

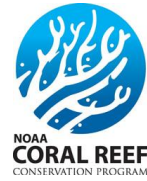
# Florida Reef Resilience Program

## Disturbance Response Monitoring



### Quick Look Report:

Summer 2016



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## **Introduction**

The summer of 2016 was a mild to moderate bleaching year for Florida's coral reefs. Moderate bleaching occurred in some areas of the South Palm Beach County, Broward-Miami, Upper Keys, Lower Keys and Dry Tortugas sub-regions while severe bleaching only occurred in the Upper Keys. Compared to the summer of 2014, which was the worst bleaching year since the Florida Reef Resilience Program (FRRP) Disturbance Response Monitoring (DRM) surveys began in 2005, and the summer of 2015, bleaching was substantially lower in 2016. Despite less prevalence of bleaching however, high disease prevalence and recent mortality were recorded at numerous sites throughout the Florida Reef Tract.

The FRRP is a collaborative effort among managers, scientists, conservation organizations and reef users, to develop resilience-based management strategies for coping with climate change and other stresses on Florida's coral reefs. With projected increases in coral bleaching due to climate change, the FRRP DRM was developed for monitoring shallow coral reefs from the Dry Tortugas to Martin County. The DRM consists of a probabilistic sampling design and a stony coral condition monitoring protocol implemented during the annual period of peak thermal stress. Each year, survey teams from federal, state, and local government agencies, universities and non-governmental organizations cooperate to complete surveys across the south Florida Reef Tract within an eight to ten-week period. In 2016, surveyors included: The Nature Conservancy, Mote Marine Laboratory, University of Miami, Nova Southeastern University, Miami-Dade County, Broward County, Florida Fish and Wildlife Conservation Commission, Florida Department of Environmental Protection, National Oceanic and Atmospheric Administration and National Park Service.

## **Methodology**

The DRM consists of a probabilistic sampling design that focuses on sampling the coral population based on how corals are distributed spatially within and across different sub-regions and zones of the overall reef tract. For the 2016 DRM season, 230 potential sample sites were allocated across 28 discrete reef zones in 10 sub-regions. Twelve survey teams of scientific divers conducted the monitoring in 2016. In addition to these sites, surveys were completed at three fixed Coral Reef Evaluation and Monitoring Project (CREMP) sites and one fixed Southeast Florida Coral Reef Evaluation and Monitoring Project (SECREMP) site.

For random sites, two independent 1x10m belt transects were randomly placed within each 100x100m sampling site. At fixed sites, a 1x10m belt transect was completed at plots 1 and 2. Transect tapes were run from the offshore to inshore stake within each plot, and chain was laid beneath the tape. Surveyors then completed the 1x10m belt transect starting from the offshore stake, working inshore. At all sites, indicators were then recorded for all stony corals greater than 4cm including: 1) hard coral size and 2) hard coral condition as determined by the presence of bleaching and paling, the precursor to bleaching, presence of disease, and percent mortality.

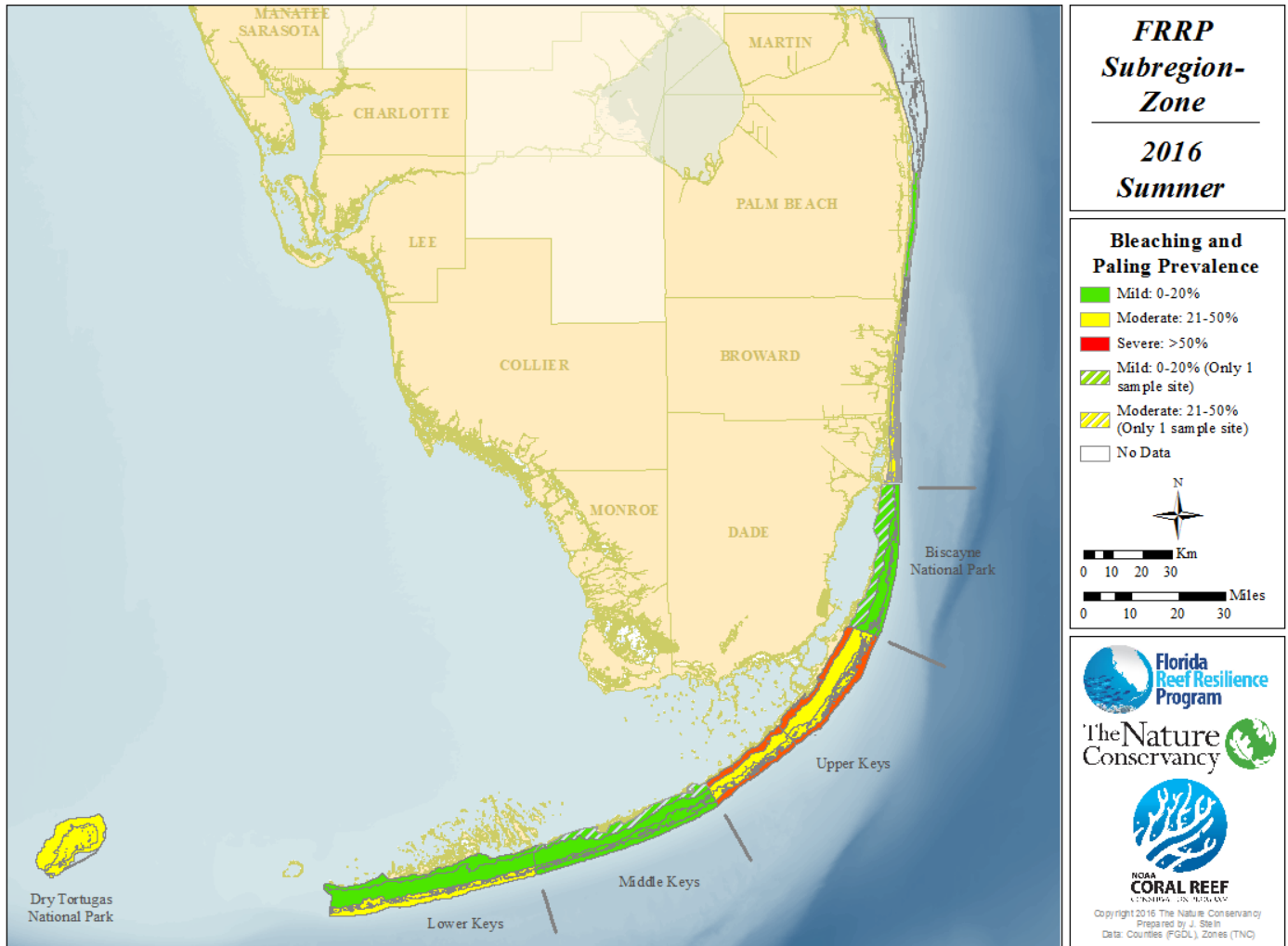
## Results

A total of 162 DRM surveys were completed from August 15<sup>th</sup> through October 21<sup>st</sup>, 2016. Frequent storms late in the bleaching season kept several survey teams from completing some of their assigned sites. This resulted in some sub-regions and zones being under represented within the dataset. Of the 28 zones surveyed during the summer 2016 bleaching season several had minimal representation of sites, four of which only had one site surveyed. The total number of surveyed sites per sub-region and zone are listed in **Table 1**. In **Figure 1** each zone is color coded to display its level of bleaching and paling prevalence. Zones that had no sites surveyed are outlined in **Figure 1** but are not symbolized based on their degree of bleaching and paling while hash shading represents a zone with only 1 sample site. Due to the limited sites surveyed in some zones, an additional map is presented in this report (**Figure 2**) to display the degree of bleaching and paling at each site.

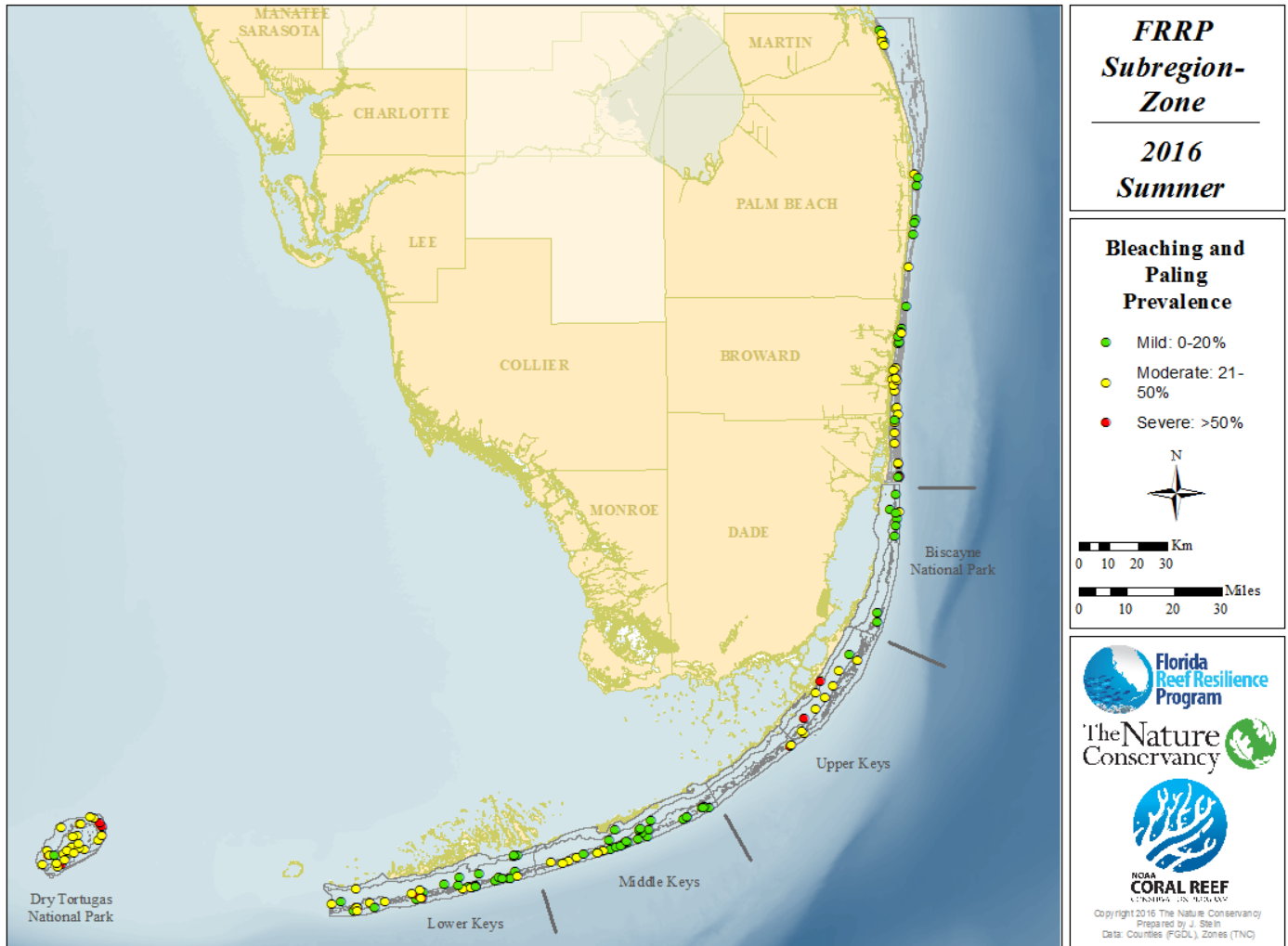
The prevalence of bleaching and paling in each zone was determined and broken into three categories: mild (0-20%), moderate (21-50%) and severe (>50%) (**Figures 1 and 2; Table 1**). Severe bleaching and paling, which is defined as >50% of all hard corals over 4cm surveyed showing signs of bleaching or paling, occurred in the inshore reef and forereef of the Upper Keys. Moderate bleaching and paling (21-50%) occurred in at least one zone within the South Palm Beach, Broward-Miami, Upper Keys, Lower Keys and Dry Tortugas sub-regions. Mild bleaching and paling (0-20%) occurred in at least one zone in the Broward-Miami, South Palm Beach and Martin sub-regions.

Among the 28 zones surveyed, 12 were categorized as having moderate bleaching and paling and two were categorized as having severe bleaching and paling. Several of these zones were heavily influenced by the prevalence of paling, especially those zones in the Upper Keys (**Table 1**). When corals are pale they are exhibiting signs of stress but have not completely expelled their symbiotic zooxanthellae to become bleached. This is important to note since pale corals can potentially recover at a faster rate than those corals that are partially or completely bleached.

Current Conditions reports for southeast Florida, between Miami-Dade and Martin County, reported “Moderate” threats of mass bleaching through the month of August but then decreased to a “Low” level threat in September. Current Conditions reports for the Florida Keys reported “Moderate” threats of mass bleaching in mid-July but the threat level decreased to “Low” in August.



**Figure 1:** Percent bleaching and paling prevalence of surveyed hard coral colonies by sub-region and zone.

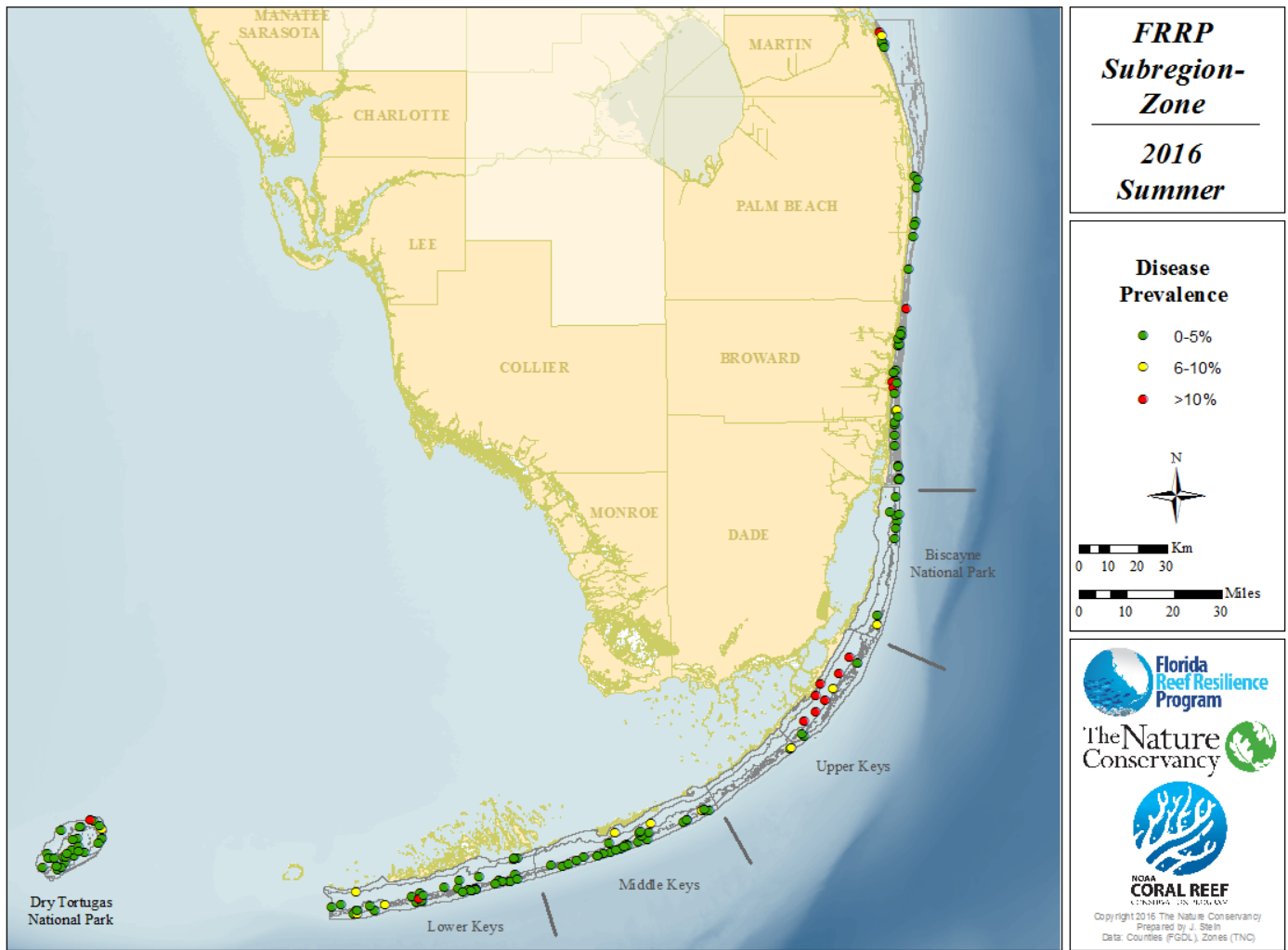


**Figure 2:** Percent bleaching and paling prevalence of surveyed hard coral colonies by site.

**Table 1:** Bleaching and paling prevalence of hard coral colonies surveyed by sub-region and zone. Red indicates severe (>50%), yellow indicates moderate (21-50%) and green indicates mild (0-20%) bleaching and paling prevalence. (\*) Identifies sub-region and zones with only one sample site completed.

Sub-Region Zone	# of Sites	% Paling Prevalence	% Bleaching Prevalence	% Bleaching and Paling
Martin-Inshore	6	5.10	12.22	17
South Palm Beach-Inshore*	1	22.22	0.00	22
South Palm Beach-Outer Reef	4	3.95	5.56	10
South Palm Beach-Undetermined	2	11.76	0.00	12
Deerfield-Outer Reef*	1	0.00	0.00	0
Broward-Miami-Inner Reef	7	21.47	4.85	26
Broward-Miami-Inshore	6	21.76	11.82	34
Broward-Miami-Middle Reef	5	14.43	10.62	25
Broward-Miami-Outer Reef	4	14.58	15.70	30
Broward-Miami-Undetermined	3	21.05	10.53	32
Biscayne-Forereef	3	5.44	11.85	17
Biscayne-Inshore*	1	14.29	0.00	14
Biscayne-Mid Channel	2	4.71	0.59	5
Biscayne-Offshore Patch Reef	3	9.38	1.05	10
Upper Keys-Forereef	2	47.43	4.79	52
Upper Keys-Inshore	2	64.14	0.00	64
Upper Keys-Mid Channel	6	30.14	4.59	35
Upper Keys-Offshore Patch Reef	3	30.39	7.30	38
Middle Keys-Forereef	26	14.83	1.14	16
Middle Keys-Inshore*	1	0.00	0.00	0
Middle Keys-Mid Channel	2	2.74	2.40	5
Middle Keys-Offshore Patch Reef	3	6.02	2.26	8
Lower Keys-Forereef	24	20.66	4.85	26
Lower Keys-Inshore	4	14.50	3.05	18
Lower Keys-Mid Channel	7	11.22	5.00	16
Lower Keys-Offshore Patch Reef	5	18.97	4.97	24
Tortugas--Dry Tortugas NP-Forereef	18	25.76	8.53	34
Tortugas--Dry Tortugas NP-Lagoon	11	19.66	7.30	27

The disease prevalence at each site was determined and broken into three categories: (0-5%), (5-10%) and (>10%) (**Figure 3**). High disease prevalence (>10%) occurred at sites within the Martin, Broward-Miami, Upper Keys, Lower Keys and Dry Tortugas sub-regions (**Table 2**). Over fifty percent of the high disease prevalence (>10%) sites are within the Upper Keys sub-region (**Table 2**).

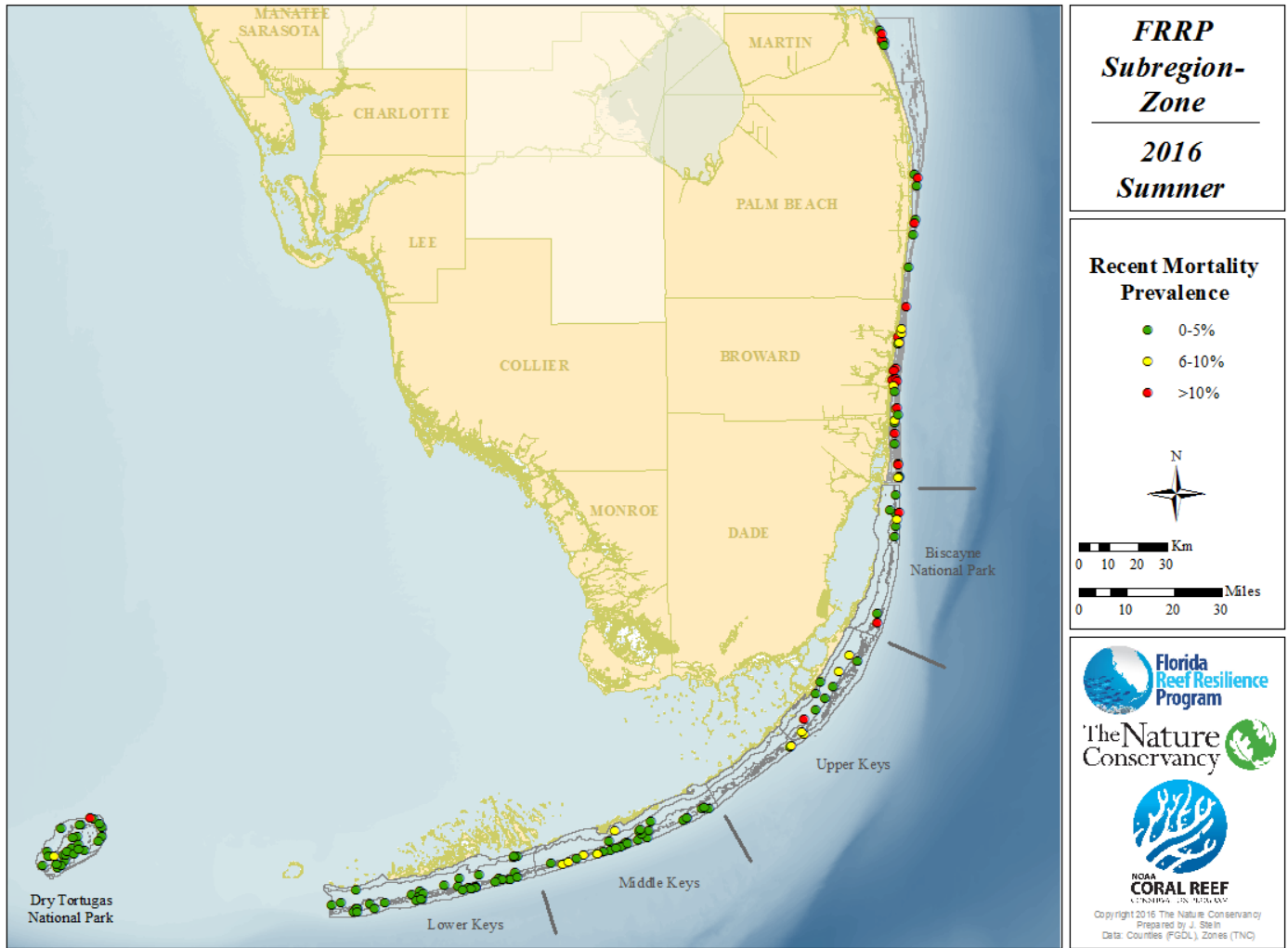


**Figure 3:** Percent disease prevalence of surveyed hard coral colonies by site.

**Table 2:** High disease prevalence (>10%) of hard coral colonies surveyed by site.

<b>Site</b>	<b>Sub-Region Zone</b>	<b>% Disease Prevalence</b>
1000	Martin-Inshore	12.50
4032	Deerfield-Outer Reef	16.67
1058	Broward-Miami-Inshore	11.76
1031	Broward-Miami-Inshore	12.50
3006	Upper Keys-Mid Channel	14.29
3007	Upper Keys-Mid Channel	15.52
3022	Upper Keys-Mid Channel	15.93
3005	Upper Keys-Mid Channel	23.81
3008	Upper Keys-Inshore	29.41
3023	Upper Keys-Mid Channel	31.58
3009	Upper Keys-Inshore	35.71
1208	Lower Keys-Offshore Patch Reef	17.20
2232	Tortugas--Dry Tortugas NP-Forereef	17.65

The prevalence of recent mortality at each site was determined and broken into three categories: (0-5%), (5-10%) and (>10%) (**Figure 4**). High recent mortality prevalence (>10%) occurred at sites within the Martin County, Broward-Miami, Upper Keys, Lower Keys and Dry Tortugas sub-regions (**Table 3**). Sixty percent of those high recent mortality prevalence (>10%) sites are within the Broward-Miami sub-region (Table 3).



**Figure 4:** Percent recent mortality prevalence of surveyed hard coral colonies by site.



**Table 3:** Recent mortality prevalence (>10%) of hard coral colonies surveyed by site.

Site	Sub-Region Zone	% Recent Mortality Prevalence
2004	Martin-Inshore	18.75
1006	Martin-Inshore	21.43
1016	South Palm Beach-Outer Reef	16.67
2014	South Palm Beach-Undetermined	33.33
4032	Deerfield-Outer Reef	50.00
1043	Broward-Miami-Inner Reef	12.00
1037	Broward-Miami-Inner Reef	14.81
1056	Broward-Miami-Inshore	11.11
1031	Broward-Miami-Inshore	12.50
1032	Broward-Miami-Inshore	33.33
1057	Broward-Miami-Inshore	36.36
1052	Broward-Miami-Middle Reef	11.76
2049	Broward-Miami-Outer Reef	9.52
1054	Broward-Miami-Outer Reef	18.18
1053	Broward-Miami-Outer Reef	25.93
4021	Biscayne-Forereef	10.53
3025	Biscayne-Offshore Patch Reef	10.71
3015	Upper Keys-Forereef	10.34
3005	Upper Keys-Mid Channel	10.71
2232	Tortugas--Dry Tortugas NP-Forereef	13.45

Comparing the 2014, 2015 and 2016 datasets, the % bleaching for the entire Florida Reef Tract was overall substantially lower in 2016 (**Table 4**). The prevalence of paling in 2016 was lower than in 2015 but slightly higher than the prevalence found in 2014. However, after two consecutive summers of mass coral bleaching in 2014 and 2015, the 2016 summer saw a higher percentage of corals with disease that was most concentrated in the Upper Keys sub-region. Despite lower sea surface temperatures in the summer months, it is likely that the coral communities remained in a state of stress making them potentially more susceptible to disease outbreak and subsequent mortality. Prevalence of recent mortality in 2016, although slightly lower than 2015, was again concentrated in the Broward-Miami region, similar to 2014 and 2015.

**Table 4:** Percent paling, bleaching, combined bleaching and paling, recent mortality and disease prevalence for the Florida Reef Tract in 2014, 2015 and 2016.

Year	% Paling Prevalence	% Bleaching Prevalence	% Bleaching and Paling Prevalence	% Recent Mortality Prevalence	% Disease Prevalence
2014	18.19	51.78	69.97	3.19	1.42
2015	23.34	28.41	51.75	2.64	1.35
2016	19.16	4.81	23.97	2.16	2.33

For more information about FRRP and its DRM effort see the website [www.frrp.org](http://www.frrp.org). For more information about the Summer 2016 DRM results contact The Nature Conservancy at (305) 872- 7071 or email Jennifer Stein, Marine Science Technician, at [Jennifer.Stein@tnc.org](mailto:Jennifer.Stein@tnc.org).