Southeast Florida Coral Reef Evaluation and Monitoring Project

Executive Summary 2017

Overview

- The Southeast Florida Coral Reef Evaluation and Monitoring Project (SECREMP) documents the status and trends in the southeast Florida (Miami-Dade, Broward, Palm Beach, and Martin counties) reef system and in 2017 completed its 15th year of annual surveys.

- In 2017, all 22 SECREMP sites were surveyed through established methodologies (see Gilliam et al. 2017 for site locations and survey protocols). All surveys were performed within four permanently marked 22m x 1m stations at all sites (Figure 1).

- Survey methods include (1) photographic transects to quantify percent cover of major benthic taxa (stony corals, sponges, octocorals, macroalgae, etc.) and (2) demographic surveys to quantify abundance, size distribution, and overall condition of stony corals (Scleractinia and Milleporidae), octocorals (Octocorallia), and *Xestospongia muta* (giant barrel sponge).

- This Executive Summary focuses on 2017 stony coral demographic data in response to community changes largely driven by an on-going, multi-year tissue-loss disease event (white syndrome). Octocoral and *X. muta* density data and stony coral, octocoral, sponge, and macroalgae 2017 benthic cover data are also presented to provide brief resource status information for these coral reef community functional groups.

- Statistical comparisons for stony coral density, disease prevalence, stony coral colony live tissue area, *Xestospongia muta* density, and octocoral densities were selectively performed region-wide (pooling all sites) for counties (pooling all sites within a county) and sites (stations as replicates). A linear mixed model (LME) was used with year as the factor to examine changes between 2013 – 2017 within counties and sites. All statistical tests were performed using the R software package (R Core Team 2016). For counties and/or sites exhibiting statistical differences between years, a Tukey's HSD post-hoc was performed and significant differences are reported based on Tukey's multiple comparison corrected p-values.

- Percent cover changes from 2016 to 2017 for the major benthic taxa (stony coral, sponges, octocorals and macroalgae) were analyzed using generalized linear mixed models (PROC GLIMMIX) in SAS Enterprise Guide® v7.1 Data for each taxa was square-root transformed and modeled using years and sites (N=22) as fixed effects. For all tests, a Gaussian/normal link function was used and a random residual statement was included to account for the repeated measures design with compound symmetry (CS) defined as the random residual error structure. Pairwise post-hoc comparisons were made to examine changes at individual sites. No p-value adjustments were used for the post-hoc site by site comparisons.

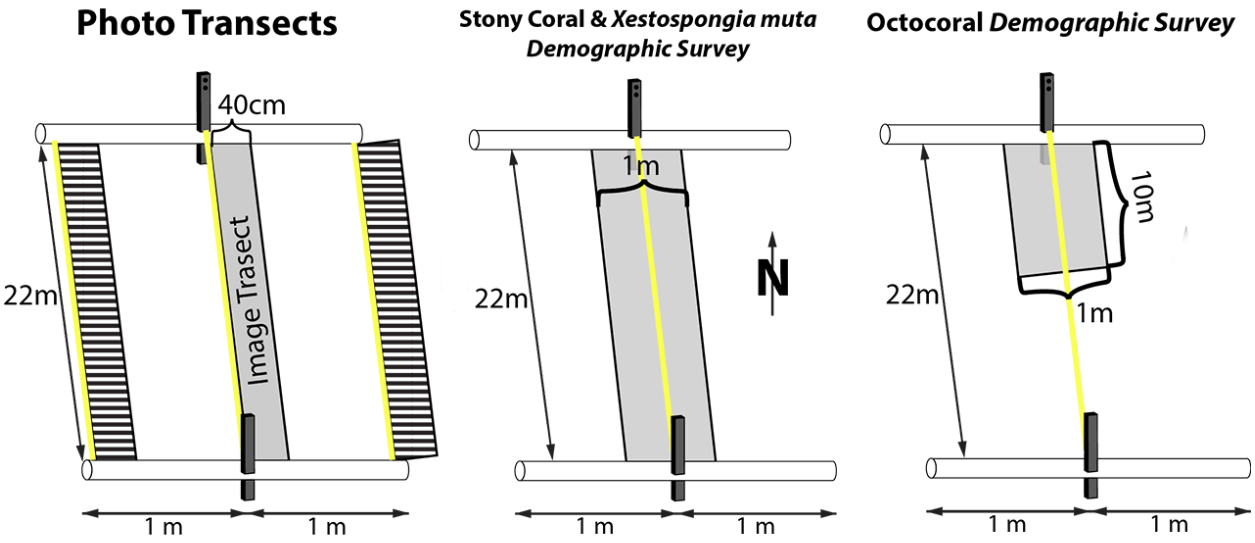

Figure 1. All SECREMP sites consist of four monitoring stations identified by permanent pins. Stations are 22m x 2m and are oriented north to south. Photo transects are taken along the center of the station surveying an 8.8m^2 area. The hashed photo transects represent additional area surveyed prior to 2014 modifications; this area is still surveyed at site BCA. Stony coral and *X. muta* demographic surveys are 22m x 1m along the center of the station. Octocoral demographic surveys are 10m x 1m along the station center. All demographic surveys were implemented in 2012.

Summary

Stony Coral Demographics

- Twenty-six stony coral species were identified region-wide which is similar to total richness identified throughout all project years (Gilliam et al. 2015). Mean (±SE) site stony coral species richness (number of species) ranged from 2.25 ± 0.48 (MC2) to 9.00 ± 0.91 (BC4) (Table 1).

- The six most abundant stony coral species, contributing greater than 80% of the total 2017 abundance, were (in order of greatest abundance) *Porites astreoides*, *Siderastrea siderea*, *Agaricia agaricites*, *Stephanocoenia intersepta*, *Montastraea cavernosa*, and *Porites porites*. Prior to 2015 *Meandrina meandrites* was annually one the six most abundant species. However, in 2015, *M. meandrites* was replaced by *P. porites*, and in 2017 *M. meandrites* was not within the top ten most abundant species. Additionally, *M. cavernosa* was previously the third most abundant species, but in 2017, was the fifth most abundant species (Table 2). *Meandrina meandrites* and *M. cavernosa* abundance declines were driven by whole colony mortality associated with the on-going disease event.

- For all colonies pooled, 2017 mean (±SE) site stony coral size (diameter) ranged from 7.55 ± 0.50cm (PB1) to 35.68 ± 2.38cm (BC1), and mean region-wide colony size was 12.35 ± 0.25cm (Table 1). Maximum and mean colony diameter has decreased since 2015, where the maximum mean stony coral diameter was 41.09 ± 2.22cm (BC1) and the mean coral size region-wide was 15.99 ± 0.18cm (Gilliam et al. 2015). The loss of whole colonies >50cm diameter illustrates changes in colony size distributions. Region-wide abundance of colonies >50cm diameter was 36% less in 2017 than 2014 (2014 had the greatest abundance of larger colonies).

Table 1. 2017 mean (±SE) site stony coral richness, diameter (cm) and, density (colonies ≥4cm/m^2). DC = Miami-Dade; BC = Broward; PB = Palm Beach; MC = Martin) (Richness = number of species, Density = colonies ≥ 4 cm diameter/m^2). Note: BCA density does not include *Acropora cervicornis* colonies.

Site	Richness			Diameter			Density		
MC1	5.00	±	0.91	12.69	±	2.09	2.18	±	0.66
MC2	2.25	±	0.48	14.41	±	1.29	0.31	±	0.08
PB1	2.75	±	0.85	7.55	±	3.71	0.25	±	0.11
PB2	3.25	±	0.48	11.05	±	0.50	1.03	±	0.42
PB3	4.50	±	0.50	11.17	±	0.93	0.68	±	0.23
PB4	4.75	±	0.48	10.46	±	0.72	1.01	±	0.23
PB5	6.00	±	0.41	9.70	±	0.57	1.65	±	0.32
BC1	6.50	±	0.65	35.68	±	0.25	1.45	±	0.34
BC2	4.75	±	0.48	11.45	±	2.38	0.58	±	0.13
BC3	5.00	±	0.41	10.46	±	1.21	0.61	±	0.04
BC4	9.00	±	0.91	11.03	±	0.97	4.90	±	0.40
BC5	5.00	±	0.71	8.18	±	0.48	0.83	±	0.14
BC6	3.50	±	0.29	10.72	±	0.50	0.41	±	0.00
BCA	4.00	±	0.00	7.80	±	1.80	3.08	±	1.10
DC1	7.00	±	0.41	16.72	±	0.18	2.28	±	0.13
DC2	5.75	±	0.63	9.24	±	1.04	1.03	±	0.04
DC3	4.00	±	0.41	11.60	±	0.71	0.28	±	0.01
DC4	6.50	±	0.96	9.96	±	1.80	0.90	±	0.18
DC5	9.00	±	1.08	9.14	±	1.20	3.30	±	0.35
DC6	6.00	±	0.71	17.15	±	0.36	1.55	±	0.35
DC7	7.00	±	0.82	9.99	±	1.30	0.85	±	0.08
DC8	4.50	±	0.50	15.29	±	0.69	0.48	±	0.05

Table 2. Species specific region-wide total colony density (colonies/m²) 2013 through 2017.

Year	*P. astreoides*	*M. cavernosa*	*S. siderea*	*S. intersepta*	*A. agaricites*	*M. meandrites*	*P. porites*
2013	0.28	0.25	0.24	0.12	0.09	0.06	0.03
2014	0.30	0.24	0.22	0.13	0.09	0.06	0.04
2015	0.30	0.24	0.21	0.13	0.11	0.05	0.06
2016	0.33	0.13	0.17	0.12	0.12	0.00	0.06
2017	0.42	0.12	0.22	0.14	0.21	0.01	0.08

- Region-wide mean (±SE) stony coral density (colonies ≥4cm) was 1.34 ± 0.25 colonies/m², and mean (±SE) site density ranged from 0.25 ± 0.11 colonies/m^2 (site PB1) to 4.9 ± 0.40 (BC4). Seventeen sites in 2017 had mean colony density less than 2 colonies/m^2 (Table 1).

- No significant changes in site stony coral colony density were identified from 2013 to 2015 (Table 3). This changed in 2016 when density significantly decreased at six sites (BC5, DC7, DC8, PB3, PB4, and PB5). In 2017, four of these sites continued to have densities significantly lower than years 2013-2015, and two additional sites (BC1 and BC6) were identified with significantly decreased densities.

- Colony density increases were also determined (Table 3). In 2017, three sites (BC4, BCA, and DC5) had significantly greater densities than all previous years. DC1 density was significantly greater in 2017 and 2016 than years 2013-2015. Density increases at these sites appear to be primarily driven by increases in two species: *A. agaricites* and *P. astreoides* (Table 2).

Table 3. 2013 – 2017 mean (±SE) SECREMP site stony coral colony density (colonies ≥4cm/m²). Bolded site values indicate the mean for that year is significantly different (Linear Mixed Model followed by a Tukey's HSD test) from other years. Sites with bolded values for 2016 and 2017 indicate that both years were significantly different than years 2013-1015.

Site	2013	2014	2015	2016	2017
MC1	0.95 ± 0.09	1.06 ± 0.11	0.98 ± 0.18	0.98 ± 0.31	2.18 ± 0.66
MC2	0.49 ± 0.06	0.4 ± 0.05	0.34 ± 0.09	0.27 ± 0.05	0.31 ± 0.08
PB1	0.23 ± 0.13	0.27 ± 0.13	0.28 ± 0.15	0.33 ± 0.14	0.25 ± 0.11
PB2	1.07 ± 0.15	1.24 ± 0.09	1.57 ± 0.31	1.07 ± 0.33	1.03 ± 0.42
PB3	1.05 ± 0.31	1.18 ± 0.34	1.11 ± 0.29	**0.63 ± 0.22**	**0.68 ± 0.23**
PB4	1.82 ± 0.38	1.63 ± 0.31	1.69 ± 0.3	**1.02 ± 0.27**	**1.01 ± 0.23**
PB5	2.3 ± 0.31	2.18 ± 0.28	2.08 ± 0.29	**1.58 ± 0.25**	**1.65 ± 0.32**
BC1	1.81 ± 0.35	2.16 ± 0.33	2.05 ± 0.34	1.66 ± 0.3	**1.45 ± 0.34**
BC2	0.64 ± 0.12	0.78 ± 0.12	0.63 ± 0.12	0.47 ± 0.1	0.58 ± 0.13
BC3	0.75 ± 0.11	0.76 ± 0.22	0.59 ± 0.08	0.42 ± 0.03	0.61 ± 0.04
BC4	3.28 ± 0.32	3.75 ± 0.22	4.05 ± 0.31	3.41 ± 0.12	**4.9 ± 0.4**
BC5	1.23 ± 0.19	1.09 ± 0.25	1.19 ± 0.22	**0.67 ± 0.08**	0.83 ± 0.14
BC6	0.64 ± 0.11	0.57 ± 0.08	0.56 ± 0.06	0.43 ± 0.05	**0.41 ± 0.00**
BCA	0.61 ± 0.18	0.58 ± 0.17	1.09 ± 0.4	1.45 ± 0.17	**3.08 ± 1.1**
DC1	1.8 ± 0.15	2.1 ± 0.16	2.14 ± 0.03	**2.36 ± 0.06**	**2.28 ± 0.13**
DC2	0.88 ± 0.09	1.08 ± 0.14	1.07 ± 0.11	0.83 ± 0.09	1.03 ± 0.04
DC3	0.31 ± 0.09	0.33 ± 0.03	0.31 ± 0.06	0.27 ± 0.07	0.28 ± 0.01
DC4	0.73 ± 0.11	0.75 ± 0.12	0.75 ± 0.2	0.57 ± 0.14	0.9 ± 0.18
DC5	2.56 ± 0.24	2.53 ± 0.14	2.33 ± 0.26	2.4 ± 0.26	**3.3 ± 0.35**
DC6	1.38 ± 0.26	1.42 ± 0.25	1.51 ± 0.25	1.44 ± 0.33	1.55 ± 0.35
DC7	1.13 ± 0.05	1.02 ± 0.12	1.1 ± 0.14	**0.67 ± 0.09**	0.85 ± 0.08
DC8	0.92 ± 0.09	0.81 ± 0.06	0.9 ± 0.14	**0.56 ± 0.07**	**0.48 ± 0.05**

- In 2017, diseased stony coral colonies were observed at seven of the 22 sites, which was half of the 15 sites identified with diseased colonies in 2016 (Gilliam et al. 2017). Of these seven sites, prevalence ranged from 0.43 ± 0.25% (BC4) to 10.70 ± 3.60% (BC1) (Table 4).

- Region-wide disease prevalence increased every year from 2013 to 2016 with a dramatic increase from a site mean of 1.5 ± 0.50% in 2015 to 3.3 ± 0.85% in 2016 (Table 5). Prevalence in 2016 was significantly greater than in 2013. In 2017, region-wide prevalence decreased to 0.91 ± 0.48%.

- Figure 2 shows the annual mean (±SE) disease prevalence by county. White syndrome (a general term used for diseases that exhibit similar visual signs and tissue loss patterns) prevalence was significantly greater in Palm Beach and Miami-Dade counties in 2016. Broward County mean white syndrome prevalence was also greatest in 2016 but not significantly greater than 2014 or 2017. White syndrome prevalence declined in West Palm, Broward, and Miami-Dade in 2017. The decline in white syndrome prevalence may be due to a number of factors including changes in environmental conditions reducing pathogen(s) abundance, or pathogen(s) virulence, or the susceptibility of those remaining colonies to the pathogen(s).

- To best capture the on-going impacts of the disease event, all further disease-related analyses presented below only included diseases that resulted in tissue mortality: Dark Spot Disease (DSD) and Skeletal Anomalies (SKA) were not included.

- At the county level, Palm Beach and Miami-Dade counties showed significant annual increases in disease prevalence; Broward County and Miami-Dade County had significant annual changes in disease prevalence at the site level (Table 5). BC5 and BC6 were the first sites to show significant increases in disease prevalence in 2014. BC1 was the only site with significantly greater disease prevalence in 2017 than in 2013-2015 (Table 5).

- To provide an additional metric to evaluate changes to the stony coral community, colony width, height and percent mortality (sum of old and recent) were used to calculate total stony coral live tissue area (LTA) for each site for 2013-2017 (see Gilliam et al. 2017 for more LTA calculation details). Region-wide LTAs were also calculated for all stony coral species or species groups (all *Orbicella* and *Agaricia* species were grouped) for 2013-2017.

- A region-wide decline in LTA was initially identified in 2016 (Gilliam et al. 2017), and LTA continued to decline region-wide such that 2017 was significantly different than years 2013-2015. For a majority of sites, LTA has been declining (Figure 3) with nine sites (BC1, BC3, BC4, BC5, DC4, DC8, PB2, PB3, and PB5) having significantly decreased LTA in 2017.

- Four species (*D. stokesii*, *M. meandrites*, *M. cavernosa*, and *Solenastrea bournoni*) were determined to have a significant decrease in LTA in 2017. *Porites porites* was the only species that had a significant increase.

Table 4. 2017 stony coral disease occurrence (number of diseased colonies) and mean (±SE) disease prevalence (includes Dark Spot Syndrome and skeletal anomalies) (DC = Miami-Dade; BC = Broward; PB = Palm Beach; MC = Martin).

Site	Disease Occurrence	Disease Prevalence	Site	Disease Occurrence	Disease Prevalence
BC1	13	10.70 ± 3.60%	DC5	0	0.00 ± 0.00%
BC2	0	0.00 ± 0.00%	DC6	2	1.96 ± 1.13%
BC3	0	0.00 ± 0.00%	DC7	1	1.32 ± 1.32%
BC4	2	0.43 ± 0.25%	DC8	0	0.00 ± 0.00%
BC5	0	0.00 ± 0.00%	MC1	0	0.00 ± 0.00%
BC6	0	0.00 ± 0.00%	MC2	0	0.00 ± 0.00%
BCA	0	0.00 ± 0.00%	PB1	0	0.00 ± 0.00%
DC1	6	3.14 ± 1.06%	PB2	0	0.00 ± 0.00%
DC2	0	0.00 ± 0.00%	PB3	1	1.47 ± 1.47%
DC3	0	0.00 ± 0.00%	PB4	0	0.00 ± 0.00%
DC4	0	0.00 ± 0.00%	PB5	3	2.62 ± 1.66%

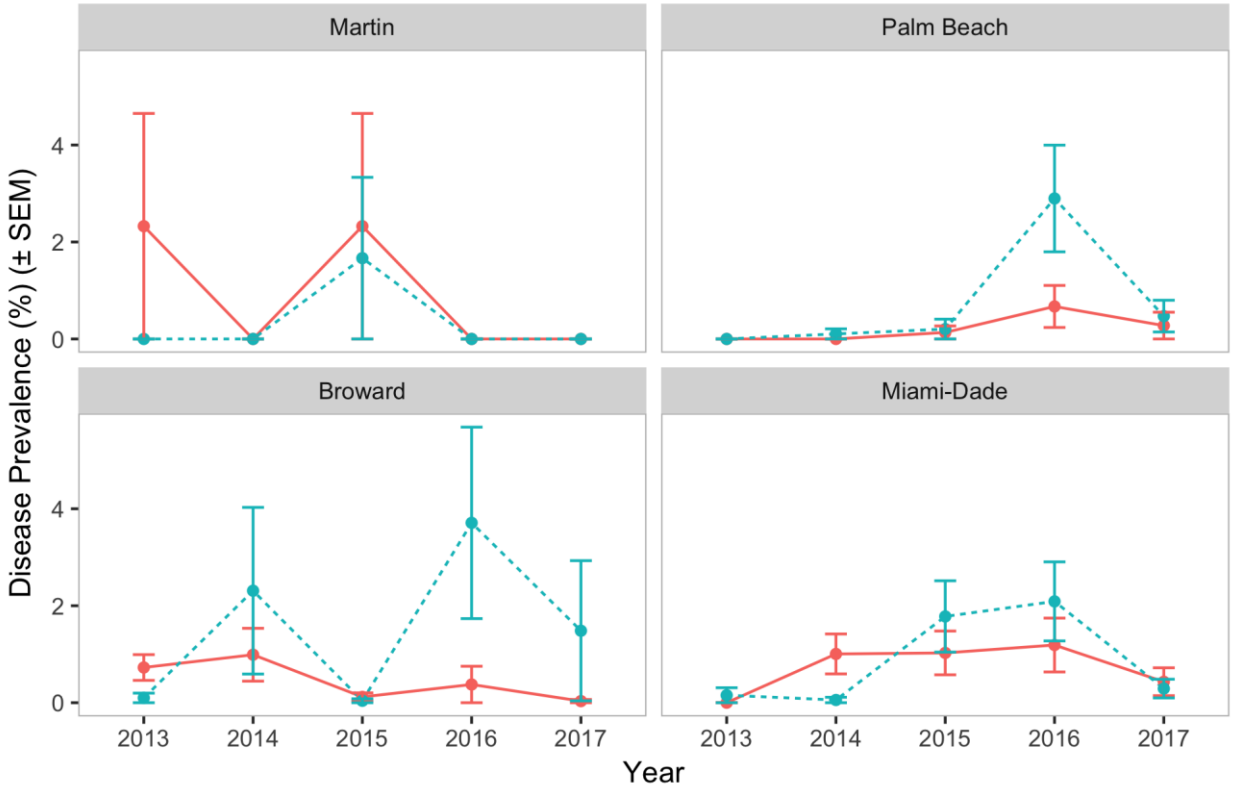

Figure 2. 2013-2017 mean (±SE) annual percent disease prevalence by county (all sites within a county pooled). The blue lines and points represents white syndrome disease prevalence only. The red lines and points represent prevalence of all other recorded diseases.

Table 5. Region-wide (all sites pooled) and 2013 – 2017 mean (±SE) percent disease prevalence only for sites that had significant (Linear Mixed Effects Model followed by a Tukey's HSD test) changes in prevalence. Bolded site values indicate the mean for that year is significantly different from the other years (*Region-wide 2016 was significantly different from 2013 and 2017; **BC1 bolded values in 2016 and 2017 indicate that both years were significantly different than years 2013-1015).

Site	2013	2014	2015	2016	2017
Region-wide	0.53 ± 0.24%	1.46 ± 0.75%	1.51 ± 0.50%	***3.30 ± 0.85%**	0.92 ± 0.48%
BC1	0.00 ± 0.00%	0.00 ± 0.00%	0.45 ± 0.45%	****14.39 ± 2.95%**	**10.70 ± 3.60%**
BC5	0.00 ± 0.00%	**4.11 ± 1.70%**	0.00 ± 0.00%	0.00 ± 0.00%	0.00 ± 0.00%
BC6	0.00 ± 0.00%	**12.61 ± 2.41%**	0.00 ± 0.00%	6.25 ± 6.25%	0.00 ± 0.00%
DC1	0.00 ± 0.00%	1.09 ± 0.63%	3.69 ± 1.58%	**6.30 ± 1.28%**	3.14 ± 1.06%
DC6	0.00 ± 0.00%	0.00 ± 0.00%	0.76 ± 0.76%	3.57 ± 1.30%	1.96 ± 1.13%
DC8	0.96 ± 0.96%	0.00 ± 0.00%	**6.76 ± 3.00%**	0.00 ± 0.00%	0.00 ± 0.00%

- *Dichocoenia stokesii* LTA has declined since 2013 with significant LTA loss first documented in 2015 (Figure 4). LTA declines were directly related to decreases in *D. stokesii* abundances. Declines in *D. stokesii* were first identified in 2015, and by 2017 all colonies (>4cm diameter) were lost from the Palm Beach and Broward sites, and at DC8, which had the greatest *D. stokesii* abundance in 2013, only two of the 21 colonies in 2013 were still alive in 2017.

- *Meandrina meandrites* has also declined since 2013 and significant LTA loss was first documented in 2016 (Figure 4). Similar to *D. stokesii*, *M. meandrites* declines were first identified in 2015, and the decline was directly related to a loss in colony (>4cm diameter) abundance. In 2014, 19 sites had *M. meandrites* colonies, but in 2017, only three sites still had living colonies. In 2016 and 2017, only one site had a single *M. meandrites* colony compared to 2013-2015 when all six Broward sites had multiple colonies.

- *Montastraea cavernosa* LTA declined in 2016, and continual LTA loss led to a significant decline in 2017 (Figure 4). *Montastraea cavernosa* is often the greatest contributor to LTA in the SECREMP region and was believed to be one of the more robust corals; therefore, it is particularly concerning to have documented a significant decline in LTA region-wide for the species.

- *Solenastrea bournoni* LTA was significantly greater in 2014 than in 2017. Total *S. bournoni* abundance has decreased from a maximum of 58 colonies in 2014 to a minimum of 28 in 2017, and the number of sites with *S. bournoni* colonies has decreased from 16 in 2013 to 11 in 2017.

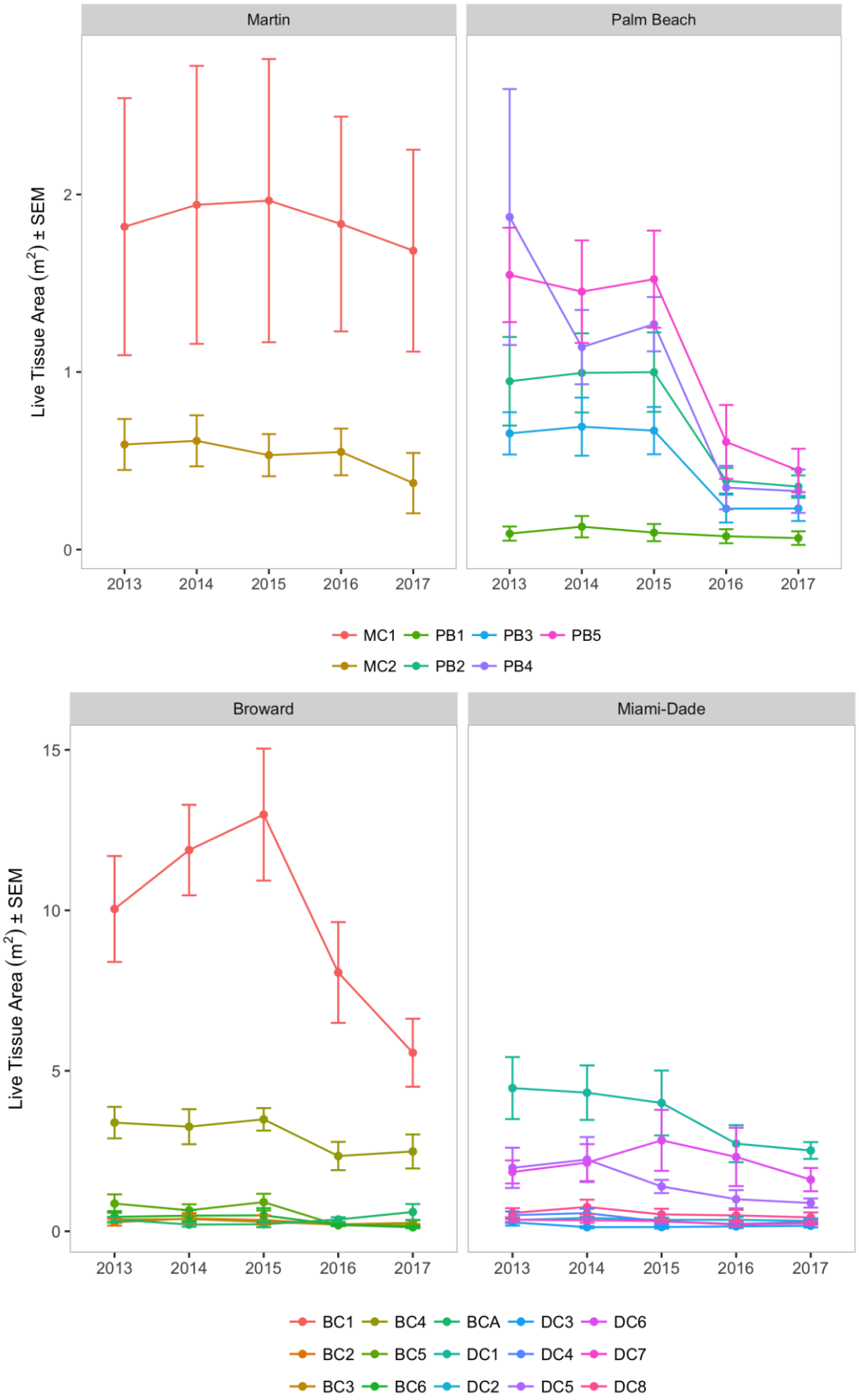

Figure 3. Mean (±SE) county site LTA 2013-2017.

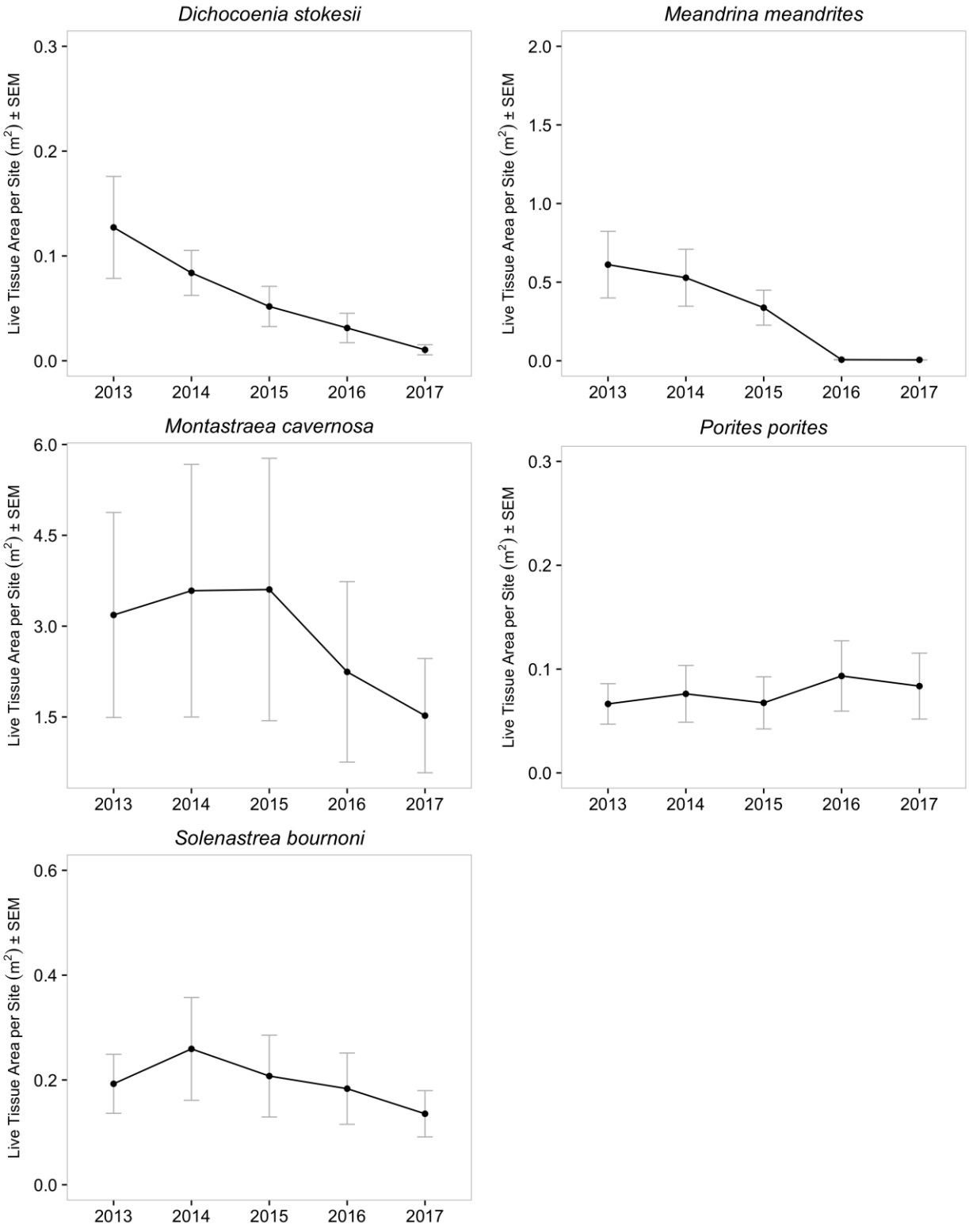

Figure 4. Mean (±SE) region-wide LTA for five species that were determined to have significant changes in LTA since 2013.

- *Porites porites* was the only species with a significant LTA increase (Figure 4) with 2017 significantly greater than 2013. Since 2013, there has been a general increase in total *P. porites* abundance (increase from 51 colonies in 2013 to 153 colonies in 2017) and the number of sites (eight in 2013 and 12 in 2017) with the species.

- Although *A. agaricites, P. astreoides,* and *S. siderea* contributed greatly to colony abundances at sites (BC1, BCA, DC1, and DC5) that had significant density increases in 2017 (Table 3), none of these species had significant region-wide LTA increases.

Octocoral and Xestospongia muta Density

- Region-wide (all sites pooled) octocoral density (colonies/m²) was significantly greater in 2015, 2016, and 2017 than in 2013 and 2014 (Figure 5).

- Three of the five octocoral target species saw significant changes in density from 2013 to 2017. *Eunicea calyculata* density was significantly greater in 2013, 2014, and 2015 than in 2016 and 2017 (Figure 6). *Gorgonia ventalina* density in 2017 was significantly greater in 2017 than 2013, and *Antilligorgia americana* density in 2015, 2016, and 2017 was significantly greater than in 2013 and 2014.

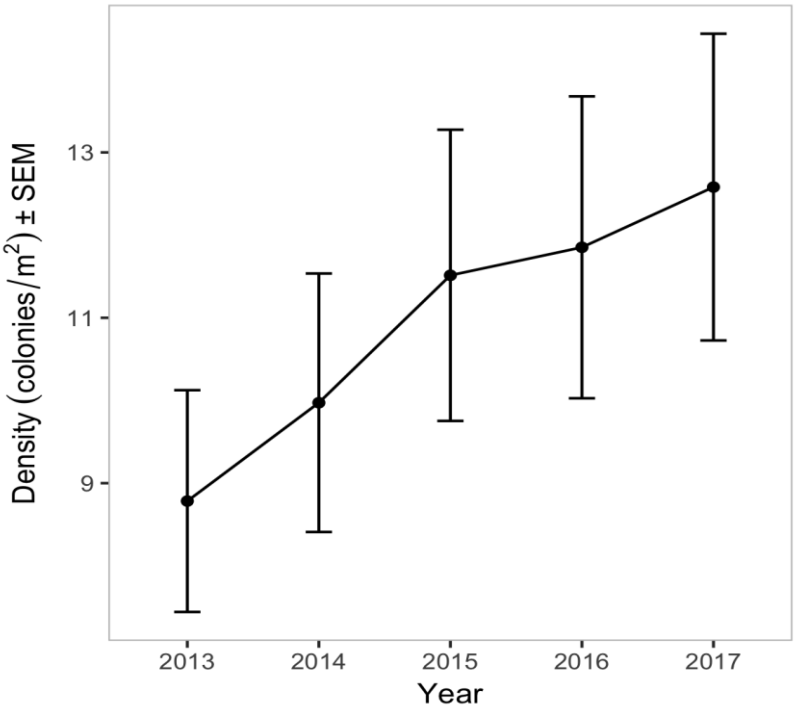

Figure 5. Mean (±SE) region-wide octocoral density (colonies/m^2) 2013-2017.

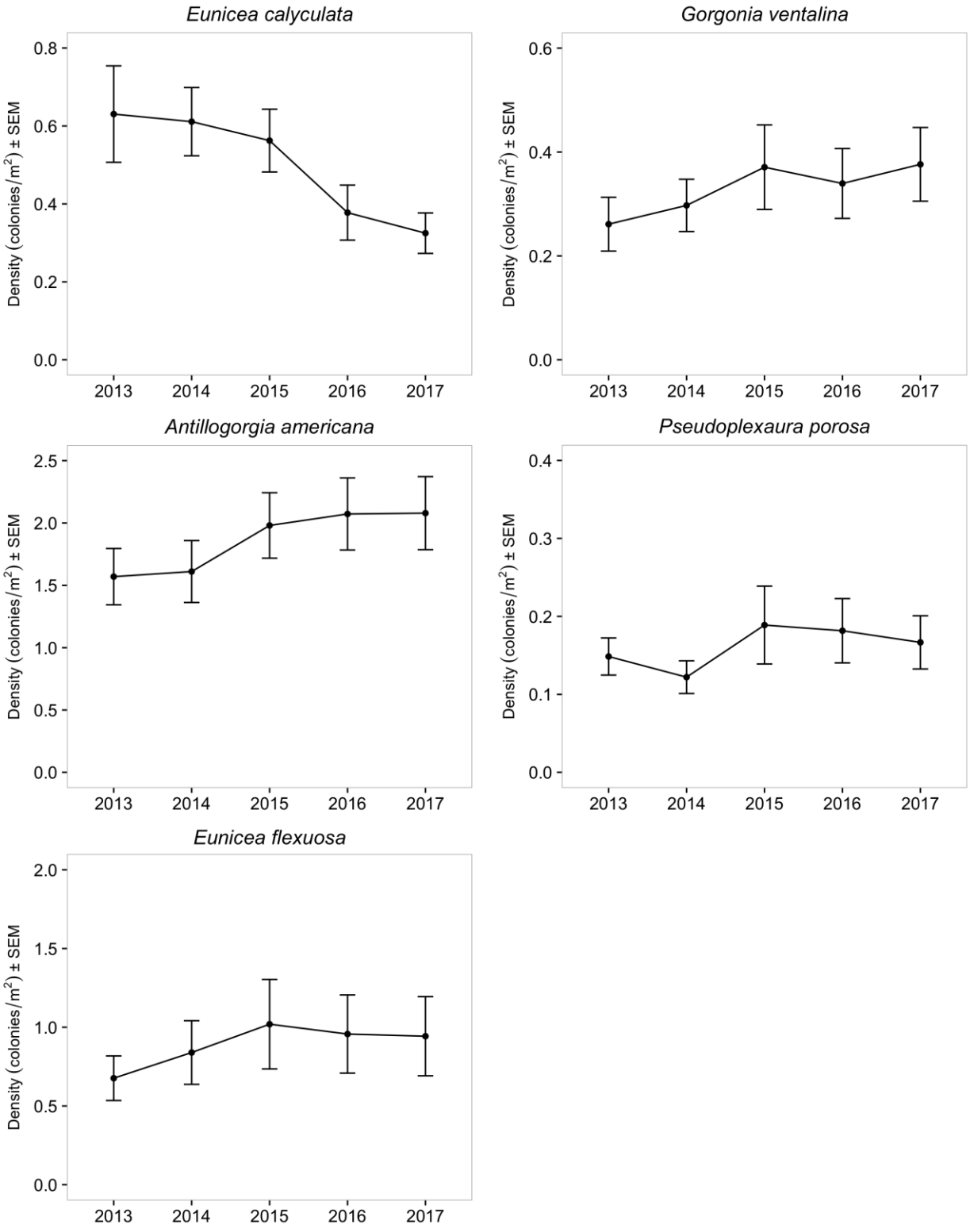

Figure 6. Mean (±SE) region-wide target species octocoral density (colonies/m^2) 2013-2017.

- Region-wide (all sites pooled) *X. muta* density has increased every year since 2013 (Figure 7), and density in 2017 was significantly greater than all previous years.

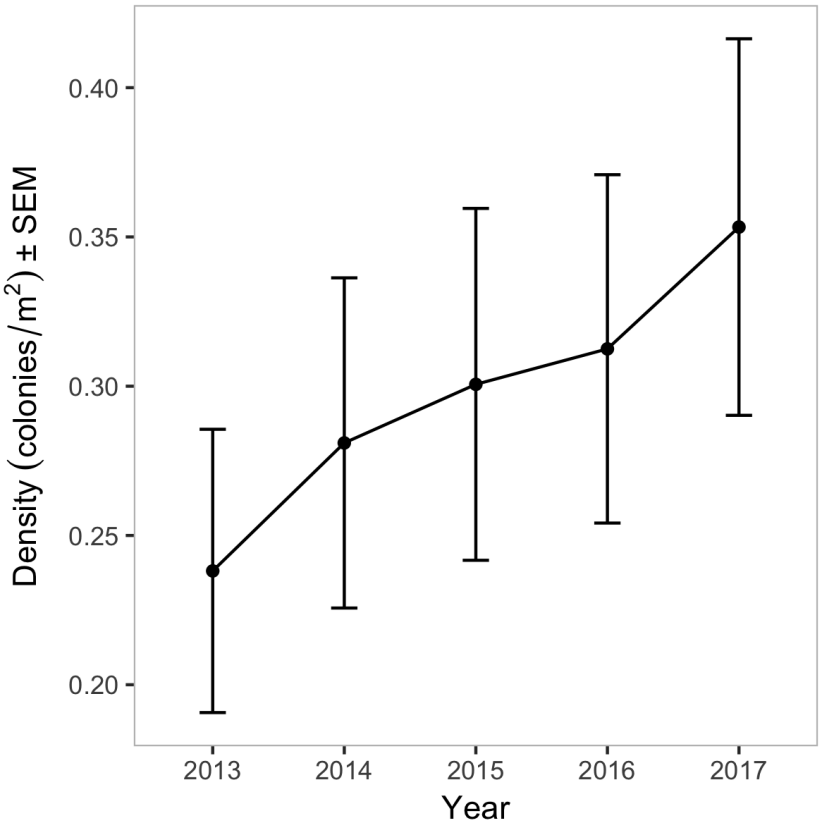

Figure 7. Mean (±SE) region-wide *X. muta* density (colonies/m^2) 2013-2017.

Functional Group Benthic Cover

- Long-term trends in benthic functional group (stony coral, octocoral, sponges, and macroalgae) cover are not presented in this Executive Summary. Long-term trend analysis (2003-2016) was presented in the 2016 comprehensive report (Gilliam et al. 2017).

- In 2017, region-wide stony coral cover was 1.47 ± 0.30% (Figure 8) and was not significantly different from the 2016 mean cover (1.52 ± 0.32%). 2016 mean cover was significantly lower than the 2015 cover (2.54 ± 0.54%) (Gilliam et al. 2017). At the site level, BC1 is the only site that had a significant decrease in cover from 7.28 ± 1.38% in 2016 to 4.91 ± 1.03% in 2017. BC1 also had a significant decrease in 2016 compared to 2015 (12.35 ± 1.17%) (Gilliam et al. 2017). BC1 cover was dominated by *M. cavernosa* and the significant loss in stony coral cover (see LTA Figure 4) in this site is directly related to disease-driven mortality. MC1 is the only site that had a significant increase in cover in 2017 (3.93 ± 1.26%) compared to 2016 (2.98 ±

1.23%). Although MC1 stony coral cover significantly increased in 2017, mean cover was similar to values in 2014 (3.60 ± 1.96%) and 2015 (3.60 ± 1.67%) (Gilliam et al 2017). An increase in cover in 2017 was attributed to an increase in *P. astreoides* abundance and cover.

- Region-wide octocoral cover in 2017 was 9.29 ± 1.23% (Figure 8) and was not significantly different from 2016 mean cover (8.76 ± 1.24%). BC2 (8.47 ± 1.44%) and DC2 (11.79 ± 1.56%) had a significant increase in cover in 2017 compared to 2016 (5.01 ± 0.63% and 8.49 ± 0.47%, respectively). PB4 was the only site that had a significant decrease in 2017 (15.40 ± 1.71%) compared to 2016 (19.12 ± 2.36) (Table 6).

- Region-wide sponge cover in 2017 (6.09 ± 0.75%) (Figure 8) was significantly greater than 2016 mean cover (5.44 ± 0.63%). BC2 cover in 2017 (6.79 ± 1.33%) was significantly greater than 2016 (4.45 ± 0.58%), and PB5 cover in 2017 (10.73 ± 1.47%) was also significantly greater than 2016 (7.49 ± 0.86%). MC2 was the only site that had a significant decrease in 2017 (1.90 ± 0.96%) compared to 2016 (3.36 ± 0.87%) (Table 6).

- In 2017, region-wide macroalgae cover was 13.09 ± 1.63% (Figure 8) and was significantly lower than the 2016 mean cover (28.30 ± 3.75%) which conversely was significantly greater than the 2015 cover (6.40 ± 1.18) (Gilliam et al. 2017). Eight sites had significantly lower cover in 2017 compared to 2016 while no sites had greater cover (Table 6).

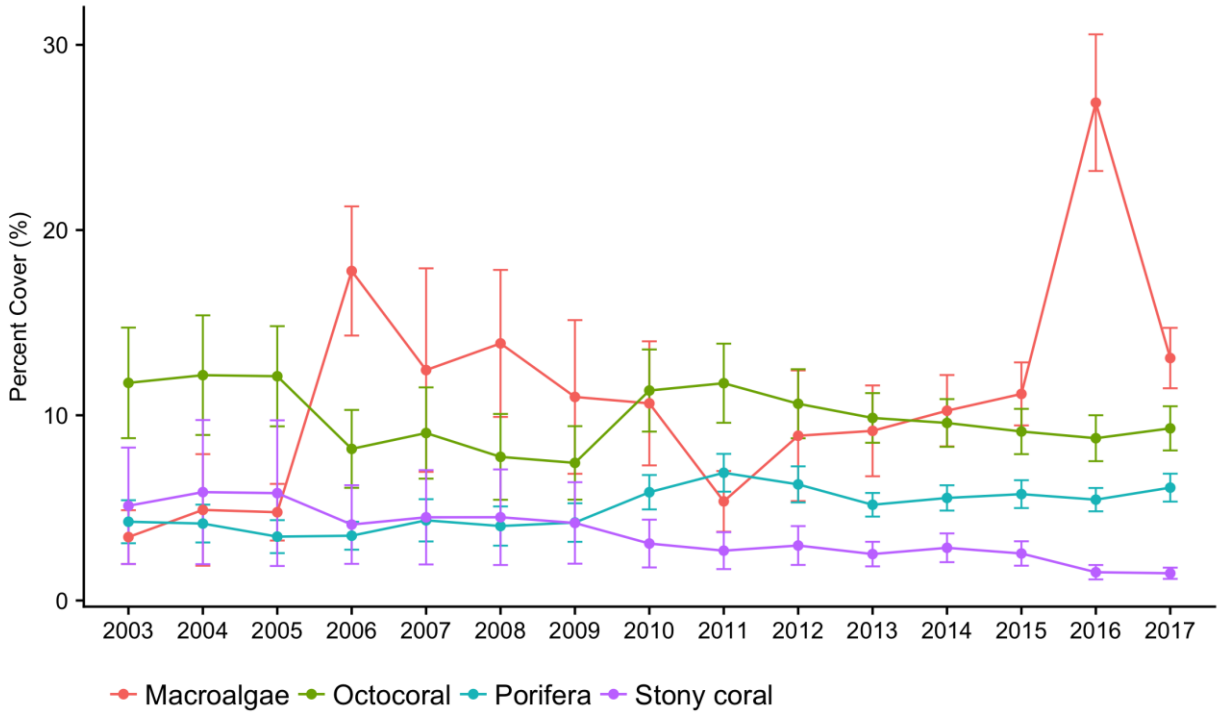

Figure 8. Mean (±SE) region-wide annual percent cover of stony coral, octocoral, sponge, and macroalgae (values for each year include all sites sampled that year).

Table 6. Mean (±SE) 2017 percent benthic cover for of stony coral, octocoral, sponge, and macroalgae. Bolded 2017 cover values with '+' are significantly greater than 2016 and cover values with '-' are significantly lower than 2016.

Site	Stony Coral	Octocoral	Sponge	Macroalgae
MC1	**+ 3.94 ± 1.14**	0.00 ± 0.00	2.14 ± 0.21	10.09 ± 3.72
MC2	1.13 ± 0.80	0.00 ± 0.00	**- 1.90 ± 0.55**	14.02 ± 4.83
PB1	0.06 ± 0.04	0.06 ± 0.06	5.65 ± 3.11	2.98 ± 1.13
PB2	1.14 ± 0.31	18.80 ± 4.19	8.13 ± 1.15	3.49 ± 1.75
PB3	0.59 ± 0.20	14.80 ± 1.71	14.78 ± 1.37	13.93 ± 3.33
PB4	1.44 ± 1.15	**- 15.40 ± 3.57**	13.23 ± 4.10	7.75 ± 2.17
PB5	0.60 ± 0.10	14.18 ± 1.21	**+ 10.73 ± 1.04**	21.73 ± 2.79
BC1	**- 4.92 ± 0.86**	6.32 ± 0.66	3.29 ± 0.11	27.00 ± 2.79
BC2	0.35 ± 0.11	**+ 8.48 ± 1.19**	**+ 6.79 ± 0.71**	**- 9.71 ± 1.68**
BC3	0.33 ± 0.12	9.38 ± 1.33	6.00 ± 0.82	21.96 ± 3.41
BC4	3.82 ± 0.57	4.58 ± 0.76	4.59 ± 0.07	28.11 ± 1.89
BC5	0.31 ± 0.12	7.05 ± 0.88	8.08 ± 1.07	**- 10.10 ± 0.70**
BC6	0.53 ± 0.16	14.09 ± 1.16	5.89 ± 0.59	19.75 ± 4.45
BCA	3.62 ± 0.75	1.16 ± 0.23	0.90 ± 0.26	5.64 ± 0.95
DC1	2.83 ± 0.35	9.37 ± 1.12	2.88 ± 0.35	**- 2.30 ± 0.34**
DC2	0.73 ± 0.19	**+ 11.79 ± 1.54**	6.38 ± 1.21	**- 9.46 ± 2.74**
DC3	0.36 ± 0.13	11.5 ± 0.94	4.55 ± 1.14	**- 15.03 ± 5.94**
DC4	1.01 ± 0.23	12.32 ± 0.64	8.14 ± 0.26	**- 7.75 ± 1.70**
DC5	0.94 ± 0.12	15.39 ± 1.56	5.72 ± 1.23	22.37 ± 4.30
DC6	2.22 ± 0.65	8.69 ± 0.68	3.02 ± 0.29	**- 6.35 ± 2.07**
DC7	0.45 ± 0.07	6.65 ± 0.84	7.73 ± 1.01	**- 12.39 ± 2.87**
DC8	1.04 ± 0.27	14.43 ± 1.4	3.48 ± 0.30	16.04 ± 4.62

Literature Cited

R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Gilliam, D.S., Walton, C.J., Brinkhuis, V., Ruzicka, R., and M. Colella. 2015. Southeast Florida Coral Reef Evaluation and Monitoring Project 2014 Year 12 Final Report. Florida DEP Report #RM085. Miami Beach, FL. pp. 43.

Gilliam, D.S., Walton, C.J., Hayes, N.K., Ruzicka, R., Colella, M., and Brinkhuis, V. 2017. Southeast Florida Coral Reef Evaluation and Monitoring Project 2016 Year 14 Final Report. Florida DEP Report #RM143. Miami Beach, FL. pp. 66.

This report should be cited as follows:

Gilliam, D.S., Hayes, N.K., Ruzicka, R., and Colella, M. 2018. Southeast Florida Coral Reef Evaluation and Monitoring Project 2017, Year 15 Executive Summary. Florida DEP Report #RM143-. Miami Beach, FL. pp. 15.

This is a report of the Florida Fish and Wildlife Conservation Commission and Nova Southeastern University pursuant to FDEP Grant No. RM143 to FWC. Though funded in part by a grant agreement from the Florida Department of Environmental Protection (FDEP) through National Oceanic and Atmospheric Administration (NOAA) Award No. NA15NOS4820036 to FDEP, the views, statement, findings, conclusions, and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the State of Florida or NOAA or any of their sub-agencies**.**