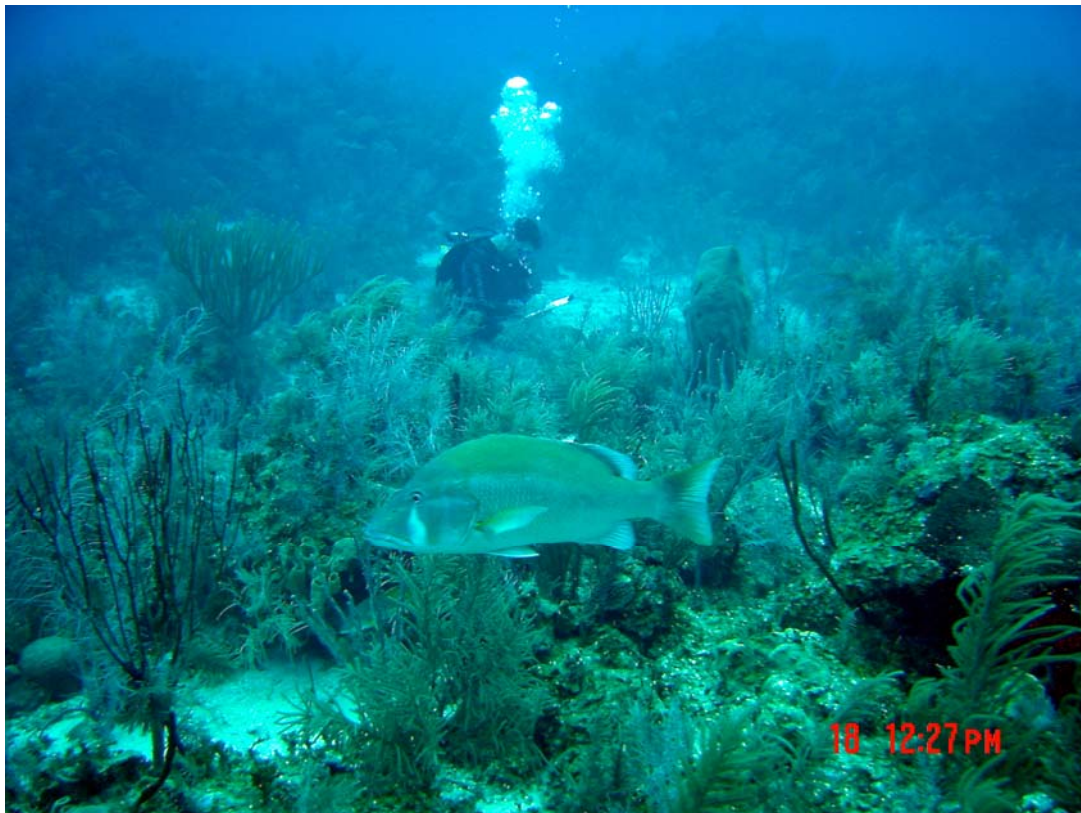




# SEFSC Coral Reef Program: FY2007 Project Accomplishments Report

Compiled By  
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March 2008



NOAA Technical Memorandum  
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National Marine Fisheries Service  
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March 2008

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# SEFSC Coral Reef Program: 2007 Project Accomplishments Report

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# **SEFSC Coral Reef Program: 2007 Project Accomplishments Report**

**March 2008**

## **I. INTRODUCTION**

Fiscal year 2007 marked the seventh year since the inception of the Coral Reef Conservation Program (CRCP). The CRCP is administered by NOAA Headquarters and includes other NOAA Line Offices, the Atlantic and the western Pacific regions. This program is integrated with other federal agencies, state and local governments, territories, and Commonwealths. The Southeast Fisheries Science Center (SEFSC) has been part of this process since 2001 and has implemented a number of projects in the South Atlantic, Gulf of Mexico and Caribbean regions with support from the CRCP. In February 2004, the SEFSC conducted an external program review for its coral reef program. This review provided valuable comments and recommendations which have helped to improve the design, performance and results of these projects. In September 2007, the CRCP conducted an external program review of the entire CRCP. The Panel Report was released in November 2007. The CRCP is currently developing a road map for moving forward with the CRCP, taking into consideration the recommendations of the external panel review.

Twenty-nine projects were funded by the CRCP in fiscal year 2007 (FY2007). Twenty-four of these projects were on-going projects, and five were new projects. This annual accomplishments report provides information on the activities that were undertaken, results and products produced, and summaries of issues related to implementation of the projects. The accomplishments are presented by CRCP theme category and by project.

## **II. PROGRAM COORDINATION**

**Project ID and Title: 1250-2007: Data Management, Assessment and Outreach**

**Duration of Project:** Ongoing project since FY2002

### **Brief description of activities conducted in FY2007:**

This project provides project coordination, data management and assessment support for SEFSC's Coral Reef Program and ensures: 1) field participation and the strategic involvement of SEFSC's efforts in planning, budget and execution components of the NOAA-wide coral reef program; 2) that SEFSC efforts are closely integrated with CoRIS; 3) that all data reporting and management requirements, as per the Coral Reef Initiative, PPBES and the Matrix Structure, are met, and collaborative endeavors and data sharing within NOAA and with external program partners are effectively achieved. In FY2007 all required data synthesis and budget resource reports were prepared, input to critical policy documents were secured; all HQ/Congressional information requests were handled, and accomplishments reports prepared. This project ensures the leveraging of SEFSC's coral reef resources with other SEFSC programs.

### **Description of accomplishments / results:**

The annual accomplishments report, "*SEFSC Coral Reef Program: 2007 Project Accomplishments Report, February 2008*," detailing the accomplishments, products, publications, partnerships, etc., in 2007 was compiled and distributed.

Other specific project activities include:

- Reviewed and submitted comments on NOAA Coral Ecosystem Research Plan.
- Reviewed and submitted comments on National Coral Reef Action Strategy.
- Reviewed and submitted recommendations on NOAA Coral Reef Grants' proposals.
- Reviewed, prioritized, and submitted comments on CRCP New FY2008 proposals.
- Reviewed and submitted comments on NOAA's Profiles of Activities: Deep Coral Communities Report.
- Participated at the C-CCREMP workshops and USCRTF meeting.
- Participated at the CRCP External Program review in Washington, DC, September 2007.
- Prepared accomplishments for USCRTF meeting in Washington, DC, March 2007.
- Monitored SEFSC Coral Reef Projects' accounts to ensure funds are obligated.
- Coordinated reconciliation of accounts with HQ and SEFSC's accounts personnel.
- Organized Coral Reef coordination meetings with HQ.
- Strengthened coordination and cooperation between the Science Center and the Regional Office on coral reef activities.
- Participated on coral reef Communications and Outreach Strategic Plan team.
- Prepared group travel and international travel (GCFI/CRTF meeting etc).
- Engaged in planning process for the 2007 CRCP external program review.

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

Increase communication, collaboration, and accountability within the SEFSC and among SEFSC PIs, the national CRCP, academic institutions, and other partners.

**How project supports management / research / other activities:**

This project provides support and coordination for SEFSC's CRCP projects and PIs with the national program, States, Territories, Commonwealth, and other partners.

**Partnerships, capacity building, education and outreach activities:**

This project worked collaboratively with other NOAA line offices involved with the CRCP. We established close coordination with state, territory, commonwealth, and other external partners. The project provided reports and educational materials to constituents, during open houses, and for various coral related meetings.

**Submissions to CoRIS:**

NOAA Coral Reef Conservation Program Southeast Fisheries Science Center Activities and Accomplishments 2004-2006.

SEFSC Coral Reef Program: 2006 Project Accomplishments Report, February 2007.

**Publications during FY2006 (including Tech. Memos.):**

As per submissions to CoRIS above.

**Presentations at professional meetings, posters, etc.:**

None

**Problems, difficulties, etc., encountered during FY07:**

The late receipt of funds continues to create logistical problems for the implementation of research projects.

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

Theo R. Brainerd (PI) – NOAA SEFSC, Miami, FL

Jennifer Schull Johnson (co-PI) – NOAA SEFSC, Miami, FL



### **III. ASSESS AND CHARACTERIZE U.S. CORAL REEFS – CORAL ECOSYSTEM INTEGRATED OBSERVING SYSTEM (CREIOS)**

**Project ID and Title: 1064-2007: Assess and Monitor Coral Reef MPAs**

**Duration of Project:** Ongoing project since FY2005

**Brief description of activities conducted in FY2007:**

The FY2007 goals of this project were to continue long-term monitoring of coral reef fish communities and coral reef habitat in the FL Keys (Miami to Key West). 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.

**Description of accomplishments / results:**

Sampling in FY2007 occurred from May - September 2007, during which 1,279 data-collection dives were made at 327 sites. Data entry for 2007 sampling has been completed and quality assurance / quality control measures are underway. Data analysis and comparison with previous years will occur in FY2008. Also underway is a comparative assessment of abundance and length metrics for fishery targeted species within versus outside of Sanctuary Protected Areas (SPAs; areas within the Florida Keys National Marine Sanctuary where the harvest of reef fish is not permitted). Initial results indicate increased abundances of fishery-targeted species in SPAs, with likely confounding effects of large-scale natural disturbances such as hurricanes. Once analyses are completed, results will be communicated to managers (FKNMS, SAFMC, State of Florida FWC) to guide future management decisions, and will support a manuscript to be submitted for publication in a peer-reviewed journal.

This project was the topic of an invited presentation by Dr. Jim Bohnsack in a symposium on Long Term Monitoring in Fisheries at the 2007 American Fisheries Society (AFS) symposium in San Francisco, CA. The presentation demonstrated how long-term, visual monitoring of coral reef fishes and coral reef habitats support ecosystem-based management in the FL Keys ecosystem.

Finally, data generated from this project were utilized in a separate CRCP-funded project, “Coral reef fish-habitat modeling to support ecosystem management”, resulting in two additional presentations at the AFS symposium (see presentations list below).

In summary, a total of 1,279 data-collection dives were made at 327 sites along the FL Keys coral reef tract to continue our long-term reef fish and coral reef habitat monitoring program. Results from this ongoing project continue to be used to guide fisheries and ecosystem management efforts, including through their use in stock assessments, assessments of the effectiveness of management actions (e.g., establishment of no-fishing zones), and in fish-habitat modeling.

**How project supports goals and objectives of CRCP:**

This project addresses multiple issues identified under the following CRCP priority areas: (1) Assessments, Inventories and Monitoring, (2) Strategic Research, (3) Marine Protected Areas, and (4) Coordination, Accountability, and Partnerships, with subsequent applicability to (5) Restoration and (6) Sustainable Fishing.

**How project supports management / research / other activities:**

Results from this ongoing project continue to be used to guide fisheries and ecosystem management efforts, including through their use in stock assessments, assessments of the effectiveness of management actions (e.g., establishment of no-fishing zones), and in fish-habitat modeling.

**Partnerships, Capacity building, education and outreach activities:**

The project is in collaboration with researchers at the University of Miami Rosenstiel School of Marine and Atmospheric Science, the National Park Service, and the State of Florida Fish and Wildlife Conservation Commission. The multi-agency collaborative work facilitates the collection and provision of data to guide fisheries and ecosystem management across jurisdictional boundaries.

**Submissions to CoRIS:**

One peer-reviewed publication (see below).

**Publications during FY2007 (including Tech. Memos.):**

Bartholomew, A., J. Bohnsack, S. Smith, J. Ault, D Harper and D. McClelland. (2008). Influence of reserve size and boundary length on the initial response of exploited reef fishes in the Florida Keys National Marine Sanctuary, USA, *Landscape Ecology* 23 Suppl. 1: 55-65.

**Presentations at professional meetings, posters, etc:**

Bohnsack, J., J. Ault, S. Smith, and T. Kellison. 2007. Visual reef fish monitoring supports ecosystem-based management in Florida. AFS Symposium 42. Looking at the Bigger Picture: Long Term Monitoring in Fisheries.

Smith, S., J. Ault, J. Luo, J. Bohnsack, and T. Kellison. 2007. Regression analysis of habitat use by reef fish species and life stages in the Florida Keys. AFS Symposium 50: Linking estuarine-marine habitats.

Ault, J., S. Smith, J. Luo, T. Kellison, and J. Bohnsack. 2007. Community-based analysis of reef fish habitat use in the Florida Keys. AFS Symposium 50: Linking estuarine-marine habitats.

**Problems, difficulties, etc., encountered during FY2007:**

N/A

**Changes / Adjustments needed:**

N/A

**Names of PIs and co-PIs:**

Jim Bohnsack (PI) – NOAA SEFSC, Miami, FL

Jerry Ault (co-PI) – UM-RSMAS, CIMAS, Miami, FL

Steve Smith (co-PI) – UM-RSMAS, CIMAS, Miami, FL

Todd Kellison (co-PI) – NOAA SEFSC, Miami, FL

**Project ID and Title: 1056-2007: Status and Exploitation of Reef Resources at Navassa Island**

**NOTE: No funding in FY2007. This project is funded on a biennial basis**

**Duration of the Project:** Ongoing project since FY2002

**Brief description of activities/accomplishments/results conducted in FY2007:**

The third CRCP Navassa reef assessment cruise was conducted in November 2006 aboard the charter vessel R/V Coral Reef II (via partnership of Shedd Aquarium). Key findings from this cruise include:

- The documentation of a major coral bleaching event
- Continued high levels of coral mortality in the most-developed reef habitats and declines in live coral cover
- Continued decline of reef fish biomass in visual census
- Absence of net fishing and overall lower levels of fishing effort than observed in 2004
- Continued expansion and good condition of local population of ESA threatened coral, *Acropora palmata*. Conversely, *A.cervicornis* remains extremely rare.

Drafted summary reports on Navassa status for 2008 Status of US Coral Reefs Report and Riegl & Dodge (eds.). Coral Reefs of the USA. Springer, In press.

**How Project Supports Goals & Objectives of CRCP:**

**Assessments, Inventories, and Monitoring:** Only ongoing coordinated monitoring/assessment information for Navassa Island NWR.

**Mapping:** Provided habitat maps and collaborated on multibeam mapping for Navassa shelf.

**Social and Economic Factors:** This project has undertaken (published in FY2007) directed work to characterize fishing communities active at Navassa Island.

**How Project Supports Management / Research/ Other Activities:**

This project provided the primary information on:

- Reef resource status (fishes and benthic communities) and changes thereto
- Mapping information on marine resources
- Information on the reef fisheries for National Wildlife Refuge.

**Partnerships, Capacity building, education and outreach activities:**

Shedd Aquarium,  
FoProBIM

Fielded requests for information from MCBI and provided published reports.

**Submissions to CoRIS:**

See publications below

**Publications during FY2007 (including Tech. Memos.):**

Miller, M.W., D.B. McClellan, J.W. Wiener, and B. Stoffle. 2007. Apparent rapid fisheries escalation at a remote Caribbean Island. *Env. Cons.* 34: 92-94.

Miller, M.W., D.E. Williams. 2006. Coral disease outbreak at Navassa, a remote Caribbean Island. *Coral Reefs* 26:97-101.

**Presentations at professional meetings. Posters, etc:**

None

**Problems, difficulties, etc., encountered during FY2007:**

None

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

Margaret Miller (PI) – NOAA SEFSC, Miami, FL  
Brent Stoffle (co-PI) – NOAA SEFSC, Miami, FL  
Todd Kellison (co-PI) – NOAA SEFSC, Miami, FL

**Project ID and Title: 10051-2007: U.S. Caribbean Comprehensive Coral Reef Ecosystem Assessment and Monitoring**

**Duration of the Project:** Ongoing project since FY-2006

**Brief description of activities conducted in FY2007:**

This project is a joint line office initiative intended to evaluate and improve coordination of existing or planned coral reef ecosystem assessment and monitoring by federal, territorial, commonwealth, academic, and private sector partners in the U.S. Caribbean. The overall goal is to develop well-coordinated mechanisms to address monitoring needs and develop compatible data so managers can understand coral reef resource conditions and changes across the region.

**Description of accomplishments / results:**

During FY2007, we completed reports covering both the Puerto Rico and Virgin Islands workshops, held in September 2006 with NOAA research partners from each jurisdiction. Workshop participants presented current research or monitoring projects and helped

identify additional projects monitoring coral reef resources – biological and environmental. Both research needs and spatial gaps were documented. Discussions of expanded coordination developed alternatives for increasing effectiveness of monitoring. The report also revised and updated the C-CCREMP Implementation Plan. Design, development, and implementation of an on-line database were also accomplished. The database was made available to NOAA researchers and partners to enter monitoring metadata, including geographic information. Data entry is proceeding but will require additional oversight. Data will be used to support the State of the Reefs Report, currently in preparation. Work has progressed in identifying additional researchers and managers for inclusion in FY2008/09 workshops for presentations of coral reef status and conservation, monitoring progress, and planning of joint monitoring projects.

The project is providing a vehicle for coral reef managers and researchers to share data and information on current monitoring efforts and provide for greater efficiency in planning to meet additional needs.

**How Project Supports Goals & Objectives of CRCP:**

**Mapping:** This project is producing a geodatabase, linked to GIS, to map monitoring and research activities across the U.S. Caribbean region. These will augment maps of biological components to assist managers and researchers.

**Assessments, Inventories, and Monitoring:** C-CCREMP is a coordinated program between federal and local partners that links data from projects that inventory, assess, and monitor U.S. Caribbean coral reefs. As a comprehensive tool it will provide greater access to necessary data to assess conditions across the region.

**Social and Economic Factors:** The project includes input of data on socio-economic studies as well as biological and environmental parameters.

**Managing Coastal Impacts:** The C-CCREMP database includes locations of monitoring, such as water quality monitoring, that have a direct impact on coral reef thereby enabling managers to develop better approaches to environmental monitoring and control.

**Outreach and Education:** The project provides the means to maximize information sharing among the management and scientific communities. It can also be expanded as an outreach tool for increased awareness and understanding of the ecological, cultural, and socioeconomic importance of coral reef ecosystems.

**Coordination, Accountability, and Partnerships:** The heart of C-CCREMP is the coordination among academic, federal and local agency partners, sharing information and developing common goals for coral reef conservation in the region.

**How Project Supports Management / Research/ Other Activities:**

This project addresses five action areas of the National Coral Reef Action Strategy:  
Understand Coral Reef Ecosystems

Assess and Monitor Reef Health  
Monitor Coral, Fish, and Other Living Resources  
Conduct Strategic Research  
Research Impacts of Management Actions

**Partnerships, Capacity building, education and outreach activities:**

The heart of the project is collaboration across NOAA line offices and among partners conducting research throughout the U.S. Caribbean. The first workshop, held in La Parguera, Puerto Rico on September 18-19 was attended by 27 individuals representing six different organizations involved in coastal monitoring, assessment, and/or management in Puerto Rico. The second of the two workshops was held in St. Thomas, USVI on September 21-22 and was attended by 33 individuals from twelve different organizations involved in coastal monitoring, assessment, and/or management in the USVI. Partners include NOAA (CRCP, SEFSC, NCCOS), USGS, National Park Service, EPA, Caribbean Fisheries Management Council, Puerto Rico Dept. of Natural and Environmental Resources (Fisheries, Reserves and Sanctuaries, Jobos Bay NEER), Virgin Islands Dept of Planning and Natural Resources (Fish and Wildlife, Coastal Zone Management Program, Dept of Environmental Protection), Univ. of Puerto Rico, Univ. of Virgin Islands, The Nature Conservancy, Ocean Conservancy, and private citizens. This group will continue to participate and other partner organizations will be added in future meetings. The geodatabase will be a valuable outreach tool for data display and planning, improving coral reef management.

**Submissions to CoRIS:**

NOAA's Coral Reef Conservation Program. 2007. *Comprehensive U.S. Caribbean Coral Reef Ecosystem Monitoring Project (C-CCREMP): Report on the Results of the C-CCREMP FY2006 Workshops*. National Oceanic and Atmospheric Administration, Coral Reef Conservation Program (NOAA CRCP). Silver Spring, MD. 12pp. + appendices.

**Publications during FY2007 (including Tech. Memos.):**

None

**Presentations at professional meetings. Posters, etc:**

None

**Problems, difficulties, etc., encountered during FY2007:**

None

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

Ron Hill (PI) - NOAA, SEFSC, Galveston, TX  
Mark Monaco (PI) - NOAA, NCCOS, Silver Spring, MD

#### IV. REDUCE IMPACTS OF COASTAL USES

##### **Project ID and Title: 1066-2007: Ecological Approach to Reef Restoration**

**Duration of the Project:** Ongoing project since FY2002

##### **Brief description of activities/results/accomplishments conducted in FY2007:**

Assessment of benthic community structure on four FKNMS restoration structures (RS) demonstrates a consistent difference in macroalgal composition between RS and adjacent natural substrates on structures that are as old as 12 years. This difference is manifested primarily as an overabundance of a cyanobacteria on RS. Experiments were conducted to test potential influence of these different macroalgal assemblages on coral larval settlement.

Successful completion of two additional experiments on larval and settlement phases of reef-building coral, *Montastraea faveolata* testing 1) differential performance of larvae from specific parent colonies, 2) potential benefit of active inoculation with zooxanthellae symbionts at immediate post-settlement stage.

Testing with additional new substrate types and treatments has determined that despite reduced settlement preference, early survivorship/growth of settlers is greatly enhanced on 'clean' substrates (lacking encrusting organisms) versus the natural reef rubble that have been used for settlement in previous years. Overall percent of settled polyps that remained (or grew) after 14 weeks was 165 for marble tiles that were minimally 'conditioned' prior to settlement, compared to less than 20 for polyps settled on natural reef rubble with abundant encrusting biota. This represents a breakthrough in our strategy for culturing surviving larval recruits.

Approximately 2,000 *Montastraea faveolata* and *Diploria strigosa* spat were outplanted to the Wellwood RS in late Sept 2007. In addition, over 500 spat of *M. faveolata* remain alive (3 months post-settlement) in aquaria at a land-based facility in Key Largo.

##### **How Project Supports Goals & Objectives of CRCP:**

**Restoration:** Advancing capacity for reef restoration via enhancement of sexual recruitment of corals.

**Strategic Research:** providing for experimental studies of coral early life history stages including effects of temperature, acidity, genotype, feeding, zooxanthellae infection, substrate characteristics.

##### **How Project Supports Management / Research/ Other Activities:**

Research support for ecology of early life stages of corals (larval culture to enable experimentation on factors effecting recruitment such as temperature, acidity, genotype, feeding, zooxanthellae infection, substrate characteristics etc.).

Advancing capacity for reef restoration (i.e. providing new corals).

Evaluation of previous FKNMS restoration projects providing insights on possible revisions for future improvement.

**Partnerships, Capacity building, education and outreach activities:**

Developed active collaboration with SECORE project (<http://www.secore.org/>), a consortium of aquarists from public zoos and aquaria with expertise in coral culture (and funded via CRCP conservation grant). SECORE member participated at our September coral spawn collection/culture effort, successfully tested a new SECORE apparatus for larval culture ('kriesel'), and provided larvae of *Montastraea faveolata* and *Diploria strigosa* to SECORE organizing institution (Columbus Zoo/Aquarium) for settlement and culture in a zoo setting. These represent new coral species within the SECORE effort. Over 1,000 settled corals remain alive in Columbus after about six weeks and plans are being developed to distribute these colonies amongst the SECORE institutions for continued culturing and public outreach/education goals.

Successful culture of surplus *Montastraea faveolata* larvae which were provided to other researchers/institutions to enable competitively funded projects (including Mote Marine lab, RSMAS, Smithsonian Marine Station, SUNY-Buffalo).

Hosted visiting researchers/engineers from Japan that traveled to South Florida to discuss coral larval culture and restoration activities. Organized a full day of discussions and field trip to Wellwood restoration site. This team is involved in state-of-the-art coral larval culture and restoration applications.

Public Lecture for FKNMS on: "Coral spawning and restoration" at the Florida Keys Community College, February 13, 2007.

**Submissions to CoRIS:**

Research Report (2006 activities)

**Publications during FY2007 (including Tech. Memos.):**

None

**Presentations at professional meetings. Posters, etc:**

Miller 'Are reef restoration structures self-defeating?' Oral presentation. Marine Benthic Ecology Meetings, April 2007, Atlanta GA.

Beard, M., B. Mason, M. Miller, V. Shestopalov, and V. Slepak. 'First identification of photosensitive cells in corals: An opsin-like protein and photoreceptor cells present in coral larvae may allow substrate discrimination during settlement.' Oral presentation. Marine Benthic Ecology Meetings. April 2007, Atlanta GA.

**Problems, difficulties, etc., encountered during FY2007:**

None

**Changes / Adjustments needed:**



None

**Names of PIs and co-PIs:**

Margaret Miller (PI) – NOAA SEFSC, Miami, FL

**Project ID and Title: 1070-2007: Effectiveness of Coral Reattachment in Recovery of Reef Habitat following Grounding of M/V Fortuna Reefer at Mona Island**

**Duration of the Project:** Ongoing project since FY2001

**Brief description of activities conducted in FY2007:**

This research is monitoring the success of the NOAA-led coral reef restoration that followed the 1997 grounding of the M/V Fortuna Reefer on Mona Island (a PR reserve) using corals and fish as indicators of habitat function and quality. It is coordinated with on-going research to monitor coral disease and disease effects on reef ecology and reef fish assemblages and with recently begun research into the ecology and productivity of staghorn coral (*Acropora cervicornis*) colonies.

**Description of accomplishments / results:**

Data collection and analysis are on-going. Publications on past monitoring activities at the Fortuna Reefer were completed and published in FY2007, including a book chapter on fates of restored *Acropora* fragments after 8 years. Additional manuscripts and presentations were produced in early FY2008 for a regional fisheries conference and additional work has been submitted for presentation and publication at the international coral reef symposium. Dr. Bruckner has been involved with restoration planning and activities making recommendations on two recent groundings in Puerto Rico. Results from field research and monitoring are incorporated into the new State of the Reef Report. Research into reef ecology and disease continue to provide insights into current status of Puerto Rican coral reef ecosystems and the conditions that contribute to successful reef restorations.

**How Project Supports Goals & Objectives of CRCP:**

**Restoration:** Increasing knowledge base for reef restoration by comprehensive assessment of earlier restoration techniques. Project is generating publications on coral and fish ecology and recommendations for future restoration improvement.

**Strategic Research:** Project is providing comprehensive biological monitoring to a PR natural reserve, linking changes in coral reef conditions with changes in reef fish assemblages. Small scale experiments (e.g., coralivorous snail removals, fragment attachment methods) have generated data on alternate restoration approaches.

**Managing Coastal Impacts:** By studying previous restoration efforts we are able to improve our capacities for future restoration success and reduce the impacts of future groundings.

**Coordination, Accountability, and Partnerships:** The work at Mona Island is coordinated with the Puerto Rico Dept. of Natural and Environmental Resources and the University of Puerto Rico. It has increased communication with local agency partners and provides a conduit for sharing information and recommendations.

**How Project Supports Management / Research/ Other Activities:**

Evaluation of previous restoration projects providing insights on possible methodological revisions to improve future restoration success. During monitoring we have been able to evaluate some alternative approaches to restoration.

This work specifically addresses overfishing Goal 4 of the Puerto Rico Local Action Strategy (Goal: 4. Reduce impacts of non-fishing activities to coral reefs such as groundings, inadequate anchoring, walking on corals, sediment and nutrient discharges, among others.) by developing successful restoration techniques that can be applied. Puerto Rico DNER was a partner in the settlement and restoration and is closely linked to our monitoring and research work.

**Partnerships, Capacity building, education and outreach activities:**

This collaboration between NOAA Fisheries Office of Habitat Conservation, SEFSC, and the Univ. of Puerto Rico assesses and monitors success of a multiagency coral reef restoration on Mona Island. By collaborating with UPR we are supporting graduate students and their research, using local industry resources [Mona Aquatics Dive Center (Dive Operator)], and reducing costs while building capacity - training graduate students in coral reef research. All work is closely coordinated with PR DNER staff and management. Recent groundings/restorations (e.g., Magara) have provided the opportunity for input to improve both restoration and monitoring planning. Complementary projects are being conducted in the Florida Keys (Bohnsack and Miller) and in the Oculina Banks (David). Shared findings should lead to a better understanding of successful techniques for coral reef restoration. NOAA's Damage Assessment Division and Restoration Center are also included in information sharing.

**Submissions to CoRIS:**

Research and Cruise Reports and publications below.

**Publications during FY2007 (including Tech. Memos.):**

Bruckner, A.W. and R.J. Bruckner 2006. Survivorship of restored *Acropora palmata* fragments over six years at the M/V *Fortuna Reefer* ship grounding site, Mona Island, Puerto Rico. Proceedings of the 10<sup>th</sup> International Coral Reef Symposium, Okinawa, Japan.

Bruckner, A.W. and R.J. Bruckner 2006. Restoration outcomes of the Fortuna Reefer Grounding at Mona Island, Puerto Rico. Chapter 19 in W.F Precht, ed. *Coral Reef Restoration Handbook – The Rehabilitation of an Ecosystem Under Siege* CRC Press, Boca Raton, FL

**Presentations at professional meetings. Posters, etc:**

Hill, R, M. Schärer, M. Nemeth, and A. Bruckner. Reef fish habitat use as a measure of coral reef restoration success at the Fortuna Reefer grounding site, Mona Island, Puerto Rico. Oral presentation, Gulf and Caribbean Fisheries Institute annual meeting, Punta Cana, Dominican Republic, November 2007.

**Problems, difficulties, etc., encountered during FY2007:**

None

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

Ron Hill (PI) – NOAA SEFSC, Galveston, TX

Andy Bruckner (co-PI) – NOAA, F/HC, Silver Spring, MD

## **V. REDUCE ADVERSE IMPACTS OF FISHING**

### **Project ID and Title: 10299–2007: Coral Reef Fish-Habitat Modeling to Support Ecosystem-based Management**

**Duration of Project:** First year

#### **Brief description of activities conducted in FY2007:**

This is a two-year project that began in FY2007. In FY2007, the following activities occurred as planned: spatially-explicit reef fish visual census and habitat relational database assimilation and assessment, and quality assurance / quality control procedures (months 1-4); continued assimilation of marine topography and habitat data from external sources (e.g., NPS/USGS; months 1-4); targeted collection of additional field data focusing on a range of high-rugosity and seascape-specific areas in the FL Keys and Dry Tortugas regions (months 5-7); initiate data analyses, statistical evaluation and model building (months 5-12).

**Description of accomplishments / results:** Data analysis thus far has utilized two complementary approaches: regression and multivariate. Analyses have focused on a suite of reef fish species, including both fishery-targeted and non-fishery-targeted species. Results from each analytical approach are used to aid in interpretation of results from the alternate approach. Results have already provided considerable information on the importance of multiple habitat variables in explaining variance in species-specific abundance metrics. Aside from providing direct information on fish-habitat correlations, this information will be used to guide reef fish sampling protocols in the closely related CRCP Project # 1064 – Assess and monitor coral reef MPAs.

Project co-PIs presented preliminary results during two presentations at the 2007 American Fisheries Society Meeting in San Francisco. In a session titled “Linking Estuarine-Marine Habitats to Fish and Fisheries using Remote Sensing, GIS, Mapping and Modeling”, co-PI Dr. Steve Smith discussed the use of regression analyses of habitat use by different reef fish species and life stages in the Florida Keys. Dr. Jerry Ault then presented results from community-based analyses of reef habitat use in the Florida Keys.

In summary, in FY2007 investigations of relationships between reef fish community structure and coral reef habitat characteristics were initiated that, when completed, will facilitate the transition to Ecosystem Based Management in the FL Keys and Dry Tortugas reef ecosystem, via improved understanding of the relationships between species (and species groups) and coral reef habitat.

#### **How project supports goals and objectives of CRCP:**

This project addresses multiple issues identified under the following CRCP priority areas: (1) Strategic Research, (2) Marine Protected Areas, (3) Sustainable Fishing, and (4) Restoration.

**How project supports management / research / other activities:**

Project results and output will facilitate single-species management and the transition to Ecosystem Based Management in the FL Keys and Dry Tortugas reef ecosystem, via improved understanding of the relationships between species (and species groups) and coral reef habitat. Aside from providing direct information on fish-habitat correlations, this information will be used to guide reef fish sampling protocols in the closely related CRCP Project # 1064 – Assess and monitor coral reef MPAs.

**Partnerships, Capacity building, education and outreach activities:**

The project is in collaboration with researchers at the University of Miami Rosenstiel School of Marine and Atmospheric Science.

**Submissions to CoRIS:**

N/A

**Publications during FY2007 (including Tech. Memos.):**

N/A

**Presentations at professional meetings, posters, etc:**

Smith, S., J. A. Ault, J. Luo, J. Bohnsack, and T. Kellison. 2007. Regression analysis of habitat use by reef fish species and life stages in the Florida Keys. American Fisheries Society Symposium 50: Linking estuarine-marine habitats.

Ault, J., A. S. Smith, J. Luo, T. Kellison, and J. Bohnsack. 2007. Community-based analysis of reef fish habitat use in the Florida Keys. American Fisheries Society Symposium 50: Linking estuarine-marine habitats.

**Problems, difficulties, etc., encountered during FY2007:**

N/A

**Changes / Adjustments needed:**

N/A

**Names of PIs and co-PIs:**

Todd Kellison (PI) – NOAA SEFSC, Miami, FL  
Jerry Ault (co-PI) – UM-RSMAS, CIMAS, Miami, FL  
Steve Smith (co-PI) – UM-RSMAS, CIMAS, Miami, FL

**Project title: 1052-2007: Grouper Distribution, Habitat Characteristics and Spawning Behavior**

**Duration of Project:** Ongoing project since FY2003

**Brief description of activities conducted in FY2007:**

The overall objective of this project is to gain insight into the factors that govern distribution and abundance patterns of shallow-water groupers in the Florida Keys, with a focus on habitat utilization patterns and seasonal movements. In FY2007, project objectives focused on (1) completing data collection and continuing data analysis for the acoustic telemetry component of the project (initiated in FY2005); (2) performing stakeholder interviews to gain a broader perspective on existing knowledge and perceptions among various user groups of black grouper seasonal distribution patterns, and (3) acquiring and preparing multiple long-term data sets for further assessment of seasonal variation in black grouper spatial distribution patterns.

**Description of accomplishments / results:**

In support of objective (1), the final data download from acoustic receivers stationed at Conch Reef (near Key Largo, FL) occurred in spring 2007, marking the end of the acoustic tracking project component of this study. Data analysis continues. In total, over one and a half million records (acoustic “hits”, in which acoustic receiver detected an acoustically tagged fish) were collected for black grouper over the course of a year and a half. Preliminary analyses indicate a high degree of site fidelity among all tagged fish, along with what appears to be some seasonal variance in behavior, with more hits around springtime (subsequent analyses will indicate whether increased numbers of hits are associated with increased grouper movements or, alternately, less movement resulting in nearly continuous hits from nearby receivers). Analyses will continue in FY2007 and will support the generation of (1) one or more manuscripts that will be submitted for publication in peer-reviewed journals, and (2) presentations at academic and professional conferences / symposia.

In support of objective (2), more than 40 interviews with members of local user groups from Key Largo to Islamorada, FL occurred from May to July 2007. Interviewees included scuba instructors, commercial fishermen, charter boat captains, restaurant owners, and other stakeholders. Preliminary findings include a general consensus on preferred black grouper habitat and seasonality, along with apparent conflicts and interactions between stakeholder groups. Analysis will be completed in FY2008 and will support the generation of a manuscript for peer-reviewed publication.

In support of objective (3), we acquired and began organizing two long-term data sets (BNP creel data and NMFS headboat data) for assessment of seasonal differences in catch rates of shallow grouper species, which in turn would correlate with seasonal changes in spatial distribution patterns.

In summary, in FY2007 the field component of a 1.5-yr acoustic tagging study focused on black groupers was completed, as were more than 40 interviews with local stakeholders. Data analysis for both projects continues. Project results will enhance our knowledge of the biology and ecology of shallow-water groupers (with a focus on black grouper) in the FL Keys, in turn providing information to guide optimal management strategies.

**How project supports goals and objectives of CRCP:**

This project addresses multiple issues identified under the following CRCP priority areas: (1) Strategic Research and (2) Marine Protected Areas, with subsequent applicability to (3) Sustainable Fishing and (4) Managing Coastal Impacts.

**How project supports management / research / other activities:**

Project results will enhance our knowledge of the biology and ecology of shallow-water groupers (with a focus on black grouper) in the FL Keys, in turn providing information to guide optimal management strategies (e.g., establishing minimum sizes for effective MPAs) and improve monitoring and assessment for the target species.

**Partnerships, Capacity building, education and outreach activities:**

The project is in collaboration with researchers at the University of Miami Rosenstiel School of Marine and Atmospheric Science, and supports the PhD dissertation of a UM-RSMAS student (Veronique Koch).

**Submissions to CoRIS:**

N/A

**Publications during FY2007 (including Tech. Memos.):**

N/A

**Presentations at professional meetings, posters, etc:**

Koch, V., Political ecology in fisheries science. University of Miami, RSMAS student presentation.

Koch, V., The use of political ecology in the study of black grouper habitat and behavior. University of Miami, RSMAS student presentation.

Koch, V., The why, how and where of fish movement- the movement behavior of black groupers (*Mycteroperca bonaci*). University of Miami, RSMAS student presentation.

**Problems, difficulties, etc., encountered during FY2007:**

N/A

**Changes / Adjustments needed:**

N/A

**Names of PIs and co-PIs:**

Todd Kellison (PI) – NOAA SEFSC, Miami, FL

David Die (co-PI) – UM-RSMAS, CIMAS, Miami, FL

Veronique Koch (co-PI) – UM-RSMAS, CIMAS, Miami, FL

## **Project ID and Title: 1317-2007: Acoustic Seabed Classification and Quantification of Reef Fish Habitat**

**Duration of Project:** Ongoing project since FY2004

### **Brief description of activities conducted in FY2007:**

The overarching goal of this project is to assess the utility of a single-beam sonar system (QTCV) for generating habitat maps in waters too deep to be mapped with conventional methods such as satellite imagery. In FY2007, efforts focused on four objectives: (1) Developing an understanding of the relationship between the acoustic data generated by the QTCV and the actual benthos, (2) Assessing the repeatability of survey results (e.g., will habitat maps be similar if the same site is mapped on multiple days differing in sea conditions such as wave height?), (3) Testing the transferability of the habitat classification system (e.g., will a set of classes differentiating hardbottom from sediment at site A do the same at site B?), (4) Linking habitat data generated with the QTCV to coral reef fish distribution and abundance patterns.

### **Description of accomplishments / results:**

Accomplishments pertaining to each of the four objectives are as follows:

- Developing an understanding of the relationship between the acoustic data generated by the QTCV and the actual benthos. Progress this year has focused on correlation of acoustic “maps” with seabed properties (sediment grain size, thickness and coverage) and sounder-seabed geometry (grazing angle). An effort to validate empirical relationships through numerical modeling has been pursued in collaboration with colleagues at the University of Victoria. During FY2007, 6000 model runs were completed, using about 1500 hours of computer time, to develop a library of simulated echoes under varying sea states and seabed properties. These simulated echoes were then processed using the same classification software used for real surveys. Qualitatively, the results support the hypothesis that the acoustic classifications in coral reef environments predominantly reflect the mixture of rock and sediment as well as the slope within the ensonified area. Work is now focused on quantifying that relationship.
- Assessing the repeatability of survey results (e.g., will habitat maps be similar if the same site is mapped on multiple days differing in sea conditions such as wave height?) This objective is continuing to be accomplished via repeat surveys at French Reef. A roll/pitch sensor was constructed during FY2007 in order to assess the effect of sea state on the classification results. Data have been collected over the same survey tracks on six days, four in May and two in August. Two more days of data collection are planned for November 2008.
- Testing the transferability of the habitat classification system (e.g., will a set of classes differentiating hardbottom from sediment at site A do the same at site B?) Results so far indicate that standard QTC processing creates accurate classifications for each survey area but that the classes are not necessarily the same between survey areas. An alternate processing method has been developed in this project that is hypothesized to create maps of different areas with classes that are the same in each area. This hypothesis is now being tested.



- Linking habitat data generated with the QTCV to coral reef fish distribution and abundance patterns. This objective is continuing to be accomplished. Five sites in the upper Florida Keys near known historical spawning aggregation sites were surveyed during August 2007. These data are now being processed to assess the relationships between the locations of the aggregations and the geomorphology and surficial geology of the seabed. A meeting was conducted in September 2007 in order to standardize methods with colleagues at Texas A&M University who are performing similar work in the Western Caribbean.

This project contributes to coral reef conservation through the assessment and further development of single-beam acoustic seabed mapping, which is a low-cost method for mapping habitats in deep water. Accomplishments from this project will contribute to the standardization of this methodology for mapping reefs. (Note: results from this research are already in use for coral reef habitat mapping and research in Navassa).

#### **How project supports goals and objectives of CRCP:**

This project addresses multiple issues identified under the following CRCP priority areas: (1) Mapping, (2) Assessments, Inventories and Monitoring, and (3) Strategic Research, with subsequent applicability to (4) Marine Protected Areas and (5) Sustainable Fishing.

#### **How project supports management / research / other activities:**

This project contributes to coral reef conservation through the assessment and further development of single-beam acoustic seabed mapping, which is a low-cost method for mapping habitats in deep water. Accomplishments from this project will contribute to the standardization of this methodology for mapping reefs. Results from this research are already in use for coral reef habitat mapping and research in Navassa.

#### **Partnerships, Capacity building, education and outreach activities:**

The project is in collaboration with researchers at the University of Miami Rosenstiel School of Marine and Atmospheric Science, and supports the PhD dissertation of a UM-RSMAS student (Art Gleason).

#### **Submissions to CoRIS:**

One peer-reviewed publication (Gleason et al. 2006; see below).

#### **Publications during FY2007 (including Tech. Memos.):**

Gleason, A.C.R., A-M. Ecklund, R.P. Reid, and V. Koch. 2006. Acoustic signatures of the seafloor: tools for predicting grouper habitat. In: Emerging technologies for reef fisheries research and management, J.C. Taylor (ed), p. 38-47. NOAA Professional Paper NMFS 5.

Miller, M. W., R.B. Halley, A.C.R. Gleason. *In press*. Reef Geology and Biology of Navassa Island, in Coral Reefs of the USA, B. Riegl, R.E. Dodge (Eds.), Springer Press.

#### **Presentations at professional meetings, posters, etc:**

N/A

**Problems, difficulties, etc., encountered during FY2007:**

N/A

**Changes / Adjustments needed:**

N/A

**Names of PIs and co-PIs:**

Todd Kellison (PI) – NOAA SEFSC, Miami, FL

Pamela Reid (co-PI) – UM-RSMAS, CIMAS, Miami, FL

Art Gleason (co-PI) – UM-RSMAS, CIMAS, Miami, FL

**Project ID and Title: 1242-2007: Hydroacoustic Biomass Assessment of Reef Fish Spawning Aggregations**

**Duration of Project:** Ongoing project since FY2004

**Brief description of activities conducted in FY2007:**

The FY2007 goals of this project were 1) continued Puerto Rico (PR) and US Virgin Islands (USVI) hydroacoustic surveys focusing on red hind during the period of December 2006 to February 2007 and associated data analysis; 2) monthly hydroacoustic surveys throughout FY2007 at two sites in PR and one site in USVI and associated data analysis; 3) expand hydroacoustic surveys to deeper reef areas than in previous surveys, and 4) assess the ability of the survey technique to detect and identify pelagic species adjacent to the shelf edge.

**Description of accomplishments / results:**

For objective (1), hydroacoustic surveys focusing on red hind spawning aggregations were performed during December, January and February at Bajo de Cico, PR and in waters adjacent to St. Croix, USVI (February). Results from these surveys, in combination with data collected during previous years, will provide a baseline of spawning aggregation size (i.e., abundance and biomass of spawners) for comparisons with data collected in future years to assess the effectiveness of regulations prohibiting harvest during the spawning season. Data analysis is underway. Scuba-based groundtruthing efforts are ongoing.

For objective (2), monthly surveys during the full moon (spawning) period were performed for all other months of FY2007 to assess locations of spawning aggregations of other reef fish species. These surveys focused mainly in the Bajo de Cico area (west coast of Puerto Rico), and will provide information on spawning aggregations and distributions of multiple species to support future management and conservation. Data analysis is underway.

For objective (3), deeper surveys were performed in waters ranging from 30-105 meters depth, for comparison with surveys from previous years that focused on shallower depths (maximum ~ 35m). These surveys have resulted in the identification of multiple likely spawning aggregations; subsequent efforts will focus on identification of the aggregations to the species level. The identification of these deeper-water aggregations has significant management and conservation implications, as most commercial fishing pressure and related reef fish management measures for Puerto Rico waters have focused on species that aggregate in shallower waters.

For objective (4), surveys in relatively deep (~100m) waters have generated acoustic signals for large pelagic fish. Interviews with commercial fishers who frequent the area have indicated that these are likely wahoo (*Acanthocybium solandri*). Groundtruthing efforts are planned using a vessel-mounted camera. These preliminary results indicate the feasibility of combining hydroacoustic surveys with known species-specific behavior and distributions to generate biomass or abundance estimates for pelagic species. Finally, project results from previous years were the focus of a peer-reviewed publication (NOAA Professional Papers series) that has been submitted to CoRIS.

**How project supports goals and objectives of CRCP:**

This project addresses multiple issues identified under the following CRCP priority areas: (1) Assessments, Inventories and Monitoring, (2) Strategic Research, and (3) Marine Protected Areas, with subsequent applicability to (4) Sustainable Fishing.

**How project supports management / research / other activities:**

Data collected in FY07 will provide information critical to the management and conservation of reef fish populations via the identification of spawning aggregation sites that can be protected from fisheries exploitation. For red hind, data generated will provide a baseline of spawning aggregation size (i.e., abundance and biomass of spawners) for comparisons with data collected in future years to assess the effectiveness of regulations prohibiting harvest during the spawning season.

**Partnerships, Capacity building, education and outreach activities:**

The project supports ongoing collaborative research in Puerto Rico, and will result in subsequent collaborative research between NOAA SEFSC (Kellison and Ron Hill), the University of Puerto Rico at Mayaguez, and independent researchers in Puerto Rico (J. Rivera).

**Submissions to CoRIS:**

One peer-reviewed publications (see below).

**Publications during FY2007 (including Tech. Memos.):**

Johnston, S.V., J.A. Rivera, A. Rosario, M.A. Timko, P.A. Nealson, and K.K. Kumagi. 2006. Hydroacoustic evaluation of spawning red hind (*Epinephelus guttatus*) aggregations along the coast of Puerto Rico in 2002 and 2003. In: Emerging technologies for reef fisheries research and management, J.C. Taylor (ed.), p. 10-17. NOAA Professional Paper NMFS 5.

**Presentations at professional meetings, posters, etc:**

N/A

**Problems, difficulties, etc., encountered during FY2007:**

N/A

**Changes / Adjustments needed:**

N/A

**Names of PIs and co-PIs:**

Todd Kellison (PI) – NOAA SEFSC, Miami, FL

Jose Rivera (co-PI) – NOAA SEFSC, Miami, FL

**Project ID & Title: 1068-2007: Assess/Monitor Effects of MPA Status on Reef Fish Populations and Spawning Aggregations in the Tortugas Ecological Reserves**

**Duration of Project:** Ongoing project since FY2003

**Brief Description of Activities Conducted in FY2007:**

Southeast Fisheries Science Center (SEFSC) staff conducted a week-long research cruise in the Tortugas Ecological Reserves from June 29-July 5, aboard the M/V Spree. Sixteen divers participated in this research effort, including biologists from the SEFSC's Beaufort NC and Miami laboratories, NCCOS's CCFHR laboratory, Florida Fish and Wildlife Commission's Marathon laboratory, the University of Miami, and volunteers from the Reef Environmental Education Foundation. A total of 316 individual dives were completed. Sampling was done on 16 stations in the south reserve and eight stations in the north reserve. Work completed included visual census transects for snapper-grouper abundance, stationary point counts and REEF roving diver surveys for total reef fish abundance, photo transects for habitat classification, retrieval and redeployment of bottom temperature loggers on three stations, and monitoring of a spawning aggregation of mutton snapper (*Lutjanus analis*). Many reproductively mature-sized mutton snapper were observed exhibiting probable pre-spawning behaviors.

**Description of Accomplishments/Results:**

This cruise was the fifth year of annual data compiled on occurrence/abundance of important snapper-grouper species in the Tortugas Ecological Reserves since the implementation of the reserves in 2001. This was the first year we used the larger dive platform and consolidated our work into one cruise with multiple personnel from multiple partner institutions. We continue to see an overall increasing abundance of mutton snapper in spawning aggregation configurations. This year we expanded upon our original habitat quadrat observations from 2003 by conducting habitat photo transects on all south reserve stations using digital cameras for qualitative/quantitative habitat characterization. We were able to retrieve temperature loggers at-large since July 2006 from two of our three stations, and unsuccessfully conducted extensive search dives for

the third logger. This gives us continuous temperature data since 2003, with the exception of the time period from summer 2005-summer 2006, when all loggers were lost to the succession of hurricanes that scoured the Tortugas area. Data has been entered into computer databases for the 2007 sampling year and in the process of being analyzed for temporal trends in abundance of individual species and species communities in order to examine the effects of protection afforded by reserve designation upon previously overfished species. We also continue to monitor the rebuilding mutton snapper spawning aggregation and refine our understanding of exactly when and where on Riley's Hump the aggregation occurs. Finally, we attempted to use fixed lasers attached to our video camera housing to obtain *in situ* measurements of commercially important snapper and grouper species during dives. These videotapes are currently being analyzed.

#### **How Project Supports Goals & Objectives of CRCP:**

**Marine Protected Areas:** Improve management of coral reef resources through a strengthened and expanded network of coral reef marine protected areas. Strengthen networks of coral reef protected areas and, by 2010, protect 20% of U.S. coral reefs as marine reserves. In 2000–2004 Task Force members worked with communities and stakeholders to establish 37 new protected areas and reserves in six jurisdictions—USVI, Hawai'i, Puerto Rico, American Samoa, CNMI, and Florida.

**Sustainable Fishing:** Reduce the impacts of fishing and other extractive uses to protect coral reef ecosystems and ensure sustainable fisheries.

#### **How Project Supports Management / Research/ Other Activities:**

This project provides management bodies such as the Florida Keys National Marine Sanctuary with important annual monitoring data on health of fish populations that they can use to gauge the effectiveness of management regimes they have implemented such as the Tortugas Ecological Reserves.

#### **Partnerships, Education, Outreach:**

This year our team partnered with other divers from the SEFSC, as well as with biologists from the Florida Fish and Wildlife Research Institute's Marathon Fisheries Laboratory. Additionally, volunteer divers from Reef Environmental Education Foundation were active participants, through coordination with the REEF office in Key Largo, FL. In terms of outreach, a presentation to the Florida Keys National Marine Sanctuary (FKNMS) Advisory Panel is planned for either the fall 2008 or spring 2009 meeting to update them on our research activities since the last presentation in 2004.

#### **Submissions to CORIS:**

Annual progress reports have been prepared and submitted to CORIS.

#### **Publications:**

None this year. Manuscript in preparation, pending analyses of final year's data.

#### **Presentations at Professional meetings:**

None this year, previous poster presented at 2004 GCFI will be updated for future presentation.

**Problems/Difficulties:**

We had malfunction problems on the cruise this year with our underwater camera strobe which almost derailed our attempts to get habitat photo transects, but we were able to fix the strobe into a continuous light-on mode and take the pictures. This problem has been addressed for the future by purchasing an additional strobe and fixing the old one. A continual problem with the ability to do work that we would like to do, however, continues to be the late arrival of funds which makes it difficult to get resources to do work in the winter. We need more timely funding mechanisms. We would like to restart our work on attempting to locate spawning aggregations of winter spawners (groupers).

**Changes/Adjustments needed:**

The main changes needed are those outlined immediately above with regards to funding the research in a timely manner.

**Names of PIs and Co-PIs:**

Michael L. Burton (PI) - NOAA SEFSC, Beaufort, NC  
Roldan Munoz (co-PI) - NOAA SEFSC, Beaufort, NC  
Kenneth Brennan (co-PI) - NOAA SEFSC, Beaufort, NC

**Project ID and Title: 1668-2007: Socio-Economic Profiles of Fishing Communities in Culebra and Vieques and U.S. Caribbean**

**Duration of the Project:** Second year

**Brief description of activities conducted in FY2007:**

Completed technical memos on community profiles for the islands of Puerto Rico and U.S. Virgin Islands (St. Thomas and St. John only).

Selected contractor (Mr. Daniel Matos from Puerto Rico's Department of Environmental and Natural Resources) for the Puerto Rico Fishermen Census.

Selected contractor (Manoj Shivilani from Murray and Associates) for the Puerto Rico Costs and Earnings Study of the hook and line, net and dive fisheries.

Selected contractor (Dr. Jim Kirkley from Virginia Institute of Marine Science) to develop the Puerto Rico Input-Output Model.

Hired graduate student to assist with the completion of the St. Croix description of fishing communities.

**Description of accomplishments / results:**

Submitted technical memos on community profiles for the islands of Puerto Rico and U.S. Virgin Islands (St. Thomas and St. John only) to CORIS.

Puerto Rico Fishermen Census: As of January 30, 2008, the survey was developed and pre-tested. Also, about 30 interviews were conducted so far.

Puerto Rico Costs and Earnings Study of the hook and line, net and dive fisheries: Contractor is coordinating with Puerto Rico's Department of Environmental and Natural Resources to conduct pre-tests.

**How Project Supports Goals & Objectives of CRCP:**

The development of the first comprehensive profiling of fishing communities in the U.S. Caribbean is an important step to understand how dependent these communities are on the goods and services provided by coral reefs. This data will be utilized to make more rigorous the analyses of upcoming fishery management amendments such as the U.S. Caribbean fish and lobster trap escape amendment.

**How Project Supports Management / Research/ Other Activities:**

The technical memos are used by the Caribbean Fishery Management Council and Regional Office for the development of fishery management plans.

**Partnerships, Capacity building, education and outreach activities:**

Partnerships were developed with Puerto Rico's Department of Environmental and Natural Resources, Virginia Institute of Marine Science.

**Submissions to CoRIS:**

Griffith, D., M.Valdés Pizzini and C.García Quijano. 2007. Entangled Communities: Socioeconomic Profiles of Fishers, their Communities, and their Responses to Marine Protective Measures in Puerto Rico. NOAA Series on U.S. Caribbean Fishing Communities. NOAA Technical Memorandum NMFS-SEFSC-556, 524 p. Agar, J. J. and B. Stoffle (editors).

Impact Assessment Inc., 2007. Community Profiles and Socioeconomic Evaluations of Marine Conservation Districts: St. Thomas and St. John, U.S. Virgin Islands. NOAA Technical Memorandum NMFS-SEFSC-557, 123 p. Agar, J. J. and B. Stoffle (editors).

**Publications during FY2007 (including Tech. Memos):**

See above under "Submissions to CORIS".

**Presentations at professional meetings:**

None

**Problems, difficulties, etc., encountered during FY2007:**

None

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

Juan Agar (PI) – NOAA SEFSC, Miami, FL

Jim Waters (Co-PI) – NOAA SEFSC, Beaufort, NC

**Project ID and Title: 1341-2007: A Spatially Explicit Datawarehouse for Socio-Economic Analysis of Recreational Fishing**

**Duration of the Project:** Ongoing project since FY2005

**Brief description of activities conducted in FY2007:**

- Data warehouse course was provided to application developers within the Southeast Fisheries Science Center.
- A preliminary analysis of the existing data records was initiated to determine the appropriate design for the data warehouse.
- Collaborated with scientists from NOAA AOML to generate environmental observations of the study area for inclusion into the database.

**Description of accomplishments / results:**

Environmental observations (sea surface temperature, chlorophyll-a concentrations, geotropic currents) were derived from satellite altimetry data and converted into a GIS-compatible format for inclusion into the database.

**How Project Supports Goals & Objectives of CRCP:**

Reduce the impacts of fishing and other extractive uses to protect coral reef ecosystems and ensure sustainable fisheries.

**How Project Supports Management / Research/ Other Activities:**

The use of this tool by NOAA partners, customers, constituents, and managers will facilitate ecosystem-based management and increase the percentage reported in compliance with the GPRA.

**Partnerships, Capacity building, education and outreach activities:**

Established a working relationship with an oceanographic scientist at NOAA AOML to provide environmental data and support its interpretation.

**Submissions to CoRIS:**

None was submitted in FY2007.

**Publications during FY2007 (including Tech. Memos.):**

Currently working on completing the Tech Memo describing the database design.

**Presentations at professional meetings. Posters, etc:**



None.

**Problems, difficulties, etc., encountered during FY2007:**

Primary contractor responsible for the development of the application moved to a different position and we were unable to hire another contractor within the available time frame.

**Changes / Adjustments needed:**

We are currently working with the Lead Developer at the Southeast Fisheries Science Center to continue the development of this project by providing assistance with the hiring of a new contract employee, training the contractor, and providing guidance with regards to our application development standards.

**Names of PIs and co-PIs:**

David W. Carter (PI) – NOAA SEFSC, Miami, FL  
Carlos Rivero (co-PI) – NOAA SEFSC, Miami, FL

**Project ID and Title: 10401-2007: Reef Fish Recruitment Dynamics: Integration and Analysis of Long-Term Visual Fish Surveys to Examine Environmental Influences**

**Duration of the Project:** First year

**Brief description of activities conducted in FY2007:**

Activities in FY2007 focused on obtaining, processing, and preliminary analysis of the two visual survey datasets: 1) reef visual census (J. Bohnsack, NOAA Fisheries) and 2) mangrove visual survey (J. Serafy, NOAA Fisheries/ Univ. of Miami). Data processing included set preparation, quality control and error checking, and spatial mapping of the two data sets. David L. Jones was hired as a full time Postdoctoral Associate under contract with CIMAS/University of Miami in Jan-2008. He is involved in preliminary multivariate statistical analyses of these data with plans to publish in Spring 2008.

**Description of accomplishments/results:**

Our objective is to synthesize the reef and mangrove survey data to establish the nature and extent of the linkage between these habitats and construct predictive models of recruitment dynamics, based on the mangrove survey data that account for environmental variation and allow estimation of reef fish stock size. Nine indicator species were identified that occur in both the mangrove and reef surveys which may exhibit ontogenetic shifts between the two habitats (i.e., 1 parrotfish, 2 snapper, 1 barracuda, 1 damselfish, 1 mojarra, and 3 grunts). Length and abundance data for the indicator species collected during >1000 mangrove survey transects over a nine year period (1999-2007) form the basis of our preliminary analysis. Data were partitioned according to one spatial (habitat) and two temporal (year, season) treatments and redundancy analysis (RDA) was used to establish the influence of these along with six environmental variables (temperature, dissolved oxygen, salinity, depth, freshwater discharge, and proximity to freshwater discharge) on the abundance of juvenile mangrove fishes. Preliminary results

from the RDA analysis indicate the distribution and abundance of the indicator species were influenced the greatest by habitat, proximity to freshwater canal discharge, salinity, and the amount of freshwater discharge (Figure 1).

Length frequency histograms were generated from the mangrove survey data using a triangular-distribution smoother (Smith et al., 2008) to partition the data according to size classes in order to construct an annual, abundance-based index of recruitment (IR). Examining the concordance between the mangrove-based IR and reef fish population size forms the basis of our current work.

**How Project Supports Goals & Objects of CRCP:**

Sustainable Fishing - Reduce the impacts of fishing and other extractive uses to protect coral reef ecosystems and ensure sustainable fisheries.

Assess and monitor reef health/monitor coral, fish, and other living resources.

**How Project Supports Management/Research/Other Activities:**

Understand connectivity, habitat utilization, and essential fish habitats.

**Partnerships, Capacity building, education, and outreach activities:**

A collaboration was formed with Dr. D. Kerstetter of NOVA Southeastern University and his graduate student E. Machemer. Mr. Machemer's work is focusing on the analysis of migration corridors used by fishes that make ontogenetic transitions from mangrove to coral reef habitats.

**Submissions to CoRIS:**

None

**Publications during FY2007:**

None

**Presentations at professional meetings:**

Jones, D. L., J. Walter, and J. E. Serafy. Contribution of mangrove nursery habitats to replenishment of adult reef fish populations in southern Florida. Submitted to 11th International Coral Reef Symposium, 7–11 July 2008, Fort Lauderdale, FL, for oral presentation.

**Problems, difficulties, etc., encountered during FY2007:**

None

**Changes/Adjustments needed:**

None

**Names of PIs and co-PIs:**

John Walter (PI) – NOAA SEFSC, Miami, FL

David L. Jones (co-PI) – UM-RSMAS, CIMAS, Miami, FL

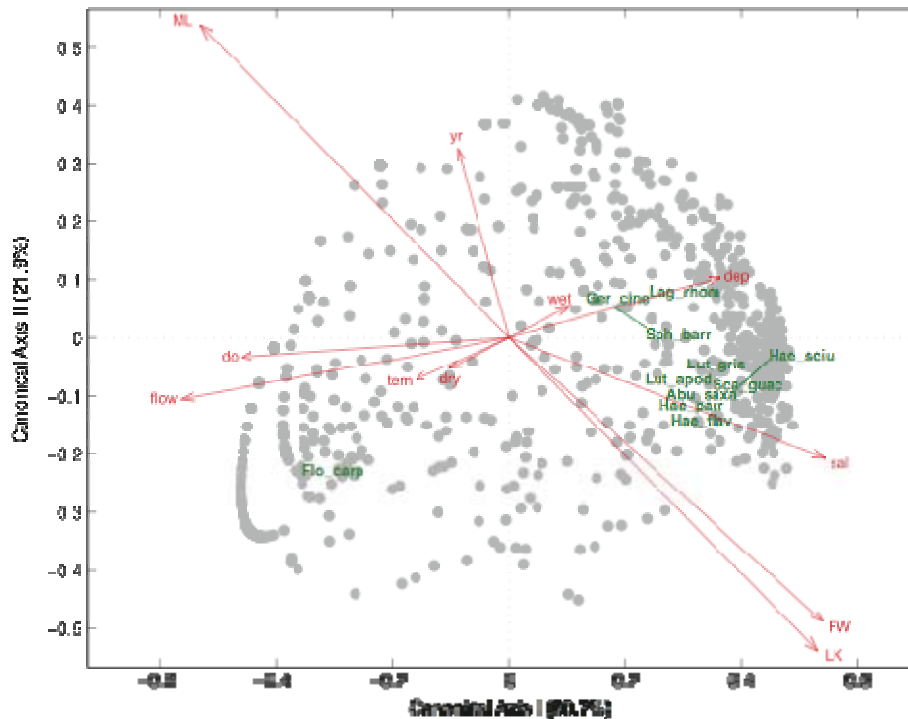


Figure 1. Distance-based redundancy analysis (db-RDA) ordination biplot ( $F=4.83$ ;  $p<0.001$ ). Circles represent visual survey transect sites ( $n = 981$ ). Species centroids (green text) represent abundance maxima for each taxa and are defined as follows: Abu\_saxa = sergeant major, Flo\_carp = Goldspotted killifish, Ger\_cine = yellowfin majorra, Hae\_parr = Sailor's choice, Hae\_sciu = bluestriped grunt, Hae\_flav = French grunt, Lag\_rhom = pinfish, Lut\_apod = schoolmaster, Lut\_gris = gray snapper, Sca\_guac = rainbow parrotfish, and Sph\_barr = great barracuda. Biplot vectors (red arrows) represent the magnitude (length) and gradient (direction) of the environmental, temporal, and spatial variables and are defined as follows: yr = year, tem = water temperature, do = dissolved oxygen, sal = salinity, dep = depth, FW = proximity to freshwater canal discharge, flow = average freshwater canal discharge during the previous 3 months, dry = dry season, wet = wet season, LK = leeward key habitat, and ML = mainland habitat.

**Project ID and Title:** 1873–2007: Recovery of Conch Populations in the U.S. Virgin Islands

**Duration of the Project:** Ongoing project since FY2005

**Brief description of activities conducted in FY2007:**

Research activities this year were conducted during four field expeditions to Fish and No Name Bays, St. John, U.S. Virgin Islands in April, June, August, and December 2007.

Visual searches were conducted in all areas of our study sites, and queen conch encountered during these surveys were tagged. Shell length and lip thickness were measured for all conch, as were environmental parameters at each site. Benthic

composition, expressed as percent cover, was quantified by centering a 1-m<sup>2</sup> quadrat directly over the individual, and visually quantifying each organism or substrate. Benthic habitats were also classified and quantified in randomly selected sites where no queen conch was found.

We manually tracked fine-scale movements of tagged queen conch among and within habitats, using physical markers and spatial coordinates to identify and measure daily and nightly distances traveled. After environmental parameters had been measured, habitat surveyed, and the conch tagged, it was replaced in its original location and the spatial coordinates marked on a hand-held GPS unit. Visual surveys were conducted morning and evening, and the conch's new location was stored in the GPS unit.

At the conclusion of tagging operations during each sampling trip, we conducted a series of transect surveys designed to provide an estimate of the total queen conch population in each bay. Data from these surveys are being analyzed using Jolly-Seber methods for estimating population abundance from tag-and-recapture data.

The VEMCO VR2 hydrophone arrays remained in their original locations as established the previous year, with the addition of two deeper water units positioned across the entrance to Fish Bay. During each field expedition we downloaded ultrasonic data collected from conch bearing acoustic tags. The data showed movements of several individuals in specific habitats in the bays, as well as some that migrated out into deeper waters. Bottom and surface temperature data was also downloaded from deployed temperature loggers, which were replaced in their original locations on each hydrophone and at various surface sites throughout each bay. During field work in April and August, we attached 8 and 2 coded acoustic tags to randomly-selected tagged individuals in Fish and No Name Bays, respectively.

### **Accomplishments and Results:**

During tag-and-recapture studies in FY2007, 1000 queen conch, *Strombus gigas*, were located, measured, and tagged using Floy T-bar tags (964 individuals located in Fish Bay and 36 in No Name Bay). Throughout the first three years of this project we have tagged 1,886 conch, 1728 in Fish Bay and 158 in No Name Bay. Tagged conch included juveniles and adults ranging from 4 to 32 cm. Quantification of benthic habitats showed that queen conch were utilizing a number of different habitat types composed of mixtures of various macroalgal species (*Halimeda spp.*, *Avrainvillea spp.*, *Ceramium spp.*, *Laurencia spp.*, *Penicillus spp.*, *Dictyota spp.*, and *Caulerpa spp.*), seagrasses (*Syringodium filiforme* and *Thalassia testudinum*), and nonvegetated areas. As expected, initial findings indicate size-related differences in habitat use and movement patterns.

During each sampling trip we conducted surveys to determine daily movement patterns and distances traveled by tagged individuals. Preliminary analysis of day and night recapture surveys shows these movements ranging from 0 to over 100 m/day; the average distance traveled was 6.5 m/day.

Mark-and-recapture transect surveys have been conducted for population estimates. In general, these bays contain more queen conch than initially anticipated from published reports based on other survey techniques. Piles of recently-discarded shells, mainly small juveniles, were discovered on the shores of both study areas, indicating poaching of under-sized animals. Inclusion of tagged conch shells has allowed some estimation of mortality rates. In No Name Bay this year, no poached conch and 5 tagged conch suffering natural mortalities (octopus) were discovered, representing 3% of the tagged population. Major predators seen in the area were stingrays, nurse sharks, octopus, and giant hermit crabs. Alternatively in Fish Bay, in addition to the 4 dead tagged conch that were recovered during visual surveys, 37 of the 578 poached shells discovered along the shores were tagged, representing 6% of the total tagged population. Our observations demonstrate a substantial increase in illegal fishing activity in Fish Bay between 2006 and 2007, not only during the mandated closed season from July 1 – September 30, but also in the taking of under-sized individuals.

#### **How Project Supports Goals and Objectives of CRCP:**

The queen conch is an important cultural component and an extremely valuable coral reef fishery resource throughout the Caribbean, second only to the spiny lobster. Historical information from these areas continues to show that queen conch populations are badly depleted and show little signs of recovery. This project directly supports one of the primary goals of the CRCP of reducing adverse impacts of fishing by investigating current stock status through the use of mark-and-recapture techniques in several bays around St. John. Additional research on population dynamics, habitat use, fine-scale movement patterns, and long-term migration completed during the course of this project also supports the objectives listed under this goal through the identification and assessment of essential fish habitat for this important species.

#### **How Project Supports Management/Research/Other Activities:**

Steady declines in populations of queen conch have been reported in all areas of its distribution; however, stock information on this important coral reef inhabitant in the U.S. Caribbean is insufficient and possibly unavailable to managers throughout the region. In 2007, SEDAR 14 (Southeast Data, Assessment and Review) undertook the task of assessing queen conch and several other reef species in the U.S. Virgin Islands and Puerto Rico. Population size estimates and natural and fishing mortality data collected directly under this project were presented at the initial SEDAR 14 Data Workshop, supplementing historical information from the SEAMAP-C surveys. The data we presented subsequently became the primary data source used by scientists and managers in their queen conch stock assessment report to the Caribbean Fishery Management Council estimating population sizes for the U.S. Virgin Islands.

#### **Partnerships, Capacity Building, Education and Outreach:**

This year we successfully completed joint field sampling activities with the NOAA/NMFS Apex Predator Program from the Narragansett Laboratory, as well as the NCCOS Biogeography Team. With our help, researchers from the Apex Predator Program are conducting acoustic monitoring of juvenile shark utilization of nursery areas in Fish Bay, and will be sharing our acoustic array and exchanging tag detection data.

Additional hydrophone arrays maintained by the NCCOS Team allowed us to deploy 6 acoustic tags on queen conch in other bays around St. John, expanding spatial coverage of local populations. The coordination of field work provided us with the opportunity to exchange hands-on knowledge and use of other types of acoustic sampling equipment.

Activities with our external partners have allowed us to maintain sampling schedules and expand intended areas of research. Continued logistical support from the Virgin Islands National Park Service included equipment storage and assistance in identifying alternate areas with historical queen conch populations. The Park Service and the USVI Division of Fish and Wildlife have participated in the initial synthesis of collected data and results, as well as providing notification whenever tagged queen conch are found in other areas of the island.

Opportunities for education and outreach have occurred locally in the Virgin Islands. We continue to disseminate project information to a local St. John homeowners' group, the Estate Fish Bay Owners' Association, keeping them informed of our activities in the area. In addition, we established a positive connection with teachers at a local school who are interested in providing assistance with field surveys and teaching their students about the conservation of this important reef organism. Activities in this area will continue into the next year.

**Submissions to CoRIS:**

Items to be provided to CoRIS are currently in progress and metadata and web links will be submitted upon completion. Included are copies of annual reports generated for the Virgin Islands National Park Service and preliminary maps showing long-term movements of tagged queen conch. These products are being added to the Galveston Laboratory's web page and once on-line, the link will be submitted to CoRIS.

**Publications during FY2007 (including Tech. Memos.):**

A manuscript entitled "Determining habitat use, movement, and migration patterns of queen conch, *Strombus gigas*, in St. John, USVI, using acoustic tagging techniques" was completed and submitted for publication in the GCFI proceedings volume.

**Presentations at professional meetings, posters, etc:**

A presentation entitled "Determining Habitat Use, Movement, and Migration Patterns of Queen Conch, *Strombus gigas*, in St. John, USVI, using Acoustic Tagging Techniques" was presented at the 60<sup>th</sup> annual Gulf and Caribbean Fisheries Institute conference held in the Dominican Republic from November 5-9, 2007.

**Problems Encountered During 2007:**

None

**Changes and Adjustments:**

None

**Names of PIs and co-PIs:**

Jennifer C. Doerr (PI) NOAA SEFSC, Galveston, TX  
Ronald L. Hill (co-PI) NOAA SEFSC, Galveston, TX  
Thomas J. Minello (NOAA SEFSC, Galveston, TX  
Megan Davis (co-PI) Harbor Branch - Fort Pierce, FL

**Project ID and Title: 1654-2007: Reef Fish Use of Coral and Mangrove Habitats at Night and/or under Turbid Conditions: Application of Dual-Frequency Sonar**

**Duration of Project:** Second year

**Brief description of activities conducted in FY2007:**

The main objective of this project is to apply a newly-developed, dual-frequency sonar system (DIDSON) to the problem of quantifying fish abundance in coral reef and mangrove nursery habitats under conditions which preclude standard visual survey techniques, and to assess the comparative utility of the sonar system for data collection under multiple conditions.

**Description of accomplishments / results:**

In FY07, project progress was made in three main areas:

- Continued analyses of data collected in FY2006 in coral reef and mangrove habitats. Data analysis, results and discussion will be included in a manuscript (in preparation) that will be submitted for publication in a peer-reviewed journal.
- Additional field work. Comparative sonar and stereo-video transects were performed in mangrove habitats in March 2007 to assess the relative ability of sonar versus stereo video to assess fish community metrics (e.g., species composition, abundance and length-frequency distributions). A novel kayak-based survey system was developed. Preliminary analyses indicate that the sonar is far superior to the stereo-video system in all aspects of data generation (including ease of use and data analysis) with the exception of species composition. The DIDSON was also used in a controlled laboratory environment to assess the precision and accuracy of DIDSON-generated length estimates. Data analysis and interpretation is underway; results continue to support the FY2006 finding that DIDSON sonar enables the quantification of fish not identified in video or visual surveys (i.e., leading to more accurate estimates of abundance). Results from this project component will also be included in the manuscript described above.
- Planning for additional field work, including continued development of a stand-alone kayak-based survey system. Additional field trials to be performed in November 2008 will involve comparative sonar and snorkeler transects in mangrove habitats; results will provide insight into the relationship between snorkeler-estimated abundances and length-frequency distributions and the likely “true” abundance and length-frequency distributions, as estimated by sonar. Planning for the FY08 field work involved the purchase of a new kayak and coordination between multiple participating agencies (NOAA Fisheries, US Geodetic Survey, University of Miami, and LGL Unlimited).

This project continues to assess the comparative utility of a high resolution, dual-frequency sonar (DIDSON) to provide fish community data in mangrove and coral reef ecosystems. Ongoing field trials indicate DIDSON is superior to visual or video surveys under many conditions. When applied, project results will improve the ability of researchers to accurately assess fish community metrics for ecological assessments of coral reef and associated ecosystems.

Finally, project developments were highlighted in a presentation at the 2007 American Fisheries Society Symposium in San Francisco.

**How Project Supports Goals & Objectives of CRCP:**

Mangrove habitats are integral components of coral reef ecosystems around the globe. By testing a new technology, this research advances the scientific basis for preserving, sustaining and restoring valuable coral reef ecosystems for future generations.

**How Project Supports Management / Research / Other Activities:**

This research evaluates a new acoustic technology for estimating the abundance and size structure of fishes occupying mangrove habitats, which constitute important nursery and feeding grounds for coral reef fishes.

**Partnerships, Capacity building, education and outreach activities:**

The project is in collaboration with researchers at the University of Miami Rosenstiel School of Marine Science, the National Park Service, the Wild Salmon Institute, and LGL unlimited.

**Submissions to CoRIS:**

N/A.

**Publications during FY2007 (including Tech. Memos.):**

Kellison, G.T., J. Luo, J. Javech, P.S. Rand, P. Johnson and J.E. Serafy. 2007. An evaluation and comparison of dual-frequency sonar and stereoscopic video for estimating fish abundance and size structure in mangrove habitats. Bull. Mar. Sci. 80(3): 923 (abstract).

**Presentations at professional meetings, posters, etc.:**

Kellison, T., J. Luo, S. Frias-Torres, P. Johnson, P.S. Rand, and J.E. Serafy. 2007. Electronics in the prop-roots: Application of multi-beam sonar and stereo video for fish community data collection in mangroves. AFS Symposium: Marine Fish Ecology.

Kellison, T., J. Luo, J. Javech, P.S. Rand, P. Johnson, & J.E. Serafy. 2006. An evaluation and comparison of dual-frequency sonar and stereo video for estimating fish abundance and size structure in mangrove habitats. 1st International Symposium on Mangroves as Fish Habitat, Miami, Florida. April 19-21, 2006.



**Problems, difficulties, etc., encountered during FY2007:**

Delay in receipt of funds caused numerous logistical problems.

**Changes / Adjustments needed:**

N/A

**Names of PIs and co-PIs:**

Joe Serafy (PI) – NOAA SEFSC, Miami, FL

Jiangang Luo (co-PI) – UM-RSMAS, CIMAS, Miami, FL

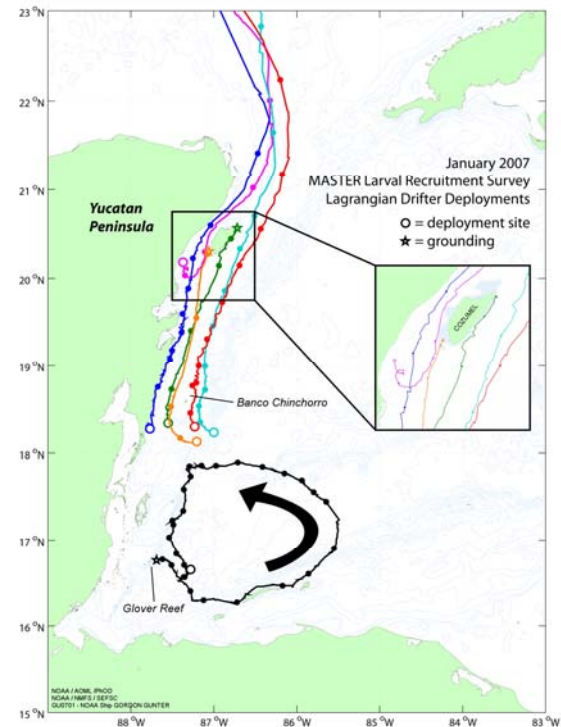
Todd Kellison (co-PI) – NOAA SEFSC, Miami, FL

**Project ID and Title: 1244-2007: Monitoring Coral Reef Fish Use of MPAs and Recruitment Connectivity between the Florida Keys and Mesoamerican Reefs**

**Duration of the Project:** Ongoing project since FY2004

**Brief description of activities conducted in FY2007:**

Larval Fish and Physical Oceanography Survey of the Mesoamerican Reef System Cruise (MASTER Cruise) was conducted in January and February, 2007. This cruise was a joint international effort between NOAA's Southeast Fisheries Science Center and the Atlantic Oceanographic and Meteorological Laboratory, El Colegio de La Frontera Sur (ECOSUR) in Chetumal, Centro de Investigacion y de Estudios Avanzados (CINVESTAV) in Merida, Mexico, Boston University, and the University of Belize. The cruise was directed at surveying the coral reef fish larval distribution and physical oceanography of the western Caribbean coast from the Yucatan Channel to southern Belize. Ninety four 1 meter and seven 10 meter MOCNESS tows, 16 juvenile fish trawls, and 101 CTD casts were conducted between the Yucatan channel and Gladden Spit Belize. Sixteen light trap and settlement trap stations were collected over a two week period coinciding with the GORDON GUNTER collections at Arrecifes de Xcalak Reserve, and Banco Chinchorro Biosphere Reserve. Zooplankton samples from 2006 have been sorted and 50 % of the samples have been identified to family (approximately 15,000 larval fish) 70% of the samples from 2007 have been sorted.



**Description of accomplishments / results:**

Both satellite tracked drifter and CTD data indicate consistently strong northern flow along the Yucatan coast with transport times from 4-days to two weeks, well with the larval period of grouper and snapper. Concurrent inshore collections made at two sites on the Yucatan Peninsula, Arrecifes de Xcalak Reserve, and Banco Chinchorro Biosphere Reserve indicated grouper settlement at this time. Both of these sites have confirmed spawning aggregations of grouper. This cruise was extended south to sample larval reef fish and other zooplankton at known spawning aggregation sites in Belize at the request of the Government of Belize and Conservation International. Preliminary results from both biological and physical data suggest that the variation in the direction and speed of the Caribbean Current may have a stronger than anticipated role in larval transport. Significant shifts in direction from NW along the Yucatan coast shifting to due west, south of Banco Chinchorro occurred in less than a week. This change was noted during the survey and drifters were launched to confirm shipboard observations. A strong change in current direction may be expected to impact onshore transport in southern Yucatan and Banco Chinchorro. However, north of this area, flow remained strongly northward. Preliminary data suggest increased larvae in the shallow and inshore collections that correspond to this shift by the major current field. Also noted in this cruise was an inshore eddy associated with increased numbers of larval grouper. This eddy occurred just south of Cozumel and was strong enough to be seen in satellite imagery. ADCP and CTD data indicate a strong southerly jet rotating counter clockwise (cyclonic) and deflecting the northward flowing current offshore. This may be one of the important mechanisms for larval retention.

**How Project Supports Goals & Objectives of CRCP:**

This project supports the goals and objectives of the CRCP by providing sound science to address coral reef managers' needs to maintain healthy reef fish stocks in primary areas of recruitment, National Parks, and MPA's.

**How Project Supports Management / Research/ Other Activities:**

This project seeks to determine the extent of reef fish and lobster population connections between the Mesoamerican and the South Florida reef ecosystems and the potential importance such connections play in replenishing stocks of reef fish in South Florida. The existence of such connections should significantly impact the management practices of reef fish stocks in this region. If larval recruitment in S. Florida depends significantly on input from upstream sources in the western Caribbean (open population), then South Florida and its associated MPAs are dependent on fisheries management practices in other countries and, therefore, the U.S. has a major stake in cooperating with and encouraging marine conservation efforts in those countries. If, on the other hand, local recruitment is the dominating factor in sustaining local populations, then local conservation measures in the FI Keys become even more important.

**Partnerships, Capacity building, education and outreach activities:**

NOAA Atlantic Oceanographic and Meteorological Laboratory  
El Colegio de La Frontera Sur (ECOSUR) in Chetumal, Mexico  
Centro de Investigacion y de Estudios Avanzados (CINVESTAV) in Merida, Mexico

Boston University  
University of Belize  
Education and outreach – Fishers Cooperatives, Bancho Chinchorro Mexico

**Submissions to CoRIS:**

WOCE Satellite Drifter Tracks  
ADCP data  
CTD/XBT profiles  
MOCNESS profiles and initial data

**Publications during FY2007 (including Tech. Memos.):**

Leptocephali of *Albula* spp. in coastal areas of the Mesoamerican Barrier Reef System:  
An unexpected episode of high abundance. Sent to Caribbean Journal of Science, ref.  
CJS07-55.

**Presentations at professional meetings. Posters, etc:**

NOAA CRCP Seminar Series  
One NOAA Seminar Series

**Problems, difficulties, etc., encountered during FY2007:**

Due to the large number of reef fish larvae collected both sorting and identification has been delayed. The samples and initial identifications are being conducted by ECOSUR. All samples will be sorted by June 2008, and we expect initial identifications completed for 2006, in July, 2008. This is a similar time frame that would be expected from the Polish sorting Center.

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

John Lamkin (PI) – NOAA SEFFSC, Miami, FL  
Bill Richards (co-PI) – NOAA SEFSC, Miami, FL  
Lourdes Vasquez Yeomans - ECOSUR  
Eloy Eosa - ECOSUR

**Project ID and Title: 1067-2007: Monitoring Coral Reef Fish Utilization of Marine Protected Areas and Inshore Habitats in Florida Bay**

**Duration of the Project:** Ongoing project since FY2003

**Brief description of activities conducted in FY2007:**

In FY2007, we used inductively coupled plasma-mass spectrometry (ICP-MS) and stable isotope analysis to resolve elemental chemistry of the otoliths of juveniles from five nursery regions. Adult otoliths have been processed and analyzed for trace elements analysis. Initial results have been submitted to Marine Biology for publication and

another to Continental Shelf Research. Trika Gerard completed her Ph.D. by analyzing the stable isotope signature of snapper and this has led to promising new research approaches at much reduced cost. She has two manuscripts in preparation. Temporal and spatial variation of juvenile grey snapper (*Lutjanus griseus*) habitats in southern Florida using otolith microchemistry.

#### **Description of accomplishments / results:**

A trace element “signature” for each region was determined by analyzing 32 elements, including a suite of rare earth elements. Eight of these elements (including 2 rare earths) were found to contribute substantially to separating fishes. This is one of the first studies in which rare earth elements in otoliths have contributed to separation of fish stocks. Resolution of sites less than 10km apart suggested high site fidelity in juvenile gray snapper and little mixing of water masses between sites. This work has been duplicated by using stable isotope analysis of carbon and oxygen in the same otoliths and was the basis for Dr. Trika Gerard’s dissertation. This venue of research is very promising and offers several new techniques to examine ontogenetic movement and habitat usages in coral reef ecosystems. Also during this year a protocol was developed by Dr. Gerard and Estrella



*Micromilling of otolith*

Malca using a computer-controlled micromill to remove the juvenile “core” from adult otoliths. Snapper age and growth curves generated for juvenile gray snapper (separate study) were used to determine the portion of an adult otolith formed during the juvenile stage of the fish. Work to extract juvenile cores from adult snapper for microchemical analysis has been completed. These data will be used, along with the results of our previous juvenile work, to determine from which South Florida nursery area each adult originated. In 2007 we expanded our analyses to



*Juvenile Lutjanids*

include two additional species that co-occur with gray snapper in southern Florida: schoolmaster (*L. apodus*) and yellowtail snapper (*L. chrysurus*). Highly significant differences in otolith microchemistry were found among these three snappers, indicating the existence of species-specific otolith elemental signatures. Our analyses also found both schoolmaster and yellowtail exhibited spatial distribution patterns similar to that of gray snapper. Work conducted as part of a senior thesis by Ms. Morgan seeks to use stable isotopes to determine differences in species signatures in nursery and adult reef habitats. Work completed as part of Dr. Gerard’s Dissertation agrees with the previous work indicating large degrees of site fidelity.

**How Project Supports Goals & Objectives of CRCP:**

This project supports the goals and objectives of the CRCP by focusing on the needs of specific management policies for healthy reef fish populations.

**How Project Supports Management / Research/ Other Activities:**

Ecosystem research on the links between habitats, particularly their function as sources and destinations of recruits, is key to the long-term monitoring and effective management of these areas. As part as the ‘Race to the Reef’ program, this project focuses on the role of ontogenetic migrations of reef fish species from juvenile habitat to the reef ecosystem. This is of particular importance given the recent efforts to restore Florida Bay and the establishment of Marine Protected Areas (MPAs) and the Tortugas Ecological Reserve. We believe that only with effective identification and protection of sources of recruits can we ensure the effective function of MPAs as reef fish sanctuaries, and ensure healthy stocks of reef fish species.

**Partnerships, Capacity building, education and outreach activities:****Submissions to CoRIS:**

Complete data base of trace element analysis.

**Publications during FY2007 (including Tech. Memos.):**

Lara, M.R., D. L. Jones, Z. Chen, J. T. Lamkin and C. M. Jones. 2007. Spatial variation of otolith elemental signatures among juvenile gray snapper (*Lutjanus griseus*) inhabiting southern Florida waters. *Marine Biology*.

Jones, D. L., M. R. Lara, J. T. Lamkin and E. Malca. 2008. Taxonomic and spatial variation of otolith microchemistry among three species of juvenile snapper (Pisces: *Lutjanidae*) from southern Florida. *Continental Shelf Research* (In review).

Gerard, T. 2008. Temporal and spatial variation of juvenile grey snapper (*Lutjanus griseus*) habitats in southern Florida using otolith microchemistry.

**Presentations at professional meetings. Posters, etc:**

Dissertation Defense

NOAA Educational Partnership Program Science and Education Forum

**Problems, difficulties, etc., encountered during FY2007:**

None

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

John Lamkin (PI) – NOAA SEFSC, Miami, FL

Trika Gerard (co-PI) – NOAA SEFSC, Miami, FL

Monica Lara (co-PI) – UM-RSMAS, CIMAS, Miami, FL

**Project ID and Title: 10292-2007: Impacts on Coral Reef Habitat Productivity from Fishing**

**Duration of the Project:** First year

**Brief description of activities conducted in FY2007:**

During earlier CRCP studies, we reported damage to important habitats for juvenile reef fishes from fishing traps, primarily staghorn, *Acropora cervicornis*. We are investigating natural variation and gear-induced damage rates on health, vitality, and productivity of staghorn colonies. During FY2007, we conducted surveys of study areas and established our initial set of permanent transects for continued investigations in the USVI and PR.

**Description of accomplishments / results:**

Research was initiated in both Puerto Rico and Virgin Islands during three separate research cruises. Permanent transects, for measuring *Acropora cervicornis* colonies and morphology, fish assemblages, environmental parameters, coral health and disturbance established at multiple sites in La Parguera, PR and St. Thomas and St. John, VI. Random transects were conducted and mapping of colonies accomplished. Additional sites were identified for future monitoring in Puerto Rico and additional permanent transects. Photo-documentation of all transects were cataloged and stored. Additional data on condition and productivity of *Acropora cervicornis* will contribute to the assessments of habitat for fishery and coral reef management and to the biological status of the threatened acroporids.

**How Project Supports Goals & Objectives of CRCP:**

**Mapping:** Research results of both permanent and random transects will be used to produce detailed maps of *A. cervicornis* distributions and data will be provided for mapping of Acroporids for biological assessments.

**Assessments, Inventories, and Monitoring:** Project will be monitoring condition of *A. cervicornis* across PR and USVI.

**Strategic Research:** It is currently unknown how fluctuations occur in *A. cervicornis* populations and how these fluctuations affect reef fishery resources. This project will address both natural and anthropogenic effects.

**How Project Supports Management / Research/ Other Activities:**

Additional data on condition and productivity of *Acropora cervicornis* will contribute to the assessments of habitat for fishery and coral reef management and to the biological status of the threatened acroporids.

**Partnerships, Capacity building, education and outreach activities:**

This project is operating jointly with other CRCP funded projects (Fortuna Reefer monitoring, Coral disease, Conch populations in the USVI). We included graduate students from Univ. of Puerto Rico and Texas A & M – Galveston in our research cruises, building capacity through hands-on training in coral reef research methods.

**Submissions to CoRIS**

Research and cruise reports are linked through CoRIS to the project website.

**Publications during FY2007 (including Tech. Memos.):**

None

**Presentations at professional meetings. Posters, etc:**

None

**Problems, difficulties, etc., encountered during FY2007:**

None

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

Ron Hill (PI) – NOAA, SEFSC, Galveston, TX

Andy Bruckner (co-PI) – NOAA, F/HC, Silver Spring, MD

**Project ID and Title: 1685-2007: Developing Site Fidelity & Essential Habitat Assessment Tools for Juvenile Snappers**

**Duration of the Project:** Third year

**Brief description of activities conducted in FY2007:**

Forty-four juvenile snappers and 16 adult snappers (collaboratively with state/local/academic partners: FFWCC, FIU, and the Loxahatchee Environmental District) were acoustically tracked for 400 days via data downloads from over 27 acoustic receivers in the Loxahatchee Estuary and from 16 receivers along the off-shore reef. Site-fidelity/habitat quality tests (via acoustic tagging and tracking of an additional six juvenile snappers) were conducted comparing man-made versus mangrove nursery habitat for a coral reef-associated snapper species. Education and outreach activities including public talks and an up-dated webpage were incorporated into the research goals and objectives.

**Description of accomplishments / results:**

Over 477,920 data points were collected that correlated 50 tagged juvenile snapper locations and movements with individual receivers and habitat types. We tracked the movements of two adult snappers out of the estuary and potentially out to the reef.

We compared habitat site-fidelity of juvenile snappers in two distinct habitat types with the Loxahatchee Estuary to determine their nursery function: sub-tidal mangrove and dock structures along hardened shorelines. Preliminary results suggest that fragmented/remnant sub-tidal mangrove habitats show a much stronger site-fidelity and diurnal/nocturnal foraging pattern compared to dock structures suggesting that site-fidelity may be used as a proxy for assessing juvenile reef fish nursery habitat quality and function.

Juvenile snapper movements in sub-tidal mangrove habitat were compared with the movements of adult mangrove snapper on the offshore reef. Initial results revealed a consistent nocturnal/diurnal movement in the mangroves and a similar, more wide-spread trend for adults on the reef.

We collaborated our outreach and education activities with Florida Atlantic Coast Tracking Project (F.A.C.T.) working group, the largest ecosystem-wide, multi-species acoustic array in Florida that covers river to reef and estuaries along Florida's east coast.

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

Mangrove habitats are integral components of coral reef ecosystems worldwide. By researching the nursery habitat requirements of juvenile coral-reef associated snapper species so that vital ecological/ecosystem connectivity between mangrove and coral reef habitats can be more effectively managed and protected, this project advances the scientific basis for preserving, sustaining and restoring valuable coral reef ecosystems for future generations.

#### **How project supports management / research/ other activities:**

This project supports management and research by:

- Studying the nursery habitat requirements of juvenile coral-reef associated snapper species so that vital ecological/ecosystem connectivity between mangrove and coral reef habitats can be more effectively managed and protected. Additionally, the focus species, mangrove snappers, are economically important as both a recreational and commercial fishery in Florida.
- Researching the mangrove habitat management approaches of the State of Florida's Loxahatchee Aquatic Preserve and its connectivity to off-shore reefs.
- Researching the impacts of mangrove habitat loss in an urbanized estuary on the nursery function of the ecosystem and its connectivity to off-shore reefs.
- Working closely with managers at the state and local level.

#### **Partnerships, Capacity building, education and outreach activities:**

Our partners include:

Florida International University, Biological Sciences Department, Miami, FL

Loxahatchee Environmental District, Jupiter, FL

Jonathan Dickenson State Park, Tequesta, FL

Florida Fish and Wildlife Conservation Commission, Tequesta, FL

Florida Atlantic Coast Tracking Project (F.A.C.T.), a state-wide collaboration of acoustic tracking arrays



University of Miami, Cooperative Institute for Marine and Atmospheric Science  
Adopt-A-Fish; Adopt-A-School (501c3 pending), [www.adoptafish.net](http://www.adoptafish.net)

**Submissions to CoRIS:**

Tagging Training Report  
NOAA Technical Memorandum: NMFS-F/SPO-82  
Connectivity Outreach Presentation  
FACT Meeting Presentation  
NOAA-DC Presentation  
AFS Poster Presentation  
Tag 2008 Presented Talk on FACT  
FIU Graduate Student Symposium Presented Talk (award winning).

**Publications during FY2007 (including Tech. Memos.):**

See second item in list above under “Submissions to CoRIS”.

**Presentations at professional meetings, posters, etc:**

See presentations in list under “Submissions to CoRIS”.

**Problems, difficulties, etc., encountered during FY2007:**

Operationally, there were no major problems encountered in FY2007. The loss of funding, however, has made moving forward with both research and education / outreach impractical.

**Changes/Adjustments needed:**

Funding from the NOAA-CRCP is needed to continue the project and the strong collaboration we have built with state, local, and academic partners.

**Names of PIs and co-PIs:**

Samantha Whitcraft (PI) - UM-CIMAS  
John Lamkin (co-PI) - NOAA SEFSC  
Bill Richards (co-PI) - NOAA SEFSC  
Craig Layman (co-PI) - FIU Biological Sciences Department  
Albrey Arrington (co-PI) - Natural Resources Manager – Loxahatchee Environmental District

## VI. REDUCE USE AND EFFECTIVENESS OF MPAS

### **Project ID and Title: 10202-2007: Survey of Coral and Fish Assemblages at Pulley Ridge, SW Florida**

**Duration of the Project:** First year

#### **Brief description of activities conducted in FY2007:**

The southern terminus of Pulley Ridge contains some of the richest coral reefs in the western hemisphere with areas of 60% live coral coverage. In excess of 60 fish species have been reported, comprised of a mixture of shallow and deep water species. Data on the abundance and distribution of flora and fauna in the unexplored portions of Pulley Ridge are needed to make effective management decisions. Of greater scientific value is the acquisition of data on shallow water species living in these depths, interactions between deep and shallow species in this unique ecosystem as well as searches for evidence of coral bleaching or other deleterious effects of climate change described in shallower ecosystems inhabited by similar species. The FY2007 survey was conducted in August aboard the NASA vessel, M/V Freedom Star. Twelve ROV dives were planned along with numerous deployments of a stationary video camera array. Failure of the ROV umbilical after seven dives precluded transect surveys of the remaining five sites, however these were examined with triplicate drops of the stationary array. Benthic grab samples were collected at nineteen sites to provide groundtruthing information and facilitate habitat classification map production as part of a companion CRCP-funded multibeam mapping project. Misty grouper (*Epinephelus mystacinus*) and queen snapper (*Etelis oculatus*) were observed during ROV dives, neither species had been previously observed on Pulley Ridge. A colleague from Harbor Branch Oceanographic Institution participated in the cruise to assist with coral and other invertebrate identification and provided faunal comparisons between species observed on this project and those seen during submersible dives in the early 1980's.

While the northern boundary of hermatypic corals was not definitively determined due to the ROV malfunction, the area of the boundary was narrowed considerably.

A non-CRCP funded project scheduled for March 2008 will transit the Pulley Ridge area and the missing ROV dives will be completed at that time with no additional cost to the CRCP. Analysis of the videotape data will be completed by May 2008 and a final report will be provided to the Gulf of Mexico Fishery Management Council one month subsequent to the completion of data analysis. Finally, maps, imagery, and data on invertebrate and vertebrate abundance and distribution will be provided to NOAA's Coral Reef Information System (CoRIS).



Queen Snapper (*Etelis oculatus*).

#### **Description of accomplishments / results:**

A research cruise using a ROV and stationary camera array was completed on Pulley Ridge in late FY2007. Information gathered is currently being analyzed and should allow description of the current abundance and distribution of fishes and invertebrates on this unique coral reef as well as comparisons to historic values compiled in the early 1980's. As this is the deepest hermatypic coral reef in U.S. waters, faunal descriptions of this ecosystem have a high value to coral reef conservation. Several ROV dives were not made during the FY2007 cruise due to a failure of the umbilical cable. The missed dives will be attempted during a March 2008 (non-CRCP) cruise.

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

This project addresses the marine protected areas goal of the CRCP: improve management of coral reef resources through a strengthened and expanded network of coral reef marine protected areas. Strengthen networks of coral reef protected areas and, by 2010, protect 20% of U.S. coral reefs as marine reserves. The primary benefits of this project which will lead to reef protection are the delineation of the portions of the Pulley Ridge platform harboring living coral reefs, the quantification of extant corals, and the evaluation of coral damage caused by bottom tending fishing gear. The results of our monitoring program are provided to the Gulf of Mexico Fishery Management Council (GMFMC). These results will allow the GMFMC to evaluate the effectiveness of the current HAPC regulations and consider additional fishing gear or method restrictions which may be needed to protect these valuable reefs. Other researchers examining coral bleaching in conspecifics to those corals found on Pulley Ridge may benefit from this project as no coral bleaching has been reported to date in this location. Comparisons between physical and chemical parameters on Pulley Ridge and the bleaching impacted areas may provide insights into the causes of coral bleaching. We will coordinate activities with other researchers working in the area and conduct public outreach through a variety of venues. These data dissemination efforts provide information gathered during monitoring programs to managers not directly associated with the northeastern Gulf of Mexico, which may be used in establishing effective MPAs in other areas.

#### **How Project Supports Management / Research/ Other Activities:**

This project will produce population density estimates of corals and targeted reef fish species within the HAPC boundaries. The HAPC has been partially mapped with multibeam sonar, stationary video and ROV imagery has further improved the characterization of these areas. Biological monitoring of habitats and living marine resources is conducted biannually. Monitoring and assessment tools are used by the Gulf of Mexico Fishery Management Council to evaluate effectiveness of this habitat protection strategy. Time series data provided by this project allows forecasting of trends in coral, invertebrate and reef fish populations in this HAPC specifically and along the outer continental shelf in general. Biennially updated population evaluations



Speckled Hind  
(*Epinephelus drummondhayi*).

provide enhanced management opportunities as well as updated information products and new publications.

**Partnerships, Capacity building, education and outreach activities:**

This project has extensive partnership with NURC-UConn, NURC-UNCW, Harbor Branch Oceanographic Institute, University of South Florida.

**Submissions to CoRIS:**

None, data still being collected and analyzed.

**Publications during FY2007 (including Tech. Memos.):**

None, data still being collected and analyzed.

**Presentations at professional meetings. Posters, etc:**

None, data still being collected and analyzed.

**Problems, difficulties, etc., encountered during FY2007:**

ROV umbilical failed after 7<sup>th</sup> dive. Remaining 5 dives will be conducted during (non-CRCP) research cruise in March 2008.

**Changes / Adjustments needed:**

As nearly half of proposed ROV dives will not be completed until end of March-April 2008 cruise, final report will be delayed until May 2008.

**Names of PIs and co-PIs:**

Andrew David (PI) – NOAA SEFSC, Panama City, FL  
Stacey Harter (co-PI) - NOAA SEFSC, Panama City, FL

**Project ID and Title: 1062-2007: Survey of Habitat and Fish Assemblages in two Marine Reserves on the west Florida Shelf**

**Duration of the Project: Ongoing project since FY2002**

**Brief description of activities conducted in FY2007:**

The Madison-Swanson and Steamboat Lumps marine protected areas (MPAs) were established by the Gulf of Mexico Fishery Management Council (GMFMC) in 1999 as a management alternative to ameliorate highly skewed sex ratios and decreased population levels in gag, *Mycteroperca microlepis*. These closed-to-fishing areas were thought to contain gag spawning aggregation sites and their closure was hoped to increase reproductive output as well as act as refugia for mature male gag. The protogynous hermaphroditic life history of gag normally leads to a low percentage of males within the population; however other factors, presumably including high fishing pressure, had led to a lower than expected percentage of males with potentially deleterious genetic consequences. The NMFS was tasked with evaluating the efficacy of the northern Gulf MPAs as a tool for correcting the demographic concerns about gag. This project has four

objectives: 1) establish baseline estimates of fish abundance, especially for species of groupers and snappers; 2) describe significant habitat features in the Madison-Swanson and Steamboat Lumps MPAs; 3) analyze the relationship between habitat and species assemblages; and 4) track changes in fish abundance and distribution within the MPAs during the closure period. A secondary objective was to locate spawning aggregations of gag and scamp (*M. phenax*). An adjacent open-to-fishing area of similar depth and habitat features (referred to as Twin Ridges) was studied with similar techniques to separate natural population fluctuations from any effect of the fishing closures within the MPAs. Sidescan-sonar mosaics and multibeam sonar bathymetry were used to stratify the MPAs and the control area based upon benthic topography and geology. Madison-Swanson, Steamboat Lumps, and Twin Ridges were sampled during 34 cruises between February 2001 and March 2007. Gear employed during the surveys included stationary video camera arrays (Hi-8 or digital cameras), chevron fish traps, and a remotely operated vehicle (ROV) for fish and habitat observations as well as CTDs for the determination of oceanographic conditions. In FY2007, 134 stations were surveyed during four cruise legs. This was the highest number of stations surveyed during any year of this seven year project. Analysis of videotapes was completed in early FY2008 and a report was delivered to the Gulf of Mexico Fishery Management Council (GMFMC) in October 2007. The GMFMC is now considering extending the duration of these MPA closures and/or increasing the amount of protected habitat, based in part upon the results of this project which has shown a significantly greater rate of increase in the targeted species in the Madison-Swanson MPA compared to the greater eastern Gulf of Mexico.



Epifauna on reef top in Madison-Swanson MPA.

#### **Description of accomplishments / results:**

More stations were surveyed in FY2007 (134) than in any other year of this annual survey (2001-2007). The positive efficacy evaluation will be used by the GMFMC during their consideration of an extension of the closure period during 2008. Conservation of the reef fish species within these MPAs has ecosystem-level benefits for the biodiversity of mid-shelf and shelf edge reef habitats of the eastern Gulf of Mexico.

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

This project addresses the marine protected areas goal of the CRCP: improve management of coral reef resources through a strengthened and expanded network of coral reef marine protected areas. Strengthen networks of coral reef protected areas and, by 2010, protect 20% of U.S. coral reefs as marine reserves. The results of this monitoring program were cited by the GMFMC during their evaluation of these MPAs in 2003 which lead to a six year extension of the initial four year closure. Further discussions in 2008 will determine if the closures should continue past 2010 and the Council has asked NMFS for additional information to allow them to make a more

informed decision. These MPAs were implemented to protect gag, however the closures have provided ecosystem-level benefits to the entire reef complex. Trawling, bottom longlining, and deep trolling have all been shown to have deleterious effects upon reefs and these activities are currently prohibited in the MPAs. Continuation of our monitoring program will insure the GMFMC remains well informed of changes within reef fish populations and coral habitats associated with these MPAs. Over time, our research should detect changes in epifaunal species as well and provide managers insight into the benefits derived by coral reef ecosystems from area closures. If, after the 10-year experimental closure, the GMFMC moves to permanent closure, a shift to biennial monitor could be considered. Oral presentations have been delivered at scientific meetings and manuscripts developed for publication in the scientific literature. We will continue to coordinate activities with other researchers working in the area and conduct public outreach through a variety of venues. These data dissemination efforts provide information gathered during this long-term monitoring program to managers not directly associated with the northeastern Gulf of Mexico, which may be used in establishing effective MPAs in other areas.

**How Project Supports Management / Research/ Other Activities:**

This project has documented a significant increase in the population of targeted reef fish species within the MPA boundaries. The MPAs have been completely mapped with multibeam sonar (556 sq km) along with an additional 6161 sq km of adjacent shelf edge habitat. Stationary video and ROV imagery has further improved the characterization of these areas by providing visual groundtruthing data. Biological monitoring of habitats and living marine resources is conducted annually. Monitoring and assessment tools are used by the Gulf of Mexico Fishery Management Council to evaluate efficacy of these MPAs and assist in determining extension of current closures scheduled to sunset in June 2010. Time series data provided by this project allows forecasting of trends in reef fish populations in these MPAs specifically and along the west Florida Shelf in particular. Annually updated population evaluations provide enhanced management opportunities as well as updated information products and new publications.

**Partnerships, Capacity building, education and outreach activities:**

None

**Submissions to CoRIS:**

Presentation given to Gulf of Mexico Fishery Management Council on 29 October 2007 in Biloxi, MS submitted to CoRIS in November 2007.

**Publications during FY2007 (including Tech. Memos.):**

None

**Presentations at professional meetings. Posters, etc:**

Presentation given to Gulf of Mexico Fishery Management Council on 29 October 2007 in Biloxi, MS. Presentation given to American Fisheries Society, Florida Chapter, Annual Meeting in February 2008 by Marta Ribera.



**Problems, difficulties, etc., encountered during FY2007:**

None

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

Andrew David (PI) NOAA SEFSC, Panama City, FL

Christopher Gledhill (co-PI) - NOAA SEFSC, Pascagoula, MS

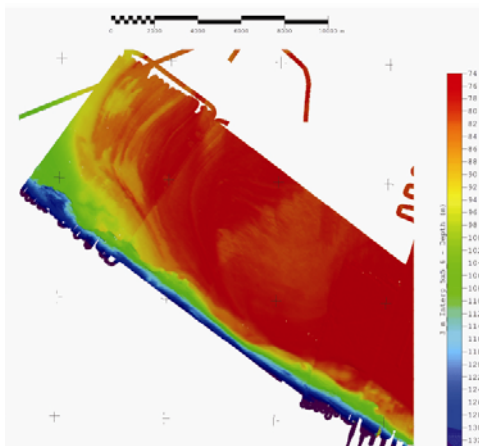
**Project ID and Title: 10012-2007: Multibeam Mapping of Pulley Ridge, SW Florida**

**Duration of the Project: Ongoing project since FY2002**

**Brief description of activities conducted in FY2007:**

Hermatypic zooxanthellate coral reefs are normally found at depths less than 30 meters. A carbonate platform off the southwest coast of Florida, known as Pulley Ridge, contains large stands of these corals at depths of nearly 70 meters, making them the deepest reefs reported in U.S. waters. To date only a small portion of the ridge has been mapped and the full extent of the coral coverage is unknown. Due to the water depths involved, aerial mapping with LIDAR or hyperspectral technology is precluded in this area, leaving acoustic mapping as the preferred methodology. Due to the high percentage of coral coverage (60% in some areas) and the uniqueness of shallow coral species at such great depths, the GMFMC has designated this area as a Habitat Area of Particular Concer(HAPC) to protect the coral of Pulley Ridge. Knowledge of the extent and location of coral reefs on the Ridge will greatly aid the Council in adjusting the borders of the HAPC if required. Bleaching has been reported in 2005 in shallow corals near the

Dry Tortugas, however ROV footage from deep corals on Pulley Ridge taken in 2004 did not indicate any bleaching of corals between the 60 and 70 meter isobaths. One of the reasons for mapping these mid-depth areas is to locate probable reef habitat for investigation of shallow-deep coral bleaching correlates. More complete knowledge of the location of corals on Pulley Ridge will be beneficial to biologists examining the bleaching phenomenon as direct comparisons can be made between deep and shallow formations exposed to similar water masses, yet different thermal regimes. The Gulf of Mexico Fishery Management Council will be provided copies of all map products for use in delineating potential new MPAs or adjusting the HAPC



Multibeam bathymetry of SW edge of Pulley Ridge.

boundaries. Pulley Ridge is a rising priority with the Gulf Council. Conservation entities

and the commercial fishing industry are increasingly at odds over this area and any action taken by the Gulf Council will be greatly aided by the information provided in this project. Mapping efforts in FY2007 were conducted by Dr. David Naar from the University of South Florida under an IDIQ contract from NOAA Fisheries. Efforts focused on a rectangular area between previously mapped areas on the western portion of the Ridge. Approximately 50 km<sup>2</sup> were mapped this year.

**Description of accomplishments / results:**

The major accomplishment in FY2007 has been the multibeam mapping of 50 km<sup>2</sup> along the western escarpment of Pulley Ridge. As this is the deepest hermatypic coral reef in U.S. waters, knowledge of the geographic extent of the coral formations has a high value to coral reef conservation.

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

This project addresses the mapping goal of the CRCP: develop comprehensive digital maps of all shallow coral reef ecosystems in the U.S. and characterize priority moderate-depth reef systems by 2009. Acoustic mapping of Pulley Ridge will provide multibeam bathymetric and acoustic backscatter data of use to several scientific and management entities. Fishery managers have shown increased interest in the coral reefs growing on Pulley Ridge in recent years and have named the area a Habitat Area of Particular Concern (HAPC). However the full extent of the reefs growing on this drowned barrier reef carbonate platform is not known. Once this multiyear mapping project is completed, this question should be answered. Accurate maps will allow managers to correctly delineate the protected area while allowing commercial and recreational activities to continue in areas where reef damage will not occur.

Many of the coral species on the ridge are shallow water species which have persisted since the sea level lowstand associated with the last ice age. The extremely clear, oligotrophic waters of the area allow sufficient sunlight to reach the bottom and permit photosynthesis in the coral's zooxanthellae. Recent surveys have revealed live coral coverage exceeding 60% at depths below 60m. Few (if any) other reefs in the U.S. Atlantic and Caribbean have such high densities of live coral. Coral bleaching, which has had so many deleterious effects on shallow reefs around the world, has not been detected on Pulley Ridge. Investigations into the differences between healthy corals on Pulley Ridge and their bleached conspecifics on shallower reefs may yield information to reduce or ameliorate these conditions elsewhere.

**How project supports management / research / other activities:**

Over the lifetime of this project, high resolution multibeam bathymetry and acoustic backscatter imagery of up to 200 sq km of the unexplored areas of Pulley Ridge will be produced. This is the deepest hermatypic coral reef in the continental U.S. and has recently had protections against damaging fishing methods extending to it by the Gulf of Mexico Fishery Management Council. New maps will allow improved management through detailed knowledge of the location and extent of corals, as well as provide new information products and metadata. The existing Habitat Area of Particular Concern (HAPC) may be expanded or acquire more stringent protection as a result of improved



information of the location of corals. Additionally, this area has not exhibited any of the bleaching events associated with similar coral species located on shallower reefs, affording coral researchers valuable information on the causes of these deleterious events.

**Partnerships, Capacity building, education and outreach activities:**

This project has involved extensive partnership with the University of South Florida.

**Submissions to CoRIS:**

Data is still being analyzed. On target to meet revised schedule of April 2008.

**Publications during FY2007 (including Tech. Memos.):**

Data is still being analyzed.

**Presentations at professional meetings. Posters, etc:**

Data is still being analyzed.

**Problems, difficulties, etc., encountered during FY2007:**

Late arrival of funds forced cancellation of original cruise, rescheduled cruise was conducted in November 2007. Completion of data analysis and submission of report pushed back to April 2008 due to this delay.

**Changes / Adjustments needed:**

Completion of data analysis and submission of reports pushed back to April 2008 due to delay in receipt of funds.

**Names of PIs and co-PIs:**

Andrew David (PI) – NOAA SEFSC, Panama City, FL

Stacey Harter (co-PI) - NOAA SEFSC, Panama City, FL

**Project ID and Title: 1693-2007: South Atlantic MPAs: Pre-Closure Evaluation of Habitat and Fish Assemblages in Five Proposed no Fishing Zones**

**Duration of the Project:** Ongoing project since FY2005

**Brief description of activities conducted in FY2007:**

The FY2007 evaluation followed the protocol established during the self-funded pilot study of April-May 2004 and the CRCP-funded FY2006 project completed in June 2006. The paucity of available multibeam bathymetric maps precluded implementation of a stratified random sampling strategy, requiring targeted sampling in the interim. Sites discovered during the 2004 and 2006 cruises or reported by other researchers were revisited in FY2007 and examined with a stationary digital camera array and a ROV. The cruise was conducted aboard the NASA vessel M/V Freedom Star. Twenty ROV dives along with numerous deployments of a stationary video camera array were completed. All five proposed MPAs between Jacksonville, FL and Cape Fear, NC were examined. Hydrographic data were collected at each site. Both the ROV and stationary

camera array were limited to daytime operations. During nighttime, the ship transited between sites and used the fathometer to search for additional reef habitat until light conditions allowed camera and ROV work. This procedure allowed all five areas to be surveyed during a seven day cruise. An outreach component was included in this project through the participation of a NOAA Teacher at Sea. Analysis of the videotape data was completed in January 2008 and a final report was provided to the South Atlantic Fishery Management Council in February 2008. An oral presentation was given to the SAFMC in early March 2008. Finally, maps, imagery, and data on invertebrate and vertebrate abundance and distribution were provided to NOAA's Coral Reef Information System (CoRIS) in February 2008.

#### **Description of accomplishments / results:**

FY2007 saw the most productive research cruise of the four year history of this project with 20 ROV dives made in five proposed MPAs during a seven day cruise. Analysis of videotapes provides, along with previously collected data, a solid baseline of pre-closure conditions in these shelf-edge reef MPAs and allow comprehensive efficacy evaluations in the future.

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

This project addresses the marine protected areas goal of the CRCP: improve management of coral reef resources through a strengthened and expanded network of coral reef marine protected areas. Strengthen networks of coral reef protected areas and, by 2010, protect 20% of U.S. coral reefs as marine reserves. The results of this monitoring program will be used by the SAFMC during their evaluation of these MPAs, as cited in the monitoring section of Amendment 14 of the Reef Fish Management Plan. These MPAs were implemented to protect five species of reef dependent grouper as well as two tilefish species which utilize adjacent mud bank habitat, however the closures will provide ecosystem-level benefits to the entire reef complex. Trawling, bottom longlining, and deep trolling have all been shown to have deleterious effects upon reefs and these activities will be prohibited in the MPAs. Additionally, the areas studied in this project contain extensive areas infested with the invasive lionfish. The lionfish population continues to expand rapidly. NOAA colleagues have recently noted a 50% population increase in one year off North Carolina. Future monitoring will assist in evaluating the ecosystem effects of this invasion and separate the effects of fishing mortality from natural mortality on the reef fish populations coincident with the lionfish populations. Continuation of our monitoring program will ensure the SAFMC remains well informed of changes within reef fish populations and coral habitats associated with these MPAs. Over time, our research should detect changes in epifaunal species as well and produce data on the benefits derived by coral reef ecosystems from area closures. A manuscript has been published in



Speckled Hind and 3 Lionfish (*Pterois volitans*) in South Carolina MPA.

the scientific literature based on this project and a second one submitted for review. Additional manuscripts will be produced as more data is gathered and results of the closures are detected. We will continue to coordinate activities with other researchers working in the area and conduct public outreach through a variety of venues. These data dissemination efforts provide information gathered during this long term monitoring program to managers not directly associated with the U.S. South Atlantic, which may be used in creating effective MPAs elsewhere.

#### **How Project Supports Management / Research/ Other Activities:**

This project has produced population density estimates of targeted reef fish species within the MPA boundaries and adjacent control areas, prior to closure and will continue to do so after closure. The MPAs have been partially mapped with multibeam sonar. Stationary video and ROV imagery has further improved the characterization of these



Teacher at Sea piloting ROV.

areas. Biological monitoring of habitats and living marine resources is conducted annually. Monitoring and assessment tools are used by the South Atlantic Fishery Management Council to evaluate efficacy of these MPAs. Time series data provided by this project allows forecasting of trends in reef fish populations in these MPAs specifically and along the U.S. South Atlantic in general. Annually updated population evaluations provide enhanced management opportunities as well as updated information products and new publications.

#### **Partnerships, Capacity building, education and outreach activities:**

This project has involved extensive partnership with NURC-UConn and NURC-UNCW.

#### **Submissions to CoRIS:**

Final report and PowerPoint presentation have been submitted to CoRIS.

#### **Publications during FY2007 (including Tech. Memos.):**

Whitfield, P.E., J.A. Hare, A.W. David, S.L. Harter, R.C. Munoz, and C.M. Addison.

2007. Abundance estimates of the Indo-Pacific lionfish *Pterois volitans/miles* complex in the Western North Atlantic. *Biological Invasions* 9:53–64.

Final report (which will serve as a technical memorandum) has been submitted to SEFSC, CoRIS and SAFMC.

#### **Presentations at professional meetings. Posters, etc:**

Oral presentation presented at March 2008 meeting of South Atlantic Fishery Management Council meeting in Jekyll Island, GA.

#### **Problems, difficulties, etc., encountered during FY2007:**

Late arrival of funds pushed original May cruise date back to late August.

**Changes / Adjustments needed:**

Cruise date had to be pushed back due to late arrival of funds.

**Names of PIs and co-PIs:**

Andrew David (PI) – NOAA SEFSC, Panama City, FL

Stacey Harter (co-PI) - NOAA SEFSC, Panama City, FL

**Project ID and Title: 10296-2007: Supplementary Support for Publication of the Proceedings of the First International Symposium on Mangroves as Fish Habitat**

**Duration of the Project:** First year

**Brief description of activities conducted in FY2007:**

The CRCP provided partial support for the First International Symposium on Mangroves as Fish Habitat, which was held at the University of Miami's Rosenstiel School of Atmospheric and Marine Science, from April 19 to 21, 2006. CRCP FY2007 funds were used to defray editorial and publication costs for the proceedings of the symposium.

**Description of accomplishments / results:**

The Proceedings of the symposium were published in the Bulletin of Marine Science: Serafy, J. E. and R. J. Araujo (eds). 2007. Proceedings of the First International Symposium on Mangroves as Fish Habitat. Bulletin of Marine Science, Volume 80, No. 3, 492 p.

These contain 25 full papers that passed peer-review and over 60 over abstracts.

CRCP funds were essential to cover page charges for contributors from developing countries.

**How Project Supports Goals & Objectives of CRCP:**

Mangrove habitats are integral components of coral reef ecosystems around the globe.

The research captured in the symposium proceedings supports effective management and sound science for the preserving, sustaining and restoring valuable coral reef ecosystems for future generations.

**How Project Supports Management / Research / Other Activities:**

The peer-reviewed papers in the symposium proceedings document the “state-of-the-art” of mangrove-fish science, with an emphasis on coral reef connectivity. Therefore, the proceedings contain essential reference material for the national and international management, conservation and scientific communities.

**Partnerships, Capacity building, education and outreach activities:**

The symposium provided a forum to exchange knowledge and perspectives between the developed and developing world (where 90% of coastal mangroves and coral reefs are located) to improve conservation and management of coral reefs and mangroves.

**Submissions to CoRIS:**

Serafy, J. E. and R. J. Araujo (eds). 2007. Proceedings of the First International Symposium on Mangroves as Fish Habitat. Bulletin of Marine Science, Volume 80, No. 3, 492 p. The full-color, 52-page Program/Abstract Book has been submitted.

**Publications during FY06 (including Tech. Memos.):**

Four articles authored by SEFSC researchers are contained in the special issue above.

**Presentations at professional meetings. Posters, etc:**

None

**Problems, difficulties, etc., encountered during FY2007:**

Delay in receipt of funds caused numerous logistical problems.

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

Joe Serafy (PI) – NOAA SEFSC, Miami, FL

**Project ID and Title: 10233-2007: USVI Distribution and Larval Supply Study****Duration of the Project:** First year**Brief description of activities conducted in FY2007:**

A research cruise aboard the NOAA R/V Nancy Foster was conducted, March 25-April 10, 2007. Collection of larvae via mocness and bongo tows with an emphasis on intense sampling south of St. Thomas at the Grammanik and Red Hind Banks grouper and snapper spawning aggregations. Additionally, current, temperature, depth, and drifter data was obtained through CTD, ADCP and drifters measurements by NOAA/AOML scientists. We also conducted inshore sampling from Brewers Bay in St. Thomas, Virgin Islands for collection of coral reef fish using light traps and beach seines. Sorting and biomass calculations of plankton samples collected from the research cruise began in summer of 2007. All of the inshore samples from beach seining and light traps were processed and identified to species.



*Collecting plankton from 1 meter mocness*

**Description of accomplishments / results:**

All biomass calculations have been completed for these plankton samples.

We collected a total of 137 plankton samples from the research cruise. Sorting results has yielded 20,000 (mocness) and 2000 (bongo) larvae to date. All samples collected south of the Virgin Islands have been identified to family and initial results show the presence of Serranidae (grouper), Lutjanidae (snapper), and Bothidae (flounder). There is also a substantial presence of early stages of cephalopods and lobster larvae. Processed inshore samples yielded a total of 1,878 fish, 1,611 (light traps) and 267 (beach seine).

Approximately 90% of inshore samples have been identified to species. Inshore samples revealed a substantial presence of *Lutjanidae chrysurus* (yellowtail snapper), *Lutjanidae*



*Example of larval fish collected in 1meter mocness*

*synagris* (lane snapper), and *Lobrisomidae*, a family with limited description in the literature. A total of 10 *Lobrisomidae* were transferred to Benjamin Victor, a well know coral reef fish taxonomist, for further

investigation. Also present in light traps and beach seine in abundance were *Albula* (bonefish). A total of seven *Albula* were transferred to ECOSUR, a graduate study university in Chetumal, Mexico, whose focus is spawning aggregations. The *Albula* were analyzed for DNA bar coding to determine species identification. Results showed three samples identified as *Albula vulpes* and two identified as *Albula garcia*.

**How Project Supports Goals & Objectives of CRCP:**

This project addresses marine protected areas of coral reef fish and sustainable fishing, reducing the impacts of fishing/overfishing. This research intensely sampled two spawning aggregations of coral reef fish, Red Hind Bank and Grammanik Bank, which are both south of St. Thomas. The intent is to gather knowledge on the abundance and composition of coral reef fish species of these MPAs. Both MPAs have experienced recent seasonal species specific closure decisions from the Caribbean Fisheries Management Council. This research seeks to generate data necessary for managers to make decisions based on sound science and ultimately determine the significance of these MPAs to the Virgin Islands fisheries.

**How Project Supports Management / Research/ Other Activities:**

This cruise represents the only potential source of fisheries independent data on a wide range of reef fish. Fisheries independent data is essential for management of threatened and heavily fished reef fish stocks.



**Partnerships, Capacity building, education and outreach activities:**

We established a partnership with the University of the Virgin Islands and hosted three of their scientists and one student to participate on the research cruise. Suggestions and research requests were taken into consideration during research planning and honored during the research cruise and inshore sampling.

**Submissions to CoRIS:**

We submitted CTD and ADCP physical oceanography data and Moccness plankton data from the first USVI research cruise March 28 to April 10, 2007 to Michele Newlin at CoRIS. Submitted in November of 2007.

**Publications during FY2007 (including Tech. Memos.):**

None

**Presentations at professional meetings. Posters, etc:**

None

**Problems, difficulties, etc., encountered during FY2007:**

None

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

Trika Gerard (PI) – NOAA SEFSC, Miami, FL

**Project ID and Title: 1053-2007: Modeling Effectiveness of Marine Reserves – Predicting Benefits to Coral Reef Ecosystems**

**Duration of the Project:** Ongoing project since FY2001

**Brief description of activities conducted in FY2007:**

During this fiscal year we completed and submitted a manuscript covering the use of our modeling approach for evaluating ecological target for ecosystem-based management. We also established new partnerships with Univ. of British Columbia Fisheries Centre and developed new service contracts that will result in completed models.

Our models and modeling approaches formed the basis of our contributions to NOAA Fisheries planning for modeling approaches, held in conjunction with the 2007 AFS conference.

**Description of accomplishments / results:**

Models have been generated to allow exploration of management policies and further exploration of data requirements. Model improvements and enhancements are

contributing to efforts to develop ecosystem-based management approaches in addition to addressing questions regarding the effectiveness of marine reserves.

**How Project Supports Goals & Objectives of CRCP:**

**Assessments, Inventories, and Monitoring:** The modeling approach draws together data generated during assessment and monitoring where it is accessible for improved management.

**Social and Economic Factors:** The model incorporates existing socio-economic data and provides a check on data that is needed for improving modeling and management.

**Marine Protected Areas:** The main goal is to simulate and predict effects of using reserves as part of an ecosystem management strategy.

**Sustainable Fishing:** The model set will be presented and discussed with the Caribbean Fisheries Management Council as a proposed ecosystem-based fisheries management tool. Its predictions can serve as working hypotheses for generating and evaluating management policies.

**Outreach and Education:** The model and its prediction are an excellent tool for involving stakeholders management discussions and decision-making.

**How Project Supports Management / Research/ Other Activities:**

Models have been generated to allow exploration of management policies and exploration of data requirements. Model improvements and enhancements are contributing to efforts to develop ecosystem-based management approaches for the Caribbean.

**Partnerships, Capacity building, education and outreach activities:**

The project has involved partners from the Univ. of Puerto Rico, Texas A & M – Galveston, and the Univ. of British Columbia, as well as fishery agencies in Puerto Rico and the VI.

**Submissions to CoRIS**

Presentations and manuscripts provided as links to project webpage.

**Publications during FY2007 (including Tech. Memos.)**

None

**Presentations at professional meetings. Posters, etc.**

None

**Problems, difficulties, etc., encountered during FY2007:**

None

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

Ron Hill (PI) – NOAA, SEFSC, Galveston, TX



## **VII. REDUCE THREATS TO INTERNATIONAL CORAL REEFS**

### **Project ID and Title: 10038-2007: *Acropora* spp. Monitoring in the Eastern Caribbean**

**Duration of the Project:** second year

#### **Brief description of activities conducted in FY2007:**

*A. palmata* demographic monitoring surveys continued at:

- Three sites (9 study plots) in Curacao, NA (2<sup>nd</sup> annual survey)
- 1 site (3 study plots) in Green Island, Antigua (3 surveys since Feb 2006)
- 1 site (4 study plots) in Bequai, SVG (3 surveys since Feb 2006)

Mapping surveys conducted at Peter Island, Guadeloupe and Green Island, Antigua  
Three semesters of Seamester students (approx 15 per semester) taught survey and spatial data collection techniques and ecology of elkhorn corals.

#### **Description of accomplishments / results:**

Monitoring manual published to facilitate comparable data collection by partners (see publications below). Mapping data submitted to *Acropora* GIS effort (under Mark Monaco, NCCOS).

#### **How Project Supports Goals & Objectives of CRCP:**

**International Threats:** Providing assessment information for *A. palmata* at several international locations (such assessment is required range-wide by ESA).

**Assessments, Inventories, and Monitoring:** Providing assessment information for *A. palmata* at several international sites (such assessment is required range-wide by ESA).

#### **How Project Supports Management / Research/ Other Activities:**

Providing assessment information for *A. palmata* at several international sites (such assessment is required range-wide by ESA).

#### **Partnerships, Capacity building, education and outreach activities:**

Partnership with SeaMester continues. SeaMester had substantial staff turnover, as a result we had to conduct training for multiple staff in survey techniques. SeaMester students were also trained and were involved in sampling.

Curacao SeaAquarium also provided partnership/leverage for sampling in Curacao.

#### **Submissions to CoRIS:**

See publications below.

#### **Publications during FY2007 (including Tech. Memos.):**

Williams D.E., M.W. Miller, K.L. Kramer. 2006. Demographic monitoring protocols for threatened Caribbean *Acropora* spp. corals. NOAA Technical Memorandum NMFS-SEFSC-543. 91pp.

**Presentations at professional meetings, posters, etc:**

None

**Problems, difficulties, etc., encountered during FY2007:**

SeaMester staff turnover necessitated additional training burden and some interruption of data stream.

**Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

Margaret Miller (PI) – NOAA SEFSC, Miami, FL

Dana Williams (co-PI) – UM RSMAS, CIMAS, Miami, FL

## VIII. ADDRESS EMERGING ISSUES

### **Project ID and Title: 2133-2007: Assessment of Candidate Corals**

**Duration of the Project:** Ongoing project since FY2002

#### **Brief description of activities conducted in FY2007:**

Completed 3 surveys of the 15 *A. palmata* demographic monitoring study plots in the FKNMS.

- *palmata* at most sites remained stable or declined slightly
- Incorporated microbial community sampling into quarterly surveys. (*See Project #10306*)

Began collaboration with CRCP Project on 'Quantitative population modeling of *Acropora* spp.' (PI Moore, SERO) by providing access to Florida Keys demographic data and field collaboration to validate means for estimating *A. palmata* live tissue cover.

Completed analysis of recruitment and submitted manuscript:

- Total estimated *A. palmata* live tissue loss in these plots ranged from 15 to 99 % since spring 2004.
- Only 31 new *A. palmata* colonies recruited; 29 newly attached fragments and 2 likely sexual recruits.
- Of the 332 colonies present at the beginning of the study, 134 (40%) were completely lost, either suffering complete mortality in situ or having been completely removed by hurricane impacts.

Completed annual survey of *A. palmata* and its snail predator:

- Began compilation and preliminary analysis of 10 year dataset
- *palmata* and snail populations have been stable over the past year.

Analysis of *A. palmata* genotype tissue samples completed and incorporated into demographic monitoring database for analysis.

Mapping survey documenting distribution of live *A. palmata* and *A. cervicornis* in Joulter's Cay, Bahamas

Two monitoring sites established at Navassa Island as well as mapping live distribution of *A. palmata* and *A. cervicornis* (*See CRCP Project #1056*)

#### **Description of accomplishments / results:**

Surveys indicate that the Florida Keys *A. palmata* population was stable this year following a drastic decline in 2005. Analysis of population ecology parameters suggest that recruitment is failing and will limit the rate of population recovery. This information is relevant and being provided to the *Acropora* Recovery Team.

#### **How Project Supports Goals & Objectives of CRCP:**

Assessments, Inventories, and Monitoring: Provides baseline information on status/trends of coral resources.

Strategic Research: Project is undertaking research to link colony genotype with colony performance.

**How Project Supports Management / Research/ Other Activities:**

This is the primary NOAA activity providing population-level status/trends information for the Florida Keys area for ESA management mandates, including data to base quantitative population model for risk analysis and prioritizing recovery actions. The project provides direct (real-time) observations to local reef managers (FKNMS) on status of local *A. palmata* population and provides for the mobilization of management rapid response.

**Partnerships, Capacity building, education and outreach activities:**

Williams “Acropora Monitoring and Research.” Presentation to US Coral Reef Task Force, St. Thomas USVI, Oct 06.

Miller “Address Emerging Issues’ priority area presentation to CRCP External Review Panel, Sept 2007, Washington DC.

Hosted/Mentored NOAA Hollings Scholar intern, Ms. Ashley Cedzo. June-July 2007.

Hosted/Mentored graduate student intern, Ms. Tali Vardi (Scripps Inst Oceanogr), Sept 2007.

Interviewed for ‘Waterways’, local public broadcast TV show, on *Acropora* spp. ecology and ESA listing.

**Submissions to CoRIS:**

See publications below.

**Publications during FY2007 (including Tech. Memos.):**

Baums, I.B., M.W. Miller, M.E. Hellberg. 2006. Geographic variation in clonal structure in a reef building Caribbean coral, *Acropora palmata*. Ecological Monographs 76:503-519.

Johnston, L., M.W. Miller. 2007. Variation in life-history traits of the corallivorous gastropod *Coralliophila abbreviata* on three coral hosts. Marine Biology 150: 1215-1225.

Williams, D.E., M.W. Miller. 2006. Morphology offers no clues to sexual vs. asexual origin of small *Acropora cervicornis* colonies. Rev Biol Trop 54 (Suppl. 3): 145-151.

Miller, M.W., I.B. Baums, D.E. Williams. 2007. Visual discernment of sexual recruits not feasible for *Acropora palmata*. Mar Ecol Prog Ser 335:227-231.

Gleason, A.C.R., D. Lirman, D.E. Williams, N.R. Gracias, B.E. Gintert, H. Madjidi, R.P. Reid, G.C. Boynton, S. Negahdaripour, M.W. Miller and P. Kramer. 2007. Documenting hurricane impacts on coral reefs using two dimensional video-mosaic technology. Marine Ecology 28:1-5.

**Presentations at professional meetings. Posters, etc:**

Williams, D., M. Miller and K.L. Kramer. ‘Effects of Multiple Hurricanes on *Acropora palmata* in the Florida Keys (U.S.A.)’. Oral presentation. Assoc. of Marine Labs of the Caribbean Meeting, St. Thomas USVI, June 07.

**Problems, difficulties, etc., encountered during FY2007:**

Loss of expert contractor (to government term position with NPS) in August 2007 invoked loss of capacity, inefficiency, and burden for training replacement.

**Changes / Adjustments needed:**

More help/ stable personnel

**Names of PIs and co-PIs:**

Margaret Miller (PI) – NOAA SEFSC, Miami, FL

Dana Williams (co-PI) – UM-RSMAS, CIMAS, Miami, FL

**Project ID and Title: 10306-2007: Assessment of ESA Threatened Corals - Supplemental**

**Duration of the Project:** First year

**Brief description of activities/accomplishments/results conducted in FY2007:**

This project was designed to address specific gaps/needs incurred upon ESA listing of *A. palmata* (Ap) and *A. cervicornis* (Ac). The following four activities were prioritized in the initial FY2007 effort:

- Facilitate compilation of comprehensive GIS to document current geographic distribution of live Ap and Ac via support of contract personnel in NOS-Biogeography Team. An initial working version has been provided to SERO and has served as a tool in the ongoing regulatory effort related to Critical Habitat designation.
- Facilitate continuation of demographic Ap monitoring in USVI. USGS had established a monitoring effort in St. John in 2004 but due to FY2007 funding cuts, anticipated ceasing data collection. This project established a contract with the University of the Virgin Islands for a graduate student assistantship to provide direct participation in field data collection and data management for this effort. Additional sites/colonies for Ap monitoring have been established in St. Thomas.
- Initiate pilot study to investigate rapid screening techniques of *Acropora* spp. surface microbial communities as a diagnostic tool for health/disease status; specifically 1) evaluate two sampling techniques (DNA swabs and syringe) for mucus collection for use in denaturing gradient gel electrophoresis techniques (DGGE); 2) determine the reliability, reproducibility and sensitivity of DGGE in bacterial community profiling and as a screening tool for health status; and 3) evaluate changes in these profiles over time and location in healthy coral and compare changes in the profiles of diseased corals as a means of evaluating the method's diagnostic potential.

Mucous samples from individually tagged *Acropora* colonies were collected by SEFSC in June and Sept 2007 from the Florida Keys. DNA has been extracted from both sets (~450 samples) and is awaiting DGGE profiling. Comparability of profiles across gels is

a well known issue with this technique. Modifications to the technique are underway to improve cross-gel comparisons (across colonies in time and space), prior to analyzing these samples.

Puerto Rico had been identified as a major geographic gap in the collection of targeted monitoring information on *Acropora* spp. corals. SEFSC initiated collaboration with Puerto Rico DNER (funded by NFWF) and UPR contractors to establish *Ap* demographic monitoring (consistent approach with SEFSC Florida Keys and eastern Caribbean efforts) at three sites in Puerto Rico (Tourmaline and Tres Palmas reserves on the west coast, La Cordillera on the east coast). Initial field work to establish monitoring plots and colonies was completed in October 2007. Nine plots and ~100 individual colonies were assessed and delineated for ongoing monitoring. These tagged colonies were also sampled for genotyping.

#### **How Project Supports Goals & Objectives of CRCP**

**Assessments, Inventories, and Monitoring:** comparative baseline assessment for population status in Puerto Rico and continuing population assessment by partners in St. John USVI; compilation of existing distributional data into comprehensive GIS.

**Strategic Research:** developing coral health screening techniques.

#### **How Project Supports Management / Research/ Other Activities:**

Fills a variety of high-priority actions/gaps identified by SERO managers of ESA coral. Constructive partnership developed with local entities in Puerto Rico (DNER, UPR).

#### **Partnerships, Capacity building, education and outreach activities:**

Partnership with Puerto Rico DNER/UPR for collaborative monitoring activities in UPR. Contract engages graduate student at UVI (St Thomas) to be involved in *Acropora* monitoring at VINP.

Partnership with private aquaculture firm in Florida Keys (SeaLife, Inc./Mr. Ken Nedimyer) to provide additional *A. cervicornis* mucous samples from field culture for microbial screening study.

#### **Submissions to CoRIS:**

See publications below

#### **Publications during FY2007 (including Tech. Memos.):**

None

#### **Presentations at professional meetings. Posters, etc:**

None

#### **Problems, difficulties, etc., encountered during FY2007:**

None

#### **Changes / Adjustments needed:**

None

**Names of PIs and co-PIs:**

Margaret Miller (PI) – NOAA SEFSC, Miami, FL