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SEFSC Coral Reef Program: FY 2013 Project Accomplishments Report

Compiled by:
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I. INTRODUCTION

The NOAA Coral Reef Conservation Program (CRCP) is a matrix program operating across four NOAA line offices: National Ocean Service (NOS), National Marine Fisheries Service (NMFS), National Environmental Satellite, Data, and Information Service (NESDIS), and Oceanic and Atmospheric Research (OAR) and is administered by NOS. The program supports coral reef regions of the United States (U.S.), has an international component, and is integrated with other federal agencies, states, territories and commonwealths, and local governments. Recommendations from a 2007 external program review, along with the subsequent planning process (the "roadmap") and a change in leadership in 2011, have shaped the recent history of the CRCP, including the genesis of the National Coral Reef Monitoring Plan (NCRMP), the Coral Program's "national status and trends" monitoring program.

The Southeast Fisheries Science Center (SEFSC) has been a leader in coral reef conservation science since 1978. Congress passed the Coral Reef Conservation Act in 2000 and SEFSC dovetailed its management-relevant coral reef science with the fledgling NOAA CRCP. SEFSC maintains a strong coral reef science program and continues to deliver high-caliber, peer-reviewed science in support of coral reef conservation and management and other NMFS mandates to conserve the nation's fisheries, essential fish habitat, and protected species. The reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (2006) puts a heavier burden on data quality in many coral reef ecosystems. Additionally, the listing of two Atlantic corals as threatened under the Endangered Species Act (ESA) in 2006, and a petition to list an additional 83 species of coral in 2009, underscores the importance of NMFS as a critical regulatory authority to effect change in coral reefs.

In Fiscal Year (FY) 2013, CRCP supported 13 SEFSC-led projects totaling ~$1.8M. While most projects addressed fishing impacts or the status and recovery of protected coral species, SEFSC also tackled projects looking at climate impacts on reef ecosystems by downscaling global climate models to a regional scale, and exploring the impacts of climate on coral spawning and settlement. New projects were funded that explore fishing behavior in St. Croix, fisher perceptions of marine protected areas in Puerto Rico, and bottlenecks that impact protected coral spawning and gamete success.

SEFSC continued its leadership role with the status review for 82 of the 83 corals petitioned for listing under the ESA. SEFSC has been proactively working with NOAA and other agencies to anticipate the impacts a listing decision may have on research, conservation, and management activities, including drafting a programmatic Environmental Assessments to ensure critical research can continue. In tandem with these ESA considerations, SEFSC is also exploring the impact of parrotfish and other herbivores on the persistence and recovery of protected corals – a subject that impacts not only corals, but reef fish fisheries as well. Work continued on reef fish distribution and abundance in support of ecosystem, fisheries, and place-based management. In an effort to identify and protect reef fish spawning aggregations, we continued research on their behavioral ecology. 2013 marked the first operational year of NCRMP. The Atlantic Biological Monitoring Team collected data in Flower Garden Banks National Marine Sanctuary and surrounding reefs and the United States Virgin Islands (USVI), St. Thomas and St. John. Behind the scenes, the NCRMP team made significant progress on methods and protocols and data management.

NMFS SEFSC plays the critical role of providing the science to support the agency's regulatory responsibilities in the Southeast, Caribbean, and Gulf regions. In 2013 SEFSC worked collaboratively with the regional Fishery Management Councils on council specific projects, addressing marine protected area (MPA) and other fisheries management questions in both the South Atlantic and Gulf of Mexico. SEFSC also helped CRCP draft CRCP's Fishing Impacts Implementation Plan which will guide CRCP's investments aimed at addressing the impacts of fishing on reef resources.

This annual accomplishments report provides information on the activities and accomplishments of SEFSC's projects funded by the CRCP in FY13, organized by the program's goals and objectives. SEFSC gratefully acknowledges funding from NOAA's CRCP.

II. PROGRAM COORDINATION

Project ID#:	1250-2013
Title:	SEFSC Coral Reef Conservation Program Coordination and Communication
PIs and co-PIs:	Jennifer Schull (SEFSC)
Duration of Project:	Year 3 of 3
Project Category:	Program Coordination

Brief description of activities conducted in FY2013

This project provided program management for SEFSC's portfolio of coral reef related activities in FY13. It covered SEFSC participation in working groups, and coordination of SEFSC projects, budgets, accomplishments reporting, proposal development, and science communication. It ensured SEFSC participation in all CRCP related strategic planning initiatives and ensured all SEFSC activities were integrated with and communicated to the relevant management entities. This project supported SEFSC representation in NCRMP development and execution.

Description of accomplishments & results

The Program Coordinator coordinated all SEFSC CRCP projects in FY13, including development of pre-proposals and full proposals, monitoring and executing budget and travel ceiling requirements, contracting and reporting for the approved projects. All updates to CRCP on project performance and accomplishments were completed, and SEFSC inputs into CoRIS (the Coral Reef Information System) were monitored. The Program Coordinator cultivated strong working relationships with management partners, including the integration of extant monitoring activities with the new NCRMP protocols. SEFSC was well represented on CRCP issues concerning fishing impacts implementation planning, performance measures, database redesign, data management, outreach and communications, and international activities. All planning documents were reviewed by SEFSC subject matter experts, and grant reviews for several CRCP grant programs were coordinated.

Integration of coral reef related activities with other NOAA and NMFS missions continues to be a priority. This year, the Program Coordinator worked with Protected Resources and Sustainable Fisheries in support of the Parrotfish Biological Opinion, oversaw continuing progress on the Octocoral project in support of the South Atlantic Fishery Management Council, wrote and edited the NOAA Caribbean Strategy and Science and Technology International Strategy, coordinated SEFSC's input into a Territorial Fishery Data Improvement Plan, and was on a working group for developing improvements to fishery independent data collection activities in the US Caribbean.

The Program Coordinator continues to serve as the principal SEFSC point of contact for NCRMP, the CRCP's status and trends monitoring program, co-leading the Atlantic Biological Monitoring initiative. In January 2013, SEFSC co-hosted a data management workshop in Miami with the goal of integrating and advancing all data assimilation, stewardship, and sharing. A report was submitted to CRCP and CoRIS in August 2013. SEFSC helped facilitate the development of new benthic protocols for NCRMP, including the hosting of a multi-agency benthic training workshop at Broad Key in April 2013. Because NCRMP involves partnership, the Program Coordinator worked extensively to communicate with existing and new regional partners to explain the evolution and implementation of NCRMP. The PI participated in

partner meetings with the CRCP program director in March 2013, and gave a presentation to partners in Florida in May 2013. SEFSC participated in the USVI and Flower Garden Banks monitoring missions in 2013, including the development and dissemination of protocols and standard operating procedures.

The Program Coordinator was responsible for submitting four documents to CoRIS in 2013 - "NOAA Coral Reef Conservation Program Southeast Fisheries Science Center Activities and Accomplishments 2007-2010" Technical Memorandum, co-authored with Tara Dolan; SEFSC's FY11 and FY12 Accomplishments report Technical Memoranda, and the Data Management Workshop final report. The PI received a 2012 Department Bronze Medal Award for her work on a CRCP funded project pioneering a cost-effective collaborative fish trap study in the USVI.

How project supports goals & objectives of CRCP

This project ensures that the SEFSC is fully engaged in CRCP-related programs and generates projects and outputs aligned with the goals and objectives of the CRCP. This project ensures SEFSC's projects meet the needs of the coral reef management community, and provides leadership support for SEFSC's role in NCRMP. It ensures that SEFSC PI's are responsive to CRCP needs and that SEFSC speaks with one voice. This project ensures that SEFSC's coral-related activities are communicated to a wide variety of audiences.

How project supports management of coral reef resources

This project guides development of coral-related projects that will have meaningful impacts on the conservation and management of coral reefs. It synthesizes the expert advice and scientific outputs of SEFSC coral reef related projects for incorporation into scientifically sound management actions. It integrates CRCP-related outputs with those from other NMFS activities related to habitat, sustainable fisheries, and protected species. It also integrates SEFSC's coral reef activities with other NOAA and NMFS initiatives nationally and internationally such as NOAA in the Caribbean and the NOAA Caribbean Strategy.

List of project partners and their roles

None

Communications, media exposure, capacity building, education and outreach activities

- Completed 2007-2010 Synoptic Coral Reef Accomplishments Tech Memo (see below)
- Completed the 2011 and 2012 SEFSC Accomplishments Report as NOAA Tech Memos (see below)
- Gave Presentation to Florida Reef Managers Meeting May 2013
- Maintained active dive status to assist PIs with field work needs
- Worked with both the Smithsonian Oceans Hall and the Miami Science Museum to develop content for exhibits and special events
- Facilitated SEFSC scientist's presentations to CRCP
- Represented SEFSC on a variety of CRCP and NOAA working groups and reported on scientific accomplishments, discoveries, publications and media to a variety of sources

Submissions to CoRIS

NOAA Coral Reef Conservation Program Southeast Fisheries Science Center Activities and Accomplishments 2007-2010. Compiled by Tara Dolan and Jennifer Schull. NOAA Technical Memorandum NMFS-SEFSC-635, 61 p.

SEFSC Coral Reef Program: FY2012 Project Accomplishment Report. Compiled by Jennifer Schull. NOAA Technical Memorandum. NMFS-SEFSC-651, 33p.

SEFSC Coral Reef Program: FY2011 Project Accomplishment Report. Compiled by Jennifer Schull. NOAA Technical Memorandum. NMFS-SEFSC-644, 36p.

NCRMP Atlantic Biological Data management Workshop Report

FY2013 Publications
See Above

FY2013 Presentations
Schull, Jennifer. 2013. NOAA NCRMP - The Coral Reef Conservation Program's National Coral Reef Monitoring Program. Florida Coral Reef Coordination Meeting. Miami, Florida.

Setbacks or challenges encountered in FY2013
None

Comments on future direction of project
This project is expected to continue providing valuable oversight and coordination of SEFSC's coral reef related activities.

III. REDUCE ADVERSE IMPACTS OF FISHING

Project ID#:	1317-2013
Title:	F082 Assessing the Locations and Status of Reef Fish Spawning Aggregations in the Florida Keys
PIs and co-PIs:	Todd Kellison (SEFSC) and Chris Taylor (NOS)
Duration of Project:	Year 1 of 2, ongoing project
Project Category:	Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2013

In FY13, efforts to identify and assess reported reef fish spawning aggregations (FSAs) in the Florida Keys continued. Building on prior research in the upper and lower Florida Keys, this project focused on multiple sites in the lower and middle Keys to accomplish two objectives: (1) assess whether reported FSA sites are characterized by similar habitat characteristics, with a focus on geomorphological features, and (2) assess fish utilization patterns of reported FSA sites.

Description of accomplishments & results

In FY13, This project (1) performed field surveys to assess the locations and status of reported reef fish spawning aggregations in the Florida Keys, and (2) communicated project results to relevant management agencies.

For the field work component, on-water (acoustic and diver) and aerial surveys were performed across a broader range of months and predicted spawning moons than in previous years – made possible by increasing sampling efficiencies and expanded partnerships. On-water and aerial surveys were performed on full moons in April (Key West and Key Largo), June (Key West), July (Key West and Key Largo) and August (Key West and Marathon), and on new moons in June (Key West) and July (Key West and Marathon). Planned surveys on the May full moon, targeting mutton snapper spawning aggregations were canceled due to poor weather, which (in a good turn for the mutton snappers) apparently precluded a majority of fishers from targeting the full moon-associated spawning aggregations.

Despite increased field efforts, limited numbers of aggregations were observed in 2013. As in previous years, large numbers of gray and mahogany snappers were observed at the Western Dry Rocks (WDR) site off Key West, where mutton snapper also aggregate. Aggregated permit were also observed at WDR in 2013. Aside from WDR, large aggregations of gray snapper were not observed at other reported spawning sites in 2013, likely indicating the high spatiotemporal variability in aggregation patterns for this species. The research team continued to survey and acoustically map predicted gray snapper spawning habitats, and in doing so identified several potential aggregation sites that will be revisited in 2014. Several promising “promontory” sites were also surveyed off Marathon for additional focus in 2014. The project team continued coordination with commercial and charter fishers, including initiating discussions with headboat operations off Key West and Marathon, and with a commercial fisher off Key Largo.

Project results were communicated to Florida Keys National Marine Sanctuary (FKNMS) managers via frequent verbal (including in-person meetings) and e-mail updates during and after the field season,

through provision of data and related information to project leaders for the ongoing CRCP-funded Biogeographic Assessment for the FL Keys, and by invited presentation to the FKNMS Ecosystem Protection: Ecological Reserves/Preservation Areas and Wildlife Protection Working Group, which makes spatial management recommendations to the FKNMS Advisory Panel.

In April 2013, The project PIs also participated in a radio interview for Captain Ted Lund's fishing program on Keys Radio 107.1FM (recorded for subsequent broadcast), discussing this project and implications for management. The PIs provided interviews and video footage for a public-television "Waterways" episode which aired in January 2014. An update on the project – objectives, accomplishments, management implications, and next steps- was given at the 66th Gulf and Caribbean Fisheries Institute meeting in Corpus Christi, Texas in November 2013.

How project supports goals & objectives of CRCP

This project addresses Objective F2.4. Results will help managers in the Florida Keys meet their Jurisdictional Objective A1.2 in developing a comprehensive zoning plan in terms of evaluation of the location, size and rezoning of Sanctuary Preservation Areas (i.e., no-take areas).

How project supports management of coral reef resources

FSAs are a vital part of the life cycle of many reef fishes. Unfortunately, the act of aggregation makes certain species particularly vulnerable to overfishing. The protection and conservation of FSAs is critical to the sustainable management of grouper, snapper and other reef fish fisheries, from both fisheries and ecosystem perspectives. Results from this ongoing research effort will help to identify aggregation locations and thus facilitate sustainable management for the aggregating species. FKNMS managers are kept abreast of research results (via direct communication from project PIs) and directly support the research through making vessel and docking facilities available to this project.

List of project partners and their roles

- NOAA NOS (NCCOS/CCFHR) – Chris Taylor serves as co-PI on the project
- University of Miami (Dr. Art Gleason) – mapping component
- Florida Fish and Wildlife Conservation Commission (FWC) (multiple personnel) – cooperative field sampling and data analysis

Communications, media exposure, capacity building, education and outreach activities

- Project PIs participated in an April 2013 radio interview for Captain Ted Lund's fishing program on Keys Radio 107.1FM
- Project PIs provided interviews and video footage for a public-television "Waterways" episode which aired January 2014

Submissions to CoRIS

None

FY2013 Publications

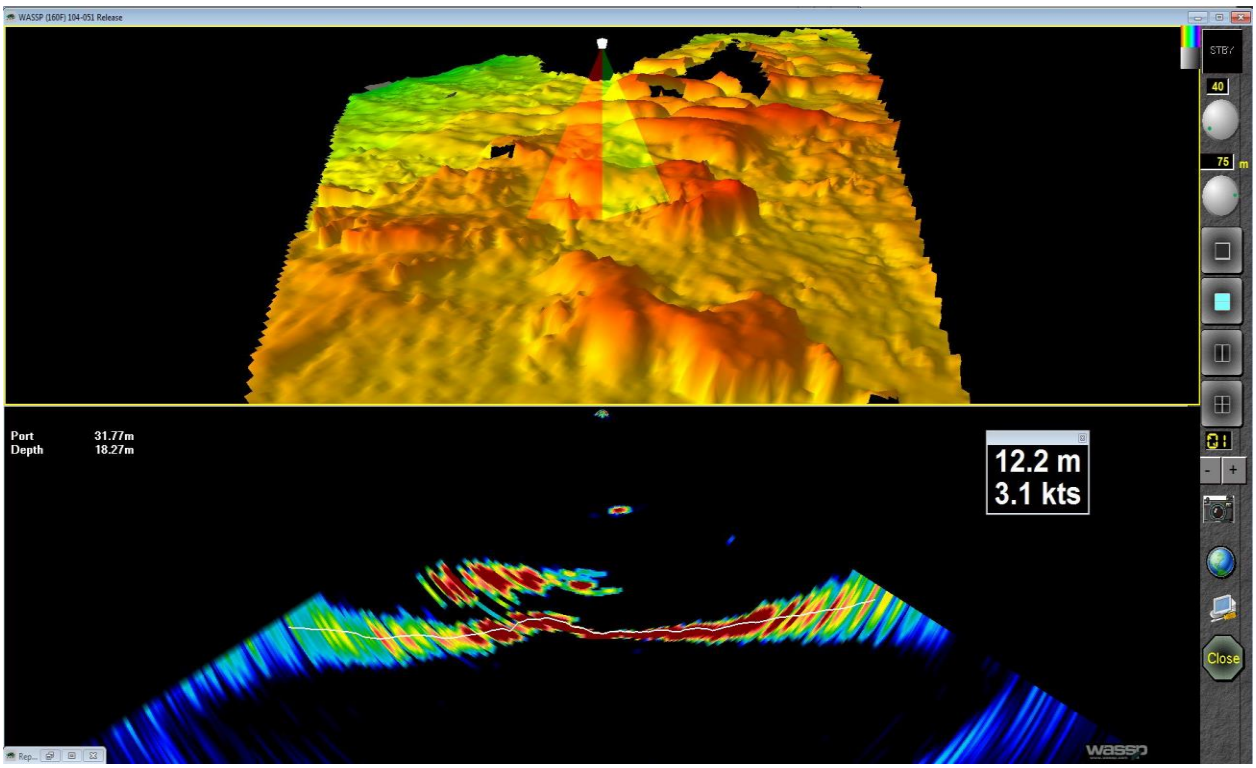
None

FY2013 Presentations

Taylor, J, T Kellison, D Morley and A Acosta. Reef fish spawning aggregations in the FL keys: an update. Gulf and Caribbean Fisheries Institute meeting, Corpus Christi, TX (November 2013).

Setbacks or challenges encountered in FY2013
None

Comments on future direction of project
PIs will seek companion funding to address similar management needs in the Southeast Florida (SEFCRI) region.



Top panel: WASSP multibeam output from Topino Reef. Bottom panel: Gray snapper aggregation at Topino Reef (image credit: Chris Taylor).

Project ID#:	1064 - 2013
Title:	National Coral Reef Monitoring Plan (NCRMP) Activities
PIs and co-PIs:	PI: Benjamin Ruttenberg (SEFSC); co-PIs: Jim Bohnsack (SEFSC), Jerry Ault (UM-RSMAS), Steven Smith (UM-RSMAS)
Duration of Project:	Year 1 of 1, ongoing project
Project Category:	Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2013

In FY13, the Bio-Atlantic team of NCRMP, co-led by NMFS SEFSC and NOS Biogeography Branch, implemented the first official year of NCRMP biological monitoring in the Atlantic jurisdictions. Major accomplishments included the development of protocols and standard operating procedures, completion of a successful data management meeting, and successful field missions to St. Thomas and St. John, USVI, and the Flower Garden Banks National Marine Sanctuary (FGBNMS). FY13 through FY15 are considered "pre-implementation" years while the team continues to refine and socialize NCRMP monitoring protocols and objectives.

Description of accomplishments & results

In January 2013, The Bio-Atlantic team hosted a biological data management workshop in Miami, Florida to begin the process of standardizing data assimilation and entry, quality assurance and quality control (QA/QC) procedures, data stewardship, accessibility and sharing. Representatives from CRCP, NMFS SEFSC, NOS NCCOS, UM-RSMAS, OAR AOML, and NOVA Southeastern University (NSU) attended. Outcomes of the workshop were summarized in an "NCRMP Atlantic Biological Data Management Workshop" Report which was submitted to CRCP and CoRIS in August 2013.

The Bio-Atlantic team agreed to implement a standard approach to benthic monitoring across all Atlantic coral reef jurisdictions (Florida, USVI, Puerto Rico and the Flower Garden Banks). A working group comprised of experts in benthic monitoring was convened in June 2012 to outline a standardized approach. Atlantic working group partners continued to develop the benthic protocols throughout 2013. In April 2013, the Bio-Atlantic team convened a large multi-agency training workshop at Broad Key, an island field station run by the UM-RSMAS. Representatives from FWC, NPS, NOS FKNMS, NMSF SEFSC, NOS NCCOS, UM-RSMAS, University of the Virgin Islands, NSU, and OAR AOML spent three days refining the benthic protocols and testing the protocols in-water. Draft benthic protocols were developed in time for the July 2013 field mission to the USVI. These protocols are expected to be published in 2014.

The Bio-Atlantic team implemented newly developed fish and benthic protocols for the first time in the USVI (St. Thomas and St. John). Overall the mission involved over 35 field staff from NOAA, NPS, University of Miami, University of Virgin Islands, NSU, and The Nature Conservancy. All surveys were conducted using small boats provided as in-kind support by partners (NPS) or contracted vessels. A total of 274 fish and line point intercept (LPI) and 211 coral demographic surveys were conducted throughout the study area. The biological team also collected 72 water samples in support of the NCRMP Climate Team's ocean acidification monitoring (AOML).

Fish and benthic surveys were also conducted on the shallow coral reefs of the Flower Garden Banks National Marine Sanctuary. Overall, 69 fish and LPI and 34 coral demographic surveys were conducted

by 10 scientists from NOAA and Texas A&M University at Galveston. The biological team also collected 24 water samples in support of ocean acidification monitoring by the NCRMP climate team.

The Bio-Atlantic team invested significant time working with regional partners to describe what NCRMP is and how the program is impacting the monitoring landscape in each of the jurisdictions. In Florida, John Christensen met with several partners in March 2013, which was followed up with a presentation to Florida partners in May 2013 at University of Miami. NOS NCCOS worked extensively with the University of the Virgin Islands (UVI) to cultivate partnerships there, and the UVI was a key implementation partner during the July 2013 field mission. The Bio-Atlantic team also contracted with Michele Scharer in Puerto Rico to begin investigating the logistics of a field mission in 2014.

How project supports goals & objectives of CRCP

NCRMP is a core activity of CRCP, and represents CRCP's largest monitoring investment. This project supports the development and implementation of standardized monitoring protocols throughout the US Atlantic coral reef jurisdictions (USVI, Puerto Rico, Florida and FGBNMS) for coral reef benthic and fish resources.

How project supports management of coral reef resources

NCRMP will provide long term, consistent monitoring data on a number of coral reef indicators including climate, ocean chemistry, socio-economics, benthic composition, and coral reef fish; ostensibly describing "how the nation's reefs are doing over time". This project supports the fish and benthic monitoring components of NCRMP in the US Atlantic coral reef jurisdictions. By implementing consistent protocols using a stratified random statistical design approach, this program will provide context for localized research and monitoring programs within the jurisdiction and will allow for some comparisons across jurisdictions (dependent on methodologies). The coral reef management community partner with NCRMP monitoring and have full access to all data and derived products resulting from NCRMP activities.

List of project partners and their roles

- NMFS-SEFSC – co-lead of the Atlantic biological monitoring components of NCRMP
- NOS-Biogeography Program - co-lead of the Atlantic biological monitoring components of NCRMP
- FGBNMS – in-kind boat and fieldwork support in FGBNMS
- OAR AOML – NCRMP climate program integration, training
- UM-RSMAS – data management, statistical design, training, fieldwork, analysis, reporting, use of Broad Key facility
- NOS-CFFHR – benthic protocol development, training
- NSU – benthic protocol development, training
- UVI – benthic protocol development, training, fieldwork
- NPS – in-kind boat and fieldwork support in the USVI
- FKNMS – in-kind boat support for Broad Key training
- FWC – participation in Broad Key training
- The Nature Conservancy – participation in field work in USVI
- Texas A&M University – participation in field work in FGBNMS

Communications, media exposure, capacity building, education and outreach activities

- Informal communications with partners and resource managers were held throughout the year to socialize the idea of NCRMP

- A large effort was made to integrate most partners and managers into the training workshop at Broad Key where most of the benthic protocols were developed and tested. By training as many partners in new NCRMP protocols as possible, NCRMP greatly increases the pool of capable field personnel for future NCRMP activities throughout the region.

Submissions to CoRIS
The "NCRMP Atlantic Biological Data Management Workshop Report" was submitted to CoRIS in August 2013. GPS coordinates for sites sampled by NCRMP in 2013 were also provided to CoRIS.

FY2013 Publications
None

FY2013 Presentations
Presentations were given to Florida researchers and managers in November 2013 and May 2013. Several informal presentations were given to regional managers and research partners.

Setbacks or challenges encountered in FY2013
Nancy Foster ship time planned for the Flower Garden Banks monitoring fell through, forcing the team to purchase ship time on the Sanctuary Vessel R/V Manta. Developing and implementing new monitoring protocols without disrupting extant monitoring partnerships continues to be a challenge. Executing the first shelf-wide monitoring mission in Puerto Rico next year will be a logistical challenge. The Bio-Atlantic team will also continue to work through differences in survey design and analysis protocols. With the implementation of new in-water protocols, QA/QC is taking longer than anticipated.

Comments on future direction of project
In FY14, the Bio-Atlantic team will continue to assimilate, analyze and share the data and results from the FY13 field missions. The FY13 monitoring protocols will be finalized and published. Monitoring missions will be mounted for the entire Florida reef tract and Puerto Rico. In Florida, extensive communication and training will continue with partners to preserve and grow the extant multi-agency partnership. The project team will attempt the first shelf-wide monitoring mission in Puerto Rico. Standard operating procedures for the two sampling missions will be drafted prior to the FY14 field missions.

Participants in the Broad Key Benthic Training Workshop, April 2013 (photo credit: NOAA).

Project ID#:	0831-2013
Title:	A Creel Survey of the Recreational (Non-Commercial), Boat-Ramp-Based, Hook and Line Fishery in St. Croix
PIs and co-PIs:	Jim Berkson (SEFSC)
Duration of Project:	Year 1 of 3
Project Category:	Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2013

In FY2013, an avenue to pass funding from NMFS to the University of Florida (UF) was identified and established. Discussions were held with team partners including Theresa Goedeke to help prepare for the ongoing planning and implementation of the project.

Description of accomplishments & results

The primary accomplishment was the establishment of the avenue to pass funds from NMFS to UF. This was anticipated to be a fairly easy and automatic step, but it proved to be extremely difficult. Significant project planning continued.

How project supports goals & objectives of CRCP

One of the key goals of the CRCP is to increase the abundance and average size of key coral reef fishery species. To do this, basic information on major fisheries in addition to population dynamics of the species is needed. The non-commercial, boat-ramp-based fisheries in St. Croix are assumed to be one of the most significant fisheries on the island, but data are not currently available. This project would begin to provide those data.

How project supports management of coral reef resources

Without information on catch, there may be overexploitation of critical stocks, impacts on multiple trophic levels, bycatch of non-target species, and impacts to habitat from fishing methods. The project will answer two important research questions: (1) What are the best vehicles for collecting fishery dependent data for these fisheries? and (2) What are the current levels of catch and effort in these fisheries? Resultant data will help inform recreational catch and effort statistics for fisheries management.

List of project partners and their roles

- NMFS/SEFSC Sustainable Fisheries Division - will review data collection protocols, data storage, and analytical tools
- NMFS/SEFSC Social Science Research Group - will review the socio-economic aspects of this study to ensure it is an effective protocol for reaching project goals
- NMFS/SERO Habitat Conservation Division - will provide on-the-ground assistance on St. Croix
- NMFS/SERO Sustainable Fisheries Division – will help develop strong relationships with the regional management agencies
- NOS NCCOS - will tackle a different aspect of the same issue by working on a complementary shore-based survey
- University of Florida - will help design, implement, manage, analyze and write-up the study
- The Caribbean Fisheries Management Council - will ensure that the project is filling a critical data need to better manage fisheries in the USVI

- The USVI Division of Coastal Zone Management - will provide information about the spatial distribution of reef habitat that can be compared with the distribution of fishing effort estimated by the creel survey
- The USVI Division of Fish and Wildlife - will provide expertise on the fish, fishers, and fisheries of St. Croix

Communications, media exposure, capacity building, education and outreach activities

- Communications will ramp up as the project enters the active phase. All of the partners listed above are aware of the progress on this project

Submissions to CoRIS

None

FY2013 Publications

None

FY2013 Presentations

None

Setbacks or challenges encountered in FY2013

As described in detail in the FY2013 CRCP database report, there were significant problems and delays identifying and implementing an avenue to pass funds from NOAA to UF. In addition, UF took significantly more indirect than was anticipated. Funding was not received until the middle of December of 2013. This caused project delays.

Comments on future direction of project

A multiple year pass through has been established which will make moving funds easier in Year 2. The companion project led by Theresa Goedeke has passed its PRA review and lessons learned from that process will hopefully expedite the PRA approval for this project. Despite delays, the project team feels very positive about the future of this project.

Project ID#:	0453-2013
Title:	Assessing Reef Fish Population Recovery and Lionfish Impacts on Prey and Predator Communities of Reef Fishes in the Tortugas Ecological Reserve
PIs and co-PIs:	Michael Burton (SEFSC)
Duration of Project:	Year 1 of 3, ongoing project
Project Category:	Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2013.
Long term monitoring (since 2003) of reef fish populations continued in the Tortugas Ecological Reserve. Researchers investigated the effects of invasive lionfish on the native reef fish communities, and the possible top down control of predators (snappers/groupers) on lionfish populations. A recently discovered cubera snapper aggregation on the western edge of Riley's Hump was investigated.

Description of accomplishments & results
The researchers conducted a mission to Riley's Hump (Tortugas South Ecological Reserve, TSER) July 23-27, 2013. During the cruise, 185 dives in the 83'-130' depth range were completed over 5 days safely. Monitoring of reef fish populations in the TSER begun in 2003 was continued. In addition to replicating randomly oriented 30 m line transects on which all snapper/grouper/predators were identified and enumerated, the team conducted fish surveys using two other methodologies: the Reef Visual Census (RVC) stationary point count, and the Reef Environmental Education Foundation (REEF) roving diver survey. Lionfish effects were studied by conducting lionfish predator and prey surveys, 50m band transects which counted conspicuous species on the way out, and identified the cryptic species components on the way back in. Additionally, time was spent investigating a recently discovered (2012) cubera snapper aggregation that forms on the western edge of Riley's Hump, in depths up to 200 ft. Over the course of the cruise, the cubera aggregations, lionfish, large groupers, and a diversity of sharks were observed. Participants included staff from NMFS, NCCOS, FWC, NPS, UM-RSMAS, and REEF.

How project supports goals & objectives of CRCP
This project supports Fishing Impacts National Objective 2.5 – Monitoring to assess the effectiveness of MPAs; National Objective 2.4 - Work with relevant agencies, offices, and communities to improve the management of MPAs; National Objective F1.3 - Obtain essential life history and ecological information on key species or functional groups to support management actions; and National Objective F1.6 - Conduct applied research and monitoring to evaluate effectiveness of coral reef ecosystem management actions on key species or groups.

The project supports the following Florida objectives and priorities: FL Objective D1.1 - Fill monitoring and assessment gaps, including fisheries dependent and independent monitoring, to further understand the effects on other trophic levels; FL Objective D1.2 - Identify larval sources, spawning areas, and aggregations; FL Coral Reef Priority A1.2 - Develop and implement a comprehensive zoning plan for the entire Florida Reef Tract and Ecosystem and implement through place-based entities and management plans within three to five years (potential expansion of MPAs is part of zoning plan consideration currently ongoing in the Florida Keys); and FL Coral Reef Priority Goal A3 - Improve understanding of status and linkages of human activities to the condition and trends of the Florida Reef Tract and Ecosystem, Objective 1 - Create a full inventory of status, trends and threats to coral reef resources

across the entire Florida Reef Tract and Ecosystem within five years. This project aids managers in understanding the benefits of properly managed marine reserves to coral reef resources, from both a habitat and fishery standpoint.

How project supports management of coral reef resources

This project will assist the CRCP and partners FKNMS and FWC in assessing the effectiveness of properly managed MPAs in recovering exploited fish stocks and maintaining proper reef ecosystem health and function. Since 2002, this project has documented the reformation of an overfished spawning aggregation of mutton snapper, and has noted other snapper/grouper species increasing in numbers in the years since reserve creation in 2001. The data from this project are consistently used by NMFS and FWC to assess the status of mutton snapper stocks.

List of project partners and their roles

- NCCOS/CCFHR – In kind donation of research diver time for cruise participation; split beam sonar mapping of habitat
- FKNMS – In kind donation of staff time, research coordination
- FWC Marathon Laboratory – In kind support of research divers for cruise participation

Communications, media exposure, capacity building, education and outreach activities

- Data from this project have been used by NOAA and FWC in SEDAR stock assessments, for the development of fishery independent indices of abundance
- Informal communications with FKNMS are ongoing

Submissions to CoRIS

None

FY2013 Publications

None

FY2013 Presentations

None

Setbacks or challenges encountered in FY2013

There were no issues with the project as originally planned.

Comments on future direction of project

This project is funded biennially, the final year of data collection will occur in 2015. No data collection activities will occur in 2014. The project team plans to continue to collect monitoring data every two years in the TSER in order to keep the time series going and gauge the continuing contribution of reserve designation on the populations of previously overexploited reef fishes. A deep-diving component for this project will be requested in 2015 to better examine the deep cubera aggregation. The initiation of an IDIQ agreement with the M/V SPREE will greatly facilitate vessel contracting.

Photograph of the cubera snapper aggregation July 2013. Photo Credit: David Bryan, CIMAS/UM.

IV. REDUCE IMPACTS OF CLIMATE CHANGE

Project ID#:	20692-2013
Title:	C169 Developing Downscaled Climate Models for Coral Reef Management Into the 21st Century
PIs and co-PIs:	John Lamkin (SEFSC) and Barbara Muhling (CIMAS/UM)
Duration of Project:	Year 3 of 3
Project Category:	Reduce Impacts of Climate Change

Brief description of activities conducted in FY2013

During the final year of the project, global climate models from the new Coupled Model Intercomparison Project (CMIP)-5 experiment were downscaled to a regional level, using the high resolution Modular Ocean Model Version 4 (MOM4). In contrast to the previous CMIP-3 models, which used CO_2 emission scenarios (e.g. A1B, A1FI), the new models consider CO_2 concentration scenarios, known as Representative Concentration Pathways (RCPs). Updating predictive models to run on these new RCPs is therefore essential in order for management products and outputs to remain up-to-date and relevant. In addition, the role of natural variability, such as the Atlantic Multidecadal Oscillation (AMO), in future conditions has been quantified, and compared to trends observed during the past 100 years.

Description of accomplishments & results

During FY13, the downscaled climate model was completed for the study area, as per the original proposal. Spatial resolution is highest in the Gulf of Mexico (0.1 degrees), and 0.25 degrees in the Caribbean Sea. The model provides projections of temperature and salinity throughout the water column through the end of the 21st century, as well as current velocities. Unlike global climate models, the downscaled model can reproduce the dynamics of the regional current systems, i.e. the Caribbean Current, Yucatan Current and Loop Current.

Outputs from this model can be applied to a number of different research questions. During FY13, PIs partnered with another collaborative project looking at climate change impacts on the Florida Keys (Keysmap). Projected future water temperatures for the Keys region were provided to GIS analysts for inclusion in their risk analyses for the region. Project leaders presented a summary of the utility of the downscaled model at a workshop in Marathon, FL, in March 2013. Collaborations between the two research groups will be ongoing. In addition, the research team was invited to present project results at a workshop on coral reefs and fisheries in May 2013 in Tampa, organized by the Gulf of Mexico Fishery Management Council (GMFMC). Future collaborations between SEFSC's research group and the GMFMC will be discussed during the coming months, and data from the models will be provided to them.

Completion of this project has resulted in a high resolution downscaled climate model for the Gulf of Mexico and Caribbean region, which can be used for any number of research and management applications. Modeled temperature, salinity and current velocity through the water column are available at high resolution for the years 1900 – 2100, which is a first for the region. These outputs have already been requested by a number of management agencies, for use in spatial planning and management. Results from this work also contributed to several ongoing projects, including a National Aeronautics and Space Administration (NASA)-funded project examining highly migratory fish species and climate change in the western Atlantic Ocean. Results from applications of the model have been used to assess

coral reef bleaching and population connectivity in the Caribbean Sea, warming trends in the Florida Keys, spawning habitat of tunas in the Gulf of Mexico, and annual migrations of billfish in the western Atlantic. Other applications are ongoing. This project's outputs have benefitted many end-users, including other scientific researchers, fisheries managers, coral reef managers and marine protected area managers, on both local and regional scales.

How project supports goals & objectives of CRCP

Model outputs are highly relevant to coral reef ecology, as they provide the first high resolution estimates of bleaching risk for Caribbean and Gulf of Mexico corals through to the end of the 21st century. This project has therefore directly addressed the CRCP goals of increasing coral reef resilience to climate change through effective management strategies, and identifying and understanding the vulnerability of coral reef ecosystems to climate change. In particular, results from this project apply to objectives C3.2 ("Through process studies and modeling, develop integrated impact models of changes in coral reef ecosystems in response to the physical and chemical processes associated with climate change and ocean acidification, and the interactions of these processes with local stressors"), and C3.4 - "Translate climate forecasts and projections into products that are relevant and useable for improved coral reef ecosystem management and decision-making". By combining physical oceanographers, modelers and biologists on this project, this project has linked complex climate models, oceanographic models, and biological models to create products which are directly relevant to coral reef managers. These products are being requested and used by multiple management agencies.

How project supports management of coral reef resources

Climate change impacts on coral reefs are expected to include increased coral bleaching events, subsequent increases in habitat fragmentation, and changes in larval connectivity mechanisms. However, temporal and spatial extent of these changes is poorly known. Coral reef managers have little information on which reef systems are likely to be most affected or which existing connections between reefs and/or marine protected areas are likely to be lost or changed. Outputs from this project can provide advance information to coral reef managers on potential future habitat shifts or loss within regional reef systems, and changes in reef resilience. Outputs from the model are available in a standard format, which can be applied to a diverse array of research questions. Several requests for model outputs have already been received, including from the FWC, the GMFMC, and others.

This project has created several user-friendly maps and outputs from the model, as examples of its capabilities. These include: (1) A quantitative map output showing how circulation patterns are predicted to change within the study area through to 2100, (2) Predictions of coral reef bleaching locations and rates through to 2100 for the Caribbean region, and predictions of resilience and management needs based on current reef condition. Other user groups have used model outputs to generate impact maps for the Florida Keys, and other products.

Overall, the downscaled model shares a better understanding of the magnitude and nature of climate change impacts on coral reefs. As a result, priority areas for conservation can be more effectively identified, and coral reef managers will be better equipped to anticipate future climate related challenges for management.

List of project partners and their roles

- OAR AOML - Yanyun Liu, Sang-Ki Lee contribute to Model Downscaling

Communications, media exposure, capacity building, education and outreach activities

- March 2013: One NOAA seminar at Silver Spring, MD.
- March 2013: Keysmap workshop in Marathon, assisting with the integration of model outputs into impact maps for the Florida Keys, FL.
- May 2013: Invited speaker at Coral Reef and Fisheries workshop in Tampa, FL.
- July 2013: Invited speaker at International Congress for Conservation Biology, Baltimore, MD.

Submissions to CoRIS

Metadata were submitted to CoRIS in November 2013, as proposed. This includes contact details for any future data requests.

FY2013 Publications

Liu, Y., Lee, S.K., Wang, C., Enfield, D.B., Muhling, B.A., Lamkin, J.T. (submitted) "On the Relationship between Atlantic Multidecadal Oscillation and North Atlantic Ocean Gyre Circulation Variability," Geophysical Research Letters.

FY2013 Presentations

Muhling, B.A., Liu, Y., Lee, S.K., Lamkin, J.T., Roffer, M.A., "Spawning of Atlantic tunas in the northern Gulf of Mexico: environmental constraints and response to climate change," International Congress for Conservation Biology, Baltimore, MD, USA, July 25, 2013.

Muhling, B.A., Liu, Y., Lee, S.K., Lamkin, J.T., Roffer, M.A., Muller-Karger, F., "Management and conservation of coral reefs and marine resources in the Caribbean Sea under future climate change scenarios," Coral Reefs and Fisheries workshop, Tampa, FL, USA, May 20-21, 2013.

Muhling, B.A., Liu, Y., Lee, S.K., Lamkin, J.T., Roffer, M.A., Muller-Karger, F., "Management and conservation of fisheries and marine resources in the Gulf of Mexico and Caribbean Sea under future climate change scenarios,", One NOAA seminar, Silver Spring, MD, USA, March 20, 2013.

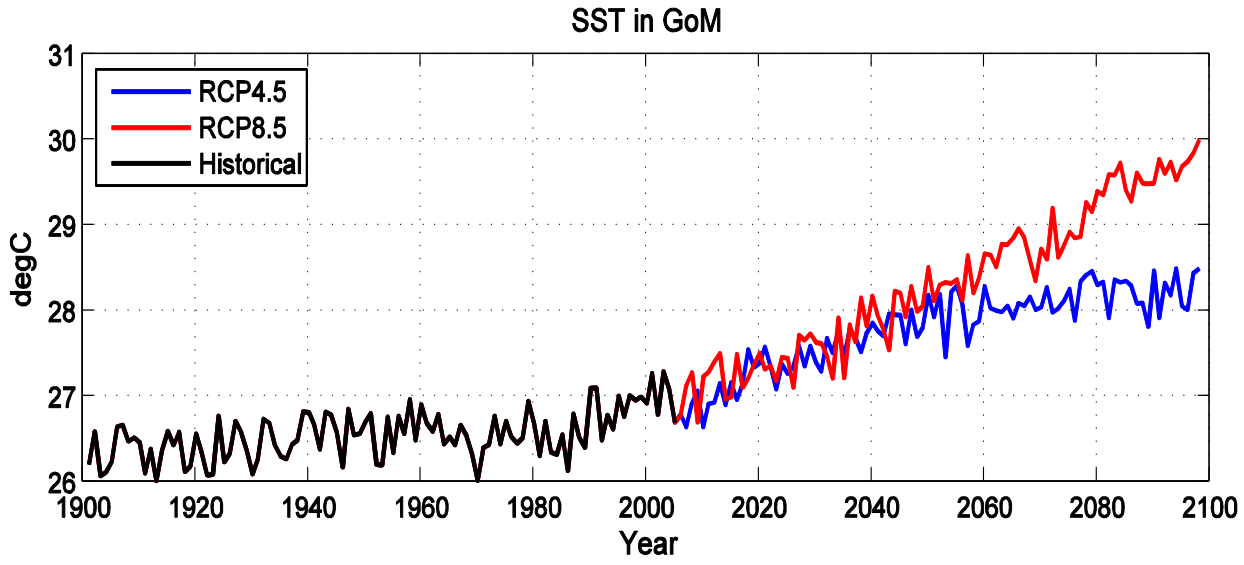
Muhling, B.A., Liu, Y., Lee, S.K., Lamkin, J.T., Roffer, M.A., Muller-Karger, F., "Developing downscaled climate models for coral reef management into the 21st Century," Keysmap workshop, Marathon, FL, USA, March 14, 2013.

Setbacks or challenges encountered in FY2013

None which significantly impacted scheduled progress

Comments on future direction of project

Project is now complete



Annual mean surface temperature in the Gulf of Mexico from past reanalysis, and future projections under two CO_2 Representative Concentration Pathways: RCP 4.5 and RCP 8.5. Image: Yanyun Liu, NOAA

V. SOCIOECONOMICS

Project ID#:	0816-2013
Title:	Puerto Rican Commercial Fishermen Perceptions of Marine Protective Measures and Management Strategies
PIs and co-PIs:	Juan Agar (SEFSC)
Duration of Project:	Year 1 of 1
Project Category:	Socioeconomics

Brief description of activities conducted in FY2013
In May 2013, the Office of Management and Budget (OMB) approval was received to conduct in-person surveys to examine fishermen's perceptions about the efficacy of marine protected areas and other management tools. In July 2013, the survey instrument was further refined with additional pre-tests. The implementation of the full data collection was delayed due to staffing issues.

Description of accomplishments & results
Obtaining OMB approval and pre-testing of the surveys were the main accomplishments in this fiscal year.

How project supports goals & objectives of CRCP
This proposal addressed Puerto Rico's top social science Priority PR-5 - Replication of study, "Entangled Communities: Socioeconomic Profiles of Fishers, their Communities, and their Responses to Marine Protective Measures in Puerto Rico". The proposed update is critical because it allows managers to gauge the ongoing performance (and perceptions of performance) of these spatial and temporal management tools, which were first reviewed in 2003-04.

The proposed study provides insight into the impact of regulations on fishermen's livelihoods and the perceived performance of protected areas and seasonal closures over time (contributing to CRCP Fishing Impacts' goals 1, 2, 3, and 4 and Puerto Rico jurisdiction goals B1 and B2). The results of the study will be compared with biological results to facilitate learning about the biological and socio-economic performance of these managed areas.

The lessons learned from these experiences will provide valuable insight into the development of new regulations to protect coral reef ecosystems and enforcement effectiveness. In addition, this study will also provide information about the fishermen's perceptions on the coral reef ecosystem, mangrove and fishing stocks' healthy. The proposed update is critical because it allows managers to gauge the performance of these spatial and temporal management tools which were first reviewed 10 years ago.

List of project partners and their roles
- Puerto Rico Department of Natural and Environmental Resources - liaisons with the local community
- Puerto Rico's NOAA Sea Grant Program - assisted with outreach

Communications, media exposure, capacity building, education and outreach activities
- An announcement of the upcoming data collection was published in SeaGrant's publication titled 'Fuete y Verguilla'

Submissions to CoRIS
None

FY2013 Publications
None

FY2013 Presentations
None

Setbacks or challenges encountered in FY2013
Loss of staff forced a delay in survey implementation.

Comments on future direction of project
None

Pre-testing of survey instrument (Photo Credit: Jesus Leon, 2013)

VI. PROTECTED CORALS

Project ID#:	20727-2013
Title:	O171 Evaluation of ESA listed *Acropora* spp. Status and Actions for Management and Recovery
PIs and co-PIs:	Margaret Miller (SEFSC) and Dana Williams (CIMAS/UM)
Duration of Project:	Year 3 of 3, ongoing project
Project Category:	Other, Protected Corals

Brief description of activities conducted in FY2013

Florida *Acropora palmata* study plots were surveyed for the 10th consecutive year and Curacao *A. palmata* study plots for the 8th year. Additional field studies investigating the functional role of *Acropora spp* predators were also conducted. The experiment investigating the effectiveness of corallivorous snail predator removal that began in 2009 concluded. Additionally, field studies to quantify the recovery rate for *A. cervicornis* branches preyed on by fireworms (*Hermodice carunculata*) were conducted. This study also evaluated simple mitigation techniques to promote recovery and regrowth of the preyed branches.

Description of accomplishments & results

The 24 existing *A. palmata* study plots were resurveyed in January, May, and September 2013. Additionally, a site not visited since 2011 was resurveyed. *A. palmata* populations in the Florida Keys remained roughly stable in terms of tissue abundance. In 2012, Hurricane Isaac resulted in a large fragmentation event and this year many of the newly recruited fragments died resulting in a decrease in the number of colonies. Because they were relatively small, there was little impact to the total amount of live tissue. Curacao populations similarly remained stable in terms of tissue abundance.

The corallivorous snail predator removal experiment that began in 2009 was concluded in Fall 2013. The experiment was established in existing study plots using a BACI design. At each site (n=6) snails were removed from only *A. palmata* only in one plot, removed them from all host coral in a second plot, and a third plot served as a control. Snails were removed at the first three surveys conducted in the first year; then at subsequent surveys were counted but not removed to quantify the rate of snail recolonization. This study determined that recolonization to pre-removal abundance would take approximately 5 years and that removing them from other neighboring host coral species did not significantly delay their return. After two years, the largest (and thus more fecund) snails have not returned.

Lastly, a fireworm predation mitigation study in 2013 evaluated two methods of enhancing recovery of *A. cervicornis* branch tips from fireworm predation. The first method included pruning dead skeleton and covering the exposed tip with a wire shield to prevent further predation while the tip healed. The second method included pruning the dead skeleton and leaving it exposed. These two strategies were compared to an un-manipulated control. Pruning the dead skeleton resulted in significantly faster recovery by a greater proportion of branches than the controls; however, shielding the branch during recovery yielded no further improvement in outcome.

How project supports goals & objectives of CRCP

This project addresses the CRCP commitment to support the science and recovery of ESA listed coral species. Specifically, this project provides ongoing population monitoring and also evaluation of potential management interventions to conserve and expand *Acropora spp*. tissue. This project addresses several Florida jurisdiction priorities. Specifically Florida identified *Acropora* monitoring as one of its top 5 mapping and monitoring needs to support management as stated in the CREIOS Workshop Report (Morgan & Waddell (eds) 2009, p.2). Similarly, endangered species recovery and reef restoration both appear as Florida management priorities (p.19 Morgan & Waddell 2009) and the snail removal and fireworm mitigation field experiments address these priorities. These FL priorities articulated in the CREIOS report are reiterated in the Florida Reef Management Priorities document which calls for implementation of the CREIOS Workshop outcomes.

How project supports management of coral reef resources

F2.1: 5 of the 7 Florida demographic monitoring sites are in no-take reserves. *A. palmata* provides habitat for economically important fisheries species and structural protection for coastal habitats as a 'key taxa' in reef crest environments. Demographic monitoring provides a means to assess *A. palmata* abundance in these areas. F2.3: Proposed experiments will conserve *Acropora* live tissue and may provide an effective management tool to conserve additional tissue. C4.1: Developing intervention strategies to preserve coral/increase resilience in priority areas. Any preservation of live coral, particularly threatened ones, increases population resilience. The current project evaluates the cost/benefit to managers of direct intervention strategies for mitigating coral loss to predation.

List of project partners and their roles

- NMFS/SERO Protected Resources - provides co-funding for monitoring of listed corals
- Coral Restoration Foundation - collaborates in fireworm mitigation experiments by providing access to outplanted *A. cervicornis* colonies.
- Florida/FWRI – coordinates the complimentary ESA Section 6 project funded to expand demographic monitoring throughout US territories.

Communications, media exposure, capacity building, education and outreach activities

- One University of Miami Masters' student intern was engaged in the execution of the field experiment on fireworm predation/mitigation.

Submissions to CoRIS

Publications below were reported to CoRIS

FY2013 Publications

Williams DE, Bright AJ (2013) White rings on the threatened coral, *Acropora palmata*, associated with foraging activity of the honeycomb cowfish, *Acanthostracion polygonius (Ostraciidae*). Coral Reefs 32:651

Bright AJ, Williams DE, Kramer KL, Miller MW (2013) Recovery of *Acropora palmata* in Curaçao: a comparison with the Florida Keys. Bull Mar Sci 89:747-757

FY2013 Presentations

Williams DE, Bright AJ, Cameron CM, Miller MW Removal of corallivorous snails as a proactive conservation tool. 36th meeting of the Association of Marine Laboratories of the Caribbean, June 17-21, 2013

Vardi T, Williams DE, Sandin S. Regional analysis of *Acropora palmata* population dynamics using matrix modeling with stochasticity. 36th meeting of the Association of Marine Laboratories of the Caribbean, June 17-21, 2013

Williams, D. E. *Acropora palmata* Genetic Monitoring and Cost/Benefit for Predator Removal. Presented at the Florida Coral Collaboration Meeting, University of Miami Rosenstiel School of Marine and Atmospheric Science, May 6, 2013 2013.

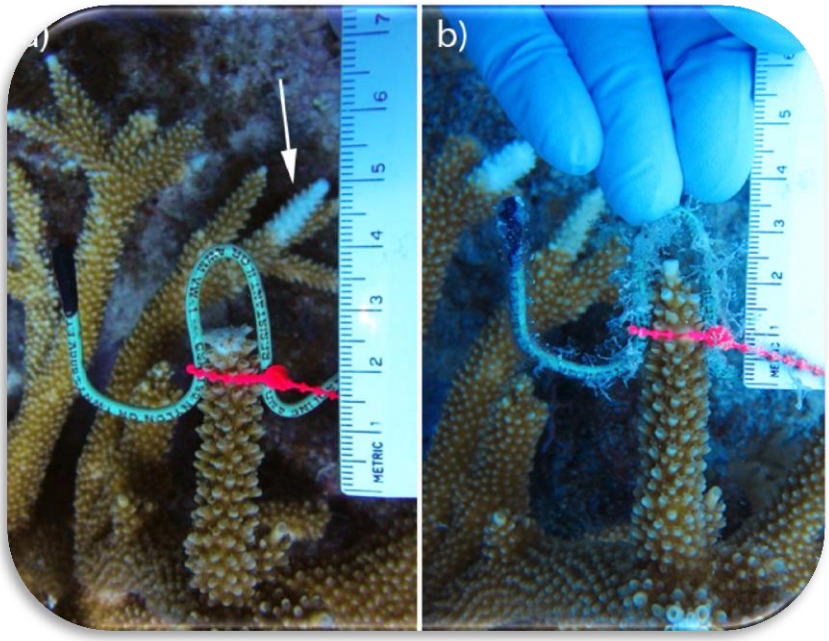
Miller, M. W. Disease Dynamics and Mitigation In Wild and Outplanted *Acropora cervicornis*. Presented at the Florida Coral Collaboration Meeting, University of Miami Rosenstiel School of Marine and Atmospheric Science, May 6, 2013 2013.

Setbacks or challenges encountered in FY2013

The furlough occurred during the fall monitoring surveys. Surveys throughout the year were delayed due to uncharacteristic persistent windy conditions.

Comments on future direction of project

The project team intends to continue this long-term monitoring which continues to provide insights on status/recovery of this listed species in the upper Florida Keys and comparison populations in Curacao. As with the predator removal experiment, the long term data set enables the project team to undertake robust evaluation of potential management/recovery actions. Proposed future activities include other manipulative experiments in these study plots.



Fireworm predation leaves bright white branch tips on *A. cervicornis* (example at arrow). In the predator mitigation experiments these dead tips were snipped off and shielded from further predation with a plastic coated metal wire (a) while they recovered (b), generally within 3-4 weeks. Results of this experiment showed recovery of a growing apical tip was significantly accelerated by this simple intervention (snipping the preyed dead skeleton away) whereas the additional use of the wire shield did not appear to offer any associated benefit.

Project **ID#:**	0797-2013
Title:	Gamete/Larval Fitness of ESA Listed and Candidate Corals
PIs and co-PIs:	Margaret Miller (SEFSC) and Cheryl Woodley (NOS/NCCOS)
Duration of Project:	Year 1 of 3
Project Category:	Other, Protected Corals

Brief description of activities conducted in FY2013

During the FY13 spawning season, the project team took advantage of a rich and diverse coral spawn, including excellent performance by *A. palmata*, to successfully execute nine separate parentage batch cross experiments (to analyze parental compatibility) including three target species. In addition, an experimental exposure to different 'water quality types' with *A. palmata* throughout larval settlement phases including pilot molecular analyses for sperm and larval condition from different parents/sites and different water quality exposures was completed.

Description of accomplishments & results

Following extremely poor spawning by *A. palmata* in the Florida Keys in 2010-2012, the project team was able to document (in partnership with State, Academic, and NGO partners) an uncharacteristically robust spawn, especially by *A. palmata*, but including *A. cervicornis*, *O. faveolata*, and *D. cylindrus* (see Miller MW, 2013 Quicklook Report. SEFSC Division Report PRBD-2013-09). This rich spawn enabled the team to execute 9 separate parentage crosses (5 with *A. palmata*, 1 with *A. cervicornis*, 3 with *O. faveolata*). This was more than expected, so the project team is currently reviewing the observed fertilization rates to prioritize the genetic analyses, since funding will not be sufficient to cover all parentage crosses. Highly variable fertilization rates were observed among the different *O. faveolata* and *A. palmata* crosses (each containing gametes from 4 haphazardly selected parental colonies or genets) likely indicating significant incompatibility amongst parental genets in these species. Very high fertilization was observed in the single cross conducted with lab-collected spawn from Coral Reef Foundation nursery-stock genets of *A. cervicornis*. This is good news in suggesting that synchronously spawning genets in this nursery stock are capable of producing larvae. Additional focus on testing *A. cervicornis* genets in future years is warranted.

The excellent spawn (and resultant high fertilization rates in cultures) by *A. palmata* enabled the research group to perform the proposed water quality exposure experiments with this species. Bulk water from the Pulaski Shoal region of Dry Tortugas National Park (an area with robust expansion of wild *A.cervicornis* populations) and the Hollywood sewer outfall surface boil (assisted by Broward Co) was collected and stored in Teflon-coated or glass vessels and filtered before usage. Two controls were used in the experiment –artificial seawater (also stored in glass) and the 'usual' water treatment historically used in previous larval culture efforts (collected from local offshore reef water in Key Largo, but stored in plastic containers). Surprisingly, larval survivorship was lowest in the traditionally-treated local reef water, but no differences were detected among the other water types. This experiment should be repeated using the glass/Teflon protection for the local water as well to further test the suggestion that plastic-exposed water has the greatest detrimental effect on spawned coral larvae.

Samples of coral sperm from different sites/parents and of larvae exposed to the different water treatment types over time were collected and fixed for pilot analyses of molecular condition by NCCOS-Charleston.

A further 'bonus' study was conducted to characterize the duration of potential settlement competence in *O. faveolata* larvae. Their larval duration was determined to be much longer than previously thought (over ~45 days). These results will eventually inform the coral connectivity modelling for Caribbean spawning species to more realistically reflect their extended dispersal capacity.

Overall, the great spawning performance by corals in the FKNMS in 2013 restored some confidence in the potential reproductive capacity of Florida corals, particularly of local *A. palmata* populations. It also allowed for many different types of experiments that are advancing understanding of factors contributing to larval survivorship in these spawning species, all of which are listed or are candidates for ESA listing.

How project supports goals & objectives of CRCP

This project supports recovery goals for ESA listed species and lends insight to effects of water quality and land based sources of pollution on coral resilience and survivorship.

How project supports management of coral reef resources

Reproductive failure is a primary factor in the decline of reef building corals in the Atlantic region. Factors affecting larval production and larval success for spawning corals are important to understand in order to prioritize management actions that might overcome this failure. This project is testing both genetic and water quality factors that may influence the success of spawned coral larvae for ESA listed and proposed species in the Florida Keys. It also contributes to field documentation of coral spawning success in the FKNMS by myriad coordinated partners.

List of project partners and their roles

- NCCOS and Pennsylvania State University - perform molecular assays for gamete/larval condition and larval genotyping, respectively.
- Coral spawning field work is arduous and necessitates the cooperation of many partners in order to maximize the chances of success. In FY13, primary project partners in documenting and collecting coral spawn included:
    - FWRI - Kate Lunz, and field crew coordination (including NPS divers)
    - Coral Restoration Foundation
    - Florida Aquarium
    - Ms. Lauri MacLaughlin - local dive shops and volunteer coordination
- Coral larvae (*A. palmata* and *O. faveolata*) was contributed to support other permitted research and culture goals of the following:
    - Mote Marine Lab
    - State University of New York (SUNY)-Buffalo
    - NSU

Communications, media exposure, capacity building, education and outreach activities

- The 2013 coral spawning effort provided valuable field experience for two UM Masters' students, one Pennsylvania State University PhD student, and provided samples to support the research project of one NSU Masters' student.

- The team's collaboration with the Florida Aquarium provides an ongoing opportunity to informally share coral larval culture techniques and scientific experience with Aquarium staff and volunteers (they bring a crew of ~ 20 people on their Keys spawning expedition each year).
- Key West Citizen 'good news' article: 28 Aug 2013, http://packedhead.net/2013/key-west-citizen-covers-the-2013-coral-spawn/

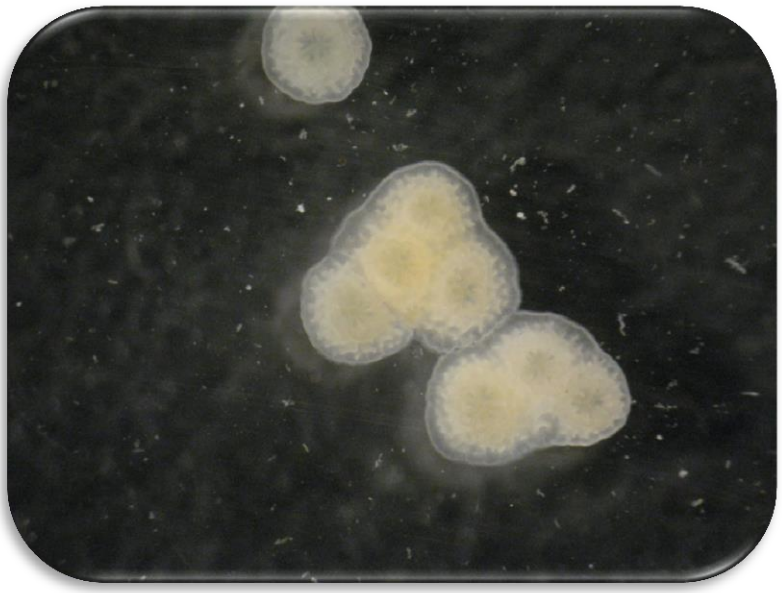
Submissions to CoRIS
None

FY2013 Publications
None

FY2013 Presentations
None

Setbacks or challenges encountered in FY2013
The lack of lab facilities at SEFSC and furlough in October impaired some of the follow-on larval experiments resulting from this project

Comments on future direction of project
For 2014, this project will increase effort to obtain spawn from multiple *A. cervicornis* genets for additional parentage crosses and include a 'local Key Largo water kept in glass/teflon treatment in future water exposure experiments.



Newly settled *Acropora palmata* polyps from the water-type exposure experiment (Photo Credit: SEFSC)

Project ID#:	0819-2013
Title:	Determining Patterns of Staghorn Coral Recovery to Establish Targets for Caribbean Reef Restoration
PIs and co-PIs:	Margaret Miller (SEFSC) and Brittany Huntington (CIMAS/UM)
Duration of Project:	Year 1 of 2, ongoing project
Project Category:	Other, Protected Corals

Brief description of activities conducted in FY2013
In 2013, the research team undertook field survey sampling and experimental outplants (coral and macroalgae) in wild *A. cervicornis* populations over a range of densities to test the hypothesis of positive feedbacks of coral growth, condition, and fish habitats with increasing staghorn coral density.

Description of accomplishments & results
Monitoring of staghorn coral was conducted at research sites in the Dry Tortugas, Florida and St. Thomas, United States Virgin Islands. Three field experiments were completed in FY13 at these sites to explore potential mechanisms driving staghorn coral condition. Biological samples and data from these field efforts are currently being processed. Results from these experiments will be used to re-frame hypotheses for FY14.

How project supports goals & objectives of CRCP
This project supports recovery goals for *A. cervicornis*, an ESA Threatened coral species.

How project supports management of coral reef resources
A. cervicornis was once a dominant coral species on Caribbean reefs but is now imperiled and listed as Threatened on the Endangered Species List. Significant knowledge gaps persist for this species that impede advancement of the ESA mandated recovery plan. This project aims to characterize rare, naturally recovering populations of *A. cervicornis* to inform the recovery strategy for this keystone species, including defining: 1) geomorphic attributes of reefs supporting healthy staghorn populations, 2) quantifiable targets for assessing staghorn abundance, and 3) best practices for outplanting nursery-reared corals to create critical fish habitat. By improving the recovery strategy for *A. cervicornis*, this project helps improve coral reef ecosystem condition in the Caribbean.

List of project partners and their roles
- Dry Tortugas National Park – permitting and facilitation for field access to Pulaski Shoal populations (lodging and boat usage)
- The Nature Conservancy (US Virgin Islands) – facilitation of field access and access to cultured corals for field experiments

Communications, media exposure, capacity building, education and outreach activities
- This project employed and provided an internship project for one UM-RSMAS Masters' student and provided a field opportunity (4 day trip to the Dry Tortugas) for an additional master's student.

Submissions to CoRIS
See below

FY2013 Publications

Huntington B and Miller MW (In press) Location-specific metrics for rapidly estimating the abundance and condition of the endangered coral, *Acropora cervicornis*. Restoration Ecology DOI: 10.1111/rec.12057.

FY2013 Presentations

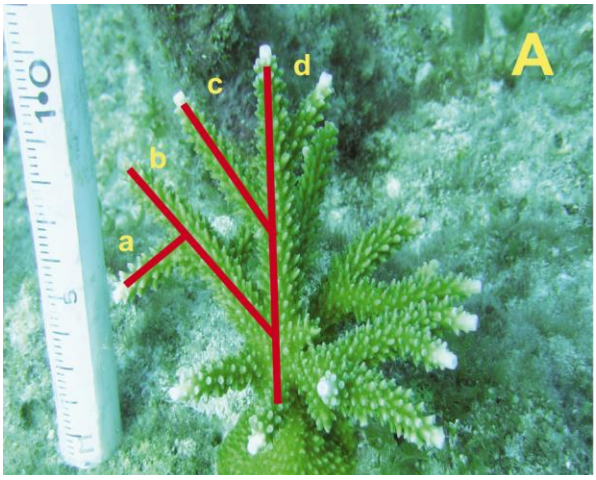
None

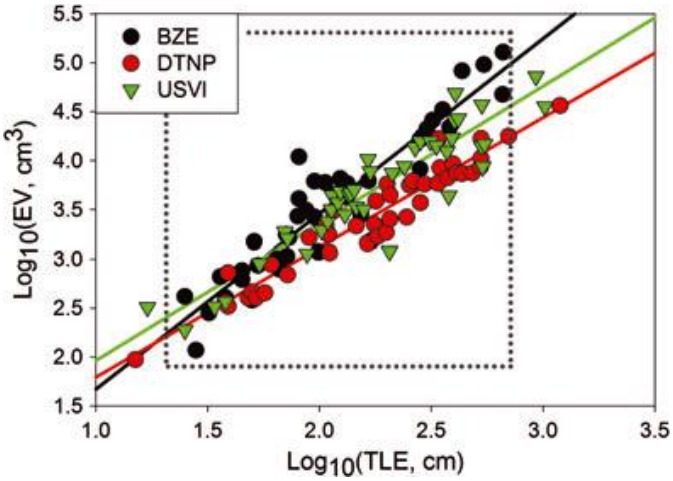
Setbacks or challenges encountered in FY2013

Permitting for proposed experimental outplants was very challenging, but accomplished with some compromise in preferred approach.

Comments on future direction of project

For FY14, the PI's plan to work with partners in the Restoration Center to expand field work to Puerto Rico (and specifically to restored *A. cervicornis* populations there).





(Left) Illustration of partial manual measurement of branch Total Linear Extent (TLE) in an *A. cervicornis* colony. While this approach is feasible for small colonies such as this one, it quickly becomes infeasible for larger colonies. Photo Credit: SEFSC. (Right) Results (from Huntington & Miller, In Press) show that TLE can be accurately estimated from the ellipsoid volume (EV) of a colony derived from relatively quick measurements of colony length, width, and height.

VII. COUNCIL COOPERATIVE AGREEMENT ACTIVITIES

Project ID#:	SAFMC Cooperative Agreement: NA11NMF4410061, GMFMC Cooperative Agreement: NA11NMF4410063
Title:	South Atlantic Bight MPAs* and Deepwater Coral HAPCs: Characterization of Benthic Habitat and Fauna Synthesis of Information on Octocoral Biology, Ecology, and Fisheries in the South Atlantic in Support of Effective Management Survey of Habitat and Fish Assemblages in Three Marine Reserves on the West Florida Shelf
PIs and co-PIs:	South Atlantic Bight MPAs: Stacey Harter (SEFSC), Andrew David (SEFSC), John Reed (Florida Atlantic University), Octocorals: Andrew David (SEFSC), Gulf MPAs: Andrew David (SEFSC) and Matthew Campbell (SEFSC)
Duration of Project:	Year 3 of 3
Project Category:	Council Cooperative Agreement Activities

Brief description of activities conducted in FY2013

The South Atlantic and Gulf Fishery Management Councils requested that SEFSC conduct targeted research and analysis towards fulfilling the activities included under the Gulf and South Atlantic Fishery Management Councils' Cooperative Agreements with the CRCP. On behalf of the SAFMC, SEFSC is executing the following two projects: South Atlantic MPAs and Deepwater Coral HAPCs: Characterization of Benthic Habitat and Fauna (herein abbreviated to "South Atlantic Bight (SAB) MPA Project"); and Synthesis of Information on Octocoral Biology, Ecology, and Fisheries in the South Atlantic in support of effective management. On behalf of the GMFMC, SEFSC is executing the project: Survey of Habitat and Fish Assemblages in Three Marine Reserves on the West Florida Shelf (herein abbreviated "Gulf MPA project"). All three of these projects have a three year time horizon (FY11-13). While funding was initiated in FY11, work will be conducted predominantly from FY12 through FY14.

Description of accomplishments & results

SAB MPA project:

The NOAA Ship PISCES was secured for the field work component and a cruise was executed in July 2013. The cruise departed and returned to Mayport Naval Air Station in Jacksonville, FL. A contract for a remotely operated vehicle (ROV) was awarded to the University of North Carolina – Wilmington (UNCW) to support this cruise. This vehicle has been used in several expeditions to the MPAs, dating back to 2004 and was again successful in meeting the goals of the project. Co-PI John Reed of Harbor Branch Oceanographic Institute is continuing the analysis of historical ROV and submersible dives in the areas now included within the CHAPCs. Considerable mapping of uncharted portions of existing and proposed MPAs was completed in 2013. The UNCW ROV has been contracted for the 2014 field work and the NOAA Ship PISCES is scheduled for a cruise in June 2014. Data quality is expected to improve in 2014 as UNCW has acquired a new ROV with high definition video cameras.

South Atlantic Octocoral Project:

A research associated, Ms. Espitia joined the research group in late 2012. Ms. Espitia focused on gorgonians for her graduate work and was an active participant in the octocoral identification workshop. Since award of the subcontract, the primary accomplishment has been the acquisition and organization of existing primary and secondary literature pertaining to octocorals of the U.S. South Atlantic.

Ultimately this extensive reference database will be one of the project deliverables. The project team has begun to organize and analyze existing data sets from southeastern Florida on the distribution density, and size structure of gorgonians in hard-bottom and coral reef habitats. The team has coordinated with historical and current marine life collectors in the region in 2013 and anticipates conducting more extensive interviews and trips in 2014.

Gulf MPA Project:
The NOAA R/V Caretta, a 58 ft. vessel owned by NOAA and operated by the Pascagoula Laboratory, was the platform used to complete the field component of this project between Feb and April 2013. This year, the project again surveyed a new MPA, The Edges, which lies between two long-standing MPAs: Madison-Swanson and Steamboat Lumps. Open-to-fishing control areas were also surveyed. Analysis of video data for fish identification and enumeration, as well as habitat determination, was completed in the fourth quarter of 2013. Fish length analysis and database entry and statistical analysis of all data will be completed by Spring 2014. The 2014 field work is scheduled for February through April.

How project supports goals & objectives of CRCP
SAB MPA Project:
This project is in direct support of SAFMC activities to characterize deep water coral ecosystems and test their efficacy of Marine Protected Areas for the protection of five deepwater grouper and two tilefish populations. It directly addresses the following CRCP National Goals and Objectives: 1. Obtain ecological information for coral reef fishes and spawning aggregations: Activities may include: a) Studies that identify, map and characterize fisheries habitat (including essential fish habitat, habitat areas of particular concern, and spawning aggregation sites) in U.S. coral reef ecosystems, and assess the condition of the habitat; b) Studies associated with coral reef areas that are currently, permanently, or seasonally closed to fishing, or that may merit inclusion in an expanded network of no-take ecological reserves; and c) Multi-beam or sidescan sonar mapping and ground truthing, habitat characterization, and monitoring of such areas, including deeper coral reefs, bands and beds.

South Atlantic Octocoral Project:
This project directly links to the CRCP National Goals and Objectives including: obtain essential life history information on coral reef species; obtaining necessary information on fishing effort in U.S. coral reef ecosystems by measuring fishing intensity, fishing mortality, frequency, area of coverage, community dependence, etc. to inform management activities; and assessing the adequacy of current coral reef fishing regulations including revisions of regulations as needed and increasing compliance with regulations that further coral reef ecosystem conservation. This project provides essential information for the conservation and management of South Atlantic coral resources under the SAFMC's Coral, Coral Reef and Live/Hardbottom Habitat Fishery Management Plan (Coral FMP). The proposed work conforms to the "Coral Reef National Action Strategy" and the "National Action Plan to Conserve Coral Reefs". This project was developed at the request of the SAFMC to help them, and the state of Florida, effectively manage the octocoral fishery which currently has very little data available for science-based management.

Gulf MPA Project:
This project is in direct support of Council activities to characterize protected deep water coral ecosystems and test the efficacy of MPAs as management tools. It directly addresses the following CRCP National Goals and Objectives: 1. Obtain ecological information for coral reef fishes and spawning aggregations: Activities may include: a) Studies that identify, map and characterize fisheries habitat (including essential fish habitat, habitat areas of particular concern, and spawning aggregation sites) in

U.S. coral reef ecosystems, and assess the condition of the habitat; b) Studies associated with coral reef areas that are currently, permanently, or seasonally closed to fishing, or that may merit inclusion in an expanded network of no-take ecological reserves; and c) Multi-beam or sidescan sonar mapping and ground truthing, habitat characterization, and monitoring of such areas, including deeper coral reefs, bands and beds

How project supports management of coral reef resources

SAB MPA Project:

The results of this MPA and Coral Habitat Area of Particular Concern (HAPC) monitoring program are being used by the SAFMC during their evaluation of the protected areas. Continuation of this monitoring program will insure the SAFMC remains well informed of changes within reef fish populations and coral habitats associated with these areas.

South Atlantic Octocoral Project:

This project will assist the SAFMC and the state of Florida in arriving at scientifically-derived levels of Acceptable Biological Catch for octocorals under its FMP. The SAFMC has been working to establish fishing level parameters mandated in the Reauthorized Magnuson Stevens Act in 2006. However, data on the status of the octocoral population in Florida, where the fishery operates, are very limited. While harvest information gathered by FWC is available, not enough information exists on the species being harvested, harvest areas, or practices. Obtaining information on population status, species harvested, species' use of this habitat by managed species, etc. would directly address management objectives in the SAFMC's Coral FMP.

Gulf MPA Project:

This Gulf of Mexico MPA monitoring program has been and will continue to be used by the GMFMC during their evaluation of the protected areas. Continuation of this monitoring program will insure the GMFMC remains well informed of changes within reef fish populations and coral habitats associated with these areas.

List of project partners and their roles

SAB MPA Project:

- UNCW – Owns and operates the ROV which will be used on the upcoming cruise
- NOS, Charleston – Provides geographer to supervise multibeam mapping procedures while at sea
- College of Charleston – Provides graduate student to assist with multibeam mapping and data processing

South Atlantic Octocoral Project:

- NSU –Project personnel, octocoral identification workshop and on-line database
- Dr. Henry Feddern – President of the Florida Marine Life Association- will provide industry support for the project
- Dr. Luiz Barbieri – FWC – will provide state support for the project and access to fishery data

Gulf MPA Project:

None

Communications, media exposure, capacity building, education and outreach activities

None

Submissions to CoRIS
None

FY2013 Publications
Bi-annual progress reports for each of these projects were provided to the South Atlantic and Gulf Councils

FY2013 Presentations
Stacey Harter gave several oral presentations to the SAFMC on results of SAB MPA project at the December 2013 SAFMC meetings in Wilmington, NC, including updates on the Oculina Banks HAPC, Amendment 14, and Amendment 17.

Setbacks or challenges encountered in FY2013
None.

Comments on future direction of project
These activities are funded for a three year period ending in FY13. Active field work will likely continue into FY14 due to the nature of the funding cycle.

**For the purposes of this work, the South Atlantic Bight (SAB) is defined as the coast of the United States between Cape Hatteras, North Carolina and Cape Canaveral, Florida*

VIII. LIST OF ACRONYMS

AOML	OAR's Atlantic Oceanographic and Meteorological Laboratory
CCFHR	NCCOS - Center for Coastal Fisheries Habitat Research
CIMAS	Cooperative Institute for Marine and Atmospheric Studies
CMIP	Coupled Model Intercomparison Project
CoRIS	Coral Reef Information System
CRCP	Coral Reef Conservation Program
CREIOS	Coral Reef Ecosystem Integrated Observing System
ESA	Endangered Species Act
FGBNMS	Flower Garden Banks National Marine Sanctuary
FKNMS	Florida Keys National Marine Sanctuary
FKNMS	Florida Keys National Marine Sanctuary
FL	Florida
FMP	Fishery Management Plan
FSA	Reef Fish Spawning Aggregation
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Florida Fish and Wildlife Research Institute
FY	Fiscal Year
GMFMC	Gulf of Mexico Fishery Management Council
HAPC	Habitat Area of Particular Concern
LPI	Line Point Intercept
MPA	Marine Protected Area
NCCOS	NOS National Centers for Coastal Ocean Science
NCRMP	National Coral Reef Monitoring Plan
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPS	National Park Service
NSU	Nova Southeastern University
OAR	Oceanic and Atmospheric Research
OMB	Office of Management and Budget
PI	Principal Investigator
QA/QC	Quality Assurance/Quality Control
R/V	Research Vessel
RCP	Representative Concentration Pathway
REEF	Reef Environmental Education Foundation
ROV	Remotely Operated Vehicle
SAB	South Atlantic Bight
SAFMC	South Atlantic Fishery Management Council
SEFCRI	Southeast Florida Coral Reef Initiative
SEFSC	Southeast Fishery Science Center
TSER	Tortugas South Ecological Reserve, also known as Riley's Hump
UF	University of Florida
UM-RSMAS	University of Miami, Rosenstiel School of Marine and Atmospheric Science
UNCW	University of North Carolina Wilmington
US	United States
USVI	United States Virgin Islands
UVI	University of Virgin Islands
WDR	Western Dry Rocks