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Project Title: Long-term Coral Bleaching Assessment of the Southeast Florida Reef Tract; An Indicator of Climate Change?

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Abstract:

The NOAA grant funding was used to implement and analyze the results of the coral bleaching assessment during the 2009 bleaching period as part of the Florida Reef Resilience Program (FRRP). The coral bleaching assessment was based on a program previously conducted during the summers of 2005-2008. The assessment area covered the reef tract from the Dry Tortugas to Martin County. During the period of this award survey teams were identified, the online-entry database was refined, training workshops were held, permits were received, contracts were created, surveys were completed, data was entered, and results were analyzed. A total of 259 surveys were completed over an eight week period, and data results determined 2009 to be a mild to moderate bleaching year, varying between the different sub-regions.

Report Narrative:

A. Introduction

The Florida Reef Resilience Program (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 Disturbance Response Monitoring (DRM) was developed for monitoring shallow coral reefs from Martin County to the Dry Tortugas. The DRM consists of a probabilistic sampling design and a stony coral condition monitoring protocol implemented across 59 discrete reef zones during the annual period of peak thermal stress. Each year, survey teams from federal, state, and local government agencies, non-profit organizations, and universities cooperate to complete surveys across the south Florida reef tract within a six to eight week period. Information is gathered on the coral population's size frequency, size structure, and bleaching prevalence. Previous results from these surveys show spatial and temporal patterns in coral bleaching and colony size frequency distribution, indicating that some zones and coral species may be more resilient to stress than others.

Funding from Florida's Wildlife Legacy Initiative was secured for coral bleaching assessments taking place during 2008. Due to a mild/no bleaching year, there was no need for follow up surveys during the winter 2008. Therefore, this grant funding was used to implement and analyze the results of the 2009 summer coral bleaching assessments.

B. Methods

Sampling Design

The DRM consists of a probabilistic sampling design which focuses on sub-sampling the coral population based on how corals are distributed spatially within and across different zones. Based on existing sampling performance measures, this should yield a coefficient of variation (CV) between 10 and 15% or the power to detect change across the FRRP region, subregions, and zones. For the 2009 DRM season, 227 sample sites were allocated across 59 discrete reef zones. These sites were then distributed between 12 survey teams to be completed over an eight week period.

Training Workshops

Two training workshops were held two to three weeks before the surveys began at Nova Southeastern University in Dania Beach and Mote Marine Laboratory in Summerland Key. Workshops consisted of inter-observer comparisons of coral colony size boundaries, condition size boundaries, condition measures, and coral identification. An in-water training session was held after the workshop at Mote Marine Laboratory, where surveys were completed at an inshore patch reef off Big Pine Key.

Surveys

Two independent 1x10m belt transects were randomly placed within each 200x200m sampling site. Four main indicators were then recorded for all stony corals greater than 4cm including: 1) live coral cover, 2) hard coral density, 3) hard coral size, and 4) hard coral condition (bleaching, disease, partial mortality).

Once the surveys were completed, the data was entered into an online database by each survey team. This data was then transferred into an Access database by the database manager that can be used to analyze the data.

C. Results

The 2009 FRRP-DRM assessment included the reef tract from the Dry Tortugas to Martin County. Permits for the FRRP-DRM sites in the Dry Tortugas National Park were submitted and approved. A permit was applied for and received in July 2008 from the Florida Keys National Marine Sanctuary to conduct surveys through the 2009 sampling season. Coordination meetings and in-water training sessions were scheduled and held on July 21st and July 28th, 2009. These trainings took place at Mote Marine Laboratory in Summerland Key and Nova Southeastern University in Dania Beach. Training materials, handouts, and presentations were created and used for these trainings, and can be found at www.frrp.org. Team leaders and their staff from each of the 12 surveying agencies (see Table 1) participated in these trainings. Contracts were finalized in August 2009 for the implementation of the surveys, maintenance of the online database, and the Dry Tortugas research vessel. TNC staff completed all dive trainings necessary to become official AAUS members, allowing staff to dive with other partner agencies. This year, TNC staff created our own randomized sampling points with the help of the previous contractors from The University of Miami RSMAS. 227 sampling points were determined (see Figure 1) based on previous year efforts, a modified sampling grid, and % reef area. These sites were distributed to the team leaders at the

trainings in July, and surveyed from August 3rd to September 30th. All survey data was then entered into the online database by October 15th. A quicklook reporting system was also created from this database, so that surveyors can query their data for their sub-region. This can also be found at www.frrp.org.

The data was then checked for errors, and analyzed to determine the degree of bleaching occurring in each of the sub-regions. Over the eight week sampling period, 12 agencies completed 259 surveys (see Figure 2). This was a record number of surveys completed since the program began in 2005. A total of 36 surveys were completed in the Dry Tortugas alone. Although bleaching reports from the NOAA Coral Reef Watch Program were anticipating a high bleaching year in the Caribbean, including the Florida Keys, based on anecdotal reports the degree of bleaching was mild. 2009 was confirmed as an overall mild to moderate bleaching year based on the data analysis (see Figure 3). Moderate bleaching occurred in at least one zone of each sub-region, except in Broward and the Dry Tortugas. The Palm Beach sub-region had moderate bleaching in all four zones.

D. Conclusions

The average number of surveys completed over the last four years (2005-2008) is 160 surveys. This year during the summer of 2009, 259 surveys were completed. This was the greatest survey effort thus far. This was mainly due to increased team collaboration in different sub-regions, and teams becoming more familiar with the surveys. Overall the 2009 FRRP-DRM surveys were the most extensive and informative to date.

Based on the analysis of the bleaching data, 2009 was a mild to moderate bleaching year. Comparing this data to the 2005 and 2008 moderate bleaching year data, the zones that displayed moderate bleaching in 2009 were not the same as in 2005 and 2008. 2006 and 2007 were overall mild bleaching years, with no moderate bleaching occurring in any zones. Comparing five years of data, it appears difficult to predict which zones will have higher levels of bleaching from year to year. Continued monitoring during bleaching events is recommended to compare datasets from year to year to detect long-term patterns and identify zones that may be more resilient over time. Annual surveys also provide surveyors with up to date trainings, materials, and a communication network for initiating surveys for other disturbance events.

E. Figures, Photos, and Tables

Figure 1: Map of the 2009 FRRP-DRM sampling points (227 total points)

FRRP-DRM 2009 Sampling Points

227 Primary and Alternate Points

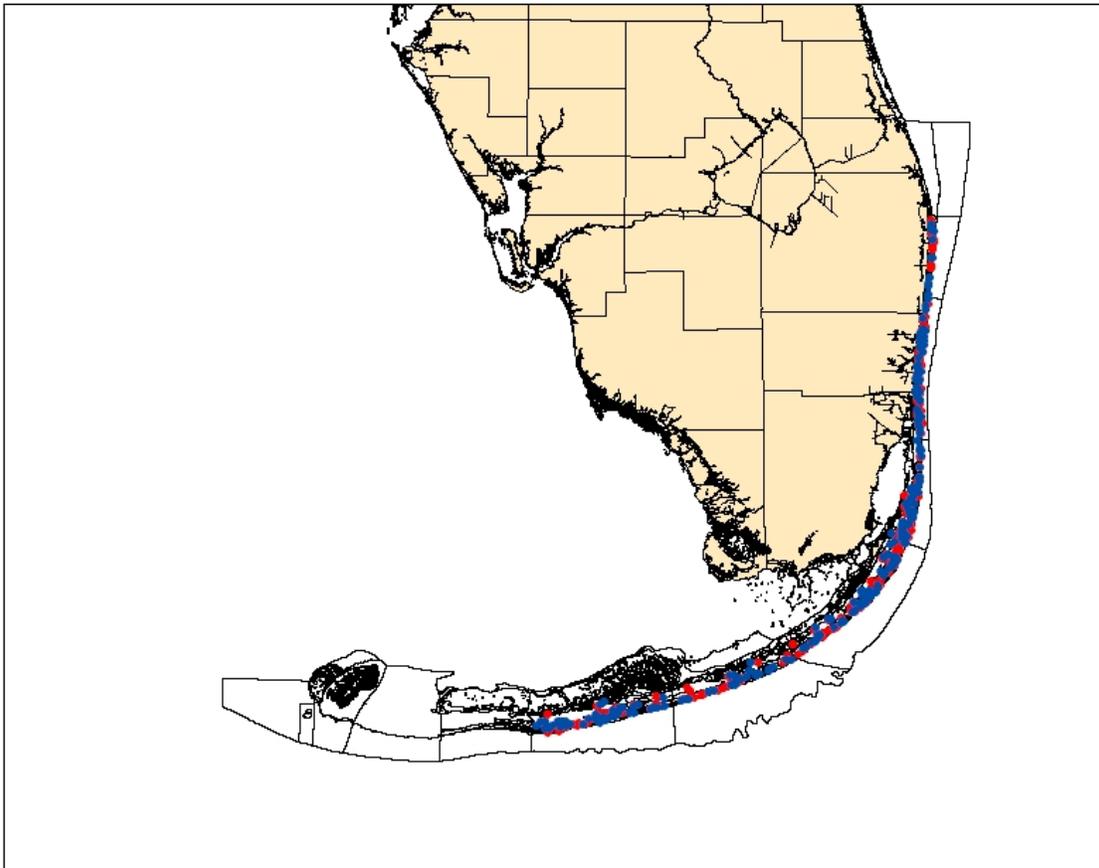


Figure 2: Map of the 2009 FRRP-DRM surveyed sites

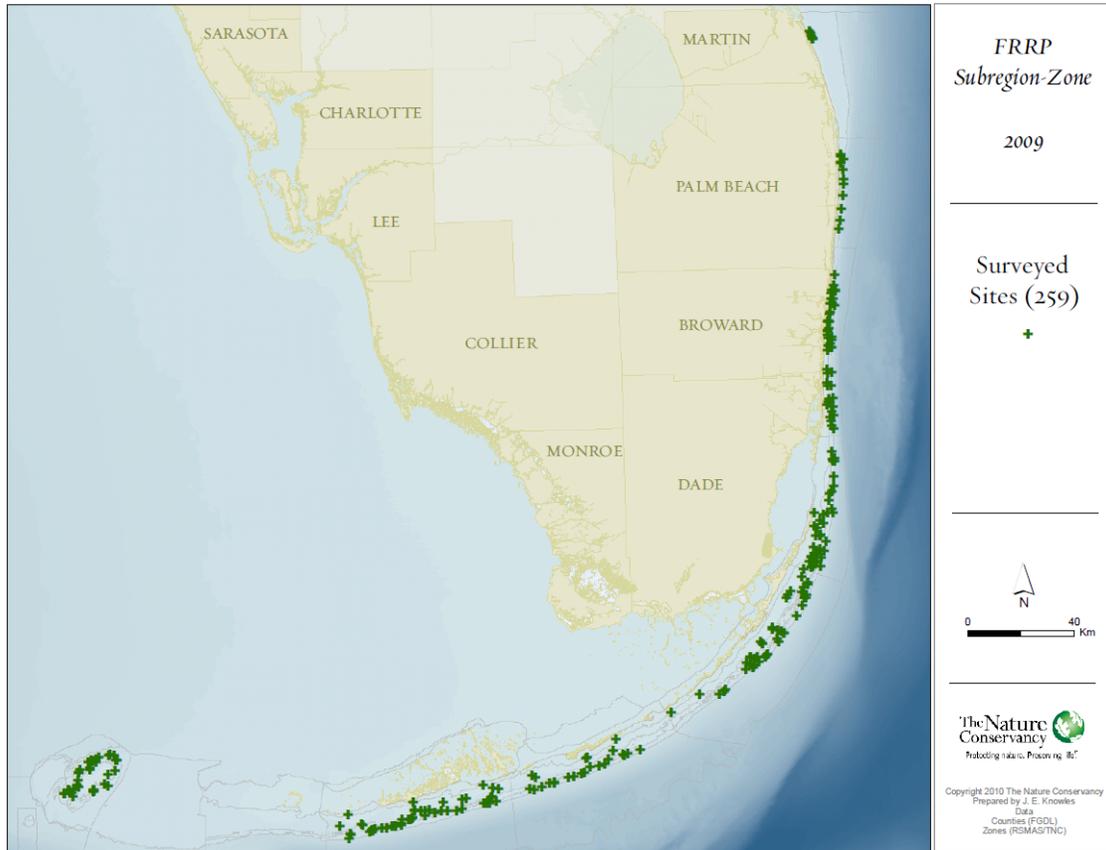


Figure 3: 2009 percent bleaching map for Martin County through the Dry Tortugas

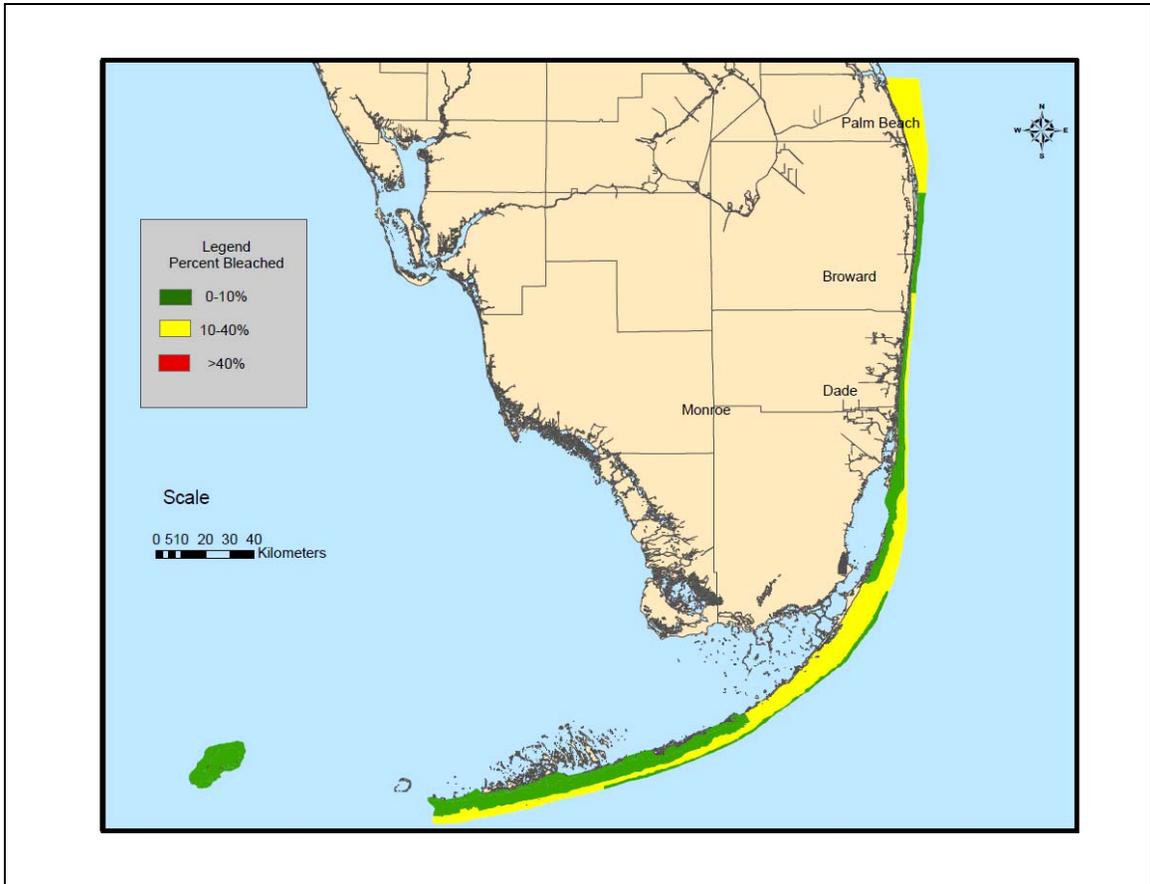


Photo 1: Surveyors in the Dry Tortugas



Photo 2: Bleached *Siderastrea siderea* coral



Table 1: List of partner agencies participating in the 2009 FRRP DRM surveys

Partner Agencies
Florida Department of Environmental Protection's (FDEP) Coral Reef Conservation Program
FDEP's- John Pennekamp State Park
Florida Fish and Wildlife Conservation Commission's (FWCC)-Division of Habitat and Species Conservation
Biscayne National Park
Broward County-Environmental Protection Department
Miami-Dade County-Environmental Restoration and Enhancement Section
Mote Marine Laboratory
Nova Southeastern University-National Coral Reef Institute (NCRI)
University of Miami-Rosenthal School of Marine and Atmospheric Science (RSMAS)
NOAA-Florida Keys National Marine Sanctuary
FWC-Fish and Wildlife Research Institute (FWRI)
DEP- Martin County