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SEFSC Coral Reef Program: FY 2008 Project Accomplishments Report

Compiled by:
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I. INTRODUCTION

Fiscal year 2008 marks the eighth year since the inception of the Coral Reef Conservation Program (CRCP). The CRCP is administered by NOAA Headquarters and is matrixed across four NOAA line offices, including NMFS. The program operates in the Atlantic and Pacific Basins and is integrated with other federal agencies, state and local governments, territories and commonwealths. While coral reef research and monitoring at the Southeast Fisheries Science Center predates the inception of the CRCP, we have been active participants in the CRCP since it was implemented in 2001, with projects in the South Atlantic, Gulf of Mexico, and Caribbean regions. In February 2004, SEFSC conducted an external program review of its coral reef program activities. Results of this review provided valuable comments and recommendations which have helped improve the design, performance and results of these projects. In September 2007, the CRCP conducted an external program review. The Panel Report was released in November 2007, followed by a suite of new planning documents by the CRCP, taking into consideration the recommendations of the external panel review. SEFSC has been an active participant and contributor to molding the direction of the program and is working internally with our Principle Investigators to be responsive to the changes that are being implemented as the CRCP follows through with the "roadmap for the future".

In Fiscal Year 2008, CRCP funded 26 individual projects, representing a CRCP investment of $2.29 million. This annual accomplishments report provides information on the activities that were undertaken, results and products produced, leverage and partnerships, management relevance, summaries of issues related to implementation of the projects, and notes on future directions. The accomplishments are presented by FY08 CRCP theme category and by project.

II. PROGRAM COORDINATION

Project ID#: 1250 - 2008

Title: Data Management, Assessment and Outreach

Names of PIs and co-PIs:
Theo Brainerd, NOAA/NMFS – SEFSC
Jennifer Schull, NOAA/NMFS – SEFSC (co-PI)

Duration of Project: Ongoing since FY 2002

Project Category:
- Program Coordination

Brief description of activities conducted in FY2008:
Internal Coordination: This project monitored CR funding, reported program variances, completed BOPS and Spend plans for projects, requested carryover for FY09, and documented must-pays. It coordinated input and responses to activities related to the CRCP Roadmap process and elevated issues to the CRCP. It provided for the review and compilation of comments on the CRCP External Panel Review Final Report, Kacky 2008 Memo (principles and priorities), and CRCP Roadmap for the Future. In FY08, we submitted the SEFSC proposal package for FY09 Funding to CRCP, reported 2007 accomplishments, and ensured deliverables were submitted to CoRIS.

Coordination and Communications: Though this project, SEFSC participated in CR conference calls, working groups, provided updates of SEFSC activities to CRCP, and reviewed CRCP external grants. PIs interfaced with the CR management community to ensure alignments of research and monitoring needs and goals. The project PI and Co-PI also managed all Deep Water Coral Activities for SEFSC in advance of the FY09 launch of the Deep Water Coral Program.

Outreach: This project led the SEFSC's participation (and coordination of PIs) at the International Coral Reef Symposium in Ft. Lauderdale 7/08 and contributed and supported the special forum: Translating Science into Management. Twenty four papers were presented by SEFSC scientists (authors or co-authors). The PI also coordinated SEFSC participation in International Year of the Reef 2008. The Co-PI served on the Coral Reef Communications and Outreach working group and edited the Discover Coral Reefs reader for Project WET.

Description of accomplishments & results:
The NOAA Technical Memorandum (NMFS-SEFSC-568) entitled "SEFSC Coral Reef Program: FY2007 Project Accomplishments Report" detailing accomplishments, products, publications, partnerships etc in 2007 was compiled and distributed.

- Organized annual CRCP Coordination Meeting between Center PIs and HQ CRCP
- Presented a review of the SEFSC CR program and accomplishments to the Center Management Team at the Center's annual management meeting.

- Ensured FY08 Projects were completed successfully and that SEFSC submitted an excellent suite of projects for FY09 CRCP consideration.

How project supports goals & objectives of CRCP:
This project increases communication, collaboration and accountability within SEFSC and among SEFSC PIs, the National CRCP, the management community, academic partners and the rest of the coral reef community (both nationally and internationally).

How project supports management of coral reef resources: See above.

List of project partners and their roles: None

Communications, media exposure, capacity building, education and outreach activities:
- Participated (and coordinated participation of PIs) at the International Coral Reef Symposium in Ft. Lauderdale 7/08. Contributed and supported special forum: Translating Science into Management. Twenty four papers were presented by SEFSC scientists (authors or co-authors). Staffed NOAA booth at ICRS and provided educational materials. Tracked SEFSC participation in the conference.

- Coordinated SEFSC participation in International Year of the Reef 2008.

- Served on Coral Reef Communications and Outreach working group and edited Discover Coral Reefs reader for Project WET.

Submissions to CoRIS: 2007 Accomplishments Report (NMFS-SEFSC-568)

Publications during FY2008:
The NOAA Technical Memorandum (NMFS-SEFSC-568) entitled "SEFSC Coral Reef Program: FY2007 Project Accomplishments Report" detailing accomplishments, products, publications, partnerships etc in 2007 was compiled and distributed.

Presentations at professional meetings: None

Setbacks or challenges encountered in FY08:
The late receipt of funds continues to create logistical problems for the implementation of research projects.

Comments on future direction of project: This project continues to ensure that SEFSC projects are fully aligned and integrated with the CRCP's goals and objectives, that our projects are responsive to management needs, and contribute towards the understanding and conservation of coral reef ecosystems.

III. ASSESS AND CHARACTERIZE U.S. CORAL REEFS – CORAL REEF ECOSYSTEM

Project ID#: 1064 - 2008

Title: Assess and monitor coral reef MPAs

Names of PIs and co-PIs:
Jim Bohnsack (NOAA SEFSC)
Todd Kellison (NOAA SEFSC)
Jerry Ault (UM-RSMAS)
Steven Smith (UM-RSMAS)

Duration of Project: 2nd year

Project Category:

- Reduce Adverse Impacts of Fishing
- Improve Use and Effectiveness of MPAs

Brief description of activities conducted in FY2008:
The FY08 goals of this project were to continue long-term monitoring efforts of coral reef fish and habitat in the FL Keys and the Dry Tortugas region. Results are used to (1) assess the effects of marine reserves and other management zones in the FL Keys and Tortugas regions, and (2) improve understanding of ecosystem dynamics and guide ecosystem management, including the maintenance of sustainable fisheries. Sampling uses non-destructive visual assessments based on a stationary-diver technique deployed in a two-stage, stratified random sampling design.

Sampling in the FL Keys has occurred since 1979. Beginning in FY08, the State of Florida's Fish and Wildlife Research Institute (FWRI) agreed to perform cooperative sampling and subsequent data sharing with NOAA SEFSC. FY08 sampling by SEFSC and FWRI began in June. As of October 31, 2008, 366 sites had been surveyed (235 by SEFSC, 131 by FWRI), totaling 1,464 research dives. Approximately 40 additional sites will be sampled before the end of the calendar year, weather permitting.

Sampling in the Dry Tortugas region occurred irregularly from 1994-1999, and has occurred every two years since 2000. Sampling in FY08 occurred in late May and early June, when researchers from NMFS and UM-RSMAS led two two-week research cruises to the region. Extensive reef fish, macroinvertebrate and coral reef habitat data were collected during a total of 1,703 research dives during 20 sea days. The Dry Tortugas research and monitoring efforts were a multi-agency collaboration, with participation from NOAA SEFSC, the University of Miami's Rosenstiel School of Marine and Atmospheric Science, the State of Florida Fish and Wildlife Conservation Commission, the National Park Service, and the University of North Carolina Wilmington, and with support from the Florida Keys National Marine Sanctuary. Data were collected across multiple management zones, including within Dry Tortugas National Park, the Florida Keys National Marine Sanctuary North Ecological Reserve, and in an open-to-fishing area of the Tortugas Bank.

Data collected during the surveys in the FL Keys and Dry Tortugas support assessment of spatial management efforts, temporal trends in reef fish populations, essential fish habitat studies, recovery from hurricane impacts, and other aspects of ecosystem-based approaches to management.

Description of accomplishments & results:
In FY08, more than 3,100 data-collection dives were performed in the FL Keys and the Dry Tortugas regions to continue long-term monitoring of reef fish community composition, habitat composition, and abundance and size structure for more 300 reef fish species on Florida's coral reef tract. Data are used to assess population and habitat trends (e.g., whether species are overfished) and ecosystem responses to fisheries management actions, including determining the effectiveness of no-take MPAs.

How project supports goals & objectives of CRCP:
Monitoring of coral reef fish and habitat resources is critical to the assessment of ecosystem status and the effectiveness of management actions.

How project supports management of coral reef resources:
Data and analytical results are shared with State of FL and FL Keys National Marine Sanctuary managers to support and guide management decisions within Florida's coral reef ecosystems.

List of project partners and their roles:
University of Miami – Rosenstiel School of Marine and Atmospheric Science: survey design, assist with data collection, data analyses
State of Florida – Fish and Wildlife Research Institute: assist with data collection

Communications, media exposure, capacity building, education and outreach activities:
Partnering with the State of FL has resulted in a significant increase in sampling power and project benefits to NOAA, the State of FL, and FKNMS managers.
FY08 monitoring efforts in the Dry Tortugas received extensive local, national and international media coverage, with research and PIs featured in newspapers, television (e.g., Good Morning America), and internet news media.

Submissions to CoRIS: N/A in FY08.

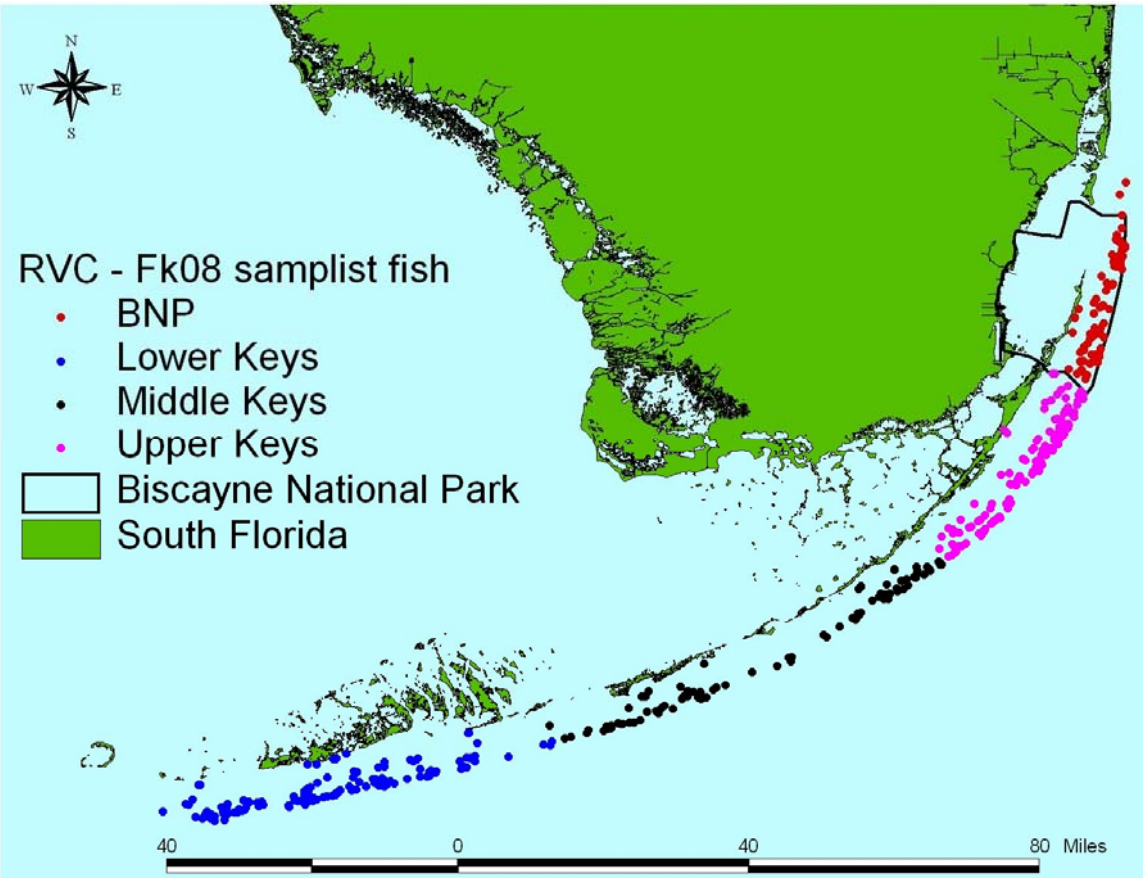
Publications during FY2008: N/A in FY08.

Presentations at professional meetings:
Oral presentation – 11th International Coral Reef Symposium, Ft. Lauderdale, FL, July 2008

Setbacks or challenges encountered in FY08: N/A in FY08.

Comments on future direction of project:
This project will continue to provide data to assess effects of natural and anthropogenic impacts to FL coral reef ecosystems.

The figure below indicates survey locations along the FL Keys coral reef tract for FY08 monitoring efforts. Four data-collection dives occurred at each site.



Project ID#: 1056-2008

Title: Reef and Fishery Assessment at Navassa Island

Names of PIs and co-PIs:
Margaret Miller (PI), NOAA-Fisheries Service, SEFSC
Brent Stoffle (co-PI), NOAA-Fisheries Service, SEFSC

Duration of Project: 5 years (initiated in 2002)

Project Category:

- Assess and Characterize US Coral Reefs – Coral Reef Ecosystem Integrated Observing System (CREIOS)
- Reduce Adverse Impacts of Fishing
- Reduce Impacts of Pollution & Coral Diseases
- Address Emerging Issues

Brief description of activities conducted in FY2008:
Two status report documents were published this year. One was in the NOAA 2008 State of US Coral Reef Ecosystems document. The other was the Navassa chapter in the Springer book, Coral Reefs of the USA edited by Riegl and Dodge (see pubs below). Both these documents presented the first-ever habitat maps for Navassa's coral reef ecosystem that were produced by this project. Additionally, a presentation was made at the 60th Gulf and Caribbean Fisheries Institute Meeting, Punta Cana, Dominican Republic, Nov 2007 on extrapolated estimates of fisheries effort and areal yield for the Navassa fishery. A manuscript will be published in the Proceedings. We contracted our partner, Fondacion pour la Protecion de la Biodiversite Marine (FoProBIM), to follow-up socio-economic work on fishing communities in Haiti, specifically better characterization of membership in these communities and specific gear profiling.

Results from this project were provided as direct management input at invitation of Caribbean Fishery Management Council at their Navassa Workshop, Ponce, Puerto Rico, March 2008. CFMC is considering construction of a Fishery Ecosystem Plan for Navassa and this project provided the majority of best available science, both biological and socio-economic, available for consideration. Discussions at this workshop provided guidance for additional socio-economic assessment work on Navassa fishing communities in Haiti.

Description of accomplishments & results: See above

How project supports goals & objectives of CRCP:
This Project has been the primary source of habitat mapping, reef, ESA-listed coral, fishery, and socio- assessment for US coral reef resources at Navassa.

How project supports management of coral reef resources:
This project provides the only source of ongoing information on marine resources and reef fisheries at Navassa NWR. In 6 yrs, reefs at Navassa (despite remoteness) have manifest the same problems as elsewhere in the Caribbean; i.e. declining fish biomass, high mortality of

corals from disease, coral bleaching, etc. Project info, including new habitat maps, were solicited and provided to the CFMC in FY08 in their consideration of a Fishery Ecosystem Plan development for Navassa Island.

List of project partners and their roles:
USFWS: Managers and collaborators
RSMAS/CIMAS: Participated in assessment cruises, mapping
FoProBIM: Haitian NGO is contractor for Haitian socio-cultural assessment and interpreter/liaison on reef assessment cruises.

Communications, media exposure, capacity building, education and outreach activities:
FoProBIM has undertaken extensive education/outreach activities amongst the southwest Haitian fishing communities

Submissions to CoRIS: See pubs below

Publications during FY2008:
Miller MW, Halley RB, Gleason A . (2008) Biology and geology of Navassa Island. IN Riegl and Dodge (eds) Coral Reefs of the USA. Springer

Miller MW, Gleason A, McClellan D, Piniak G, Williams D, Wiener JW, Gude A, Schwagerl J (2008) The State of Coral Reef Ecosystems of Navassa Island. Pp. 117-229. IN Waddell JE, Clarke AM (Eds). The State of Coral Reef Ecosystems of the United States and Pacific Freely Associated States: 2008. NOAA Technical Memorandum NOS NCCOS 73. NOAA NCCOS Center for Coastal Monitoring and Assessment's Biogeography Team. Silver Spring, MD 569 pp.

Presentations at professional meetings:
Miller MW, Wiener JW, McClellan DB, Stoffle B. (2008) Preliminary effort and yield estimates from the Haitian fishery at Navassa Island. 60th GCFI Symposium, Dominican Republic, Nov 2007.
(Note this will also appears a paper in the published proceedings)

Setbacks or challenges encountered in FY08:
Ongoing issues with supposed allocated ship time on the Nancy Foster has upcoming assessment cruise in limbo.

Comments on future direction of project:
This project supports research and monitoring at a remote oceanic island site in US waters and serves as a reference site for impacts of climate change and (the lack of) land based sources of pollution. Navassa also supports one of the most genetically diverse populations of *A. palmata* sampled in the Western Caribbean.

Project ID#: 10051-2008

Title: U.S. Caribbean Comprehensive Coral Reef Ecosystem Assessment and Monitoring (C-CCREMP)

Names of PIs and co-PIs:
Dr. Ron Hill NMFS/SEFSC
Dr. Mark Monaco, NOS, NCCOS

Duration of Project: On-going project since FY-2006

Project Category:

- Assess and Characterize US Coral Reefs – Coral Reef Ecosystem Integrated Observing System (CREIOS)

Brief description of activities conducted in FY2008:
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 US Caribbean. The overall goal is to develop well-coordinated mechanisms to address monitoring needs and develop compatible data so mangers can understand coral reef resource conditions and changes across the region.

During FY-07, we completed reports covering both the Puerto Rico and Virgin Islands workshops, held in September 2006 with NOAA research partners from each jurisdiction. During FY-08, we completed implementation of the on-line database and integration of the database with a geographical information system (GIS) for mapping, display, and spatial analysis of current research or monitoring projects assessing coral reef resources, both biological and environmental. Local coordinators for both Puerto Rico and the Virgin Islands were contracted and they have worked with territorial, commonwealth and academic mangers and researchers to ensure their metadata are properly entered into the system. 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.

Description of accomplishments & results:
Discussions of expanded coordination have continued in FY-08 to develop alternatives for increasing effectiveness of monitoring. Design, development, and implementation of our on-line database were also accomplished. The database is available for NOAA researchers and partners to enter monitoring metadata, including geographic information. Data entry was proceeding at a slow pace; therefore, local coordinators were contracted in both the Virgin Islands and Puerto Rico to provide additional assistance to local partners. Entry and spatial analysis are on-going. Data from the workshops and project supported the State of the Coral Reefs report, released in July 2008 at the International Coral Reef Symposium in Ft. Lauderdale, FL.

How project supports goals & objectives of CRCP:
Mapping: The project is producing a geodatabase, linked to GIS, to map monitoring and research activities across the US Caribbean region. These will augment maps of biological

components to assist managers and researchers in evaluating current projects and targeting additional efforts.

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 reefs 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 core 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 of coral reef resources:
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. It provides the means for local researchers to coordinate their efforts and make their results translatable across a broader landscape. It provides the means for local and federal managers to evaluate conditions locally across the regions and informs all participants of likely partners to improve efficiency and effectiveness of monitoring and research.

List of project partners and their roles:
The heart of the project is collaboration across NOAA line offices and among partners conducting research throughout the US Caribbean. 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. The first workshop, held in La Parguera, Puerto Rico on September 18-19, 2006 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, 2006 and was attended by 33 individuals from twelve different organizations involved in coastal monitoring, assessment, and/or management in the USVI.

This group is continuing to participate and other partner organizations will be added in future meetings.

Communications, media exposure, capacity building, education and outreach activities:
Continued discussions with local managers have identified additional potential partners for inclusion in future efforts. Opportunities for education and outreach are being sought with regional and international conferences and fora. The geodatabase will be a valuable outreach tool for data display and planning, improving coral reef management.

Submissions to CoRIS: Links to the C-CCREMP database have been provided.

Publications during 2008: none

Presentations at professional meetings: none

Setbacks or challenges encountered in FY08:
Funding was less than expected and limited the initiation of planned field work. Funding was directed to contractors completing modification of the database and providing on-site coordination to improve data entry rates.

Comments on future direction of project:
The project was originally presented as a continuing effort to improve regional monitoring of coral reef resources, particularly by supporting and implementing synoptic monitoring cruises across the US Caribbean, and coordinating additional reef monitoring. It can play a major role in the planning for increased efforts in the Caribbean by NOAA and other resource agency partners. It is an important communications tool for regional scientists and managers to understand the suite of activities taking place in the region.

IV. REDUCE IMPACTS OF COASTAL USES

Project ID#: 1066-2008

Title: Ecological Approach to Reef Restoration

Names of PIs and co-PIs:
Margaret Miller (PI), NOAA-Fisheries Service, SEFSC

Duration of Project: 6 years

Project Category:
- Reduce Impacts of Coastal Uses
- Address Emerging Issues

Brief description of activities conducted in FY2008:
We Initiated the Aquarius Coral Restoration/Resilience Experiment collaboratively with NURP/OAR, in June 2008, including completing complicated permitting, coordinating with multilateral partners, and leading a successful Aquarius saturation diving mission. This long-term experiment, based directly on needs expressed by FKNMS managers, will evaluate the risks and benefits of restocking coral populations from different transplant source populations. We collected and cultured few *A. palmata* larvae (TS Fay precluded collection during the main spawning nights) and *M.faveolata* larvae during Aug 2008 spawning, and implemented experiments on effects of temperature on larval success and gene expression with collaborators at Penn State Univ. During and following Aug 2008 spawning, we initiated pilot studies with UM collaborators to evaluate the effects of ocean acidification on fertilization success and growth rates of early settlers of reef-building corals.

Description of accomplishments & results:
Over 300 coral fragments (*A.cervicornis* and *M.faveolata*) were transplanted from seven different source populations to Aquarius site in June 2008. Periodic observations show variation in survivorship of *A.cervicornis* fragments from different sources.

Settled corals from FY07 spawning/larval culture efforts were kept alive in aquaria in record numbers (several hundred) for record time (8 mos). Results reported in ICRS presentation (Valdivia et al see below).

Submitted proposal and received leveraged supplemental funding from Mote Marine Lab 'Protect our Reefs' program ($24K) for coral settlement experiments.

How project supports goals & objectives of CRCP:
This project is involved in both evaluation of existing FKNMS 'reef restoration' projects and in developing tools and needed knowledge for effective re-population (both fragment- and larval-enhancement) of imperiled Caribbean coral species. This project will enhance best management practices and factors influencing success in support of future restoration activities.

How project supports management of coral reef resources:
Results of the evaluation of reef restoration structures (see submitted ms) were communicated directly to restoration colleagues/managers in the National Marine Sanctuaries program and feedback received prior to submission. Subject and design of ACRRE project component were explicitly developed from direct discussions with FKNMS managers and a FKNMS staff member was an active participant (i.e. Aquanaut).

List of project partners and their roles:
FKNMS (L.MacGlaughlin): ACRRE focus, design, and implementation partner
Coral Restoration Foundation (K.Nedimyer): Collaboration and provided coral transplants for the ACRRE study
Penn State Univ (I.Baums): Collaboration in larval experiments on temperature and gene expression
UM/RSMAS (C.Langdon/R.Albright): Collaboration in larval experiments on ocean acidification
Many other partners are collaboration in the ACRRE study by providing access and permitting coral fragments and various analyses to assess fragment performance.

Communications, media exposure, capacity building, education and outreach activities:
Coral restoration research featured in News Focus piece in December 2007 Science magazine (Pennisi (2007) Science 318:1712-1717)
Television news (NBC6-Miami) feature on ACCRE project aired 16 June 2008. (http://www.nbc6.net/community/16622549/detail.html)
NBC news (Ft Meyers) feature on coral spawning/restoration research aired 2 Sept 2008 (http://www.nbc-2.com/articles/readarticle.asp?articleid=21359&z=3)
Invited talk on project at Corals and Restoration Workshop (Key West FL, April 2008) sponsored by FKNMS, Florida Aquarium, and Disney Foundation.

Submissions to CoRIS: None in FY08

Publications during FY2008:
Miller MW, et al. (in review) Alternate benthic assemblages on reef restoration structures and cascading effects on coral settlement. Mar Ecol Prog Ser

Vermeij MJA, Sandin S (2008) Density dependent settlement and mortality structure the earliest life phases of a coral population. Ecology 89:1994-2004.

Presentations at professional meetings:
Valdivia A, Miller MW, et al. 'Post-settlement development of the scleractinian corals *Acropora palmata*, *Montastrea faveolata* and *Diploria strigosa'*. 11th ICRS, Ft Lauderdale, July 2008
NOTE: This presentation is being submitted as a manuscript to the published 11ICRS Proceedings

Miller M, et al. 'Alternate benthic assemblages on artificial reef restoration structures and their effects on coral larval Settlement' 11th ICRS, Ft Lauderdale, July 2008

Setbacks or challenges encountered in FY08:
Tropical Storms Fay and Ike inhibited coral spawn collection and limited the experiments we had intended for this year. Uncharacteristic uncertainties related to status of the NOAA Dive Program hindered productivity

Comments on future direction of project:
The two ongoing aspects of this project (larval ecology of corals and evaluating risks/benefits of coral restocking via transplanted fragments) are essential components to management if we are to continue to enjoy the ecosystem services provided by coral reefs in the Caribbean region. Our capacity in larval ecology of reef-building corals provides a context to evaluate effects of Climate Change (both temperature and acidification) on what is likely the most vulnerable life stage. The past approach of 'conservation' reef management has yielded drastic decline of reefs via mortality of adult corals combined with recruitment failure (by both larvae and asexual propagules). Thus, these aspects (stemming adult mortality and stemming recruitment failure) must be foci for research and management. This project is addressing multiple facets of the latter.

Fragments of *Acropora cervicornis* cultured in the field nursery of the Coral Restoration Foundation being removed for transplant in the ACRRE study.

Project ID#: 1070 - 2008

Title: Effectiveness of Coral Reattachment in Recovery of Reef Habitat Following Grounding of M/V Fortuna Reefer at Mona Island, Puerto Rico

Names of PIs and co-PIs:
Dr. Ron Hill, NMFS/SEFSC
Dr. Andy Bruckner, NMFS/OHC

Duration of Project: On-going project since FY2001

Project Category: Reduce Impacts of Coastal Uses, Restore Injured Habitats

Brief description of activities conducted in FY2008:
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 DNER 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 research into the ecology and productivity of staghorn coral (*Acropora cervicornis*) colonies in the same areas.

Research activities this year were conducted during two field expeditions to Puerto Rico, in February and June 2008. Although our days in the field were reduced, we completed surveys of the restoration site, as planned. Coral fragments were surveyed and assessed for survival, growth, cementation to the substrate, and vitality. Benthic characteristics of the site were assessed with point intercept transects and fish assemblages were quantified. Data from continuously recording temperature loggers were downloaded and loggers were reset and redeployed.

Continuous tracking of restoration success over a 10-year period has allowed us to recommend better attachment methods for dislodged coral fragments and has given us a better understanding of the dynamics of reef fish colonization of restored habitat. Recommendations from this work will improve the effectiveness of grounding site restorations in the future.

Description of accomplishments & results:
During FY-08, we completed surveys of the Fortuna Reefer restoration site documenting survival of restored fragments and natural colonies, reef fish assemblages, and benthic characteristics. Measurements of fragment growth and production of protobranches serve as a proxy for the development of 3-dimensional habitat structure. Surveys in surrounding control areas adjacent to the grounding site provide comparisons to un-impacted areas. Results from reef fish surveys, as related to fragment growth and survival, were presented, and submitted for publication, to the Gulf and Caribbean Fisheries Institute annual science and management meeting in Punta Cana, Dominican Republic, November 2007. Analyses of 10-year studies of both fragment survival and growth and reef fish assemblage response were presented, and submitted for publication to the International Coral Reef Symposium in Ft. Lauderdale, FL, USA

in July 2008. Findings from the research, as well as direct involvement of the PI (Bruckner), have helped to guide planning and execution of restoration at the M/T Margara grounding site on southern Puerto Rico.

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 alternative 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 of coral reef resources:
Coral reef managers must have data to support conservation actions. Restoration can be a conservation tool if executed using best practices. Monitoring of restoration projects is critical for providing insights into possible methodological revisions to improve future restoration success. During monitoring of the Fortuna Reefer, we have evaluated methods originally used and identified 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.

List of project partners and their roles:
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. Collaborative field work continued with other projects funded by CRCP. Joint field work is conducted with the Coral Disease (PIs: Bruckner and Hill), Coral Transplantation (PI: Borneman, CRCP-grants) and Fortuna Reefer (PIs: Hill and Bruckner) projects sharing manpower, boat use and minimizing travel expenses.

Communications, media exposure, capacity building, education and outreach activities: Opportunities for education and outreach have occurred through regional (Gulf and Caribbean Fisheries Institute) and international (International Coral Reef Symposium) scientific conferences and in meetings with local agency staff conducting new restorations. Findings have been shared with NOAA's Damage Assessment Office, the Restoration Center, and SERO.

Submissions to CoRIS:
Research cruise reports have been generated and links provided to CoRIS. Maps and project details are being added to the NMFS/SEFSC Galveston Laboratory's web page and have been included in the C-CCREMP website of Caribbean monitoring projects. Copies of manuscripts listed below will be submitted following publication.

Publications during 2008:
submitted for publication in 2008
Ron Hill, Michelle Schärer, Michael Nemeth, and Andy Bruckner. *Reef fish habitat use as a measure of coral reef restoration success at the Fortuna Reefer grounding site, Mona Island, Puerto Rico* prepared for submission to Proceeding of the 60th Gulf and Caribbean Fisheries Institute, Punta Cana, Dominican Republic, November 2007.

A.W. Bruckner, R.J. Bruckner, and R.Hill. Improving restoration approaches for *Acropora palmata*: Lessons from the Fortuna Reefer grounding in Puerto Rico. Proceedings of the 11th International Coral Reef Symposium, Ft. Lauderdale, Florida, 7-11 July 2008

Presentations at Professional Meetings:
Ron Hill, Michelle Schärer, Michael Nemeth, and Andy Bruckner. Reef fish habitat use as a measure of coral reef restoration success at the Fortuna Reefer grounding site, Mona Island, Puerto Rico. Presented by Ron Hill at the 60th Gulf and Caribbean Fisheries Institute, Punta Cana, Dominican Republic, November 2007.

A.W. Bruckner, R.J. Bruckner, and R.Hill. Survivorship of *Acropora palmata* fragments over 10 years at the Fortuna Reefer restoration site. Presented by Andy Bruckner at the 11th International Coral Reef Symposium, Ft. Lauderdale, Florida, 7-11 July 2008

Ron Hill, Michelle Schärer, Michael Nemeth, and Andy Bruckner. Restoration -- more than corals: Reef fish habitat use measures coral reef restoration success at the Fortuna Reefer grounding site, Mona Island, Puerto Rico. Presented by Ron Hill at the 11th International Coral Reef Symposium, Ft. Lauderdale, Florida, 7-11 July 2008

Setbacks or challenges encountered in FY08: None

Comments on future direction of the project:
The project was originally presented as a long-term effort to monitor an important restoration site off the west coast of Puerto Rico. After 10 years we have accumulated data that can be attributed directly to the restoration techniques used. Any additional surveys in the future will be less frequent, for example, a follow-up survey in 3-5 years to determine changes occurring in the site relative to surrounding control areas.

V. REDUCE ADVERSE IMPACTS OF FISHING

Project ID#: 10299-2008

Title: Coral reef fish-habitat modeling to support ecosystem-based management

Names of PIs and co-PIs:
Todd Kellison (NOAA SEFSC)
Jerry Ault (UM-RSMAS)
Steven Smith (UM-RSMAS)
Jiangang Luo (UM-RSMAS)

Duration of Project: 2nd year

Project Category:

- Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2008:
Activities in FY08 focused on fish and habitat data from the Dry Tortugas coral reef ecosystem. Project PIs performed data analysis and model-building using two complementary approaches: regression and multivariate. Analyses focused on a suite of reef fish species, including both fishery-targeted (e.g., red grouper, black grouper, hogfish, gray snapper and mutton snapper) and non-fishery-targeted species (e.g., damselfish and grunts), as well as grouped response variables such as species richness. Results from analyses from each analytical approach were used to aid in interpretation of results from the alternate approach. Statistical analyses identifying the most powerful explanatory habitat variables enabled the subsequent building of models for multiple species to predict distributions of that species (or other response variable such as species richness) based on habitat characteristics. Model predictions can then be tested (planned for FY09 funds) by comparing predicted versus observed distributions.

Description of accomplishments & results:
We have identified and are continuing to identify specific suites of habitat characteristics that, in combination, best explain the distribution of reef fish species (e.g., black grouper, hogfish, yellowtail snapper), species groups (e.g., all groupers), and community indices (e.g., species richness).

How project supports goals & objectives of CRCP:
The CRCP supports effective management and sound science to preserve, sustain and restore valuable coral reef ecosystem. Results from this project will improve and facilitate effective fisheries and ecosystem management decisions by giving managers easy-to-interpret maps of species distributions, which can be used to guide zoning decisions in the Florida Keys National Marine Sanctuary and in other regions.

How project supports management of coral reef resources:
Aside from providing direct information on fish-habitat correlations, this information has been and will continue to be used to guide reef fish sampling protocols in the closely related CRCP

Project # 1064 – Assess and monitor coral reef MPAs. For example, the stratification system used to generate survey sites for FY08 CRCP-funded reef fish monitoring in the Dry Tortugas was improved based on results from the analyses described above. Since the monitoring efforts are used to assess the effectiveness of management actions (e.g., marine reserve establishment), this project has direct management utility. Additionally, project PIs have remained in close communication with Florida Keys National Marine Sanctuary (FKNMS) managers regarding output of this project. Managers have indicated that project results will be used in upcoming reassessments of marine reserve size, number and location in the FKNMS.

List of project partners and their roles:
University of Miami – Rosenstiel School of Marine and Atmospheric Science: UM-RSMAS researchers are leading the analytical component of this project.

Communications, media exposure, capacity building, education and outreach activities:
N/A in FY08.

Submissions to CoRIS: N/A in FY08.

Publications during FY2008: N/A in FY08.

Presentations at professional meetings: N/A in FY08.

Setbacks or challenges encountered in FY08:
Because funding can only be transferred from NOAA to co-PIs / project leaders at the University of Miami in June of each year, there is a 10-month lag between the beginning of the federal fiscal year (Oct. 1) and the time in which funds can be transferred to the co-PIs at the University of Miami. Thus, although FY08 has concluded, we are still only mid-way through the second year of funding (i.e., the second year of funding will end June 1, 2009).

Comments on future direction of project:
A multi-day workshop to communicate project output to federal and state managers is planned for 2009.

Project ID#: 1052 - 2008

Title: Grouper distribution, habitat characteristics and spawning behavior

Names of PIs and co-PIs:
Todd Kellison (NOAA SEFSC)

Duration of Project: 5th year

Project Category:
- Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2008:
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 FY08, efforts focused on two major project components: (1) completing analyses of telemetry data collected in FY06-07, and (2) completing analysis and assessment of stakeholder interviews pertaining to black grouper habitat utilization patterns.

Description of accomplishments & results:
For the telemetry component, preliminary analyses indicate relatively small movement ranges (high site fidelity) for black grouper regardless of season, suggesting the species could be effectively protected within spatial closures (marine reserves). A manuscript is in preparation for submission to a peer-reviewed journal.

For the stakeholder interview component, more than 50 stakeholders were interviewed. Interviewees included scuba instructors, commercial fishermen, charter boat captains, restaurant owners, and others. Consistent with findings from initial interviews performed in FY07, results suggest a general consensus on preferred black grouper habitat and seasonality, along with apparent conflicts and interactions between stakeholder groups. A manuscript is in preparation for peer-reviewed publication.

How project supports goals & objectives of CRCP:
Black grouper are likely a keystone predator in FL Keys and Dry Tortugas coral reef ecosystems. Project results will provide information on the likely utility of marine reserves versus other management approaches to effectively manage black grouper populations.

How project supports management of coral reef resources:
As indicated above, project results will provide information on the likely utility of marine reserves versus other management approaches to the effective management of black grouper populations. Once completed, results will be communicated to the scientific and management community through peer-reviewed publications and via direct communication with local managers (state and FL Keys National Marine Sanctuary).

List of project partners and their roles:
University of Miami – Rosenstiel School of Marine and Atmospheric Science: this project is the focus of and has funded a PhD student's dissertation research.

Communications, media exposure, capacity building, education and outreach activities:
N/A in FY08 aside from direct communication to FKNMS managers.

Submissions to CoRIS: N/A in FY08.

Publications during FY2008: N/A in FY08.

Presentations at professional meetings: N/A in FY08.

Setbacks or challenges encountered in FY08: N/A in FY08.

Comments on future direction of project:
FY08 is the final year of this project.

Project ID#: 1317 - 2008

Title: Acoustic seabed classification and quantification of reef fish habitat

Names of PIs and co-PIs:
Todd Kellison (NOAA SEFSC)
Art Gleason (UM-RSMAS)
Pam Reid (UM-RSMAS)

Duration of Project: 5th year

Project Category:

- Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2008:
The overarching goal of this project is to assess a single-beam sonar system (QTCV) for generating habitat maps in water too deep to be mapped with conventional methods such as satellite imagery. In FY08, efforts focused on determining if there is a relationship between benthic habitat characteristics and the locations of known historical fish spawning aggregation sites (FSAs) in the upper Florida Keys. Specifically, the objectives for FY08 were to complete mapping known FSA sites using the QTCV, summarize benthic habitat and geomorphology at the FSA sites, and prepare publications. These objectives were all met in FY08.

Description of accomplishments & results:
This project has resulted in the development of a habitat-mapping technology that is already being used in research to guide coral reef ecosystem management actions.

How project supports goals & objectives of CRCP:
This project is resulting in better assessments of the FL Keys coral reef ecosystem and in the identification of critical locations for management protection.

How project supports management of coral reef resources:
This project has indicated the likely ecological importance of reef habitats that are predominantly unmapped within the FL Keys National Marine Sanctuary due to their depth (> 20m). This project continues to result in the identification of critical locations (reef fish spawning aggregations) for management protection.

List of project partners and their roles:
University of Miami – Rosenstiel School of Marine and Atmospheric Science: this project has supported the dissertation research of a PhD student.

Communications, media exposure, capacity building, education and outreach activities:
Outreach has involved frequent discussions and a data presentation to State of FL and FKNMS managers.

Submissions to CoRIS: N/A in FY08.

Publications during FY2008:
Gleason, ACR, GT Kellison, RP Reid (in review) Geomorphology of grouper and snapper spawning aggregation sites in the upper Florida Keys, USA. Professional Geographer.

Gleason, ACR, RP Reid, GT Kellison. (in review) Single beam acoustic remote sensing for coral reef mapping. Proceedings of the 11th International Coral Reef Symposium, Ft. Lauderdale, FL.

The following manuscripts were partially supported by this project:
Miller, M. W., R.B. Halley, A.C.R. Gleason, 2008: Reef Geology and Biology of Navassa Island, in Coral Reefs of the USA, B. Riegl, R.E. Dodge (Eds.), Springer Press: pp. 407-434.

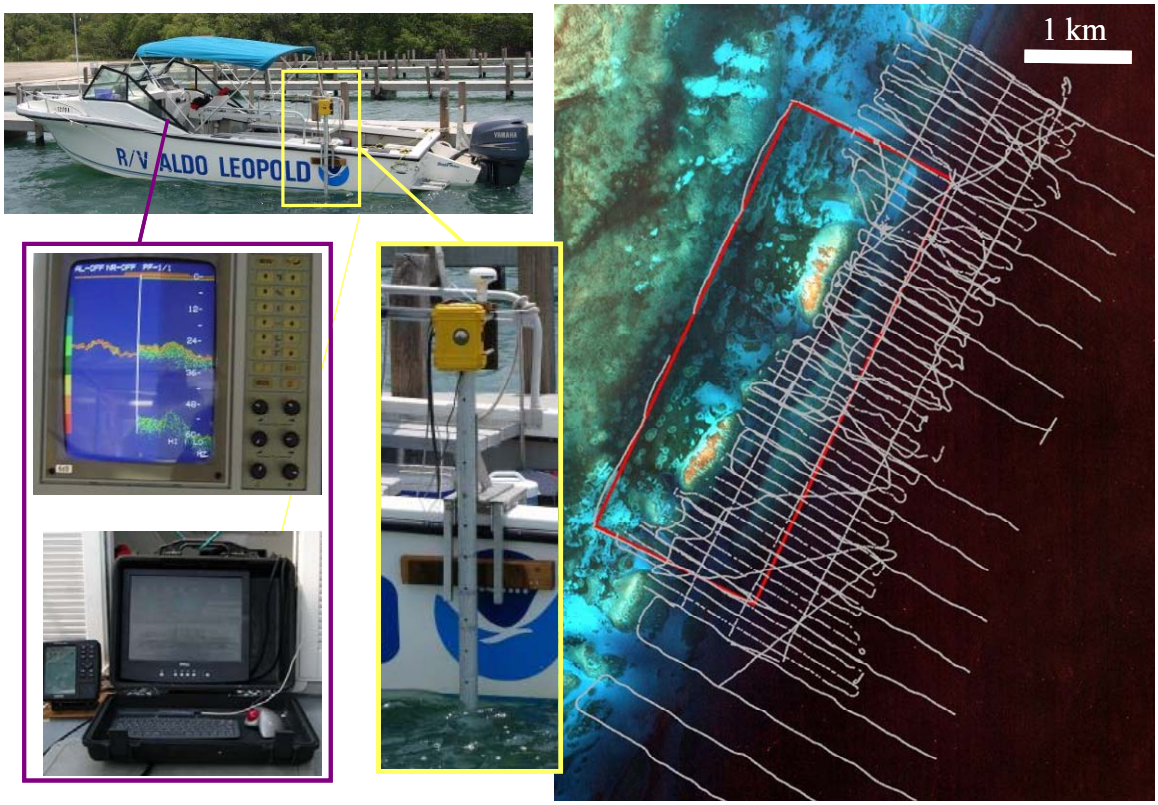
Miller, M. W., A. Gleason, D. McClellan, G. Piniak, D. Williams, J. W. Wiener, A. Gude and J. Schwagerl (2008). The State of Coral Reef Ecosystems of Navassa Island. in The State of Coral Reef Ecosystems of the United States and Pacific Freely Associated States: 2008. J. E. Waddell and A. M. Clarke, Eds. Silver Spring, MD, NOAA Technical Memorandum NOS NCCOS 73. NOAA / NCCOS Center for Coastal Monitoring and Assessment's Biogeography Team: pp. 117-129.

Presentations at professional meetings:
Oral presentation – annual meeting of the Association of American Geographers, Boston, MA, April 2008.
Oral presentation – 11th International Coral Reef Symposium, Ft. Lauderdale, FL, July 2008

Setbacks or challenges encountered in FY08: N/A in FY08.

Comments on future direction of project:
FY09 research will mark initiation of cooperative work with researchers from the National Ocean Service and the state of FL.

The figure below shows the QTCV acoustic mapping system developed under this proposal and an overhead view of Carysfort Reef (image on right) with white lines representing mapping transects and the red rectangle representing the borders of a marine reserve.



Project ID#: 1242 - 2008

Title: Hydroacoustic biomass assessment of reef fish spawning aggregations

Names of PIs and co-PIs:
Todd Kellison (NOAA SEFSC)
Jose Rivera (independent contractor)

Duration of Project: 5th year

Project Category:
- Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2008:
The objectives for FY08 were: 1) continued hydroacoustic surveys focusing on red hind spawning aggregations during the period of December 2007 to February 2008 and associated data analysis; 2) monthly hydroacoustic surveys throughout FY08 and associated data analysis at two of the following three sites (determined by weather and vessel availability), chosen for their importance as spawning aggregation areas based on previous years' surveys: Mona Island, Bajo de Sico, and Cabo de Rojo; and 3) potential expansion of surveys to known spawning aggregation sites in the northern Florida Keys.

Objectives 1 and 2 were fully accomplished. The potential expansion of surveys identified in Objective 3 did not occur, as we chose to focus efforts for baseline assessments at the sites listed in Objective 2. Surveys pertinent to Objective 3 are planned for FY09 under the related CRCP-funded project "Acoustic seabed classification and quantification of reef fish habitat" (T. Kellison, PI).

Description of accomplishments & results:
Project objectives were accomplished. Data were generated to support assessments of reef fish spawning aggregations and to be utilized in habitat utilization research.

How project supports goals & objectives of CRCP:
The CRCP supports effective management and sound science to preserve, sustain and restore valuable coral reef ecosystem. Results from this project continue to facilitate the status assessment of reef fish spawning aggregations and the effectiveness of temporal and spatial closures in protecting those aggregations.

How project supports management of coral reef resources:
Project results have been widely distributed to and used by managers, guiding multiple management actions.

Management actions initiated by the Puerto Rico DNER (Feb 10, 2004, Fishing Regulation No. 6768) which included closures to commercial and recreational fishing on the entire shelf of PR

jurisdictional waters during the red hind (*Epinephelus guttatus*) spawning season (December 1st to February 28th).
Mona Island, Puerto Rico, 2007: project results provided data that resulted in changing the protected area boundary to the 600m contour (versus more shallow) to protect deeper-water reef fish spawning aggregations.

The Caribbean Fisheries Management Council (CFMC) is currently (Nov. 2008) considering additional management actions for Bajo de Sico (BDS), one of the focal sites for this study. Based in part on output from previous years of this study which identified high densities of aggregating fishes at BDS, a number of management actions (seasonal closures and the prohibition of bottom gear such as traps) were enacted to protect reef fish at this site. The additional management actions being considered would limit fishing in the area to that targeting pelagic species (i.e., all bottom fishing would be prohibited, resulting in the protection of snapper and grouper stocks). In September 2008, the NMFS Southeast Regional Office, which is coordinating with the CFMC on the BDS management actions, requested data collected at BDS from our research project to guide the management process.

List of project partners and their roles:
Jose Rivera, independent contractor

Communications, media exposure, capacity building, education and outreach activities:
Direct and frequent communication of project updates to Puerto Rico and Caribbean Fishery Management Council representatives.

Submissions to CoRIS: N/A in FY08.

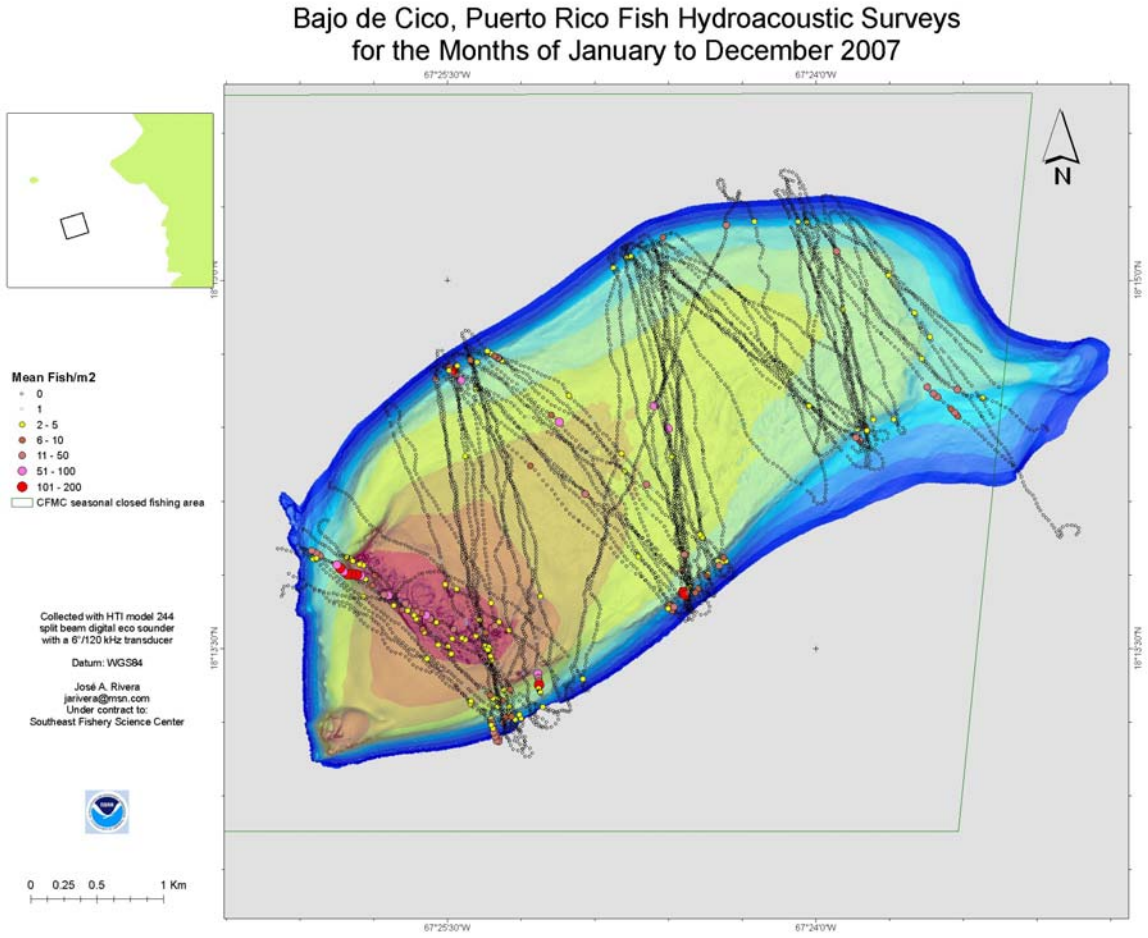
Publications during FY2008: N/A in FY08.

Presentations at professional meetings: N/A in FY08.

Setbacks or challenges encountered in FY08: N/A in FY08.

Comments on future direction of project:
FY09 research marks the initiation of direct collaboration with Puerto Rico researchers (led by Dr. Rich Appeldoorn, University of Puerto Rico at Mayaguez) and even closer coordination with Puerto Rico DNER managers.

As an example of project output, the figure below presents acoustically-derived reef fish density distributions during grouper spawning periods at Bajo de Sico, Puerto Rico.



Project ID#:1068-2008

Title: Assess/monitor effects of MPA status on reef fish populations and spawning aggregations in the Tortugas Ecological Reserves

Names of PIs and co-PIs:
Michael Burton (NMFS/SEFSC – Beaufort)
Roldan Munoz, Ken Brennan (Co-PIs)

Duration of Project: 5 years

Project Category:

- Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2008:
We conducted a 6 day research cruise to the Tortugas Ecological Reserves in July 2008 with 16 scientists and volunteers. Participants included biologists from the NMFS Beaufort Laboratory, NOS's CCFHR Beaufort facility, the SEFSC's Miami laboratory, the NOAA Coral Reef Conservation Program's headquarters staff, the Florida Fish and Wildlife Commission's Marathon Laboratory, the University of Miami's Rosenstiel School of Marine and Atmospheric Sciences, and volunteers from the Reef Environmental Education Foundation.

Description of accomplishments & results:
We completed 122 visual fish census sampling transects on the 16 stations of the south reserve and we completed 35 fish census transects on the nine sampling sites in the north reserve. We completed digital photographic habitat transects on 15 of 16 south reserve stations. We continued our search for spawning aggregations of mutton snapper using visual census and drift dive transects. We also explored probable and known SPAG sites by deploying split beam sonar and towing the acoustic fish for approximately 3 to 4 hours on two of the nights. We acquired large quantities of acoustic data that will be analyzed this winter that may yield SPAG locations.

Additionally, we assisted a new FWC project studying the movements of acoustically tagged adult reef fishes. Spatial and temporal rates of movement of acoustically tagged snappers and groupers will continued to be measured in the Tortugas region, including annual spawning migratory movements between Riley's Hump (RH), the Tortugas Ecological Reserves (TERs) and the Dry Tortugas National Park (DRTO), including the Research Natural Area (RNA). Results will assess the importance of habitat linkages between adjacent MPAs and provide information for an ecosystem-based approach to reef fisheries management. Movements are being monitored via an array of 65 VEMCO VR2 acoustic receivers deployed during 2008. In addition, the VemcoVR28 tracking system, a 4-channel receiver that provides transmitter position and bearing, was towed to confirm the presence of tagged fish at Riley's Hump two weeks after fish were implanted with tags. The VR28 tracking system will be used in the future to expand the geographic coverage of the VR2s.

In the first attempt at documenting and mapping the distribution of potential SPAGs of snapper that have been observed during previous cruises, we used a new Simrad ES60 split-beam

transducer and echosounder deployed using a custom tow-fish to hydroacoustically map the bottom along the southern edge of Riley's Hump where aggregations have been seen previously. The surveys were successful at detecting fishes in several locations, some appearing as dense aggregations.

How project supports goals & objectives of CRCP:
The primary goal of the CRCP is to protect, conserve, restore and manage coral reef resources by maintaining healthy ecosystem function and biodiversity while taking in to account local social and economic needs and cultural practices. Understanding and addressing the impacts of fishing is one of the major priorities of the program. Our project addresses these goals and priorities, by assessing the impacts of prudent fishery resource management practices like MPAs on the population of previously exploited fishery resources. We are trying to document the magnitude of resiliency of SPAGs once pressure on the fish stocks and habitat are abated.

How project supports management of coral reef resources:
Project results are provided to CORIS. A presentation will be made to the Florida Keys National Marine Sanctuary's Advisory Committee in 2009.

List of project partners and their roles:
Florida Keys National Marine Sanctuary – permitting for TER
FWC - cruise participation by biologists from their Marathon FL laboratory and reciprocal aid to their mutton snapper acoustic tagging project
The Reef Environmental Education Foundation - supplied volunteer divers the last three years and supplies their visual census data to the project for comparative analyses
National Ocean Service's CCFHR Beaufort Laboratory - supplied several divers to cruise efforts and new acoustic habitat survey to identify potential aggregation sites.

Communications, media exposure, capacity building, education and outreach activities:
An attempt was made to secure a NOAA Teacher at Sea for our summer cruise, but all available slots were allocated by the time we asked. Hopefully we will be able to secure one for next summer, if funded.

Submissions to CoRIS: Annual final report turned into CORIS.

Publications during FY2008: (including reports, tech Memos, etc): None completed, in progress.

Presentations at professional meetings:
Co-author on ICRS poster, June 2008, on effects of reserve designation in Tortugas North Ecological Reserve on fish populations

Setbacks or challenges encountered in FY08: None

Comments on future direction of project:
This project will continue to build on novel acoustic technologies to locate and monitor resiliency of exploited reef fish aggregations.

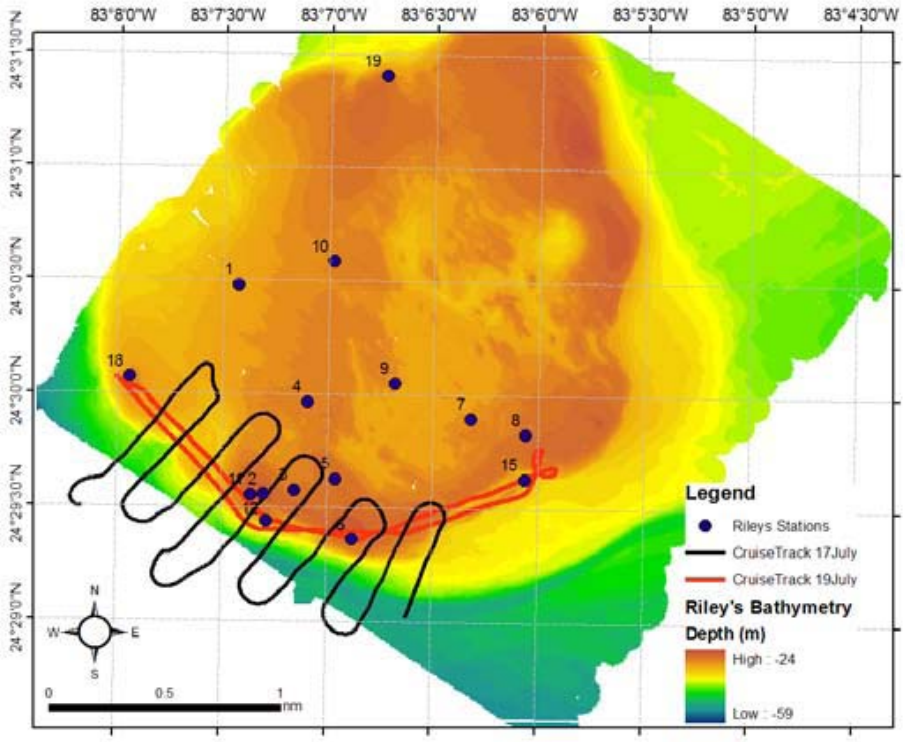


Figure 1. *Riley's Hump hydroacoustics survey design for 17 and 19 July. Bathymetry was provided by U of South Florida (B. Donahue, pers. comm.). Dive observation stations are added for reference. Survey lines for 17 July (black) followed a series of parallel lines perpendicular to the depth contours. Lines for 19 July (red) were parallel to depth contours at about 30 m.*

Project ID#:1668-2008

Title: Socio-economic profiles of fishing communities in US Caribbean

Names of PIs and co-PIs:
Juan Agar, NOAA/NMFS – SEFSC/Miami
James R. Waters, NOAA/NMFS – SEFSC/Beaufort

Duration of Project: 2 years

Project Category:

- Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2008:
The project had four main activities completed in FY08, a) Conduct the census of Puerto Rican commercial fishermen, b) Develop pilot input-output models for the Puerto Rico and U.S. Virgin Islands economies, c) Conduct socio-economic research drawing on community profiles already conducted, and d) Develop and pre-test costs and earnings survey for the hook and line, net and dive fisheries in Puerto Rico.

Description of accomplishments & results:
Fieldwork and data entry were complete, with a report due in 2009. Dr. Kirkley (VIMS) submitted pilot input-output models for Puerto Rico and USVI. A Report titled *'Cruzan Fishermen's Perspectives on the Performance of the Buck Island Reef National Monument and the Red Hind Seasonal Closure'* was completed with Ms. Stacee Karras (UM/MAF intern), and pre-testing on the survey instrument is complete. Fieldwork will be conducted in 2009.

How project supports goals & objectives of CRCP:
The successful implementation of coral reef protection policies requires understanding how these policies will affect the various users of this resource. This project seeks to advance coral reefs protection actions by providing managers with a deeper understanding of how fishing communities adjust to management actions. In the past, failure to understand and incorporate the human dimension into coral reef conservation strategies, often led to failed policies, because they lacked sensitivity to the local cultural, economic, political and social environment.

How project supports management of coral reef resources:
This project supports the management of coral reef resources by updating our knowledge of fishing communities (e.g., fishermen censuses, community profiles, trap costs and earnings) and by developing additional tools (i.e., input output models) that better assist us in examining the impacts of regulations. This project will benefit coral reef ecosystems by refining a set of best management practices (adaptive management), and by helping develop culturally sensitive policies, which can promote regulatory acceptance and compliance and improve biological conservation.

List of project partners and their roles:
Mr. Daniel Matos, PR DNER, field work on commercial fishermen census (contractor).
Dr. James Kirkley, VIMS, model development (contractor).
Ms. Stacee Karras, University of Miami (Department of Marine Affairs and Policy), research and report writing (graduate intern)
Mr. Manoj Shivlani, Thomas Murray and Associates, pre-testing of costs and earnings survey instrument (contractor).

Communications, media exposure, capacity building, education and outreach activities:
Summary on community profile work in Puerto Rico was featured in "Fuete and Verguilla", Vol. 2, No. 3 (August 2008), which is a SeaGrant publication geared towards commercial fishermen in Puerto Rico. (See, http://www.seagrantpr.org/catalog/files/fuete/vol2num3.pdf)

This project supports the development of a cadre of new scientists (via internships) interested in coral reef issues.

Submissions to CoRIS: None

Publications during FY2008:
Agar, J., J. Waters, M. Valdes-Pizzini, M. Shivlani, T. Murray, J. Kirkley, and D. Suman, 2008. U.S. Caribbean Fish Trap Fishery Socioeconomic Study. *Bulletin of Marine Science*, Vol. 82, No. 3, pp. 315-331.

Publication titled 'Cruzan Fishermen's Perspectives on the Performance of the Buck Island Reef National Monument and the Red Hind Seasonal Closure' was submitted to *Ocean and Coastal Management.*

Presentations at professional meetings:
Agar, J. and M. Valdes-Pizzini, 2008. The Quest for the Real and Authentic Fishing Community: Ethnography, Economic and Policies in the Case of St. Croix, United States Virgin Islands. Society for Applied Anthropology, Memphis, Tennessee.

Karras, C. and J. Agar, 2008. Cruzan Fishermen's Perspectives on the Performance of the Buck Island Reef National Monument and the Red Hind Seasonal Closure. 61st Annual Meeting of the Gulf and Caribbean Fisheries Institute, Gosier, Guadeloupe French West Indies.

Setbacks or challenges encountered in FY08: None

Comments on future direction of project: N/A

Project ID#: 1341-2008

Title: A Spatially Explicit Datawarehouse for Socio-Economic Analysis of Recreational Fishing

Names of PIs and co-PIs: Carlos Rivero (PI) – NOAA SEFSC, Miami, FL

Duration of Project: Ongoing project since FY2005

Project Category:

- Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2008:
We completed the geodatabase design document and published the Technical Memorandum, and procured a contractor to complete the development of the data warehouse.

Description of accomplishments & results:
The geodatabase design document describes the procedures and analyses that were used to create the geodatabase. This document provides users the necessary background information and understanding to ensure that the data is used correctly. We increased the number of registered users by 30%.

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 of coral reef resources:
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. We are working with Stock Assessment scientists to incorporate additional data sets and functionality to support enhanced spatial modeling of exploited reef fish species

List of project partners and their roles: None

Communications, media exposure, capacity building, education and outreach activities:
None

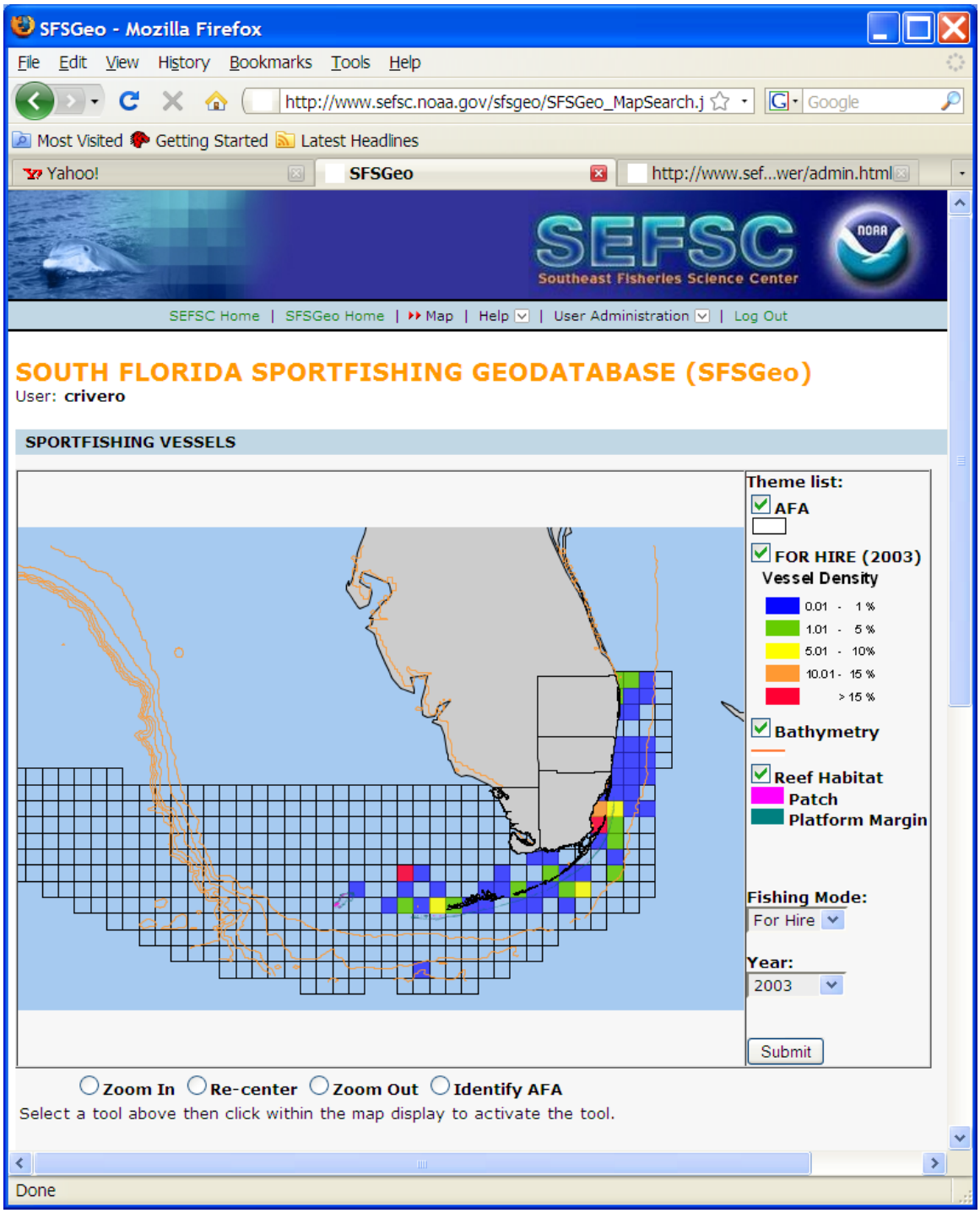
Submissions to CoRIS: Pending in 2009

Publications during FY2008 (including reports, tech Memos, etc):
NOAA Technical Memorandum NMFS-SEFSC-578
South Florida Sportfishing Geodatabase (SFSGeo) Design Document

Presentations at professional meetings: None

Setbacks or challenges encountered in FY08:
We were unable to hire a suitable contractor until September 2008.

Comments on future direction of project:
We are working with Stock Assessment scientists to incorporate additional data sets and functionality to support enhanced spatial modeling of exploited reef fish species



Screen Capture from the Geodatabase.

Project #: 10401-2008

Title: Reef fish recruitment dynamics: integration and analysis of long-term visual fish surveys to examine environmental influence

Names of PIs and co-PIs:
John F. Walter (PI), NOAA-Fisheries Service, SEFSC
David L. Jones (co-PI), University of Miami, CIMAS
Joseph E. Serafy (co-PI), NOAA-Fisheries Service, SEFSC

Duration of Project: 2 years

Project Category:
- Reduce Adverse Impacts of Fishing
- Reduce Impacts of Coastal Uses
- Improve Use and Effectiveness of MPAs

Brief description of activities conducted in FY2008:
The replenishment of certain reef fishes, operating through ontogenetic migrations from mangrove to reef habitats, was investigated by synthesizing two long-term monitoring efforts of populations of fishes from 1) the Florida Keys (J. Bohnsack, NOAA Fisheries) and 2) Biscayne Bay (J. Serafy, Univ. of Miami/NOAA Fisheries). Activities this year focused on obtaining, processing, quality control, mapping, and analysis of the two data sets with the goal of establishing the nature and extent of the linkage between juvenile mangrove nursery and adult reef habitats. This involves construction of predictive models of recruitment dynamics that incorporate ontogenetic habitat shifts (i.e., mangrove to reef), account for environmental variation, and allow estimation of reef fish stock size. Development of an annual, abundance-based index of recruitment, based on the juvenile survey data, will ultimately allow identification of essential juvenile fish habitat and provide the information necessary for appropriate fisheries and habitat management and adequate stock assessment.

Description of accomplishments & results:
Based on their presence and abundance in both the mangrove and reef surveys, ten target species from seven families were identified as having potential to exhibit ontogenetic shifts between the two habitats. These include commercially and recreationally valuable families (e.g., snapper, barracuda, and grunt) as well as ecologically important taxa (porgy, parrotfish, mojarra, and damselfish). Length and abundance data for these species collected during 981 mangrove and 931 reef surveys conducted over nearly a decade (1999–2007), along with associated environmental and habitat data, form the basis of our analytical work.

The mangrove data were partitioned according to spatial (habitat, lat/long) and temporal (year, season) treatments and redundancy analysis (RDA) was used to establish the influence of these along with several other environmental variables (i.e., salinity, temperature, depth, dissolved oxygen, freshwater discharge) on the distribution and abundance of juvenile mangrove fishes. Habitat provided the greatest influence on these fishes. Most (80%) of the target species showed an affinity for Leeward Key sites, which were farther from the influence of freshwater canal discharge than sites along the Mainland and closer to offshore waters where the adults

reside and larval input originates. Large-scale spatial trends in utilization of mangrove nursery sites within Biscayne Bay further highlight the importance of Leeward Key mangroves in providing essential nursery habitat, as 90% of the target species immature stages were significantly more abundant here than along the Mainland. Juveniles and/or subadults of all target species showed greatest abundances in the mangroves during the wet season, ostensibly coincident with seasonal peaks in reproduction. Life history stage data provide evidence suggesting habitat shifts from the mangroves occur between the juvenile and adult stages in 90% of the species examined. Patterns of habitat utilization among closely related species indicate alternative life history strategies exist to minimize competition among at least four of the target species.

Length and abundance data for the 10 target species were partitioned according to year-class (age $0–4^{+}$) using von Bertalanffy growth functions and used to generate nominal annual abundance indices separately for juveniles/sub-adults from mangrove surveys and adults from the reef. The relationship between indices derived from mangrove (juvenile) and reef (adult) fishes were examined after including a temporal lag from 1–4 years to allow for ontogenetic habitat shifts. Preliminary results based solely on nominal indices indicate strong, significant correlations exist between age-1 gray snapper from mangroves and age-2 adults on the reef ($r^2 = 0.69$, $p = 0.001$). Similar results were also found between age-0 and age-1 bluestriped grunt ($r^2 = 0.59$, $p = 0.011$).

How project supports goals & objectives of CRCP:

This project primarily addresses the following three issues of the National Coral Reef Action Strategy: 1) Reduce adverse impacts of fishing; 2) Reduce impacts of coastal use; and 3) Improve use and effectiveness of MPAs. Connectivity between mangrove forests and coral reefs, mediated by ontogenetic migrations of reef fishes that use mangroves for juvenile nursery habitat, may be crucial for the replenishment of adult populations on the reef. Indeed, strong linkages between these habitats appear to exist in the Caribbean (Mumby et al. 2004; Nature 427:533-536) and southern Florida (Ley and McIvor 1999, Ecosystem Sourcebook; Serafy et al. 2003, Bull. Mar. Sci. 54:299-306). However, direct evidence of this linkage and an understanding of the influence variability of juveniles within mangrove nurseries has on the dynamics of nearby adult reef fish populations is lacking—mainly because previous studies were focused on single habitats or life-history stages or used methodologies that precluded comparisons between habitats (Nagelkerken 2007, Bull. Mar. Sci. 80:595–607).

Integrating the data from both mangrove (juvenile) and reef (adult) surveys provides a unique opportunity to address questions related to recruitment dynamics and habitat connectivity not afforded to previous studies. The temporal overlap and similar experimental design and field methods employed by these surveys, combined with our ability to make age-class assignments based on fish length, allow us to overcome the limitations of previous studies and make direct comparisons between habitats and life-history stages.

The end products of this work will consist of 1) analytical results describing the nature and extent of the linkage between mangrove and reef fish populations, 2) indices-of-recruitment for Biscayne Bay mangrove and Florida reef tract fishes, 3) predictive models validating the indices and allowing estimation of reef fish stock size, and 4) GIS maps delineating essential fish habitat. These will be provided to policy-makers to support ecosystem-based management and

science-based assessment of fish stocks, such as that required by the fishery management plan currently under review by Biscayne National Park.

How project supports management of coral reef resources:
First, the combined datasets present a unique opportunity to examine patterns in the recruitment process that may have direct bearing in assessing the stock status of multiple fishes and, in turn, the overall health of coral reefs. To date, reef fish stock assessments based on fishery-independent, visual fish survey data for the Florida reef tract (e.g., Ault et al. 1998, Fish. Bull. 96:395-414) have not considered the variability (and low average sizes) of sub-adult and juvenile reef fishes that occupy adjacent mangrove habitats inshore. Furthermore few assessments of reef fishes incorporate recruitment indices which these datasets will allow us to develop and validate.

Second, by examining the connectivity of mangroves to the reef systems through one of the main routes of biomass transfer, the fish themselves, we may be able to determine landscape-level processes (development, extent of mangrove habitat, hydrography) that correlate with reef fish biomass. If, indeed, there are demonstrable linkages between mangrove habitats and the Florida Reef tract then mangroves may be a critical habitat for coral reef protection. In fact, Mumby (2006; Biological Conservation 128:215-222) has developed algorithms for the design of marine reserves which explicitly incorporate mangroves as nursery habitats for parrotfish, snapper and grunt species. The findings of this study may also have important implications for similar mangrove-reef systems, especially those that rim the Caribbean Basin.

Results obtained this year provide direct evidence that connectivity between adjacent mangrove and reef habitats occurs via ontogenetic migration and is largely responsible for driving replenishment of adult reef fish populations. This holds great promise for providing managers with the ability to: (1) project relative reef fish abundances 1-2 years into the future; and (2) account for recruitment variability when applying length-based and more conventional stock assessment methods, which typically assume constant recruitment.

List of project partners and their roles:
A collaboration was formed with Dr. D. Kerstetter of NOVA Southeastern University and his graduate student E. Machemer, whose work is focused on the analysis of occupancy and migration of fishes that make ontogenetic transitions from mangrove to coral reef habitats.

Communications, media exposure, capacity building, education and outreach activities:
In Fall 2008 a meeting was held with the superintendent and management staff of Biscayne National Park in which we described recent results of our project and discussed ways that our work can facilitate development of the Park's new fishery management plan.

Submissions to CoRIS:
FY2008 accomplishments report, FY2009 project proposal

Publications during FY2008: 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. Presented at the 11th International Coral Reef Symposium, 7–11 July 2008, Fort Lauderdale, FL.

Jones, D. L., J. Walter, and J. E. Serafy. Contribution of mangrove nursery habitats to replenishment of adult reef fish populations in southern Florida. Accepted for oral presentation at the 2008 Florida Bay and Adjacent Marine Systems Science Conference, December 8-11, 2008, Naples, FL.

Setbacks or challenges encountered in FY08: None.

Comments on future direction of project:
This project will likely finish in FY 2009, at which time we expect it to produce 1-2 publishable manuscripts.

Project ID#: 1873 – 2008

Title: Recovery of conch populations in the U.S. Virgin Islands

Names of PIs and co-PIs:
Jennifer C. Doerr, NMFS/SEFSC - Galveston
Dr. Ronald L. Hill, NMFS/SEFSC - Galveston
Dr. Thomas J. Minello NMFS/SEFSC - Galveston

Duration of Project: 4 years

Project Category: Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2008:
Research activities this year were conducted during two field expeditions to St. John, U.S. Virgin Islands, in March and July 2008. Mark-and-recapture, acoustic tracking, and habitat utilization studies continued in our historic study sites (Fish and No Name Bays) and were also successfully expanded to four new study sites. Brown Bay, on the northern coast of St. John, is located within VI National Park boundaries (no commercial and restricted recreational/subsistence fishing); Princess Bay, Otter Creek, and Water Creek are on the southeastern end of the island in VI Coral Reef National Monument (no-take reserve) waters. Extensive visual searches were conducted in all of our study sites. Queen conch encountered during these surveys were measured (shell length and lip thickness), tagged (if not previously tagged), and released. Environmental parameters were recorded at each conch location. Benthic composition, expressed as percent cover, was documented by centering a 1-m^2 quadrat directly over each conch and quantifying each organism (plant or sessile animal) or substrate.

After three years of data collection in areas under VI Division of Fish and Wildlife control (open to conch fishing per local regulations), it was deemed important to compare movement and survival within more closely managed resource zones. We expanded both tag-and-release and acoustic tracking to the study sites mentioned above. Several receivers were removed from the original array in Fish Bay and all receivers were removed from No Name Bay. The remaining receivers in Fish Bay will continue to provide coverage for the bulk of the bay's perimeter in areas that have been important to queen conch as well as to our collaborators studying neonate shark distributions and habitat use around St. John.

Hydrophone receiver arrays were established in Brown Bay, within Park waters (no commercial fishing, 2 conch/day/person - somewhat restricted fishing) and Princess Bay, Otter Creek and Water Creek, within Monument (no fishing) waters. Detection zones were defined for each newly located hydrophone receiver. During each field expedition we also performed routine maintenance and downloaded ultrasonic data collected from conch bearing acoustic tags. Bottom and surface temperature loggers were also downloaded and replaced in their original locations on each hydrophone and at various surface sites throughout the bays.

We continued to analyze downloaded acoustic data sets using ArcView GIS software and updated digital maps of long-term movements of individuals. Spatial coordinates of recaptured

conch were mapped and analyzed with benthic habitat data to estimate site fidelity and home range sizes for juvenile and adult tagged conch in Fish Bay. A presentation was made and a manuscript on conch home range size and movement rates was submitted to the 11th International Coral Reef Symposium. Mark-and-recapture data from 2008 were added to previous years data to add robustness to the Jolly-Seber analysis of recruitment, growth and survival that is the subject of an upcoming manuscript.

Description of accomplishments & results:
During tag-and-recapture studies this fiscal year, 1176 queen conch were located, measured, and tagged using Floy T-bar tags (439 in Brown Bay, 94 in Princess Bay, 234 in Otter Creek, and 409 in Water Creek). Throughout the first four years of this project we have tagged 3063 conch in six different bays around the island of St. John. Tagged conch included juveniles and adults ranging from 6 to 27 cm in length. Quantification of benthic habitats showed that queen conch in Brown Bay utilized mainly seagrass beds of *Syringodium filiforme*, *Thalassia testudinum*, and *Halodule wrightii*. Queen conch in Princess Bay, Water Creek, and Otter Creek were predominantly found in shallow reef habitats (rubble, *Porites spp.*, *Millepora spp.*, sponges) with sparse macroalgae (*Penicillus spp*., *Caulerpa spp*., *Dictyota spp*.) and bordered by mangroves.

Recapture surveys continued in our original study sites, Fish and No Name Bay. We were able to locate, measure, and collect spatial coordinates for 236 previously tagged conch between both areas. Many of these conch have been recaptured on multiple occasions over the past several years, providing valuable data on long-term movements and shifts in habitat utilization patterns over time.

Population estimates based on mark-recapture data and visual transect surveys in the original sites (Fish and No Name Bay) showed more queen conch than initially anticipated from published reports based on other survey techniques. The new study areas added this year (Brown and Princess Bay, Otter and Water Creek) were found to contain similar population densities. Discoveries of recently discarded shells from exploited conch continued along the shoreline of Fish Bay, with 152 total shells recovered. Nearly all of these were undersized juveniles (98%), 45 (30%) of which had numbered tags. This suggests a decrease in fishing activity from the previous year, during which we recovered 578 fished shells, although the illegal take of under-sized conch continues. Discarded shells were also found along the shoreline of Brown Bay (within the VI National Park) not only during our field visits, but also later by National Park Service rangers. Sixty-one shells were recovered, 16 (26%) of which were tagged juveniles

How project supports goals & 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. Conch are grazers that once were abundant in these reef ecosystems. Comparisons of past studies with current densities from these areas continue to show that queen conch populations are depleted although we may be seeing small signs of increase. This project's goals of understanding habitat needs, movement rates and migration corridors, and population trends through the use of traditional mark-and-recapture techniques and innovative sonic tracking technologies in bays around St. John that undergo different levels of fishery management directly addresses one of the primary goals of the CRCP of reducing adverse impacts of fishing. As contrast is established between areas under

different management controls, we can document the effect of management on population or demographic rates, and at the same time explore acceptable variance in habitat requirements leading us to habitat restoration or environmental controls. Additional research on population dynamics, habitat use, fine-scale movement patterns, and long-term migrations completed during the course of this project also supports the objectives listed under this goal refining the identification and assessment of essential fish habitat for this important species.

How project supports management of coral reef resources:
Continued funding of this project in FY-08 allowed expansion of research to protected areas within the VI National Park (no commercial and restricted fishing) and the VI Coral Reef National Monument (no-take reserve), thereby increasing available information regarding the impact on protection of the local queen conch populations. This permits direct comparisons of conch densities, growth and survival rates, and movement and migration rates between fished and non-fished areas, as well as the evaluation of the MPA/no-take reserve. There have been few studies to judge the success of past management actions on conch populations in the region. These data are needed to assess the effectiveness of current and future management practices.

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. Population size estimates and natural and fishing mortality data collected by this project were presented at the initial SEDAR 14 data collection workshop, supplementing historical information from the SEAMAP-C surveys. The data we presented 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 (standing stock biomass) for the U.S. Virgin Islands. While it was judged that the densities of conch for the USVI were low but possibly showing signs of some improvement, the need for more fishery-independent data has been identified by SEDAR as a high priority in order to reevaluate conch stocks in 2010.

List of project partners and their roles:
Collaborative field work continued with the NOAA/NMFS Apex Predator Program from the Narragansett Laboratory, as well as the NCCOS Biogeography Team. With our assistance, researchers from the Apex Predator Program are conducting acoustic monitoring of juvenile shark utilization of nursery areas in Fish Bay and Coral Bay, sharing our acoustic array and exchanging tag detection data. They have also installed additional receivers in Coral Bay (near our VI Coral Reef National Monument study areas), expanding detection coverage for acoustically tagged conch within Monument waters. Additional hydrophone arrays maintained by the NCCOS Team are also passively monitoring for acoustic tags deployed on queen conch around St. John, expanding spatial coverage of local populations. We have provided them with several tag returns to augment their detections in their reef fish study.

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 includes equipment storage and assistance in identifying alternate areas with historical queen conch populations. The Park Service and the USVI Division of Fish and Wildlife

participated in the initial synthesis of collected data and results and continue to provide notification when tagged conch, generally fished, are found around our sites or in other areas of the island.

Communications, media exposure, capacity building, education and outreach activities:
Opportunities for education and outreach have occurred locally in the Virgin Islands. We have spent a number of hours each trip talking to local residence about our research and the need for increased coral reef conservation. An educational initiative was also developed to disseminate information on queen conch and coral reef conservation to area schools around St. John. In FY-2008 we worked with participating teachers in two different grade levels at the Gifft Hill School on St. John to develop lesson plans, classroom sessions, and field activities for implementation in FY-2009. In 2008, we collected underwater video footage of conch activities including movement, feeding, mating, and laying of egg masses to supplement classroom activities.

Submissions to CoRIS:
The publication listed below has been provided to CoRIS. Additional 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. Maps are being updated using data collected during our recent trip in August 2008. These products are being added to the NMFS/SEFSC Galveston Laboratory's web page and the link has been provided to CoRIS.

Publications during FY2008:
Doerr, J.C and R. L. Hill. 2008. A Preliminary Analysis of Habitat Use, Movement, and Migration Patterns of Queen Conch, *Strombus gigas*, in St. John, USVI, Using Acoustic Tagging Techniques. Proceedings of the 60th Annual Gulf and Caribbean Fisheries Institute, Punta Cana, Dominican Republic, November 2007. **60:**509-515.

In addition, the accompanying manuscript to the presentation described below, entitled "Movement patterns of queen conch, *Strombus gigas*, and utilization of coral reef habitats in St. John, U.S. Virgin Islands," was submitted to the ICRS proceedings journal.

Presentations at Professional Meetings: A poster presentation, "Movement Patterns of Queen Conch, *Strombus gigas*, and Utilization of Coral Reef Habitats in St. John, U.S. Virgin Islands" was made at the 11th International Coral Reef Symposium held in Ft. Lauderdale, FL, from July 7-11, 2008.

Setbacks or challenges encountered in FY2008:
Due to increased travel costs (and a static funding amount), only two sampling trips could be completed this year. Although we extended those trips by a few days, the diminished sampling schedule reduced the inputs for population estimates, decreased the frequency of collecting habitat and spatial use data, limiting our ability to assess seasonal variability in habitat use and affecting our interpretation of fine-scale habitat use patterns.

Comments on future direction of project:
We plan to complete the field portion of the project with FY-2010 funds, with possible partial funding in FY 2011 to complete data analysis, reporting, outreach, and publication efforts. This will give us a complete 3-year data set within the Park and Monument waters. That is the minimum needed for the Jolly-Seber analysis of demographic rates (survival and growth) and population size for a robust comparison between protected and fished areas. However, there is a strong need for continued monitoring of reef species like queen conch, in order to assess the effectiveness of management measures and adapt management as needed. We have been actively seeking funding through other mechanisms to institute additional monitoring in St. Croix, Virgin Islands. Continued support of similar projects through the CRCP would be leveraged to provide the maximum benefit to this important reef resource.

Project ID#: 1244 - 2008

Title: Monitoring Coral Reef Fish Use of MPAs and Recruitment Connectivity Between the Florida Keys and Mesoamerican Reef

Names of PIs and co-PIs:
John Lamkin - NMFS/SEFSC

Duration of Project: 5

Project Category:

- Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2008:
Zooplankton samples are being identified and sorting of samples from 2007 completed this year. Workshop conducted to begin synthesis of data sets

Description of accomplishments & results:
To date this study has used inshore collecting at known grouper and snapper spawning aggregations along the Yucatan coast and two cruises (2006 and 2007) aboard the NOAA Ship GORDON GUNTER to map larval reef fish distributions and recruitment mechanisms. The main inshore study sites in the Yucatan are the Biosphere Reserves of Sian Ka'an, Xcalak, and Banco Chinchorro. These are located along the southern coast of Quintana Roo, Mexico and represent some of the most extensive and well preserved coral reef ecosystems of the Mexican Caribbean. In 2003 we met with our colleagues from El Colegio de La Frontera Sur (ECOSUR) in Chetumal and Centro de Investigacion y de Estudios Avanzados (CINVESTAV) in Merida, who began monthly sampling throughout 2004 monitoring inshore settlement at Ascension Bay (in Sian Ka'an) and Xcalak (southern Quintana Roo). In 2005 (March and August) we conducted an intensive joint field project with ECOSUR monitoring the influx of larval fishes, collecting associated meteorological and oceanographic data, and identifying spawning aggregation sites. Cooperative efforts resulted in identifying 25 spawning aggregations along the Mexico coast, primarily in the southern Yucatan Peninsula. Distribution of larval grouper will allow verification or some of these sites. Larval reef fish transport modeling, technology transfer, training, and public outreach in Mexico are significant components of the program. Workshops were conducted in Mexico with regional fishing cooperatives and residents of the local community. Efforts are being coordinated with ongoing projects by the World Wildlife Fund, the World Bank, and The Nature Conservancy. The long term goal of this project is to ensure that coral reef fish populations are managed in a way that ensures a vibrant and healthy ecosystem and abundant marine resources for generations to come.

How project supports goals & objectives of CRCP:
Protect and enhance coral reef fisheries and protect spawning aggregations by identifying aggregations, monitoring recruitment, and determining larval transport trajectories.

How project supports management of coral reef resources:
The Mesoamerican Reef Ecoregion extends for 1000 Km from the Honduran coast to the northern tip of Mexico's Yucatan Peninsula. South Florida's reef system begins with the Dry Tortugas Marine Reserve and National Park. Both areas face threats to coral reef health from agricultural runoff and development and the escalating degradation of both reef systems has become a concern. In response to these threats the U.S. has developed management plans and monitoring efforts. However, in the Mesoamerican reef system, even basic baseline data often does not exist, and this lack of information hinders our ability to evaluate impacts to the reef ecosystem. In addition, these two ecoregions are hydrographically connected by the Caribbean Current which flows north along the Yucatan Peninsula shelf into the Gulf of Mexico, then along the Florida shelf via the Loop Current. But are they linked biologically, and to what extent? Previously the dominant view held that reef fish populations are demographically open, that the majority of reef fish spawned along the reef do not return to the natal population. More recent work has challenged that view suggesting that reef fish populations are retained to some degree, with the majority of larval fish returning to the natal population. This study is designed to map the distribution and abundance of larval reef fish and oceanographic currents along the shelf and inshore, develop comparative baseline recruitment data for snapper and groupers, and provide data to examine the biological linkage between these two eco-regions. This information is necessary for management of these species, evaluating the effectiveness of Marine Reserves, and developing sustainable fishing practices in both the U.S. and Mexico, and learning how US reefs are impacted by upstream practices. Ultimately our success will be measured by the degree to which we are able to obtain a clearer understanding of the processes involved in connecting marine ecosystems through population replenishment.

List of project partners and their roles:
Atlantic Oceanographic and Meteorological Laboratory - physical oceanography analysis
El Colegio de La Frontera Sur (ECOSUR) in Chetumal - inshore recruitment
Centro de Investigación y de Estudios Avanzados (CINVESTAV) in Mérida, and Centro de Investigacion – larval fish identification
Científica y de Educación Superior de Ensenada (CICESE) in Baja California, México, - long term analysis of current trajectories
University of Belize - Ichthyoplankton analysis
Boston University – recruitment studies on grouper, collaboration with Conservation International

Communications, media exposure, capacity building, education and outreach activities:
A project workshop was held at the University of Miami, RSMAS in September 2008 to review progress on this project, assign data compilation and analysis tasks and create an outline of responsibilities for publication and report genesis.

Submissions to CoRIS:Yes

Publications during FY2008: Report for cruise activities 2007.

Presentations at professional meetings: None

Setbacks or challenges encountered in FY08: None

Comments on future direction of project:
This project will end in 2010. No further collecting efforts are planned. Further work will be synthesis, publication and dissemination of collected information

September 2008 Workshop Participants

Project ID#: 1067-2008

Title: Monitoring Coral Reef Fish Utilization of Marine Protected Areas and Inshore Habitats in Florida Bay

Names of PIs and co-PIs: Trika Gerard and John Lamkin (NMFS/SEFSC)

Duration of Project: 5 years

Project Category:

- Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2008:
This study examines the concentration of $\delta^{13}C$ and $\delta^{18}O$ stable isotopes in the otoliths of four snapper species found in Florida Bay as an indicator of environmental factors and metabolic activity of these fishes. Interspecies and temporal analyses were performed on samples taken from seven sites over five years including 133 km of representative habitat (mangrove and seagrass) in Florida Bay (see Figure 1). Collections of fish samples from Florida Bay was continued to extend the temporal extent of the study into 2009. The second component of this study analyzes the juvenile portion of adult gray snapper otoliths collected within the Florida Keys National Marine Sanctuary in order to potentially match them to one of five previously assigned nursery regions (Gerard, PhD dissertation). Adult gray and yellowtail snappers (n = 194) were collected from nine sites along the Florida reef tract in 2004 (see Figure 1).

Description of accomplishments & results:
Results suggest that stable isotope concentrations in snapper in Florida Bay are species-specific. Interspecies comparisons were inconsistent, with the most promising interspecies comparison occurring between schoolmaster and gray snapper found in the Northeast portion of Florida Bay. Further research with more comprehensive data is necessary to draw stronger conclusions. For the second component, we have successfully removed the juvenile portion of 194 adult otoliths, analysis is ongoing.

How project supports goals & objectives of CRCP:
Commercially, recreationally and ecologically important snapper species migrate to reefs from juvenile nursery areas such as seagrass and mangrove habitats including those in Florida Bay and the lower Florida Keys. Many of these nursery areas face degraded water quality, shoreline development and other anthropogenic threats. Understanding the ontogenetic migration corridors that exist between nursery and reef, and the timing of these migrations is critical to building sustainable populations and effective MPA's. Ecosystem research on the links between habitats and particularly their function as sources and destinations of recruits is key to the long-term monitoring and effective management of these areas. The South Florida Coral Reef Initiative calls for the establishment of no-take reserves within these MPA's and we believe that only with effective identification and protection of sources of recruits can we ensure the effective function of MPA s as reef fish sanctuaries.

How project supports management of coral reef resources:
Fish density and biomass on reefs are correlated to the reef's connection with adjacent seagrass and mangrove systems. Many western Atlantic reef fish species appear to make ontogenetic migrations

that follow the sequence of utilization from seagrass to mangrove to reef habitats. This project is designed to map the source of recruits of snapper species in south Florida to better understand the large to small scale processes driving reef fish recruitment. New technology enables scientists to detect the microchemical constituents of fish otoliths and determine trace "elemental signatures". These signatures can differ among stocks exposed to different water masses and environmental conditions allowing them to serve as natural tags for tracking fishes. The ability to reconstruct the environmental history of individual fish is a significant advancement and offers a new tool to fisheries management.

The source of recruits for reef fish is of particular importance given the recent efforts to restore Florida Bay and the upstream Everglades and the establishment of MPA's and the Tortugas Ecological Reserve. Otolith microchemical analysis perfected during this research endeavor paved the way for further studies that can identify sole or multiple sources of recruits to MPA's such as the Tortugas Ecological Reserve. This project will provide new methods of managing coral reef fish for long term sustainability.

List of project Partners and their roles:
Florida Keys National Marine Sanctuary - sampling input and design
University of Miami, RSMAS - Stable Isotope Laboratory, otolith sample analysis.

Communications, media exposure, capacity building, education and outreach activities:
Part of this project was submitted and accepted as a Senior Thesis by Anne Morgan to the Biology Department at the University of Miami.

Submissions to CoRIS: none

Publications during FY2008:
Lara, M., Jones, D., Chen, Z., Lamkin, J., Jones, C. 2008. Spatial variation of otolith elemental signatures among juvenile gray snapper (*Lutjanus griseus*) inhabiting southern Florida waters. Mar. Biol. 153:235-248.

Presentations at professional meetings:
Variations in Carbon and Oxygen Stable Isotopes Snapper (Lutjanidae) in Florida Bay and Florida Keys. By A. Morgan, T. Gerard, B. Muhling, E. Malca, and J. Lamkin; Oral presentation at the Florida Bay and Adjacent Marine Systems science conference, December 2008, Naples, FL.

Setbacks or challenges encountered in FY08:
The Micromill, which is the precision drill instrument used to measure the juvenile portion of otolith, was offline and delayed some laboratory work. However the problem has been fixed.

Comments on future direction of project (outyear plans and notes on how project (or future projects) will align with new CRCP priorities going forward):
We have developed methodologies to look at habitat linkages between nursery areas and coral reefs. We intend to apply our expertise to the US Virgin Islands targeting reef fish species such as snappers, groupers and parrot fishes.

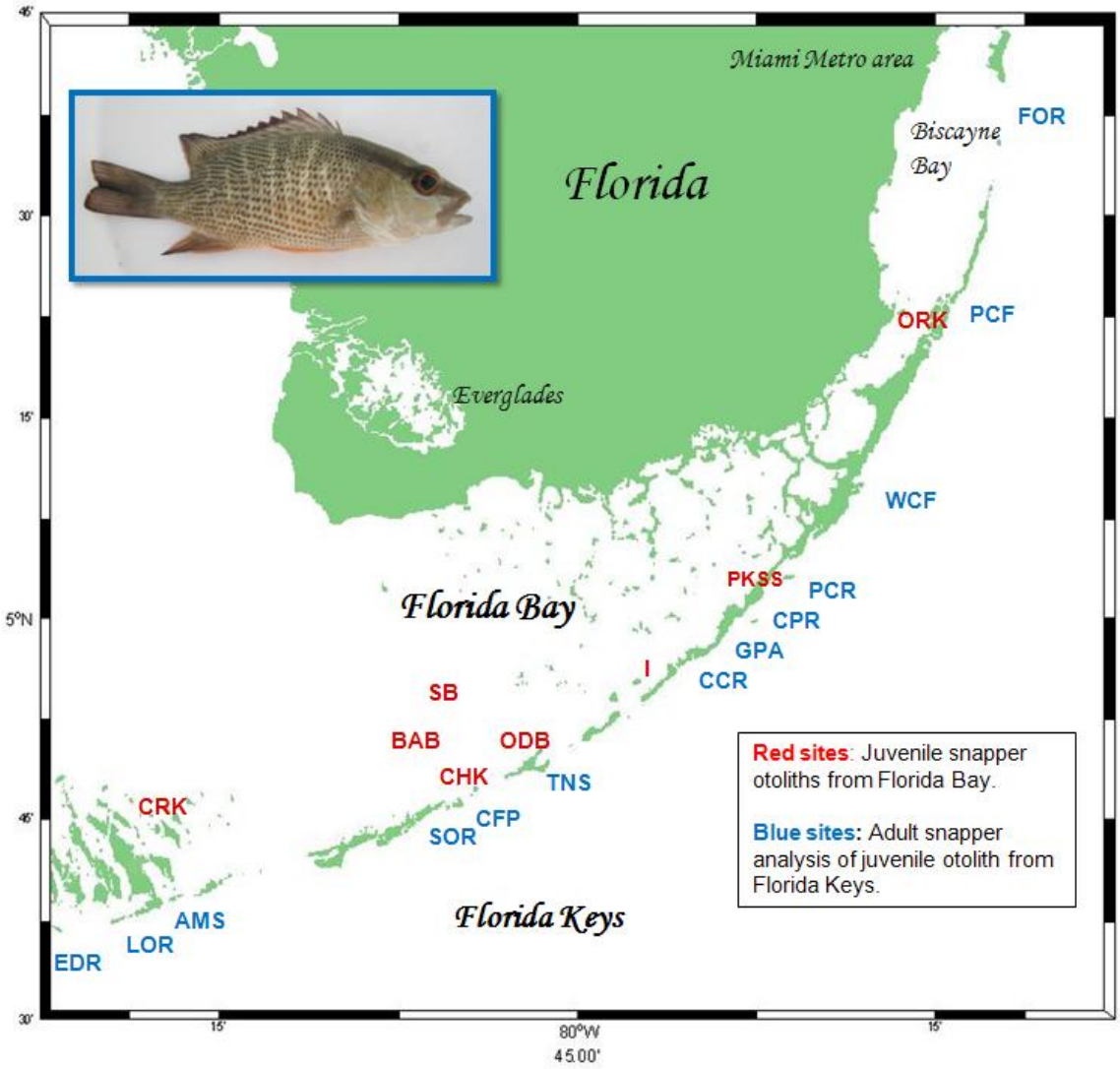


Figure 1: Map depicting sampling sites for interspecies project (red) with adult stations on the Florida Keys reef track (blue).

Project ID#: 10292 - 2008

Title: Impacts on coral reef habitat productivity from fishing (Renamed 2009: Productivity of *Acropora cervicornis* habitat and impacts from natural and human disturbance)

Names of PIs and co-PIs:
Dr. Ron Hill, NMFS/SEFSC
Dr. Andy Bruckner, NMFS/OHC

Duration of Project: 2 years

Project Category:

- Reduce Adverse Impacts of Fishing

Brief description of activities conducted in FY2008:
Research activities this year were conducted during two field expeditions to St. John, U.S. Virgin Islands, in March and July 2008 and two field expeditions to Puerto Rico, in February and June 2008. We completed surveys of all 19 permanent transects (2 x 10m), recording point intercept measures of coral cover, observations of coral health (i.e., disease or predation effects), size measurements of coral colonies or thickets, censuses of reef fishes (i.e., lowest taxa, abundance, and size), and disturbance incidents. Photoquadrats for cover analysis were completed for all transects at 1 m intervals, right and left of taut center line. During surveys, water quality parameters (i.e., dissolved oxygen, temperature, and salinity) were measured. Data from continuously recording temperature loggers were downloaded and loggers were reset and redeployed. During the March visit to the VI, we found a piece of a presumed cargo net entangled in the *A. cervicornis* of one transect. The net was removed, extent of damage was described and photographed, and subsequent assessments have included recovery characteristics of the colonies. Additional nearby colonies have been measured and mapped around St. Thomas sites and San Cristobal in La Parguera.

Description of accomplishments & results:
This research is documenting the contribution *Acropora cervicornis* makes to productivity of shallow coral reef ecosystems by linking coral growth/vitality and fish production. Data will support valuation studies of coral reefs and, by correlating environmental parameters to positive or negative changes in growth and productivity, it will guide conservation actions.

Sample sites with permanent transects have been established at Mona Island (2 sites, 5 transects) and La Parguera (2 sites, 5 transects) in Puerto Rico and Thatch Key (4 transects), Lovango Key (2 transects), and No-name Bay (3 transects), St. John in the USVI. Each site consists of permanent transects (10 x 2 m) that have been surveyed repeatedly, collecting data on coral cover, colony height and width, incidence of disease or predators, and fish assemblages. Conditions were documented with photo-quadrats. In adjacent areas, random transects have been completed as well as identifying and monitoring individual colonies. At Mona Island we worked with a CRCP grant-funded researcher (Univ. of Houston) to transplant *A. cervicornis* coral nubbins to nearby areas to compare with natural colony growth. Surveys in FY-08 documented

effects from a net in one of the Thatch Key transects. The net was removed and recovery is being studied as part of the design.

Overall, signs of *A. cervicornis* growth were evident at Thatch Key and No-name Bay, signs of decline were evident at Lovango Key, San Cristobal and Coral Gardens (La Parguera). Continuous nutrient monitoring is being instigated in 2009 to evaluate additional water quality parameters as drivers for change in colony vitality. Documentation of juvenile habitat use by snapper and grunts and parrotfishes have been a strong component of the research.

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 contributed to mapping of Acroporids for biological assessments and ESA recovery determinations**.**
Assessments, Inventories, and Monitoring: Project will be monitoring condition of *A. cervicornis* across PR and USVI for comparisons among sites, among reefs and among islands.
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 observed.

How project supports management of coral reef resources:
At present we do not understand the ways coral reef ecosystems vary under natural conditions making it hard to differentiate natural and anthropogenic changes. This project focuses on the threatened staghorn coral and documents its growth patterns and its function as reef fish habitat, for example, for juvenile snappers, grunts, and parrotfishes. It is coupling environmental measurements with changes in coral vitality and growth and subsequent changes in fish habitat value. Additional surveys of damage from fishing gear (e.g., traps or nets) will help distinguish natural (e.g., storm) damage from human-induced damage. Parameters such as site-specific nutrient loading and temperature variations are being correlated with changes in coral colonies, such as algal overgrowth or coral disease. We will be looking to link cycles in environmental conditions with cycles in coral decline or rejuvenation. This will help us identify conditions under which corals can flourish and those under which corals decline. By knowing which conditions are important for long-term coral survival, various human activities (e.g., land-use practices) can be examined for linkages to coral loss and degradation. By identifying natural variations and the timeframe over which changes occur, it will give us a better understanding of which conditions should be of concern to managers. Understanding the ways in which *A. cervicornis* communities change in support of healthy reef systems will allow managers to more fully address the impacts to these habitats, improving capacities for both coral reef management and reef fisheries management.

List of project partners and their roles:
Collaborative field work continued with other projects funded by CRCP. Joint field work is conducted with the Conch Population study (SEFSC-Galveston, PI: Doerr), Coral Disease (NOAA Fisheries, PIs: Bruckner (Office of Habitat Conservation) and Hill (SEFSC-Galveston)), Fortuna Reefer (NOAA Fisheries, PIs: Hill and Bruckner) sharing manpower, boat use and minimizing travel expenses. Continued logistical support from the Virgin Islands National Park Service (NPS) includes equipment storage and NPS and USGS have provided assistance in

research planning, identifying areas for surveys. Reports of results are shared with NPS, USVI Division of Fish and Wildlife, and NOAA Fisheries Protected Resources Office. In Puerto Rico, the Department of Marine Sciences, University of Puerto Rico-Mayagüez, is providing logistical support and graduate students have provided field assistance.

Communications, media exposure, capacity building, education and outreach activities:
Opportunities for education and outreach have occurred locally in the Virgin Islands and Puerto Rico. We have spent a number of hours each trip talking to local residents about our research and the need for increased coral reef conservation. These include fishermen, dive operators, boaters, tourists, and students.

Submissions to CoRIS:
To date, research cruise reports have been generated and links provided to CoRIS. Maps and project details are being added to the NMFS/SEFSC Galveston Laboratory's web page and have been included in the C-CCREMP website of Caribbean monitoring projects (see project 10051-2008).

Publications during 2008: None, data collection on-going.

Presentations at Professional Meetings: None

Setbacks or challenges encountered in FY08:
Due to increased travel costs, a slightly reduced sampling effort was accomplished this year. Efforts to sample random sites and map additional colonies were reduced with preference given to monitoring permanent transects. Purchase of the Microlab Nutrient Analyzer was delayed until after field work had been completed so initiation of continuous nutrient monitoring was delayed. The unit will be deployed as early in 2009 as possible.

Comments on future direction of project:
The project was originally presented as a long-term effort to monitor the threatened *A. cervicornis* and its contribution to coral reef productivity and coral reef fisheries. We will be seeking continued funding through CRCP and additional funding through other sources to extend this work with a timeframe effective in testing research hypotheses and supporting improved management of these important reef resources.

Project ID#: 1685-2008

Title: Race to the Reef: Juvenile Snapper Acoustic Tagging and Tracking (previously: Developing Site Fidelity & Essential Habitat Assessment Tools for Juvenile Snappers

Names of PIs and co-PIs:
Samantha Whitcraft (PI), University of Miami-CIMAS;
John Lamkin, NOAA – Fisheries Service, SEFSC;
Craig Layman (co-PI), Florida International University

Duration of Project: 4 years (CRCP funded 2005-2007)
NOTE: This project was not funded by CRCP in FY-08, however, a self-funded study was conducted and described herein.

Project Category:

- Reduce Adverse Impacts of Fishing
- Improve Use and Effectiveness of MPAs
- Address Emerging Issues

Brief description of activities conducted in FY2008:
In May 2008, 44 sub-adult mangrove snapper were acoustically tagged in two different habitats (mangrove and man-made/hardened shoreline) in the Loxahatchee Estuary. The project then tracked the movement of these fishes inside the estuary and river via 21 acoustic receivers. In April 2008, an additional 13 receivers were installed as 'migration gates" at the all inlets/outlets to the estuary in order to determine movements linking the estuarine nursery habitat with coastal and off-shore adult reef habitats (Fig 1). Receivers were downloaded approximately every other month between May and December 2008.

As part of the Florida Atlantic Coast Telemetry (FACT) Project, the snapper tagging project is exchanging fish tag codes with 15 other PI's along Florida's Atlantic Coast and the wider Bahamas in order to cooperatively track both local and large-scale movements of multiple reef-associated species (Fig 2).

Description of accomplishments & results:
Sub-adult snappers, as compared to juvenile snappers, show a less distinct and consistent diurnal/nocturnal movement patterns and those that do leave the mangrove habitat at night, to forage, avoid the transition zone at the mangrove/seagrass interface.

Starting in the spring, with increased freshwater inflow into the estuary, juvenile snapper movements tend be in downstream direction toward the more marine habitat at the inlet.

In August, one of the largest sub-adult mangrove snappers was spear-fished at a reef approximately two miles south of Jupiter Inlet; the tag was reported on a community webpage/blog and state officials contacted NOAA-SEFSC. This positive interaction provided for important community outreach opportunities with local recreational fisherman; we posted a

project update and contact information on the community webpage/blog to allow for future community outreach opportunities.

The mangrove snapper spear-fished on the marine reef was originally caught and tagged at an estuarine mangrove habitat in May and demonstrates the connectivity between the limited sub-tidal nursery habitats in the Loxahatchee central embayment and the offshore reefs as adult habitat.

Additionally, educational outreach activities included a project presentation to undergraduate students at Florida International University as part of a Marine Coastal Conservation class; students were invited to tour the SEFSC to learn more about NOAA's role in local conservation and management.

As part to the larger, Florida Atlantic Coast Telemetry Project (FACT) – now including 15+ local, state and federal partners tracking 7 marine species across a combined acoustic array covering all the inlets and much of the offshore reef of the central Florida Atlantic coast – the NOAA CRCP's Juvenile Snapper Acoustic Tracking Project coordinated a two-day data analysis and exchange workshop for all FACT partners. The coordinated working group allows for expensive acoustic receivers to be more efficiently placed to cover more habitats across the coastal ecosystem – so that fish are tracked from river to reef.

Data analysis of >700,000 data points of fish movements within and out of mangrove/seagrass habitats and the trend of the movements towards the offshore reefs is on-going.

How project supports goals & objectives of CRCP:
This project assesses habitat utility of various life stages of a commercially important reef fish. This information is important for effective management, including citing of marine protected areas in order to ensure corridors for ontogenetic migrations. This project also assesses impacts of anthropogenic activities on fish utility of estuarine nursery habitats.

How project supports management of coral reef resources:
See text above. Results are communicated to managers and academic communities via the Loxahatchee Science Symposium 2007, coordination of research objectives, design, and data with management community, monthly meetings and/or phone conferences, our project website: www.adoptafish.net

List of project partners and their roles:
University of Miami-CIMAS – staffing
Florida International University – study design, logistics, boat- use, project webpage, and student interns
Loxahatchee River District – staffing, logistics, boat-use
Amirix-Vemco, Inc. – consulting on equipment
National Fish and Wildlife Foundation – funding

Communications, media exposure, capacity building, education and outreach activities:
1. Loxahatchee Science Symposium 2007

2. Friends of the Loxahatchee Meetings
3. Student intern participation/training – UM and FIU
4. www.adoptafish.net
5. July 2008 article in Palm Beach Post

Submissions to CoRIS: Yes

Publications during FY2008: None

Presentations at professional meetings:
1. Presented talk at Biology Symposium, FIU
2. Presented talk at Tag2008 Conference, New Zealand
3. Poster at the International Coral Reef Society Meeting, Ft. Lauderdale 2008

Setbacks or challenges encountered in FY08: Lack of funding

Comments on future direction of project:
N/A

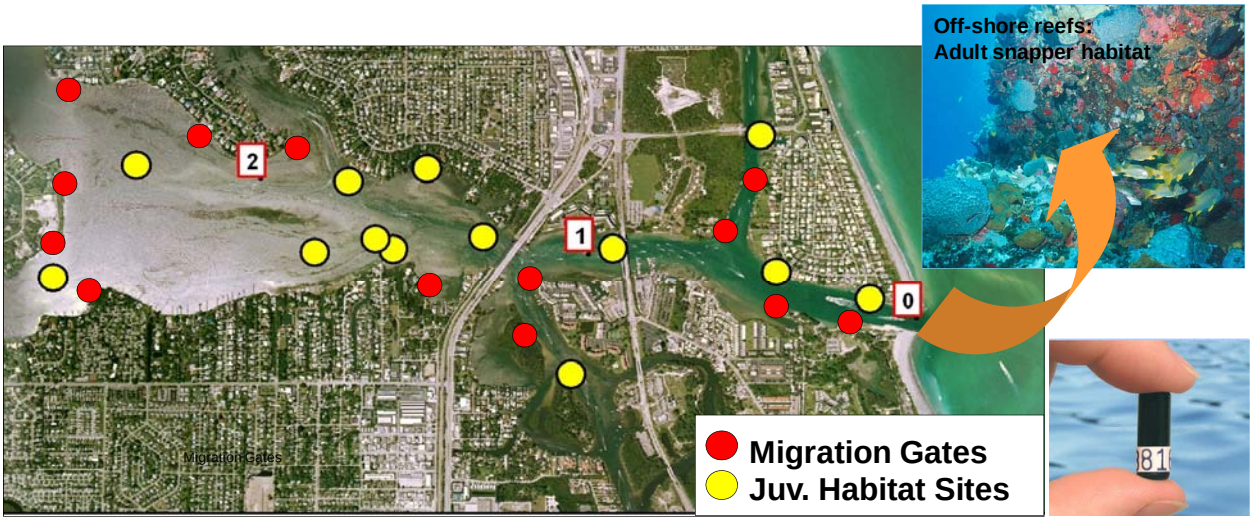


Figure 1. Placement of acoustic migration gates in the Loxahatchee estuary.

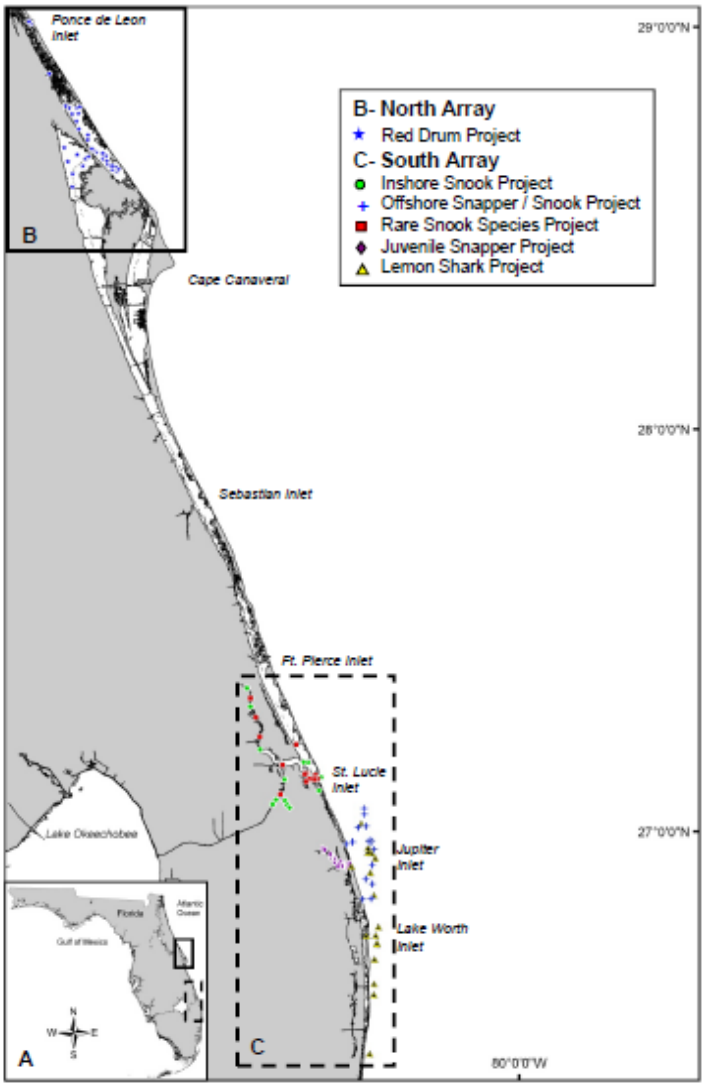


Figure 2. FACT array.

VI. IMPROVE EFFECTIVENESS OF MPAS

Project ID#: 10202 - 2008

Title: Survey of coral and fish assemblages at Pulley Ridge, SW Florida*

**NOTE: This project was not funded by the CRCP in FY-08, however a self-funded survey was conducted and is described herein*

Names of PIs and co-PIs:
Andrew David – NMFS/SEFSC – Panama City
Stacey Harter – NMFS/SEFSC - Panama City

Duration of Project Continuing multi-year project. Begun in FY-2007 and funded in alternate years.

Project Category:

- Improve Use and Effectiveness of MPAs

Brief description of activities conducted in FY2008:
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 FY-2008 survey was conducted in April aboard the NOAA Ship, Gordon Gunter. Twelve ROV dives were completed. The exact northern boundary of hermatypic corals was narrowed considerably. 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).

Description of accomplishments & results:
A research cruise using ROVs and stationary camera arrays was completed to Pulley Ridge in April 2008. 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.

How project supports goals & objectives of CRCP:
This project supplies managers with information on ecosystem composition and condition in order to characterize areas of high intrinsic value or potential value as a protected area. This

project uses state of the art tools to characterize these deep hermatypic reef ecosystems, and quantify their extent and health.

How project supports management of coral reef resources:
The results of our monitoring program will be provided to the Gulf of Mexico Fishery Management Council (GMFMC). 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 coral damage caused by bottom tending fishing gear. 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 (a possible thermal refugia). 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 program to managers not directly associated with the northeastern Gulf of Mexico, which may be used in establishing effective MPAs in other areas.

List of project partners and their roles: NURC-UNCW – provided ROV and pilot for survey at reduced cost.

Communications, media exposure, capacity building, and education and outreach activities: A NOAA Teacher-at-Sea participated in the research cruise.

Submissions to CoRIS: Annual report

Publications during FY2008:
Report to the Gulf of Mexico Fishery Management Council

Presentations at professional meetings: None.

Setbacks or challenges encountered in FY08: None.

Comments on future direction of project:
This project is well matched to the revised goals of the CRCP, it is strongly oriented towards support of management activities. The GMFMC has shown increasing interest in this area, recently designating Pulley Ridge as a HAPC. As more is learned about the shallow coral species growing at significant depths on this platform, interest is likely to increase further. This project should contribute to ecosystem-level projects and directly addresses questions about area closures as a management tool. Additionally, the project can be used as a comparative ecosystem for effects of climate and warm water events on deeper coral resources.

Project ID#: 1062 - 2008

Title: Survey of habitat and fish assemblages in two Marine Reserves on the west Florida shelf

Names of PIs and co-PIs:
Andrew David – NMFS/SEFSC Panama City
Chris Gledhill – NMFS/SEFSC Pascagoula

Duration of Project Continuing multi-year project. Begun in FY-2000, conducted annually through FY-2008, now funded in alternate years.

Project Category:

- Improve Use and Effectiveness of MPAs

Brief description of activities conducted in FY2008:
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 to 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 40 cruises between February 2001 and March 2008 Gear employed during the surveys included stationary video camera arrays (Hi-8, digital or stereo 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 FY-08, 73 stations were surveyed during six cruise legs. This was an average number of stations surveyed compared to the other years of this survey. Close spacing of weather fronts prevented cruise legs longer than two days for much of the vessel availability window and as a result no data was collected in Steamboat Lumps this year. Analysis of videotapes was completed in early FY-09 and a report will be delivered to the Gulf of Mexico Fishery Management Council (GMFMC) in early 2009. 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.

Description of accomplishments & results:
Poor weather conditions hampered activities in FY-08, however 73 stations were surveyed in Madison-Swanson MPA and the Twin Ridges Control Area. The positive efficacy evaluation will be used by the Gulf FMC during their consideration of an extension of the closure period as it nears its current sunset date of June 2010. Conservation of the reef fish species within these MPAs has ecosystem-level benefits for the biodiversity of midshelf and shelf edge reef habitats of the eastern Gulf of Mexico.

How project supports goals & objectives of CRCP:
This project supports several goals and objectives of the CRCP. This project supplies managers with information on ecosystem composition and condition in order to characterize areas of high intrinsic value and/or value as a protected area. This project uses state of the art tools to characterize these deep hermatypic reef ecosystems, quantify their extent and health, and determine efficacy of place based management strategies in the eastern Gulf of Mexico.

How project supports management of coral reef resources:
The results of our 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 and 2009 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. 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.

List of project partners and their roles: None.

Communications, media exposure, capacity building, education and outreach activities:
None.

Submissions to CoRIS: None

Publications during FY2008: Cruise Report completed

Presentations at professional meetings: None in FY-08.

Setbacks or challenges encountered in FY08: Weather precluded sampling in Steamboat Lumps this year.

Comments on future direction of project:
This project is well matched to the revised goals of the CRCP, it is strongly oriented towards support of management activities. The GMFMC has repeatedly requested continuation of this project as it directly addresses their questions about area closures as a management tool.

Project ID#: 10012 - 2008

Title: Multibeam mapping of Pulley Ridge, SW Florida

Names of PIs and co-PIs:
Andrew David – NMFS/SEFSC Panama City
Stacey Harter – NMFS/SEFSC Panama City

Duration of Project Continuing multi-year project. Annual project begun in FY-2006, scheduled for completion in FY-2010.

Project Category: Improve Use and Effectiveness of MPAs

Brief description of activities conducted in FY2008:
To date 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. Multibeam sonar produces high resolution, georeferenced bathymetry as well as acoustic backscatter. The bathymetric data reveals the shape of the bottom and allows likely reef areas to be located while the backscatter data indicates the hardness of the bottom allowing delineation between rocky, sandy and silty areas. We established an Indefinite Delivery Indefinite Quantity (IDIQ) contract for multibeam mapping and data processing with the University of South Florida (USF) in 2006 which will streamline the process of awarding multibeam mapping contracts for the purpose of habitat delineation. Dr. David Naar at USF has mapped several areas on the southern end and western edge of the ridge and will conduct all mapping activities under the IDIQ contract. The participation of Dr. Naar and USF in this project provides continuity of mapping locations and uniformity of equipment between the current CRCP efforts and previous non-CRCP mapping. A parallel, CRCP-funded project monitors fishes, corals, and other invertebrates with stationary video cameras deployments and ROV transects. These data along with benthic grab samples taken during the monitoring cruises provide groundtruthing information for the multibeam data as well as a habitat classification project underway at the Panama City Laboratory. Mapping is expected to continue during the outyears with the location of each year's survey based upon data collected in the previous mapping and monitoring cruises. Input from the Gulf of Mexico Fishery Management Council will also be taken into account during planning of outyear mapping locations.

Description of accomplishments & results:
FY-08 was the third year of CRCP funding for multibeam mapping on Pulley Ridge. Efforts during the first year (FY-06) focused upon establishing an Indefinite Delivery / Indefinite Quantity (IDIQ) contract to allow fixed price mapping to be conducted by a single vendor for five years. Previous annual mapping contracts had been extremely difficult and time consuming to execute. In recent years a group representing a consortium of mapping engineering firms became involved and was awarded several CRCP funded contracts. These firms simply subcontracted the work to an academic institution and applied an 18-20% overhead fee. Under these contracts, the amount of mapped area was reduced by roughly one fifth and the delivery of products was significantly delayed by considerable bureaucratic requirements. In FY-06, we

sought to use the IDIQ process to contract directly with the actual mapping entities, eliminate the annual replication of the contracting process, and maximize the area mapped per dollar. The engineering firm threatened to protest our intended action under the Brooks Act and lengthy negotiations ensued between the Office of the General Counsel of the Department of Commerce, NOAA's contracting office in Kansas City, and the principal investigator of the project. In the end, the Brooks Act challenge was averted, the IDIQ process was completed and the University of South Florida was awarded a five year contract to conduct multibeam mapping for NOAA in the Gulf of Mexico. The first task order was completed at the end of FY-06 and the mapping was completed in December 2006. Post processing was completed within the timeline provided in the contract and the data was provided to NOAA Fisheries in time for dive site selection for a ROV survey of coral habitat and fish assemblages on Pulley Ridge in August 2007. The second year of funding supported mapping which was collected in late 2007 and delivered after post processing in early 2008. CRCP funds awarded in FY-08 were used to fund a third task order for additional mapping of Pulley Ridge to be conducted in April 2009. Delays in awarding the contract forced cancellation of an earlier sailing date, however USF has acquired a new vessel and the April product should be improved due to the new vessel's faster speed and longer endurance. USF is honoring the agreed upon price even though the new vessel is more expensive to operate.

How project supports goals & objectives of CRCP:
This project supports the discovery and characterization of reef resources in US Federal waters and contributes to the mapping goals of the CRCP. Characterization of this ecosystem has relevance for potential place based management strategies, and also provides a study ground for potential thermal refugia in the face of climate impacts to shallower coral reefs.

How project supports management of coral reef resources:
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. Additionally there are management implications which extend beyond Pulley Ridge itself. 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 density 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.

List of project partners and their roles: University of South Florida – Dr. David Naar was awarded a five year IDIQ contract to perform the data collection and processing..

Communications, media exposure, capacity building, education and outreach activities: None.

Submissions to CoRIS: Metadata will be submitted once completed.

Publications during FY2008: Report to the Gulf of Mexico Fishery Management Council will be submitted once completed.

Presentations at professional meetings: None.

Setbacks or challenges encountered in FY08: None.

Comments on future direction of project:
This project is well matched to the revised goals of the CRCP, it is strongly oriented towards support of management activities. The GMFMC has shown increasing interest in this area, recently designating Pulley Ridge as a HAPC. As more is learned about the shallow coral species growing at significant depths on this platform, interest is likely to increase further. This project should contribute to ecosystem-level projects and directly addresses questions about area closures as a management tool.

Project ID#: 1693 - 2008

Title: South Atlantic MPAs: Evaluation of habitat and fish assemblages in five no fishing zones

Names of PIs and co-PIs:
Andrew David – NMFS/SEFSC Panama City
Stacey Harter – NMFS/SEFSC Panama City

Duration of Project: Continuing multi-year project. Begun with self-funded survey in FY-2004, funded annually through CRCP since FY-2005.

Project Category: Improve Use and Effectiveness of MPAs

Brief description of activities conducted in FY2008:
FY-2008 research followed the protocol established during the self-funded pilot study of April-May 2004 and the CRCP-funded FY-06 and FY-07 projects. 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, 2006, and 2007 cruises or reported by other researchers were revisited in FY-08 and examined with a stationary digital camera array and a ROV. The cruise was conducted aboard the NASA vessel M/V Liberty Star. Eleven 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 was collected at each site. Both the ROV and stationary camera array were limited to daytime operations, at night 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 December 2008 and a final report will be provided to the South Atlantic Fishery Management Council in 2009. An oral presentation will be given to the SAFMC in 2009. Finally, maps, imagery, and data on invertebrate and vertebrate abundance and distribution will be provided to NOAA's Coral Reef Information System (CoRIS) in 2009.

Description of accomplishments & results:
FY-2008 was a productive year for this project. We again used the NASA vessel M/V Liberty Star and Phantom S2 ROV owed and operated by NURC/UNCW. A tropical storm developed as we departed and required a shift in the order the MPA sites were surveyed. Eleven ROV dives were made in four of the five MPAs, strong currents swept the ROV umbilical into the ship's propeller and disabled the vehicle precluding dives in the last MPA. The camera array was deployed in all MPAs as well as CTD casts to collect hydrographic data. Analysis of videotapes will provide, 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 characterizes the ecosystems of the MPAs in direct support of management action to close the areas to fishing. Data collected provides a baseline to assess the impact of the closures on habitat and fish distribution and abundance.

How project supports management of coral reef resources:
The results of our 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 will be prohibited in the MPAs. Over time, our research should detect changes in epifaunal species and produce data on the benefits derived by coral reef ecosystems from area closures. A manuscript has been published in the scientific literature based on this project and a second one was submitted for review. Additional manuscripts will be produced as more data is gathered and results of the closures are detected. Additionally, the MPAs are infested with the invasive lionfish, whose populations are rapidly expanding in the SE. NOAA colleagues 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. 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 local and regional managers as well as to the broader MPA community to add to the body of knowledge on creating and monitoring effective MPAs.

List of project partners and their roles: None.

Communications, media exposure, capacity building, and education and outreach activities: A Teacher-at-Sea participated on our research cruise in July.

Submissions to CoRIS: Annual report will be submitted once completed.

Publications during FY2008: Report to the South Atlantic Fishery Management Council will be submitted once completed.

Presentations at professional meetings: Presentation was made at June 2008 SAFMC Meeting

Setbacks or challenges encountered in FY08: None.

Comments on future direction of project:
This project is well matched to the revised goals of the CRCP, it is strongly oriented towards support of management activities. The SAFMC has expressed appreciation for the data collected during this project and incorporated a monitoring program in the Fishery Management Plan (Amendment 14) which defined these MPAs.

Project ID#: 10233-2008

Title: USVI Distribution and Larval Supply Study

Names of PIs and co-PIs: Trika Gerard, NOAA-Fisheries Service, SEFSC

Duration of Project: 2 years

Project Category:

- Improve Use and Effectiveness of MPAs

Brief description of activities conducted in FY2008:
The USVI larval distribution and supply study completed its second research cruise March 11-24, 2008. This large-scale ichtyoplankton sampling entailed multiple opening and closing net environmental sampling system (MOCNESS), Bongo, and Neuston tows south and north of the U.S. and British Virgin Islands, the Anegada passage, and along the Leeward Islands toward St. Kitts. Sampling tracks were designed to sample near shore, at the shelf break, and offshore, with intense sampling around the Grammanik and Red Hind Banks, well known spawning aggregations for various species of groupers. Physical oceanography data was collected using conductivity, temperature, and depth (CTD) device, lowered acoustic Doppler current profiler, (LADCP), and Lagrangian drifters. Ichtyoplankton sampling yielded 257 samples (180 mocness, 69 bongo, and 8 neuston) from 79 stations.

The inshore component of the USVI larval distribution and supply research endeavor was also completed. Light trap and settlement traps were deployed and sampled during April 1-10, 2008. Sampling was conducted on the eastern end of the island with concentrated sampling in the mangrove lagoon marine protected areas and unprotected areas and surrounding marine areas suitable for settlement by larval coral reef fish. The sorting of these samples have been completed and identification in ongoing.

Description of accomplishments & results:
All samples collected in 2008 have been sorted and have yielded 32,091 fish from MOCNESS tows and Bongo net tows. Inshore samples produced: 340 fish from light traps and 10 from 3 seine tows. Families of commercial importance were: serranidae, albulidae, acanthuridae, carangidae, labridae, monocanthidae.

How project supports goals & objectives of CRCP:
This project monitors the effectiveness of MPAs and interconnectivity of reef resources in the Caribbean.

How project supports management of coral reef resources:
This project focuses on the ecology of larval reef fish that depend ultimately on coral reefs as a habitat. The synthesis of larval fish and physical oceanography data will help us determine the location and relative importance of spawning sites specific to coral reef fish. The incorporation of this information into fisheries oceanographic models assists local resource managers in making decisions as to marine protected areas (MPAs) and optimal seasonal closures.

Additionally, this project will lead managers to developing an integrated ecosystem assessment of coral reef-based fisheries for the USVI.

We communicate our results and research designs with local stakeholders and managers. For example, we presented our research data and results to date to the Caribbean Fisheries Management Council meeting on December 9, 2008. At that meeting there was meaningful dialogue, helping to incorporate management priorities into the science we provide in order to meet their needs.

List of project partners and their roles:
University of the Virgin Islands- actively participates in the design of study and ichthyoplankton and inshore sampling
Virgin Islands Department of Planning and Natural Resources-actively participates in the design and sampling of larval fishes near shore in St. Thomas, VI

Communications, media exposure, capacity building, and education and outreach activities:
Physical oceanography Lagrangian satellite drifter track data is the basis for a master's thesis of a University of the Virgin Islands graduate student.

Submissions to CoRIS:
Biological data of abundance and composition of larval fish from 2007 fisheries oceanography survey and physical oceanography data from 2008 fisheries oceanography survey. Both submitted November 2008

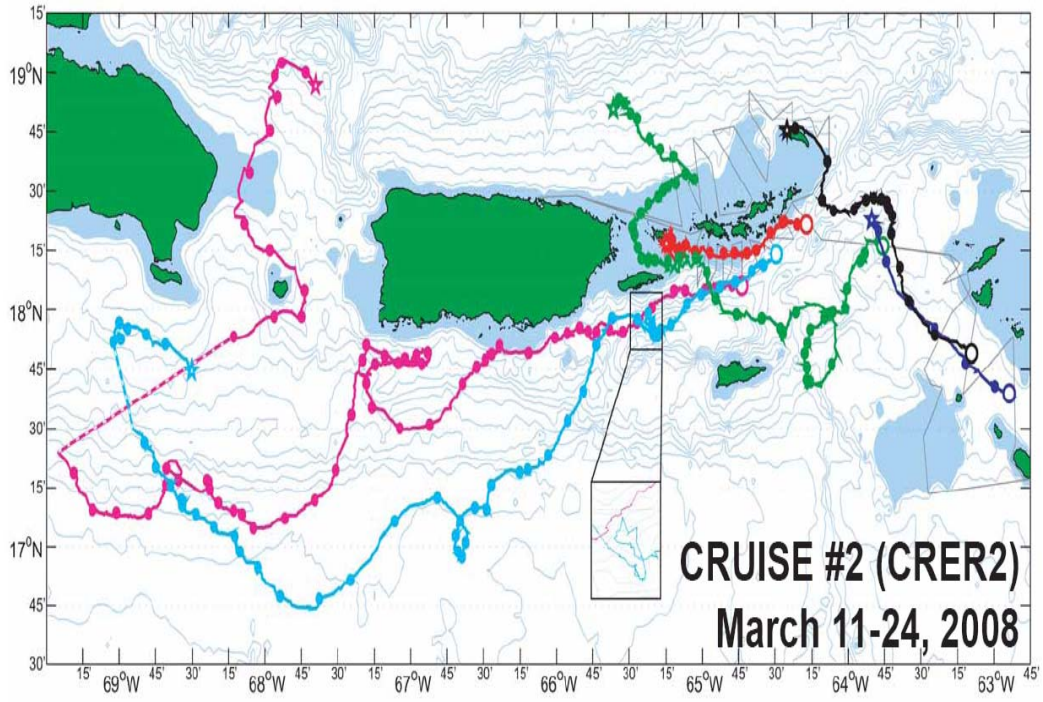
Publications during FY2008:
CRER 0805 Nancy Foster cruise report

Presentations at professional meetings:
Poster presentation at the American Geophysical Association in May 2008.
Two posters were presented at the Larval Fish Conference in August 2008.

Setbacks or challenges encountered in FY08:
Weather conditions (strong winds and rough seas) made near shore sampling a challenge and collections were smaller compared to the previous year and small boat operations were affected.

Comments on future direction of project:
This pilot study will enter into its third year with a cruise and inshore sampling planned. The project will fit the new CRCP goals and objectives and the priorities from local managers will be met.

Selected Larval fishes of the USVI: (Left to right, starting at top): Squirrelfish, Blenny, Spaghetti Eel, Seahorse, Grouper, Large tooth flounder, Cardinalfish, Deepwater Cardinalfish, Snake Mackerel, Snapper, Codlet, Dolphinfish, Helmetfish, Surgeonfish, Filefish, Lanternfish, Grouper, Left Eye Flat fish



Lagrangian drifter buoy tracks

VII. REDUCE THREATS TO INTERNATIONAL CORAL REEFS

Project ID#: 10038-2008

Title: Acropora spp. monitoring in the Eastern Caribbean

Names of PIs and co-PIs:
Margaret Miller (PI), NOAA-Fisheries Service, SEFSC
Dana Williams (co-PI), University of Miami, CIMAS

Duration of Project: 3 years

Project Category:

- Reduce Threats to International Coral Reefs
- Address Emerging Issues

Brief description of activities conducted in FY2008:
The partnership with Sea-Mester has continued to provide monitoring data from *A.palmata* populations in remote areas of St. Vincent/Grenadines and Antigua. No major disturbances or population changes have been observed in these areas.

SEFSC personnel conducted monitoring trips to Tortola BVI (Oct 2007), and Curacao NA (April 2008) to perform follow-up surveys of permanently marked elkhorn populations in theses areas.

Description of accomplishments & results:
Results confirm that *A.palmata* populations in the Eastern Caribbean region remain more robust than those monitored in Florida and Puerto Rico – highlighting important demographic differences among populations throughout the range of the species.

How project supports goals & objectives of CRCP:
This project provides assessment of international status of Acropora spp. resources with completely comparable methods to demographic monitoring in US jurisdictions (upper Florida Keys, Puerto Rico, Navassa).

How project supports management of coral reef resources:
This project provides status and trends assessment for elkhorn coral populations outside of US jurisdiction in a region where it appears somewhat more robust that in US territories. This information is required for balanced status and recovery assessment throughout the species range, as required by the ESA. Results are communicated directly to SERO (and Acropora Recovery Team) as well as via scientific fora.

List of project partners and their roles:
SeaMester- educational NGO which conducts data collection in St.Vincent/Grenadines and Antigua

Communications, media exposure, capacity building, education and outreach activities:
We continue working with SeaMester staff and they are able to engage their students in monitoring activities.

Submissions to CoRIS: None in FY08

Publications during FY2008: See below

Presentations at professional meetings:
K. L. Kramer, D. E. Williams, M. W. Miller, C. Bégin, J. Fry, A. Valdivia 'Demographic comparison of the Threatened Coral Species, *Acropora palmata*, in the Eastern Caribbean'
NOTE: This presentation is being submitted as a manuscript to the published 11ICRS Proceedings

Setbacks or challenges encountered in FY08:
Weather challenges limited data collection in Curacao. Staff turnover in SeaMester increased training time.

Comments on future direction of project:
This important monitoring project provides myriad benefits over and above documenting Acropora status and trends. Additional capacity is requested from Protected Resources, however, the CRCP should retain responsibility for understanding, documenting, and developing mitigative strategies for Caribbean *Acropora spp*. given their keystone status in providing reef accretion and habitat.

VIII. ADDRESS EMERGING ISSUES

Project ID#: 2133-2008

Title: Assessment of Candidate Corals

Names of PIs and co-PIs:
Margaret Miller (PI), NOAA-Fisheries, SEFSC
Dana Williams (co-PI), University of Miami, CIMAS

Duration of Project: 7 years

Project Category:
- Assess and Characterize US Coral Reefs
- Address Emerging Issues

Brief description of activities conducted in FY2008:
The primary activity of this project involves continued long term demographic monitoring of Florida Keys *A.palmata* populations. Three surveys were completed (Dec 2007, May 2008 and Sept 2008). Two tropical storms impacted the monitoring region (TS Fay and Hurricane Ike) and rapid assessments (counts of fragments retained in the monitored plots) following the storms were conducted. Overall, several entire colonies were lost from storm impacts and post-storm tissue loss/disease but severity was much less than observed in 2005.

Description of accomplishments & results:
Two peer-reviewed journal publications from this project were submitted in FY08 One has appeared, documenting the lack of both sexual and asexual recruitment within depauperate Florida Keys elkhorn populations. The other, documenting experimental evaluation of different methods for artificial stabilization of elkhorn fragments to enhance successful asexual recruitment, is still in review.

Results from this project provided input for the Florida Keys chapter in the 2008 State of Coral Reef Ecosystems of the United States and Pacific Freely Associated States (Donahue et al. 2008). Results continue to provide essential information to inform ESA relevant status and trends. The PI is actively involved with the Acropora Recovery Team.

How project supports goals & objectives of CRCP:
This project provides primary monitoring for ESA Threatened coral *Acropora palmata* in the FKNMS, in addition to spin-off research activities such as the relationship of genotype to colony resilience/performance.

How project supports management of coral reef resources:
Information from this project is communicated directly to management efforts, specifically the Acropora Recovery Team via membership by Miller on the Team and direct informal communication with SERO (Jennifer Moore). Results from this project were also used collaboratively to enable another project commissioned by SERO to construct predictive

demographic models for *A.palmata* as a tool for predicting population responses and prioritizing recovery actions.

List of project partners and their roles:
D. Williams - CIMAS staff Co-PI, CIMAS employees also serve as field staff for this project.
I. Baums - Penn State Univ - genetic aspects of the study
T. Vardi - Academic collaborator (Scripps) utilizing the demographic monitoring data in quantitative population models to be used as tool for prioritizing management actions
SERO and FKNMS - Primary management partners with whom we maintain direct communication regarding project results

Communications, media exposure, capacity building, education and outreach activities:
Miller provided interview for Waterways TV show (public access, produced by NOAA and National Park Service) on *Acropora* biology and ESA listing
Invited presentation, Florida Marine Science Educators Convention, St. Augustine, FL. 8 Dec 2007
Miller participated in South Florida CRCP congressional staff visit, 20 Aug 2008

Submissions to CoRIS:
One journal publication (see below) and one data set with metadata record (geographic survey of Acropora spp. distribution in the upper FKNMS)

Publications during FY2008:
Williams DE, Miller MW, Kramer KL (2008) Recruitment failure in Florida Keys *Acropora palmata*, a threatened Caribbean coral. Coral Reefs 27:697-705

Williams DE, Miller MW (in revision) Stabilization of fragments to enhance asexual recruitment in *Acropora palmata*, a threatened Caribbean coral. Restoration Ecology

Presentations at professional meetings:
Williams DE, Miller MW, Kramer KL, Valdivia A 'Recruitment failure in *Acropora palmata*, a threatened Caribbean coral'
Johnston L, Baums IB, and Miller MW. 'Plasticity of the corallivorous gastropod *Coralliophila abbreviata*: Implications for imperiled Caribbean coral'
Vardi T, Williams DE, Kramer KL 'What is the future of the threatened *Acropora palmata*? Population projections and management recommendations'

Setbacks or challenges encountered in FY08:
Uncharacteristic uncertainties related to status of the NOAA Dive Program hindered productivity.

Comments on future direction of project:
This project provides myriad benefits over and above documenting Acropora status and trends. Though additional support from Protected Resources has been requested, the CRCP should retain responsibility for understanding, documenting, and developing mitigative strategies for Caribbean *Acropora* spp. given their keystone status in providing reef accretion and habitat.

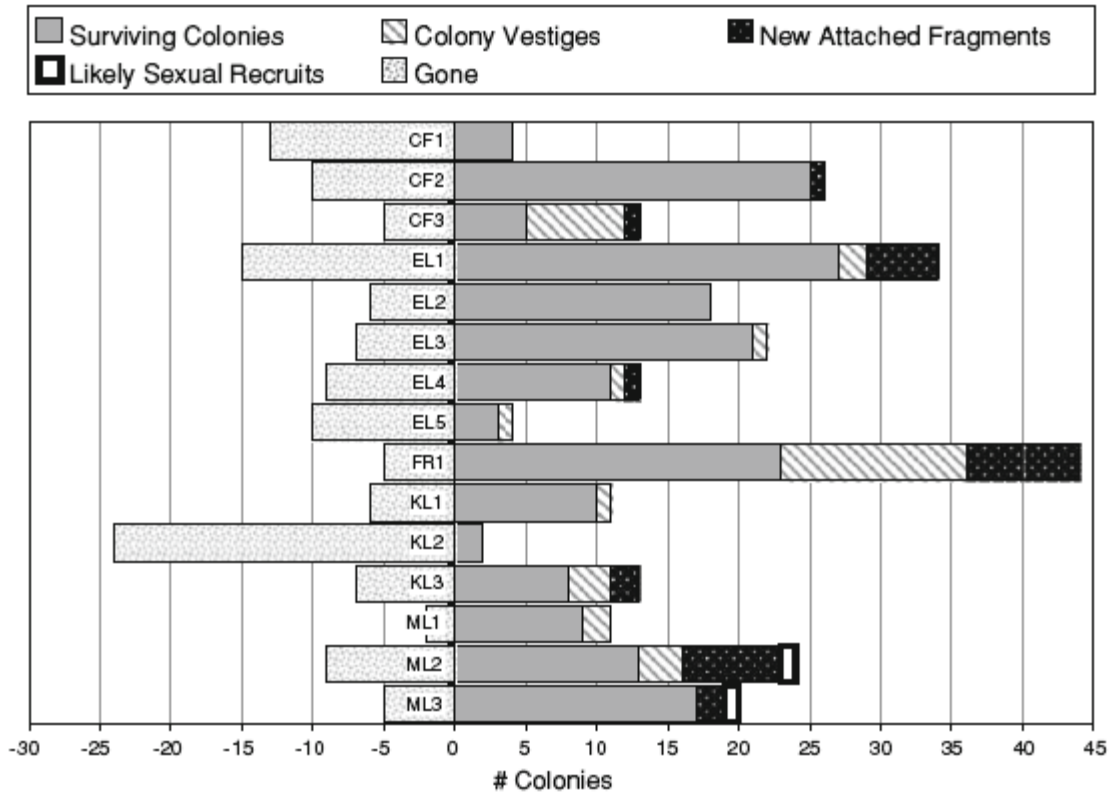


Figure: Recruitment failure in Florida Keys *A.palmata*.
Fate of *Acropora palmata* colonies as of April 2007 first observed in Oct 2004 in each permanent monitoring plot. Colonies that died or were physically removed between October 2004 and April 2007 are grouped as "gone" and plotted as negative values. "Surviving Colonies" are those that were alive for the initial survey, and were still recognized as living colonies in April 2007. "Colony Vestiges" represent living *A. palmata* tissue that was initially considered part of another mapped colony, but due to breakage or mortality could no longer be defined as a single colony. Thus they do not represent any new living material. Only colonies categorized as "Likely Sexual Recruits" and "New Attached Fragments" represent new recruitment to the population (from Williams et al. 2008).

Project ID#: 10306-2008

Title: Assessment of ESA Listed Corals – Supplemental

Names of PIs and co-PIs:
Margaret Miller (PI), NOAA-Fisheries Service, SEFSC

Duration of Project: 2 years

Project Category:

- Assess and Characterize US Coral Reefs – Coral Reef Ecosystem Integrated Observing System (CREIOS)
- Reduce Impacts of Pollution & Coral Diseases
- Address Emerging Issues

Brief description of activities conducted in FY2008:
Continued support of elkhorn monitoring in St. John, USVI (begun by Dr. Caroline Rogers, USGS) via contract with Univ of the Virgin Islands. Contractors were able to add two additional monitoring sites in St. Thomas, USVI under this activity. In FY08 we were able to establish this as an IDIQ contract which will streamline future collaborations.

Initiated successful collaboration (with DNER and UPR) to undertake demographic monitoring of A.palmata at three sites in Puerto Rico. Permanent plots were established in Oct 2007 and a second monitoring survey was accomplished in April 2008.

Under the disease diagnostic tool development component of this project, mucous samples were collected to document baseline microbial communities in the Florida Keys (Dec 2007 and May 2008) and in Puerto Rico. Following tropical storm impacts in the Florida Keys in Aug/Sept 2008, good samples from both diseased and apparently healthy elkhorn colonies were obtained for comparison.

Description of accomplishments & results:
Both the USVI and Puerto Rico monitoring components were able to document and are following impacts from a large swell event which occurred in spring 2008 and caused extensive elkhorn coral damage at a subset of the monitoring sites in both areas. A substantial disease outbreak was documented following this disturbance in the USVI population.

How project supports goals & objectives of CRCP:
This project addresses specific gaps identified following the *Acropora* spp. ESA listing.

How project supports management of coral reef resources:
Project reports and progress are communicated directly to managers (Carlos Diez, Puerto Rico collaborator in DNER; and Jennifer Moore, SERO Protected Resources).

List of project partners and their roles:
Puerto Rico DNER (C. Diez and UPR contractors): collaboration and local logistics for PR demographic monitoring
UVI (T. Smith/A. Bright) and USGS/BRD (C.Rogers): implementing monitoring in St John and St. Thomas, USVI
NCCOS (C. Woodley): collaboration in analysis of coral mucous samples for diagnostic tool development

Communications, media exposure, capacity building, education and outreach activities:
None explicitly linked to this project

Submissions to CoRIS: None in FY08

Publications during FY2008: See below

Presentations at professional meetings:
Shärer MT, Nemeth M, Valdivia A, Williams D, Miller M, Diez C. 'Elkhorn coral distribution and condition throughout the Puerto Rican archipelago'
NOTE: This presentation is being submitted as a manuscript to the published 2008 ICRS Proceedings

Setbacks or challenges encountered in FY08: Weather issues deterred field work in Puerto Rico.

Comments on future direction of project:
This project provides myriad benefits over and above documenting Acropora status and trends. Though additional support from Protected Resources is requested, the CRCP should retain responsibility for understanding, documenting, and developing mitigative strategies for Caribbean Acropora spp. given their keystone status in providing reef accretion and habitat.

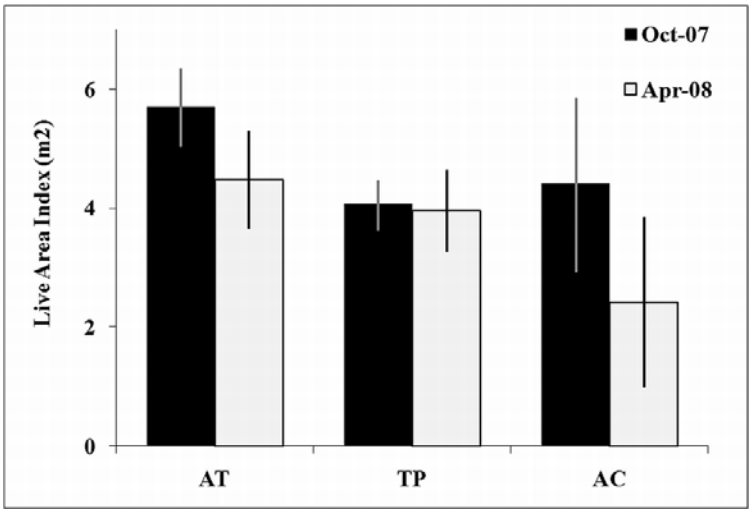


Figure: Initial declines (mean (SE) live area index) have been documented in permanently tagged colonies at three sites in Puerto Rico over the first 6 months of monitoring. Losses were predominantly due to physical disturbance from a spring swell event. AT=Arrecifes Tourmaline, TP=Tres Palmas, AC=Arrecifes de Cordillero (Shärer et al. in review)