



NOAA Technical Memorandum NMFS-SEFSC-644

# SEFSC Coral Reef Program: FY 2011 Project Accomplishments Report

Compiled by:  
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National Marine Fisheries Service  
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May 2013





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Cover photograph: Neon goby on Great Star Coral Photo Credit: Jiangang Luo, RSMAS

**SEFSC Coral Reef Program: FY 2011 Project Accomplishments Report  
Table of Contents**

<b>I. INTRODUCTION</b> .....	1
<b>II. PROGRAM COORDINATION</b>	
<b>Schull:</b> SEFSC Coral Reef Conservation Program Coordination and Communication. . . . .	2
<b>III. REDUCE ADVERSE IMPACTS OF FISHING</b>	
<b>Burton:</b> Coupling of Passive and Active Acoustics to Assess Grouper Aggregations in the Tortugas Ecological Reserve. . . . .	4
<b>Burton:</b> Assess/Monitor Effects of MPA Status on Reef Fish Populations and Spawning Aggregations in the Tortugas Ecological Reserves . . . . .	7
<b>Kellison:</b> Assessing the Locations and Status of Reef Fish Spawning Aggregations in the Florida Keys . . . . .	10
<b>Ruttenberg:</b> Assess and Monitor Coral Reef MPAs. . . . .	13
<b>Ruttenberg:</b> Using Existing Data to Develop a Comprehensive Reef Fish Monitoring Program for the Southeast Florida Region . . . . .	18
<b>Ruttenberg:</b> The Importance of Parrotfish (fam. Scaridae) on the Maintenance and Recovery Of Coral-Dominated Reefs . . . . .	20
<b>IV. REDUCE IMPACTS OF CLIMATE CHANGE</b>	
<b>Lamkin:</b> Developing Downscaled Climate Models for Coral Reef Management in the 21 <sup>st</sup> Century . . . . .	22
<b>Miller:</b> Climate Change Impacts on reef organisms: potential for recovery/resilience of reef building corals and algal interference . . . . .	25
<b>V. PROTECTED CORALS</b>	
<b>Miller:</b> Evaluation of <i>Acropora</i> Status for Management, Recovery and Climate Response . . . . .	28
<b>VI. COUNCIL COOPERATIVE AGREEMENT ACTIVITIES</b>	
<b>David:</b> South Atlantic MPAs: Pre-closure Evaluation of Habitat and Fish Assemblages in Five Proposed No Fishing Zones. . . . .	31
<b>David:</b> Survey of Habitat and Fish Assemblages in Two Marine Reserves on West Florida Shelf. . . . .	31
<b>David:</b> Synthesis of Information on Octocoral Biology, Ecology and Fisheries in The South Atlantic in Support of Effective Management . . . . .	31
<b>VII. REDUCE THREATS TO INTERNATIONAL CORAL REEFS</b>	
<b>Lamkin:</b> Applying Bio-Physical Monitoring and Capacity Assessments to Mesoamerican Reef MPAs . . . . .	34



## I. INTRODUCTION

The NOAA Coral Reef Conservation Program (CRCP) is administered by NOAA's National Ocean Service (NOS) and is a matrix program operating across four NOAA line offices: (NOS), National Marine Fisheries Service (NMFS), National Environmental Satellite, Data, and Information Service (NESDIS), and Oceanic and Atmospheric Research (OAR). The program supports all coral reef regions of the US, has an international component, and is integrated with other federal agencies, state and local governments, territories and commonwealths. In September 2007, CRCP conducted an external program review for an independent assessment of the CRCPs effectiveness in achieving its mandates and to provide recommendations for improving its impact and performance. Recommendations from this review, along with the subsequent planning process (the "roadmap") shaped the recent history of the CRCP. In 2011, CRCP welcomed a new program manager, John Christensen, to lead the program forward.

The Southeast Fisheries Science Center (SEFSC) has had a leadership role in coral reef conservation science since 1978. Congress passed the Coral Reef Conservation Act in 2000 and SEFSC was able to dovetail its management relevant coral reef science with the developing directives of the NOAA CRCP. SEFSC has maintained a strong coral reef science program since inception of the CRCP in 2001, and has continued 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 recent reauthorization of the Magnuson-Stevens Fisheries Act and the listing of two Atlantic corals as Threatened under the ESA in 2006 further positioned NMFS as a critical regulatory authority to effect change in coral reefs.

In Fiscal Year 2011, CRCP supported 14 SEFSC-led projects totaling \$1.8M. While most projects addressed fishing impacts or concerns about the status and recovery of protected coral species, SEFSC also tackled projects looking at the impacts of climate on coral reef ecosystems by downscaling global climate models to be useful on a regional scale, and exploring the impacts of climate on coral spawning and settlement success. SEFSC was also a leader in developing the status review for 82 corals recently petitioned for listing under the ESA. SEFSC continued its important work on reef fish distribution and abundance in support of ecosystem and fisheries management and continued work on the behavioral ecology of reef fish spawning aggregations in an effort to identify and protect these important assets. Three papers published by our invaluable academic partners (Smith et al. 2011<sup>1</sup>, Smith et al. 2011<sup>2</sup>, and Brandt et al. 2011<sup>3</sup>) described the sophisticated survey design procedures and the genesis of the successful multi-agency collaboration underway and expanding in Florida (and beyond) in order to transfer the methodology to our regional partners and expand the scope and scale of these activities. Insights from these publications are informing the development of the CRCP's "national status and trends" monitoring program (NCRMP). By building on these peer-reviewed best practices, CRCP has the opportunity to develop a state of the art, cost effective and scientifically rigorous monitoring program across coral reef jurisdictions in the United States. SEFSC is proud to be an integral part of the development of the NCRMP.

As part of NMFS, SEFSC plays a critical role in the Southeast, Caribbean and Gulf regions in providing the science to support the agency's regulatory responsibilities. This year, SEFSC worked collaboratively with the regional Fishery Management Councils to develop research programs that would meet the Council's needs. By working together, SEFSC is helping address MPA and Fishery issues in both the South Atlantic and Gulf of Mexico.

This annual accomplishments report provides information on the activities and accomplishments of our coral reef projects funded by the CRCP in FY11, organized by the program's newly refined and narrower goals and objectives. SEFSC gratefully acknowledges funding from NOAA's Coral Reef Conservation Program.

<sup>1</sup>Smith, S.G., J.S. Ault, J.A. Bohnsack, D.E. Harper, J. Luo, and D.B. McClellan. 2011. Multispecies survey design for assessing reef-fish stocks, spatially-explicit management performance, and ecosystem condition. *Journal of Fisheries Research* 109(1): 25-41.

<sup>2</sup>Smith, S.G., D.W. Swanson, M. Chiapone, S.L. Miller, J.S. Ault. Probability sampling of stony coral populations in the Florida Keys. *Environ. Monit. Assess* (2011) 183: 121-138.

<sup>3</sup>Brandt, M., Zurcher, N., Atkinson, A., Acosta, A., Ault, J.S., Bohnsack, J.A., Feeley, M.W., Harper, D.E., Hunt, J.H., Kellison, G.T., McClellan, D.B., Patterson, M.E., Smith, S.G. 2011. The Opportunities and Challenges in Development of a Multi-agency Program to Monitor and Assess Reef Fish Populations in the Florida Keys Coral Reef Ecosystem. *Proc. Gulf Carib. Fishery Inst.* 62: 348-357.

## II. PROGRAM COORDINATION

<b>Project ID#:</b>	1250-2011
<b>Title:</b>	SEFSC Coral Reef Conservation Program coordination and communication
<b>PIs and co-PIs:</b>	Jennifer Schull, NOAA/SEFSC
<b>Duration of Project:</b>	Year 2 of 3, ongoing project
<b>Project Category:</b>	Program Coordination

### **Brief description of activities conducted in FY2011**

This project provided coordination and communications assistance for SEFSC's portfolio of coral reef related activities for FY11. It covered SEFSC participation in working groups, coordination of SEFSC projects, budgets, accomplishments reporting, and proposal development. 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.

### **Description of accomplishments & results**

In FY11, the Program Coordinator served on 1) the CRCP status and trends monitoring working group (NCRMP) including the biological monitoring subgroup and meeting steering committee; 2) the Jurisdictional working group for the USVI for FY11 proposal development activities; as well as 3) teams working on spend plan redevelopment, performance measures, database redesign, data management, outreach and communications, and international activities. The Program Coordinator ensured significant planning documents were reviewed by subject matter experts (i.e. OA plan, lionfish strategy), and coordinated grant review for several CRCP grant programs. The Program Coordinator participated in the Coral Reef Task Force Meeting and Resiliency Workshop, the SEFCRI LAS strategic planning workshop for FY12-16, and the Linking Science to Management professional conference.

The Program Coordinator managed all SEFSC projects in FY11 as well as the FY11 pre-proposal and proposal portfolios, and then executed all reporting, contracting, and budget requirements for the approved projects. Updates were submitted to CRCP regarding project progress, accomplishments, missions and publications, as well as coordination of SEFSC PI input into CoRIS. In FY11, the Program Coordinator assisted PIs in developing two novel projects related to parrotfish and octocorals that were successfully funded and are ongoing; and relationships with key management partners (i.e. Fishery Management Councils and State of Florida) were maintained and expanded. Other accomplishments include coordination of SEFSC's input for the FY12 CRCP Report to Congress and the NMFS 2010 research report, participation in monthly and biweekly coral calls, significant scoping for FY12 spend plan development, and hosting an annual meeting with NMFS CRCP representatives in June 2011.

FY11 funds were used to offer a part time internship at SEFSC in FY12. The purpose of the internship was to assist the Program Coordinator with development of a synoptic SEFSC CRCP report covering the transitional years between 2007-2010 as well as assist with other science writing responsibilities and development of SEFSC coral reef related website content and photo and video archiving.



**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 that align well with the goals and objectives of the CRCP as well as meeting the needs of the coral reef management community. This project ensures that SEFSC PI's are responsive to CRCP needs and that SEFSC speaks with one voice. Additionally, 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, and synthesizes the expert advice and scientific outputs of SEFSC coral reef related projects so they can be incorporated into scientifically sound management actions. Additionally, it integrates CRCP related outputs with those from other NMFS activities related to habitat, sustainable fisheries, and protected species, and it also integrates SEFSC's coral reef related activities with other NOAA and NMFS engagement 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**

The Program Coordinator hired a part-time intern who will hone science writing and communications skills during her internship at SEFSC working on coral reef related activities in FY12. The Program Coordinator hosted several CRCP staff, a fishery scientist from the Ivory Coast, and the NOAA Sea Grant Population Dynamics & Socioeconomics fellows at SEFSC, and traveled to Silver Spring to interface with key CRCP personnel. . The Program Coordinator completed the 2010 SEFSC Accomplishments Report as a NOAA Tech Memo (see below). The Program Coordinator also maintained active dive status to assist PIs with field work needs. The Program Coordinator continues to represent SEFSC on a variety of CRCP and NOAA working groups and reports on scientific accomplishments, discoveries, publications and media to a variety of sources.

**Submissions to CoRIS**

SEFSC Coral Reef Program: FY2010 Project Accomplishment Report. Compiled by Jennifer Schull. NOAA Technical Memorandum. NMFS-SEFSC-628, 44p.

**FY2011 Publications**

See above

**FY2011 Presentations**

None

**Setbacks or challenges encountered in FY2011**

None

**Comments on future direction of project**

This project is ongoing and provides valuable oversight and coordination of SEFSC's coral related activities.

### III. REDUCE ADVERSE IMPACTS OF FISHING

<b>Project ID#:</b>	20505-2011
<b>Title:</b>	F103 Coupling of Passive and Active Acoustics to Assess Grouper Aggregations in the Tortugas Ecological Reserve
<b>PIs and co-PIs:</b>	Michael L. Burton
<b>Duration of Project:</b>	Year 2 of 2
<b>Project Category:</b>	Reduce Adverse Impacts of Fishing

#### **Brief description of activities conducted in FY2011**

In February 2011 we retrieved, downloaded, and redeployed three acoustic digital spectrum recorders (DSGs) that had been deployed over the winter at three stations. Three additional DSGs were deployed on new stations that were selected in July 2011. Visual census transect dives and RVC point counts were completed on all six stations over the course of the two cruises in order to compare fish community data with acoustic data.

#### **Description of accomplishments & results**

In February 2011, we retrieved and redeployed acoustic recorders on our original three stations and accomplished visual census transects and RVC point counts. By leveraging a complementary project, we were able to retrieve, download and redeploy the original three DSGs in July 2011. We also deployed three additional recorders on sites we determined were likely grouper spawning habitat based on our active split beam sonar work from previous cruises. These recorders will be retrieved in July 2012, providing SEFSC with a second full winter of acoustics data.

The initial year of acoustic data has been preliminarily analyzed, with no evidence of acoustic signals that could be definitively attributed to grouper spawning aggregations. We still believe these are likely aggregation sites based on observed species composition, hence redeployment of acoustic equipment in the same locations. By analyzing our limited split beam sonar data and data collected during summer months from a complementary snapper aggregations project, we selected three additional target sites with high species diversity and habitat complexity.

The project now has a good geographic range of recorders on the sites on Riley's Hump most likely to hold grouper aggregations. By working with our leveraged funds and charter vessel, we will be able to leave the recorders out for an additional winter spawning season. If we are able to detect acoustic signals that can be attributed to grouper spawning aggregations, this will provide more evidence of the capability of the MPA to recover multiple exploited stocks of reef fish, and should support the continued use of MPAs as an effective management tool by fishery management agencies, Councils, and Sanctuaries.

#### **How project supports goals & objectives of CRCP**

The CRCP invests resources in both reducing the adverse impacts of overfishing, and advocating for the use of science based spatial planning, including the implementation and management of marine protected areas. In addition, long term biennial monitoring of the Tortugas Ecological Reserve (TER) contributes to our understanding of coral reef ecosystems. Employing cutting edge acoustic methodologies to the complement of activities at Riley's Hump increases the scale, scope, and coverage

of monitoring at Riley's Hump in the hopes of documenting an increase in biomass and numbers of commercially and ecologically important apex predators, and most importantly the return of spawning to this multi-species aggregation site.

### **How project supports management of coral reef resources**

This project attempts to provide evidence that severely exploited species, once protected from excessive fishing pressure, may indeed recover. The previous finding of mutton snapper spawning occurring again after years of heavy overexploitation advanced the use of marine protected areas as a viable management tool to protect both coral reef fishes and coral reef habitat. Concurrent with the depletion of mutton snapper stocks on Riley's Hump was the decrease in abundance of top predators such as black grouper. Since 2009, researchers have documented increasing sighting frequency for most grouper species found in the TER. Documentation of the increases in abundance of exploited species once they are protected from fishing benefits coral reef ecosystems (reef fish populations plus the coral reef habitat they use) by showing the effectiveness and utility of using MPAs as a management tool.

### **List of project partners and their roles**

- NOS/NCCOS: Expertise and equipment to collect split beam sonar data for characterization of both habitat and fish stocks.
- NOS/FKNMS: Assists in permitting process and guiding our overall research through discussions of the Sanctuary's research information needs
- FWC, NCCOS, USF, REEF and SEFSC: Staff, divers, and data collection and analysis

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

Informal communications with partners and management agencies about ongoing progress of this project

### **Submissions to CoRIS**

Progress reports, cruise reports and metadata reports were submitted to CoRIS

### **FY2011 Publications**

None

### **FY2011 Presentations**

None

### **Setbacks or challenges encountered in FY2011**

This project was behind schedule due to contracting delays. We had three cruises scheduled for FY11 and two were completed, with the third delayed until summer 2012 for final equipment retrieval. We will have two winters' worth of acoustic and visual survey data to analyze for the successful completion of this project.

### **Comments on future direction of project**

Upon retrieval of deployed acoustic recorders and several more nights of split beam sonar data from the July 2012 cruise, we will begin analyses of data to determine function of our study sites as grouper aggregation habitat. We will continue collecting active split beam sonar data opportunistically from sites on Riley's Hump as part of the Assess/monitor reef fish populations project (CRCP ID#1068), biennially with CRCP funding for monitoring in FY13.



Figure 1. Co-PI Jim Locascio, USF, and Ken Brennan, NMFS Beaufort Laboratory, deploy underwater cameras with hydrophones at selected stations to study acoustics of grouper spawning aggregations. (Photo: Mike Judge, NMFS, SEFSC, Miami Laboratory).

<b>Project ID#:</b>	1068-2011
<b>Title:</b>	F104 Assess/monitor effects of MPA status on reef fish populations and spawning aggregations in the Tortugas Ecological Reserves
<b>PIs and co-PIs:</b>	Michael L. Burton
<b>Duration of Project:</b>	Year 1 of 1, ongoing biennially
<b>Project Category:</b>	Reduce Adverse Impacts of Fishing

**Brief description of activities conducted in FY2011**

Transects, RVC cylinder point counts, and REEF (Reef Environmental Education Foundation) roving diver surveys were completed on fixed stations in the North and South Tortugas Ecological Reserves in order to characterize resident fish populations. Habitat characterization transects were conducted on stations in both reserves. We retrieved and redeployed temperature loggers and overnight video cameras on the primary stations where mutton snapper aggregate in large numbers. Additionally, we completed a total of 22 hours of split beam sonar operations over three nights, mapping and characterizing habitat and fish aggregations.

**Description of accomplishments & results**

A six day cruise to the TER was completed July 13-18, 2011. Sixteen research divers completed a total of 219 research dives, sampling 16 stations in the south reserve (Riley’s Hump) and nine stations in the north reserve. Randomly oriented transect visual censuses were completed on all stations. Stationary point counts were completed on 14 of 16 stations on Riley’s Hump and five of nine stations in the north reserve. REEF surveys were completed on nine of 16 Riley’s Hump stations and two of six north reserve stations. Lionfish predator-prey transects and habitat characterization transects were completed at all Riley’s stations and seven of nine north reserve stations. We completed three nights (22 hrs) of split beam sonar operations to characterize potential spawning aggregations of reef fish and their habitat. Three bottom temperature loggers were retrieved, downloaded and redeployed.

We continue to document recovery of previously exploited reef fish species since the inception of reserve designation. Numbers of transects on Riley’s Hump on which key species were seen and percentage of total transects completed are given below and compared to sighting frequencies from 2009.

Species	Sighting Frequency (2011)	Sighting Frequency (2009)
<b>Mutton Snapper</b>	40%	51%
<b>Black Grouper</b>	26%	21%
<b>Yellowfin Grouper</b>	6%	1%
<b>Nassau Grouper</b>	2%	2%
<b>Goliath Grouper</b>	2%	1%
<b>Red Grouper</b>	18%	6%
<b>Other Grouper (hinds, scamp, yellowmouth, graysby, coney</b>	43%	20%

Since 2009, we documented substantial increases in sighting frequency for most groupers. While mutton snapper sighting frequencies appeared to decrease in 2011, the number of transects on which we sighted more than 40 mutton snapper increased. The average number of mutton snapper counted per transect increased from 3.9 in 2009 to 5.5 fish in 2011. Thus, we continue to document increasing numbers of mutton snapper aggregating at Riley's Hump, offering evidence of a continued recovery of the spawning aggregation. Over the course of our work documenting the recovery of reef fish aggregations, we have also documented the alarming invasion of lionfish to the Tortugas Ecological Reserve. Our first lionfish observation occurred in April 2010. By July 2011, divers observed lionfish on 26% of transects, with over 50 observed in total. To capture the impact, we instituted a lionfish predator-prey transect survey on this cruise, which we hope to continue in future years, so that we may gather both pre- and post-invasion prey community data to determine if lionfish are impacting the local fish communities. Our reef fish monitoring project is a good vehicle for documenting any impacts on the ecosystem caused by lionfish.

### **How project supports goals & objectives of CRCP**

The CRCP invests resources in both reducing the adverse impacts of overfishing and advocating for the use of science based spatial planning, including the implementation and management of marine protected areas. In addition, long term biennial monitoring of the Tortugas Ecological Reserve contributes to our understanding of coral reef ecosystems. This well established, science based research and monitoring program is documenting an increase in biomass and numbers of commercially and ecologically important apex predators, and most importantly the return of spawning to this multi-species aggregation site; which may result in population gains for the region.

### **How project supports management of coral reef resources**

This project continues to provide evidence that severely exploited species, once protected from excessive fishing pressure, may indeed recover. The previous finding of mutton snapper spawning occurring again after years of heavy overexploitation should further justify and advance the use of marine protected areas as a viable management tool to protect both coral reef fishes and coral reef habitat. Documentation of the increases in abundance of exploited species once they are protected from fishing benefits coral reef ecosystems (reef fish populations plus the coral reef habitat they use) by showing the effectiveness and utility of using MPAs as a management tool to protect these ecosystem components. This location may also offer a laboratory to observe if the lionfish invasion is mitigated by having a healthy grouper/snapper population.

### **List of project partners and their roles**

- NOS/NCCOS: expertise and equipment to collect split beam sonar data for characterization of both habitat and fish stocks; plus contributions of staff, divers, and data analysis
- NOS/FKNMS: Assists in permitting process and guiding our overall research through discussions of the Sanctuary's research information needs
- Florida FWC, The University of South Florida (USF), Reef Environmental Education Foundation (REEF) and SEFSC: contributions of staff, divers, and data collection and analysis

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

Informal communications with management entities and partners

### **Submissions to CoRIS**

Progress reports, cruise reports and metadata reports have all been submitted to CoRIS

**FY2011 Publications**

None

**FY2011 Presentations**

None

**Setbacks or challenges encountered in FY2011**

Minor delays were experienced due to weather and high current, resulting in a 15% reduction in transect effort in 2011 vs. 2009.

**Comments on future direction of project**

We plan to continue biennial monitoring of snapper/grouper stocks and habitat in the Tortugas Ecological Reserve pending funding in 2013. In addition, we plan to continue data collection on prey community composition and lionfish abundance at Riley's Hump in order to draw conclusions about how lionfish are impacting native fish communities and potentially vice-versa.



Fig 1. (L) First Indo-Pacific lionfish observed at Riley's Hump, Station 15, April 2010; (R) A diver swims by three large black grouper at Riley's Hump July 2011.

<b>Project ID#:</b>	1317-2011
<b>Title:</b>	F082 Assessing the locations and status of reef fish spawning aggregations in the Florida Keys
<b>PIs and co-PIs:</b>	Todd Kellison and Chris Taylor (NOS)
<b>Duration of Project:</b>	Year 1 of 1; ongoing project
<b>Project Category:</b>	Reduce Adverse Impacts of Fishing

**Brief description of activities conducted in FY2011**

In FY11, we continued efforts to identify and assess reported reef fish spawning aggregations (FSAs) in the Florida Keys. Building on our prior research in the upper and lower Keys, we focused on multiple sites in the lower 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**

For the mapping component, we used acoustics (single and split-beam echosounders) to survey a large, previously unmapped (aside from coarse bathymetry) area off Key West. The area contained a reported gray snapper aggregation site (conveyed by a retired commercial fisherman) and an area identified as a potential aggregation site based on vessel and diver surveys during FY10 fieldwork. The resulting acoustic data was analyzed and interpolated to create a detailed bathymetric representation (i.e., map) of the survey area, including identification of hardbottom versus non-hardbottom habitats. As predicted from the conceptual model developed from prior years’ research, the suspected aggregation sites were associated with a previously unmapped outlier reef.

For the fish utilization component, fisheries sonar and diver surveys were performed in FY11 at reported or suspected reef fish aggregation sites (n = 5 sites) in the lower Keys during predicted full-moon spawning periods from May to July. Aerial surveys were also performed during predicted spawning moons to assess relative levels of fishing pressure on the reported aggregation sites, and to attempt to infer the location of additional sites from potential groupings of fishing vessels. One of the five focal sites was a mutton snapper site and four of the sites were gray snapper sites. At the mutton snapper site, aerial surveys documented intense fishing pressure on the mutton snapper aggregation in May (the apparent peak month of the 2010 mutton snapper aggregation); with 38 commercial and recreation vessels observed fishing on the aggregation site during one aerial survey. Fishing and diving surveys by researchers on the site during this period documented aggregated mutton snappers. Acoustic and diver surveys at the gray snapper sites were unsuccessful in documenting large aggregations of fish during any of the full moons in summer 2011, despite having observed large numbers of gray snappers at several of those sites during several full moons in the summer of 2010. In nearly all cases, commercial and/or recreational fishing vessels were observed targeting the suspected / reported aggregation sites.

**How project supports goals & objectives of CRCP**

This project addresses Objective F2.4. Our 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**

Reef fish spawning aggregations are a vital part of the life cycle of many reef fishes. Unfortunately, the act of aggregation makes aggregating 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. Florida Keys National Marine Sanctuary managers are kept abreast of research results (via direct communication from project PIs) and directly support the research through making resources available for use (e.g., vessels and docking facilities).

### **List of project partners and their roles**

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

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

PIs Kellison and Taylor participated in a radio interview focusing on FL Keys spawning aggregation research on Keys Radio 107.1FM in July 2011.

### **Submissions to CoRIS**

Gleason, ACR, GT Kellison and PR Reid. 2011. Geomorphic Characterization of Reef Fish Aggregation Sites in the Upper Florida Keys, USA, Using Single-Beam Acoustics. *The Professional Geographer* 63(4), 443-455, DOI:10.1080/00330124.2011.585075

### **FY2011 Publications**

Gleason, ACR, GT Kellison and PR Reid. 2011. Geomorphic Characterization of Reef Fish Aggregation Sites in the Upper Florida Keys, USA, Using Single-Beam Acoustics. *The Professional Geographer* 63(4), 443-455, DOI:10.1080/00330124.2011.585075

### **FY2011 Presentations**

D. Morley, T. Kellison, C. Taylor, A. Acosta, M. Feeley and A. Gleason. Assessment of geomorphological characteristics and reef fish utilization of reported reef fish aggregation sites in the Florida Keys, USA. FL Keys Marine Ecosystem Conference (10.10)

B. Binder, A. Acosta, T. Kellison, C. Taylor, M. Feeley, D. Morley and A. Gleason. Estimating Fishing Intensity on Spawning Aggregation Sites by Means of Aerial Survey. FL Keys Marine Ecosystem Conference (10.10)

GT Kellison, A Gleason, JC Taylor, D Morley, M Feeley, and A Acosta. Progress in Assessing Geomorphological Characteristics and Reef Fish Utilization of Reported Reef Fish Aggregation Sites in the Florida Keys, USA. 63<sup>rd</sup> Gulf and Caribbean Fisheries Institute Symposium, San Juan, Puerto Rico (11.10)

JC Taylor, GT Kellison, ACR Gleason, D. Morley, A. Acosta and M. Feeley. In Search Of: Sonar and scuba surveys of reef fish spawning aggregations in the Florida Keys. NC Science and Education Dive Symposium, Pine Knoll Shores, NC (3.11)

**Setbacks or challenges encountered in FY2011**

None

**Comments on future direction of project**

In 2012, we plan to focus efforts on reported reef fish aggregation sites off the middle Keys (Big Pine / Marathon area).



Fig. 1: Commercial and recreational fishing vessels targeting a mutton snapper spawning aggregation off Key West, FL in May 2011 (credit: FL FWC).

<b>Project ID#:</b>	1064 - 2011
<b>Title:</b>	F180 Assess and monitor coral reef MPAs
<b>PIs and co-PIs:</b>	PI: Benjamin Ruttenberg (NOAA SEFSC); co-PIs: Jim Bohnsack, Jerry Ault (UM-RSMAS), Steven Smith (UM-RSMAS)
<b>Duration of Project:</b>	Year 1 of 1, ongoing project
<b>Project Category:</b>	Reduce Adverse Impacts of Fishing

**Brief description of activities conducted in FY2011**

The FY11 goals of this project were to continue long-term monitoring efforts of coral reef fish and habitat in the FL Keys and the Dry Tortugas region. Results are used to (1) assess the effects of marine reserves and other management zones in the FL Keys and Tortugas regions, and (2) improve understanding of ecosystem dynamics and guide ecosystem management, including the maintenance of sustainable fisheries. Sampling uses non-destructive visual assessments based on a stationary-diver technique deployed in a two-stage, stratified random sampling design.

Sampling in the FL Keys has occurred since 1979. Beginning in FY08, the State of Florida’s Fish and Wildlife Research Institute (FWRI) and the National Park Service (NPS) agreed to perform cooperative sampling and subsequent data sharing with NOAA SEFSC, and this collaboration began in earnest in FY09. Sampling in the Dry Tortugas region occurred irregularly from 1994-1999, and has occurred every two years since 2000. However, a no-take marine reserve was implemented in Dry Tortugas National Park in early 2007, with an agreement to evaluate its effectiveness in 5 years. Sampling for FY11 began in May, and included 410 sites and over 1544 research dives in the Florida Keys and Biscayne National Park, and 224 sites and 888 research dives in the Dry Tortugas Region. Staff from NOAA SEFSC, NPS, FWRI, University of Miami-RSMAS, NOVA Southeastern University and Florida International University participated in field research efforts

All data have been entered and passed through the initial quality assurance/quality control procedures, and we are in the final stages of QA/QC procedures. We anticipate distributing FY11 data to all partners by April, and we will use FY11 data to generate sampling points for FY12 surveys by late April or early May 2012.

**Description of accomplishments & results**

In FY11, divers conducted photo-documentation, RVC fish surveys, and habitat assessments at 410 sites in the Florida Keys and 224 sites in the Dry Tortugas (4 divers/site). NOAA SEFSC divers collaborated with the UM - RSMAS, Florida Keys National Marine Sanctuary (FKNMS), FWRI, and NPS (South Florida and Caribbean Network). In the Florida Keys, approximately 33.9% of the RVC dives were made by NOAA divers and the remaining 66.1% completed by contract, university, NPS, and FWRI divers. In total, 1544 dives were needed to complete the 2011 mission to monitor reef fish community composition, habitat composition, and abundance and size structure for more 300 reef fish species on Florida's coral reef tract. Additionally, in the Dry Tortugas (NPS cruise), 28.9% of the dives were completed by NOAA personnel, and the remaining 71.1% completed by other agencies. Data are used to assess population and habitat trends (e.g., whether species are overfished) and ecosystem responses to fisheries management actions, including determining the effectiveness of no-take MPAs

### **How project supports goals & objectives of CRCP**

Monitoring of coral reef fish and habitat resources is critical to the assessment of ecosystem status and the effectiveness of management actions, particularly as they relate to MPAs and the effects of fishing on coral reef ecosystems.

### **How project supports management of coral reef resources**

Data and analytical results are shared with State of Florida, the NPS, and FKNMS managers to support and guide management decisions within Florida's coral reef ecosystems. In particular, data from FY11 was critical because the governor and cabinet of the State of Florida will evaluate the effectiveness of the no-take zone in Dry Tortugas National Park in 2012.

### **List of project partners and their roles**

- University of Miami - RSMAS,: create survey design; assist with data collection and with data analyses and writing of technical reports
- State of Florida, FWRI: assist with data collection
- U.S. NPS: assist with data collection

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

Partnership with the FWRI and the NPS has resulted in a significant increase in sampling power and project benefits to NOAA, the State of Florida, the NPS, and FKNMS managers.

### **Submissions to CoRIS**

Metadata for RVC sampling 2011 is complete and was submitted to CoRIS

### **FY2011 Publications**

- Ault, J.S. 2011. Overfishing has reduced fish stocks in south Florida. *South Florida Marine Environments: An ecological synthesis*. In 'Tropical Connections: South Florida's marine environment', W. Kruczynski and P. Fletcher (eds.). IAN Press, College Park, MD.
- Ault, J.S. 2011. Marine and estuarine habitats in south Florida are physically and biologically connected. *South Florida marine environments: An ecological synthesis*. In 'Tropical Connections: South Florida's marine environment', W. Kruczynski and P. Fletcher (eds.). IAN Press, College Park, MD.
- Ault, J.S. 2011. Marine and estuarine habitats in south Florida are physically and biologically connected. *South Florida marine environments: An ecological synthesis*. In 'Tropical Connections: South Florida's marine environment', W. Kruczynski and P. Fletcher (eds.). IAN Press, College Park, MD.
- Ault, J.S. and J.A. Bohnsack. (In press) Benefits of no-take marine reserves for exploited reef stocks in southern Florida. *In South Florida Marine Environments: An ecological synthesis*. B. Kruczynski and P. Fletcher, eds. Florida Sea Grant.
- Ault, J.S., Bohnsack, J.A. 2011. No take marine reserves can improve south Florida's reef fisheries. *South Florida marine environments: An ecological synthesis*. In 'Tropical Connections: South Florida's marine environment', W. Kruczynski and P. Fletcher (eds.). IAN Press, College Park, MD.
- Ault, J.S., S.G. Smith and J.T. Tilmant. 2010. Are the coral reef finfish fisheries of south Florida sustainable? *Proceedings of the 11<sup>th</sup> International Coral Reef Symposium 11: 989-993.*

- Bohnsack, J.A. (In press). Reef Fishes in the Florida Keys. *In* South Florida Marine Environments: An ecological synthesis. B. Kruczyiski and P. Fletcher, eds. Florida Sea Grant.
- Brandt, M., Zurcher, N., Atkinson, A., Acosta, A., Ault, J.S., Bohnsack, J.A., Feeley, M.W., Harper, D.E., Hunt, J.H., Kellison, G.T., McClellan, D.B., Patterson, M.E., Smith, S.G. 2010. The Opportunities and Challenges in Development of a Multi-agency Program to Monitor and Assess Reef Fish Populations in the Florida Keys Coral Reef Ecosystem. *Proc. Gulf Carib. Fish. Inst.* 62: 348-357.
- Karnauskas, M., D.B. McClellan, J.W. Wiener, M.W. Miller and E.A. Babcock. (2011). Inferring trends in a small-scale, data-limited tropical fishery based on fishery-independent data. *Fisheries Research* 111(1-2):40-52.
- Ruttenberg, B. I. and E. F. Granek. 2011. Bridging the marine-terrestrial disconnect in coastal zone science and management. *Marine Ecology Progress Series* 434:203-212.
- Ruttenberg, B. I., S. L. Hamilton, S. M. Walsh, M. K. Donovan, A. Freidlander, E. DeMartini, E. Sala, and S. A. Sandin. 2011. Demographic shifts in coral reef fish communities across a gradient of human disturbance. *PLoS One* 6(6): e21062. doi:10.1371/journal.pone.0021062
- Smith, S.G., J.S. Ault, J.A. Bohnsack, D.E. Harper, J. Luo, and D.B. McClellan. 2011. Multispecies survey design for assessing reef-fish stocks, spatially-explicit management performance, and Ecosystem condition. *Fisheries Research* 109: 25-41.
- Smith, S.G., Swanson, D.W., Chiappone, M., Miller, S.L., Ault, J.S. 2011. Probability sampling of stony coral populations in the Florida Keys. *Environmental Monitoring and Assessment* 183(1-4): 121-138.

#### **FY2011 Presentations**

- Acosta, A., P Barbera and J Colcovoreses. (Poster). "Mutton snapper (*Lutjanus analis*) abundance indices based on a fishery-independent visual census survey from the Florida Keys", Florida. Linking science to management. A conference and workshop on the Florida Keys Marine ecosystem. October 19-22, 2010. Duck Key, Florida.
- Ault, J.S., Smith, S.G., Kellison, G.T. 2010. "Coral reef fish-habitat modeling to support ecosystem-based management". Gulf & Caribbean Fisheries Institute Annual Meeting. San Juan, Puerto Rico. September 2010.
- Ault, J.S., Smith, S.G., Luo, J., Bohnsack, J.A., Ruttenberg, B., Kimball, D. 2011. "Assessing reef fish changes and marine reserve dynamics in the Dry Tortugas, Florida". In 'Assessing the Role of Marine Protected Areas In Restoring, Sustaining, and/or Enhancing Fisheries'. American Fisheries Society 141st Annual Meeting, Seattle, Washington. September 2011.
- Ault, J.S. 2011. "Establishing acceptable biological catches (ABCs) for reef fish". In 'Developing Annual Catch Limits Guidelines for Pacific Island Reef Fisheries: Defining Issues and Arriving at Prioritized Actions'. Western Pacific Regional Fishery Management Council workshop. Honolulu, Hawaii. February 2011.

- Ault, J.S., Smith, S.G., Vaughan, N.R., Nadon, M.O., Zurcher, N. 2011. "A quantitative toolbox for sustaining coral reef fisheries of Puerto Rico". Workshop sponsored by Puerto Rico Department of Natural Resources and the National Fish & Wildlife Foundation. San Juan & Joyuda, Puerto Rico. August 2011.
- Ault, J.S. 2011. "Length-based assessment of exploitation status and sustainability benchmarks for coral reef fish". NOS Science Seminar Series. NOAA Headquarters SSMC-4. Silver Spring, Maryland. April 2011.
- Ault, J.S., Franklin, E.C. 2011. "Fisheries resource status and management alternatives for the Southeast Florida coral reef region". Florida Department of Environmental Protection (FDEP) Coral Reef Conservation Program (CRCP) & NOAA Project meeting. Dania Beach, FL. September 2011.
- Ault, J.S. 2010. "Fishery dynamics of the south Florida marine ecosystem". Plenary Session III: Present State and Change Over time of the Keys Ecosystem. Florida Keys Science Conference. October 2010.
- Bohnsack, J.A., Ault, J.S., Smith, S.G., McClellan, D.B., Harper, D.E., Javech, J., Zurcher, N. 2010. "Impacts of the 1997 FKNMS management zones on coral reef fish populations over 10 years". Florida Keys Science Conference. October 2010.
- Brock, R.J., Ault, J.S., Bohnsack, J.A. 2010. "Ecological scorecards: A powerful communication tool capable of distilling complex technical information into a format useable by many". Theme 'Science Related to Spatial Management of the Florida Keys Marine Ecosystem'. Florida Keys Science Conference. October 2010.
- Johnson, A and M Tellier (Poster) "Habitat Preferences of Redband parrotfish (*Sparisoma viride*) and Stoplight parrotfish, (*Sparisoma aurofrenatum*) as determined by Fishery-Independent Visual Census Surveys in the Florida Keys". Linking science to management. A conference and workshop on the Florida Keys Marine ecosystem. October 19-22, 2010. Duck Key, FL.
- Miller, MW, M Karnauskas, D McClellan, and DE Williams. 2011. (Abstract). "Catastrophes and phase shift on reefs of remote Caribbean Island". Marine Benthic Ecology Meeting. Mobile. AL.
- Rios, A. "Tropical Cyclone Effects on Fish Stocks and Fisheries in the Florida Keys." American Fisheries Society Annual Meeting, Sept 2011, Seattle, WA.
- Ruttenberg, B. I. "Thirty years of change in reef fish communities in the Florida Keys: causes and effects." College of Marine Sciences Seminar Series, University of South Florida, St. Petersburg, FL. Sept. 2011.
- Ruttenberg, B. I. "Thirty years of change in reef fish communities in the Florida Keys: where do we go from here?" Florida Keys National Marine Sanctuary-Sanctuary Advisory Committee Meeting. Marathon, FL. Aug. 2011.
- Ruttenberg, B. I. "Thirty years of change in reef fish communities in the Florida Keys: short- and long-term trends." Smithsonian Marine Station Seminar Series, Fort Pierce, FL. Jan. 2011.

Ruttenberg, B. I., J. A. Bohnsack, J. S. Ault, S. G. Smith, D. B. McClellan, D. E. Harper, J. Serafy, and K. Huebert. "Thirty years of change in reef fish communities in the Florida Keys driven by habitat loss and marine reserves." American Fisheries Society Annual Meeting, Sept 2011, Seattle, WA.

Ruttenberg, B. I., J. A. Bohnsack, J. S. Ault, S. G. Smith, D. B. McClellan, D. E. Harper, J. Serafy, and K. Huebert. "Thirty years of change in reef fish communities in the Florida Keys: importance of the long view." International Marine Conservation Congress, May 2011, Victoria, Canada.

Ruttenberg, B. I., J. A. Bohnsack, J. S. Ault, S. G. Smith, D. B. McClellan, D. E. Harper, J. Serafy, and K. Huebert. "Thirty years of change in reef fish communities in the Florida Keys: results from a long-term monitoring program." Linking Science to Management: A Conference & Workshop on the Florida Keys Marine Ecosystem, Oct 2010, Duck Key, FL.

Vaughan, N.R., Ault, J.S., Gedamke, T. 2011. "New developments in length-based mortality estimation for data limited fisheries". American Fisheries Society 141st Annual Meeting, Seattle, WA. September 2011.

Zurcher, N. 2011. Annual Multi-agency Reef Fish Visual Census Training. South Florida NPS Headquarters, Palmetto Bay Village Center, 18001 Old Cutler Road, Palmetto Bay, FL 33157. April 2011.

**Setbacks or challenges encountered in FY2011**

None

**Comments on future direction of project**

This project will continue to provide data to assess effects of natural and anthropogenic impacts to FL coral reef ecosystems, with an emphasis on the effects of MPAs and the effects of fishing on target species, the fish community in general, and on ecosystem resilience.

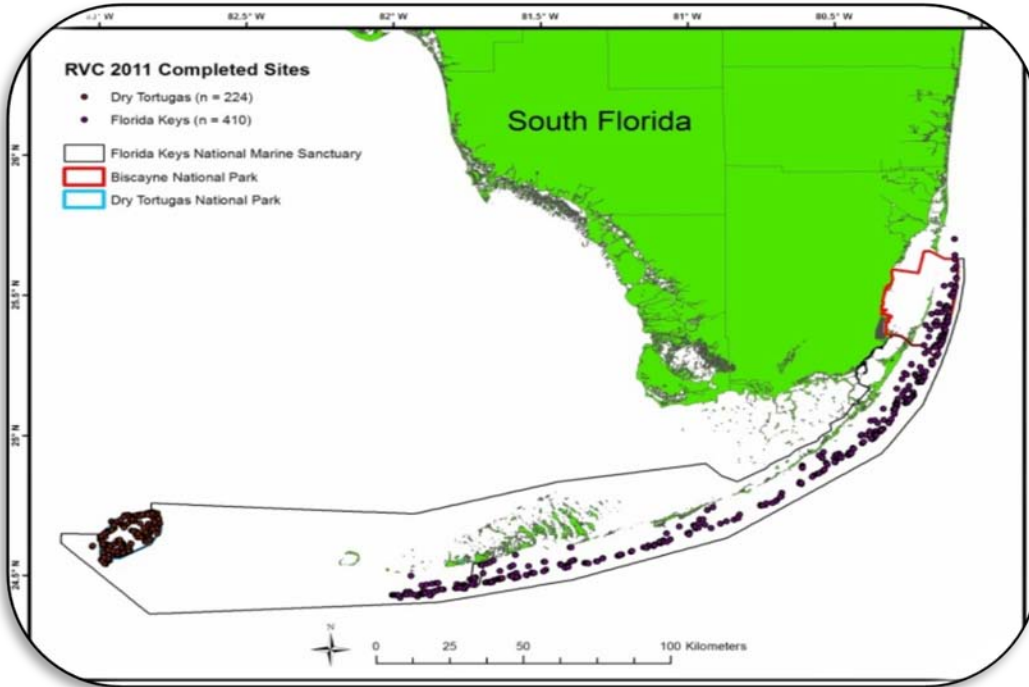


Fig 1. This figure shows survey locations along the Florida Keys reef tract during FY11, including the Dry Tortugas region. Sites include all those surveyed by NOAA, the State of Florida, and the National Park Service. Four data collection dives occurred at each site



<b>Project ID#:</b>	20656-2011
<b>Title:</b>	F183 Using existing data to develop a comprehensive reef fish monitoring program for the Southeast Florida Coral Reef Initiative
<b>PIs and co-PIs:</b>	Benjamin Ruttenberg, Dana Wusinich-Mendez (NOS)
<b>Duration of Project:</b>	Year 1 of 1
<b>Project Category:</b>	Reduce Adverse Impacts of Fishing

### **Brief description of activities conducted in FY2011**

This project partially funded a data assimilation project to generate gridded habitat maps and habitat strata of the Southeast Florida Coral Reef Initiative (SEFCRI) region, assimilate existing biological information to inform the variance structure of the different strata (when possible) and generate a sampling allocation plan for the SEFCRI region to be executed in 2012. A small amount of funding supported multiple project planning, data management, and training workshops for local partners.

### **Description of accomplishments & results**

This project proceeded as planned; mapping data have been assimilated into a gridded habitat map in a similar way as the Florida Keys, with a slight modification. Habitat maps are higher resolution in SEFCRI, so we were able to generate 100x100m grid cells, as opposed to 200x200m grid cells in the Florida Keys. Smaller grid cells improve the accuracy of the maps. Other existing biological data (primarily fish count data from Broward County) were included to provide initial estimates of the variance structure of some habitats to help improve the efficiency of the initial sampling allocation. Finally, the sampling allocation was created, resulting in ~350 sampling points randomly allocated by habitat, depth/reef line, and subregion throughout the SEFCRI region. We also conducted several workshops for local partners (state and county offices and agencies in the SEFCRI region) to introduce the goals of the project and feedback from local partners and train data managers and field personnel in the specifics of the method and the data management procedures that follow. Field sampling is currently underway; progress can be followed in near real-time using a tracking tool (developed by our data manager, J. Blondeau): <http://rvcmaps.herokuapp.com/sefcricriMap>

### **How project supports goals & objectives of CRCP**

This project is integral to the monitoring mandate of CRCP, and will allow us to complete the first comprehensive survey of the status of fish communities along the entire length of the Florida Reef Tract, from Martin County in SEFCRI to the Dry Tortugas.

### **How project supports management of coral reef resources**

This project will provide the first comprehensive information on the status of fish communities in the SEFCRI region, and may be used to improve management in the region. In addition, this information is spatially explicit, with even coverage throughout the region, so it will begin providing essential data the State of Florida needs as it considers using spatial management tools in the region.

### **List of project partners and their roles**

- University of Miami/RSMAS: assimilated mapping data and biological data; generated gridded habitat map; generated sampling plan; assisted with training.
- Nova Southeastern University Oceanographic Center: fieldwork lead
- NOAA-NMFS-Habitat Conservation Division: assist with logistics

- FL DEP-Coral Reef Conservation Program-Miami: funding partner, assist with logistics
- FL DEP-Southeast District-West Palm Beach: assist with fieldwork
- FL DEP-State Parks: assist with fieldwork
- Miami-Dade PERA: assist with fieldwork
- Broward-DERD: assist with fieldwork
- Palm Beach-ERM: assist with fieldwork
- Martin County-Engineering: assist with fieldwork
- FL FWC-Habitat and Species Conservation: assist with fieldwork
- FL-FWC-FWRI-Tequesta Lab: assist with fieldwork

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

Training workshops for all relevant SEFCRI agencies is building capacity in SEFCRI to conduct field sampling and manage data. Outreach to partner agencies to ensure their participation and ensure that data will meet their needs, and to ensure that they understand the goals and objectives as well as the science to be able to communicate it to their management agencies.

**Submissions to CoRIS**

None

**FY2011 Publications**

None

**FY2011 Presentations**

Multiple training presentations and workshops

**Setbacks or challenges encountered in FY2011**

None

**Comments on future direction of project**

Field sampling is currently underway and should be complete by fall 2012. Data management/QAQC will occur in Q1/2 of FY13.

<b>Project ID#:</b>	20645-2011
<b>Title:</b>	F182 The importance of parrotfish (fam. Scaridae) on the maintenance and recovery of coral-dominated reefs
<b>PIs and co-PIs:</b>	Benjamin Ruttenberg
<b>Duration of Project:</b>	Year 1 of 2
<b>Project Category:</b>	Reduce Adverse Impacts of Fishing

#### **Brief description of activities conducted in FY2011**

During FY11, we successfully transferred funds to our academic partner, Dr. Deron Burkepile, at Florida International University (FIU). We recruited an excellent candidate, Dr. Thomas Adam, to fill the postdoctoral position. However, because funds were received late in FY11, we were delayed in advertising the position, and as a result, Dr. Adam was unable to begin until June 2012.

#### **Description of accomplishments & results**

Because of the delay in receiving funds and the cascading delays in recruitment and hiring, we have delayed the start of this project. Instead of beginning at the end of CY11 as originally projected, the project began in June 2012. However, we are very pleased with the skills and experience of Dr. Adam, to conduct the literature review and we are confident that he will produce an excellent synthesis. The project will proceed as originally conceived, albeit 6 months behind the original schedule. Working with Drs. Burkepile and Adam, and including Dr. Michelle Paddock, we have generated an outline of the review, including the key specific questions this review must address, and we have also tentatively identified some of the key gaps in our knowledge. We decided to restrict this analysis to the Atlantic/Caribbean only, since the key management needs for this information are in this ocean basin. Dr. Adam is currently filling in portions of the outline with relevant papers and information from the scientific literature.

#### **How project supports goals & objectives of CRCP**

This project will provide information about the relative impact of parrotfish grazing on the resilience of corals, and directly relates to Fisheries relevant performance measures (PMs) (eg. F1: PM1 and F2: PM1 and PM2) in that managing parrotfish effectively maintains or increases biomass on reefs of an important suite of species (taxa) that may have an important ecological role in maintaining reef health. It also addresses land based sources of pollution PMs (eg. L2: PM1 and PM2) in that parrotfish management may improve coral demographics and reduce the impact of algae and nutrient stressors. In addition, a number of local partners (particularly on St. Croix) have expressed keen interest in having this information, and in conducting some of the field sampling on that island such that information can be used directly on St. Croix.

#### **How project supports management of coral reef resources**

This project will provide the first comprehensive review of the impacts of parrotfish and other grazers on coral, via direct and indirect interactions. It will also identify key gaps in our knowledge of these impacts. The final year of this project will involve fieldwork that begins to identify these gaps, all of which will help set future research priorities for this topic. Ultimately, we hope that improved understanding of the functional role of herbivores will allow us to better manage their populations to promote healthier coral reef ecosystems.

**List of project partners and their roles**

- Dr. Deron Burkepile, FIU: Professor and academic supervisor of postdoctoral fellow (Dr. Thomas Adam)
- Dr. Margaret Miller, NOAA: intellectual collaborator
- Dr. Michelle Paddack, Santa Barbara City College: intellectual collaborator

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

None

**Submissions to CoRIS**

None

**FY2011 Publications**

None

**FY2011 Presentations**

None

**Setbacks or challenges encountered in FY2011**

None

**Comments on future direction of project**

Dr. Thomas Adam is currently compiling scientific literature on the topic and will begin synthesizing this information near the end of CY12. We will begin conducting some fieldwork based on initial identification of knowledge gaps in FY13, and we anticipate that we will have a draft of the full review by summer CY13.

#### IV. REDUCE IMPACTS OF CLIMATE CHANGE

<b>Project ID#:</b>	20692-2011
<b>Title:</b>	C169 Developing downscaled climate models for coral reef management into the 21st Century
<b>PIs and co-PIs:</b>	John Lamkin and Barbara Muhling (CIMAS)
<b>Duration of Project:</b>	Year 1 of 3
<b>Project Category:</b>	Reduce Impacts of Climate Change

##### **Brief description of activities conducted in FY2011**

This project initially aimed to downscale IPCC global climate models to a regional scale, focusing on the Gulf of Mexico and Caribbean Sea. During FY11, dynamic downscaling of the global climate models to the Gulf of Mexico region was performed by using the Miami Isopycnic Coordinate Ocean Model coupled to the Atmospheric Mixed Layer (MICOM-AML). Outputs from this initial modeling effort included estimates of water temperatures and mean oceanographic circulation at both the surface and at depth for the study region, through to the end of the 21<sup>st</sup> century.

##### **Description of accomplishments & results**

Our FY11 work plan involved constraining the high-resolution regional ocean model with initial and boundary conditions predicted by the global climate models. This work has been completed. The high-resolution downscaled model results indicated that the Gulf of Mexico is likely to warm throughout the 21<sup>st</sup> century. However, the spatial pattern of warming may be quite different to that predicted by the low-resolution global climate models. In particular, the surface temperature increase in the high-resolution model was less marked in the northern Gulf of Mexico away from the Florida west coast. A potential cause for this difference may be the weakening of the Loop Current, and the associated reduction in the warm water transport through the Yucatan Channel, which are not well simulated in the global climate models. The downscaled model outputs showed an estimated 20 - 25% reduction in volume transport across the Yucatan Channel during the 21st century, consistent with a similar rate of reduction in the Atlantic meridional overturning circulation (AMOC).

In the Caribbean Sea, increases in surface temperature of 1-2°C were predicted by the model. Depending on rates of acclimation to heat stress, these conditions may prove stressful for corals in the region, and result in habitat loss through bleaching. Analyses of temperatures at 200m depth showed some spatial heterogeneity in warming, with less severe warming within the Caribbean Current system. This is consistent with results from the Gulf of Mexico, suggesting a general slowing of the Caribbean Current-Loop Current system through the 21<sup>st</sup> century.

##### **How project supports goals & objectives of CRCP**

This project directly addresses 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 will 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, we have the ability to link complex climate models, oceanographic models, and biological models to create user-friendly outputs and products which are directly relevant to coral reef managers.

In addition, results from our work will apply to objective C2.4 (“Promote conservation of coral reef ecosystems through identification of areas that are potentially resilient to climate change and vulnerable areas where actions are likely to increase resilience”). By taking a regional approach to studying the potential consequences of climate change on the oceanic environment, we will be able to compare predicted impacts across the Caribbean Sea and Gulf of Mexico. This can assist managers to prioritize areas for conservation, and to direct resources to where they will be most effectively utilized.

### **How project supports management of coral reef resources**

Climate change impacts on coral reefs are expected to manifest through increased coral bleaching events, subsequent increases in habitat fragmentation, and changes in larval connectivity mechanisms. However, the likely temporal and spatial extent of these changes is currently poorly known. Coral reef managers have little information on which reef systems are likely to be most severely affected, and which existing connections between reefs or marine protected areas are likely to be lost. Outputs from our project can provide advance information to coral reef managers on potential future habitat loss within regional reef systems, and changes in reef resilience.

From our model output, we will derive the following management-relevant products:

- 1) A user-friendly, quantitative map output showing how circulation patterns are predicted to change within the study area through to 2100.
- 2) Based on the first product, we will provide a quantitative map output showing which reef habitats and MPAs may lose or gain connectivity with each other, and the timescales over which this may occur.
- 3) We will apply existing coral reef bleaching criteria from the NOAA Coral Reef Watch program into water temperature predictions from the downscaled climate model. This will allow us to predict coral reef bleaching locations and rates through to 2100.
- 4) As the downscaled model will provide predictions of temperature through the water column, we will assess how bleaching rates may vary between deep and shallow reefs.

If the magnitude and nature of climate change impacts on coral reefs are better understood, priority areas for conservation can be more effectively identified, and coral reef managers will be better placed to anticipate future management requirements.

### **List of project partners and their roles**

- NOAA-AOML (Yanyun Liu and Sang-Ki Lee): Model downscaling

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

None

### **Submissions to CoRIS**

Our CoRIS products are due in 2013, and are on schedule for delivery.

### FY2011 Publications

Liu, Y., Lee, S.K., Muhling, B.A., Lamkin, J.T., Enfield, D.B. (submitted) "Significant Reduction of the Loop Current in the 21st Century and Its Impact on the Gulf of Mexico", *Journal of Geophysical Research – Oceans*

Muhling, B.A., Lee, S-K, Lamkin, J.T. (2011) Predicting the effects of climate change on bluefin tuna (*Thunnus thynnus*) spawning habitat in the Gulf of Mexico. *ICES Journal of Marine Science* 68: 1051-1062.

### FY2011 Presentations

Muhling, B.A., Lee, S., Schirripa, M., Ingram, W., Lamkin, J. (2010) "Predicting the effects of climate change on bluefin tuna (*Thunnus thynnus*) spawning habitat in the Gulf of Mexico", *Climate Change Effects on Fish and Fisheries conference, Sendai, Japan, May 2010*

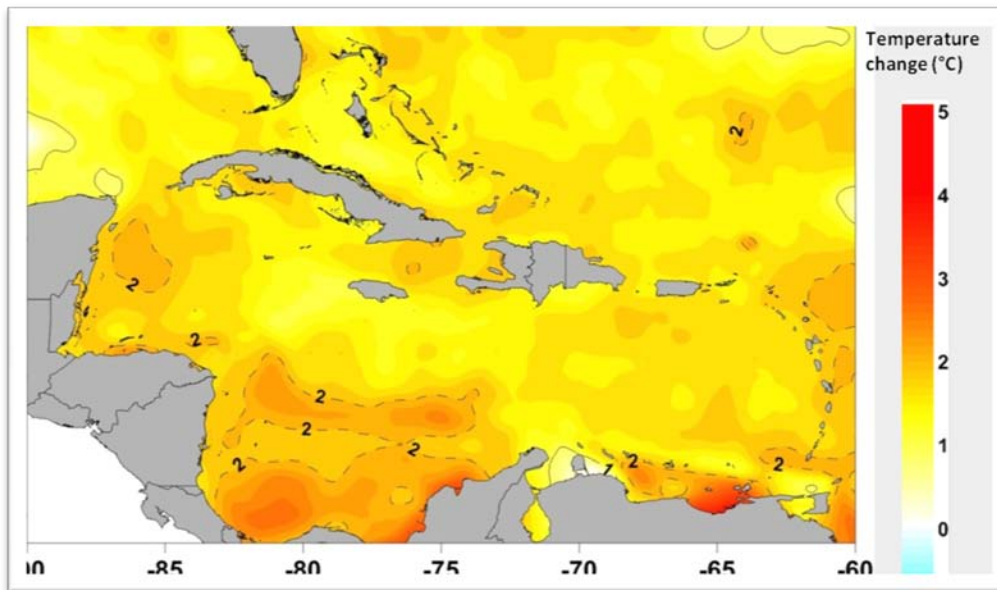
Muhling, B.A., Lee, S., Lamkin, J. (2010) "Developing models of climate change impacts for the Gulf of Mexico, with application to highly migratory fish species", *The Mexico-United States (MEXUS) collaborative research meeting: Miami, USA, July 2010*

### Setbacks or challenges encountered in FY2011

Our main challenge has been accessing computing resources to complete model runs. We are hopeful that a proposal to access the NASA super-computer will be successful, and will reduce this issue.

### Comments on future direction of project

This project is proceeding on schedule.



**Figure 1:** Predicted increase in surface temperatures in the Caribbean Sea by the end of the 21<sup>st</sup> century, from the downscaled model

<b>Project ID#:</b>	20692-2011
<b>Title:</b>	C173 Climate change impacts: potential for recovery/resilience of corals and algal interference
<b>PIs and co-PIs:</b>	Margaret W. Miller
<b>Duration of Project:</b>	Year 1 of 2
<b>Project Category:</b>	Reduce Impacts of Climate Change

### **Brief description of activities conducted in FY2011**

Accomplishments during FY11 were primarily start-up for the project. Coral larvae were collected in Aug 2011 (though poor *A. palmata* spawning limited the availability of this species for experimentation) and pilot experiments were run to determine appropriate methods for exposing larvae to different CO<sub>2</sub> conditions. Preliminary results were obtained for *Montastraea faveolata* and *Diploria strigosa* larvae.

### **Description of accomplishments & results**

The intended staffing of the project with a competent post-doc was not possible, so instead a new graduate student was recruited (to work in Dr. Chris Langdon's lab at University of Miami) to be a primary player in the actions of the project. While this strategy has meant a slower start (due to recruitment and class requirements), it should provide high returns in the medium-term.

Grant/contract was established with UM/CIMAS to execute the tasks over a three year term.

Preliminary larval experiments were undertaken in Aug 2011. *M. faveolata* larvae were subjected to two temperatures (27°C and 30°C) and two carbon dioxide concentrations (targeted at 400 ppm and 800 ppm, but measured to be  $507.1 \pm 16.4$  ppm and  $886.2 \pm 17.4$  ppm respectively). Larvae were exposed to one of four treatments, 27°C\_400 ppm (LTLC=low temp, low CO<sub>2</sub>), 30°C\_400 ppm (HTLC), 27°C\_800 ppm (LTHC) and 30°C\_800 ppm (HTHC). Survivorship was quantified after two days. The highest survivorship was seen at the control treatment, LTLC, where  $82 \pm 23\%$  survived. The lowest survivorship was observed at the HTHC treatment at  $63 \pm 14\%$ , which was even lower than the high temperature or high CO<sub>2</sub> treatments alone (HTLC=  $72 \pm 17\%$  and LTHC=  $72 \pm 20\%$ ). Settlement experiments were carried out following this experiment using two day old larvae that were held at control temperatures prior to the experiments. The same treatments were used for the settlement experiments. Variability was very high in these experiments, but at LTLC 11% settled, at HTLC only 1% settled, at LTHC 4% settled, and at HTHC 5% settled successfully. Further experiments are planned for Aug 12 to look at the combined effects of increased temperature and CO<sub>2</sub> with greater replication and hopefully including *Acropora* spp. larvae.

Larvae of *A. palmata*, *M. faveolata* and *D. strigosa* were batch settled and deployed into the field. 45 days post spawning a subset of settlement tiles was brought to the Rosenstiel School of Marine and Atmospheric Sciences where they were counted and put in four closed system tanks with regulated temperature and CO<sub>2</sub> levels corresponding to the four treatments used in the previous experiments. The initial number of larvae was 156 *A. palmata*, 324 *M. faveolata* and 155 *D. strigosa*. 1 month post-exposure all of the *A. palmata* larvae died, while 44 *M. faveolata* and 36 *D. strigosa* larvae remained alive, with the highest survivorship found in the HTLC treatment. Additional *D. strigosa* larvae were transported from the field into the experimental conditions 97 days post spawning. Growth was measured biweekly for three months under a compound microscope alongside picture analysis using coral point count (CPCe). *M. faveolata* did not show clear trends, but at 30°C *D. strigosa* grew



significantly more when exposed to elevated CO<sub>2</sub> levels as opposed to ambient levels. These preliminary results indicate that this species may be able to take advantage of the combined effects of elevated temperature and CO<sub>2</sub> as the oceans change in the coming century (at least in terms of overall growth, further tradeoffs will need to be investigated). Further experimentation will be carried out this coming season to verify these findings.

#### **How project supports goals & objectives of CRCP**

Much of the degradation of Caribbean reefs in the past decade(s) relates to decreased coral abundance and consequent coral/algal 'phase shifts'. Reef plants have both positive (settlement cues) and negative (preempting substrate, trapping sediment, allelopathy) interactions with corals and their larvae. Emerging experimental work now shows that ocean acidification (OA) and warming temperatures can each negatively impact multiple early stages of Caribbean reef building corals. However, these impacts are occurring together and combined impacts (OA and warming) must be understood. Meanwhile, virtually nothing is known about the impacts of OA (alone or in tandem with warming) on either calcareous or non-calcareous reef plants or their complex interactions with corals.

#### **How project supports management of coral reef resources**

The studies proposed directly address management's research needs, articulated in the jurisdictional management priorities for both PR (4A2) and USVI (5.1). Florida Management Priority CC B2.1 calls for a comprehensive CC predictive model, and calls for additional data collection to support it. These stated management objectives recognize that better understanding of cumulative CC impacts, both direct on vulnerable coral life phases and indirect on coral/algal interactions, is needed for managers to have realistic expectations of future impacts and develop more effective resilience strategies. Proposed studies also directly address the priorities in the NOAA OA Implementation Strategy and the draft CRCP OA Strategy and the need for better understanding of CC impacts on ESA listed corals as two of the target species are currently listed and the third is under active consideration for listing. The project provides documentation of coral spawning and larval success for three key species in the Keys, addressing FL Management Priority FDOU Obj D1.2.

#### **List of project Partners and their roles**

- UM/RSMAS – Dr. Chris Langdon Laboratory : Primary collaborators in design and execution of climate change experiments
- Florida Keys National Marine Sanctuary: collecting and culturing coral spawn in the Florida Keys: Provided valuable logistic support in the extensive field operations for coral spawning documentation and collection
- Florida Aquarium & SECORE partners: Field support in observing, collecting, and culturing coral spawn/larvae
- Coral Restoration Foundation: Field support in observing, collecting, and culturing coral spawn/larvae
- SUNY-Buffalo: Field support in observing, collecting, and culturing coral spawn/larvae

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

Training in coral larval culture approaches was provided to NGO partners during coral spawning (Florida Aquarium and SECORE partners). Direct report of spawning outcomes was provided to FKNMS and other managers in late Sept 2011.

#### **Submissions to CoRIS**

None

### FY2011 Publications

None

### FY2011 Presentations

None

### Setbacks or challenges encountered in FY2011

Aside from expected challenges related to unreliability of coral spawning, the intent to execute proposed algal fieldwork in collaboration with other OA projects has not born out so there have been some changes in this component of the project. Our slow start on the algal component of the project and the movement of the OA testbed site from Puerto Rico to the Florida Keys has yielded changes in this component. We have chosen to focus algal measurements at the new Florida Keys OA (MAP-CO<sub>2</sub> buoy) focal site at Cheeca Rocks. Algal fieldwork was begun at Cheeca Rocks in March 2012 with pilot deployment of algal settlement plates and pilot photosynthesis/productivity measurements for three macroalgal species (*Halimeda tuna*: green calcareous, *Asperigopsis taxiformis*: red fleshy, and *Dictyota* sp: brown fleshy). Photosynthesis/respiration measurements have been incorporated (since the proposal) as more precise measurements of productivity (less subject to complications of grazing reduction) in addition to some biomass accumulation growth measurements.

### Comments on future direction of project

None

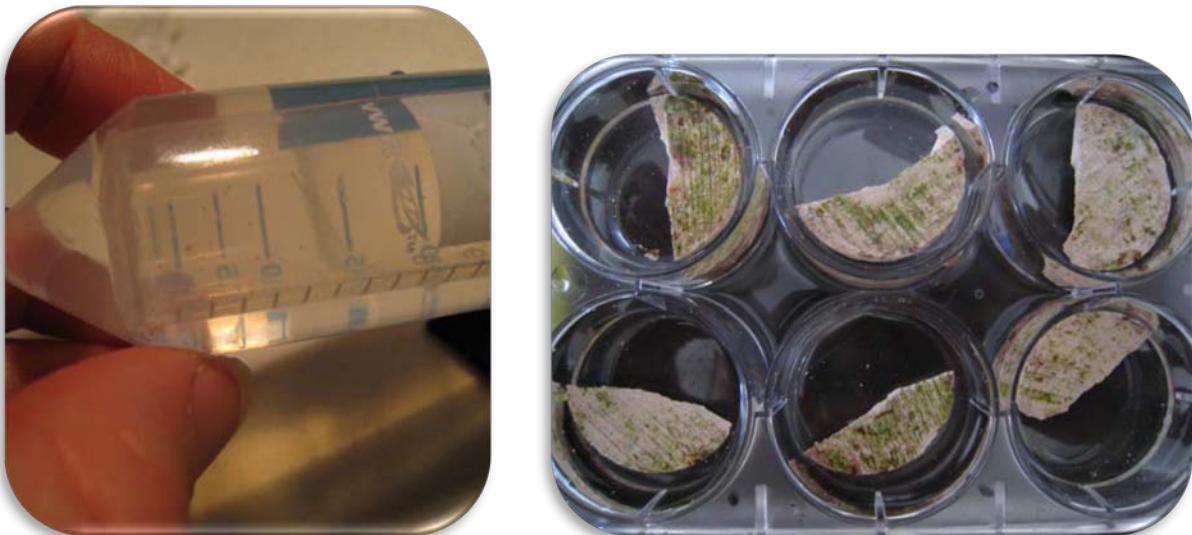


Figure 1. Left: *M.faveolata* larvae (tiny dots) in larval 'cage' used to expose them to different CO<sub>2</sub> treatment seawater. These tubes were floated in two different temperature baths (~ 27°C and ~29°C). Right: surviving larvae were subsequently placed in settlement assays with field-conditioned substrate in the CO<sub>2</sub> treatments (only room temperature)

## V. PROTECTED CORALS

<b>Project ID#:</b>	20727-2011
<b>Title:</b>	O171 Evaluation of ESA listed <i>Acropora</i> spp. status and actions for management and recovery
<b>PIs and co-PIs:</b>	Margaret W. Miller and Dana Williams (CIMAS)
<b>Duration of Project:</b>	Year 1 of 3, ongoing project
<b>Project Category:</b>	Other, Protected Corals

### **Brief description of activities conducted in FY2011**

Surveys conducted in 2011 marked the 8th year of this study for Florida sites (6th for Curaçao sites) making this effort the longest known demographic study of Florida Keys *Acropora palmata* to date. Additionally two *in situ* experiments aimed at evaluating potential management actions to reduce coral mortality were begun. Our expanded coverage and partnership will provide important context for the trends observed to date as well as an improved ability to discern any regional differences within the Florida Keys *A. palmata* population which will support NMFS recovery planning and inform sanctuary management actions

### **Description of accomplishments & results**

In 2011 we completed 3 surveys of all study plots and an additional study plot was established in September 2011. Presently this project consisted of 28 150 m<sup>2</sup> study plots at 8 reef sites in the Florida Keys that are monitored for *A. palmata* survivorship and recruitment. A manuscript reporting results from this project was accepted for publication in Coral Reefs in 2011. Data from this project is the foundation for population modeling conducted by a partner at Scripps which will directly support the ESA recovery plan. This collaboration resulted in the submission of a co-authored manuscript submitted to Endangered Species Research in late 2011.

In 2011 we continued our partnership with Florida Fish and Wildlife Conservation Commission as they continue an *A. palmata* monitoring project in the middle and lower Keys and Biscayne National Park utilizing the methods established as part of this project in FY06 (Williams et al 2006 NOAA Tech Memo). In May 2011 monitoring sites (3 sites, 9 study plots) in Curaçao were re-surveyed as planned, and an additional site (3 study plots) was established. Data from the first six years was used to compile a report and also resulted in the submission of a manuscript to Bulletin of Marine Science.

Since 2004 when our monitoring began there has been a loss of 45% of the *A. palmata* from our study plots. Most of this decline occurred as a result of the 2005 hurricane season and since then there has been a modest (10%) recovery. Analysis of threats facing *A. palmata* has revealed that in the absence of hurricane impacts, disease is the primary cause of tissue loss to standing colonies and accounts for more than one third (36%) of lost tissue followed by snail predation (26%) and skeletal breakage (20%). Based on this finding two *in situ* experiments were begun in 2011; one evaluating removal of coral-eating snails and a second evaluating *in situ* techniques (applying epoxy band to disease line and excising healthy branch tips from diseased colonies to reduce disease mortality). Between May-Sept 2011 we undertook regular surveillance of restocked *Acropora cervicornis* colonies at 6 sites and applied these disease mitigation treatments to diseased colonies we encountered, paired with appropriate controls. Results

were ambiguous with some treatment replicates showing arrested tissue loss and some showing complete mortality. This experiment will continue in FY12.

The predator removal experiment was conducted in existing study plots using a BACI design. At each site (n=6) we removed the snails from *A. palmata* only in one plot, all host coral in a second plot and a third plot serves as a control. Although the predator removal experiment is still in progress we generated a report of early findings. After four surveys we found that both the abundance of predators and prevalence of feeding scars on *A. palmata* were significantly reduced to a similar low level in both removal treatments, suggesting removal snails from non-*Acropora* coral hosts does not provide additional benefit.

### **How project supports goals & objectives of CRCP**

While this project does not directly address the priority CRCP Objectives (though it contributes to several), the local Florida jurisdiction has articulated several priorities that are addressed by the current proposal. 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 both the intervention strategy evaluation experiments proposed directly address this priority. More generally, Florida managers identified a need to better assess coral recruitment (including *Acropora* spp.) within their region (p.22, Morgan & Waddell 2009). These FL priorities articulated in the CREIOS report are backed up 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 our 7 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 means to assess stability or increase in *A. palmata* abundance in these areas. F2.3: Proposed experiments will conserve *Acropora* live tissue and may indicate 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 two direct intervention strategies for mitigating coral loss to predation and disease to provide cost/benefit to managers.

### **List of project partners and their roles**

- NMFS/SERO-PR: Co-funding for monitoring of listed spp.
- Coral Restoration Foundation: Collaborating in disease surveillance/mitigation experiments by providing access to nursery and outplanted populations.
- Florida/FWRI: Coordinating the ESA Section 6 project funded to expand demographic monitoring throughout US territories so we are coordinating closely with them, providing training, etc.

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

The PIs provided field demographic monitoring training for state and territorial partners (coordinated by FWRI) and completed a collaborative public outreach document with FKNMS (see below).

### **Submissions to CoRIS**

Public Outreach Document: Diersing, FKNMS 'Science Summary' Elkhorn Coral: Science of Recovery. See <http://floridakeys.noaa.gov/scisummaries/elkhorn2011.pdf>

Williams DE, Cameron C, Miller MW. Interim report on effectiveness of snail removal. PRBD-2011\_11.

Williams DE, Miller MW (2012) Attributing mortality among drivers of population decline in *Acropora palmata* in the Florida Keys (USA). *Coral Reefs*. DOI 10.1007/s00338-011-0847-y

**FY2011 Publications**

See above

**FY2011 Presentations**

Presentation (oral) for “Linking Science to Management in the Florida Keys” Conference (Oct 2010, Duck Key) <http://conference.ifas.ufl.edu/floridakeys/Presentations/Thursday/AM/0900%20Williams%20D.pdf>

**Setbacks or challenges encountered in FY2011**

In FY11 we experience turnover in our small contract staff which has costly consequences for productivity (recruitment, authorization, and training for replacement). It appears that the ESA Section 6 project, despite initial award for 3 years, has been cut substantially in years 2 and 3 such that substantial holes will remain in monitoring for these listed species within the US range.

**Comments on future direction of project**

We intend to continue this long-term monitoring which continues to provide insights on status/recovery of listed corals in the upper Florida Keys and comparison populations in Curaçao. The long term data set is enabling us to undertake robust (BACI-design) evaluation for potential management/recovery action of snail predator removal. We anticipate additional project components to advance the scientific basis for recovery actions in future.

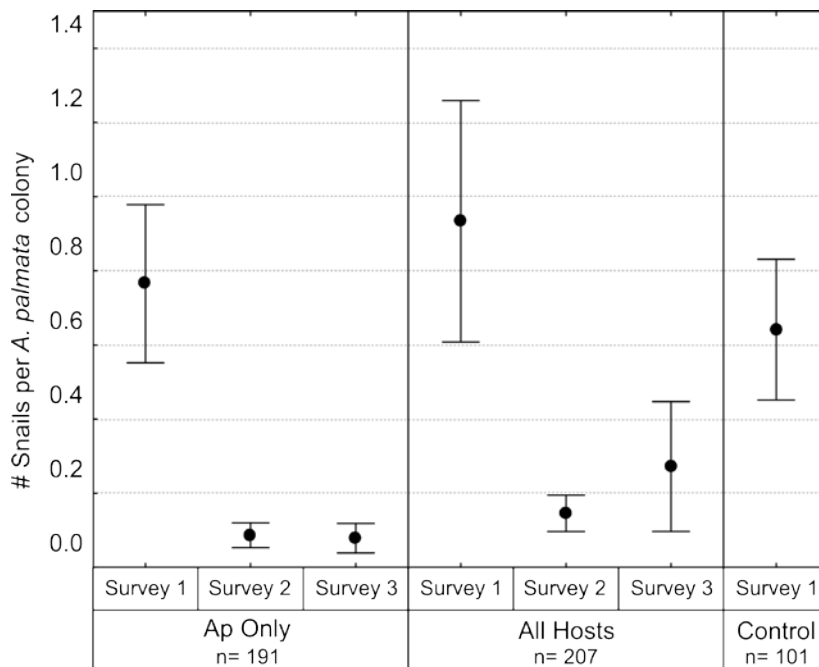


Figure 1. Preliminary results for snail removal experiments showing initial effectiveness of removal treatments. The mean ( $\pm$  SE) number of snails found on *A. palmata* colonies in the removal treatments for three surveys and the control treatment plot for survey one. The initial survey (Survey 1) was done 14-16 June, 2011, Survey 2 was completed 21 d later (~ 7 July, 2011), and Survey 3 was completed 75 d after the initial survey (~ 20 September, 2011). It appears that it is equally effective to remove snails from only *A. palmata* as it is to remove snails from all species of coral within the plots as the return of snails to focal *A. palmata* colonies is similar.

**VI. COUNCIL COOPERATIVE AGREEMENT ACTIVITIES**

<b>Project ID#:</b>	SAFMC Cooperative Agreement: NA11NMF4410061, GMFMC Cooperative Agreement: NA11NMF4410063
<b>Title:</b>	South Atlantic 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.
<b>PIs and co-PIs:</b>	SA MPAs: Stacey Harter, Andrew David, John Reed (FAU/HBOI); SA Octocorals: Andrew David; Gulf MPAs: Matthew Campbell, Andrew David
<b>Duration of Project:</b>	Year 1 of 3
<b>Project Category:</b>	Council Cooperative Agreement Activities

**Brief description of activities conducted in FY2011**

The South Atlantic and Gulf of Mexico Fishery Management Councils invited SEFSC to conduct targeted research and analysis towards fulfilling the activities included under the Gulf of Mexico and South Atlantic Fishery Management Councils’ Cooperative Agreements with the Coral Reef Conservation Program (CRCP). On behalf of the South Atlantic Fishery Management Council, SEFSC will execute the following two projects: South Atlantic MPAs and Deepwater Coral HAPCs: Characterization of Benthic Habitat and Fauna; and Synthesis of information on octocoral biology, ecology, and fisheries in the South Atlantic in support of effective management. On behalf of the Gulf of Mexico Fishery Management Council, SEFSC will execute the project: Survey of habitat and fish assemblages in three Marine Reserves on the west Florida shelf. All three of these projects have a three year time horizon. While funding was initiated in FY11, work will be conducted predominantly from FY12 to FY14.

**Description of accomplishments & results**

*South Atlantic MPA project:*

The NOAA Ship Pisces was secured for the field work component and a cruise was executed between 05-20 July 2012. The cruise departed and returned to Mayport Naval Air Station in Jacksonville, FL. A contract for an ROV was awarded to the University of North Carolina at 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 Reed has begun the analysis of historical ROV and submersible dives in the areas now included within the CHAPCs.

*South Atlantic Octocoral Project:*

The project awarded a contract to Dr. Chuck Messing at NOVA Southeastern University to conduct a shallow water octocoral identification workshop and develop an on-line identification tool – both of these activities took place in early FY12. The Project PI and technical monitors developed the contract for the remainder of the project and that was awarded in June FY12.

*Gulf MPA Project:*

The NOAA R/V Caretta was used to complete the field component of this project. This year, the project surveyed a new MPA, The Edges, which lies between two long-standing MPAs: Madison-Swanson and Steamboat Lumps. Control areas open to fishing were also surveyed. Analysis of video data for fish

identification and enumeration, as well as habitat determination, has been completed. Fish length analysis and database entry and statistical analysis of all data will be completed by January 2013.

### **How project supports goals & objectives of CRCP**

#### *SA MPA Project:*

This project is in direct support of Council activities to characterize protected deep water coral ecosystems and test their efficacy. 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.

#### *SA 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 South Atlantic Fishery Management Council 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 also 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**

#### *SA MPA Project:*

The results of our and MPA and CHAPC monitoring program will be used by the SAFMC during their evaluation of the protected areas and continuation of our monitoring program will insure the SAFMC remains well informed of changes within reef fish populations and coral habitats associated with these areas.

*SA Octocoral Project:*

This project will assist the SAFMC and the state of Florida in arriving at Acceptable Biological Catch (ABC) 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 Florida's 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:*

Our 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 our 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**

*SA MPA Project:*

- University of North Carolina/Wilmington: Owns and operates the ROV used on the research cruise.

*SA Octocoral Project:*

- NOVA Southeastern University: will execute an octocoral identification workshop and develop an on-line accessible guide to regional octocorals resources
- Dr. Henry Feddern -President of the Florida Marine Life Association (FMLA): will provide industry support for the project
- Dr. Luiz Barbieri – Florida Fish and Wildlife Commission: 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. Most project activities will occur in FY12-14.

**Submissions to CoRIS**

None

**FY2011 Publications**

None

**FY2011 Presentations:**

None

**Setbacks or challenges encountered in FY2011:**

None.

**Comments on future direction of project**

These activities are funded for a three year period, pending positive annual progress reports.



## VII. REDUCE THREATS TO INTERNATIONAL CORAL REEFS

<b>Project ID#:</b>	20647 - 2011
<b>Title:</b>	I170 Applying bio-physical monitoring and capacity assessments to Mesoamerican Reef marine protected areas (MPAs)
<b>PIs and co-PIs:</b>	John Lamkin and Estrella Malca (CIMAS)
<b>Duration of Project:</b>	Year 1 of 1, ongoing project
<b>Project Category:</b>	Reduce Threats to International Coral Reefs

### **Brief description of activities conducted in FY2011**

Follow up visit to carry out field work in Isla Contoy National park with ECOSUR and CONANP

### **Description of accomplishments & results**

Our team coordinated and executed additional field collections in Isla Contoy National Park (ICNP) Jan 31- Feb 4, 2011 in order to continue to 1) assess the critical habitats in the interior lagoons and shallow coral reefs of ICNP as they are identified areas of particular concern for the current revision of their management plan, 2) determine the biomass and species composition of juvenile coral reef-associated fishes using light-traps, settlement traps, and plankton nets, and 3) carry out routine maintenance on temperature sensors deployed in the park in collaboration with ICNP staff and rangers.

### **How project supports goals & objectives of CRCP**

This project created and maintained a coalition comprised of MPA managers/staff, ECOSUR, MAR Fund and NOAA-UM/CIMAS, fostering communication and coordination of workshops, defining regional priorities, and refining specific initiatives. The field component assesses the larval fish assemblages in critical shallow coral reef habitats and associated nursery habitats at an ICNP. The MPA is strategically located in the Mexican Caribbean and bathed by the Yucatan Current before it turns into the Loop Current in the Gulf of Mexico. Data collected will contribute towards ecosystem-scale management in the Mexican Caribbean as it complements previous larval fish collections made upstream in the Mesoamerican barrier reef tract by previous NOAA ELH/ECOSUR/CONANP projects as well as upcoming NOAA/INAPESCA/ECOSUR projects in 2011-13.

### **How project supports management of coral reef resources**

The project increases capacity in bio-physical monitoring. This is a data-poor area within NOAA's CRCP International Priority Region (Wider Caribbean) and ICNP is an actively managed MPA that protects coral reef habitat, coral reef fishes and nursery habitat for settling coral, fishes and lobsters.

### **List of project partners and their roles**

- ECOSUR: academic partner providing scientific support and leadership in carrying out fieldwork
- MAR Fund: provided logistic and administrative support to organize workshop and maintain management focus.
- NOAA/UM-CIMAS: provided funding, logistical planning and executed workshop

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

Undergraduate and graduate students participated in the field activities, adding regional science capacity

Project websites:

A website was created to promote communication and information exchange:

[http://www.marfund.org/en/new\\_projects/introduction.html](http://www.marfund.org/en/new_projects/introduction.html)

**Submissions to CoRIS**

None

**FY2011 Publications**

None

**FY2011 Presentations**

Larval fishes, Connectivity, and Management: A Mesoamerican Reef case study. Linking Science to Management: A conference & workshop on the FL Keys Marine Ecosystem, October 19-22, Duck Key, FL (poster)

**Setbacks or challenges encountered in FY2011**

None

**Comments on future direction of project**

In FY 12, we plan to carry out the 2<sup>nd</sup> Regional workshop to continue enhancing capacity amongst the four countries within the Mesoamerican Connectivity Network with the participation of NGOs, MPA practitioners, academic and government partners.



**Figure 1:** Field and lab work conducted at Contoy National Park Ranger Station with CIMAS, El Colegio de la Frontera Sur and Comisión Nacional de Áreas Naturales Protegidas.