SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL

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COOPERATIVE AGREEMENT (NA06NMF4410081)
OCTOBER 1, 2006 – DECEMBER 31, 2008

FINAL REPORT

During the grant award period – October 1, 2006 to December 31, 2008 -- the South Atlantic Fishery Management Council (SAFMC) worked to ensure the mandates of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) are met relative to the conservation and management of the South Atlantic coral and coral reef resources.

Project 1: NOAA CRG 2006 Support and Maintenance for Serving Maps of Coral and Live/Hard Bottom EFH and EFH-HAPCs via the Internet.
The Florida Fish and Wildlife Research Conservation Commission Fish & Wildlife Research Institute (FWRI) provided technical assistance to the SAFMC to create and distribute comprehensive habitat data in the South Atlantic region. FWRI also continued to enhance and maintain the Internet Map Service (IMS) application for the SAFMC. The products developed for this project will directly assist the Council to manage and conserve fishery resources, including coral, in the South Atlantic region. This project focused on the following tasks:

1. EcoResearch Database
2. TEST EcoSpecies Database
3. Meetings
4. Coordination
5. Maintenance of Habitat and Ecosystem IMS

EcoResearch Database
The EcoResearch Database was designed to provide a catalogue of relevant ecosystem research in the South Atlantic region. This project should help to determine scientific information needs and potential data gaps occurring in SAFMC's jurisdiction. FWRI reviewed several in-house projects that could benefit the South Atlantic EcoResearch database web structure. Coordination with principal investigators of these projects took place to leverage efforts where appropriate and to build a framework for the EcoResearch database queries and metadata retrievals. It was determined that the EcoResearch database could be linked to the IMS through a query developed with Cold Fusion software. Therefore the Cold Fusion software was purchased and installed to evaluate its potential use for the EcoResearch Database.

The main advantages of this programming were identified:

- The EcoResearch Database would be more tightly coupled to the IMS service
- FWRI staff have familiarity with Cold Fusion software and Open Database Connectivity (ODBC) sources
- Offers users the opportunity to query research projects using tabular or spatial (map-based) query interfaces
- Search research projects by title, principal investigator, organization, or themes of keywords or places

At this time, the spatial footprints of the EcoResearch Database will be served as a GIS layer in the IMS application. The spatial query will use ColdFusion to access a database consisting of abbreviated project metadata records. FWRI is leveraging progress from similar efforts at FWRI such as Geospatial Assessment http://research.myfwc.com/game of Marine Ecosystems (GAME) and Florida Ocean and Coastal Council Research Review http://ocean.floridamarine.org/focc/overview.cfm.   Where available, there will be links to full metadata records, a browse graphic depicting the spatial footprint, and direct links to the data themselves.

Approximately 174 research project footprints have been compiled for the South Atlantic region to date. Most of the projects have accompanying metadata records as well. **Figure 1** below provides an overview map of the project footprints. Keep in mind that many footprints overlay one another.
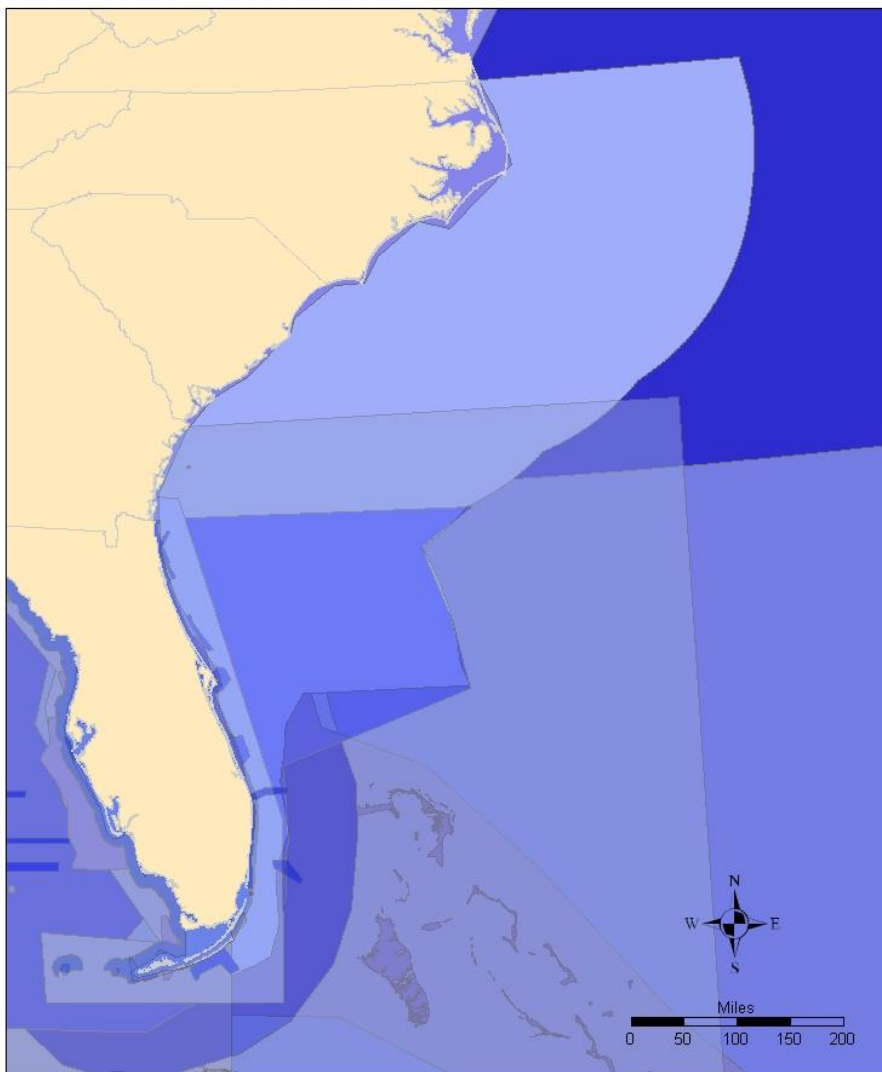
Figure 1. EcoResearch footprints for the South Atlantic region.

Once the accompanying database of metadata records is finalized, FWRI will be able to add the EcoResearch shapefile to the existing SAFMC Habitat and Ecosystem IMS. At that time, the Cold Fusion custom code will be implemented and spatial queries will be allowed.

EcoSpecies Database
FWRI reviewed the Florida Estuarine Marine Living Resources (FLEMLR) database and project history and identified several staff members involved in the development of FLEMLR database and its transitions over the years. The next few paragraphs give a brief overview of the project and FWRI's recommendations to improve the existing product.

In the early stages of the FLEMLR project, FWRI contracted with Mote Marine Laboratory to create an application for data entry and to populate the life history database for 18 estuarine fish and 9 invertebrate species. Several contracts with Mote resulted as more species and estuarine data were entered. Mote later subcontracted Harbor Branch Oceanographic Institute to update existing Species Life Histories (SLH) and to create new SLHs.

The FLEMLR database was originally developed on a Macintosh platform using HyperCard and Oracle 2 for the RDBMS. When the popularity of Macintosh computers waned, the database was converted to a Microsoft platform with Access as the main database software.

A review of historical documentation of FLEMLR revealed that the following estuaries: Florida Bay, Tampa Bay, Sarasota Bay, and the Indian River Lagoon, were prioritized for developing Species Life History profiles from the species information. Therefore, FWRI staff will focus on the east coast estuaries, Florida Bay and Indian River Lagoon to develop summary products for the SAFMC.

FWRI created a personal geodatabase for importing spatial and non-spatial data related to the FLEMLR database. A personal geodatabase is the common data storage and management framework for ArcGIS. A strategic feature of the geodatabase is the use of coded-value domains. The use of coded-value domains can prevent incorrect codes, increase editing speeds, and provide meaningful code descriptions for map labeling or report generation. Coded-value domains were created for all estuaries and species of the FLEMLR geodatabase. Once the domains were established, the estuary and species fields for each table of the geodatabase were assigned to the domains. Several datasets for the EcoSpecies project were clipped for inclusion in the geodatabase. These datasets included hydrographic polygons and lines, federal lands, and cities.

Another key component of this effort involved relating FLEMLR estuary codes to a spatial estuary dataset. We are currently standardizing naming conventions in a GIS data layer for estuaries and water bodies in Florida. The standardization was necessary due to differences in naming conventions across datasets. For example, the spatial estuary dataset refers to Indian River and Indian River North, while the FLEMLR table has one reference for Indian River Lagoon. Another example is the spelling of St. Johns River versus Saint Johns River. Once this step was finalized, we were able to effectively relate the estuary codes in FLEMLR with the spatial estuary data. The EcoSpecies geodatabase has relationship classes defined that link estuarine spatial data with FLEMLR tables of species' abundance, attributes, habitats, reproduction, and value status.

FWRI identified a technical difficulty for displaying domains and relationships defined in the EcoSpecies geodatabase. Once, a species profile is created to serve through the SAFMC IMS application http://ocean.floridamarine.org/efh_coral/ims/, the ArcIMS "Identify" or "Query" tools will not display the domains or relationships established within the geodatabase. The inability to display "related" information is a shortfall of the ArcIMS software. A possible alternative for the future may be to take advantage of the ArcGIS Server environment, which addresses this problem. FWRI is currently in the process of deploying for SAFMC online GIS needs.

The EcoSpecies geodatabase design is valid but there are problems using relates to convey information cartographically. For example, ArcGIS does not offer the functionality to symbolize a data layer based on a relate (http://forums.esri.com/Thread.asp?c=93&f=985&t=47623).

Figure 2 highlights the Indian River Lagoon with the related FLEMLR information accessible through the "Identify" tool. Although, this feature is useful to view tabular information, it is difficult to represent the FLEMLR data in a map format.
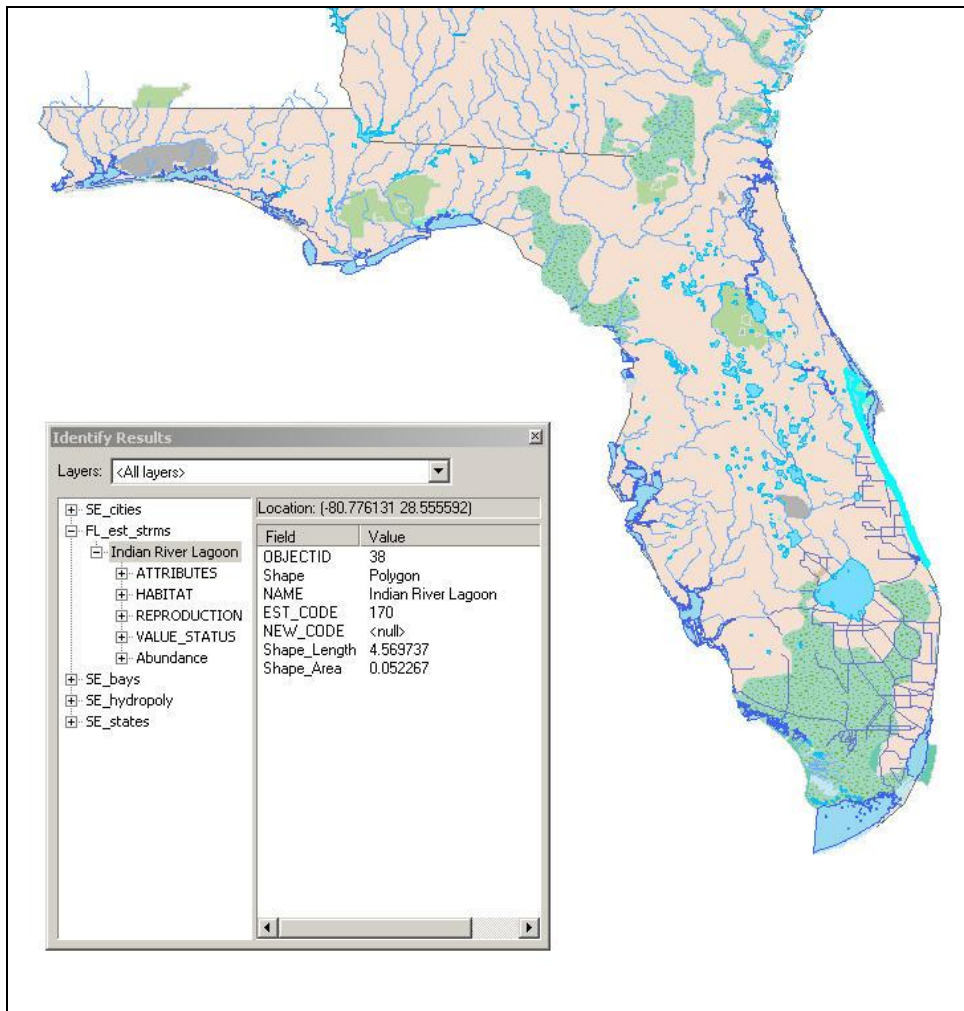
Figure 2. Indian River Lagoon with related FLEMLR tables.

Also, since the relationship classes defined in the EcoSpecies geodatabase are considered "one-to-many", one cannot successfully perform a spatial join. If such a join is attempted, only the first record found is joined, the other related records are ignored. ArcGIS only allows users to symbolize and query by attributes if you join a table. At this time, FWRI cannot successfully perform joins with relationship classes built out of the box. A custom attribute query or creation of a custom renderer is necessitated through code development. FWRI downloaded sample code from the ESRI Developer Network
<http://edn.esri.com/index.cfm?fa=codeExch.sampleDetail&pg=/arcobjects/9.1/Samples/Cartography/Labeling_and_Annotation/OneToManyLabels/OneToManyLabels.htm> designed for labeling features based on attribute values accessible through one-to-many relationships. However, the sample code did not help to rectify these cartographic issues.
With the use of ArcMap reporting tools, FWRI created summary tables for the Indian River Lagoon. Example products are provided in **Appendix A**.

Meetings

- FWRI met with SAFMC staff in St. Petersburg in August 2007 to plan future dataset creation and direction for the South Atlantic Habitat and Ecosystem IMS http://ocean.floridamarine.org/efh_coral/ims/ application.

- FWRI staff attended the Joint Meeting of the SAFMC Habitat Advisory Panel and the Coral Advisory Panel in Charleston, SC, November 7-9, 2007.   FWRI staff presented materials on the ESDIM deepwater habitat mapping project and the South Atlantic Habitat and Ecosystem IMS.

- FWRI staff attended the South Atlantic Ecosystem Tools and Model Development Workshop at the Duke Repass Center, February 21-22, 2008. FWRI staff presented material highlighting the SAFMC GIS and IMS products in the region.

- FWRI hosted the SAFMC Ecosystem and Habitat IMS Workshop November 5-7, 2008. The main topic of the workshop was to identify GIS needs supporting management, research, and regional collaboration to enhance the IMS as a support tool for ecosystem-based management. Participants gave recommendations for enhancing and/or refining the functional capabilities of the IMS to better support local, state, other regional habitat and ecosystem GIS needs.

- FWRI staff attended the Joint Habitat and Coral Advisory Panel meeting in Charleston, SC November 17-20, 2008 and gave a presentation highlighting the present and future structure of the South Atlantic Habitat and Ecosystem IMS (Researcher Section, EcoFish Module, EcoSpecies Module, etc.).

Maintenance

- Routine maintenance for the production and development servers occurred throughout the duration of this project. This included the installation of several patches and log file processing of log files.

- A new production server was purchased to allow for the same configuration and software as the development server. This purchase has helped with development and troubleshooting of the IMS application

- FWRI brought the new production and development servers online. This included migrating data from the old production server to the new server. FWRI also installed the following software on the new production server:

    o Operating System – Windows Server 2003

    o Web Server – IIS 6.0

    o Servlet Engine – Tomcat 5.0.28

    o Web Mapping – ArcIMS 9.1

- SAFMC notified FWRI of the final Deepwater MPA areas for the region. The Deepwater MPA shapefile and metadata records were updated and posted on the IMS. The final MPAs are listed below:

    o Snowy Grouper Wreck MPA

    o Northern South Carolina MPA

    o Edisto MPA

    o Georgia MPA

    o North Florida MPA

    o St. Lucie Hump MPA

    o East Hump/Un-named Hump MPA

- FWRI created Snapper Grouper Vessel Homeport shapefiles for limited and unlimited permits. SAFMC requested this data layer for the September Council meeting. Metadata records were created and the new shapefiles were posted to the IMS.

- Continued the maintenance of the SAFMC virtual image server dedicated solely for the SAFMC Habitat and Ecosystem IMS application. The SAFMC virtual server is allocated a dedicated block of memory; so if other IMS services go down, the SAFMC IMS application will not be affected.

- Updated the Proposed Deepwater Coral HAPC shapefile to include the Blake Ridge Diapir.

- Created a Microsoft Access database with JDBC authentication to restrict services hosted at FWRI. Confirmed that "ArcIMS_ACL" system DSN was added to the ODBC Data Source Administrator. This was necessary to restrict an IMS service to users with a login and password. The database defines which services are restricted and what users/passwords are accepted. This is in preparation for a "researchers only" site in the future.

- Modified the Esrimap_prop file to include the following:

    o authenticate=True

    o authMethods=Digest

    o authenticateWithSessions=True

    o useJdbc=True

    o jdbcDriver=sun.jdbc.odbc.JdbcOdbcDriver

- o jdbcUrl=jdbc:odbc:ArcIMS_ACL

- o jdbcUser=<user>

- o jdbcPassword=<password>

- o jdbcPermTable=acl_permissions

- o jdbcUserTable=acl_users

- o jdbcUidColumn=userid

- Created a new shapefile and metadata record representing the beginning dive locations of survey tracks for the Southeastern United States Deep-Sea Corals (SEADESC) Initiative: A Collaboration to Characterize Areas of Habitat Forming Deep-Sea Corals, described in NOAA Technical Memorandum OAR OER 1 (2007). The shapefile provides integrated hyperlinks to pdf documents describing the dive track, biological and physical environments, and habitat images.

- Updated several files for the IMS and GIS Data download page, zipped shapefiles, Google Earth KMZ files, and metadata records were updated for the following data layers:

  - o Florida Mangroves

  - o Florida Artificial Reefs

  - o Florida Seagrass

  - o Florida Tidal Flats

  - o Right Whale Critical Habitat

  - o Southeast Bathymetry

  - o Florida Salt Marsh

- Upgraded production and development servers from ArcIMS 9.1 to ArcIMS 9.3. The Tomcat Servlet Engine and Java Developers Kit were also upgraded.

Coordination

- FWRI participated in a conference call with SAFMC and NOAA to discuss the inclusion of ECO-GIS products in the IMS application. The SAFMC would ultimately like to incorporate 'canned' layers to show catch tied to depth contours and statistical areas. At that time, NOAA did not have data available for the South Atlantic region.

- FWRI provided GIS technical assistance on the Gray's Reef National Marine Sanctuary and SAFMC Research Cruise May 31-June 10, 2007. FWRI staff

participated on the research cruise and provided the following shapefiles prior to the cruise to help identify high priority mapping areas:

- ESDIM Deepwater Habitat Data

- Fishery Data

    - SAFMC – snapper grouper limited and unlimited permits

    - Golden Crab – data compiled by fishermen

- John Reed Files – georeferenced bathy charts, dive locations

- NOAA Charts – 1:250,000

- *Oculina* Data – boundaries and geotiffs

- George Sedberry Files - OE Cruise Coverage, Past Bump Surveys, geotiffs

- SAFMC/Gray's Reef Research Cruise data – priority areas, geotiffs

- Steve Ross Files – SEADESC subset data, and *Lophelia* locations off NC

- US_Seabed Data – variety of data related to bottom sediments

- FWRI created a Comprehensive Habitat map document for the September 2007 Council meeting. The map document contained a variety of data to highlight the significant deepwater coral habitat areas of the region and thus assist the SAFMC in their proposal to designate deepwater Coral Habitat Areas of Particular Concern (CHAPCs).

- The Southern Shrimp Alliance requested copies of FWRI presentations and datasets concerning the proposed deepwater CHAPCs. FWRI staff used the *Write Features to Text File* ArcMap tool to create a textual representation of the CHAPC shapefile. Staff worked with P-SEA technical support to determine the necessary format for importing .txt files in the WINDPLOT software and converted the coordinates of the .txt file from Decimal Degrees to Degree Decimal Minutes. Staff then manually edited the file to add leading zeroes for single digit minute values.

- FWRI staff assisted John Reed of HBOI with data conversions to view *Oculina* and *Lophelia* multibeam imagery within a GIS environment. FWRI also provided John Reed reprojected shapefiles representing variations to the proposed deepwater Coral HAPC shapefiles as recommended by the SAFMC Shrimp Advisory Panel.

- Worked with SAFMC staff to create an ArcReader project for the SAFMC Golden Crab Advisory Panel meeting. The ArcReader project provided golden crab fishermen the opportunity to view the proposed deepwater CHAPCs, detailed bathymetry, and fishing effort on their personal computers.

- Provided copies of the proposed deepwater CHAPC and bathymetry shapefiles to NMFS staff at the Southeast Fisheries Science Center in Miami, Florida.

- Coordinated with Tim Haverland, EcoGIS developer, to obtain summarized maps of fishing effort and catch from logbook, observer, or fishery-independent survey data sets. The summarized maps included data for royal red shrimp, rock shrimp, wreckfish, king mackerel, golden crab, gag grouper, and black sea bass. The maps include values for sum of live pounds for the years 1990-2006 and average live pounds per year.

- Converted coordinates provided by SAFMC to create shapefiles for the proposed Allowable Golden Crab Fishing Areas and Shrimp Fishery Access Area (SFAA) within the proposed deepwater CHAPCs. These areas are located within the proposed Stetson Reefs, Savannah and East Florida Lithoherms and Miami Terrace CHAPC and Pourtales Terrace CHAPCboundaries.

- Converted coordinates for the Golden Crab Middle Zone lines: These lines represent points provided by golden crab fishermen to delineate allowable gear areas.

- Created a point layer for each CHAPC. These point layers were used to label latitude and longitude values for vertices of the CHAPC polygons.

- Created an ArcGIS label expression file to display select coordinates of the proposed deepwater CHAPCs. This file was used for maps presented to the SAFMC Coral and Habitat Advisory Panels and in the SAFMC's Comprehensive Ecosystem-based Amendment 1.

- Worked with SAFMC staff to create point location shapefiles for the SFAA and Golden Crab Allowable Fishing Areas. The point shapefiles were used to provide tables listing relevant vertices of the polygon shapefiles.

- Provided the proposed Marine Protected Areas shapefile and metadata record to James Sinclair of the Minerals Management Service.

- Coordinated with Pace Wilber of NOAA Habitat Conservation Division to modify the EFH metadata records for spiny lobster, snapper grouper, red drum, golden crab, coastal migratory pelagics, shrimp, and coral, coral reefs and live/hard bottom.

- Compared spreadsheets and shapefile .dbf tables to confirm vertices coordinates for CHAPCs, SFAAs, and Golden Crab Allowable Fishing Areas.

- Assisted SAFMC staff with updating the proposed deepwater CHAPC shapefile and metadata record.

- Created GeoPDF for SAFMC to display points and polygons for the SFAA and Golden Crab Allowable Fishing Areas in relation to the proposed deepwater CHAPCs (See **Appendix B**).

- Created map depicting proposed deepwater CHAPC as they were defined in 2004 for a presentation given at the 4th International Deep Sea Coral Symposium held in Wellington, New Zealand, in December 2008.

Appendix A (attached)

Summary reports for the Indian River Lagoon.

1. **Attributes**
    o **Life Mode**
    o **Spatial Strategy**
    o **Trophic Mode**
2. **Zones**
    o **Riverine**
    o **Estuarine**
    o **Oceanic**
3. **Water Column Habitat**
    o **Salinity Classification**
    o **Temperature**
4. **Substrate Habitat**
    o **Vegetation**
    o **Soft Bottom**

    o **Live/Hard Bottom**

Appendix B (attached)

FWRI created a GeoPDF for SAFMC to display points and polygons of the Shrimp Fishery Access Area, and Golden Crab Allowable Fishing Areas in relation to the proposed deepwater Coral HAPCs. FWRI purchased the MAP2PDF software which allows GIS professionals to publish and distribute maps with no need for the recipients of the GeoPDF to have any knowledge of GIS. Clients only need the free GEOPDF toolbar to access the extended PDF tools. The GEOPDF toolbar offers greater functionality than normal .PDF documents providing users with the ability to measure distances, manipulate maps, and/or zoom to specific coordinates.

Project 2: NOAA CRG 2006 Maintenance of Council GIS capabilities.
Funds were used to maintain the SAFMC's GIS license and obtain software upgrades.

Project 3: NOAA CRG 2006 Updating and Expanding Comprehensive Status Reports on Deepwater Coral Systems to Support the Designation of Deepwater Coral Habitat Areas of Particular Concern and Creation of a High Definition Film of Deepwater Coral Research and Management in the South Atlantic Region.
This project was composed of two distinct tasks. The first task was assigned to S.W. Ross of the University of North Carolina at Wilmington (UNCW) and involved updating and expanding the 2004 deepwater coral report produced for the SAFMC. The second task involves the creation of a DVD on regional research on deepwater corals.

Task 1. The updated review of deepwater corals by S.W. Ross was completed in 2006 and submitted to the SAFMC (submitted to CRCP in previous progress report). It is available on the SAFMC's website at http://www.safmc.net/Portals/0/Fep_teams/Ross_reportMay06.pdf.

Task 2. The development of the research DVD, *Revealing the Deep,* was completed in early September 2007. This work was conducted by Art Howard (ARTWORK, Inc.) and Julie Dixon with assistance from S.W. Ross. During the final period of the project, the draft DVD (audio and video) were assembled and reviewed by S.W. Ross. SAFMC representatives, Roger Pugliese and Myra Brouwer, also reviewed the draft film. Adjustments were incorporated and a final master DVD plus 200 copies standard definition and 50 copies high definition were delivered to the SAFMC. The film received its first public airing at the American Fisheries Society meeting (4 Sep 2007, San Francisco) in a special deep-sea coral session. The SAFMC, in cooperation with the Sustainable Seafood Alliance, also held a "premiere" event at the SC Aquarium in November 2007 to publicize the film. The SAFMC has continued to order copies of the film for public dissemination. *Revealing the Deep* was awarded the 2007 Silver Telly Award.

Project 4: NOAA CRG 2006 Support Fisheries Scientist to provide Additional Technical Support for Council Coral Conservation and Management Activities.
- The Fishery Scientist has provided support and coordination for the development of a Deepwater Coral Research and Monitoring Plan for the South Atlantic region. The latter was partially approved by the Council at their March 2007 meeting.

- The Fishery Scientist continued to assist in the maintenance and enhancement of the Council's Habitat and Ecosystem website. She presented an update on website usage to the Information and Education Committee in March 2007.

- The Fishery Scientist developed webpages to accompany the joint Gray's Reef/ SAFMC research cruise that took place in June 2007. Daily logs and photographs were posted daily on the site as well as interviews with crew and researchers. To browse the pages go to:
http://www.safmc.net/HabitatManagement/DeepwaterCorals/LopheliaCommunities/ExpeditionsandExplorers/GraysReefandSAFMCAssessmentCruise/tabid/507/Default.aspx

- The Fishery Scientist presented an update on the website to the Information and Education Advisory Panel in August 2007. The Advisory Panel made suggestions and recommendations that were incorporated into the site.

- The Fishery Scientist presented the SAFMC's new film on deepwater corals, *Revealing the Deep* (see above project) to the Information and Education Advisory Panel in August 2007 and requested the Panel's suggestions for distributing and promoting the DVD.

- The Fishery Scientist participated in NOAA's External Review of the Coral Reef Conservation Program which took place in Washington, DC on September 24 – 26, 2007. She served as a panelist and provided recommendations on behalf of the SAFMC as a grantee under the CRCP's "Projects to Improve or Amend Coral Reef Fishery Management Plans."

- The Fishery Scientist reviewed a CRCP application and provided feedback to CRCP for a project involving *Oculina* coral.

- The Fishery Scientist assisted in developing a spatial representation of golden crab fishing activities to assess whether impacts on the proposed deepwater CHAPCs are foreseeable and the Council can take appropriate action to minimize those impacts.

- The Fishery Scientist prepared coral progress reports for projects funded through CRCP and prepared the proposal for the 2008-2010 funding cycle.

- The Coral Fishery Scientist attended the 11th International Coral Reef Symposium in Ft. Lauderdale, Florida, in July 2008.

- The Fishery Scientist participated in other Council activities as needed.

Final Report, Coral 2006
Prepared by:

Robert K. Mahood   3/27/09
Executive Director   Date