SEACOOS July Workshop
15-16 November, 2005
Ecosystems/Fisheries Application Team

A. PLENARY SUMMARY AND ACTION ITEMS (July 26, 2005)

(presented by Bill Arnold, Florida Fish and Wildlife Commission)

There was recognition of present fiscal constraints, that there are limitations to what is logistically feasible. It was felt that there a need for developing a framework of common concepts and common language to integrate Living Marine Resources/Fisheries management topics into the COOS concept. There was a good deal of discussion on the value of and need for case studies, and possible sites/processes for focus of such studies.

Proposed Action Items:

1. **Choose processes/sites for demonstration projects for integrating COOS concepts/products with Living Marine Resourcess issues, develop experimental designs for such studies. Suggested options for sites for demonstration projects were the West Florida Shelf, Oculina Bank, and the South Atlantic Bight.**

2. **Investigate the compatibility of physical and biological data sets / data management and data matching. Enhance communication between PO researchers and Fisheries Scientists (SAFMC and Gulf of Mexico and Caribbean) and continue the dialog initiated with the White Paper discussion. Use concepts of scale (time and space) for organizing the discussion and emphasize data integration and analyses for common goals;**

3. **Facilitate sensor development through coordination with the Alliance for Coastal Technologies (ACT), and use of the SEACOOS test bed infrastructure, and in particular, encourage development of appropriate biological sensors.**

B. Breakout session notes
Tues 26 July

Introduction
Cisco Werner (UNC) chaired the break-out session. He noted the need to keep in mind the fiscal realities and focus on what can be accomplished given the present budget levels. A list serve sign-up sheet for the Fisheries/Ecosystem Application Team was circulated.

Several topics for discussion were suggested:

- Initial ideas to be pursued by the Ecosystems/Fisheries Application Team and the data needs for these;
- The level of resolution in time and space for appropriate overlap of physical and biological variables;
- Needs for new instrumentation/sensors;
- The suite of models required to address the Ecosystems/Fisheries area in the SEACOOS domain, and how to couple models;
- Case studies as an approach for the initial applications.

Discussion

Current status
It was recognized that there are substantial gaps in the existing Ecosystems/Fisheries observation/modeling network for the SE. The suggested immediate term strategy was to assess the existing capabilities and define an initial course for the Application Team that starts with what we have now. From the SEACOOS side, a feasible, near-term starting point could be based on the SEACOOS database/Mapserver (GIS) capabilities. These might be used to link SEACOOS observations and model products with fisheries databases and applications. Other areas for near-term activity are assessment of requirements for fisheries research/management and cataloging which sensors are presently deployed and maintained. The latter could build on the SEACOOS "sensor inventory."

For portions of the domain, it was felt that there exists sufficient time series data to define climatological annual cycle and to assess seasonal and inter-annual variability in factors such as fresh water input, river plumes and boundary current position. The SEACOOS strategy could be to start with coastal ocean circulation, developing appropriate climatologies for circulation within the SEACOOS domain, identify where there are gaps, then target enhancements that would serve the application requirements. This should be pursued in coordination with the science plans of the Fisheries Management Councils and with NOAA groups (such as the National Marine Sanctuaries, and other "sub-ecosystem" working groups).

Fisheries / Ecosystem Information needs.
From a fisheries management perspective, SEACOOS could provide monitoring of core (largely physical) environmental variables on appropriate time scales for assessment of seasonal, annual and inter-annual environmental variability. This would need to consider the appropriate system design for this network for fisheries applications, and identification of priorities for additional observing points and sensors. Among the fisheries management needs are identification of key conditions for spawning and recruitment, and better prediction of environmental effects on various species or management groups (examples include the reef species complex and tilefish). Benthic habitat characterization, and subsurface observations in general, are also important to many fisheries applications. It was noted that the available information on most pelagics and forage species was mostly obtained in the 1970's, and that information on predation as a source of variability on various fish populations is lacking.

Technology/sensor development.
It was suggested that SEACOOS could play a role in technology/sensor development for Fisheries/Ecosystems applications. There are a number of potential chemical, biological, and optical sensors under development, but sustained field deployments are still a good number of years off in most cases. Other new information sources include video and acoustics, with UW video systems currently deployed or anticipated through SEACOOS and affiliate efforts at several locations. There are presently no offshore acoustic studies being conducted in the SE. Potential targets for both video and acoustics would be known "hot-spots" for spawning of fish species of management interest. Peter Betzer (USF) also reported that there are new larval fish survey tools being developed/tested by the USF Marine Engineering group. Present SEACOOS resources (infrastructure and personnel) could be leveraged to provide test-beds in a number of locations in the SE coastal ocean.

The potential role of the Alliance for Coastal Technologies (ACT) in promoting development of new sensors relevant to fisheries/ecosystem applications was discussed. It was felt that ACT could foster links between industry and managers with researchers. NSF programs, such as OTIC and ORION, are also potential avenues of support for development of sensor test-beds in the SE.

Potential pilot study sites and target species
An important area for the fisheries management community is assessment of potential sites for Marine Protected Areas (MPAs); for example designing MPA networks that will enhance survivorship at key life history stages for various species. There is presently a mismatch between the proposed MPA sites and where in situ observations are located. An example being Oculina Bank along the margin of the EFS. However, it was noted that there are modeling programs underway for the EFS, including NPZ-type modeling. It was recognized that information on the larger scale physical dynamics would be critical to focused work at specific sites, such as MPA design and assessment. This is an area of potentially beneficial collaboration between SEACOOS and the management community, and is relevant to other environmental management issues, such as offshore gas exploration, offshore terminals for oil and gas delivery. A focus on processes as

opposed to specific sites was suggested as an appropriate approach; that is, understanding the three-dimensional, time-dependent variability in the system. Roger Pugliese (South Atlantic Fisheries Management Council) felt that the fisheries management councils can provide some push to bring resources for focused pilot studies.

Target species suggested for pilot studies were king mackerel (and the baitfish it preys upon) as a pelagic species, and gag grouper as a benthic, reef-associated species. King mackerel are a major target for sportsfishing interests throughout the SEACOOS domain, and thus a potential means of building regional stakeholder interest. And while, from the management perspective king mackerel are not under the population stress comparable to gag grouper and other heavily exploited species, there is the advantage of "more data points." Gag grouper is also of commercial and recreational interest, and provides a benthic species which also demonstrates the need for consideration of regional "connectivity." In addition to fish species, it was suggested that SE coral reef habitat assessments and analyses could be considered as an area of focus for fisheries/ecosystems applications; it being noted that considerable resources are presently directed toward coral reef monitoring in other regions.

Dave Eslinger (NOAA Coastal Services Center) related his experience in working with Alaska pink salmon stock assessment. There, the impact of ocean conditions on stocks was the key unknown. He suggested that modeling could serve as a starting point for similar stock assessments in the SE, but raised the questions of appropriate target species and environmental variables. One potential example could be aggregation/spawning “hot-spots”, where assessment of physical dynamics could be associated with temperature thresholds, etc. that affect year-class strength.

C. Team Members (last updated, August 2005)

Listserve address: SEACOOS-Team-Fisheries-Circulation@listserv.unc.edu

Name	Subscribed Email
Amber Von Harten	ambervh@clemson.edu
Behzad Mahmoudi	B.Mahmoudi@myfwc.com
Aida Alvera	aalvera@marine.usf.edu
Charlie Barans	baransc@mrd.dnr.state.sc.us
Bill Arnold	bill.arnold@myfwc.com
Braxton Davis	braxton.davis@sc.edu
Brian Keller	brian.keller@noaa.gov
Frank Muller-Karger	carib@marine.usf.edu
Cisco Werner	cisco@unc.edu
Chris Mooers	cmooers@rsmas.miami.edu
Carrie Wall	cwall@marine.usf.edu
Dave Eslinger	Dave.Eslinger@noaa.gov
David Mann	dmann@marine.usf.edu
Dawn Lavoie	dlavoie@usgs.gov
Richard Dodge	dodge@nova.edu
Dana Savidge	dsavidge@skio.peachnet.edu
Madilyn Fletcher	fletcher@biol.sc.edu
Gary Hitchcock	g.hitchcock@miami.edu
Harvey Seim	hseim@email.unc.edu
Jack Thigpen	jack_thigpen@ncsu.edu
Jerome Fiechter	jfiechter@rsmas.miami.edu
John Lamkin	john.lamkin@noaa.gov
Jon Hare	Jon.Hare@noaa.gov
Judy Gray	judy.gray@noaa.gov
Karen Edwards	kpehrson@email.unc.edu
Laura Kracker	laura.kracker@noaa.gov
Lundie Spence	lundie.spence@scseagrant.org
Maria M. Crailes	mcriales@rsmas.miami.edu
Merrie Beth Neely	Merrie.Neely@MyFWC.com
Michael Henderson	michael.henderson@noaa.gov
Jim Nelson	nelson@skio.peachnet.edu
Parker Lumpkin	oceanosailor@hotmail.com
Peter R. Betzer	pbetzer@marine.usf.edu
Peter Ortner	peter.ortner@noaa.gov
Pat Welsh	pwelsh@unf.edu
Rebecca Shuford	rebecca@sc.edu

Rick Gleeson	rglee@whitney.ufl.edu
Rick Jahnke	rick@skio.peachnet.edu
Robert Bacon	Robert.Bacon@scseagrant.org
Mitchell A. Roffer	roffers@bellsouth.net
Roger Pugliese	roger.pugliese@safmc.net
Rod Zika	rzika@rsmas.miami.edut
Sandy Bernard	Sandy.Bernard@scseagrant.org
Sara Mirabilio	saram@csi.northcarolina.edu
Scott Cross	scott.cross@noaa.gov
George Sedberry	sedberryg@mrd.dnr.state.sc.us
Andy Shepard	sheparda@uncw.edu
Chris Simoniello	simo@marine.usf.edu
Sandra Vargo	svargo@marine.usf.edu
Tom Gustafson	tgustafs@nsu.nova.edu
Thomas Wheatley	twheatley@conservefish.org
Bill Venezia	veneziawa@nswccd.navy.mil
Robert Weisberg	weisberg@marine.usf.edu
Bill Lindberg	wjl@ufl.edu
Yonggang Liu	yliu@marine.usf.edu

Appendix I. White paper version 19 July 2005

White paper developed in preparation for the
SEACOOS-SECOORA Workshop
25-28 July 2005, Jacksonville, FL

SEACOOS Fisheries Oceanography Team[(1)]

This document outlines a draft 2-3 year Fisheries Oceanography action plan for the Southeastern Region Coastal Ocean Observing Systems (SEACOOS). Implementation of the plan seeks to develop information relevant to Living Marine Resources (LMRs), Fisheries, and Ecosystem-Based Management. The action plan specifically addresses the need of development of biological sensors and their deployment strategies, and defining links for integration of LMR information with fisheries management, resource users, recreational and commercial fishermen, the general public, and other interested stakeholders.

Fisheries Oceanography focuses largely on observation rather than experimentation, because in most cases controls and/or repeatability of observed phenomena are not possible. Observations are then used to formulate theories and management responses, rather than having general laws that are broadly applied. Indeed, *"the critical foundation of any program that seeks to manage the health of stocks in relation to human activities is an observing system providing periodic information about resource abundance and factors potentially influencing that abundance (either human-induced or naturally occurring)"* (Murawksi, 2002).

Biological components of marine ecosystems may be observed using shipboard surveys, hydro-acoustic systems (including tagging of fish and marine mammals), video capabilities, remote sensing, in-water sampling devices, etc. These observations are essential as input and boundary conditions for physical and biological models that help understand an ecosystem and eventually predict its future state. An important objective is to consider responses to "what if" scenarios, e.g., in response to changes in management approaches or in natural variability.

A. Action Plan Components

Issues that we propose to discuss at the workshop include:

1. Understand the role of COOS as a component of Ecosystem-Based Management – see Section B for a discussion of specific approaches. Determine target fisheries and ecosystems and identify the oceanographic parameters, essential habitats, study area, and time frame most applicable to satisfy the need of stakeholders.
2. Develop strategies to make the collection of fishery oceanography data part of the observing system framework – through direct links and cooperation with the Regional Fisheries Management Councils (RFMC) and state/interstate fisheries management agencies, private initiatives, etc.
3. Develop a conceptual framework for development and deployment of new technologies aimed at measuring biological variables and modeling biological processes, including initial assessment of stakeholder needs, technologies available, and possible deployment strategies.
4. Identify critical fishery oceanography data to be collected and combined with synoptic remote sensing and three-dimensional water column data to:

- refine characterization of essential habitat;
- provide critical parameters required by physical-biological models and enable their integration with ecosystem-based models that may be used by resource managers.

5. Develop pilot projects for the RFMC and state agencies to use the SEACOOS results in current fisheries management plans.

B. Coastal Ocean Observing Systems and Ecosystem Management

Considering Ocean Observing Systems are an integral part of the transition to ecosystem management in the Southeast region a broad approach would be to identify how they can meet areas addressed in the Ecosystem Report to Congress and in the developing South Atlantic Council Fishery Ecosystem Plan.

Ecosystem Management South Atlantic Fishery and Fishery Ecosystem Plan: Development: "*The Fishery Ecosystem Plan will evolve from the Council's Habitat Plan. The transition from single species management to* ***ecosystem management*** *will involve incremental steps to better characterize the system and understand the complex relationships among humans, harvested fish and prey, all marine life and essential habitat and environmental characteristics of the South Atlantic Ecosystem. This effort will provide the Council with a foundation from which to attain a more comprehensive understanding of habitat and biology of species, fishery information, social and economic impacts of management and ecological consequences of conservation and management. The Fishery Ecosystem Plan will specify research and monitoring needed to fully address ecosystem management."* SAFMC Action Plan for Ecosystem-Based Management*

Building on the recommendations outlined in the Ecosystem Report to Congress, the Council's Fishery Ecosystem Plan and Comprehensive Ecosystem Amendment will include the following (a preliminary list of ocean observing activities which could address each activity are included to stimulate discussion with a list of additional potential target species included in the Appendix to this document):

1. Define the ecosystem boundaries;

   a. Better define current regimes and model dynamic systems (e.g., Gulf Stream and Florida Current both designated as Essential Fish Habitat - Habitat Areas of Particular Concern for multiple managed species) affecting primary production and fish production in the southeast.

2. Characterize the ecological (biological, chemical and physical), human and institutional elements of the ecosystem;

   Biological-

   a. Define migratory pathways (inshore/offshore and north/south) from acoustic/satellite monitoring of managed species.

   b. Monitor and model current systems which define larval transport and/or settlement characteristics of managed species (e.g., gag grouper) - See SAFMC Oculina Evaluation Plan **

   Chemical-

   a. Monitoring from observing system used to present all significant chemical parameters

defining the southeast ecosystem. Model changes in chemical characteristics linking impacts to changes in habitat/species distribution (e.g., ph change as it relates to tropical coral distribution.

Physical-

a. Model impacts of physical disturbances (e.g., hurricanes) and changes in habitat distribution and species production.

b. Monitoring surface to bottom temperatures to characterize upwelling events. Model rapid temperature changes in relationship to reef fish mortality

3. Describe the habitat needs of different life history stages for all managed species;

a. Provide more accurate presentations of water column characteristics defining the SA Ecosystem (e.g., seasonal temperature (surface to benthos) and salinity changes so they can be related to various life stages of managed species).

b. Monitor and characterize physical characteristics of snapper grouper spawning locations.

c. Integrate/enhance/establish monitoring systems to characterize physical characteristics of water column associated with major benthic habitat distributions along the South Atlantic shelf, slope and deepwater (e.g., deepwater coral systems designated or proposed as Coral Habitat Areas of particular Concern (*Lophelia* and *Oculina*), shelf edge (e.g., snowy grouper tilefish habitat 100-300m), mid-shelf habitat (e.g., red snapper gag grouper vermilion snapper) and near-shore/shallow water habitats (e.g., black seabass).

d. Design/enhance/integrate ocean observing capabilities to document the life history of Gag in the South Atlantic region. This grouper species life history emphasizes the need for ecosystem-based management. The following depicts the complexity of the species life history and habitat use patterns. This effort would also emphasize the connectivity of southeast habitats and water systems from rivers to off the continental shelf.

*General Gag life history and habitat use in the South Atlantic****

Spawning locations are south of settlement areas in deepwater habitat (e.g., shelf break, Oculina Bank HAPC and Experimental Closed Area).

Transport of larvae via Gulf Stream north and dispersal over the shelf via eddies created from the deflection of the Charleston Bump possible entrainment and grow out in the Charleston Gyre.

Movement through inlets to Wetland estuarine habitat specifically: Oyster reefs in South Carolina and Georgia and Seagrass in North Carolina and Florida depending on area of settlement and growout.

Juveniles move out of inlets to near-shore live/hard bottom to mid-shelf live/hard bottom, artificial reefs including Special Management Zones and growth to spawning size on the shelf coral and hard-bottom habitats.

Mature adults move inshore in the fall to near-shore / mid-shelf hard bottom coral communities forming pre-spawning aggregations / associations.

Movement south to deepwater coral, live hard bottom habitat (EFH-HAPC) to spawn and return north.

4. Develop a conceptual model of the food web;

   a. Characterize and monitor primary production in region for incorporation into Ecosystem models (e.g., Ecopath and Ecosim).

5. Calculate and characterize total fishery removals (i.e., landings, discards, bycatch);

   a. Acoustic systems included in monitoring packages could monitor fishing and other vessel traffic.

6. Develop indices of ecosystem health;

   a. Ocean observing systems provide the platform to establish baselines, trends and predictive models for physical and chemical characteristics of the South Atlantic ocean. In addition, the observations could be linked to watershed information from river systems (e.g., freshwater volume, rates and contents including nutrients, pesticides, etc.) to define the link between rivers, estuaries nearshore and offshore ocean environments.

7. Recommend research and monitoring activities;

   a. Fishery Ecosystem Plan to address ocean observing systems role/needs in enhancing habitat, fisheries and ecosystem management in the southeast region.

C. Future Activities

The approaches to achieve these tasks will include workshops with SEACOOS and other academics, commercial and recreational fishermen, NOAA Southeast Fisheries Science Center, state fisheries scientists, and fisheries managers (including state fishery managers, the South Atlantic and Gulf of Mexico Fishery Management Councils, NOAA Fisheries Southeast Regional Office and interstate marine fishery commissions). A discussion among all these parties will uncover issues/needs that can be addressed through SEACOOS.

In addition, workshops have value for SECOORA in that SECOORA will be the formal administrative and governance structure overseeing the observing system, and therefore will need to establish and manage communications between stakeholders and the observing system. The Education and Extension Working Group (E&E WG) has offered to take leadership in the identification of key participants (especially fishermen, State, Federal, and council fishery managers, and fisheries scientists), and deal with the logistical details. Where possible, coordination should occur through fisheries agencies which have formal advisory panels.

A relevant regional workshop is being planned by the SAFMC (targeted for November 2005) on Research and Monitoring Needs for Ecosystem-Based Management (a national and international forum to provide guidance for long-term planning to support the developing regional fishery ecosystem plan). There will be a session to address a developing section of the South Atlantic Council Fishery Ecosystem Plan dedicated to ocean observing systems role in fisheries, fisheries management and the evolution to ecosystem management in the South Atlantic region.

An ocean observing system module will be established on the South Atlantic Council Habitat and Ecosystem Homepage****. In lieu of an excess number of workshops, the interactive capability

of the web portal could support further development of an action plan which details present capabilities and potential uses in habitat and fisheries management and expanded capabilities which will be necessary to support the transition from single species fisheries management to ecosystem management.

(1) The team's composition as initially identified at the SEACOOS 2004 Charleston Fall workshop includes: Cisco Werner (chair); Frank Muller-Karger; Roger Pugliese; Madilyn Fletcher; Bob Bacon; George Sedberry; Charlie Barans; Jim Nelson; Chris Simeniello; Bob Weisberg; Rick Jahnke; Chris Mooers; Jerome Fiecther; Dana Savidge, Jack Thigpen and Lundie Spence. The team's charge, membership and structure will be revisited at the Jacksonville meeting.

References

Murawski, S.A. (2002) Scientific challenges in supporting living marine resource management. Statement to the US Commission on Ocean Policy.
http://www.oceancommission.gov/meetings/jul23_24_02/murawski_testimony.pdf

*SAFMC Action Plan for Ecosystem-Based Management:
http://ocean.floridamarine.org/efh_coral/pdfs/FEP12_04.pdf

**Oculina Evaluation Plan:
http://ocean.floridamarine.org/efh_coral/pdfs/Oculina/FINALEvaluationPlan.pdf

***Gag Life History: http://map.mapwise.com/safmc/Default.aspx?tabid=68

****Habitat and Ecosystem Homepage: http://map.mapwise.com/safmc/Default.aspx

Appendix: Potential target species for the SEACOOS domain.

- ***Reef fishes in general, Gag and Red Grouper in particular:*** Gag Grouper (and other reef fishes) spend their adult lives offshore and their juvenile phases in nearshore and inshore seagrass beds or oyster reefs. Evidence exists on adult spawning regions (shelf break) and times (late winter to spring) as well as on the juvenile settlement times (late spring to summer). However, the 3D pathways and mechanisms by which the larvae transit to settlement, both of these being significant factors in larval survival and recruitment, remain to be determined.
- ***Shallow and Deep coral reefs:*** habitat characterization and restoration of shallow coral reefs, as well as deep *Oculina* and *Lophelia* coral reefs require understanding the physical and biological processes determining the environment at the shelf-edge, over the shelf, and near the coast, including the importance of self-seeding, sensitivity to changes in feeding and hydrographic fields, connectivity with other parts of a larger ecosystem, regional water quality, etc.
- ***Interactions and linkages between various populations; scallops in particular:*** Bivalves such as scallops and other commercial species are not distributed uniformly along the coast. Are there relationships between species distributions and the seasonally varying currents and other physical factors such as temperature and salinity? Are there significant inter-annual variations that impact these population linkages and resultant abundances?
- ***Forage species and their role in supporting pelagic species biomass:*** Pelagic fishes depend on the abundances and distributions of smaller forage species. What environmental factors control the abundances and distributions of the forage species and thus the migrations/distributions of the pelagic species?
- ***Species life history for those fish that spend part of their life in the estuaries and part offshore, i.e., estuarine-dependent species such as mullet, menhaden, spot, flounder, croaker, gag, gray snapper, Spanish mackerel, etc.:*** Specific pathways (to be determined) exist between the major estuaries and the coastal ocean that depend on buoyancy (salinity in particular), winds and tides. Mullet, menhaden and others may be target species; however, this topic pertains to many commercially and recreationally important species. Modeling and observational tools presently exist to make this a tractable problem for scientific investigation.
- ***The benthic connection, e.g., shrimp:*** Three-dimensional studies must include the benthos since the bottom boundary layer likely provides an important connection in the general pathways/mechanisms framework. Hence primary and secondary productivity within the bottom boundary layer is likely important for the higher trophic levels considered above. Shrimp, as a commercially important species provides a focus.