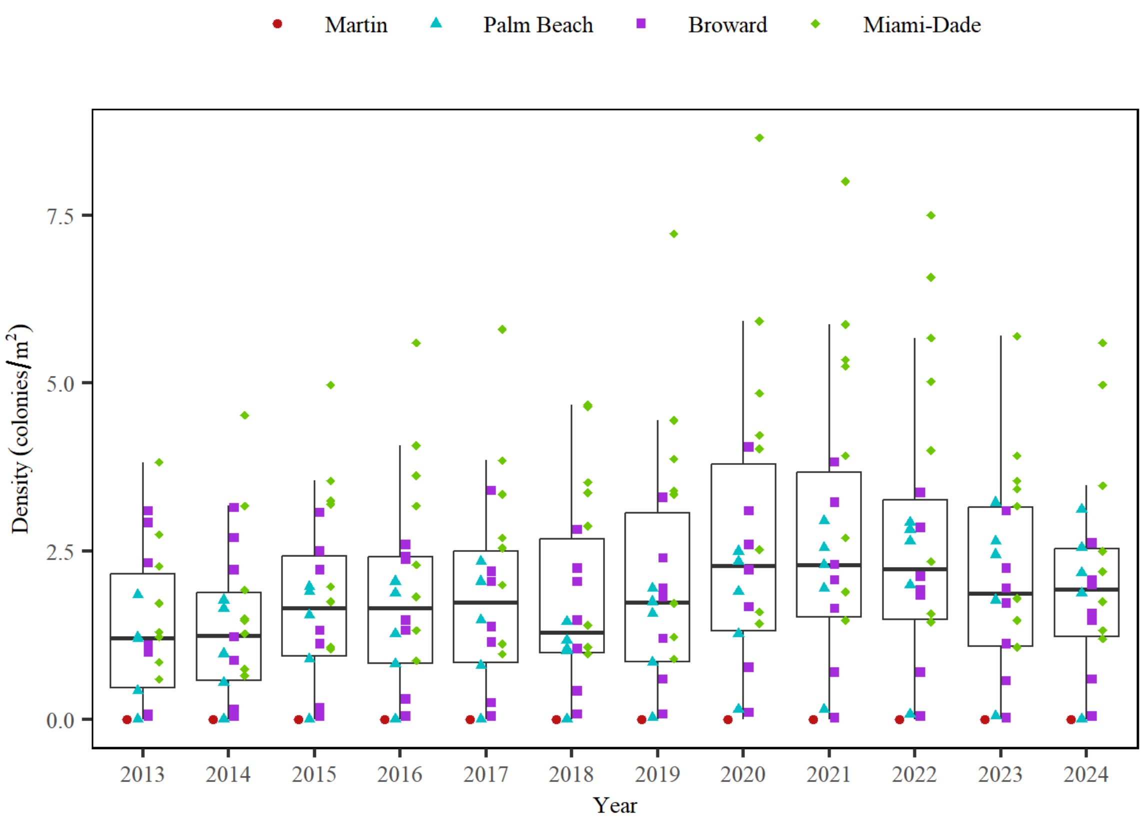


Figure 17. *Antillogorgia americana* regional density (colonies/m^2) distribution from 2013 to 2024. Each point is the density at a site, with both point shape and color representing county. For an explanation of the box and whisker components, please see the caption for Figure 6. Density in 2020-2024 was significantly higher than in 2013-2018; density in 2023 was significantly higher than 2014, but significantly lower than 2021. Density was significantly lower in 2024 than in 2021 and 2022 (Tukey post-hoc: $p < 0.05$; see Appendix 10 for statistical p-values).

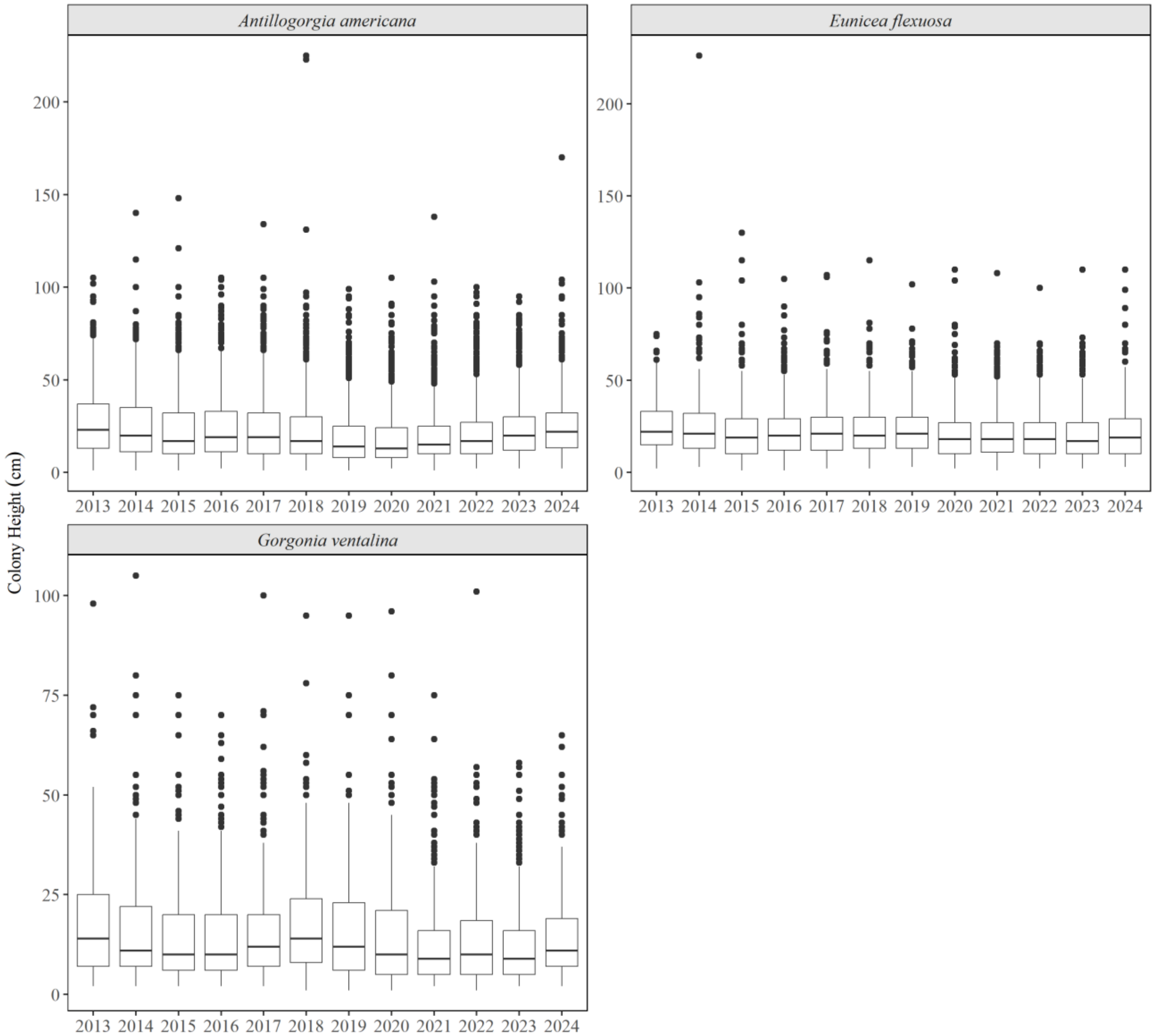


Figure 18. Octocoral target species colony height distribution from 2013 to 2024. The middle bar in the boxplot is the median height for the region, the areas above and below the median (hinges) represent the 1st and 3rd quartiles, respectively. The whiskers, upper and lower, extend from the hinge to the largest value no greater than 1.5*IQR, where IQR in the inter-quartile range (distance between 1st and 3rd quartiles). Points lying beyond the whiskers are considered outliers.

Barrel Sponge (*Xestospongia muta*)

A significant region-wide change in *X. muta* density was identified (Figure 19), where 2013 (0.24 ± 0.05 sponges/m²) was significantly lower than 2016 (0.31 ± 0.06 sponges/m²), 2017 (0.35 ± 0.06 sponges/m²), 2019 (0.32 ± 0.06 sponges/m²), 2020 (0.32 ± 0.06 sponges/m²), 2021 (0.31 ± 0.06 sponges/m²), 2022 (0.36 ± 0.06 sponges/m²), 2023 (0.36 ± 0.06 sponges/m²), and 2024 (0.40 ± 0.07 sponges/m²). Additionally, 2024 was significantly higher than 2014 (0.28 ± 0.06 sponges/m²), 2015 (0.30 ± 0.06 sponges/m²), 2016, 2018 (0.28 ± 0.05 sponges/m²), 2019, 2020, and 2021 (linear mixed-effects model ANOVA: $p < 0.05$; see Appendix 7 or region mean values and Appendix 8 for statistical *p*-values). *Xestospongia muta* individuals were observed at all sites in 2024 except for 4 of the 5 sites located on the nearshore ridge complex habitat: MC1, MC2, DC6, and DC8. PB1 is also located on the nearshore ridge complex, but one *X. muta* was observed. The three sites with the highest *X. muta* densities in 2024 were all located in Palm Beach County (PB3: 0.93 ± 0.17 sponges/m², PB4: 0.86 ± 0.07 sponges/m², and PB5: 0.85 ± 0.17 sponges/m²), and eight sites had densities greater than 0.5 sponges/m² (see Appendix 7 for site mean values).

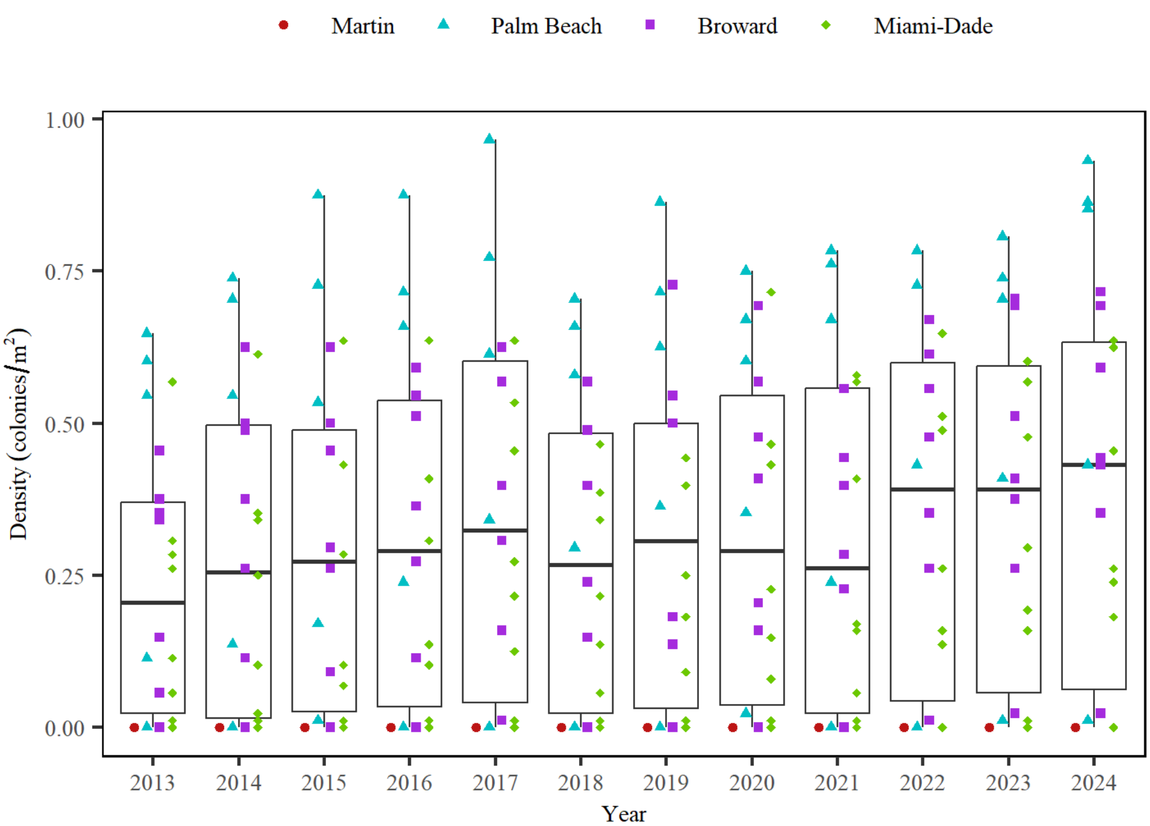


Figure 19. *Xestospongia muta* regional density (sponges/m^2) distribution from 2013 to 2024. Each point is the density at a site, with both point shape and color representing county. For an explanation of the box and whisker components, see the caption for Figure 6. Density in 2013 was significantly lower than 2016, 2017, and 2019-2024; 2024 was also significantly higher than 2014-2016 and 2018-2021 (Tukey post-hoc: $p < 0.05$; see Appendix 7 for region mean values and Appendix 8 for statistical *p*-values).

Sponge and Macroalgae Percent Cover

Macroalgal cover significantly increased at most sites in both long-term comparisons, although it was highly variable from year to year. Macroalgal cover is the most variable among the four major taxa analyzed and can fluctuate wildly from year to year due to ephemeral events like upwelling or localized weather patterns that may increase rainfall and the input of nutrients (Figure 20). For the 2003-2005 time period, macroalgal cover was low; all but one site had macroalgal cover below 5.0% (Table 6, see Appendix 3 for site values and statistical *p*-values). Mean macroalgal cover, averaged for the 10 sites, increased from 4.36 ± 1.78% in 2003-2005 to 5.50 ± 0.88% in 2013-2015. For the 10 sites evaluated between the 2003-2005 and the 2013-2015 time periods, macroalgal cover significantly increased at eight sites (BC1, BC2, BC3, BCA, DC3, PB1, PB2 and PB3), significantly decreased at one site (DC1), and was unchanged at one site (DC2) (Table 6, see Appendix 3.for site values and statistical *p*-values). Significant increases in macroalgae cover varied but were generally between 1.0% and 5.0%. The largest increase in macroalgal cover occurred at PB3, where cover increased from 1.63 ± 0.49% in 2003-2005 to 7.26 ± 1.24% in 2013-2015. The only site with a significant decrease in cover was DC1, which was the only site with macroalgae cover above 5.0% during the 2003-2005 time period. Cover at DC1 decreased from 19.67 ± 4.66% in 2003-2005 to 7.24 ± 1.27% in 2013-2015 (Table 6, see Appendix 3 for site values and statistical *p*-values).

Macroalgal cover increased at nearly all sites during the last decade. Mean macroalgae cover, averaged for 22 sites, increased from 10.19 ± 1.87% in 2013-2015 to 17.81 ± 1.80% in 2022-2024. Between the 2013-2015 and 2020-2022 time periods, macroalgal cover significantly increased at 17 of 22 sites, significantly decreased at two sites (MC1 and MC2), and was unchanged at three sites (BC5, DC5, PB5) (Table 6, see Appendix 3 for site values and statistical *p*-values). All ten sites first surveyed in 2003 increased in macroalgae cover between the 2013-2015 and the 2020-2022 time periods. These significant increases were in addition to the rise in macroalgal cover at eight sites during the first 10 years. The largest increase in macroalgal cover occurred at DC7, where cover increased from 5.96 ± 1.12% in 2013-2015 to 33.59 ± 0.86% in 2022-2024. While not all increases in macroalgal cover were as substantial as at DC7, many sites experienced considerable increases in macroalgal cover between these two timeframes. The only two sites that declined in macroalgae cover were the two Martin County sites (MC1 and MC2), however, these two sites had the highest and second highest macroalgae cover of all 22 sites in 2013-2015, and cover in 2022-2024 at both sites was still higher than the regional average (Table 6, see Appendix 3 for site values and statistical *p*-values).

Over the last two years (2023 and 2024), macroalgal cover, averaged for 22 sites, increased from 16.00 ± 1.77% in 2023 to 19.78 ± 2.69% in 2024. Macroalgal cover significantly increased at ten sites (BC4, DC1, DC3, DC, DC8, MC1, MC2, PB2, PB3, and PB4), significantly decreased at six sites (BC6, BCA, DC4, DC5, PB1 and PB5), and was similar at six sites (see Appendix 1 for region-wide and site mean values and Appendix 2 for statistical *p*-values). Increases in macroalgae cover at the site-level were generally much higher than decreases. The largest increase occurred at BC4, where cover increased from 24.02 ± 2.70% in 2023 to 48.91 ± 3.69% in 2024. Five additional sites (DC3, DC7, DC8, MC1 and MC2) also increased in macroalgal cover by more than 10%. The largest decrease occurred at PB1, where cover decreased from 17.33 ± 2.05 in 2023 to 10.19 ± 4.70% in

2024 (see Appendix 1 for region-wide and site mean values and Appendix 2 for statistical *p*-values). These year-to-year results reflect the high interannual and inter-site variability of macroalgae cover.

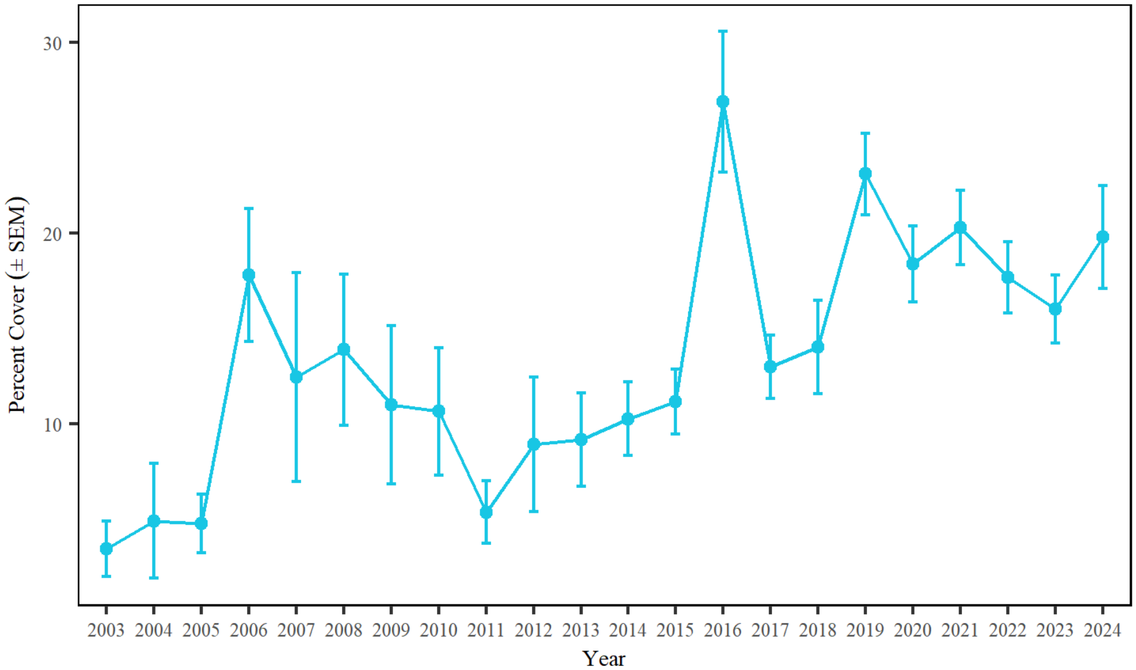


Figure 20. Mean macroalgae percent cover (± SEM) for all sites combined.

Table 6. Macroalgae long term percent cover change for the 10 original SECREMP sites (N=10) and the 22 current SECREMP sites (N=22). Increasing denotes the number of sites with a significant increase in cover, decreasing denotes the number of sites with a significant increase, and no change indicates sites that have not significantly changed between each time interval (2003-2005, 2013-2015, 2022-2024).

N	Overall Mean 2003-2005	Overall Mean 2013-2015	Overall Mean 2022-2024	Increasing	Decreasing	No Change
10	4.36 ± 1.78%	5.50 ± 0.88%		8	1	1
22		10.19 ± 1.87%	17.81 ± 1.80%	17	2	3

Sponge cover increased at many sites during the first 10 years of SECREMP monitoring, but has been similar the last 10 years (Figure 21). The cover of sponges at the 10 original SECREMP sites significantly increased from 3.95 ± 0.89% in 2003-2005 to 5.15 ± 0.94% in 2013-2015, with significant increases occurring at seven sites (BC1, BC2, BC3, BCA, DC1, PB2, and PB3) and a significant decrease occurring at one site (PB1) (Table 7, see Appendix 3 for site values and statistical *p*-values). Increases in sponge cover over this time period were generally between 1.0 and 3.0%, with the largest increase occurring at PB2, where cover increased from 3.96 ± 0.52% in 2003-2005 to 7.94 ± 0.40% in 2013-2015.

While PB1 was the only site to decrease in sponge cover over this time period, the largest change in cover occurred there, from 7.04 ± 0.17% in 2003-2005 to 2.76 ± 1.39% in 2013-2015.

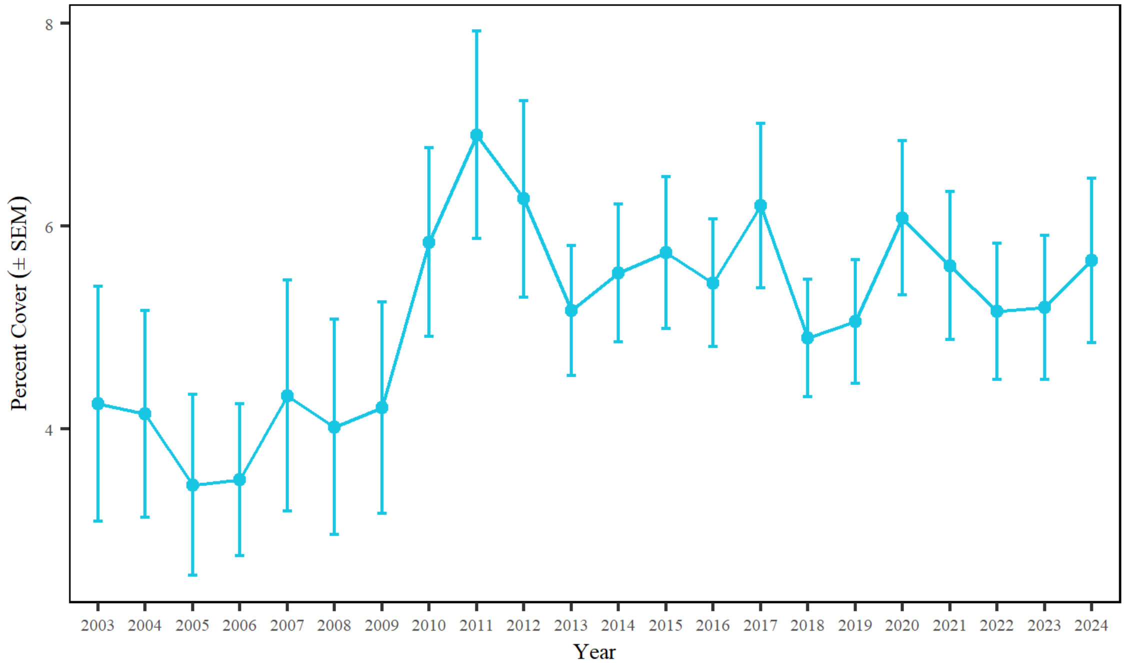
During the last decade, sponge cover significantly declined from 5.48 ± 0.68% in 2013-2015 to 5.34 ± 0.71% in 2022-2024, with cover significantly increasing at 2 sites (BC6 and PB1) and significantly decreasing at 6 sites (BC1, BCA, DC5, MC1, MC2, PB2) (Table 7, see Appendix 3 for site values and statistical *p*-values). Of the ten sites first surveyed in 2003, one significantly increased, three significantly decreased, and six were unchanged between the 2013-2015 and 2022-2024 time periods. The largest increase in sponge cover occurred at BC6, where cover increased from 4.89 ± 0.87% in 2013-2015 to 7.06 ± 1.30% in 2022-2024. The largest decrease occurred at PB2, which declined in sponge cover from 7.94 ± 0.40% in 2013-2015 to 5.98 ± 0.80% in 2022-2024. Changes across the 22 sites were generally less than 1.0%, even in cases where a significant change was found.

Over the last two years (2023 and 2024) sponge cover has remained relatively constant across the region. Mean sponge cover, averaged for 22 sites decreased from 5.20 ± 0.71% in 2023 to 5.66 ± 0.81% in 2024. It significantly increased at two sites (PB1 and PB2), significantly decreased at one site (BC4), and remained unchanged at 19 sites (see Appendix 1 for region-wide and site mean values and Appendix 2 for statistical *p*-values). The largest increase between these two years occurred at PB2, from 5.08 ± 0.71% in 2023 to 8.24 ± 1.35% in 2024, and the largest (and only significant) decrease occurred at BC4, from 3.84 ± 0.80% in 2023 to 2.62 ± 0.53% in 2024. At most sites sponge cover did not change by more than 1.0%.

Table 7. Sponge long term percent cover change for the 10 original SECREMP sites (N=10) and the 22 current SECREMP sites (N=22). Increasing denotes the number of sites with a significant increase in cover, decreasing denotes the number of sites with a significant increase, and no change indicates sites that have not significantly changed between each time interval (2003-2005, 2013-2015, 2022-2024).

N	Overall Mean 2003-2005	Overall Mean 2013-2015	Overall Mean 2022-2024	Increasing	Decreasing	No Change
10	3.95 ± 0.89%	5.15 ± 0.94%		7	1	2
22		5.48 ± 0.68%	5.34 ± 0.71%	2	6	14

Figure 21. Mean sponge percent cover (± SEM) for all sites combined.



Site Benthic Temperature

During the 2024 sites visits, all temperature loggers were successfully recovered. At least one logger that successfully recorded data was recovered at each site and data were downloaded for all 22 sites. The 2024 monitoring dates shown in Table 1 were the same dates that temperature loggers were collected and redeployed at each of the 22 sites. Table 8 presents the dates of the maximum and minimum temperatures (°C) for each site from late winter 2007 into spring 2024. Thirteen sites attained their maximum temperature on record in July or August 2023 (all ≥31.0 °C). Two sites (MC1 and MC2) reached their maximum recorded temperature in August 2022 (both 31.1 °C). The remaining 7 sites had their maximum recorded temperature in August 2014. Two sites (DC7, DC8) recorded their minimum temperature in February 2021. Two sites (BC4, DC6) recorded their minimum temperature in January 2018. All other sites recorded their minimum temperature prior to spring 2014 (Table 8). In both 2022 and 2023, all sites reached temperatures greater than 30.5 °C (Table 9; 2024 was not included because a full year of temperature data was not collected at the time each site was monitored). DC8 consistently has the most days over 30.5 °C (Table 9).

Table 8. Maximum and minimum water temperatures (°C) and date recorded for all 22 sites, with temperature loggers recording winter 2007 through April 2024.

	Maximum		Minimum	
Site	**Temp**	**Date**	**Temp**	**Date**
DC1	31.9	8 Aug 14	19.7	23 Jan 09
DC2	31.2	25 Aug 14	20.1	4 Mar 10
DC3	31.3	24 Aug 14	20.4	1 Feb 11
DC4	31.2	24 Aug 14	20.3	31 Jan 11
DC5	31.4	24 Aug 14	20.3	31 Jan 11
DC6	31.7	22 Aug 14	21.0	19 Jan 18
DC7	31.2	3 Aug 23	22.0	3 Feb 21
DC8	32.6	25 Jul 23	20.8	3 Feb 21
BCA	31.6	15 Jul 23	19.0	6 Feb 09
BC1	31.6	14 Jul 23	19.6	5 Mar 10
BC2	31.3	20 Aug 23	20.4	5 Mar 10
BC3	31.1	19 Aug 23	20.0	22 Feb 11
BC4	31.4	24 Aug 14	21.9	21 Jan 18
BC5	31.1	14 Jul 23	22.3	23 Mar 14
BC6	31.1	20 Aug 23	22.1	23 Mar 14
PB1	31.1	13 Jul 23	19.5	6 Mar 10
PB2	31.2	24 Aug 23	18.5	5 Apr 11
PB3	31.1	24 Aug 23	19.7	7 Mar 10
PB4	31.0	24 Aug 23	19.6	5 Apr 11
PB5	31.1	21 Aug 23	19.7	22 Feb 11
MC1	31.1	23 Aug 22	13.4	11 Jan 10
MC2	31.1	23 Aug 22	13.8	11 Jan 10

Table 9. Number of days per year with water temperature ≥30.5 °C for the 22 sites, with temperature loggers recording winter 2007 through 2023 (NA = sites not yet established) (2024 is not included because a full year of temperature data was not collected at the time each site was monitored).

Site	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
DC1	11	0	7	5	18	0	0	29	33	13	9	7	15	12	10	51	34
DC2	0	0	0	0	6	0	0	8	20	0	0	0	1	0	0	24	18
DC3	1	0	0	0	1	0	0	7	5	0	0	0	1	0	0	14	18
DC4	0	0	0	0	1	0	0	9	12	0	0	0	2	1	2	26	29
DC5	0	0	0	2	8	0	0	18	15	1	11	1	14	9	5	37	40
DC6	NA	NA	NA	NA	NA	NA	0	18	49	11	11	7	11	12	8	55	33
DC7	NA	NA	NA	NA	NA	NA	0	6	5	0	0	0	0	0	0	18	19
DC8	NA	NA	NA	NA	NA	NA	0	41	64	30	50	45	43	43	34	56	52
BCA	21	0	7	0	0	0	0	22	36	4	11	6	12	11	6	52	42
BC1	8	0	6	0	13	0	0	19	30	3	6	1	10	5	2	39	37
BC2	0	0	0	0	1	0	0	7	3	0	0	0	0	0	0	20	25
BC3	0	0	0	0	2	0	0	4	1	0	0	0	0	0	0	18	15
BC4	NA	NA	NA	NA	NA	NA	0	12	13	0	0	0	2	0	1	25	34
BC5	NA	NA	NA	NA	NA	NA	0	6	3	0	0	0	0	0	0	26	27
BC6	NA	NA	NA	NA	NA	NA	0	4	0	0	0	0	0	0	0	22	23
PB1	0	0	0	0	0	6	0	4	3	0	0	0	0	0	0	20	20
PB2	0	0	0	0	0	2	0	3	0	0	0	0	0	0	0	10	10
PB3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	7
PB4	0	0	0	0	0	5	0	1	0	0	0	0	0	0	0	18	18
PB5	0	0	0	0	0	7	0	4	1	0	0	0	0	0	0	20	21
MC1	0	0	1	0	0	0	0	3	0	0	0	0	0	0	0	13	3
MC2	0	0	2	0	0	0	0	3	0	0	0	0	0	0	0	12	4

Discussion

The coral reef ecosystem within the Kristin Jacobs Coral Aquatic Preserve (Coral AP) is a high-latitude reef system near the environmental threshold for significant coral reef growth and represents the northernmost extent of Florida's Coral Reef (FCR). SECREMP, which was established in 2003 as an expansion of monitoring efforts in the Florida Keys, has provided valuable information about reef community dynamics in the Coral AP over the last 22 years. Coral AP reefs generally have similar stony coral species richness, but reduced stony coral cover, compared to the southern regions of Florida's Coral Reef (i.e., the Florida Keys and Dry Tortugas) (Ruzicka et al. 2010; Ruzicka et al. 2012, Jones et al. 2020). Benthic cover by octocorals and macroalgae is similar throughout FCR, while sponges appear to contribute more to cover in the Coral AP than in the Florida Keys or Dry Tortugas (Ruzicka et al. 2010; Ruzicka et al. 2012; Ruzicka et al. 2013). Benthic cover of octocorals and sponges is also far greater than that of stony corals.

The Coral AP has experienced significant stony coral assemblage declines across the study period (2003-2024). These losses were primarily driven by an outbreak of stony coral tissue loss disease (SCTLD), which began spreading throughout the Coral AP in 2014. SCTLD is known to affect more than 22 species of stony corals with varying degrees of severity (SCTLD Case Definition, 2018). Peak regional SCTLD prevalence was observed in 2016, although there were smaller scale spatial differences in disease timing within each county subregion. Significant losses, particularly in stony coral cover and live tissue area (LTA), coincided with this peak disease prevalence, and continued until 2018. Since 2018, SCTLD prevalence has remained low (below 1%) and no further significant declines in the coral assemblage have been detected. In 2024, regional SCTLD prevalence reached its lowest value (0.2%) since 2020. The low disease observed is likely due to a combination of low SCTLD prevalence and the low abundance of species that are susceptible to the disease. Now that SCTLD is endemic (i.e., part of normal, background disease levels) and no longer causing significant losses, understanding trends in reef recovery has become a priority for long-term monitoring efforts, such as SECREMP.

Region-wide stony coral cover, as determined based on transect image analysis, declined every year between 2015 and 2018, coinciding with the epidemic phase of the SCTLD outbreak (Gilliam et al. 2019). Since 2018, there have been no significant increases or decreases in coral cover within the Coral AP region. Although there was a slight increase in coral percent from 2023 to 2024, this was a non-significant change, from only 1.08% to 1.09%. Twelve sites increased in coral cover between 2023 and 2024, but all of these increases were less than 1%, and none of them were statistically significant. As of 2024, 13 of the 22 SECREMP sites have less than 1% stony coral cover, and 19 of the sites have less than 2%. The only sites with greater than 2% stony coral cover are BC1, BC4, and DC1, which are all located in similar nearshore ridge and inner reef habitats.

Stony coral live tissue area (LTA) was estimated using demographic field data for all colonies to provide an additional, and perhaps more sensitive, metric for describing changes in the amount of coral live tissue in the region. Regional LTA in all years from 2017 to 2024 was significantly lower than the LTA in 2013, 2014, and 2015, years prior to the observed peak of SCTLD prevalence. From 2015 to 2018, there was an estimated 58% loss in regional

LTA. Although no significant recovery has been recorded, regional LTA has remained relatively stable from 2019-2024, and LTA in 2024 was the highest recorded since 2017.

Coral species exhibit varying degrees of susceptibility to SCTLD (SCTLD Case Definition, 2018) and differences in LTA loss across these SCTLD susceptibility groups were observed, demonstrating the variable effect of SCTLD on the coral assemblage. Of the four groupings analyzed (highly, intermediately, lowly, and presumed susceptible to SCTLD), only the highly and intermediately SCTLD-susceptible species had significant changes in LTA across the monitoring period: losses within these groups were the primary drivers of the regional losses in LTA observed. For highly SCTLD-susceptible species, regional LTA in all years between 2016 and 2024 was significantly lower than LTA in 2013 and 2014. These species, which include *Colpophyllia natans*, *Dendrogyra cylindrus* (not found within SECREMP sites), *Dichocoenia stokesii*, *Diploria labyrinthiformis*, *Eusmilia fastigiata*, *Meandrina meandrites*, *Pseudodiploria strigosa*, and *P. clivosa*, are among the first to become infected with SCTLD and often experience the most rapid disease progression and mortality. Although many of these species are not particularly common within SECREMP sites, in total, they have suffered an approximately 93% decline in LTA between 2013 and 2024 and have shown no significant signs of recovery.

For intermediately SCTLD-susceptible species, regional LTA was significantly lower in all years between 2017 and 2024 than it was in 2015, near the beginning of the SCTLD outbreak. Between 2013 and 2024, approximately 47% of intermediately SCTLD-susceptible species LTA was lost: although their regional LTA was not significantly different in 2024 than it was is 2013, before the outbreak began, this is due to the high inter-site variation in LTA. There has been no significant gain in LTA for intermediately susceptible species since the end of the epidemic phase of the SCTLD event. The loss of intermediately SCTLD-susceptible species is of particular concern, as this group contains the vital reef-building species *Montastraea cavernosa* and *Orbicella* spp. *Montastraea cavernosa* is historically the most abundant reef-building coral in Southeast Florida, contributing greatly to stony coral benthic cover and LTA, and is present across all four counties and reef habitats within the Coral AP. It is also one of the more common large (>50 cm diameter) framework-building species that is considered "robust" and capable of surviving in variable habitats and conditions, including heat stress (Manzello et al. 2015).

The LTA trends seen for highly and intermediately SCTLD-susceptible species contrast with that seen for lowly SCTLD-susceptible species. Lowly susceptible species, which include the smaller and weedy *Porites* spp., did not appear to be negatively impacted by the outbreak of SCTLD. In fact, between 2013 and 2024, they experienced a 67% increase in LTA, although this was not statistically significant. Additionally, the highest LTA recorded for lowly susceptible species occurred in 2024. Lowly susceptible species are now contributing more greatly to the stony coral live tissue area with the Coral AP.

Despite regional LTA remaining relatively unchanged since the SCTLD epidemic, regional stony coral density has been steadily increasing since 2013. Stony coral density in 2024 was the highest density recorded within the last decade and was significantly higher than densities recorded from 2013 to 2019 – years from before, during, and after the SCTLD outbreak. While an increase in density suggests that there is successful coral reproduction occurring, an important indicator of reef recovery, it has been predominantly driven by increases in small, weedy, generalist coral species that were minimally impacted by SCTLD and that do not contribute greatly to LTA, especially the lowly susceptible species *Porites astreoides* and the intermediately susceptible species *Siderastrea siderea*. Although *S. siderea* is classified as intermediately susceptible to SCTLD, the extent to which *S. siderea* is truly susceptible to SCTLD has also been questioned, given differences in its disease epidemiology and low disease prevalence in some areas (Kolodziej et al. 2021; Toth et al. 2023). Nonetheless, it experienced declines as a result of SCTLD, but has made substantial strides in recovery. It is known to be stress-tolerant, especially in shallow and nearshore habitats with anthropogenic inputs (Muthiga and Szmant 1987, Castillo et al. 2014), and has experienced a reproductive boom within the last several years (Harper et al. 2023), explaining its increased contribution to stony coral density as these juveniles grow into the adult population.

To better assess the critical recruitment patterns required for reef recovery within the Coral AP, tallying coral colonies <4 cm in diameter was incorporated into the data collection methods in 2018. The number of juvenile coral colonies observed has increased over time: in 2024, it was approximately 64% greater than in 2018, at the end of the epidemic phase of the SCTLD event. The greatest contributors to corals of this size class were *Siderastrea siderea*, *Porites astreoides*, and *Montastraea cavernosa*, which together accounted for about 84% of juveniles in 2024. *Siderastrea siderea* and *Porites astreoides* dominated the juvenile counts, contributing to 76% of observed juveniles. They are generalist species and, although they are reef-building corals, they are not considered framework builders, meaning that even with enough time in optimal conditions, they will not grow to significantly contribute to reef structural complexity. *Montastraea cavernosa*, which was heavily impacted by SCTLD, has increasingly contributed to juvenile abundances since 2018, a promising sign for the future of this species. However, the extent to which these juveniles will grow to much larger sizes is currently unknown and will be a subject of future monitoring efforts. Juveniles of highly SCTLD-susceptible species have been rare since 2018 and decreasing over time. In 2024, only 19 individuals of highly SCTLD-susceptible species were observed across all SECREMP sites, down from 58 in 2018. Yet, the lack of juveniles is not necessarily indicative of poor performance: for example, the declining number of *Meandrina meandrites* juveniles over time is due to them successfully growing into the adult size class (≥4 cm diameter). Adult colonies of *Meandrina meandrites* have increased from a low of 5 colonies in 2016 to 38 colonies in 2024. However, this pattern does not hold for all SCTLD-susceptible species. *Colpophyllia natans*, for example, has displayed a consistent number of juveniles annually since 2018, but the number of adult colonies have declined over time (9 in 2013, but only 2 in 2024).

From June to September 2023, Florida experienced some of the hottest ocean temperatures on record for the region, leading to unprecedented coral bleaching (Goreau and Hayes 2024, Neely et al. 2024). While the southern regions of FCR were subjected to a catastrophic bleaching event, with some reefs experiencing 100% bleaching prevalence and high mortality (Neely et al. 2024), the Coral AP experienced minimal bleaching. Only 1.4% (56 of 3998) of adult colonies surveyed during the SECREMP monitoring period were recorded as having either total or partial bleaching. Continuous water temperature monitoring revealed that 13 of 22 sites experienced their warmest temperature recorded as part of SECREMP in July or August 2023. All sites experienced temperatures surpassing the accepted bleaching threshold for the region (30.5 °C; Manzello et al. 2007), with one site in

Miami-Dade County (DC8) having 52 days above this threshold. Considering that SECREMP site visits are discrete events, it is possible that extensive bleaching may have been missed due to the timing of surveys; however, between 2023 and 2024, both coral LTA and density increased, suggesting that there was no major mortality from this marine heatwave. Additionally, other non-SECREMP field research conducted within the Coral AP during this time period did not observe any significant bleaching (personal observation). The accumulation of thermal stress from prolonged warm water temperatures appears to have been lower within the Coral AP than within the Florida Keys, Dry Tortugas, and Marquesas (NOAA Coral Reef Watch 2025), sparing the northern extent of FCR from extensive bleaching.

There is no clear relationship between the changes documented in the stony coral assemblage and the octocoral or sponge assemblages. Octocoral cover has generally decreased over time, as 13 of the 20 sites with sizable octocoral communities had significantly lower cover in 2022-2024 than in 2013-2015 and only three sites had a significant increase in octocoral cover. Although regional density increased from 2013 to 2017, it declined significantly between 2017 and 2018 due to impacts from Hurricane Irma. Density subsequently recovered to pre-disturbance density by 2020, but has declined every year since. In 2024, regional octocoral density was not significantly different from that in the years following Hurricane Irma. However, octocorals still represent a prominent component of the benthos at most SECREMP sites, far outnumbering stony corals. Two of the three target octocoral species, *Antillogorgia americana* and *Gorgonia ventalina*, have exhibited significant changes in density over time. Both have generally increased in density, with *G. ventalina* reaching its peak density in 2024 and *A. americana* reaching its peak density in 2021. The disparity between decreasing octocoral benthic cover estimates and increasing density is likely explained by the use of transect images to generate benthic cover data: benthic cover images take octocoral canopy cover into account. Therefore, larger colonies contribute more greatly to percent cover estimates than smaller colonies, while all living colonies, regardless of size contribute equally to density measurements. Additionally, average colony heights of *A. americana*, the most common octocoral seen at SECREMP sites, have been decreasing over time, suggesting that the region may be experiencing a decrease in colony size and/or an increase in partial mortality in the larger classes, both of which would further contribute to reduced cover and a likely increase in smaller colony abundance. Interestingly, for both *G. ventalina* and *A. americana,* a decrease in average height and an increase in density has been observed in recent years, suggest that successful reproduction is occurring for these species: more new colonies are present, skewing colony size downward.

Regional density of *Xestospongia muta*, the giant barrel sponge, has generally increased over time, with the highest observed *X. muta* density recorded so far occurring in 2024. Although there was a decrease in density in 2018 due to the passing of Hurricane Irma in late 2017, density has increased in each subsequent year. Although little is known about *X. muta* demographics, research suggests that increasing *X. muta* abundance in Florida may be due to large recruitment pulses (McMurray et al. 2010). Benthic cover of sponges was temporally consistent, with mean cover approximately 4-6%. Although sponge cover did significantly decline between 2013-2015 and 2022-2024, the decline was by less than 1% and 14 of 22 sites experienced no significant changes in sponge cover during this time. The conditions driving the changes in other benthic community constituents do not appear to be, at the current level of examination, impacting the sponge communities. However, sponge cover is expected to increase on coral reefs in the coming decades, with potentially negative impacts on coral recruitment and growth (Brandt et al. 2019, Olinger et al. 2021).

Macroalgae cover was the most variable of all benthic groups examined but generally increased in the last decade at almost all sites. From 2013-2015 compared to 2022-2024, 17 of 22 sites saw a significant increase in macroalgal cover, although it was highly variable between years. Furthermore, increases in macroalgal cover were generally greater in magnitude than decreases in macroalgae. Between the last two monitoring years (2023-2024), significant macroalgal increases were seen at ten of 22 sites, while significant decreases were seen at only six sites. Interpreting changes in macroalgal cover is difficult given the ephemeral nature of macroalgae and the temporally limited sampling design of an annual monitoring program because macroalgal cover can change significantly over very short time periods (Lirman and Biber, 2005). The data herein indicate that region-wide conditions, including increased nutrients, water temperatures, substrate availability, and other factors not specifically addressed as part of SECREMP's monitoring, appear to be favorable to macroalgal growth.

SECREMP is an annual monitoring program and, as such, is designed to provide both current status and long-term trend information. Capturing the processes that contribute to the observed changes is a challenge for annual sampling since each site is visited only once per year. Diseased and unhealthy individuals are a normal part of all populations, but they may not be captured as part of annual monitoring, as processes contributing to mortality may show seasonal variation or operate over long timescales. Several biotic and abiotic environmental factors, including predation prevalence, competition, water temperature, sedimentation and turbidity, and other water quality parameters strongly contribute to coral health status, and it is impossible to quantify and define all of them within one monitoring program. Although SCTLD was a major driver of mortality for the majority of years covered in this report, not all mortality was caused by disease, especially in more recent years when SCTLD prevalence has been low. A combination of factors likely drove the observed SCTLD event and is driving current mortality (Vega Thurber et al. 2014, Miller et al. 2016, Pollock et al. 2016, Precht et al. 2016).

With the low disease prevalence seen in recent years, there is hope that some natural recovery may be evident within the next few years. Promising signs include that both stony coral density and LTA have been consistently increasing since the end of the SCTLD epidemic, although only the former has been statistically significant. However, the species driving these increases are mostly weedy, low-relief species (i.e., *Siderastrea* spp. and *Porites* spp.) that do not provide as much reef structure and habitat as those larger species that were heavily impacted by SCTLD (i.e., *Montastraea cavernosa* and *Orbicella* spp.). The changes in coral assemblage composition and diversity across the region will affect reef recovery by spatially limiting reproduction for certain species, particularly those that experienced the largest declines from SCTLD. While there have been encouraging trends in some SCTLD-impacted species, including *Montastraea cavernosa* juveniles, mitigation and active intervention may be necessary to assist those species with the greatest losses from SCTLD in order to see any significant recovery.

As previously mentioned, the reefs in the Coral AP represent a crucial economic resource to the region. The reef system has been estimated to protect over $500 million in infrastructure and $440 million in economic activity from storm-related flooding (Storlazzi et al. 2019). These reefs have also been estimated to generate more than $6 billion in sales and income (adjusted for inflation) and support more than 35,000 jobs (Johns et al. 2001, 2004). The entirety of Florida's Coral Reef has an estimated asset value of $11.7 billion and generates $2.7 billion in local income (adjusted for inflation) (Brander et al. 2013). Furthermore, the predicted loss of structural complexity will likely impact the reef's ability to provide critical ecosystem services, such as coastal protection and habitat for recreationally important fish species.

Disturbances on coral reefs, including disease outbreaks, heat stress events, hurricanes, and nutrient enrichment are expected to become more frequent and severe (Emslie et al. 2024). The chronic nature of disturbances to and the significant economic value of Coral AP reefs requires comprehensive, long-term monitoring to be conducted to define and quantify change and to help identify threats to the ecosystem. Long-term monitoring has emerged worldwide as a critical tool for understanding coral reef dynamics and guiding restoration and management (Edmunds and Riegl 2020, Sommer et al. 2024). The region-wide information generated during the annual SECREMP site visits provide scientifically valid status and trend data designed to assist local resource managers in understanding the condition of the resource and possible implications of actions occurring in terrestrial and adjacent marine habitats. Both continual region-wide monitoring (SECREMP) and improved incident-specific monitoring are necessary for resource managers to develop sound management plans for coral reefs that allow for continued use and realization of the economic value of these fragile marine ecosystems.

The expansion of CREMP to include sites in Broward, Miami-Dade, Palm Beach, and Martin Counties through SECREMP has ensured that a suite of important parameters is being monitored for much of Florida's Coral Reef. As a monitoring project under the NOAA Coral Reef Conservation Program Cooperative Agreement for the Southeast Florida coast, SECREMP will continue to provide valuable Southeast Florida coral reef status and long-term trend data. SECREMP provides resource managers with the critical information required to manage this valuable, yet increasingly threatened, natural resource.

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Appendices

Appendix 1. Mean cover (%) by site, based on transect images. R = region-wide comparison (n = 22), BC = Broward County, DC = Miami-Dade County, PB = Palm Beach County, MC = Martin County. Region-wide values are calculated as an average of the sum of each site. Site-level values are calculated as an average of the stations. For cover data for years prior to 2013 see Gilliam et al. (2013).

		2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Variable	**Level**	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
Stony Coral	R	2.51 ± 0.66	2.84 ± 0.78	2.54 ± 0.66	1.53 ± 0.39	1.42 ± 0.31	1.02 ± 0.29	1.24 ± 0.33	1.4 ± 0.37	1.23 ± 0.32	1.21 ± 0.27	1.08 ± 0.25	1.09 ± 0.21
	DC1	4.24 ± 0.92	5.44 ± 1.65	5.33 ± 2.54	2.7 ± 0.76	2.83 ± 0.35	2.5 ± 0.32	2.21 ± 0.7	2.18 ± 0.47	2.05 ± 0.38	2.29 ± 0.49	2.89 ± 0.45	2.64 ± 0.63
	DC2	0.95 ± 0.48	1.55 ± 0.4	1.22 ± 0.29	0.76 ± 0.2	0.73 ± 0.19	0.5 ± 0.05	0.51 ± 0.17	0.34 ± 0.08	0.48 ± 0.09	0.81 ± 0.21	0.59 ± 0.12	0.53 ± 0.20
	DC3	0.24 ± 0.07	0.4 ± 0.17	0.19 ± 0.09	0.22 ± 0.11	0.36 ± 0.13	0.24 ± 0.11	0.31 ± 0.15	0.38 ± 0.18	0.51 ± 0.16	0.32 ± 0.06	0.31 ± 0.07	0.29 ± 0.06
	DC4	1.52 ± 0.5	1.36 ± 0.56	1.32 ± 0.37	1.09 ± 0.12	1.01 ± 0.23	0.78 ± 0.15	1.04 ± 0.17	1.08 ± 0.27	1.14 ± 0.21	1.16 ± 0.19	0.80 ± 0.34	1.03 ± 0.16
	DC5	1.59 ± 0.28	2.94 ± 1.08	1.16 ± 0.29	0.7 ± 0.06	0.94 ± 0.12	0.4 ± 0.06	1.09 ± 0.3	1.2 ± 0.29	0.98 ± 0.18	1.19 ± 0.26	0.81 ± 0.19	1.03 ± 0.32
	DC6	2.5 ± 0.48	2.86 ± 0.8	3.24 ± 0.84	2.72 ± 0.69	2.22 ± 0.65	1.28 ± 0.42	1.6 ± 0.5	1.66 ± 0.72	1.45 ± 0.55	1.66 ± 0.6	1.34 ± 0.55	1.57 ± 0.62
	DC7	0.51 ± 0.09	0.5 ± 0.17	0.42 ± 0.04	0.16 ± 0.07	0.45 ± 0.07	0.34 ± 0.18	0.31 ± 0.16	0.29 ± 0.15	0.62 ± 0.24	0.82 ± 0.17	0.52 ± 0.07	0.76 ± 0.17
	DC8	1.51 ± 0.55	1.51 ± 0.34	1.18 ± 0.24	1.36 ± 0.51	1.04 ± 0.27	0.97 ± 0.4	1.04 ± 0.31	1.34 ± 0.56	0.55 ± 0.25	1.3 ± 0.49	0.91 ±0.29	0.85 ± 0.21
	BC1	12.67 ± 1.93	12.27 ± 1.73	12.35 ± 1.17	7.28 ± 1.38	4.92 ± 0.86	6.43 ± 1.47	6.48 ± 0.89	6.56 ± 1.6	6.43 ± 1.11	5.62 ± 0.62	5.31 ± 0.83	4.50 ± 0.85
	BC2	0.73 ± 0.43	0.78 ± 0.21	0.89 ± 0.47	0.38 ± 0.1	0.35 ± 0.11	0.46 ± 0.17	0.38 ± 0.07	0.22 ± 0.12	0.31 ± 0.14	0.41 ± 0.11	0.39 ± 0.15	0.40 ± 0.20
	BC3	0.69 ± 0.32	0.61 ± 0.22	0.69 ± 0.32	0.41 ± 0.31	0.33 ± 0.12	0.24 ± 0.09	0.36 ± 0.15	0.66 ± 0.12	0.33 ± 0.04	0.41 ± 0.11	0.41 ± 0.10	0.72 ± 0.18
	BC4	4.04 ± 0.92	4.23 ± 0.88	4.38 ± 1.13	3.49 ± 0.67	3.82 ± 0.57	1.71 ± 0.36	2.65 ± 0.79	2.09 ± 0.46	2.37 ± 0.42	1.95 ± 0.33	2.03 ± 0.30	2.43 ± 0.51
	BC5	1.49 ± 0.3	1.08 ± 0.39	1.43 ± 0.2	0.16 ± 0.03	0.31 ± 0.12	0.23 ± 0.05	0.39 ± 0.17	0.43 ± 0.15	0.21 ± 0.09	0.25 ± 0.07	0.49 ± 0.09	0.77 ± 0.19
	BC6	0.76 ± 0.19	0.58 ± 0.23	0.6 ± 0.22	0.31 ± 0.09	0.53 ± 0.16	0.39 ± 0.1	0.36 ± 0.11	0.43 ± 0.18	0.31 ± 0.11	0.44 ± 0.08	0.49 ± 0.14	0.49 ± 0.23
	BCA	10.93 ± 1.67	13.85 ± 1.69	9.88 ± 2.06	4.75 ± 1.06	3.41 ± 0.9	2.44 ± 0.54	4.29 ± 0.87	6.11 ± 1.08	4.28 ± 0.82	2.97 ± 0.37	0.99 ± 0.12	0.68 ± 0.18
	PB1	0.11 ± 0.06	0.03 ± 0.03	0.1 ± 0.07	0.1 ± 0.07	0.06 ± 0.04	0.03 ± 0.03	0.1 ± 0.07	0.11 ± 0.06	0.06 ± 0.03	0.09 ± 0.03	0.03 ± 0.03	0.12 ± 0.05
	PB2	1.68 ± 0.38	2.09 ± 0.66	2.04 ± 0.42	0.87 ± 0.23	1.14 ± 0.31	1 ± 0.38	0.67 ± 0.23	1.08 ± 0.2	0.78 ± 0.35	1.08 ± 0.28	1.21 ± 0.19	1.10 ± 0.28
	PB3	1.49 ± 0.45	1.27 ± 0.43	1.04 ± 0.12	0.57 ± 0.1	0.59 ± 0.2	0.59 ± 0.17	0.47 ± 0.24	0.67 ± 0.28	0.65 ± 0.19	0.6 ± 0.13	0.52 ± 0.18	0.47 ± 0.16
	PB4	1.7 ± 0.42	1.73 ± 0.42	1.56 ± 0.54	0.4 ± 0.12	1.44 ± 1.15	0.48 ± 0.15	0.38 ± 0.11	0.36 ± 0.14	0.47 ± 0.16	0.28 ± 0.09	0.38 ± 0.13	0.67 ± 0.09
	PB5	1.94 ± 0.58	2.35 ± 0.37	2.04 ± 0.45	0.79 ± 0.24	0.6 ± 0.1	0.58 ± 0.31	0.7 ± 0.13	0.85 ± 0.23	1.06 ± 0.18	0.75 ± 0.15	0.98 ± 0.25	1.11 ± 0.26
	MC1	2.97 ± 1.47	3.6 ± 1.96	3.6 ± 1.67	2.98 ± 1.32	3.94 ± 1.14	0.89 ± 0.55	1.84 ± 1.14	2.65 ± 1.21	1.93 ± 0.74	2.09 ± 0.76	2.28 ± 0.63	1.60 ± 0.61
	MC2	1.52 ± 0.63	1.12 ± 0.39	1.31 ± 0.38	1.23 ± 0.56	1.13 ± 0.8	0.15 ± 0.15	0.03 ± 0.03	0.05 ± 0.05	0.14 ± 0.07	0.11 ± 0.08	0.19 ± 0.04	0.29 ± 0.14

Appendix 1. Continued.

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Variable	**Level**	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
Octocoral	R	9.86 ± 1.34	9.59 ± 1.29	9.12 ± 1.22	8.76 ± 1.24	9.52 ± 1.27	7.45 ± 0.94	7.47 ± 0.94	8.08 ± 1.07	8.5 ± 1.12	8.44 ± 1.11	8.02 ± 1.13	8.69 ± 1.23
	DC1	8.34 ± 0.49	12.08 ± 1.49	9.45 ± 1.95	9.67 ± 0.72	9.37 ± 1.12	9.04 ± 1.29	6.51 ± 0.82	5.73 ± 0.57	7.01 ± 0.41	6.85 ± 0.62	6.44 ± 1.00	6.49 ±1.77
	DC2	11.37 ± 0.47	12.04 ± 0.86	12.44 ± 0.79	8.49 ± 0.47	11.79 ± 1.54	7.06 ± 0.76	8.83 ± 0.65	8.76 ± 0.21	11.91 ± 1.24	9.58 ± 0.96	10.01 ± 1.08	10.74 ± 1.06
	DC3	8.38 ± 0.94	7.97 ± 1.42	9.19 ± 2.11	9.98 ± 0.48	11.5 ± 0.94	8.95 ± 0.45	7.84 ± 1.18	8.98 ± 0.52	11.18 ± 1.94	10.52 ± 1.34	10.55 ± 0.39	12.03 ± 0.87
	DC4	14.58 ± 1.36	12.15 ± 1.11	12.26 ± 0.78	12.34 ± 1.48	12.32 ± 0.64	9.92 ± 0.86	10.64 ± 0.65	8.54 ± 0.64	12.2 ± 1.05	13.13 ± 1.28	9.84 ± 0.71	10.96 ± 0.42
	DC5	16.74 ± 2.27	12.93 ± 1.42	12.67 ± 2.41	15.26 ± 1.17	15.39 ± 1.56	11.11 ± 2.08	9.83 ± 1.29	10.18 ± 0.43	11.44 ± 0.99	17.5 ± 1.27	13.30 ± 0.49	13.73 ± 0.24
	DC6	9.37 ± 1.47	7.04 ± 0.93	7.55 ± 0.92	6.87 ± 0.56	8.69 ± 0.68	4.94 ± 0.52	6.65 ± 0.55	5.37 ± 0.46	5.69 ± 0.63	5.45 ± 0.58	5.61 ± 1.27	8.70 ± 0.97
	DC7	8.09 ± 1.64	7.73 ± 0.33	11.79 ± 1.82	5.39 ± 0.7	6.65 ± 0.84	6.18 ± 1.28	6.5 ± 0.67	6.73 ± 0.38	8.79 ± 0.52	8.47 ± 0.24	5.93 ± 0.76	6.40 ± 1.62
	DC8	15.82 ± 1.84	14.11 ± 2.03	13.12 ± 0.62	12.23 ± 0.85	14.43 ± 1.4	11.56 ± 1.06	15.36 ± 0.86	9.18 ± 1.28	8.77 ± 0.83	9.63 ± 0.67	10.41 ± 0.46	9.62 ± 0.78
	BC1	7.36 ± 0.43	7.1 ± 0.56	5.74 ± 1.00	5.42 ± 0.74	6.32 ± 0.66	7.82 ± 0.44	9.93 ± 0.65	8.8 ± 0.82	7.23 ± 0.24	8.67 ± 0.73	5.70 ± 0.92	6.36 ± 1.15
	BC2	4.69 ± 0.87	7.98 ± 0.96	5.18 ± 0.45	5.01 ± 0.63	8.48 ± 1.19	7.25 ± 1.38	5.65 ± 0.84	8.94 ± 0.89	6.64 ± 1.09	6.39 ± 0.86	5.09 ± 0.54	7.07 ± 0.22
	BC3	13.12 ± 0.48	8.65 ± 1.68	9.28 ± 1.29	9.95 ± 0.9	9.38 ± 1.33	10.45 ± 1.49	7.83 ± 1.12	10.34 ± 1.25	12.14 ± 1.4	10.05 ± 1.53	11.70 ± 0.61	11.16 ± 0.57
	BC4	4.28 ± 0.58	4.2 ± 0.68	4.61 ± 0.51	5.03 ± 0.68	4.58 ± 0.76	2.14 ± 0.42	2.43 ± 0.74	3.01 ± 0.57	2.3 ± 0.55	3.68 0.59	3.22 ± 0.88	3.95 ± 0.81
	BC5	6.76 ± 0.95	8.41 ± 0.76	6.51 ± 0.79	5.52 ± 0.48	7.05 ± 0.88	5.7 ± 0.41	6.81 ± 0.76	6.97 ± 0.3	6.3 ± 0.6	5.41 ± 0.51	6.87 ± 0.26	5.89 ± 0.22
	BC6	16.44 ± 1.4	16.79 ± 0.8	13.22 ± 0.49	13.69 ± 1.04	14.09 ± 1.16	11.64 ± 0.68	13.42 ± 0.9	16.86 ± 1.67	14.58 ± 1.17	9.02 ± 1.35	8.06 ± 1.07	8.42 ± 0.82
	BCA	2.96 ± 0.65	2.85 ± 0.4	2.25 ± 0.53	1.19 ± 0.23	1.13 ± 0.23	1.77 ± 0.22	2.00 ± 0.28	2.27 ± 0.49	1.44 ± 0.37	2.04 ± 0.3	0.81 ± 0.86	0.75 ± 1.70
	PB1	0.00 ± 0.00	0.00 ± 0.00	0.1 ± 0.07	0.00 ± 0.00	0.06 ± 0.06	0.00 ± 0.00	0.06 ± 0.06	0.03 ± 0.03	0.17 ± 0.07	0.32 ± 0.2	0.35 ± 0.14	0.00 ± 0.00
	PB2	17.12 ± 5.12	18.45 ± 4.22	18.61 ± 3.56	16.63 ± 3.29	18.8 ± 4.19	14.36 ± 3.14	8.93 ± 2.75	12.77 ± 3.91	13.26 ± 4.77	14.84 ± 3.27	15.94 ± 2.91	17.81 ± 2.76
	PB3	12.99 ± 1.89	11.91 ± 1.72	12.41 ± 1.36	17.03 ± 0.63	14.8 ± 1.71	9.8 ± 1.85	10.06 ± 0.91	12.6 ± 1.51	13.21 ± 0.96	14.48 ± 3.27	17.13 ± 0.91	20.26 ± 2.04
	PB4	18.93 ± 2.1	22.03 ± 2.11	20.71 ± 1.29	19.12 ± 2.36	15.4 ± 3.57	11.84 ± 2.18	12.31 ± 0.27	15.32 ± 0.92	16.59 ± 1.11	14.68 ± 1.61	16.26 ± 2.03	14.93 ± 1.51
	PB5	19.81 ± 1.27	16.62 ± 0.25	14.05 ± 1.95	13.88 ± 1.14	14.18 ± 1.21	12.62 ± 1.57	12.58 ± 1.03	16.41 ± 1.05	15.97 ± 0.37	14.9 ± 0.6	13.22 ± 0.85	15.82 ± 1.01
	MC1	0.12 ± 0.12	0.02 ± 0.02	0.05 ± 0.03	0.03 ± 0.03	0.00 ± 0.00	0.00 ± 0.00	0.03 ± 0.03	0.00 ± 0.00	0.13 ± 0.13	0.12 ± 0.12	0.00 ± 0.00	0.00 ± 0.00
	MC2	0.00 ± 0.00	0.03 ± 0.03	0.00 ± 0.00	0.03 ± 0.03	0.00 ± 0.00	0.00 ± 0.00	0.03 ± 0.03	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

Appendix 1. Continued

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Variable	**Level**	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
Sponge	R	5.17 ± 0.64	5.54 ± 0.68	5.74 ± 0.75	5.44 ± 0.63	6.2 ± 0.81	4.9 ± 0.58	5.06 ± 0.61	6.08 ± 0.76	5.61 ± 0.73	5.16 ± 0.67	5.20 ± 0.71	5.66 ± 0.81
	DC1	2.64 ± 0.48	2.66 ± 0.33	3.34 ± 0.38	3.17 ± 0.18	2.88 ± 0.35	3.37 ± 0.51	3.07 ± 0.4	3.93 ± 1.11	4.09 ± 0.82	3.18 ± 0.34	3.37 ± 0.15	3.23 ± 0.59
	DC2	4.93 ± 0.35	4.97 ± 0.52	5.69 ± 0.33	5.88 ± 0.7	6.38 ± 1.21	4.59 ± 1.04	3.57 ± 0.23	5.74 ± 0.28	7.12 ± 1.43	5.3 ± 0.58	3.66 ± 0.15	4.84 ± 0.38
	DC3	5.47 ± 0.91	3.59 ± 0.9	3.19 ± 0.84	4.86 ± 1.45	4.55 ± 1.14	4 ± 0.67	3.85 ± 0.54	6.44 ± 1.65	4.36 ± 0.85	4.17 ± 0.94	4.89 ± 1.23	3.60 ± 1.13
	DC4	7.5 ± 1.54	7.34 ± 1.44	8.64 ± 1.39	7.74 ± 1.57	8.14 ± 0.26	6.64 ± 0.46	5.93 ± 0.83	7.78 ± 0.59	6.95 ± 0.69	8.26 ± 0.33	6.81 ± 0.32	6.94 ± 0.84
	DC5	3.5 ± 0.57	4.22 ± 0.95	5.72 ± 1.08	5.02 ± 1.38	5.72 ± 1.23	3.36 ± 0.52	4.72 ± 0.68	4.96 ± 1.07	5.05 ± 1.24	4.09 ± 1.00	2.70 ± 0.28	3.74 ± 0.36
	DC6	2.28 ± 0.38	2.14 ± 0.37	1.75 ± 0.24	2.42 ± 0.19	3.02 ± 0.29	1.84 ± 0.52	2.93 ± 0.68	2.67 ± 0.36	1.78 ± 0.41	1.78 ± 0.26	1.55 ± 0.46	1.96 ± 0.59
	DC7	7.52 ± 1.1	7.47 ± 1.48	8.6 ± 0.6	7.82 ± 0.66	7.73 ± 1.01	6.18 ± 1.4	7.99 ± 1.77	9.75 ± 1.54	10.19 ± 0.49	9.53 ± 1.57	6.58 ± 0.48	7.17 ± 0.67
	DC8	2.58 ± 0.28	3.19 ± 0.43	3.6 ± 0.27	3.78 ± 0.7	3.48 ± 0.3	3.07 ± 0.6	3.87 ± 0.34	4.01 ± 0.88	2.17 ± 0.24	3.51 ± 0.33	3.32 ± 1.26	3.69 ± 0.85
	BC1	3.25 ± 0.3	3.72 ± 0.57	3.7 ± 0.82	3.17 ± 0.73	3.29 ± 0.11	3.63 ± 0.57	3.22 ± 0.48	3.21 ± 0.61	2.39 ± 0.41	2.36 ± 0.42	3.01 ± 0.80	2.56 ± 0.53
	BC2	5.22 ± 0.5	5.67 ± 0.63	6.55 ± 0.9	4.45 ± 0.58	6.79 ± 0.71	5.74 ± 0.96	5.29 ± 0.6	6.49 ± 0.37	7.64 ± 0.37	6.62 ± 1.11	5.43 ± 0.77	5.94 ± 1.12
	BC3	6.42 ± 0.5	5.09 ± 0.55	5.84 ± 0.39	4.48 ± 0.51	6 ± 0.82	6.37 ± 0.44	5.01 ± 0.21	5.62 ± 0.46	5.83 ± 0.76	6.16 ± 0.48	5.85 ± 0.49	6.48 ± 0.83
	BC4	3.01 ± 0.35	3.93 ± 0.48	3.9 ± 0.93	3.52 ± 0.53	4.59 ± 0.07	2.47 ± 0.54	3.5 ± 0.82	3.49 ± 0.73	3.32 ± 0.64	3.2 ± 0.67	3.84 ± 0.69	2.62 ± 0.15
	BC5	6.92 ± 0.51	7.11 ± 1.14	7.3 ± 1.05	7.00 ± 0.86	8.08 ± 1.07	6.29 ± 0.91	8.63 ± 0.73	7.74 ± 0.96	5.76 ± 1.23	7.34 ± 1.2	7.66 ± 0.11	7.60 ± 0.23
	BC6	3.8 ± 0.7	5.92 ± 1.34	4.96 ± 0.89	5.53 ± 0.42	5.89 ± 0.59	4.46 ± 1.4	5.8 ± 0.23	6.65 ± 0.83	6.12 ± 1.08	6.02 ± 0.83	7.14 ± 1.54	8.02 ± 1.81
	BCA	3.58 ± 1.59	0.72 ± 0.35	0.87 ± 0.17	0.75 ± 0.29	0.82 ± 0.33	2.05 ± 0.77	1.43 ± 0.08	1.58 ± 0.29	0.82 ± 0.16	0.89 ± 0.21	1.27 ± 0.78	0.99 ± 0.69
	PB1	1.82 ± 1.02	3.47 ± 1.87	3.01 ± 1.29	3.98 ± 2.1	5.65 ± 3.11	2.4 ± 1.36	2.41 ± 1.43	2.75 ± 1.43	3.36 ± 1.38	3.24 ± 1.57	3.40 ± 1.55	4.96 ± 1.98
	PB2	7.44 ± 0.45	8.47 ± 0.71	7.92 ± 0.87	7.24 ± 0.48	8.13 ± 1.15	6.31 ± 0.92	4.81 ± 0.16	8.06 ± 1.02	6.52 ± 1.28	4.6 ± 0.76	5.08 ± 0.71	8.24 ± 1.35
	PB3	10.65 ± 0.88	12.26 ± 1.59	12.39 ± 1.22	11.8 ± 0.93	14.78 ± 1.37	11.24 ± 1.6	12.63 ± 1.11	16.55 ± 1.33	12.54 ± 0.7	11.18 ± 1.23	12.57 ± 0.78	13.67 ± 1.56
	PB4	12.69 ± 2.79	13.34 ± 2.17	14.76 ± 2.44	13.24 ± 1.88	13.23 ± 4.1	10.48 ± 0.71	9.98 ± 0.99	11.73 ± 1.56	12.58 ± 1.55	10.52 ± 1.06	12.49 ± 1.32	14.44 ± 0.53
	PB5	8.6 ± 1.28	9.79 ± 0.75	9.78 ± 1.4	7.49 ± 0.86	10.73 ± 1.04	8.94 ± 1.59	8.28 ± 1.25	9.08 ± 1.01	10.39 ± 2.09	9.29 ± 1.56	10.48 ± 0.94	11.06 ± 1.54
	MC1	1.54 ± 0.33	2.72 ± 0.43	1.88 ± 0.47	2.72 ± 0.17	2.14 ± 0.21	2.59 ± 0.59	2.65 ± 0.89	2.66 ± 0.34	1.97 ± 0.5	1.45 ± 0.56	1.29 ± 0.41	0.89 ± 0.37
	MC2	2.56 ± 0.64	3.72 ± 0.75	3.01 ± 0.48	3.36 ± 0.87	1.9 ± 0.55	1.75 ± 0.48	1.64 ± 0.48	2.93 ± 0.88	2.39 ± 0.6	0.82 ± 0.23	2.02 ± 0.31	1.89 ± 0.64

Appendix 1. Continued

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Variable	**Level**	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
Macro-algae	R	9.16 ± 2.45	10.25 ± 1.93	11.15 ± 1.7	26.88 ± 3.69	12.98 ± 1.65	14 ± 2.45	23.09 ± 2.13	18.37 ± 1.99	20.27 ± 1.96	17.66 ± 1.86	16.00 ± 1.77	19.78 ± 2.69
	DC1	15.26 ± 3.42	3.6 ± 0.62	2.88 ± 1.09	17.85 ± 2.7	2.3 ± 0.34	20.91 ± 3.72	25.21 ± 8.8	31.22 ± 0.78	21.6 ± 4.03	20.38 ± 1.57	18.19 ± 0.98	21.35 ± 1.29
	DC2	5.73 ± 2.7	5.59 ± 1.84	4.28 ± 1.6	67.44 ± 3.03	9.46 ± 2.74	23.7 ± 4.23	38.27 ± 2.81	24.55 ± 2.1	25.6 ± 6.9	19.33 ± 0.92	19.36 ± 3.07	18.39 ± 2.40
	DC3	1.13 ± 0.37	6.49 ± 0.94	3.57 ± 0.61	67.34 ± 3.52	15.03 ± 5.94	2.23 ± 1.77	30.11 ± 11.62	9.96 ± 4.9	23.58 ± 6.43	6.23 ± 3.46	5.25 ± 5.81	18.45 ± 4.55
	DC4	2.22 ± 0.68	8.38 ± 2.02	5.21 ± 1.76	21.26 ± 7.35	7.75 ± 1.7	11.52 ± 2.54	21.67 ± 2.81	28.5 ± 5.14	12.02 ± 1.86	20.35 ± 6.16	11.89 ± 7.84	6.05 ± 5.76
	DC5	7.06 ± 2.81	25.18 ± 2.48	25.72 ± 2.95	27.62 ± 4.12	22.37 ± 4.3	36.29 ± 2.57	24.02 ± 3.96	28.32 ± 3.42	13.4 ± 2.16	15.76 ± 3.48	22.79 ± 1.16	19.46 ± 4.23
	DC6	10.02 ± 0.8	9.8 ± 0.74	12.66 ± 2.7	31.97 ± 1.76	6.35 ± 2.07	40.39 ± 3.18	27.26 ± 3.54	32.65 ± 4.29	46.42 ± 1.36	46.88 ± 8.02	27.88 ± 5.47	25.13 ± 4.78
	DC7	2.53 ± 0.85	6.44 ± 1.41	8.91 ± 2.96	42.23 ± 3.74	12.39 ± 2.87	30.15 ± 6.36	32.28 ± 2.3	24.3 ± 2.74	17.22 ± 1.01	24.54 ± 4.33	31.08 ± 1.06	45.14 ± 5.92
	DC8	6.28 ± 0.91	7.79 ± 2.43	15.44 ± 4.11	26.53 ± 6.43	16.04 ± 4.62	14.23 ± 0.91	23.25 ± 2	24.22 ± 3.74	0.67 ± 0.19	13.67 ± 4.45	9.91 ± 4.74	24.13 ± 1.59
	BC1	7.04 ± 1.37	7.81 ± 1.07	15.21 ± 3.76	32.24 ± 6.36	27 ± 2.79	14.34 ± 3.4	23.12 ± 1.88	13.2 ± 1.32	26.64 ± 3.38	16.67 ± 2.25	27.99 ± 2.70	28.79 ± 3.69
	BC2	3.21 ± 0.8	6.13 ± 1.61	7.42 ± 2.8	25.62 ± 4.39	9.71 ± 1.68	0.9 ± 0.25	23.45 ± 2.74	9.43 ± 4.13	21.63 ± 6.63	19.85 ± 2.62	15.67 ± 3.76	16.14 ± 1.49
	BC3	1.88 ± 0.45	12.2 ± 2.59	11.55 ± 9.45	37.08 ± 8.75	21.96 ± 3.41	1.38 ± 0.74	24.22 ± 4.56	12.93 ± 4.84	19.13 ± 11.66	15.13 ± 4.56	12.91 ± 4.62	15.03 ± 4.81
	BC4	26.08 ± 3.2	18.87 ± 2.12	22.91 ± 1.84	40.16 ± 3.74	28.11 ± 1.89	21.4 ± 3.12	23.69 ± 2.7	22.94 ± 4.53	32.18 ± 5.44	22.74 ± 2.64	24.02 ± 2.83	48.91 ± 3.56
	BC5	10.92 ± 3.37	7.31 ± 0.58	18.71 ± 5.42	27.21 ± 4.9	10.1 ± 0.7	11.43 ± 3.99	9.71 ± 0.96	21.96 ± 3.96	21.88 ± 5.16	13.29 ± 1.84	12.00 ± 1.02	10.33 ± 1.03
	BC6	4.36 ± 1.21	4.39 ± 0.55	4.63 ± 0.7	9.67 ± 2.53	19.75 ± 4.45	17.5 ± 6.1	13.06 ± 2.55	10.57 ± 4.87	10.92 ± 1.94	12.16 ± 2.52	16.20 ± 4.36	10.97 ± 1.59
	BCA	2.69 ± 1.7	6.66 ± 4.37	2.54 ± 0.51	8.01 ± 3.32	6.05 ± 1.88	2.21 ± 0.79	6.03 ± 2.05	7.4 ± 0.85	18.23 ± 4.17	10.94 ± 2.38	18.13 ± 1.89	14.55 ± 5.11
	PB1	0.28 ± 0.16	1.75 ± 1.45	3.66 ± 0.94	1.43 ± 0.89	2.98 ± 1.13	2.4 ± 0.56	10.9 ± 3.16	16.85 ± 4.72	25.69 ± 1.26	4.6 ± 1.43	17.33 ± 2.05	10.19 ± 4.70
	PB2	0.6 ± 0.31	1.19 ± 0.38	3.38 ± 1.38	9.87 ± 3.19	3.49 ± 1.75	2.38 ± 0.98	19.47 ± 5.48	5.62 ± 2.69	14.08 ± 4.9	16.30 ± 4.47	1.47 ± 0.25	7.20 ± 5.30
	PB3	5.12 ± 0.89	7.21 ± 1.3	9.46 ± 2.56	16.1 ± 3.32	13.93 ± 3.33	8.24 ± 1.76	16.09 ± 2.31	4.9 ± 1.54	18.3 ± 2.78	10.11 ± 2.7	5.20 ± 1.23	10.52 ± 4.33
	PB4	3.22 ± 0.65	2.22 ± 0.47	6.07 ± 3.16	8.39 ± 0.83	7.75 ± 2.17	4.04 ± 1.25	6.82 ± 2.45	12.06 ± 2.9	10.15 ± 1.51	15.6 ± 4.86	2.50 ± 0.59	4.75 ± 3.53
	PB5	11.91 ± 1.8	15.19 ± 1.38	10.72 ± 1.41	30.3 ± 4.52	21.73 ± 2.79	9.89 ± 1.2	27.2 ± 3.07	11.26 ± 2.18	17.37 ± 0.02	12.43 ± 2.56	13.88 ± 2.58	9.60 ± 1.28
	MC1	23.38 ± 6.52	23.05 ± 2.77	26.35 ± 8.89	12.21 ± 7.54	10.09 ± 3.72	9.81 ± 3.31	39.04 ± 5.97	15.77 ± 2.44	19.96 ± 3.17	23.39 ± 5.9	13.32 ± 2.67	25.60 ± 4.34
	MC2	50.38 ± 3.07	38.72 ± 4.63	24.18 ± 7.2	31.35 ± 10.52	14.02 ± 4.83	22.21 ± 2.71	43.02 ± 7.55	35.48 ± 6.54	29.19 ± 5.74	28.18 ± 12.52	25.02 ± 0.90	44.39 ± 0.53

Appendix 2. Year-to-year model estimation of change in stony coral, octocoral, sponge, and macroalgae percent cover per year by region and by site from 2023 to 2024. Significant trends in cover are bolded and indicated as increasing (↑), decreasing (↓), or no significant change (-). Significance is based on Bonferroni adjusted α values; α = 0.002273.

Variable	Level	*p*-value	Significant Change
Stony Coral	DC1	0.4614	-
	DC2	0.6552	-
	DC3	0.8621	-
	DC4	0.2797	-
	DC5	0.3534	-
	DC6	0.4272	-
	DC7	0.1903	-
	DC8	0.7853	-
	BC1	0.1105	-
	BC2	0.9846	-
	BC3	0.0747	-
	BC4	0.2252	-
	BC5	0.1391	-
	BC6	0.9898	-
	BCA	0.0085	-
	PB1	0.2062	-
	PB2	0.6517	-
	PB3	0.8411	-
	PB4	0.0765	-
	PB5	0.5941	-
	MC1	0.0318	-
	MC2	0.3911	-
Octocoral	DC1	0.9713	-
	DC2	0.3814	-
	DC3	0.0489	-
	DC4	0.1065	-
	DC5	0.6063	-
	DC6	**<0.0001**	↑
	DC7	0.3966	-
	DC8	0.2375	-
	BC1	0.2594	-
	BC2	**0.0005**	↑
	BC3	0.4439	-
	BC4	0.0721	-
	BC5	0.0941	-
	BC6	0.5401	-
	BCA	0.6029	-
	PB1	n/a	-
	PB2	0.0258	-
	PB3	**0.0008**	↑
	PB4	0.1645	-
	PB5	**0.0014**	↑
	MC1	n/a	n/a
	MC2	n/a	n/a

Appendix 2. Continued.

Variable	Level	*p*-value	Significant Change
Sponge	DC1	0.7064	-
	DC2	0.0159	-
	DC3	0.0056	-
	DC4	0.8225	-
	DC5	0.0159	-
	DC6	0.2042	-
	DC7	0.3014	-
	DC8	0.4387	-
	BC1	0.2893	-
	BC2	0.3419	-
	BC3	0.2440	-
	BC4	**0.0014**	↓
	BC5	0.9145	-
	BC6	0.1668	-
	BCA	0.0404	-
	PB1	**0.0011**	↑
	PB2	**0.0000**	↑
	PB3	0.1580	-
	PB4	0.0171	-
	PB5	0.4459	-
	MC1	0.0954	-
	MC2	0.7646	-
Macroalgae	**DC1**	**0.0006**	↑
	DC2	0.3709	-
	DC3	**<0.0001**	↑
	DC4	**<0.0001**	↓
	DC5	**0.0006**	↓
	DC6	0.0046	-
	DC7	**<0.0001**	↑
	DC8	**<0.0001**	↑
	BC1	0.3625	-
	BC2	0.6214	-
	BC3	0.0053	-
	BC4	**<0.0001**	↑
	BC5	0.0233	-
	BC6	**<0.0001**	↓
	BCA	**<0.0001**	↓
	PB1	**<0.0001**	↓
	PB2	**<0.0001**	↑
	PB3	**<0.0001**	↑
	PB4	**<0.0001**	↑
	PB5	**<0.0001**	↓
	MC1	**<0.0001**	↑
	MC2	**<0.0001**	↑

Appendix 3. Long-term model estimation of change in stony coral, octocoral, sponge, and macroalgae percent cover across time intervals (± SEM). Each site was analyzed separately, where the 10 original SECREMP sites were analyzed between 3 time intervals (2003-2005, 2013-2015, 2022-2024). The full 22 sites were analyzed between 2 time intervals (2013-2015, 2022-2024). Mean values per site across each time interval were calculated. Significant trends in cover are bolded and indicated as increasing (↑), decreasing (↓), or no significant change (-). Significance is based on Bonferroni adjusted α values; α = 0.002273.

Stony Coral				
Site Code	**2003-2005 (A)**	**2013-2015 (B)**	***P*-value A vs B**	**Significant change**
BC1	11.26 ± 2.20%	12.43 ± 1.55%	0.0053	–
BC2	0.61 ± 0.26%	0.80 ± 0.32%	0.0999	–
BC3	**0.38 ± 0.11%**	**0.66 ± 0.29%**	0.0046	↑
BCA	**37.07 ± 1.41%**	**11.43 ± 1.06%**	**<0.0001**	↓
DC1	**2.55 ± 0.71%**	**5.00 ± 1.67%**	**<0.0001**	↑
DC2	**0.59 ± 0.13%**	**1.24 ± 0.34%**	**<0.0001**	↑
DC3	0.20 ± 0.08%	0.28 ± 0.08%	0.3248	–
PB1	**0.45 ± 0.14%**	**0.08 ± 0.04%**	**<0.0001**	↓
PB2	1.81 ± 0.63%	1.94 ± 0.48%	0.6266	–
PB3	0.96 ± 0.22%	1.27 ± 0.32%	0.0373	–

Appendix 3. Continued.

Stony Coral				
Site Code	**2013-2015 (B)**	**2022-2024 (C)**	***P*-value B vs C**	**Significant change**
BC1	**12.43 ± 1.55%**	**5.14 ± 0.74%**	**<0.0001**	↓
BC2	**0.80 ± 0.32%**	**0.40 ± 0.13%**	**0.0001**	↓
BC3	0.66 ± 0.29%	0.51 ± 0.06%	0.1122	–
BC4	**4.22 ± 0.94%**	**2.14 ± 0.37%**	**<0.0001**	↓
BC5	**1.33 ± 0.11%**	**0.50 ± 0.04%**	**<0.0001**	↓
BC6	0.64 ± 0.20%	0.47 ± 0.14%	0.0741	–
BCA	**11.43 ± 1.06%**	**1.55 ± 0.12%**	**<0.0001**	↓
DC1	**5.00 ± 1.67%**	**2.61 ± 0.37%**	**<0.0001**	↓
DC2	**1.24 ± 0.34%**	**0.64 ± 0.15%**	**<0.0001**	↓
DC3	0.28 ± 0.08%	0.30 ± 0.04%	0.6728	–
DC4	1.40 ± 0.42%	1.00 ± 0.20%	0.0033	–
DC5	**1.90 ± 0.50%**	**1.01 ± 0.23%**	**<0.0001**	↓
DC6	**2.87 ± 0.59%**	**1.52 ± 0.59%**	**<0.0001**	↓
DC7	0.48 ± 0.08%	0.70 ± 0.10%	0.0330	–
DC8	1.40 ± 0.33%	1.02 ± 0.33%	0.0108	–
MC1	**3.39 ± 1.67%**	**1.99 ± 0.55%**	**<0.0001**	↓
MC2	**1.32 ± 0.38%**	**0.20 ± 0.07%**	**<0.0001**	↓
PB1	0.08 ± 0.04%	0.08 ± 0.02%	0.9434	–
PB2	**1.94 ± 0.48%**	**1.13 ± 0.14%**	**<0.0001**	↓
PB3	**1.27 ± 0.32%**	**0.53 ± 0.11%**	**<0.0001**	↓
PB4	**1.66 ± 0.39%**	**0.44 ± 0.10%**	**<0.0001**	↓
PB5	**2.11 ± 0.44%**	**0.94 ± 0.20%**	**<0.0001**	↓

Octocoral				
Site Code	**2003-2005 (A)**	**2013-2015 (B)**	***P*-value A vs B**	**Significant change**
BC1	6.43 ± 0.57%	6.73 ± 0.57%	0.3164	–
BC2	**7.80 ± 0.38%**	**5.95 ± 0.53%**	**<0.0001**	↓
BC3	**13.36 ± 0.83%**	**10.35 ± 0.89%**	**<0.0001**	↓
BCA	**1.97 ± 0.08%**	**2.32 ± 0.15%**	**0.0044**	↑
DC1	**6.24 ± 0.19%**	**9.96 ± 1.08%**	**<0.0001**	↑
DC2	**13.23 ± 1.51%**	**11.95 ± 0.51%**	**0.0041**	↓
DC3	**13.96 ± 0.99%**	**8.51 ± 1.41%**	**<0.0001**	↓
PB1	**1.95 ± 0.67%**	**0.03 ± 0.02%**	**<0.0001**	↓
PB2	**27.04 ± 4.09%**	**18.06 ± 4.20%**	**<0.0001**	↓
PB3	**28.09 ± 2.41%**	**12.44 ± 1.37%**	**<0.0001**	↓

Appendix 3. Continued.

Octocoral				
Site Code	**2013-2015 (B)**	**2022-2024 (C)**	***P*-value B vs C**	**Significant change**
BC1	6.73 ± 0.57%	6.91 ± 0.72%	0.6754	–
BC2	5.95 ± 0.53%	6.18 ± 0.58%	0.4605	–
BC3	10.35 ± 0.89%	10.97 ± 1.15%	0.1470	–
BC4	**4.36 ± 0.48%**	**3.62 ± 0.88%**	**0.0016**	↓
BC5	**7.23 ± 0.66%**	**6.05 ± 0.29%**	**0.0008**	↓
BC6	**15.49 ± 0.28%**	**8.50 ± 0.81%**	**<0.0001**	↓
BCA	**2.32 ± 0.15%**	**1.20 ± 0.21%**	**<0.0001**	↓
DC1	**9.96 ± 1.08%**	**6.59 ± 0.62%**	**<0.0001**	↓
DC2	**11.95 ± 0.51%**	**10.11 ± 0.56%**	**<0.0001**	↓
DC3	**8.51 ± 1.41%**	**11.03 ± 1.05%**	**<0.0001**	↑
DC4	**13.00 ± 1.05%**	**11.31 ± 0.61%**	**0.0001**	↓
DC5	14.11 ± 1.95%	14.84 ± 1.27%	0.0548	–
DC6	7.98 ± 0.93%	6.58 ± 0.33%	<0.0001	↓
DC7	9.21 ± 1.15%	6.93 ± 0.46%	<0.0001	↓
DC8	14.35 ± 1.21%	9.89 ± 0.61%	<0.0001	↓
MC1			n/a	n/a
MC2			n/a	n/a
PB1	**0.03 ± 0.02%**	**0.22 ± 0.11%**	**0.0007**	↑
PB2	**18.06 ± 4.20%**	**16.19 ± 2.95%**	**<0.0001**	↓
PB3	**12.44 ± 1.37%**	**17.29 ± 1.16%**	**<0.0001**	↑
PB4	**20.56 ± 1.57%**	**15.29 ± 1.54%**	**<0.0001**	↓
PB5	**16.83 ± 0.80%**	**14.65 ± 0.68%**	**<0.0001**	↓

Sponge				
Site Code	**2003-2005 (A)**	**2013-2015 (B)**	***P*-value A vs B**	**Significant change**
BC1	**2.53 ± 0.57%**	**3.56 ± 0.44%**	**<0.0001**	↑
BC2	**3.14 ± 0.43%**	**5.81 ± 0.47%**	**<0.0001**	↑
BC3	**3.37 ± 0.34%**	**5.78 ± 0.43%**	**<0.0001**	↑
BCA	**0.38 ± 0.07%**	**1.73 ± 0.68%**	**<0.0001**	↑
DC1	**1.09 ± 0.26%**	**2.88 ± 0.30%**	**<0.0001**	↑
DC2	4.48 ± 0.33%	5.20 ± 0.16%	0.0167	–
DC3	3.51 ± 0.91%	4.08 ± 0.83%	0.0284	–
PB1	**7.04 ± 0.17%**	**2.76 ± 1.39%**	**<0.0001**	↓
PB2	**3.96 ± 0.52%**	**7.94 ± 0.40%**	**<0.0001**	↑
PB3	**10.01 ± 1.75%**	**11.77 ± 0.86%**	**0.0002**	↑

Appendix 3. Continued.

Sponge				
Site Code	**2013-2015 (B)**	**2022-2024 (C)**	***P*-value B vs C**	**Significant change**
BC1	**3.56 ± 0.44%**	**2.64 ± 0.38%**	**<0.0001**	↓
BC2	5.81 ± 0.47%	6.00 ± 0.69%	0.5873	–
BC3	5.78 ± 0.43%	6.16 ± 0.64%	0.2067	–
BC4	3.61 ± 0.43%	3.22 ± 0.65%	0.0883	–
BC5	7.11 ± 0.76%	7.54 ± 1.02%	0.2413	–
BC6	**4.89 ± 0.87%**	**7.06 ± 1.30%**	**<0.0001**	↑
BCA	**1.73 ± 0.68%**	**1.05 ± 0.12%**	**<0.0001**	↓
DC1	2.88 ± 0.30%	3.26 ± 0.20%	0.0716	–
DC2	5.20 ± 0.16%	4.60 ± 0.47%	0.0133	–
DC3	4.08 ± 0.83%	4.22 ± 0.65%	0.6817	–
DC4	7.83 ± 1.42%	7.34 ± 0.66%	0.1022	–
DC5	**4.48 ± 0.83%**	**3.51 ± 0.48%**	**0.0003**	↓
DC6	2.06 ± 0.24%	1.76 ± 0.13%	0.0913	–
DC7	7.86 ± 1.00%	7.76 ± 1.28%	0.8100	–
DC8	3.12 ± 0.29%	3.51 ± 0.04%	0.1172	–
MC1	**2.05 ± 0.38%**	**1.21 ± 0.39%**	**<0.0001**	↓
MC2	**3.10 ± 0.59%**	**1.58 ± 0.31%**	**<0.0001**	↓
PB1	**2.76 ± 1.39%**	**3.87 ± 1.70%**	**<0.0001**	↑
PB2	**7.94 ± 0.40%**	**5.98 ± 0.80%**	**<0.0001**	↓
PB3	11.77 ± 0.86%	12.47 ± 0.91%	0.0905	–
PB4	13.60 ± 2.36%	12.48 ± 0.79%	0.0159	–
PB5	9.39 ± 1.06%	10.28 ± 1.29%	0.0241	–

Macroalgae				
Site Code	**2003-2005 (A)**	**2013-2015 (B)**	**P-value A vs B**	**Significant change**
BC1	**4.81 ± 1.50%**	**10.02 ± 1.76%**	**<0.0001**	↑
BC2	**3.61 ± 1.18%**	**5.59 ± 0.85%**	**<0.0001**	↑
BC3	**4.58 ± 0.96%**	**8.54 ± 3.04%**	**<0.0001**	↑
BCA	**0.92 ± 0.19%**	**3.80 ± 1.28%**	**<0.0001**	↑
DC1	**19.67 ± 4.66%**	**7.24 ± 1.27%**	**<0.0001**	↓
DC2	4.56 ± 0.52%	5.20 ± 0.49%	0.0173	–
DC3	**2.66 ± 0.43%**	**3.73 ± 0.18%**	**<0.0001**	↑
PB1	**0.79 ± 0.31%**	**1.90 ± 0.77%**	**<0.0001**	↑
PB2	**0.37 ± 0.21%**	**1.72 ± 0.41%**	**<0.0001**	↑
PB3	**1.63 ± 0.49%**	**7.26 ± 1.24%**	**<0.0001**	↑

Appendix 3. Continued.

Macroalgae				
Site Code	**2013-2015 (B)**	**2022-2024 (C)**	***P*-value B vs C**	**Significant change**
BC1	**10.02 ± 1.76%**	**24.48 ± 2.37%**	**<0.0001**	↑
BC2	**5.59 ± 0.85%**	**17.22 ± 1.80%**	**<0.0001**	↑
BC3	**8.54 ± 3.04%**	**14.36 ± 2.76%**	**<0.0001**	↑
BC4	**22.62 ± 1.57%**	**31.89 ± 2.19%**	**<0.0001**	↑
BC5	12.31 ± 2.73%	11.87 ± 1.46%	0.1880	–
BC6	**4.46 ± 0.43%**	**13.11 ± 2.62%**	**<0.0001**	↑
BCA	**3.80 ± 1.28%**	**14.54 ± 1.15%**	**<0.0001**	↑
DC1	**7.24 ± 1.27%**	**19.97 ± 1.83%**	**<0.0001**	↑
DC2	**5.20 ± 0.49%**	**19.03 ± 3.84%**	**<0.0001**	↑
DC3	**3.73 ± 0.18%**	**9.98 ± 2.41%**	**<0.0001**	↑
DC4	**5.27 ± 1.04%**	**12.76 ± 2.85%**	**<0.0001**	↑
DC5	19.32 ± 1.71%	19.34 ± 1.28%	0.7902	–
DC6	**10.83 ± 0.89%**	**33.30 ± 3.51%**	**<0.0001**	↑
DC7	**5.96 ± 1.12%**	**33.59 ± 0.86%**	**<0.0001**	↑
DC8	**9.84 ± 1.80%**	**15.90 ± 2.48%**	**<0.0001**	↑
MC1	**24.26 ± 1.65%**	**20.77 ± 4.11%**	**<0.0001**	↓
MC2	**37.76 ± 2.20%**	**32.53 ± 3.96%**	**<0.0001**	↓
PB1	**1.90 ± 0.77%**	**10.70 ± 1.94%**	**<0.0001**	↑
PB2	**1.72 ± 0.41%**	**8.32 ± 1.74%**	**<0.0001**	↑
PB3	**7.26 ± 1.24%**	**8.61 ± 2.28%**	**0.0001**	↑
PB4	**3.84 ± 1.00%**	**7.62 ± 1.91%**	**<0.0001**	↑
PB5	12.61 ± 1.49%	11.97 ± 1.23%	0.1373	–

Appendix 4. Stony coral live tissue area (m^2) by region and site. For region-wide values (n = 22), the live tissue area of all colonies within a site were summed and the average of all sites taken. Site values are the average of the sum of the live tissue area of all colonies within a station. Note that, starting in 2023, LTA estimates for MC1 and MC2 are based on only the first 10 meters of survey data.

	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Level	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
R	6.11 ± 1.87	6.38 ± 2.16	6.48 ± 2.38	4.20 ± 1.50	3.53 ± 1.09	2.72 ± 1.01	3.08 ± 1.08	3.11 ± 1.03	2.95 ± 0.96	3.16 ± 0.98	3.18 ± 1.03	3.46 ± 1.08
DC1	4.46 ± 0.97	4.32 ± 0.85	4.00 ± 1.01	2.73 ± 0.58	2.52 ± 0.26	2.31 ± 0.37	2.13 ± 0.27	2.21 ± 0.28	2.27 ± 0.23	2.62 ± 0.36	2.60 ± 0.27	2.78 ± 0.35
DC2	0.35 ± 0.09	0.42 ± 0.03	0.36 ± 0.07	0.36 ± 0.09	0.32 ± 0.08	0.22 ± 0.05	0.28 ± 0.07	0.22 ± 0.04	0.29 ± 0.06	0.27 ± 0.03	0.34 ± 0.08	0.36 ± 0.06
DC3	0.28 ± 0.1	0.13 ± 0.03	0.13 ± 0.05	0.15 ± 0.05	0.17 ± 0.05	0.11 ± 0.01	0.12 ± 0.02	0.15 ± 0.02	0.16 ± 0.02	0.17 ± 0.02	0.20 ± 0.08	0.21 ± 0.07
DC4	0.50 ± 0.11	0.57 ± 0.14	0.30 ± 0.08	0.23 ± 0.07	0.29 ± 0.08	0.30 ± 0.06	0.28 ± 0.04	0.35 ± 0.05	0.39 ± 0.05	0.39 ± 0.07	0.43 ± 0.04	0.47 ± 0.05
DC5	1.98 ± 0.63	2.25 ± 0.71	1.40 ± 0.21	1.00 ± 0.28	0.88 ± 0.14	0.70 ± 0.11	1.12 ± 0.14	0.99 ± 0.17	1.23 ± 0.20	1.30 ± 0.25	0.87 ± 0.17	1.06 ± 0.19
DC6	1.85 ± 0.36	2.14 ± 0.58	2.83 ± 0.95	2.32 ± 0.91	1.61 ± 0.36	0.90 ± 0.36	1.10 ± 0.26	1.18 ± 0.31	0.91 ± 0.31	1.18 ± 0.36	1.07 ± 0.35	1.22 ± 0.41
DC7	0.36 ± 0.07	0.34 ± 0.08	0.32 ± 0.05	0.21 ± 0.05	0.25 ± 0.05	0.25 ± 0.08	0.28 ± 0.07	0.28 ± 0.06	0.31 ± 0.05	0.40 ± 0.12	0.32 ± 0.06	0.37 ± 0.09
DC8	0.57 ± 0.15	0.76 ± 0.23	0.53 ± 0.18	0.50 ± 0.17	0.43 ± 0.15	0.33 ± 0.14	0.47 ± 0.15	0.43 ± 0.18	0.30 ± 0.09	0.45 ± 0.20	0.49 ± 0.16	0.45 ± 0.13
BC1	10.04 ± 1.65	11.88 ± 1.41	12.98 ± 2.06	8.06 ± 1.57	5.56 ± 1.06	5.51 ± 0.90	5.90 ± 1.15	5.64 ± 0.90	5.12 ± 0.63	5.13 ± 0.89	5.54 ± 0.87	5.84 ± 1.02
BC2	0.28 ± 0.10	0.40 ± 0.17	0.35 ± 0.15	0.22 ± 0.05	0.26 ± 0.08	0.23 ± 0.07	0.22 ± 0.07	0.35 ± 0.13	0.28 ± 0.09	0.28 ± 0.07	0.40 ± 0.11	0.40 ± 0.09
BC3	0.37 ± 0.07	0.38 ± 0.12	0.29 ± 0.05	0.21 ± 0.05	0.26 ± 0.09	0.18 ± 0.01	0.19 ± 0.01	0.18 ± 0.03	0.19 ± 0.02	0.20 ± 0.05	0.21 ± 0.03	0.27 ± 0.01
BC4	3.39 ± 0.49	3.26 ± 0.55	3.49 ± 0.35	2.35 ± 0.44	2.49 ± 0.53	1.20 ± 0.07	1.46 ± 0.24	1.47 ± 0.28	1.32 ± 0.26	1.60 ± 0.31	1.46 ± 0.29	1.51 ± 0.28
BC5	0.86 ± 0.29	0.65 ± 0.19	0.91 ± 0.26	0.19 ± 0.02	0.18 ± 0.04	0.18 ± 0.05	0.19 ± 0.06	0.20 ± 0.03	0.18 ± 0.04	0.23 ± 0.05	0.34 ± 0.08	0.40 ± 0.12
BC6	0.45 ± 0.18	0.49 ± 0.17	0.50 ± 0.22	0.20 ± 0.03	0.13 ± 0.03	0.19 ± 0.06	0.18 ± 0.04	0.20 ± 0.06	0.21 ± 0.07	0.18 ± 0.06	0.30 ± 0.08	0.33 ± 0.08
BCA	0.37 ± 0.09	0.21 ± 0.07	0.22 ± 0.09	0.37 ± 0.07	0.60 ± 0.25	0.53 ± 0.19	0.59 ± 0.21	0.74 ± 0.23	0.35 ± 0.09	0.35 ± 0.09	0.30 ± 0.09	0.51 ± 0.12
PB1	0.05 ± 0.03	0.06 ± 0.04	0.07 ± 0.04	0.08 ± 0.04	0.06 ± 0.04	0.04 ± 0.02	0.04 ± 0.01	0.07 ± 0.04	0.03 ± 0.01	0.04 ± 0.09	0.03 ± 0.01	0.02 ± 0.01
PB2	0.95 ± 0.25	1.00 ± 0.22	1.00 ± 0.22	0.39 ± 0.07	0.35 ± 0.06	0.35 ± 0.10	0.30 ± 0.10	0.28 ± 0.09	0.33 ± 0.10	0.30 ± 0.09	0.27 ± 0.06	0.41 ± 0.06
PB3	0.65 ± 0.12	0.69 ± 0.16	0.67 ± 0.13	0.23 ± 0.08	0.23 ± 0.07	0.23 ± 0.09	0.25 ± 0.08	0.28 ± 0.09	0.21 ± 0.06	0.27 ± 0.09	0.35 ± 0.09	0.40 ± 0.13
PB4	1.87 ± 0.72	1.14 ± 0.21	1.27 ± 0.15	0.35 ± 0.12	0.33 ± 0.12	0.23 ± 0.08	0.29 ± 0.07	0.29 ± 0.10	0.32 ± 0.09	0.32 ± 0.10	0.32 ± 0.09	0.45 ± 0.15
PB5	1.55 ± 0.27	1.45 ± 0.29	1.52 ± 0.27	0.61 ± 0.21	0.45 ± 0.12	0.46 ± 0.13	0.46 ± 0.11	0.45 ± 0.10	0.54 ± 0.14	0.52 ± 0.09	0.62 ± 0.10	0.76 ± 0.18
MC1	1.82 ± 0.72	1.94 ± 0.78	1.97 ± 0.80	1.83 ± 0.60	1.68 ± 0.57	0.50 ± 0.20	1.09 ± 0.49	1.11 ± 0.54	1.26 ± 0.57	1.16 ± 0.39	1.02 ± 0.55	0.76 ± 0.35
MC2	0.60 ± 0.14	0.61 ± 0.14	0.53 ± 0.12	0.55 ± 0.13	0.37 ± 0.17	0.02 ± 0.01	0.02 ± 0.01	0.02 ± 0.01	0.03 ± 0.01	0.03 ± 0.00	0.06 ± 0.02	0.05 ± 0.02

Appendix 5. Regional stony coral live tissue area of each SCTLD-susceptible species group. Live tissue area was summed at each site and the regional live tissue area is the average of all sites. Note that, starting in 2023, LTA estimates for MC1 and MC2 are based on only the first 10 meters of survey data, so estimates for the low, intermediate, and presumed susceptible groups may slightly underestimate the true value. No highly susceptible species have been documented at Martin County SECREMP sites in 2023 and 2024.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Susceptibility Group	Mean ± SE (m^2)	Mean ± SE (m^2)	Mean ± SE (m^2)	Mean ± SE (m^2)	Mean ± SE (m^2)	Mean ± SE (m^2)	Mean ± SE (m^2)	Mean ± SE (m^2)	Mean ± SE (m^2)	Mean ± SE (m^2)	Mean ± SE (m^2)	Mean ± SE (m^2)
Low	0.64 ± 0.23	0.77 ± 0.3	0.82 ± 0.3	0.84 ± 0.31	0.78 ± 0.27	0.71 ± 0.2	0.95 ± 0.29	0.97 ± 0.29	0.91 ± 0.29	1.00 ± 0.31	0.96 ± 0.29	1.07 ± 0.28
Intermediate	4.03 ± 1.79	4.28 ± 2.11	4.73 ± 2.39	2.86 ± 1.5	2.13 ± 0.99	1.83 ± 0.98	1.9 ± 1.02	1.9 ± 0.99	1.79 ± 0.90	1.89 ± 0.9	2.00 ± 0.96	2.14 ± 1.02
High	1.23 ± 0.35	1.14 ± 0.37	0.93 ± 0.34	0.59 ± 0.44	0.57 ± 0.41	0.03 ± 0.01	0.04 ± 0.02	0.04 ± 0.02	0.04 ± 0.01	0.06 ± 0.01	0.06 ± 0.01	0.08 ± 0.01
Presumed	0.22 ± 0.1	0.26 ± 0.14	0.28 ± 0.13	0.27 ± 0.12	0.33 ± 0.15	0.24 ± 0.12	0.33 ± 0.18	0.31 ± 0.17	0.27 ± 0.15	0.3 ± 0.17	0.23 ± 0.09	0.28 ± 0.11

Appendix 6. Stony coral live tissue area (LTA) statistics.

Linear Mixed Effects Model ANOVA results.

Variable	**Level**	**Intercept**	**Year**
Region	DF	1	11
	F	9.108563	7.7173924
	P	0.0028	<.0001
High Susp. Spp.	DF	1	11
	F	4.413399	10.216798
	P	0.0371	<.0001
Intermediate Susp. Spp.	DF	1	11
	F	4.128280	4.230224
	P	0.0433	<.0001
Presumed Susp. Spp.	DF	1	11
	F	4.622944	0.519398
	P	0.0330	0.8883
Low Susp. Spp.	DF	1	11
	F	10.463185	1.373106
	P	0.0014	0.1869

Appendix 6. Continued

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Region	2014 - 2013	0.27246	0.7556	0.361	1
	2015 - 2013	0.37273	0.7556	0.493	1
	2016 - 2013	-1.90547	0.7556	-2.522	0.3253
	2017 - 2013	-2.57196	0.7556	-3.404	0.0332
	2018 - 2013	-3.38656	0.7556	-4.482	<0.01
	2019 - 2013	-3.02817	0.7556	-4.008	<0.01
	2020 - 2013	-3.0003	0.7556	-3.971	<0.01
	2021 - 2013	-3.15492	0.7556	-4.175	<0.01
	2022 - 2013	-2.94125	0.7556	-3.893	<0.01
	2023 - 2013	-2.92083	0.7556	-3.866	<0.01
	2024 - 2013	-2.64659	0.7556	-3.503	0.0233
	2015 - 2014	0.10027	0.7556	0.133	1
	2016 - 2014	-2.17793	0.7556	-2.882	0.146
	2017 - 2014	-2.84443	0.7556	-3.764	<0.01
	2018 - 2014	-3.65902	0.7556	-4.843	<0.01
	2019 - 2014	-3.30063	0.7556	-4.368	<0.01
	2020 - 2014	-3.27276	0.7556	-4.331	<0.01
	2021 - 2014	-3.42738	0.7556	-4.536	<0.01
	2022 - 2014	-3.21371	0.7556	-4.253	<0.01
	2023 - 2014	-3.19329	0.7556	-4.226	<0.01
	2024 - 2014	-2.91905	0.7556	-3.863	<0.01
	2016 - 2015	-2.2782	0.7556	-3.015	0.1041
	2017 - 2015	-2.9447	0.7556	-3.897	<0.01
	2018 - 2015	-3.7593	0.7556	-4.975	<0.01
	2019 - 2015	-3.4009	0.7556	-4.501	<0.01
	2020 - 2015	-3.37303	0.7556	-4.464	<0.01
	2021 - 2015	-3.52765	0.7556	-4.669	<0.01
	2022 - 2015	-3.31398	0.7556	-4.386	<0.01
	2023 - 2015	-3.29356	0.7556	-4.359	<0.01
	2024 - 2015	-3.01932	0.7556	-3.996	<0.01
	2017 - 2016	-0.66649	0.7556	-0.882	0.9993
	2018 - 2016	-1.48109	0.7556	-1.96	0.7209
	2019 - 2016	-1.1227	0.7556	-1.486	0.9448
	2020 - 2016	-1.09483	0.7556	-1.449	0.9536
	2021 - 2016	-1.24945	0.7556	-1.654	0.8889
	2022 - 2016	-1.03578	0.7556	-1.371	0.9691
	2023 - 2016	-1.01536	0.7556	-1.344	0.9734
	2024 - 2016	-0.74112	0.7556	-0.981	0.9981
	2018 - 2017	-0.8146	0.7556	-1.078	0.9956
	2019 - 2017	-0.45621	0.7556	-0.604	1
	2020 - 2017	-0.42833	0.7556	-0.567	1
	2021 - 2017	-0.58296	0.7556	-0.772	0.9998
	2022 - 2017	-0.36928	0.7556	-0.489	1
	2023 - 2017	-0.34886	0.7556	-0.462	1
	2024 - 2017	-0.07463	0.7556	-0.099	1

Appendix 6. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Region	2019 - 2018	0.35839	0.7556	0.474	1
	2020 - 2018	0.38626	0.7556	0.511	1
	2021 - 2018	0.23164	0.7556	0.307	1
	2022 - 2018	0.44532	0.7556	0.589	1
	2023 - 2018	0.46573	0.7556	0.616	1
	2024 - 2018	0.73997	0.7556	0.979	0.9981
	2020 - 2019	0.02787	0.7556	0.037	1
	2021 - 2019	-0.12675	0.7556	-0.168	1
	2022 - 2019	0.08693	0.7556	0.115	1
	2023 - 2019	0.10734	0.7556	0.142	1
	2024 - 2019	0.38158	0.7556	0.505	1
	2021 - 2020	-0.15462	0.7556	-0.205	1
	2022 - 2020	0.05905	0.7556	0.078	1
	2023 - 2020	0.07947	0.7556	0.105	1
	2024 - 2020	0.35371	0.7556	0.468	1
	2022 - 2021	0.21367	0.7556	0.283	1
	2023 - 2021	0.23409	0.7556	0.31	1
	2024 - 2021	0.50833	0.7556	0.673	0.9999
	2023 - 2022	0.02042	0.7556	0.027	1
	2024 - 2022	0.29465	0.7556	0.39	1
	2024 - 2023	0.27424	0.7556	0.363	1

Appendix 6. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
High	2014 - 2013	-0.12957	0.147228	-0.88	0.9993
	2015 - 2013	-0.3426	0.147228	-2.327	0.4556
	2016 - 2013	-0.80465	0.162777	-4.943	<0.01
	2017 - 2013	-0.88231	0.170672	-5.17	<0.01
	2018 - 2013	-0.90671	0.163097	-5.559	<0.01
	2019 - 2013	-0.93147	0.154245	-6.039	<0.01
	2020 - 2013	-0.92389	0.15166	-6.092	<0.01
	2021 - 2013	-0.97509	0.154262	-6.321	<0.01
	2022 - 2013	-0.91221	0.156967	-5.811	<0.01
	2023 - 2013	-0.91385	0.156967	-5.822	<0.01
	2024 - 2013	-0.89084	0.156967	-5.675	<0.01
	2015 - 2014	-0.21303	0.147426	-1.445	0.9542
	2016 - 2014	-0.67508	0.162956	-4.143	<0.01
	2017 - 2014	-0.75274	0.170843	-4.406	<0.01
	2018 - 2014	-0.77714	0.163275	-4.76	<0.01
	2019 - 2014	-0.8019	0.154434	-5.192	<0.01
	2020 - 2014	-0.79432	0.151852	-5.231	<0.01
	2021 - 2014	-0.84552	0.154451	-5.474	<0.01
	2022 - 2014	-0.78264	0.157153	-4.98	<0.01
	2023 - 2014	-0.78428	0.157153	-4.991	<0.01
	2024 - 2014	-0.76128	0.157153	-4.844	<0.01
	2016 - 2015	-0.46205	0.162956	-2.835	0.1639
	2017 - 2015	-0.53971	0.170843	-3.159	0.0686
	2018 - 2015	-0.56411	0.163275	-3.455	0.0268
	2019 - 2015	-0.58887	0.154434	-3.813	<0.01
	2020 - 2015	-0.58129	0.151852	-3.828	<0.01
	2021 - 2015	-0.63249	0.154451	-4.095	<0.01
	2022 - 2015	-0.56961	0.157153	-3.625	0.0155
	2023 - 2015	-0.57125	0.157153	-3.635	0.0143
	2024 - 2015	-0.54825	0.157153	-3.489	0.0242
	2017 - 2016	-0.07766	0.182613	-0.425	1
	2018 - 2016	-0.10206	0.177591	-0.575	1
	2019 - 2016	-0.12681	0.17012	-0.745	0.9999
	2020 - 2016	-0.11924	0.167447	-0.712	0.9999
	2021 - 2016	-0.17043	0.170166	-1.002	0.9977
	2022 - 2016	-0.10756	0.172871	-0.622	1
	2023 - 2016	-0.10919	0.172871	-0.632	1
	2024 - 2016	-0.08619	0.172871	-0.499	1
	2018 - 2017	-0.0244	0.183491	-0.133	1
	2019 - 2017	-0.04916	0.176339	-0.279	1
	2020 - 2017	-0.04158	0.174733	-0.238	1
	2021 - 2017	-0.09278	0.177084	-0.524	1
	2022 - 2017	-0.0299	0.17977	-0.166	1
	2023 - 2017	-0.03154	0.17977	-0.175	1
	2024 - 2017	-0.00854	0.17977	-0.047	1

Appendix 6. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
High	2019 - 2018	-0.02476	0.167859	-0.147	1
	2020 - 2018	-0.01718	0.166244	-0.103	1
	2021 - 2018	-0.06838	0.168501	-0.406	1
	2022 - 2018	-0.0055	0.170491	-0.032	1
	2023 - 2018	-0.00714	0.170491	-0.042	1
	2024 - 2018	0.015865	0.170491	0.093	1
	2020 - 2019	0.007577	0.157543	0.048	1
	2021 - 2019	-0.04362	0.159798	-0.273	1
	2022 - 2019	0.019257	0.162443	0.119	1
	2023 - 2019	0.017619	0.162443	0.108	1
	2024 - 2019	0.040621	0.162443	0.25	1
	2021 - 2020	-0.0512	0.158086	-0.324	1
	2022 - 2020	0.011681	0.16076	0.073	1
	2023 - 2020	0.010043	0.16076	0.062	1
	2024 - 2020	0.033045	0.16076	0.206	1
	2022 - 2021	0.062877	0.161849	0.388	1
	2023 - 2021	0.061239	0.161849	0.378	1
	2024 - 2021	0.084241	0.161849	0.52	1
	2023 - 2022	-0.00164	0.163855	-0.01	1
	2024 - 2022	0.021364	0.163855	0.13	1
	2024 - 2023	0.023002	0.163855	0.14	1

Appendix 6. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Intermediate	2014 - 2013	0.25003	0.726399	0.344	1
	2015 - 2013	0.587466	0.735836	0.798	0.9997
	2016 - 2013	-1.27658	0.735836	-1.735	0.8519
	2017 - 2013	-1.89602	0.726399	-2.61	0.2731
	2018 - 2013	-2.19676	0.726399	-3.024	0.1023
	2019 - 2013	-2.13326	0.726399	-2.937	0.1289
	2020 - 2013	-2.12873	0.726399	-2.931	0.1302
	2021 - 2013	-2.23761	0.726399	-3.08	0.0871
	2022 - 2013	-2.13852	0.726399	-2.944	0.1256
	2023 - 2013	-2.03415	0.726399	-2.8	0.1804
	2024 - 2013	-1.89324	0.726399	-2.606	0.2764
	2015 - 2014	0.337436	0.735836	0.459	1
	2016 - 2014	-1.52661	0.735836	-2.075	0.6412
	2017 - 2014	-2.14605	0.726399	-2.954	0.1215
	2018 - 2014	-2.44679	0.726399	-3.368	0.0372
	2019 - 2014	-2.38329	0.726399	-3.281	0.0475
	2020 - 2014	-2.37876	0.726399	-3.275	0.0496
	2021 - 2014	-2.48764	0.726399	-3.425	0.0307
	2022 - 2014	-2.38855	0.726399	-3.288	0.0464
	2023 - 2014	-2.28418	0.726399	-3.145	0.072
	2024 - 2014	-2.14327	0.726399	-2.951	0.1242
	2016 - 2015	-1.86404	0.743493	-2.507	0.335
	2017 - 2015	-2.48348	0.735836	-3.375	0.0357
	2018 - 2015	-2.78423	0.735836	-3.784	<0.01
	2019 - 2015	-2.72073	0.735836	-3.697	0.0116
	2020 - 2015	-2.7162	0.735836	-3.691	0.0122
	2021 - 2015	-2.82508	0.735836	-3.839	<0.01
	2022 - 2015	-2.72599	0.735836	-3.705	0.0111
	2023 - 2015	-2.62161	0.735836	-3.563	0.019
	2024 - 2015	-2.48071	0.735836	-3.371	0.0367
	2017 - 2016	-0.61944	0.735836	-0.842	0.9995
	2018 - 2016	-0.92018	0.735836	-1.251	0.9848
	2019 - 2016	-0.85668	0.735836	-1.164	0.9915
	2020 - 2016	-0.85215	0.735836	-1.158	0.9919
	2021 - 2016	-0.96104	0.735836	-1.306	0.9786
	2022 - 2016	-0.86194	0.735836	-1.171	0.991
	2023 - 2016	-0.75757	0.735836	-1.03	0.9971
	2024 - 2016	-0.61666	0.735836	-0.838	0.9996
	2018 - 2017	-0.30075	0.726399	-0.414	1
	2019 - 2017	-0.23724	0.726399	-0.327	1
	2020 - 2017	-0.23271	0.726399	-0.32	1
	2021 - 2017	-0.3416	0.726399	-0.47	1
	2022 - 2017	-0.2425	0.726399	-0.334	1
	2023 - 2017	-0.13813	0.726399	-0.19	1
	2024 - 2017	0.002776	0.726399	0.004	1

Appendix 6. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Intermediate	2019 - 2018	0.063501	0.726399	0.087	1
	2020 - 2018	0.068031	0.726399	0.094	1
	2021 - 2018	-0.04085	0.726399	-0.056	1
	2022 - 2018	0.058241	0.726399	0.08	1
	2023 - 2018	0.162614	0.726399	0.224	1
	2024 - 2018	0.303521	0.726399	0.418	1
	2020 - 2019	0.00453	0.726399	0.006	1
	2021 - 2019	-0.10436	0.726399	-0.144	1
	2022 - 2019	-0.00526	0.726399	-0.007	1
	2023 - 2019	0.099113	0.726399	0.136	1
	2024 - 2019	0.24002	0.726399	0.33	1
	2021 - 2020	-0.10889	0.726399	-0.15	1
	2022 - 2020	-0.00979	0.726399	-0.013	1
	2023 - 2020	0.094583	0.726399	0.13	1
	2024 - 2020	0.23549	0.726399	0.324	1
	2022 - 2021	0.099095	0.726399	0.136	1
	2023 - 2021	0.203467	0.726399	0.28	1
	2024 - 2021	0.344374	0.726399	0.474	1
	2023 - 2022	0.104373	0.726399	0.144	1
	2024 - 2022	0.24528	0.726399	0.338	1
	2024 - 2023	0.140907	0.726399	0.194	1

Appendix 6. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Presumed	2014 - 2013	0.046156	0.078248	0.59	1
	2015 - 2013	0.064896	0.078248	0.829	1
	2016 - 2013	0.052768	0.077976	0.677	1
	2017 - 2013	0.095053	0.079399	1.197	0.989
	2018 - 2013	0.023823	0.077919	0.306	1
	2019 - 2013	0.106108	0.080195	1.323	0.976
	2020 - 2013	0.112016	0.077368	1.448	0.954
	2021 - 2013	0.068267	0.077368	0.882	0.999
	2022 - 2013	0.090659	0.078726	1.152	0.992
	2023 - 2013	-0.01691	0.081804	-0.207	1
	2024 - 2013	0.067775	0.078654	0.862	0.999
	2015 - 2014	0.01874	0.077291	0.242	1
	2016 - 2014	0.006612	0.077556	0.085	1
	2017 - 2014	0.048898	0.078707	0.621	1
	2018 - 2014	-0.02233	0.078381	-0.285	1
	2019 - 2014	0.059952	0.079488	0.754	1
	2020 - 2014	0.06586	0.076671	0.859	0.999
	2021 - 2014	0.022111	0.076671	0.288	1
	2022 - 2014	0.044503	0.078027	0.57	1
	2023 - 2014	-0.06307	0.081093	-0.778	1
	2024 - 2014	0.021619	0.077952	0.277	1
	2016 - 2015	-0.01213	0.077556	-0.156	1
	2017 - 2015	0.030158	0.078707	0.383	1
	2018 - 2015	-0.04107	0.078381	-0.524	1
	2019 - 2015	0.041212	0.079488	0.518	1
	2020 - 2015	0.04712	0.076671	0.615	1
	2021 - 2015	0.003371	0.076671	0.044	1
	2022 - 2015	0.025763	0.078027	0.33	1
	2023 - 2015	-0.08181	0.081093	-1.009	0.998
	2024 - 2015	0.002879	0.077952	0.037	1
	2017 - 2016	0.042286	0.078707	0.537	1
	2018 - 2016	-0.02894	0.078373	-0.369	1
	2019 - 2016	0.05334	0.079489	0.671	1
	2020 - 2016	0.059249	0.076671	0.773	1
	2021 - 2016	0.0155	0.076671	0.202	1
	2022 - 2016	0.037891	0.078027	0.486	1
	2023 - 2016	-0.06968	0.081093	-0.859	0.999
	2024 - 2016	0.015007	0.077952	0.193	1
	2018 - 2017	-0.07123	0.079833	-0.892	0.999
	2019 - 2017	0.011054	0.080956	0.137	1
	2020 - 2017	0.016963	0.078133	0.217	1
	2021 - 2017	-0.02679	0.078133	-0.343	1
	2022 - 2017	-0.00439	0.079494	-0.055	1
	2023 - 2017	-0.11197	0.082556	-1.356	0.971
	2024 - 2017	-0.02728	0.079409	-0.344	1

Appendix 6. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Presumed	2019 - 2018	0.082285	0.079513	1.035	0.997
	2020 - 2018	0.088193	0.07707	1.144	0.993
	2021 - 2018	0.044444	0.07707	0.577	1
	2022 - 2018	0.066836	0.078074	0.856	0.999
	2023 - 2018	-0.04073	0.081094	-0.502	1
	2024 - 2018	0.043952	0.078401	0.561	1
	2020 - 2019	0.005908	0.077744	0.076	1
	2021 - 2019	-0.03784	0.077744	-0.487	1
	2022 - 2019	-0.01545	0.078707	-0.196	1
	2023 - 2019	-0.12302	0.081365	-1.512	0.938
	2024 - 2019	-0.03833	0.078774	-0.487	1
	2021 - 2020	-0.04375	0.074983	-0.583	1
	2022 - 2020	-0.02136	0.076307	-0.28	1
	2023 - 2020	-0.12893	0.079329	-1.625	0.9
	2024 - 2020	-0.04424	0.076625	-0.577	1
	2022 - 2021	0.022392	0.076307	0.293	1
	2023 - 2021	-0.08518	0.079329	-1.074	0.996
	2024 - 2021	-0.00049	0.076625	-0.006	1
	2023 - 2022	-0.10757	0.08027	-1.34	0.974
	2024 - 2022	-0.02288	0.077622	-0.295	1
	2024 - 2023	0.084687	0.080337	1.054	0.996

Appendix 6. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Low	2014 - 2013	0.129582	0.144651	0.896	0.999
	2015 - 2013	0.177064	0.144651	1.224	0.987
	2016 - 2013	0.194579	0.144651	1.345	0.973
	2017 - 2013	0.143683	0.144651	0.993	0.998
	2018 - 2013	-0.00906	0.148697	-0.061	1
	2019 - 2013	0.232191	0.148697	1.562	0.923
	2020 - 2013	0.249642	0.148697	1.679	0.878
	2021 - 2013	0.239991	0.146639	1.637	0.896
	2022 - 2013	0.331069	0.146639	2.258	0.507
	2023 - 2013	0.317478	0.144651	2.195	0.553
	2024 - 2013	0.391998	0.146639	2.673	0.238
	2015 - 2014	0.047482	0.144651	0.328	1
	2016 - 2014	0.064997	0.144651	0.449	1
	2017 - 2014	0.014101	0.144651	0.097	1
	2018 - 2014	-0.13864	0.148697	-0.932	0.999
	2019 - 2014	0.102609	0.148697	0.69	1
	2020 - 2014	0.12006	0.148697	0.807	1
	2021 - 2014	0.110408	0.146639	0.753	1
	2022 - 2014	0.201486	0.146639	1.374	0.968
	2023 - 2014	0.187896	0.144651	1.299	0.979
	2024 - 2014	0.262416	0.146639	1.79	0.824
	2016 - 2015	0.017515	0.144651	0.121	1
	2017 - 2015	-0.03338	0.144651	-0.231	1
	2018 - 2015	-0.18612	0.148697	-1.252	0.985
	2019 - 2015	0.055127	0.148697	0.371	1
	2020 - 2015	0.072578	0.148697	0.488	1
	2021 - 2015	0.062927	0.146639	0.429	1
	2022 - 2015	0.154005	0.146639	1.05	0.996
	2023 - 2015	0.140415	0.144651	0.971	0.998
	2024 - 2015	0.214935	0.146639	1.466	0.95
	2017 - 2016	-0.0509	0.144651	-0.352	1
	2018 - 2016	-0.20364	0.148697	-1.369	0.969
	2019 - 2016	0.037612	0.148697	0.253	1
	2020 - 2016	0.055063	0.148697	0.37	1
	2021 - 2016	0.045411	0.146639	0.31	1
	2022 - 2016	0.136489	0.146639	0.931	0.999
	2023 - 2016	0.122899	0.144651	0.85	1
	2024 - 2016	0.197419	0.146639	1.346	0.973
	2018 - 2017	-0.15274	0.148697	-1.027	0.997
	2019 - 2017	0.088508	0.148697	0.595	1
	2020 - 2017	0.105959	0.148697	0.713	1
	2021 - 2017	0.096308	0.146639	0.657	1
	2022 - 2017	0.187386	0.146639	1.278	0.982
	2023 - 2017	0.173796	0.144651	1.201	0.989
	2024 - 2017	0.248316	0.146639	1.693	0.872

Appendix 6. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Low	2019 - 2018	0.241248	0.151711	1.59	0.913
	2020 - 2018	0.258699	0.151711	1.705	0.866
	2021 - 2018	0.249048	0.150093	1.659	0.886
	2022 - 2018	0.340126	0.150093	2.266	0.501
	2023 - 2018	0.326536	0.148697	2.196	0.551
	2024 - 2018	0.401056	0.150093	2.672	0.24
	2020 - 2019	0.017451	0.151711	0.115	1
	2021 - 2019	0.0078	0.150093	0.052	1
	2022 - 2019	0.098878	0.150093	0.659	1
	2023 - 2019	0.085287	0.148697	0.574	1
	2024 - 2019	0.159808	0.150093	1.065	0.996
	2021 - 2020	-0.00965	0.150093	-0.064	1
	2022 - 2020	0.081427	0.150093	0.543	1
	2023 - 2020	0.067836	0.148697	0.456	1
	2024 - 2020	0.142356	0.150093	0.948	0.999
	2022 - 2021	0.091078	0.148055	0.615	1
	2023 - 2021	0.077488	0.146639	0.528	1
	2024 - 2021	0.152008	0.148055	1.027	0.997
	2023 - 2022	-0.01359	0.146639	-0.093	1
	2024 - 2022	0.06093	0.148055	0.412	1
	2024 - 2023	0.07452	0.146639	0.508	1

Appendix 7. Stony coral, octocoral, and *Xestospongia muta* density (colonies/m^2) data across the region and by site. Regional density was calculated as an average of all sites, where site is the sum of all four stations. Site level values were calculated as an average of the four stations. Note that, starting in 2023, stony coral density was calculated based on only the first 10 meters of survey data for MC1 and MC2.

		2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Variable	**Level**	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
Stony	R	1.21 ± 0.16	1.26 ± 0.18	1.29 ± 0.19	1.07 ± 0.17	1.35 ± 0.25	1.40 ± 0.23	1.54 ± 1.54	1.74 ± 0.32	1.71 ± 0.31	1.92 ± 0.36	2.02 ± 0.33	2.22 ± 0.36
Coral	DC1	1.80 ± 0.15	2.10 ± 0.16	2.15 ± 0.03	2.36 ± 0.06	2.28 ± 0.13	2.70 ± 0.27	2.80 ± 0.11	3.36 ± 0.24	3.51 ± 0.33	4.38 ± 0.55	4.91 ± 0.49	5.51 ± 0.66
	DC2	0.88 ± 0.09	1.08 ± 0.14	1.07 ± 0.11	0.83 ± 0.09	1.03 ± 0.04	1.10 ± 0.10	1.16 ± 0.06	1.07 ± 0.11	1.34 ± 0.11	1.14 ± 0.12	1.20 ± 0.12	1.51 ± 0.04
	DC3	0.31 ± 0.09	0.33 ± 0.03	0.31 ± 0.06	0.27 ± 0.07	0.28 ± 0.01	0.44 ± 0.03	0.42 ± 0.01	0.48 ± 0.06	0.41 ± 0.05	0.45 ± 0.04	0.53 ± 0.04	0.53 ± 0.09
	DC4	0.73 ± 0.11	0.75 ± 0.12	0.75 ± 0.20	0.57 ± 0.14	0.90 ± 0.18	0.90 ± 0.10	0.91 ± 0.11	0.95 ± 0.08	1.18 ± 0.10	1.34 ± 0.09	1.47 ± 0.08	1.53 ± 0.07
	DC5	2.56 ± 0.24	2.55 ± 0.14	2.33 ± 0.26	2.40 ± 0.26	3.30 ± 0.35	2.94 ± 0.41	4.01 ± 0.57	3.64 ± 0.48	4.73 ± 0.59	5.55 ± 0.63	3.77 ± 0.40	4.49 ± 0.59
	DC6	1.38 ± 0.26	1.42 ± 0.25	1.51 ± 0.25	1.44 ± 0.33	1.55 ± 0.35	1.51 ± 0.25	1.58 ± 0.27	1.45 ± 0.18	1.45 ± 0.24	1.75 ± 0.21	2.24 ± 0.46	2.49 ± 0.38
	DC7	1.13 ± 0.05	1.02 ± 0.12	1.1 ± 0.14	0.67 ± 0.09	0.85 ± 0.08	0.98 ± 0.14	1.14 ± 0.10	1.30 ± 0.10	1.39 ± 0.13	1.34 ± 0.11	1.15 ± 0.03	1.33 ± 0.13
	DC8	0.92 ± 0.09	0.82 ± 0.06	0.91 ± 0.15	0.56 ± 0.07	0.48 ± 0.05	0.6 ± 0.03	0.61 ± 0.06	0.73 ± 0.05	0.52 ± 0.03	1.00 ± 0.03	0.93 ± 0.07	1.09 ± 0.10
	BC1	1.81 ± 0.35	2.16 ± 0.33	2.05 ± 0.34	1.66 ± 0.30	1.45 ± 0.34	1.41 ± 0.34	1.47 ± 0.33	1.70 ± 0.29	1.44 ± 0.30	1.47 ± 0.35	1.76 ± 0.43	1.92 ± 0.38
	BC2	0.64 ± 0.12	0.78 ± 0.12	0.78 ± 0.12	0.47 ± 0.10	0.05 ± 0.13	0.95 ± 0.19	0.82 ± 0.10	1.11 ± 0.12	0.92 ± 0.13	0.95 ± 0.11	1.22 ± 0.13	1.35 ± 0.13
	BC3	0.75 ± 0.11	0.76 ± 0.22	0.59 ± 0.08	0.09 ± 0.03	0.61 ± 0.04	0.83 ± 0.09	0.72 ± 0.03	0.85 ± 0.09	0.93 ± 0.06	0.92 ± 0.08	1.06 ± 0.05	1.05 ± 0.07
	BC4	3.28 ± 0.32	3.75 ± 0.22	4.05 ± 0.31	3.41 ± 0.12	4.90 ± 0.40	3.83 ± 0.18	4.43 ± 0.16	5.03 ± 0.23	4.74 ± 0.29	5.69 ± 0.38	5.94 ± 0.60	5.88 ± 0.56
	BC5	1.23 ± 0.19	1.09 ± 0.25	1.19 ± 0.22	0.67 ± 0.08	0.83 ± 0.14	0.90 ± 0.12	1.01 ± 0.26	1.18 ± 0.16	1.06 ± 0.12	1.35 ± 0.08	1.78 ± 0.22	1.97 ± 0.25
	BC6	0.64 ± 0.11	0.59 ± 0.07	0.56 ± 0.06	0.43 ± 0.05	0.41 ± 0.00	0.45 ± 0.12	0.50 ± 0.09	0.59 ± 0.13	0.69 ± 0.17	0.68 ± 0.17	0.91 ± 0.14	1.14 ± 0.13
	BCA	0.61 ± 0.18	0.58 ± 0.17	1.09 ± 0.4	1.45 ± 0.17	3.08 ± 1.10	3.47 ± 1.15	3.66 ± 1.28	4.95 ± 1.44	2.58 ± 0.72	2.52 ± 0.58	2.26 ± 0.53	3.06 ± 0.78
	PB1	0.23 ± 0.15	0.27 ± 0.17	0.28 ± 0.15	0.33 ± 0.14	0.25 ± 0.11	0.40 ± 0.15	0.40 ± 0.07	0.75 ± 0.18	0.34 ± 0.10	0.49 ± 0.12	0.50 ± 0.17	0.27 ± 0.07
	PB2	1.07 ± 0.15	1.24 ± 0.09	1.57 ± 0.31	1.07 ± 0.33	1.03 ± 0.42	0.86 ± 0.25	0.82 ± 0.14	0.68 ± 0.13	0.72 ± 0.07	0.84 ± 0.05	1.02 ± 0.12	1.65 ± 0.30
	PB3	1.05 ± 0.31	1.18 ± 0.34	1.11 ± 0.29	0.63 ± 0.22	0.68 ± 0.23	0.67 ± 0.19	0.73 ± 0.17	0.76 ± 0.24	0.76 ± 0.25	0.93 ± 0.28	1.01 ± 0.24	1.11 ± 0.27
	PB4	1.82 ± 0.38	1.63 ± 0.31	1.70 ± 0.29	1.02 ± 0.27	1.01 ± 0.23	1.06 ± 0.24	1.01 ± 0.22	1.15 ± 0.30	1.32 ± 0.29	1.28 ± 0.22	1.57 ± 0.31	1.88 ± 0.35
	PB5	2.30 ± 0.31	2.2 ± 0.29	2.08 ± 0.29	1.58 ± 0.25	1.65 ± 0.32	1.75 ± 0.40	1.77 ± 0.34	1.85 ± 0.27	2.06 ± 0.30	2.28 ± 0.21	2.60 ± 0.31	2.91 ± 0.48
	MC1	0.95 ± 0.09	1.06 ± 0.11	0.98 ± 0.18	0.98 ± 0.31	2.18 ± 0.66	2.82 ± 0.78	3.70 ± 1.20	4.35 ± 1.32	4.89 ± 1.09	5.44 ± 1.01	5.68 ± 2.27	5.45 ± 2.11
	MC2	0.49 ± 0.06	0.40 ± 0.05	0.34 ± 0.05	0.27 ± 0.05	0.31 ± 0.08	0.11 ± 0.05	0.22 ± 0.05	0.32 ± 0.10	0.53 ± 0.13	0.49 ± 0.08	0.88 ± 0.27	0.65 ± 0.27

Appendix 7. Continued.

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Variable	**Level**	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
Octocoral	R	8.68 ± 1.34	9.97 ± 1.55	11.52 ± 1.76	11.85 ± 1.83	12.58 ± 1.85	10.36 ± 1.5	11.57 ± 1.61	14.05 ± 2.01	13.38 ± 1.87	12.14 ± 1.6	11.89 ± 1.73	10.53 ± 1.47
	DC1	6.93 ± 1.42	8.18 ± 0.74	11.6 ± 1.52	13.25 ± 1.28	11.38 ± 1.19	10.63 ± 1.09	8.98 ± 0.91	11.7 ± 0.54	12.05 ± 1.41	10.48 ± 0.5	10.75 ± 0.89	10.03 ± 0.94
	DC2	6.88 ± 2.3	14.25 ± 1.8	19.5 ± 2.09	17.98 ± 1.44	19.93 ± 1.91	14.7 ± 1.77	17.75 ± 1.14	20.83 ± 1.42	22.8 ± 0.52	19 ± 2.18	16.18 ± 1.28	17.93 ± 1.68
	DC3	6.18 ± 1.43	7.23 ± 1.23	7.55 ± 1.36	9.33 ± 0.44	10.15 ± 1.19	9.2 ± 0.97	9.7 ± 1.12	12.23 ± 1.75	10.5 ± 1.72	12.35 ± 1.36	11.73 ± 1.41	10.25 ± 1.22
	DC4	11.23 ± 2.52	12.43 ± 3.18	14.45 ± 2.6	11.93 ± 1	14.9 ± 2.36	14 ± 2.03	15.85 ± 2.95	21.68 ± 2.93	19.5 ± 3.92	21.1 ± 3.34	18.18 ± 2.38	17.33 ± 2.45
	DC5	6.58 ± 1.19	7.15 ± 0.8	8.95 ± 0.91	8.63 ± 0.96	9.7 ± 0.58	7.08 ± 0.73	10.38 ± 1.1	11.23 ± 1.16	10.25 ± 1.08	10.3 ± 1.06	8.6 ± 1.18	8.18 ± 0.84
	DC6	6.9 ± 0.75	8.13 ± 0.97	9.53 ± 1.83	9.88 ± 1.65	10.85 ± 1.38	6.93 ± 0.99	7.65 ± 0.9	11.65 ± 0.82	11.95 ± 1.13	12.8 ± 1.55	13.23 ± 1.48	14.5 ± 0.93
	DC7	3.43 ± 0.26	3.83 ± 0.14	7.13 ± 0.47	6.95 ± 0.41	6.7 ± 0.54	6.75 ± 0.78	8.03 ± 0.91	11.6 ± 1.84	11.73 ± 2.09	9.38 ± 1.29	10.5 ± 1.90	11.95 ± 2.03
	DC8	14.9 ± 1.45	16.28 ± 1.7	19.9 ± 1.91	19.28 ± 1.41	21.33 ± 1.48	17.23 ± 2.84	21.13 ± 1.13	23.65 ± 2.98	19.7 ± 3.42	21.68 ± 2.8	23.05 ± 1.31	21.68 ±1.17
	BC1	10.75 ± 0.79	11.15 ± 0.99	11.15 ± 0.96	11.68 ± 0.88	11.05 ± 1.3	13.58 ± 0.81	14.93 ± 1.86	20.13 ± 1.49	14.85 ± 2.58	14.45 ± 2.4	14.4 ± 2.16	14.2 ± 1.81
	BC2	7.4 ± 1.11	8.65 ± 1.3	8.63 ± 1.65	9.28 ± 1.99	10.18 ± 1.56	9.4 ± 1.7	10.88 ± 2.23	10 ± 1.79	9.23 ± 2.22	8.3 ± 1.45	7.58 ± 1.51	6.13 ± 1.07
	BC3	12.9 ± 1.06	12.75 ± 1.3	11.53 ± 1.4	14.3 ± 1.89	15.23 ± 1.3	12.28 ± 1.6	14.08 ± 1.11	11.2 ± 2.85	12.95 ± 0.93	15.18 ± 1.89	15.78 ± 2.66	10.58 ± 2.32
	BC4	3.73 ± 0.61	3.95 ± 0.97	5.23 ± 0.58	4.08 ± 0.68	6.65 ± 1.21	3.28 ± 0.85	4.78 ± 1.63	6.58 ± 2.04	5.93 ± 1.49	5.85 ± 1.62	5.53 ± 1.50	5.8 ± 1.16
	BC5	5.73 ± 0.53	7.45 ± 0.56	6.55 ± 0.63	6.18 ± 0.71	7.7 ± 1.37	5.68 ± 0.66	7.03 ± 0.96	11.3 ± 1.01	9.73 ± 1.15	7.78 ± 0.73	6.58 ± 0.83	5.28 ± 0.70
	BC6	20.78 ± 3.78	19.28 ± 1.91	21.18 ± 2.13	23.48 ± 0.88	25.8 ± 1.02	20.63 ± 2.76	23.2 ± 3.16	26.1 ± 1.78	21.9 ± 0.62	16.13 ± 0.63	11.2 ± 0.47	9.98 ± 0.80
	BCA	1.15 ± 0.51	0.85 ± 0.39	1.1 ± 0.54	0.58 ± 0.28	1.1 ± 0.46	1.58 ± 0.5	2.1 ± 0.41	3.15 ± 0.76	2.48 ± 0.6	1.88 ± 0.59	0.6 ± 0.14	1.05 ± 0.12
	PB1	0.23 ± 0.14	0.18 ± 0.09	0.13 ± 0.05	0.05 ± 0.03	0.03 ± 0.03	0.00 ± 0.00	0.7 ± 0.33	0.75 ± 0.4	0.7 ± 0.25	0.65 ± 0.21	0.53 ± 0.19	0.5 ± 0.19
	PB2	17.03 ± 3.85	20.55 ± 5.32	23.45 ± 5.59	23.48 ± 4.99	23.33 ± 4.55	17.48 ± 3.77	16.88 ± 5.68	16.65 ± 6.69	21.53 ± 5.92	16.25 ± 3.53	20.88 ± 5.10	15.13 ± 4.39
	PB3	12.85 ± 3.18	12.45 ± 2.56	14.15 ± 2.39	17.33 ± 3.14	18.55 ± 3.2	14.28 ± 2.32	13.25 ± 2	14.6 ± 1.65	16.95 ± 2.91	17.25 ± 2.51	17.3 ± 2.06	12.25 ± 1.66
	PB4	15.63 ± 2.31	17.65 ± 1.09	23.48 ± 2.48	23.8 ± 4.01	22.43 ± 2.93	20 ± 0.81	23.08 ± 0.87	28.98 ± 1.59	27.7 ± 2.93	19.25 ± 1.89	17.23 ± 1.10	13.55 ± 1.73
	PB5	19.8 ± 2.36	27.03 ± 4.61	28.25 ± 4.98	29.33 ± 3.83	29.83 ± 3.38	23.3 ± 2.11	24.13 ± 1.73	35.13 ± 3.57	32.1 ± 5.98	27.05 ± 1.21	31.85 ± 3.17	25.38 ± 3.00
	MC1	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
	MC2	0.03 ± 0.03	0.03 ± 0.03	0.03 ± 0.03	0.03 ± 0.03	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

Appendix 7. Continued.

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Variable	**Level**	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
X. muta	R	0.24 ± 0.05	0.28 ± 0.06	0.3 ± 0.06	0.31 ± 0.06	0.35 ± 0.06	0.28 ± 0.05	0.32 ± 0.06	0.32 ± 0.06	0.31 ± 0.6	0.36 ± 0.06	0.36 ± 0.06	0.40 ± 0.07
	DC1	0.06 ± 0.04	0.02 ± 0.02	0.07 ± 0.04	0.1 ± 0.04	0.13 ± 0.04	0.06 ± 0.01	0.09 ± 0.03	0.08 ± 0.02	0.06 ± 0.03	0.16 ± 0.03	0.19 ± 0.03	0.24 ± 0.03
	DC2	0.31 ± 0.02	0.35 ± 0.04	0.43 ± 0.04	0.41 ± 0.06	0.45 ± 0.06	0.34 ± 0.05	0.4 ± 0.04	0.47 ± 0.03	0.57 ± 0.06	0.51 ± 0.05	0.57 ± 0.07	0.64 ± 0.11
	DC3	0.26 ± 0.07	0.25 ± 0.07	0.28 ± 0.07	0.31 ± 0.11	0.27 ± 0.08	0.22 ± 0.08	0.25 ± 0.09	0.23 ± 0.1	0.17 ± 0.05	0.26 ± 0.11	0.30 ± 0.09	0.26 ±0.06
	DC4	0.57 ± 0.04	0.61 ± 0.05	0.64 ± 0.03	0.64 ± 0.03	0.64 ± 0.03	0.47 ± 0.04	0.44 ± 0.05	0.43 ± 0.04	0.41 ± 0.06	0.49 ± 0.07	0.48 ± 0.05	0.45 ± 0.08
	DC5	0.15 ± 0.02	0.1 ± 0.03	0.1 ± 0.03	0.14 ± 0.06	0.22 ± 0.02	0.14 ± 0.04	0.18 ± 0.06	0.15 ± 0.06	0.16 ± 0.05	0.14 ± 0.04	0.16 ±0.04	0.18 ± 0.02
	DC6	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.01	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
	DC7	0.28 ± 0.05	0.34 ± 0.03	0.43 ± 0.04	0.41 ± 0.06	0.53 ± 0.02	0.39 ± 0.08	0.44 ± 0.08	0.72 ± 0.14	0.58 ± 0.09	0.65 ± 0.1	0.60 ± 0.07	0.63 ± 0.10
	DC8	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
	BC1	0.06 ± 0.04	0.11 ± 0.06	0.09 ± 0.04	0.11 ± 0.05	0.16 ± 0.07	0.15 ± 0.11	0.14 ± 0.09	0.16 ± 0.1	0.23 ± 0.1	0.26 ± 0.1	0.26 ± 0.06	0.35 ± 0.09
	BC2	0.35 ± 0.05	0.5 ± 0.05	0.05 ± 0.07	0.51 ± 0.08	0.57 ± 0.09	0.57 ± 0.08	0.52 ± 0.06	0.57 ± 0.06	0.56 ± 0.05	0.61 ± 0.03	0.69 ± 0.03	0.72 ± 0.05
	BC3	0.34 ± 0.04	0.63 ± 0.08	0.63 ± 0.11	0.55 ± 0.12	0.63 ± 0.14	0.49 ± 0.1	0.35 ± 0.11	0.41 ± 0.1	0.44 ± 0.11	0.56 ± 0.04	0.41 ± 0.08	0.44 ± 0.05
	BC4	0.15 ± 0.02	0.26 ± 0.04	0.26 ± 0.04	0.27 ± 0.06	0.31 ± 0.05	0.24 ± 0.06	0.18 ± 0.03	0.2 ± 0.04	0.28 ± 0.03	0.35 ± 0.07	0.38 ± 0.03	0.43 ± 0.12
	BC5	0.45 ± 0.11	0.49 ± 0.14	0.44 ± 0.11	0.59 ± 0.09	0.63 ± 0.08	0.57 ± 0.12	0.73 ± 0.16	0.69 ± 0.14	0.56 ± 0.2	0.67 ± 0.26	0.70 ± 0.16	0.60 ± 0.12
	BC6	0.38 ± 0.1	0.38 ± 0.11	0.25 ± 0.09	0.36 ± 0.11	0.4 ± 0.08	0.4 ± 0.07	0.5 ± 0.11	0.48 ± 0.12	0.4 ± 0.08	0.48 ± 0.11	0.51 ± 0.05	0.69 ± 0.06
	BCA	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.01 ± 0.01	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.01 ± 0.01	0.02 ± 0.01	0.02 ± 0.01
	PB1	0.00 ± 0.00	0.00 ± 0.00	0.01 ± 0.01	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.02 ± 0.02	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
	PB2	0.11 ± 0.05	0.14 ± 0.04	0.17 ± 0.02	0.24 ± 0.05	0.34 ± 0.05	0.3 ± 0.07	0.36 ± 0.1	0.35 ± 0.12	0.24 ± 0.06	0.43 ± 0.18	0.41 ± 0.12	0.43 ± 0.09
	PB3	0.55 ± 0.1	0.55 ± 0.1	0.71 ± 0.13	0.66 ± 0.13	0.61 ± 0.11	0.58 ± 0.16	0.63 ± 0.13	0.6 ± 0.12	0.67 ± 0.12	0.78 ± 0.09	0.74 ± 0.16	0.93 ± 0.17
	PB4	0.6 ± 0.1	0.7 ± 0.07	0.64 ± 0.1	0.72 ± 0.09	0.77 ± 0.06	0.7 ± 0.06	0.72 ± 0.06	0.67 ± 0.08	0.76 ± 0.1	0.72 ± 0.07	0.81 ± 0.08	0.86 ± 0.07
	PB5	0.65 ± 0.05	0.74 ± 0.09	0.88 ± 0.07	0.88 ± 0.07	0.97 ± 0.11	0.66 ± 0.08	0.86 ± 0.12	0.75 ± 0.1	0.78 ± 0.08	0.78 ± 0.11	0.70 ± 0.08	0.85 ± 0.17
	MC1	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
	MC2	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

Appendix 8. Stony coral, octocoral, and *Xestospongia muta* density statistics.

Linear Mixed Effects Model ANOVA results.

Variable	Level	Intercept	Year
Stony Coral	DF	1	11
	F	40.84457	8.31395
	P	<.0001	<.0001
Octocoral	DF	1	11
	F	50.69201	9.28950
	P	<.0001	<.0001
Xestospongia Muta	DF	1	11
	F	31.75791	8.82421
	P	<.0001	<.0001

Appendix 8. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Stony Coral	2014 - 2013	0.05372	0.17706	0.303	1
	2015 - 2013	0.0811	0.17706	0.458	1
	2016 - 2013	-0.13946	0.17706	-0.788	0.9998
	2017 - 2013	0.14101	0.17706	0.796	0.9997
	2018 - 2013	0.18957	0.17706	1.071	0.9958
	2019 - 2013	0.33419	0.17706	1.887	0.7674
	2020 - 2013	0.53409	0.17706	3.016	0.1042
	2021 - 2013	0.49948	0.17706	2.821	0.1714
	2022 - 2013	0.71798	0.17706	4.055	<0.01
	2023 - 2013	0.81219	0.17706	4.587	<0.01
	2024 - 2013	1.01074	0.17706	5.708	<0.01
	2015 - 2014	0.02738	0.17706	0.155	1
	2016 - 2014	-0.19318	0.17706	-1.091	0.9951
	2017 - 2014	0.08729	0.17706	0.493	1
	2018 - 2014	0.13585	0.17706	0.767	0.9998
	2019 - 2014	0.28048	0.17706	1.584	0.9152
	2020 - 2014	0.48037	0.17706	2.713	0.2188
	2021 - 2014	0.44576	0.17706	2.518	0.3291
	2022 - 2014	0.66426	0.17706	3.752	<0.01
	2023 - 2014	0.75847	0.17706	4.284	<0.01
	2024 - 2014	0.95702	0.17706	5.405	<0.01
	2016 - 2015	-0.22056	0.17706	-1.246	0.9853
	2017 - 2015	0.05992	0.17706	0.338	1
	2018 - 2015	0.10847	0.17706	0.613	1
	2019 - 2015	0.2531	0.17706	1.429	0.9581
	2020 - 2015	0.453	0.17706	2.558	0.3033
	2021 - 2015	0.41839	0.17706	2.363	0.4312
	2022 - 2015	0.63688	0.17706	3.597	0.0163
	2023 - 2015	0.7311	0.17706	4.129	<0.01
	2024 - 2015	0.92965	0.17706	5.25	<0.01
	2017 - 2016	0.28048	0.17706	1.584	0.9152
	2018 - 2016	0.32903	0.17706	1.858	0.7854
	2019 - 2016	0.47366	0.17706	2.675	0.2388
	2020 - 2016	0.67355	0.17706	3.804	<0.01
	2021 - 2016	0.63895	0.17706	3.609	0.0161
	2022 - 2016	0.85744	0.17706	4.843	<0.01
	2023 - 2016	0.95165	0.17706	5.375	<0.01
	2024 - 2016	1.15021	0.17706	6.496	<0.01
	2018 - 2017	0.04855	0.17706	0.274	1
	2019 - 2017	0.19318	0.17706	1.091	0.9951
	2020 - 2017	0.39308	0.17706	2.22	0.5348
	2021 - 2017	0.35847	0.17706	2.025	0.6766
	2022 - 2017	0.57696	0.17706	3.259	0.0512
	2023 - 2017	0.67118	0.17706	3.791	<0.01
	2024 - 2017	0.86973	0.17706	4.912	<0.01

Appendix 8. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Stony Coral	2019 - 2018	0.14463	0.17706	0.817	0.9997
	2020 - 2018	0.34452	0.17706	1.946	0.7296
	2021 - 2018	0.30992	0.17706	1.75	0.8444
	2022 - 2018	0.52841	0.17706	2.984	0.113
	2023 - 2018	0.62262	0.17706	3.516	0.022
	2024 - 2018	0.82118	0.17706	4.638	<0.01
	2020 - 2019	0.1999	0.17706	1.129	0.9934
	2021 - 2019	0.16529	0.17706	0.934	0.9988
	2022 - 2019	0.38378	0.17706	2.167	0.574
	2023 - 2019	0.478	0.17706	2.7	0.2267
	2024 - 2019	0.67655	0.17706	3.821	<0.01
	2021 - 2020	-0.03461	0.17706	-0.195	1
	2022 - 2020	0.18388	0.17706	1.039	0.9968
	2023 - 2020	0.2781	0.17706	1.571	0.9197
	2024 - 2020	0.47665	0.17706	2.692	0.2291
	2022 - 2021	0.21849	0.17706	1.234	0.9863
	2023 - 2021	0.31271	0.17706	1.766	0.8364
	2024 - 2021	0.51126	0.17706	2.887	0.145
	2023 - 2022	0.09421	0.17706	0.532	1
	2024 - 2022	0.29277	0.17706	1.653	0.8892
	2024 - 2023	0.19855	0.17706	1.121	0.9938

Appendix 8. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Octocoral	2014 - 2013	1.29205	0.69121	1.869	0.7781
	2015 - 2013	2.83864	0.69121	4.107	<0.01
	2016 - 2013	3.17159	0.69121	4.588	<0.01
	2017 - 2013	3.9	0.69121	5.642	<0.01
	2018 - 2013	1.68068	0.69121	2.432	0.3848
	2019 - 2013	2.88523	0.69121	4.174	<0.01
	2020 - 2013	5.36932	0.69121	7.768	<0.01
	2021 - 2013	4.70341	0.69121	6.805	<0.01
	2022 - 2013	3.45909	0.69121	5.004	<0.01
	2023 - 2013	3.21136	0.69121	4.646	<0.01
	2024 - 2013	1.84773	0.69121	2.673	0.24
	2015 - 2014	1.54659	0.69121	2.238	0.5217
	2016 - 2014	1.87955	0.69121	2.719	0.2167
	2017 - 2014	2.60795	0.69121	3.773	<0.01
	2018 - 2014	0.38864	0.69121	0.562	1
	2019 - 2014	1.59318	0.69121	2.305	0.4732
	2020 - 2014	4.07727	0.69121	5.899	<0.01
	2021 - 2014	3.41136	0.69121	4.935	<0.01
	2022 - 2014	2.16705	0.69121	3.135	0.0744
	2023 - 2014	1.91932	0.69121	2.777	0.1908
	2024 - 2014	0.55568	0.69121	0.804	0.9997
	2016 - 2015	0.33295	0.69121	0.482	1
	2017 - 2015	1.06136	0.69121	1.536	0.9308
	2018 - 2015	-1.15795	0.69121	-1.675	0.8798
	2019 - 2015	0.04659	0.69121	0.067	1
	2020 - 2015	2.53068	0.69121	3.661	0.0135
	2021 - 2015	1.86477	0.69121	2.698	0.2266
	2022 - 2015	0.62045	0.69121	0.898	0.9992
	2023 - 2015	0.37273	0.69121	0.539	1
	2024 - 2015	-0.99091	0.69121	-1.434	0.9571
	2017 - 2016	0.72841	0.69121	1.054	0.9964
	2018 - 2016	-1.49091	0.69121	-2.157	0.5817
	2019 - 2016	-0.28636	0.69121	-0.414	1
	2020 - 2016	2.19773	0.69121	3.18	0.0649
	2021 - 2016	1.53182	0.69121	2.216	0.5378
	2022 - 2016	0.2875	0.69121	0.416	1
	2023 - 2016	0.03977	0.69121	0.058	1
	2024 - 2016	-1.32386	0.69121	-1.915	0.7499
	2018 - 2017	-2.21932	0.69121	-3.211	0.0595
	2019 - 2017	-1.01477	0.69121	-1.468	0.9492
	2020 - 2017	1.46932	0.69121	2.126	0.604
	2021 - 2017	0.80341	0.69121	1.162	0.9916
	2022 - 2017	-0.44091	0.69121	-0.638	1
	2023 - 2017	-0.68864	0.69121	-0.996	0.9978
	2024 - 2017	-2.05227	0.69121	-2.969	0.1178

Appendix 8. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Octocoral	2019 - 2018	1.20455	0.69121	1.743	0.8484
	2020 - 2018	3.68864	0.69121	5.336	<0.01
	2021 - 2018	3.02273	0.69121	4.373	<0.01
	2022 - 2018	1.77841	0.69121	2.573	0.2953
	2023 - 2018	1.53068	0.69121	2.214	0.5387
	2024 - 2018	0.16705	0.69121	0.242	1
	2020 - 2019	2.48409	0.69121	3.594	0.0167
	2021 - 2019	1.81818	0.69121	2.63	0.2637
	2022 - 2019	0.57386	0.69121	0.83	0.9996
	2023 - 2019	0.32614	0.69121	0.472	1
	2024 - 2019	-1.0375	0.69121	-1.501	0.9407
	2021 - 2020	-0.66591	0.69121	-0.963	0.9984
	2022 - 2020	-1.91023	0.69121	-2.764	0.1957
	2023 - 2020	-2.15795	0.69121	-3.122	0.0771
	2024 - 2020	-3.52159	0.69121	-5.095	<0.01
	2022 - 2021	-1.24432	0.69121	-1.8	0.8184
	2023 - 2021	-1.49205	0.69121	-2.159	0.5802
	2024 - 2021	-2.85568	0.69121	-4.131	<0.01
	2023 - 2022	-0.24773	0.69121	-0.358	1
	2024 - 2022	-1.61136	0.69121	-2.331	0.4547
	2024 - 2023	-1.36364	0.69121	-1.973	0.7118

Appendix 8. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Xestospongia muta	2014 - 2013	0.042872	0.020306	2.111	0.6145
	2015 - 2013	0.057851	0.020306	2.849	0.1589
	2016 - 2013	0.075413	0.020306	3.714	0.0111
	2017 - 2013	0.108988	0.020306	5.367	<0.01
	2018 - 2013	0.046488	0.020306	2.289	0.4846
	2019 - 2013	0.079029	0.020306	3.892	<0.01
	2020 - 2013	0.079546	0.020306	3.917	<0.01
	2021 - 2013	0.07438	0.020306	3.663	0.0131
	2022 - 2013	0.119835	0.020306	5.901	<0.01
	2023 - 2013	0.12345	0.020306	6.079	<0.01
	2024 - 2013	0.159091	0.020306	7.835	<0.01
	2015 - 2014	0.014979	0.020306	0.738	0.9999
	2016 - 2014	0.032541	0.020306	1.603	0.9086
	2017 - 2014	0.066116	0.020306	3.256	0.0518
	2018 - 2014	0.003616	0.020306	0.178	1
	2019 - 2014	0.036157	0.020306	1.781	0.8281
	2020 - 2014	0.036674	0.020306	1.806	0.8155
	2021 - 2014	0.031508	0.020306	1.552	0.9257
	2022 - 2014	0.076963	0.020306	3.79	<0.01
	2023 - 2014	0.080579	0.020306	3.968	<0.01
	2024 - 2014	0.116219	0.020306	5.723	<0.01
	2016 - 2015	0.017562	0.020306	0.865	0.9994
	2017 - 2015	0.051136	0.020306	2.518	0.3281
	2018 - 2015	-0.01136	0.020306	-0.56	1
	2019 - 2015	0.021178	0.020306	1.043	0.9967
	2020 - 2015	0.021694	0.020306	1.068	0.9959
	2021 - 2015	0.016529	0.020306	0.814	0.9997
	2022 - 2015	0.061984	0.020306	3.052	0.0941
	2023 - 2015	0.065599	0.020306	3.23	0.056
	2024 - 2015	0.10124	0.020306	4.986	<0.01
	2017 - 2016	0.033574	0.020306	1.653	0.8887
	2018 - 2016	-0.02893	0.020306	-1.424	0.959
	2019 - 2016	0.003616	0.020306	0.178	1
	2020 - 2016	0.004132	0.020306	0.203	1
	2021 - 2016	-0.00103	0.020306	-0.051	1
	2022 - 2016	0.044422	0.020306	2.188	0.5587
	2023 - 2016	0.048037	0.020306	2.366	0.4291
	2024 - 2016	0.083678	0.020306	4.121	<0.01
	2018 - 2017	-0.0625	0.020306	-3.078	0.0872
	2019 - 2017	-0.02996	0.020306	-1.475	0.9474
	2020 - 2017	-0.02944	0.020306	-1.45	0.9536
	2021 - 2017	-0.03461	0.020306	-1.704	0.8667
	2022 - 2017	0.010847	0.020306	0.534	1
	2023 - 2017	0.014463	0.020306	0.712	0.9999
	2024 - 2017	0.050103	0.020306	2.467	0.3616

Appendix 8. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
Xestospongia muta	2019 - 2018	0.032541	0.020306	1.603	0.9086
	2020 - 2018	0.033058	0.020306	1.628	0.8989
	2021 - 2018	0.027893	0.020306	1.374	0.9685
	2022 - 2018	0.073347	0.020306	3.612	0.016
	2023 - 2018	0.076963	0.020306	3.79	<0.01
	2024 - 2018	0.112603	0.020306	5.545	<0.01
	2020 - 2019	0.000517	0.020306	0.025	1
	2021 - 2019	-0.00465	0.020306	-0.229	1
	2022 - 2019	0.040806	0.020306	2.01	0.6872
	2023 - 2019	0.044422	0.020306	2.188	0.5583
	2024 - 2019	0.080062	0.020306	3.943	<0.01
	2021 - 2020	-0.00517	0.020306	-0.254	1
	2022 - 2020	0.040289	0.020306	1.984	0.7046
	2023 - 2020	0.043905	0.020306	2.162	0.5776
	2024 - 2020	0.079546	0.020306	3.917	<0.01
	2022 - 2021	0.045455	0.020306	2.238	0.5206
	2023 - 2021	0.04907	0.020306	2.417	0.3945
	2024 - 2021	0.084711	0.020306	4.172	<0.01
	2023 - 2022	0.003616	0.020306	0.178	1
	2024 - 2022	0.039256	0.020306	1.933	0.7381
	2024 - 2023	0.035641	0.020306	1.755	0.842

Appendix 9. Mean site density (colonies/m^2) per year for the octocoral target species.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Species	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
G. ventalina	0.21 ± 0.05	0.24 ± 0.05	0.3 ± 0.08	0.29 ± 0.07	0.33 ± 0.07	0.28 ± 0.07	0.29 ± 0.07	0.35 ± 0.09	0.41 ± 0.09	0.36 ± 0.08	0.24 ± 0.10	0.44 ± 0.11
A. americana	1.36 ± 0.24	1.39 ± 0.26	1.71 ± 0.28	1.79 ± 0.31	1.8 ± 0.31	1.7 ± 0.3	1.98 ± 0.37	2.54 ± 0.45	2.64 ± 0.45	2.61 ± 0.45	2.05 ± 0.32	1.96 ± 0.31
E. flexuosa	0.58 ± 0.14	0.73 ± 0.2	0.83 ± 0.27	0.78 ± 0.24	0.77 ± 0.24	0.6 ± 0.19	0.68 ± 0.23	0.81 ± 0.25	0.81 ± 0.25	0.78 ± 0.26	0.76 ± 0.23	0.76 ± 0.23

Appendix 10. Octocoral density statistics.

Linear Mixed Effects Model ANOVA results.

Variable	**Level**	**Intercept**	**Year**
G. ventalina	DF	1	11
	F	20.312573	4.530488
	P	<.0001	<.0001
A. americana	DF	1	11
	F	36.90248	11.88306
	P	<.0001	<.0001
E. flexuosa	DF	1	11
	F	10.963952	1.629978
	P	0.0011	0.0913

Appendix 10. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
G. ventalina	2014 - 2013	0.029545	0.047225	0.626	1
	2015 - 2013	0.089773	0.047225	1.901	0.759
	2016 - 2013	0.079545	0.047225	1.684	0.8757
	2017 - 2013	0.111364	0.047225	2.358	0.4346
	2018 - 2013	0.064773	0.047225	1.372	0.969
	2019 - 2013	0.073864	0.047225	1.564	0.922
	2020 - 2013	0.134091	0.047225	2.839	0.163
	2021 - 2013	0.196591	0.047225	4.163	<0.01
	2022 - 2013	0.148864	0.047225	3.152	0.0704
	2023 - 2013	0.206818	0.047225	4.379	<0.01
	2024 - 2013	0.226136	0.047225	4.789	<0.01
	2015 - 2014	0.060227	0.047225	1.275	0.9821
	2016 - 2014	0.05	0.047225	1.059	0.9962
	2017 - 2014	0.081818	0.047225	1.733	0.8535
	2018 - 2014	0.035227	0.047225	0.746	0.9999
	2019 - 2014	0.044318	0.047225	0.938	0.9987
	2020 - 2014	0.104545	0.047225	2.214	0.5393
	2021 - 2014	0.167045	0.047225	3.537	0.0205
	2022 - 2014	0.119318	0.047225	2.527	0.3237
	2023 - 2014	0.177273	0.047225	3.754	<0.01
	2024 - 2014	0.196591	0.047225	4.163	<0.01
	2016 - 2015	-0.01023	0.047225	-0.217	1
	2017 - 2015	0.021591	0.047225	0.457	1
	2018 - 2015	-0.025	0.047225	-0.529	1
	2019 - 2015	-0.01591	0.047225	-0.337	1
	2020 - 2015	0.044318	0.047225	0.938	0.9987
	2021 - 2015	0.106818	0.047225	2.262	0.5042
	2022 - 2015	0.059091	0.047225	1.251	0.9847
	2023 - 2015	0.117045	0.047225	2.478	0.3532
	2024 - 2015	0.136364	0.047225	2.888	0.1452
	2017 - 2016	0.031818	0.047225	0.674	0.9999
	2018 - 2016	-0.01477	0.047225	-0.313	1
	2019 - 2016	-0.00568	0.047225	-0.12	1
	2020 - 2016	0.054545	0.047225	1.155	0.9921
	2021 - 2016	0.117045	0.047225	2.478	0.3533
	2022 - 2016	0.069318	0.047225	1.468	0.9492
	2023 - 2016	0.127273	0.047225	2.695	0.2299
	2024 - 2016	0.146591	0.047225	3.104	0.0811
	2018 - 2017	-0.04659	0.047225	-0.987	0.998
	2019 - 2017	-0.0375	0.047225	-0.794	0.9997
	2020 - 2017	0.022727	0.047225	0.481	1
	2021 - 2017	0.085227	0.047225	1.805	0.8161
	2022 - 2017	0.0375	0.047225	0.794	0.9997
	2023 - 2017	0.095455	0.047225	2.021	0.6789
	2024 - 2017	0.114773	0.047225	2.43	0.3856

Appendix 10. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
G. ventalina	2019 - 2018	0.009091	0.047225	0.193	1
	2020 - 2018	0.069318	0.047225	1.468	0.9494
	2021 - 2018	0.131818	0.047225	2.791	0.1843
	2022 - 2018	0.084091	0.047225	1.781	0.8288
	2023 - 2018	0.142045	0.047225	3.008	0.1068
	2024 - 2018	0.161364	0.047225	3.417	0.0313
	2020 - 2019	0.060227	0.047225	1.275	0.9822
	2021 - 2019	0.122727	0.047225	2.599	0.279
	2022 - 2019	0.075	0.047225	1.588	0.914
	2023 - 2019	0.132955	0.047225	2.815	0.1728
	2024 - 2019	0.152273	0.047225	3.224	0.0566
	2021 - 2020	0.0625	0.047225	1.323	0.9762
	2022 - 2020	0.014773	0.047225	0.313	1
	2023 - 2020	0.072727	0.047225	1.54	0.9295
	2024 - 2020	0.092045	0.047225	1.949	0.7278
	2022 - 2021	-0.04773	0.047225	-1.011	0.9975
	2023 - 2021	0.010227	0.047225	0.217	1
	2024 - 2021	0.029545	0.047225	0.626	1
	2023 - 2022	0.057955	0.047225	1.227	0.9869
	2024 - 2022	0.077273	0.047225	1.636	0.8956
	2024 - 2023	0.019318	0.047225	0.409	1

Appendix 10. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
A. americana	2014 - 2013	0.035227	0.179996	0.196	1
	2015 - 2013	0.354545	0.179996	1.97	0.7143
	2016 - 2013	0.434091	0.179996	2.412	0.3982
	2017 - 2013	0.439773	0.179996	2.443	0.3757
	2018 - 2013	0.344318	0.179996	1.913	0.7512
	2019 - 2013	0.628409	0.179996	3.491	0.0239
	2020 - 2013	1.186364	0.179996	6.591	<0.01
	2021 - 2013	1.288636	0.179996	7.159	<0.01
	2022 - 2013	1.257955	0.179996	6.989	<0.01
	2023 - 2013	0.690909	0.179996	3.838	<0.01
	2024 - 2013	0.605682	0.179996	3.365	0.037
	2015 - 2014	0.319318	0.179996	1.774	0.8322
	2016 - 2014	0.398864	0.179996	2.216	0.5377
	2017 - 2014	0.404545	0.179996	2.248	0.5141
	2018 - 2014	0.309091	0.179996	1.717	0.8606
	2019 - 2014	0.593182	0.179996	3.296	0.0459
	2020 - 2014	1.151136	0.179996	6.395	<0.01
	2021 - 2014	1.253409	0.179996	6.964	<0.01
	2022 - 2014	1.222727	0.179996	6.793	<0.01
	2023 - 2014	0.655682	0.179996	3.643	0.0145
	2024 - 2014	0.570455	0.179996	3.169	0.0675
	2016 - 2015	0.079545	0.179996	0.442	1
	2017 - 2015	0.085227	0.179996	0.473	1
	2018 - 2015	-0.01023	0.179996	-0.057	1
	2019 - 2015	0.273864	0.179996	1.521	0.935
	2020 - 2015	0.831818	0.179996	4.621	<0.01
	2021 - 2015	0.934091	0.179996	5.189	<0.01
	2022 - 2015	0.903409	0.179996	5.019	<0.01
	2023 - 2015	0.336364	0.179996	1.869	0.7786
	2024 - 2015	0.251136	0.179996	1.395	0.9647
	2017 - 2016	0.005682	0.179996	0.032	1
	2018 - 2016	-0.08977	0.179996	-0.499	1
	2019 - 2016	0.194318	0.179996	1.08	0.9955
	2020 - 2016	0.752273	0.179996	4.179	<0.01
	2021 - 2016	0.854545	0.179996	4.748	<0.01
	2022 - 2016	0.823864	0.179996	4.577	<0.01
	2023 - 2016	0.256818	0.179996	1.427	0.9585
	2024 - 2016	0.171591	0.179996	0.953	0.9985
	2018 - 2017	-0.09546	0.179996	-0.53	1
	2019 - 2017	0.188636	0.179996	1.048	0.9966
	2020 - 2017	0.746591	0.179996	4.148	<0.01
	2021 - 2017	0.848864	0.179996	4.716	<0.01
	2022 - 2017	0.818182	0.179996	4.546	<0.01
	2023 - 2017	0.251136	0.179996	1.395	0.9646
	2024 - 2017	0.165909	0.179996	0.922	0.9989

Appendix 10. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
A. americana	2019 - 2018	0.284091	0.179996	1.578	0.9173
	2020 - 2018	0.842045	0.179996	4.678	<0.01
	2021 - 2018	0.944318	0.179996	5.246	<0.01
	2022 - 2018	0.913636	0.179996	5.076	<0.01
	2023 - 2018	0.346591	0.179996	1.926	0.7433
	2024 - 2018	0.261364	0.179996	1.452	0.9528
	2020 - 2019	0.557955	0.179996	3.1	0.0824
	2021 - 2019	0.660227	0.179996	3.668	0.013
	2022 - 2019	0.629545	0.179996	3.498	0.0233
	2023 - 2019	0.0625	0.179996	0.347	1
	2024 - 2019	-0.02273	0.179996	-0.126	1
	2021 - 2020	0.102273	0.179996	0.568	1
	2022 - 2020	0.071591	0.179996	0.398	1
	2023 - 2020	-0.49546	0.179996	-2.753	0.2006
	2024 - 2020	-0.58068	0.179996	-3.226	0.0568
	2022 - 2021	-0.03068	0.179996	-0.17	1
	2023 - 2021	-0.59773	0.179996	-3.321	0.0428
	2024 - 2021	-0.68296	0.179996	-3.794	<0.01
	2023 - 2022	-0.56705	0.179996	-3.15	0.0713
	2024 - 2022	-0.65227	0.179996	-3.624	0.0155
	2024 - 2023	-0.08523	0.179996	-0.473	1

Appendix 10. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
E. flexuosa	2014 - 2013	0.140909	0.08886	1.586	0.915
	2015 - 2013	0.25	0.08886	2.813	0.174
	2016 - 2013	0.198864	0.08886	2.238	0.521
	2017 - 2013	0.1875	0.08886	2.11	0.616
	2018 - 2013	0.017045	0.08886	0.192	1
	2019 - 2013	0.098864	0.08886	1.113	0.994
	2020 - 2013	0.221591	0.08886	2.494	0.343
	2021 - 2013	0.225	0.08886	2.532	0.319
	2022 - 2013	0.2	0.08886	2.251	0.512
	2023 - 2013	0.184091	0.08886	2.072	0.643
	2024 - 2013	0.171591	0.08886	1.931	0.74
	2015 - 2014	0.109091	0.08886	1.228	0.987
	2016 - 2014	0.057955	0.08886	0.652	1
	2017 - 2014	0.046591	0.08886	0.524	1
	2018 - 2014	-0.12386	0.08886	-1.394	0.965
	2019 - 2014	-0.04205	0.08886	-0.473	1
	2020 - 2014	0.080682	0.08886	0.908	0.999
	2021 - 2014	0.084091	0.08886	0.946	0.999
	2022 - 2014	0.059091	0.08886	0.665	1
	2023 - 2014	0.043182	0.08886	0.486	1
	2024 - 2014	0.030682	0.08886	0.345	1
	2016 - 2015	-0.05114	0.08886	-0.575	1
	2017 - 2015	-0.0625	0.08886	-0.703	1
	2018 - 2015	-0.23296	0.08886	-2.622	0.268
	2019 - 2015	-0.15114	0.08886	-1.701	0.869
	2020 - 2015	-0.02841	0.08886	-0.32	1
	2021 - 2015	-0.025	0.08886	-0.281	1
	2022 - 2015	-0.05	0.08886	-0.563	1
	2023 - 2015	-0.06591	0.08886	-0.742	1
	2024 - 2015	-0.07841	0.08886	-0.882	0.999
	2017 - 2016	-0.01136	0.08886	-0.128	1
	2018 - 2016	-0.18182	0.08886	-2.046	0.661
	2019 - 2016	-0.1	0.08886	-1.125	0.994
	2020 - 2016	0.022727	0.08886	0.256	1
	2021 - 2016	0.026136	0.08886	0.294	1
	2022 - 2016	0.001136	0.08886	0.013	1
	2023 - 2016	-0.01477	0.08886	-0.166	1
	2024 - 2016	-0.02727	0.08886	-0.307	1
	2018 - 2017	-0.17046	0.08886	-1.918	0.748
	2019 - 2017	-0.08864	0.08886	-0.997	0.998
	2020 - 2017	0.034091	0.08886	0.384	1
	2021 - 2017	0.0375	0.08886	0.422	1
	2022 - 2017	0.0125	0.08886	0.141	1
	2023 - 2017	-0.00341	0.08886	-0.038	1
	2024 - 2017	-0.01591	0.08886	-0.179	1

Appendix 10. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
E. flexuosa	2019 - 2018	0.081818	0.08886	0.921	0.999
	2020 - 2018	0.204545	0.08886	2.302	0.474
	2021 - 2018	0.207955	0.08886	2.34	0.447
	2022 - 2018	0.182955	0.08886	2.059	0.652
	2023 - 2018	0.167045	0.08886	1.88	0.772
	2024 - 2018	0.154545	0.08886	1.739	0.85
	2020 - 2019	0.122727	0.08886	1.381	0.967
	2021 - 2019	0.126136	0.08886	1.419	0.96
	2022 - 2019	0.101136	0.08886	1.138	0.993
	2023 - 2019	0.085227	0.08886	0.959	0.998
	2024 - 2019	0.072727	0.08886	0.818	1
	2021 - 2020	0.003409	0.08886	0.038	1
	2022 - 2020	-0.02159	0.08886	-0.243	1
	2023 - 2020	-0.0375	0.08886	-0.422	1
	2024 - 2020	-0.05	0.08886	-0.563	1
	2022 - 2021	-0.025	0.08886	-0.281	1
	2023 - 2021	-0.04091	0.08886	-0.46	1
	2024 - 2021	-0.05341	0.08886	-0.601	1
	2023 - 2022	-0.01591	0.08886	-0.179	1
	2024 - 2022	-0.02841	0.08886	-0.32	1
	2024 - 2023	-0.0125	0.08886	-0.141	1

Appendix 11. Octocoral target species mean height (cm) across all sites.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Species	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE	Mean ± SE
G. ventalina	18.26 ± 1.12	16.52 ± 1.02	14.82 ± 0.78	15.17 ± 0.83	16.43 ± 0.82	17.64 ± 0.88	16.7 ± 0.88	14.83 ± 0.79	13 ± 0.6	13.9 ± 0.69	13.04 ± 0.56	14.37 ± 0.57
A. americana	27.15 ± 0.52	25.09 ± 0.52	23.24 ± 0.46	23.76 ± 0.42	23.34 ± 0.44	21.8 ± 0.46	19.06 ± 0.36	17.89 ± 0.3	19.3 ± 0.3	20.87 ± 0.31	22.99 ± 0.35	24.79 ± 0.38
E. flexuosa	24.87 ± 0.59	24.43 ± 0.67	21.53 ± 0.55	22.34 ± 0.55	22.89 ± 0.54	23.07 ± 0.61	22.61 ± 0.55	20.28 ± 0.54	20.9 ± 0.5	20.64 ± 0.52	20.17 ± 0.53	21.42 ± 0.55

Appendix 12. Octocoral height statistics.

Linear Mixed Effects Model ANOVA results.

Variable	**Level**	**Intercept**	**Year**
G. ventalina	DF	1	11
	F	83.18354	4.50401
	P	<.0001	<.0001
A. americana	DF	1	11
	F	581.5999	51.4812
	P	<.0001	<.0001
E. flexuosa	DF	1	11
	F	531.8304	6.9631
	P	<.0001	<.0001

Appendix 12. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
E. flexuosa	2014 - 2013	-0.6609	0.8323	-0.794	0.9997
	2015 - 2013	-3.4857	0.8103	-4.302	<0.01
	2016 - 2013	-2.4274	0.8188	-2.965	0.1188
	2017 - 2013	-1.9496	0.8225	-2.37	0.4256
	2018 - 2013	-1.6828	0.8709	-1.932	0.738
	2019 - 2013	-2.2406	0.8448	-2.652	0.2495
	2020 - 2013	-4.5702	0.8173	-5.592	<0.01
	2021 - 2013	-3.9599	0.8142	-4.864	<0.01
	2022 - 2013	-4.2402	0.8215	-5.162	<0.01
	2023 - 2013	-4.4159	0.8245	-5.356	<0.01
	2024 - 2013	-3.3688	0.8317	-4.051	<0.01
	2015 - 2014	-2.8249	0.7597	-3.718	0.0106
	2016 - 2014	-1.7666	0.7705	-2.293	0.481
	2017 - 2014	-1.2887	0.7737	-1.666	0.8832
	2018 - 2014	-1.0219	0.8246	-1.239	0.9858
	2019 - 2014	-1.5797	0.7974	-1.981	0.7062
	2020 - 2014	-3.9093	0.7672	-5.096	<0.01
	2021 - 2014	-3.299	0.7649	-4.313	<0.01
	2022 - 2014	-3.5793	0.7713	-4.641	<0.01
	2023 - 2014	-3.7551	0.7755	-4.842	<0.01
	2024 - 2014	-2.708	0.7833	-3.457	0.0264
	2016 - 2015	1.0583	0.7428	1.425	0.9587
	2017 - 2015	1.5361	0.7453	2.061	0.65
	2018 - 2015	1.8029	0.799	2.256	0.5068
	2019 - 2015	1.2452	0.7711	1.615	0.9036
	2020 - 2015	-1.0844	0.7398	-1.466	0.9496
	2021 - 2015	-0.4742	0.7372	-0.643	1
	2022 - 2015	-0.7545	0.7432	-1.015	0.9974
	2023 - 2015	-0.9302	0.7482	-1.243	0.9854
	2024 - 2015	0.1169	0.7564	0.155	1
	2017 - 2016	0.4778	0.7569	0.631	1
	2018 - 2016	0.7446	0.8094	0.92	0.9989
	2019 - 2016	0.1869	0.7819	0.239	1
	2020 - 2016	-2.1428	0.7512	-2.852	0.1591
	2021 - 2016	-1.5325	0.7485	-2.047	0.6597
	2022 - 2016	-1.8128	0.7554	-2.4	0.4053
	2023 - 2016	-1.9885	0.7593	-2.619	0.268
	2024 - 2016	-0.9414	0.768	-1.226	0.9869
	2018 - 2017	0.2668	0.8115	0.329	1
	2019 - 2017	-0.291	0.7849	-0.371	1
	2020 - 2017	-2.6206	0.7538	-3.476	0.0254
	2021 - 2017	-2.0103	0.7513	-2.676	0.2385
	2022 - 2017	-2.2906	0.7576	-3.024	0.101
	2023 - 2017	-2.4664	0.7618	-3.238	0.0548
	2024 - 2017	-1.4192	0.7708	-1.841	0.7946

Appendix 12. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
E. flexuosa	2019 - 2018	-0.5578	0.8349	-0.668	1
	2020 - 2018	-2.8874	0.8054	-3.585	0.0175
	2021 - 2018	-2.2771	0.8037	-2.833	0.1662
	2022 - 2018	-2.5574	0.8096	-3.159	0.0689
	2023 - 2018	-2.7331	0.8126	-3.363	0.0363
	2024 - 2018	-1.686	0.8223	-2.05	0.6574
	2020 - 2019	-2.3296	0.7772	-2.997	0.1083
	2021 - 2019	-1.7193	0.7751	-2.218	0.5349
	2022 - 2019	-1.9996	0.7811	-2.56	0.3021
	2023 - 2019	-2.1754	0.7853	-2.77	0.1929
	2024 - 2019	-1.1283	0.7933	-1.422	0.9594
	2021 - 2020	0.6103	0.7432	0.821	0.9996
	2022 - 2020	0.33	0.7496	0.44	1
	2023 - 2020	0.1542	0.7538	0.205	1
	2024 - 2020	1.2013	0.7609	1.579	0.9168
	2022 - 2021	-0.2803	0.7476	-0.375	1
	2023 - 2021	-0.4561	0.7521	-0.606	1
	2024 - 2021	0.5911	0.7595	0.778	0.9998
	2023 - 2022	-0.1757	0.7583	-0.232	1
	2024 - 2022	0.8714	0.7652	1.139	0.9929
	2024 - 2023	1.0471	0.7712	1.358	0.9709

Appendix 12. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
G. ventalina	2014 - 2013	-1.19804	1.140233	-1.051	0.9964
	2015 - 2013	-2.45393	1.087145	-2.257	0.5044
	2016 - 2013	-2.06712	1.09641	-1.885	0.7662
	2017 - 2013	-0.55234	1.076341	-0.513	1
	2018 - 2013	0.547642	1.109372	0.494	1
	2019 - 2013	-0.5571	1.102758	-0.505	1
	2020 - 2013	-2.07294	1.060411	-1.955	0.7215
	2021 - 2013	-3.52516	1.03048	-3.421	0.0301
	2022 - 2013	-3.08314	1.051288	-2.933	0.1284
	2023 - 2013	-4.09336	1.024789	-3.994	<0.01
	2024 - 2013	-2.23895	1.019566	-2.196	0.5496
	2015 - 2014	-1.25589	1.045918	-1.201	0.9888
	2016 - 2014	-0.86907	1.053266	-0.825	0.9996
	2017 - 2014	0.645699	1.03196	0.626	1
	2018 - 2014	1.745685	1.067199	1.636	0.8948
	2019 - 2014	0.640942	1.061454	0.604	1
	2020 - 2014	-0.87489	1.020223	-0.858	0.9994
	2021 - 2014	-2.32712	0.987585	-2.356	0.4328
	2022 - 2014	-1.8851	1.011333	-1.864	0.7796
	2023 - 2014	-2.89532	0.98314	-2.945	0.1238
	2024 - 2014	-1.0409	0.976842	-1.066	0.9959
	2016 - 2015	0.386812	0.99463	0.389	1
	2017 - 2015	1.901583	0.971709	1.957	0.7201
	2018 - 2015	3.00157	1.008445	2.976	0.1141
	2019 - 2015	1.896826	1.001769	1.893	0.7611
	2020 - 2015	0.380992	0.957843	0.398	1
	2021 - 2015	-1.07124	0.924359	-1.159	0.9917
	2022 - 2015	-0.62921	0.949206	-0.663	1
	2023 - 2015	-1.63943	0.919087	-1.784	0.8249
	2024 - 2015	0.21498	0.911603	0.236	1
	2017 - 2016	1.514771	0.977809	1.549	0.9257
	2018 - 2016	2.614758	1.015462	2.575	0.2908
	2019 - 2016	1.510014	1.009356	1.496	0.9413
	2020 - 2016	-0.00582	0.966753	-0.006	1
	2021 - 2016	-1.45805	0.932532	-1.564	0.9211
	2022 - 2016	-1.01602	0.958257	-1.06	0.9961
	2023 - 2016	-2.02624	0.927518	-2.185	0.5576
	2024 - 2016	-0.17183	0.919406	-0.187	1
	2018 - 2017	1.099987	0.991105	1.11	0.9942
	2019 - 2017	-0.00476	0.98423	-0.005	1
	2020 - 2017	-1.52059	0.940881	-1.616	0.9021
	2021 - 2017	-2.97282	0.90442	-3.287	0.0463
	2022 - 2017	-2.53079	0.931509	-2.717	0.2156
	2023 - 2017	-3.54102	0.899855	-3.935	<0.01
	2024 - 2017	-1.6866	0.891224	-1.892	0.7615

Appendix 12. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
G. ventalina	2019 - 2018	-1.10474	1.021102	-1.082	0.9954
	2020 - 2018	-2.62058	0.97952	-2.675	0.2351
	2021 - 2018	-4.07281	0.94529	-4.309	<0.01
	2022 - 2018	-3.63078	0.971089	-3.739	<0.01
	2023 - 2018	-4.641	0.94066	-4.934	<0.01
	2024 - 2018	-2.78659	0.933123	-2.986	0.1112
	2020 - 2019	-1.51583	0.970017	-1.563	0.9212
	2021 - 2019	-2.96806	0.936032	-3.171	0.0661
	2022 - 2019	-2.52604	0.960463	-2.63	0.259
	2023 - 2019	-3.53626	0.931219	-3.797	<0.01
	2024 - 2019	-1.68185	0.923705	-1.821	0.8045
	2021 - 2020	-1.45223	0.884994	-1.641	0.8923
	2022 - 2020	-1.0102	0.911215	-1.109	0.9943
	2023 - 2020	-2.02042	0.880862	-2.294	0.4781
	2024 - 2020	-0.16601	0.871638	-0.19	1
	2022 - 2021	0.442025	0.875373	0.505	1
	2023 - 2021	-0.5682	0.84294	-0.674	0.9999
	2024 - 2021	1.286216	0.833462	1.543	0.9273
	2023 - 2022	-1.01022	0.870319	-1.161	0.9915
	2024 - 2022	0.844191	0.862549	0.979	0.9981
	2024 - 2023	1.854412	0.828628	2.238	0.5183

Appendix 12. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
A. americana	2014 - 2013	-2.23158	0.63725	-3.502	0.0233
	2015 - 2013	-3.86472	0.60753	-6.361	<0.01
	2016 - 2013	-3.19838	0.6018	-5.315	<0.01
	2017 - 2013	-3.64109	0.60163	-6.052	<0.01
	2018 - 2013	-5.05929	0.60931	-8.303	<0.01
	2019 - 2013	-8.06668	0.59019	-13.668	<0.01
	2020 - 2013	-9.25564	0.56326	-16.432	<0.01
	2021 - 2013	-7.79174	0.55933	-13.93	<0.01
	2022 - 2013	-6.12667	0.56089	-10.923	<0.01
	2023 - 2013	-4.26711	0.58639	-7.277	<0.01
	2024 - 2013	-2.29491	0.59204	-3.876	<0.01
	2015 - 2014	-1.63314	0.6033	-2.707	0.2189
	2016 - 2014	-0.9668	0.59745	-1.618	0.9014
	2017 - 2014	-1.40951	0.59716	-2.36	0.4302
	2018 - 2014	-2.82772	0.60519	-4.672	<0.01
	2019 - 2014	-5.8351	0.58554	-9.965	<0.01
	2020 - 2014	-7.02407	0.55838	-12.579	<0.01
	2021 - 2014	-5.56016	0.5545	-10.027	<0.01
	2022 - 2014	-3.89509	0.55616	-7.004	<0.01
	2023 - 2014	-2.03554	0.58165	-3.5	0.0233
	2024 - 2014	-0.06334	0.58789	-0.108	1
	2016 - 2015	0.66634	0.56446	1.181	0.9903
	2017 - 2015	0.22363	0.56418	0.396	1
	2018 - 2015	-1.19457	0.57217	-2.088	0.6286
	2019 - 2015	-4.20195	0.55166	-7.617	<0.01
	2020 - 2015	-5.39092	0.52278	-10.312	<0.01
	2021 - 2015	-3.92702	0.51839	-7.575	<0.01
	2022 - 2015	-2.26194	0.51971	-4.352	<0.01
	2023 - 2015	-0.40239	0.54756	-0.735	0.9999
	2024 - 2015	1.56981	0.5533	2.837	0.1623
	2017 - 2016	-0.44271	0.55763	-0.794	0.9997
	2018 - 2016	-1.86092	0.5656	-3.29	0.046
	2019 - 2016	-4.8683	0.5449	-8.934	<0.01
	2020 - 2016	-6.05727	0.51576	-11.744	<0.01
	2021 - 2016	-4.59336	0.5113	-8.984	<0.01
	2022 - 2016	-2.92829	0.51257	-5.713	<0.01
	2023 - 2016	-1.06873	0.54093	-1.976	0.7068
	2024 - 2016	0.90346	0.54668	1.653	0.888
	2018 - 2017	-1.41821	0.56533	-2.509	0.3303
	2019 - 2017	-4.42559	0.54455	-8.127	<0.01
	2020 - 2017	-5.61456	0.51561	-10.889	<0.01
	2021 - 2017	-4.15065	0.51108	-8.121	<0.01
	2022 - 2017	-2.48558	0.51236	-4.851	<0.01
	2023 - 2017	-0.62602	0.5406	-1.158	0.9917
	2024 - 2017	1.34617	0.54633	2.464	0.3601

Appendix 12. Continued.

Tukey post hoc test.

Variable	Years	Est.	SE	z	P > |z|
A. americana	2019 - 2018	-3.00738	0.55224	-5.446	<0.01
	2020 - 2018	-4.19635	0.52375	-8.012	<0.01
	2021 - 2018	-2.73245	0.51947	-5.26	<0.01
	2022 - 2018	-1.06737	0.52058	-2.05	0.6548
	2023 - 2018	0.79218	0.54897	1.443	0.9543
	2024 - 2018	2.76438	0.55442	4.986	<0.01
	2020 - 2019	-1.18897	0.50013	-2.377	0.4186
	2021 - 2019	0.27494	0.49609	0.554	1
	2022 - 2019	1.94001	0.49764	3.898	<0.01
	2023 - 2019	3.79956	0.52674	7.213	<0.01
	2024 - 2019	5.77176	0.53333	10.822	<0.01
	2021 - 2020	1.4639	0.46376	3.157	0.0688
	2022 - 2020	3.12898	0.46546	6.722	<0.01
	2023 - 2020	4.98853	0.49636	10.05	<0.01
	2024 - 2020	6.96073	0.5033	13.83	<0.01
	2022 - 2021	1.66507	0.46048	3.616	0.0159
	2023 - 2021	3.52463	0.49171	7.168	<0.01
	2024 - 2021	5.49683	0.49847	11.027	<0.01
	2023 - 2022	1.85955	0.49302	3.772	<0.01
	2024 - 2022	3.83175	0.49924	7.675	<0.01
	2024 - 2023	1.9722	0.5281	3.735	0.0104