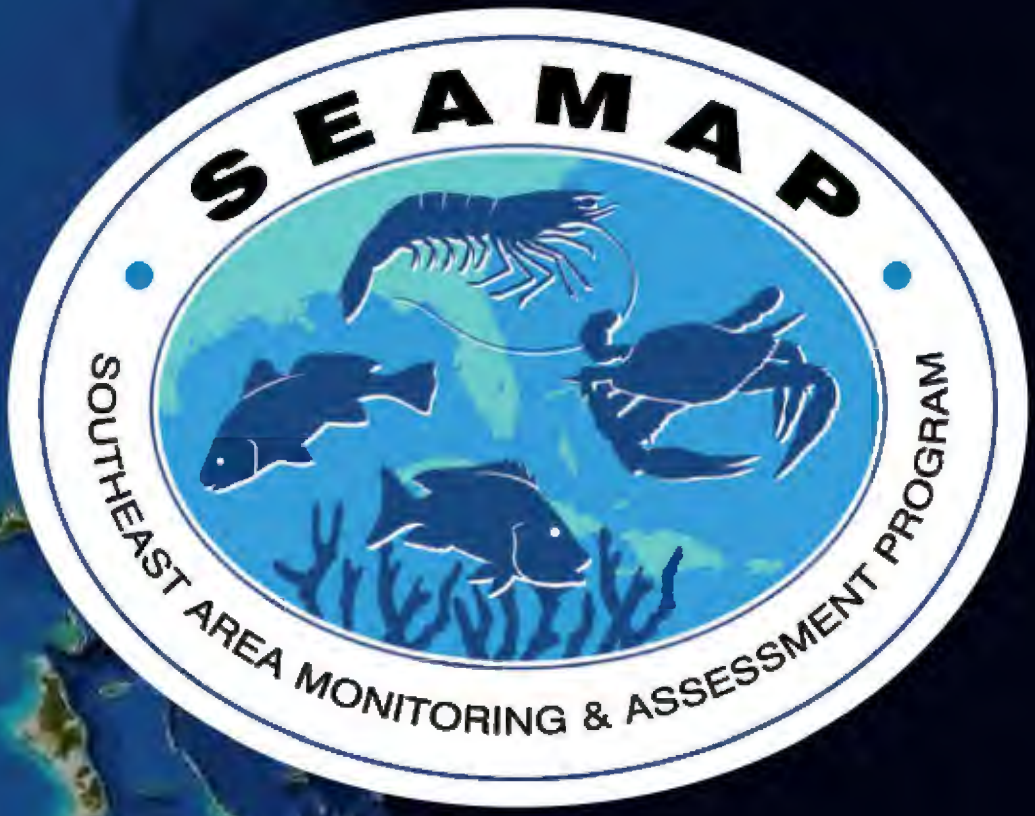
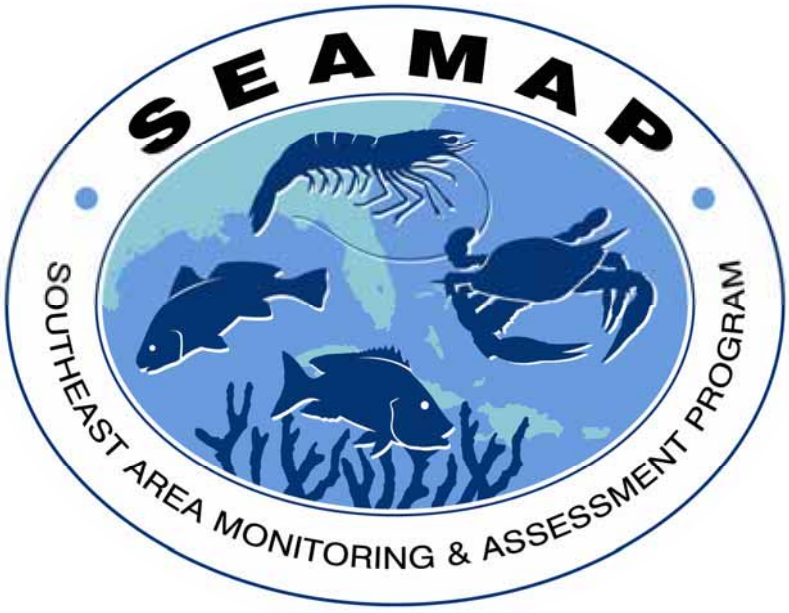
2011-2015 Management Plan



Collection, Management and Dissemination of Fishery-independent Data from Waters of the Southeastern United States

Caribbean, Gulf of Mexico and South Atlantic Regions

2011-2015 Management Plan



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PREFACE

Fisheries are a vital part of the nation's economy and, more specifically, the coastal communities and states of the South Atlantic, Gulf of Mexico, and Caribbean. In the region in which the Southeast Area Monitoring and Assessment Program (SEAMAP) is conducted, fisheries resources support valuable commercial and recreational fishing industries. In 2009, this region's commercial fishermen landed over 2.8 billion pounds of seafood worth almost $2 billion[1]. In the same year, recreational anglers landed at least 175 million pounds of fish[2]. Recreational fishing is a growing industry in the SEAMAP region, where over 5.2 million U.S. recreational anglers took over 41 million fishing trips in 2009[3]. Overall, recreational fishing in the SEAMAP region accounted for 60% of the total 2009 U.S. marine recreational fishing catch.

Kim Iverson, South Atlantic Fishery Management Council

Fishing and tourism industries contribute significantly to the economies of the nation's coastal communities by generating employment opportunities and associated revenues. As such, these industries directly improve quality of life and contribute to community diversity by maintaining traditional fisheries. Sustainable recreational and commercial fisheries are dependent on responsible resource management, which, in turn, needs accurate and timely data as a basis for management decisions. SEAMAP plays an integral role in providing fishery-independent data critically needed for effective fisheries management throughout the Southeastern United States, including the Atlantic, Gulf of Mexico, and Caribbean regions.

As the focus of fisheries management expands from single species management to ecosystem-based fisheries management, the need for basic information has also increased significantly. For example, in addition to the ongoing baseline data required for effective management of recreational and

[1] Based on NMFS 2009 landings data.
[2] Based on MRFSS data.
[3] *Ibid*.

commercial fisheries, improved information is needed on prey and predator species life histories and interactions, essential fish habitat, and the effects of changing environmental conditions.

Long-term fishery-independent databases provide information essential to evaluating the status of the nation's fisheries, including population abundances, mortalities, recruitment, and ecological relationships. These fundamental parameters, combined with long-term assessments and monitoring, constitute the backbone of effective fisheries management. Only with this basic information can fisheries managers ascertain trends, determine potential causes of changes, and react responsibly to address these changes. Ongoing, regional fishery-independent efforts, such as those undertaken by SEAMAP, can generate data critically needed by fisheries management to address these issues.

Adequate funding continues to be a challenge in fisheries science and management. Federal and state government funding for fisheries activities will likely decrease over the coming years in order to meet the fiscal objectives of balanced budgets and reduced spending. This could significantly impact the nation's capability to manage its valuable fisheries resources. However, by building partnerships, the federal and state governments can combine their limited resources to address issues of common interest. In particular, cooperative programs for collecting essential fisheries data would benefit all partners, providing valuable scientific information for management at the state, federal, and regional levels.

SEAMAP is a model partnership for cooperative federal and state data collection. SEAMAP is truly collaborative; fiscal, physical, and personnel resources are shared among participants and decisions are made by consensus. The experience and success of SEAMAP over the last 30 years illustrate its effectiveness. SEAMAP has great potential to increase and improve its usefulness for fisheries management by expanding its fishery-independent data collection programs, provided additional funding is made available. We strongly support this worthwhile program and its expansion to collect more fishery-independent data for purposes of fishery management.

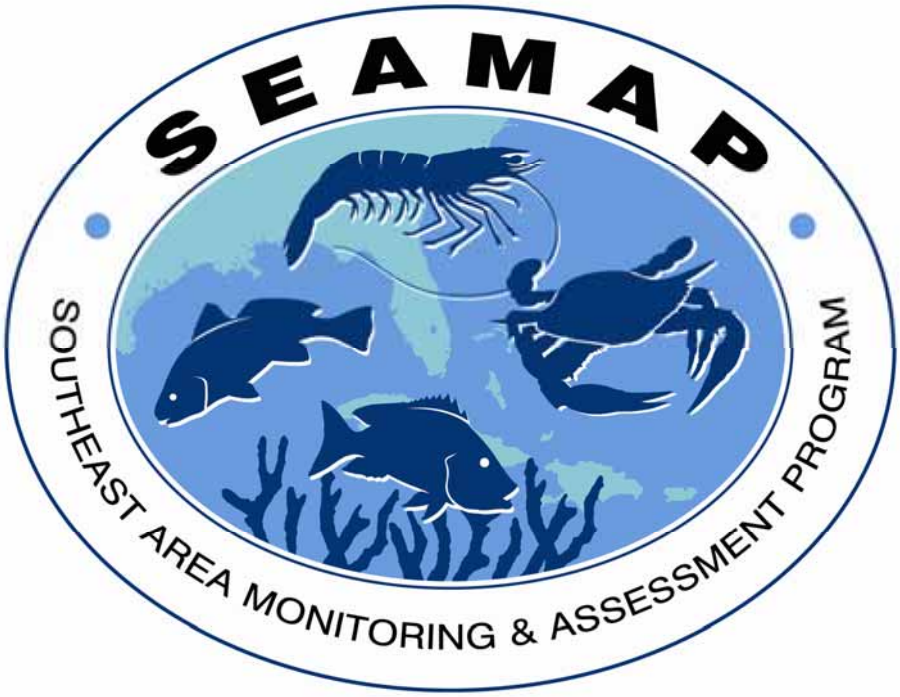
Read Hendon	Roger Pugliese	Jed Brown
Chair	*Chair*	*Chair*
SEAMAP-Gulf	SEAMAP-South Atlantic	SEAMAP-Caribbean

ACKNOWLEDGMENTS

The SEAMAP Gulf, South Atlantic, and Caribbean Committees (Appendix A) would like to acknowledge those who have helped make SEAMAP such a successful program. Many individuals from various federal, state, and academic organizations provided their expertise to SEAMAP projects by serving as members of work groups. The committees would like to thank all of the work group members for their efforts. In addition, the committees would like to thank the following: Jeff Rester (GSMFC), Melissa Paine (ASMFC), and Edgardo Ojeda (UPRSGCP) for their work as coordinators; Aida Rosario, SEAMAP-Caribbean Chair through 2010 for her work as Chair, as well as input on this plan; Dr. Roy Crabtree and Dr. Lisa Desfosse, NMFS Regional Administrator and Regional Science Director, respectively, for their support of SEAMAP projects, including strategic planning; and the Atlantic States Marine Fisheries Commission staff for administrative support of this project. The committees also acknowledge Terry Henwood for his efforts and support as SEAMAP's Program Manager at NMFS. Contributing to the success of the program are many other persons who assisted with the resource surveys and projects by providing equipment and donating their time and expertise.

The committees would also like to thank Meredith Wilson (ASMFC) for editing the document and Tina Berger (ASMFC) for editing, formatting and printing this document.

Cover photo courtesy of the Gulf States Marine Fisheries Commission.



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Gulf of Mexico Fishery Management Council
Louisiana Department of Wildlife and Fisheries (LDWF)
Mississippi Department of Marine Resources (MDMR)
NOAA Fisheries
North Carolina Division of Marine Fisheries (NC DMF)
South Atlantic Fishery Management Council
South Carolina Department of Natural Resources (SC DNR)
Texas Parks and Wildlife Department (TPWD)
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SEAMAP COLLABORATIONS

Marine Resources Monitoring, Assessment and Prediction Program (MARMAP)
NOAA Beaufort, NC Laboratory
Southeast Coastal Ocean Observing Regional Association (SECOORA)
Southeast Fisheries Science Center Southeast Fishery-independent Survey (SEFIS) group

Future collaborations
Belle W. Baruch Institute for Marine and Coastal Sciences in Georgetown, SC
Governor's South Atlantic Alliance
The Southeast Coastal Ocean Observing Regional Association (SECOORA)
South Atlantic Landscape Conservation Cooperative (SALCC)
Regional fish habitat partnerships, including the Southeast Aquatic Resource Partnership (SARP) and the Atlantic Coast Fish Habitat Partnership (ACFHP)

ABBREVIATIONS & ACRONYMS

ACL	annual catch limits
AM	accountability measures
ASMFC	Atlantic States Marine Fisheries Commission
BRD	bycatch reduction device
CEBA1	Comprehensive Ecosystem-based Management Amendment 1
CFMC	Caribbean Fishery Management Council
COASTSPAN	Cooperative Atlantic States Shark Pupping and Nursery Survey
CPUE	catch per unit effort
CaRA-CarCOOS	Caribbean Regional Association - Caribbean Coastal Ocean Observing System
DOC	Department of Commerce
EEZ	exclusive economic zone
EFH	essential fish habitat
ESA	Endangered Species Act
FEP	fishery ecosystem plan
FMP	fishery management plan
FSCS	Fisheries Scientific Computer System
FRL	Fisheries Research Laboratory (Caribbean)
GCOOS-RA	Gulf of Mexico Coastal Ocean Observing Regional Association
GIS	Geographic Information System
GMFMC	Gulf of Mexico Fishery Management Council
GSMFC	Gulf States Marine Fisheries Commission
GSMFC-TCC	Gulf States Marine Fisheries Commission-Technical Coordinating Committee
LNG	liquefied natural gas
MARMAP	Marine Resources Monitoring Assessment and Prediction Program
MRFSS	Marine Recreational Fisheries Statistics Survey
MSRA	Magnuson-Steven Fishery Conservation and Management Reauthorization Act
NMFS	National Marine Fisheries Service (also referred to as NOAA Fisheries)
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
OCS	Outer Continental Shelf
PR	Puerto Rico
SAB	South Atlantic State-Federal Fisheries Management Board
SAFIMP	South Atlantic Fishery-Independent Monitoring Program workshop
SAFMC	South Atlantic Fishery Management Council
SEAMAP	Southeast Area Monitoring and Assessment Program
SEAMAP-C	Southeast Area Monitoring and Assessment Program-Caribbean
SEAMAP-SA	Southeast Area Monitoring and Assessment Program-South Atlantic
SECOORA	Southeast Coastal Ocean Observing Regional Association
SEDAR	Southeast Data Assessment and Review
SEFIS	SEFSC Southeast Fishery-independent Survey (SEFIS)
SEFSC	Southeast Fisheries Science Center
SERO	Southeast Regional Office
SERTC	Southeast Regional Taxonomic Center
SIPAC	SEAMAP Invertebrate Plankton Archiving Center
SPR	spawning potential ratio
USFWS	U.S. Fish and Willdlife Service
USVI	U.S. Virgin Islands
UPRSGCP	University of Puerto Rico Sea Grant College Program

EXECUTIVE SUMMARY

The SEAMAP 2011-2015 Management Plan provides a statement of current goals, management policies, procedures, and priorities for all SEAMAP components and partnerships. The plan also serves as a reference on SEAMAP history and accomplishments, as well as detailing priorities for future activities.

SEAMAP is a cooperative state/federal/university program for the collection, management, and dissemination of fishery-independent data and information in the Southeastern U.S. and Caribbean. Representatives from Texas, Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina, North Carolina, Puerto Rico, the U.S. Virgin Islands, the USFWS, and the NMFS jointly plan and conduct surveys of economically important fish and shellfish species and the critical habitats that support them.

NOAA, Florida National Marine Sanctuary

SEAMAP's mission, detailed in Chapter 1 along with goals and objectives, is to provide an integrated and cooperative program to facilitate the collection and dissemination of fishery-independent information for use by fisheries managers, government agencies, recreational and commercial fishing industries, researchers, and others to enhance knowledge of marine fisheries and their associated ecosystems.

SEAMAP is intended to maximize the effective capability of fishery-independent and associated survey activities to satisfy data and information needs of living marine resource management and research organizations in the region. The primary means of performing that task is to optimize coordination and deployment of sampling platforms used in the region to obtain regional, synoptic surveys and to provide access to the collected data through documents and accessible computerized databases. Additional roles of SEAMAP are to document long and short-term needs for fishery-independent data to meet current and future critical management and research needs, and to establish compatible and consistent databases for holistic ecosystem and predictive modeling applications. SEAMAP promotes coordination among data collection, processing, management, and analysis activities emphasizing those specifically concerned with living marine resource management and habitat protection, and provides a forum for coordination of other fishery-related activities.

SEAMAP organization and management procedures and policies, fully described in Chapter 2, are structured to facilitate the implementation of the above roles. These policies and procedures include responsibilities of each member agency, development of planning documentation, and policies for program funding and budget priorities. The program presently consists of three operational components, SEAMAP-Gulf of Mexico, formed in 1981, SEAMAP-South Atlantic (1983), and SEAMAP-Caribbean (1988). Each SEAMAP component operates independently, planning and conducting surveys specific to each geographical region. Information dissemination conforms to administrative policies and guidelines of the NOAA Fisheries Southeast Regional Office (SERO). Joint coordination of the three regions is conducted annually.

Since 1982, SEAMAP has sponsored long-term standardized surveys that have become the backbone of fisheries and habitat management in the Southeast and Caribbean (Chapter 3). SEAMAP currently provides the only region-wide mechanism for monitoring long-term status and trends of populations and habitats within the region. As a cooperative effort, SEAMAP has the potential capability to monitor the distribution and abundance of fish and other populations from North Carolina through Texas and into the Caribbean.

SEAMAP data have proven essential in SouthEast Data, Assessment and Review (SEDAR) stock assessments and management decisions, including the following:

- Assessing long-term trends in coastal marine species, thus providing data for linking population trends with changes in environmental conditions such as global warming, nutrient enrichment, and overfishing (all surveys)
- Documenting and defining essential fish habitat in fishery management plans for the Gulf of Mexico, South Atlantic, and Caribbean Fishery Management Councils (all surveys)
- Long-term monitoring of (juvenile) red snapper abundances and providing necessary information for red snapper stock assessments and habitat requirements in the region (Caribbean, Gulf & Atlantic Reef Fish Surveys; Gulf & Atlantic Trawl Surveys; Gulf Plankton Surveys)
- Identifying and verifying the recovery of Gulf and South Atlantic king mackerel stocks, leading to increased fishing quotas (Gulf Plankton & South Atlantic Trawl Surveys)
- Providing the international community with essential data, demonstrating the need to discontinue longline fishing for Atlantic bluefin tuna in the Gulf of Mexico (Gulf Plankton Surveys)
- Determining population size structures, abundances, and necessary life history information for (SEDAR) stock assessments of a variety fish, crustaceans mollusks, and other species (Caribbean, Gulf & Atlantic Reef Fish Surveys, Gulf & South Atlantic Trawl Surveys)
- Evaluating the abundance and size distribution of penaeid shrimp in federal and state waters to assist in determining the opening and closing dates for commercial fisheries (Gulf South Atlantic Trawl Surveys)
- Assessing population structure and harvest estimates within the migratory Atlantic coast striped bass stock (Cooperative Winter Tagging Cruise)
- Surveillance of hypoxia (dead zone) in the Gulf of Mexico that continues to threaten the marine resources of Louisiana and adjacent states (Summer Trawl Survey)
- Estimation of finfish bycatch in the shrimp fisheries of the Gulf and South Atlantic, supporting bycatch reduction device regulations
- Evaluating the community structure and trophic interactions in the various regions to assist with the development of ecosystem models and support the move to ecosystem based management
- Collection of bottom habitat and snapper grouper species information, supporting the designation of essential fish habitat and the establishment of deepwater
- Initial contribution to the compilation of existing deepwater habitat distribution and geologic information, which supports the South Atlantic Council's creation and conservation of 23,000 square miles of Deepwater Coral Habitat Areas of Particular Concern in the South Atlantic - the largest and least impacted deepwater coral ecosystem in the world

The SEAMAP Joint Committee has developed a list of future project activities and prioritized them in three broad categories that maintain and expand upon existing SEAMAP data collection activities and propose new data collection efforts, dependent on the availability of additional funding (Chapter 4). Funding provided in FY2010 for SEAMAP was $5,090,065, which allows for the dissemination of readily available regional fish and habitat data for use in stock assessments of state and federally managed species. Enhancement and expansion of the program will directly improve the ability of scientists to refine existing assessments with better data, as well as perform more assessments of overfished resources, eventually leading to more effective management in the Southeast region.

I. Maintain existing programs at current levels and develop to full utilization (~$2.5 million/year)

Survey costs will continue to increase over time. In order to avoid scaling back to account for these rising costs, modest annual increases will need to be considered. Another imminent consideration is replacing aging research vessels to maintain survey operations.

II. Expand current projects to collect additional data on existing platforms (~$2.75 million/year)

Several additional data collection activities could be performed as low-cost expansions of current surveys. As fisheries management moves to age-based assessments, there is a greater need to collect age, growth, and reproductive data and expand the geographical scope and capabilities of existing program trawl, plankton, lobster, conch, and bottom mapping surveys. Furthermore, with increasing focus on ecosystem management, there is a critical need for data on stomach contents and environmental variables that can be collected during existing surveys.

III. Develop new fishery-independent data collection programs (~$4.5 million/year)

Additional identified priorities include fishery-independent surveys targeting adult finfish, plankton, crustaceans, identification/mapping of existing live bottom and other essential fish habitat, pelagic fish monitoring, and assessments of deepwater reef fish, including snapper and grouper stocks.

The most compelling argument to continue funding is SEAMAP's ability to respond to recent and ongoing critical demands for data and information that only the program can provide. For example, SEAMAP data has been used in assessing the impacts of the Deepwater Horizon oil spill in the Gulf of Mexico. SEAMAP trawl and plankton data will serve as the primary baseline data in the Natural Resource Damage Assessment (NRDA) to determine impacts of the oil spill on the marine ecosystem. SEAMAP data were also used during the initial stages of the spill to identify species likely to be impacted and where these impacts might occur. SEAMAP plankton data were also the only data source when investigating the potential impacts of liquefied natural gas (LNG) facilities on marine fishery stocks in the Gulf of Mexico. Unfortunately, SEAMAP does not collect data during all seasons and in all areas. Therefore, assessments of true impacts are never fully known. SEAMAP needs full funding not only to provide better data for management of nationally economically important fisheries, but also for the oil and gas industry, LNG industry, and other interests that use biological and environmental data.

Accurate population assessment and informed resource decisions are impossible without basic annual data. Data collection and distribution activities, such as those performed by SEAMAP, are the foundation of resource assessments and responsible fisheries management. In turn, sustainable fisheries promote a continued source of recreation and employment for coastal communities. This 2011-2015 Management Plan sets the guidelines and priorities for fishery-independent data collection efforts that most appropriately use SEAMAP resources and address the needs of fisheries management in the Southeast and Caribbean regions.

Marine Resources Monitoring, Assessment, and Prediction

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CHAPTER 1. PROGRAM OVERVIEW

INTRODUCTION

SEAMAP is a cooperative state/federal program for the collection, management, and dissemination of fishery-independent data in the Southeastern U.S. Resulting data are used by state, federal, and interstate fisheries managers, academic researchers, and fishing industry (commercial and recreational). Long-term time series data are the foundation of SEAMAP. SEAMAP presently consists of three geographical components: SEAMAP-Gulf of Mexico, established in 1981; SEAMAP-South Atlantic (1983); and SEAMAP-Caribbean (1988).

SEAMAP encompasses marine and estuarine waters and living marine resources within U.S. internal waters, territorial seas, and exclusive economic zones (EEZ) in the Gulf of Mexico, South Atlantic Bight, and Caribbean Sea. The scope may be expanded to include geographical areas beyond the EEZ in order to coordinate efforts with foreign governments and international bodies or commissions regarding resources of common interest. In general, the primary emphasis of SEAMAP has been on fisheries stocks subject to cooperative state/federal management, as opposed to stocks exclusively under the jurisdiction of a single political entity. However, SEAMAP can address issues involving resources managed primarily by a single entity that may affect fishery resources on a regional or national level.

Gulf States Marine Fisheries Commission

SEAMAP is a successful example of a state/federal partnership in which the participants work jointly in a cost-effective manner toward common goals and objectives to obtain and utilize scientific information regarding living marine resources. Fishery management and research agencies at the state and federal levels share interest in and responsibilities for common fisheries resources, but often lack the funding needed to support regional surveys throughout the range of these resources. SEAMAP provides funds to involve regional member organizations in the coordination of fishery-independent sampling activities, sampling platforms, and procedures. Fishery-independent data are collected from research vessels following scientifically designed long-term surveys.

Successful fisheries management relies on combining fishery-independent data with information derived from fishermen. Fishery-dependent data is defined as fishery statistics, either raw or analyzed, that are collected directly from recreational and commercial fishing activities. Fishery-dependent data may be significantly influenced by varying economic conditions, changes in management regulations, changes in vessel and gear designs, discard patterns, willingness of fishermen to provide accurate data, and changes in fishing strategies and practices that cannot necessarily be measured. As managers implement alternative regulatory schemes, such as seasonal quotas or individual transferable quotas, the issue of bias in the fishery-dependent data must be considered.

Fishery-independent data are not statistically influenced or biased by changes in regulations or market considerations, and provide a relative measure of abundance compared to previous years when conducted with standard protocols. Fishery-independent data typically provide relevant, unbiased information for conducting population assessments in conjunction with fishery-dependent data. There is great potential for increased use of SEAMAP data in fisheries management. The data requirements for stock assessments are increasing, as evidenced by the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA). This act introduced new tools that, when implemented, would end and prevent overfishing in order to achieve the optimum yield from a fishery. The requirements are referred to as annual catch limits (ACLs) and accountability measures (AMs). An ACL is the level of annual catch of a stock that, if met or exceeded, triggers some corrective action. AMs are management controls to prevent ACLs from being exceeded and to correct overages of ACLs if they occur. These mandates require even more data, for which SEAMAP data collection and analyses are critical. The South Atlantic Fishery Management Council (SAFMC) and Gulf of Mexico Fishery Management Council (GMFMC) have both developed research and monitoring needs for 2011-2015 (Appendix B and C) in response to a mandate by the MSRA for federal Regional Fishery Management Councils to develop prioritized research plans. These highlight the need for life history data and fishery-independent sampling in support of stock assessments, especially for snapper-grouper priority species. The Atlantic States Marine Fisheries Commission's (ASMFC) 2009 list of prioritized research needs identifies numerous needs for information on its managed south Atlantic species that may be fulfilled through SEAMAP (Appendix D). Specific examples of fisheries for which SEAMAP data are now being used to reach management decisions include red snapper, Atlantic bluefin tuna, king mackerel, shrimp, and Spanish mackerel in the Gulf of Mexico; rock shrimp, red drum, Atlantic croaker, red snapper, black sea bass, spot, and Atlantic

SEAMAP-South Atlantic Coastal Survey

menhaden in the South Atlantic; and queen conch and red hind in the Caribbean (see "Applications of SEAMAP Data" in Chapter 3).

SEAMAP data and the results of data management have played a key role in providing information to the SouthEast Data, Assessment, and Review (SEDAR) stock assessments. SEDAR is a cooperative Regional Fishery Management Council process initiated in 2002 to improve the quality and reliability of fishery stock assessments in the South Atlantic, Gulf of Mexico, and U.S. Caribbean. The SEDAR process has significantly improved the scientific quality of stock assessments and greatly improved constituent and stakeholder participation in assessment development and transparency. Recent examples are SEDAR 9 (gray triggerfish), SEDAR 12 (red grouper), SEDAR 15A (mutton snapper), SEDAR 16 (king mackerel), SEDAR 18 (red drum), SEDAR 20 (Atlantic menhaden and croaker), and SEDAR 24 (red snapper). Please see Appendix E for the current SEDAR schedule.

This five-year management plan describes the current SEAMAP and serves as a statement of goals, objectives, and management policies and procedures. Directives, policies, and procedures presented in this five-year plan, and subsequent annual operations plans, supersede those set forth in previous SEAMAP operations plans. Also included in this plan are descriptions of resource surveys (Chapter 3) as well as proposed activities (Chapter 4) that build upon the existing base program and, as such, will be dependent on the availability of additional funding.

Since its establishment, SEAMAP has developed data sets of sufficient quality and temporal scope to be particularly useful in providing indices of abundance and life history information for fisheries stock assessments. SEAMAP data have also been used in the development of fishery management plans and essential fish habitat amendments. Examples include providing data on the distribution of coral in order to protect it from rock shrimp trawling in the South Atlantic and consolidating bottom mapping data, which is now used by the SAFMC to define essential fish habitat. The time-series and quality of fishery-independent data now available to fisheries managers and others interested in marine resources can be attributed to the success of the state/federal partnerships supported by SEAMAP. It is important to note that in addition to collecting marine fisheries data, SEAMAP collects vital environmental data, including physical, biological, geological, and chemical oceanographic information. Furthermore, SEAMAP provides sampling opportunities and educational experiences for researchers and students of various disciplines by allowing them to take part in SEAMAP cruises (if possible) to collect samples for their own analyses. This has the potential to considerably increase participation and maximize the use of survey/research platforms, especially since vessel costs are often prohibitive for smaller research projects. Thus, SEAMAP serves as a catalyst, bringing together available scientific resources and fishery-independent information within a region for use by fisheries managers, scientists, and others interested in our coastal marine fisheries.

REGIONAL ISSUES & NEEDS

The Southeast region, like other global common use areas subject to multiple jurisdictions, is a dynamic system of competing uses. Southeast fisheries support valuable commercial and recreational fishing industries. In 2009, commercial fishermen in the region landed over 2.8 billion pounds of seafood worth almost $2 billion[4]. In the same year, recreational anglers landed at least 175 million pounds of fish[5]. Recreational fishing is a growing

[4] Based on NMFS 2009 landings data.
[5] Based on MRFSS data.

industry in the SEAMAP region, where over 5.2 million U.S. recreational anglers took over 41 million fishing trips in 2009[6]. Overall, recreational fishing in the SEAMAP region accounted for 60% of the 2009 total U.S. marine recreational fishing catch[7].

The Southeast region is also a major area for oil and natural gas extraction, which is governed by a system of leases controlled by the federal government. The search for alternative energy sources is a major issue in this region, and interest in technologies for wind, solar, wave, and current power is increasing. Non-consumptive regional uses run the gamut from boating and bird watching, to simply enjoying the view from a stroll on the beach.

Fisheries management in the Southeast takes place within the context of these competing uses and thus is very complex. Fisheries management has moved towards even more sophisticated ecosystem management and/or ecosystem-based approaches. The approach of this broad-based resource management "strives to meet human requirements to use natural resources while maintaining the biological richness and ecological processes necessary to sustain the composite structure and function of the habitat or ecosystem concerned"[8]. Fisheries management becomes more integrated with the management of the other sectors sharing marine resources. SAFMC developed a South Atlantic Habitat Plan[9] to support regional habitat conservation and designation of essential fish habitat for managed species through a Comprehensive Essential Fish Habitat (EFH) Amendment[10]. SAFMC, expanding the South Atlantic Habitat Plan to support the move to ecosystem-based management, developed the Fishery Ecosystem Plan (FEP)[11] for the South Atlantic region which serves as the source document to support regulatory action through comprehensive management documents, such as the Comprehensive Ecosystem-based Management Amendment 1 (CEBA1)[12]. SEAMAP regional partners provided expertise and data for development of the FEP and continue to support development and refinement of associated spatial tools (South Atlantic Habitat and Ecosystem Internet Map Server and Arc Services presenting SEAMAP data). This expanded approach provides an even greater impetus for the SEAMAP mission.

In general, management needs can be addressed under two main themes: conservation of sustainable resources and management of fishing activities, and allocation among sectors. Key topics are overfishing, habitat loss, and environmental degradation; these must be addressed to achieve sustainable harvest. Management issues include allocating resources among various fishing sectors (commercial and recreational), reducing interactions with protected species, and addressing spatial conflicts from non-fishing activities including offshore sand removal, dredge disposal, cable and pipe placement, and potential renewable energy development. These management issues are not unique to the Southeast region, but are manifested globally as well. In all cases, the

[6] *Ibid.*
[7] *Fisheries of the United States, 2009*. 2010. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Washington, DC.
[8] FAO 2003.
[9] SAFMC. 1998. Habitat Plan for the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Circle., Ste 306, Charleston, South Carolina.
[10] SAFMC. 1998. Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, South Carolina.
[11] SAFMC. 2009. Fishery Ecosystem Plan for the South Atlantic Region, Volumes I-V. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Suite 201, North Charleston, South Carolina.
[12] SAFMC. 2009b. Comprehensive Ecosystem-Based Amendment 1. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Suite 201, North Charleston, South Carolina.

need for adequate data to accurately monitor conditions is paramount. Effective regulatory decision-making requires good information, preferably a long time-series of biological and environmental information to evaluate fluctuations in resource abundance and distribution. Development of such databases, and the analytical skill needed to use them, requires an integrated, coordinated, and cooperative approach by the entire fisheries management community. In addition, such databases will provide information necessary for considering the fisheries in the context of their respective ecosystems. SEAMAP was conceived to provide much of the necessary information on abundance trends, distribution, and environmental changes.

Conservation of Resources

Overfishing

Many fish stocks targeted by fishermen have shown indications of overfishing. In the South Atlantic, several stocks are overfished and SEAMAP data has tracked the status of resources such as weakfish, red drum, and summer flounder. Many reef fish, red drum, and mackerel stocks in the Gulf of Mexico are in the process of recovery from previously overfished conditions. Oceanic stocks have also shown the effects of intense fishing pressure in declining catch-per-unit-effort (CPUE) of swordfish and declining bluefin tuna spawning stock. Fishing pressure for yellowfin and bigeye tuna and other oceanic pelagics has continued to grow. In the Caribbean, the conch, spiny lobster, and reef fish stocks are depressed and average reef fish sizes have declined. The condition of the queen conch stocks led to the total prohibition of harvest in federal waters and in state waters, a whole set of management actions that include seasonal closure, size limit, and catch quota. The fishery for coastal sharks poses specific concern for managers in all areas because of their low reproductive rate and the limited biological data available for most species. Several species of the snapper-grouper complex prompted the establishment of seasonal and total closures, establishment of deepwater Marine Protected Areas (MPAs), a total prohibition of harvest of red snapper, and a depth based closure of deepwater species as management actions to protect these valuable species. SEAMAP fishery-independent data become even more relevant when fishery closures arise, such as with the snapper-grouper complex in the South Atlantic and Caribbean.

SEAMAP-Caribbean

Species management is driven by the Congressional mandate to end overfishing by a certain date. The MSRA requires the Regional Fishery Management Councils and NOAA Fisheries to implement measures to end overfishing. Revisions require fishery management plans (FMPs) for fisheries subject to overfishing to specify ACLs at a level that prevents overfishing. By 2011, FMPs for all overfished fisheries, except fisheries for species

with annual life cycles, must meet these requirements. SEAMAP data collection and analyses are critical to addressing these federal mandates and state regulatory needs.

Bycatch

Complicating fisheries management in the Southeast are bycatch and interactions between fisheries and protected species. Bycatch of non-target species has occurred in a number of different fisheries throughout the region. Fishery-independent data will be required to assess the status of any Endangered Species Act (ESA) listed species which face bycatch issues, e.g., Atlantic sturgeon. Well-publicized bycatch problems include the incidental catch of billfish and turtles in longline fisheries and the finfish bycatch (e.g., weakfish, croaker, spot) in the Gulf and South Atlantic trawl fisheries. Shrimp trawls in federal waters of the Gulf of Mexico are now required to contain bycatch reduction devices (BRDs) to decrease the incidental catch of finfish. Of particular concern are the overfished red snapper stocks in the Gulf of Mexico where recovery to conservation standards established by the GMFMC will not occur unless bycatch from the shrimp fishery is significantly reduced.
In the South Atlantic, the SEAMAP program facilitated the cooperation of NOAA Fisheries and state partners to review and characterize bycatch in the South Atlantic shrimp fishery. This characterization provided the SAFMC with data necessary to develop Amendment 1 to the Shrimp FMP requiring the use of BRDs on vessels fishing for penaeid shrimp. In addition, data compiled in this process supported the development of a BRD testing protocol to facilitate testing and development of new bycatch reduction gear.

Habitat Loss and Environmental Degradation

The primary habitat issue for the Southeast region is the loss and degradation of inshore and nearshore areas, including seagrass beds, marshes, mangroves, shallow water bays, and coral reefs. Inshore and nearshore habitat degradation is caused by alteration of freshwater inflow, influx of nutrient-laden river water leading to eutrophication, hypoxia, toxic contamination of wetlands, and human development activities. The increasing loss of coastal marshes is predicted to result in major fishery declines, particularly impacting valuable commercial and recreational fisheries because many fish are dependent on adequate inshore habitat during the critical nursery period in their life cycle. Environmentally induced fish diseases and fish kills have been recorded in the Gulf and South Atlantic regions. Severe decreases in oyster and hard clam harvests have also been attributed to pollution, disease, salinity changes, and habitat losses.

NOAA, Florida National Marine Sanctuary

Coral reefs are of great importance for marine resources in the Southeast and especially the Caribbean. These important ecosystems have been degraded by sedimentation, contamination, and other anthropogenic causes leading to exposure to high water temperature. These occurrences of high water temperature have lead to several bleaching events. The 2005 event resulted in the 50% loss of coral reef tissue in many areas in the Caribbean and the collapse of reproduction of the *Montastreae* coral complex in the

following three years. This coral complex is the major reef builder in the Caribbean and is currently being evaluated to be listed as endangered by the NMFS Protected Resources Division.

Management of Fishing and Non-Fishing Activities and Conflict Resolution

Regional management must ensure conservation while balancing resource allocations among more than 20 major commercial fisheries, as well as between commercial and recreational fishing sectors. Recreational and commercial user conflicts have occurred in fisheries for coastal pelagics, reef fish, seatrout, drums, and flounders. In addition, conflicts have arisen among commercial fishermen using different gear types, such as trawls, longlines, nets, and traps. Management must also consider the views of conservation and other non-governmental groups that have become a potent force in the debates, whether in regards to interactions with protected species or spatial conflicts from renewable energy development. Information on species and marine habitat derived from the SEAMAP program provides essential data and information that can be used by managers in reducing conflict between fisheries and potentially competing uses of the ocean including, but not limited to, placement of wind farms, harnessing ocean energy, oil and gas development, establishment of marine aquaculture facilities, and dredging activities.

Tina Berger, Atlantic States Marine Fisheries Commission

PROGRAM MISSION

> *The mission of SEAMAP is to provide an integrated and cooperative program to facilitate the collection, interpretation and dissemination of fishery-independent information for use by government agencies, the fishing industry (commercial and recreational), researchers, and others to enhance knowledge of marine fisheries and their associated ecosystems.*

It is the *fishery-independent* collection of data that distinguishes SEAMAP. In the context of SEAMAP, fishery-independent data are defined as those data that are obtained without direct reliance on activities of commercial or recreational fishing. Data may be taken from such non-industry activities as trawl surveys for bottom-fish and aircraft surveys for schooling fish.

SEAMAP proposes to maintain the basic pattern of regional fisheries monitoring activities and enhance coordination of survey activities yielding non-duplicative data that can be incorporated into a region-wide, fishery-independent database.

- **Maximize the effective capability of fishery-independent and associated survey activities** to satisfy data and information needs of living marine resource management and research organizations in the region
- **Optimize coordination and deployment of sampling platforms used in the region**, including submersibles, research and charter vessels, aircraft, and satellites in an effort to obtain regional, synoptic surveys
- **Maximize the usefulness of fishery-independent and associated survey data** through documented sampling and data collection activities and through documented and accessible computerized databases
- **Document long and short-term needs for fishery-independent data to meet current and future critical management and research needs**, and to establish compatible and consistent databases for holistic ecosystem and predictive modeling applications
- **Promote coordination among data collection, processing, management, and analysis activities** emphasizing those specifically concerned with living marine resource management and habitat protection
- **Oversee quality control and error tracking of submitted data**
- **Collect and analyze data on priority species to support stock assessments** conducted through the SEDAR program and other evaluations highlighting state, interstate and council needs
- **Provide a forum for coordination of other fishery-related activities**

The overall approach of SEAMAP emphasizes the collection of fishery-independent data to fill specific short and long-term state, interstate, and council management needs. Maintenance of regional, multipurpose databases accessible to all participating management agencies allows for efficient data entry, storage, and dissemination. The SEAMAP database provides information for managers and scientists to monitor and assess the condition of species or species groups subject to management programs. Environmental parameters and community structure are monitored in order to provide insight concerning the dynamics of Southeast area living marine resources. Data collection and management procedures are coordinated among participants in order to enhance the usefulness of the data, minimize costs, and increase the accessibility of information to fishery managers,

administrators, and researchers. SEAMAP builds on current activities to develop optimum resource sampling and assessment capabilities.


Don DeMaria

Gathering and disseminating information are long-term goals of SEAMAP, as fisheries management is a dynamic function having a continuing requirement for current data. Moreover, as data are accumulated, their value and utility for assessing fish stocks increase. Long-term data are needed to describe and explain population trends and responses to fishing activities, environmental factors, and regulatory programs. Predictive capabilities for stock abundance, recruitment, and yield also require long-term time series of data.

No single fishery management agency has the resources to meet the objectives of existing state, interstate, and federal fishery management plans currently in place, nor those planned for the future. However, SEAMAP's integrated approach to fishery-independent data collection can fulfill priority data needs for the development of fishery management plans in the southeast region. For example, relatively few gear types and sampling designs are needed to obtain desired data because multiple species groups can be sampled by one type of gear or by one sampling cruise. For example, bottom trawling yields data not only on shrimp, but also on juvenile mackerels, crustaceans, and bottom feeders such as croaker, spot, seatrout, and flounder. Many other species living in the same habitats will also be sampled. Additionally, some plankton and environmental surveys could be conducted in conjunction with other surveys by deploying plankton nets and hydrographic gear from the trawling vessels, which would provide valuable data on early life history stages, environmental factors affecting species abundance and distribution, as well as other vital parameters.

GOALS AND OBJECTIVES

Goal 1. Collect long-term, standardized, fishery-independent data consistent with established fisheries data systems on the condition of regional living marine resources and their environment, and make information and analyses available to (SEDAR) assessment teams and regional resource managers

Objectives:

- Conduct routine surveys and special studies, as needed, of regional resources and their environments
- Develop and evaluate sampling systems and procedures needed for SEAMAP surveys and special studies


Dr. Anthony R. Picciolo, NOAA NODC

- Standardize and calibrate sampling systems and procedures used in SEAMAP surveys and special studies
- Obtain, process and archive, as appropriate, biological specimens and samples
- Obtain data, such as remotely-sensed temperatures, from other agencies and organizations in order to plan and conduct SEAMAP activities
- Develop partnerships with governmental and non-governmental organizations to improve acquisition of fishery-independent and associated ecological data for the Southeast region
- Collect and analyze data on priority species to support stock assessments conducted through the SEDAR process and other evaluations
- Collect information on species habitat use at different life stages, which will enhance and refine essential fish habitat and essential fish habitat-habitat areas of particular concern designations

Goal 2: Cooperatively plan and evaluate SEAMAP-sponsored activities

Objectives:

- Develop an annual operations plan for each SEAMAP component (Gulf, South Atlantic, Caribbean) consistent with budget and operational constraints
- Develop an annual budget allocation plan that considers program needs, annual operations plans, and participant capabilities
- Conduct annual internal reviews of program activities
- Conduct periodic coordinated external reviews of specific management, administrative, and technical elements of the program
- Sponsor individual and joint meetings of the SEAMAP components to cooperatively plan and evaluate activities
- Sponsor special workshops and symposia to help evaluate or plan sampling strategies, design, or methods
- Cooperatively plan activities with representatives of foreign governments
- Establish working groups, as needed, in each component under the auspices of the SEAMAP committees with appropriate expertise to assist in planning and evaluating SEAMAP activities
- Highlight SEAMAP program and contributions on partner websites

Goal 3: Operate the SEAMAP data management systems (Gulf of Mexico, South Atlantic, Caribbean) for efficient management, timely dissemination, and analysis of fishery-independent data and information

Objectives:

- Design, implement, upgrade, and maintain SEAMAP data management support systems that can be used to assess and monitor selected living marine resources and associated environmental and habitat factors
- Establish data handling and processing protocols for all SEAMAP data
- Compile and maintain a computerized directory of SEAMAP monitoring activities, including data summaries and inventories by gear, species, species-group, and geographic areas
- Create geographic information system (GIS) and metadata products for priority species' abundance, distribution, and habitat served through an internet mapping application
- Create secure and stable data storage and backup procedures that ensures sample information, associated environmental data, and other SEAMAP data are protected and archived
- Coordinate and integrate, when feasible, the SEAMAP data management support systems (Gulf of Mexico, South Atlantic, Caribbean) with non-SEAMAP databases
- Make information and initial analyses available to (SEDAR and other) stock assessment teams in an accessible format in support of assessing the status of the resources
- Collect data to characterize benthic and pelagic habitats and species use (by life stage) of these habitats to enhance and refine essential fish habitat and essential fish habitat-habitat areas of particular concern designations

Goal 4: Identify and describe existing non-SEAMAP databases and activities that are of value in fishery-independent assessments of regional living marine resources.

Objectives:

- Provide information to SEAMAP participants and other appropriate organizations
- Move to enhance connection of biological sampling with oceanographic characterization – enhance links with Southeast Coastal Ocean Observing Regional Association (SECOORA), the Gulf of Mexico Coastal Ocean Observing Regional Association (GCOOS-RA) and the Caribbean Regional Association-Caribbean Coastal Ocean Observing System (CaRA-CarICOOS) and use of data and model capability

Goal 5: Coordinate and document SEAMAP activities and disseminate programmatic information.

Objectives:

- Coordinate SEAMAP administrative functions, information dissemination, the SEAMAP data management systems, archiving centers, and data collection by SEAMAP participants
- Document joint SEAMAP activities, the activities of each SEAMAP component, and planned SEAMAP activities
- Inform fisheries research and management agencies, the fishing industry, and the general public of SEAMAP activities by the preparation and dissemination of newsletters, annual reports, annual operations plans, and/or other means
- Develop partnerships with governmental and non-governmental organizations to improve dissemination and utilization of SEAMAP fisheries-independent and ecological data

CHAPTER 2. PROGRAM ORGANIZATION & MANAGEMENT

PROGRAM ORGANIZATION

The geographical components of SEAMAP – Gulf, South Atlantic, and Caribbean regions – operate independently but possess functionally similar systems. All components include systems consisting of two basic elements: program operations and program management. These elements are briefly summarized as follows, and are discussed in more detail later in the document:

Operations

- Resource surveys
- Sampling gear assessment and standardization
- Data management
- Dissemination of SEAMAP derived information
- Survey methodology workshops

Management

- Program and operations planning and administration
- Program evaluation

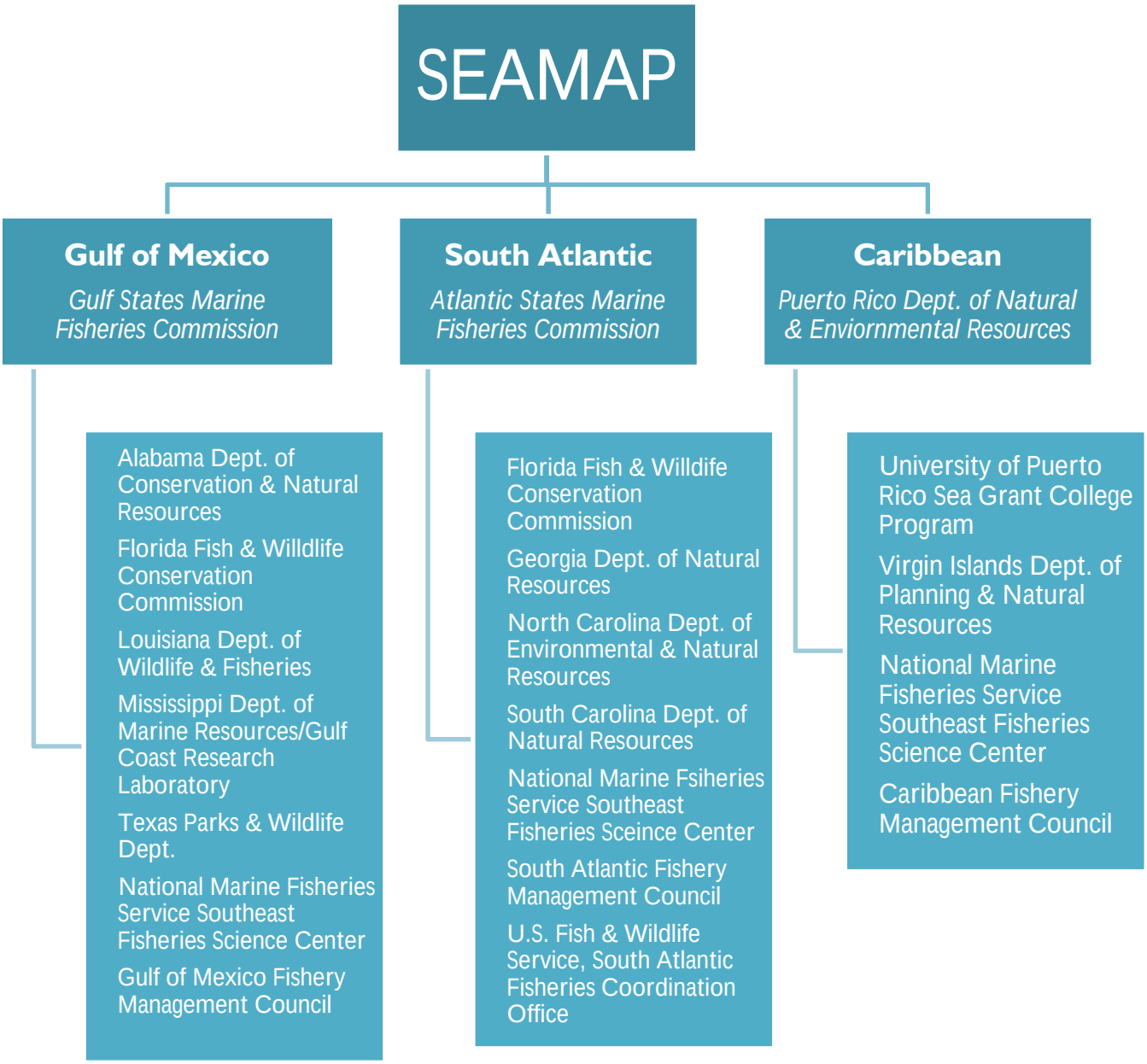
The activities for each element are performed by the structural bodies of each component, which are also similar in organization (see chart on next page).

Program Component Structure

SEAMAP-Gulf

SEAMAP-Gulf is administered by the SEAMAP Subcommittee of the GSMFC's Technical Coordinating Committee (TCC). The committee membership consists of one representative from each of the five participating Gulf states and representatives from the GMFMC and NOAA Fisheries Southeast Fisheries Science Center (SEFSC). Committee approved plans, evaluations, and budget requirements are submitted to the TCC for approval. Daily operations of the program are administered by the SEAMAP-Gulf coordinator, an employee of GSMFC funded through SEAMAP, who is under the direction of the committee chair. Administrative supervision of the coordinator is performed by the GSMFC Executive Director, with authority to recruit, employ, and discharge the coordinator, in concurrence with the SEAMAP committee. The coordinator is employed on a yearly basis, subject to review by the committee, committee chair, and executive director.

In addition to the standing management agency (GSMFC), management body (TCC), and committee, work groups are established by the committee as needed to address specific issues. Work groups are not standing committees, but are formed to accomplish specific objectives and are disbanded upon completion. The plankton, shrimp/groundfish, environmental data, data coordinating, reef fish, and adult finfish work groups are all currently functioning in the Gulf component.



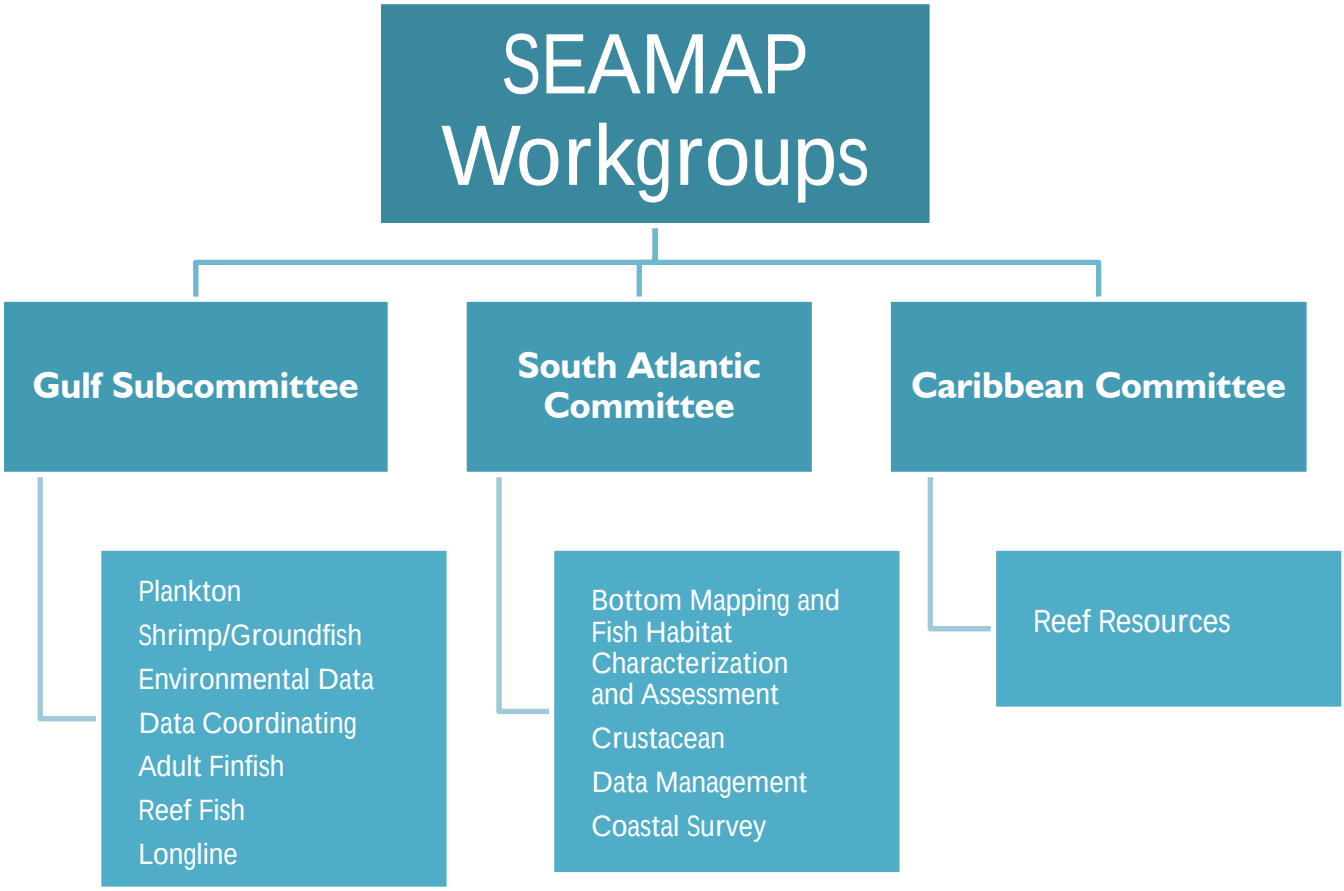
SEAMAP-South Atlantic

SEAMAP-South Atlantic is one of several cooperative state-federal programs under the aegis of the ASMFC's Science Program. Within the ASMFC, policy and fiscal matters for SEAMAP-South Atlantic are approved by the South Atlantic State-Federal Fisheries Management Board (SAB), a fisheries decision-making body composed of members from the South Atlantic state delegations (a marine fishery management agency director, governor appointee, and state legislator from each state), and representatives of the SERO, USFWS, and SAFMC. The SEAMAP-South Atlantic Committee is the technical committee responsible for budget preparation and plan preparation and implementation. The committee consists of one representative from each participating South Atlantic state (NC-FL), the SAFMC, ASMFC, and SEFSC. Routine operations are administered by the SEAMAP-South Atlantic coordinator, an employee of the ASMFC, funded wholly or in part by SEAMAP. The SEAMAP-South Atlantic coordinator receives assistance from the ASMFC office and technical guidance from the committee. Work groups may be established in addition to the standing management agency (ASMFC), management body

(SAB), and committee (SEAMAP-South Atlantic Committee). Current work groups established by the committee include the data management work group, coastal survey work group, bottom mapping and fish habitat characterization work group, and crustacean work group.

SEAMAP-Caribbean

SEAMAP-Caribbean is administered currently by the University of Puerto Rico Sea Grant College Program (UPRSGCP). Due to differences in political entities, the SEAMAP-Caribbean Committee membership differs from that of the other SEAMAP components and consists of one member each from the Commonwealth of Puerto Rico Department of Natural and Environmental Resources, U.S. Virgin Islands Department of Planning and Natural Resources, Puerto Rico Sea Grant College Program, USFWS, SEFSC, and the Caribbean Fishery Management Council. The SEAMAP-Caribbean coordinator is an employee of the UPRSGCP funded in part by SEAMAP. The coordinator receives administrative support from the UPRSGCP and technical guidance from the committee. Work groups may be established in addition to the committee. Currently, the Reef Resources Work Group coordinates the sampling strategies of reef fish, spiny lobster, queen conch, whelk, habitat assessment and bottom mapping.



Program Responsibilities

Management Agency Responsibilities

Administrative services are provided by the GSMFC for the Gulf component, ASMFC for the South Atlantic component, and the UPRSGCP for the Caribbean component through their respective SEAMAP coordinator.

Administrative services rendered by each management agency include:

- Provide budget information to the SEAMAP committee
- Coordinate SEAMAP meetings
- Coordinate and schedule workshops
- Administer funds associated with SEAMAP activities
- Administer guidance of the coordinators
- Supervise clerical personnel
- Affirm committee representatives
- Annually evaluate management personnel and facilities
- Review annual report

Management Body Responsibilities

Each SEAMAP component is sponsored by its respective management body, namely the TCC for the Gulf component, the SAB for the South Atlantic component, and the UPRSGCP for the Caribbean component. The management bodies for the Gulf and South Atlantic report to the GSMFC and ASMFC, respectively. The UPRSGCP acts as its own management body and management agency. Administrative and planning responsibilities of the management bodies include:

- Provide an ex-officio member to the respective committee
- Review and approve component operations plans
- Review annual report
- Accept or reject actions recommended by an external or internal program review
- Review and approve committee approved plans, evaluations, and budget requirements
- Approve special surveys
- Provide program policy
- Coordinate program and management agency directives

Committee Organization and Responsibilities

Each program component is managed by their respective SEAMAP committee (Gulf Subcommittee, South Atlantic Committee, Caribbean Committee). Committee membership is determined by the respective management agency, with voting rights determined by that management agency. Obligatory committee members and designated alternates to the committees are selected by participant organizations and affirmed in accordance with procedures of the management agency. A committee member may designate a proxy to serve at a given SEAMAP meeting, in accordance with the guidelines set forth by the committee member's organization. Additionally, an authorized representative from the management body to each committee may serve as an ex-officio member of that committee.

The committee chair and vice-chair are elected annually by the Gulf and Caribbean SEAMAP committees, and may serve an unlimited number of one-year terms. The chair and vice-chair for the South Atlantic SEAMAP committee both serve two-year terms; at the end of their terms, the vice-chair then accedes to the chair position and a new vice-chair is elected. Each committee meets as necessary to accomplish stated goals and

objectives. Meetings are open to all interested persons except during discussions of personnel matters and other actions legally conducted at closed sessions, in accordance with statutes and regulations of the various program participants. Committee decisions may be made by either consensus or by a majority of the voting committee quorum. Recorded votes will be taken upon request of one voting member. Minutes must be prepared for each committee meeting.

At least annually, the three committees meet jointly. The presiding chair is one of the committee chairs and rotates each year as determined by the collective committee chairs. Joint committee decisions will usually be made by consensus; however, important issues will be determined by vote when requested. In such instances, each program will be assigned a single vote, for a total of three. During joint committee meetings, one of the coordinators will be selected by the chair to prepare minutes.

SEAMAP committees are responsible for program management and take the leading role in program planning. The general responsibilities of each SEAMAP Committee include:

- Determine regional fishery-independent data needs that can be met by SEAMAP activities
- Plan activities to meet identified data needs
- Coordinate official survey activities in a fashion that will permit collection of the most useful data in the most cost-effective manner
- Provide technical guidance to the coordinators, data managers, and curators
- Determine program budgets
- Establish work groups with specific areas of expertise to assist in the development and evaluation of survey activities
- Develop and maintain a data management system
- Support of an archiving system to process and store SEAMAP specimen collections
- Sponsor workshops and other activities that will generate information needed to improve program operations
- Develop information dissemination plans
- Approve special travel and activity requests
- Develop short term (operations) and long term (management) plans
- Identify funding needs for SEAMAP operations
- Define evaluation and review policies and procedures
- Recommend actions to correct problems that may jeopardize reliability of survey data bases
- Submit annual report to the respective oversight body, summarizing SEAMAP activities, accomplishments, needs, and plans

Coordinator Responsibilities

Coordinators are also responsible for program administration and planning in accordance with committee guidance. General coordinator responsibilities include:

- Work closely with the committee chair in all aspects of program coordination, administration, and operation
- Implement plans and program directives developed by the committee and approved by the management body
- Coordinate committee meetings and recommend appropriate agendas

- Serve as information liaison between the committee and the oversight agency, participants, and organizations interested in SEAMAP activities
- Submit preliminary administrative budget recommendations and assist the committee with preparation of the budget
- Prepare or supervise preparation of selected SEAMAP publications
- Distribute approved SEAMAP information in accordance with committee policies and procedures
- Assist in representing the program to the community through public educational activities
- Assist in the identification of regional needs that can be satisfied by SEAMAP activities
- Maintain a file of all reports and publications which relied on SEAMAP data or SEAMAP specimens, and provide an annual listing to the committee
- Prepare the annual report to the oversight body

Work Group Organization and Responsibilities

Work groups are established by a committee to address specific issues or accomplish specific objectives. Directives to a work group may include:

- Plan approved surveys
- Evaluate surveys
- Generate an appropriate sampling design
- Develop a data format compatible with the SEAMAP Data Management System
- Estimate costs and related needs associated with SEAMAP activities in accordance with a specific schedule
- Develop a schedule for processing collected data and samples and recommending persons or agencies that will be responsible for accomplishing this work

Members of work groups are appointed by the respective committee and are generally not members of that committee. Work group members may be drawn from universities, state and federal marine resource agencies, and the fishing industry in order to obtain the best scientific advice. Work group leaders may be elected by the work group or appointed by the committee at the committee's discretion. When elected, work group leaders are subject to approval by the committee and are responsible for preparing a written report to the respective committee after each work group meeting. Upon the completion of specific tasks assigned to the work group by its appointing committee, the work group may be disbanded by the committee or, depending upon the objectives assigned to the work group, may exist indefinitely.

NMFS/SEFSC Program Management and Responsibilities

NMFS employees are appointed as program manager by the SEFSC Director and program officer by the SERO Administrator. These positions were created to ensure program compliance with Department of Commerce (DOC) rules, regulations, and policies. The program manager has overall authority and responsibility for the program, including allocation of funds among participants and ensuring that goals, objectives, and activities are appropriate to the program mission.

The program officer is responsible for insuring proper program documentation by the respective components, especially cooperative agreements and cooperative agreement amendments. These documents must be complete, accurate, and submitted on time in order to ensure timely processing and distribution of funds. The program officer also ensures that participants are in compliance with their cooperative agreements, and assists in communication among program components, and, when necessary, the DOC grants administration offices.

Cooperators and Other Interested Parties

Cooperators and other interested parties are not SEAMAP member organizations, although their input to the program is essential to the cooperative approach of the program. Cooperators include persons or organizations actively involved in SEAMAP operations, such as work group members or researchers collecting data for SEAMAP. For example, Sea Grant organizations are included as cooperators in the SEAMAP Gulf and South Atlantic components. In the Caribbean component, Sea Grant is a full participating member of the program, and as cooperators, their participation is voluntary. Sea Grant organizations are invited to participate in all SEAMAP committee meetings as non-voting participants. Their technical, management, and administrative advice and assistance are often sought, especially in forming work groups, evaluating program performance, organizing workshops and symposia, and disseminating information from and about the program. Sea Grant is generally perceived as representing all universities within a region.

Universities also serve as a major source of technical expertise for work groups. As cooperators, university investigators are often invited to officially participate in functions of SEAMAP, such as committee and work group meetings, with their travel costs paid by SEAMAP.

Program Coordination

SEAMAP Project Initiation

A SEAMAP survey is a fishery-independent project that is fully or partially funded via SEAMAP resources. Its data are fully integrated and compatible with other SEAMAP surveys, and are used by state, federal, and interstate fisheries managers, academic researchers, and fishing industry (commercial and recreational) to provide information on managed species' stock trends and status. Data collection and sampling protocols for SEAMAP surveys should undergo a review and acceptance from partner workgroups and be approved by the appropriate management body.

The following steps are taken to develop a new SEAMAP survey within each component:

- Partners (SEAMAP work groups or state/interstate fisheries managers) identify a topic of concern where present data are either missing or insufficient for stock assessment and/or fishery management purposes.
- The appropriate SEAMAP work group(s) discusses the issue and begins developing methods to address the concerns. Outside experts from state, federal, and interstate agencies should be involved in the discussion to ensure the survey is statistically robust, unbiased, and the data are suitable for stock assessments.
- The work group chair (or their proxy) will present the concerns and proposed survey to the appropriate management body, including proposed methodologies, required funding, goals, expected benefits, and principal participants.
- The appropriate management body will discuss the merits and importance of the survey and prioritize the need among existing on-going projects. If approved, the appropriate management body will recommend the survey for funding under existing financial restrictions.
- If approved by the appropriate management body, the principals will submit a SEAMAP proposal through NOAA for funding.
- Once established, the survey principals will provide updates on an annual basis, and if the survey is long-term, undergo a peer review after year three and every five years after to ensure data collection methods and sampling are of the highest statistical integrity.

A SEAMAP partner survey is one that receives no directed funding from SEAMAP, but whose data are valuable for regional fisheries management and stock assessment. State, federal, and interstate agencies all possess surveys that can be of value, including, but not limited to:

- **USFWS**
  - Cooperative Winter Tagging Cruise
- **Florida Wildlife Research Institute (FWRI)**
  - Fisheries-independent Monitoring Program
- **Georgia Department of Natural Resources (GA DNR)**
  - Ecological Trawl Survey
  - Marine Sportfish Population Health Survey
- **North Carolina Division of Marine Fisheries (NC DMF)**
  - Juvenile Trawl Survey
  - Pamlico Sound Gill Net Survey
- **National Marine Fisheries Service (NMFS)/South Carolina Department of Natural Resources (SC DNR)**
  - Marine Resources Monitoring, Assessment and Prediction Program (MARMAP)
- **NMFS**
  - Southeast Fishery Independent Survey (SEFIS)
  - Bottom Longline Survey
  - Marine Mammal Survey
  - Pelagic Trawl Survey
  - Beaufort (NC) Ichthyoplankton Survey
- **Alabama Department of Conservation and Natural Resources (ADCNR)**
  - Fisheries-independent Monitoring
- **Mississippi Department of Marine Resources (MDMR)**
  - Fisheries-independent Monitoring
- **Gulf Coast Research Laboratory (GCRL)**
  - Fisheries-independent Monitoring
- **Louisiana Department of Wildlife and Fisheries (LDWF)**
  - Fisheries-independent Monitoring
- **Texas Parks and Wildlife Department (TPWD)**
  - Fisheries Independent Monitoring

SEDAR stock assessment research recommendations have included the importance of and desire to standardize the collection of information across programs. SEAMAP has served as a vehicle to accomplish such standardizations. For example, the SEAMAP reef fish monitoring group and the recently started SEFIS group (established in 2010 as a cooperative effort with MARMAP; see below) have adopted many of the MARMAP

Patrick Raley, National Marine Fisheries Service

sampling protocols. Staff was cross-trained in sampling methods, sample processing, and data management. This comprehensive approach means that new data can be integrated into the long-term data set without compromising the integrity of the existing information and analyses. Additionally, several state programs involved in red drum monitoring funded by SEAMAP made slight changes after standardization issues were discussed by the groups involved. As a result, CPUE estimates are now more comparable among states, and, as such, are more useful in stock assessments.

Collaborations

The coordinated efforts of data collection and management are invaluable for providing stock assessment teams (SEDAR and others) and resource managers with consistent high quality data. The centralized data management also provides an efficient quality control mechanism and can serve as a vehicle to efficiently update data when new information becomes available.

SEAMAP benefits from partnerships and collaborations between multiple federal and state agencies, as well as with academic institutions. In the South Atlantic, SEAMAP's mission is carried out as a cooperative effort between the USFWS, NOAA Fisheries, the SAFMC, the ASMFC, and the states of North Carolina, South Carolina, Georgia, and Florida. An example of cooperative efforts includes fishery-independent sampling to monitor spatiotemporal trends in abundance of reef fish species in South Atlantic waters. Historically, these efforts have been carried out entirely by the SC DNR MARMAP Program and SEAMAP-South Atlantic. Beginning in 2010, the SEFIS group was established at the NOAA Beaufort Laboratory (NC) to work cooperatively with MARMAP and SEAMAP-South Atlantic to enhance fishery-independent sampling efforts in South Atlantic waters. MARMAP, SEAMAP-South Atlantic, and SEFIS are integral partners in the fishery independent data collection for the snapper/grouper management complex in the Southeast region.

MARMAP, SEAMAP-South Atlantic, and the SEFIS program are the sole providers of fishery-independent data for reef fish in South Atlantic waters. Data and analyses have been provided to the stock assessment teams and

MARMAP/SEAMAP staff have participated in (SEDAR) stock assessment workshops and contributed to the assessment reports. Information has also been provided to NMFS staff and other organizations (e.g., OBIS). It is understood that information about relative abundance (index) and life history acquired through all aspects of these monitoring efforts are an essential part of the assessment process. All programs involved can only provide the best available scientific information if data is gathered, treated, and analyzed in a comprehensive manner using a consistent protocol. While SEAMAP has provided funding for sea days, MARMAP has provided personnel to accomplish the sampling. Data management and the process of making information and analyses available to third parties (NMFS, etc.) has been highly coordinated between MARMAP, SEAMAP, and SEFSC, which provides funding for MARMAP. This sharing and coordination has been, and will continue to be, a high priority within SEAMAP and partner projects for efficient collection and use of fishery-independent data.

Collection of data and samples, as well as processing and analyses, are done in a consistent and coordinated effort to assure quality and consistency of long term data streams. Data management is coordinated, in part, through SEAMAP. Diet studies conducted under the SEAMAP-South Atlantic Coastal Survey, Reef Fish Survey, and Southeast Regional Taxonomic Center (SERTC) are closely collaborating with MARMAP diet study efforts. This has resulted in streamlining operations and pooling staff expertise. Efforts are being made to form a Diet Study Group to further these collaborations to increase efficiency and avoid duplication of efforts. Since 2010, the collaborations have resulted in a considerable increase in sample processing and examination of samples.

SEAMAP constituent groups are also developing cooperative efforts with groups such as the Southeast Coastal Ocean Observing Regional Association (SECOORA) to obtain physical oceanographic data that can be linked to fish distribution data, and with multiple groups to acquire multi-beam habitat coverage for research into the relationships between habitat characteristics and reef fish distributions. SEAMAP is positioned to provide information on the distribution, status, and habitat of South Atlantic species to collaborate with regional partners as the move to ecosystem management and marine spatial planning is realized. Developing partnerships in the region include, but are not limited to, the Governor's South Atlantic Alliance, SECOORA, South Atlantic Landscape Conservation Cooperative (SALCC), and regional fish habitat partnerships including the Southeast Aquatic Resource Partnership (SARP) and the Atlantic Coastal Fish Habitat Partnership (ACFHP). Appendix F highlights the opportunity for SEAMAP to provide data or directly collaborate with these organizations.

Gulf Partnerships

Due to multi-state input the program receives on fishery-independent sampling matters within and among each of its regions, SEAMAP programs represent partnerships in the truest sense of the word. As SEAMAP surveys are implemented and methodologies approved by each of the component's committees and working groups, those surveys then become a template by which partner states can develop future inshore surveys or modify existing fishery-independent programs within state territorial waters. In the Gulf, SEAMAP's partnership with the states of Florida, Alabama, Mississippi, Louisiana, and Texas has lead to individual states adopting SEAMAP sampling and data protocols, in whole or in part, for state-managed fisheries research projects. For instance, Mississippi has modified the laboratory processing procedures for its inshore trawl survey to be consistent with current SEAMAP guidelines, resulting in data sets that are more readily integrated for assessment purposes. Recent longline survey development has also been a collaborative measure, with both the federal and state components discussing and agreeing to adopt uniform standards for vertical longline sampling. Additionally, states are investigating the potential for utilizing the SEAMAP Fisheries Scientific Computer System (FSCS) for

laboratory processing of samples collected through state monitoring efforts. The integration of FSCS with electronic fish measuring boards and bench top scales provides for more efficient data acquisition, reduces data recording and entry errors, and allows for more efficient data integration.

PLANNING DOCUMENTATION

Three levels of planning documents are used in SEAMAP: the five-year plan, annual operations plans, and cooperative agreements. This five-year plan serves as the basis for program coordination among the Gulf, South Atlantic, and Caribbean components and provides a set of goals and objectives for all components, along with an outline of policies and procedures for program management. This plan is revised every five years to assure current relevance to all aspects of SEAMAP.

Details of activities developed by each component to meet annual objectives for their region are given in the annual operations plan of each component. These plans are prepared by each committee to specify survey objectives and activities for the upcoming year, guide development of cooperative agreements, guide the operations of work groups, and provide an initial basis for budget allocations. These plans are brief (4-5 pages) and are prepared in draft form for review at the joint summer program meeting. Cooperative agreements serve two purposes: they provide the basic legal document used by NOAA to transfer funds, and they provide the detailed annual operating and budget plan for each SEAMAP partner, with the exception of NMFS and other federal agencies. Annual detailed NMFS plans are included in each of the cooperative agreements prepared by the other participants. If SEAMAP funds are transferred to another federal agency, such as in the Caribbean component, the transfer is done through a memorandum of understanding which details that agency's activities under SEAMAP.

PROGRAM FUNDING AND BUDGET MANAGEMENT

Program Funding

Funding for SEAMAP activities depends on congressional and state legislative allocations, with the largest share funded through NOAA. Federal funds provided through SEAMAP are used primarily to fund or expand existing state and federal survey programs.

Fiscal Year	Gulf of Mexico 41.3%	South Atlantic 32.9%	Caribbean 10.5%	NMFS 15.2%	TOTAL (millions)
2005	$612,430	$357,387	$185,000		$1.385
2006	$612,430	$383,981	$143,132		$1.385
2007	$2,500,755	$383,981	$143,749	$1,340,515	$4.369
2008	$1,812,082	$1,443,523	$460,699	$671,304	$4.388
2009	$2, 068,331	$1,647,653	$525,847	$848,234	$5.090
2010	$2, 068,331	$1,647,653	$525,847	$848,234	$5.090

The fiscal year (FY) 2005 budget was $1.385 million dollars and was funded at that level again for FY 2006. In FY 2007, the entire SEAMAP received $4.369 million as NMFS and the Gulf component were allocated additional funds partly in response to Hurricane Katrina, while the South Atlantic and Caribbean components were level funded that year. In FY 2008, SEAMAP received $4,387,608 that was allocated proportionally amongst the components. In FY 2009 and 2010, SEAMAP received $5,090,065 each year.

SEAMAP is conducted as a zero-based budget program. Federal funds are allocated annually to each geographic program component in accordance with approved annual operations plans, while non-federal participants contribute various amounts of support for SEAMAP activities such as salaries and equipment. Allocations of federal funds to participants are made to maximize participation and operating efficiencies. The components have agreed to percent allocations as follows: Gulf of Mexico (41.3%), South Atlantic (32.9%), Caribbean (10.5%), and NMFS (15.2%). Internal state and federal budget allocations for specific surveys and survey-related functions may vary significantly among participants and fiscal years. Thus, the individual state or federal share of the SEAMAP appropriation also may vary significantly from year to year, depending on budget needs to meet program objectives.

Budget Policies

Federal SEAMAP funds are allocated, administered, and monitored in accordance with DOC, NOAA, and SERO policies, directives, and guidelines. The program manager, as designee of the SEFSC Director, has approval authority for allocation of SEAMAP funds provided by NMFS. The program officer, as designee of the Southeast Regional Administrator, has administrative oversight responsibility for SEAMAP funds allocated to the states, commissions, councils, and others through cooperative agreements and contracts.

Every effort is made to ensure full and efficient utilization of SEAMAP funds. If for any reason allocated funds are determined to be in excess of the planned needs of a participant, the participant will immediately notify the program officer and manager of the projected excess. An attempt will be made to reallocate the excess funds to satisfy other program needs. SEAMAP may accept supplemental and reimbursable funds for specific activities and functions. Administration of these funds can be arranged through a number of mechanisms, such as contracts or cooperative agreements with NMFS, the interstate commissions, or the states.

The cost of all program support activities will be minimized. The committees will continually review the need for funding of support functions. Authorized travel on programmatic funds shall be defined by each committee. Out-of-state and foreign SEAMAP travel to other than approved SEAMAP functions (committee and work group meetings) must be approved in advance by the affected committee. However, for SEAMAP-South Atlantic, travel is authorized in advance by the ASMFC. SEAMAP meeting, workshop, and symposia locations will be selected to minimize meeting and travel expenses.

Budget Priorities

SEAMAP funds may be used for surveys, including vessel and aircraft operations and charters, gear, supplies, personnel and travel; coordinator salaries; administrative support; staff, facilities, equipment, and supplies; communications; specimen archiving (including personnel, equipment, facilities, and supplies); publications; travel; meetings (committees, work groups, workshops, and symposia); survey-related analyses; data management (hardware, software, operations, and personnel); program reviews; and other purposes designated by the committees and program manager.

SEAMAP budget priorities are as follows:

1. Long-term fishery-independent surveys
2. Data management
3. Coordination (coordinator salaries, meeting costs and coordination, and administration)
4. Calibration trials
5. Sorted specimen archives (including aging structures, gonads, and stomachs for diet)
6. Special surveys
7. Unsorted specimen archives
8. Workshops, symposia, and special meetings

Budget priorities 1-3 are considered by the committee to be essential for maintaining the integrity of the program. Priorities 4-8 are determined on a case-by-case basis in the context of each component's activities, SEAMAP's goals and objectives, and available funding.

Budget Planning

Budget planning is conducted in open meetings. The following annual procedure has been developed jointly by all three SEAMAP components:

1. Draft annual operations plans for the next year will be developed by each committee in the late spring or early summer. These plans provide the initial basis for subsequent budget allocations.
2. Based on best available information, the program manager will provide a preliminary target budget for the program in mid-summer.
3. The program manager will meet with the chairpersons and coordinators from each program component collectively to develop preliminary budget targets for each program component.
4. A late summer joint SEAMAP meeting will be held soon after the meeting defined in step 3 to present budget needs and plans, to negotiate component budgets (based on the preliminary targets), and to arrive at a recommended budget allocation plan for the total program. This plan will include a budget breakdown by participant.
5. If agreement cannot be achieved during any step in the budget planning process, the program manager will develop a recommended budget allocation plan. Each program participant will use this recommended budget plan for subsequent planning until either a new plan is negotiated, or the program manager's plan is overruled by the SEFSC Director.
6. Individual component operations plans will be revised in accordance with the budget plan and submitted to the respective management body for review and approval.
7. Individual cooperative agreements will be developed based on the budget allocation plan and appropriate operations plan for submission to the program officer. These agreements normally will be submitted on or about the start of the new federal fiscal year.
8. If the budget allocation plan has to be changed for any reason (such as due to a change in the appropriated amount or in the amount made available to SEAMAP by NMFS), the program manager will immediately notify the committees and work with the committees in developing a modified allocation plan.

With the exception of NMFS, budget allocations to SEAMAP participants normally are made through individual cooperative agreements. This method, however, does not explicitly exclude the use of contracts by NMFS when cost effective and appropriate.

PROGRAM REVIEW AND EVALUATION

Program reviews and evaluations will be conducted to determine program effectiveness in meeting defined objectives and to improve data collection and standardization, data management (including specimen archives), and information dissemination. Program reviews may be classified into two categories: regional program evaluation and external. Regional program evaluations serve as a summary of activities and are performed by each of the structural components of SEAMAP. External reviews can be designed to either evaluate the functional or technical aspects of SEAMAP.

Regional Program Evaluation

A review of each programmatic element, including administration, expenditures, survey operations, data management, and information dissemination will be conducted primarily through internal procedures within and among SEAMAP components each year. This review will be included in the annual report of program administration, data management, and information dissemination prepared by the coordinators in accordance with approved policies and procedures. The report will be submitted to the appropriate committee and management body for review. Responsibility for the reviews resides with the committee. Portions of the review may be delegated to the coordinators, work groups, data manager and curators. In addition, SERO's grant administration of SEAMAP amounts to an annual review, with acceptance of annual progress reports on the various grants under SEAMAP.

External Reviews

External reviews may be executed at the request of any management body in accordance with the collective direction of all management bodies. The program manager may request an external review of any aspect of program activities at any time. These requests will be coordinated with the appropriate committee and management body. External reviews will be written and documented and no such review will be released publicly without evaluation and comment by affected committees, management bodies, management agencies, and the program manager. When accepted by the affected committees and management bodies, actions recommended by an external or internal review will be executed within a reasonable time frame.

External technical reviews to evaluate specific operations and other aspects of the program can be called for and sponsored by any committee, with approval from the management bodies and program manager. These reviews are fully coordinated with all program components, and, whenever possible and appropriate, they are conducted jointly. Examples of operations which might be reviewed include plankton sampling, bottom trawling, and data processing and management procedures. An external review was conducted in FY 1987.

Prior to public release, technical publications produced by SEAMAP undergo peer review. Explicitly excluded from this requirement are data summary documents (e.g., atlases), reports to oversight bodies (e.g., annual reports), and reports from workshops and symposia, which represent collections of individual papers and abstracts.

CHAPTER 3. SEAMAP ACCOMPLISHMENTS

SEAMAP has been functional since 1981 and has been collecting fishery-independent data since 1982. Program accomplishments can best be summarized when considered by activity type. Activity types include: resource surveys, specimen archiving, data management, and information dissemination. The following also reviews the history of SEAMAP accomplishments as well as the application of SEAMAP data.

HISTORY

Since its beginning in 1981 in the Gulf of Mexico, SEAMAP has evolved into three components, each developing long-term data collection programs for monitoring valuable marine resources in the Gulf of Mexico, South Atlantic, and Caribbean regions. In addition, other important SEAMAP activities have been conducted, such as special studies and workshops. For the first three operational years (FY 1982-1984), SEAMAP received no federal programmatic funding and was supported through existing state and federal resources. Dedicated federal programmatic funding for SEAMAP began in FY1985 at approximately $1 million. For most of its history, SEAMAP has been level funded and in the last couple years, support has increased to $5.09 million each for FY2009 and FY2010. Continuing the resource surveys for long-term data sets has been a priority, and the potential of the program has been more fully realized with the recent funding increases. Unfortunately, most states are currently facing difficult fiscal situations and do not have additional financial resources to supplement SEAMAP. While the increase in funds in FY2008 has allowed for restoration of activities and development of new projects, decreased funding with coincident increased costs will erode the base program, jeopardizing the effort and accomplishments already invested in the program since 1981.

The initial phase of SEAMAP resulted in the publication of the SEAMAP Strategic Plan in January 1981. This document provided a conceptual framework for planning the program by outlining and considering goals, objectives, requirements, priorities, approaches, and guidelines for consistent actions by state and federal agencies, as well as other NOAA components. Along with input from regional fishery management councils, state marine fisheries agencies, interstate fishery commissions, appropriate federal agencies, and other interested parties, the SEAMAP Strategic Plan served as a basis for the development of the subsequent operational plans, including SEAMAP Gulf of Mexico Operations Plan: 1985-1990 and the SEAMAP South Atlantic Operations Plan: 1986-1990. The SEAMAP Management Plans (1990-1995, 1996-2000, 2001-2005, 2006-2010) and this document provide the conceptual framework for all three SEAMAP components.

The first joint meeting between the Gulf and South Atlantic components took place in October 1984, and resulted in the decision to meet jointly every year and to publish a joint annual program report, beginning in FY 1985. Each component reviews its activities at each meeting and within each report.
More information on the history of SEAMAP since 1981 can be found in Appendix G.

History of SEAMAP-Gulf Accomplishments

The first SEAMAP component, SEAMAP-Gulf, was implemented in the Gulf of Mexico in December 1981, under guidelines formulated by the GSMFC TCC. Since SEAMAP sampling began in 1982, the Reef Fish, Spring and Fall Plankton, and Summer and Fall Shrimp/ Groundfish Surveys have formed the backbone for SEAMAP fishery

independent sampling in the Gulf of Mexico. Initially, SEAMAP surveys were designed to be seasonal surveys, but level funding never allowed for seasonal surveys.

SEAMAP received increased funding in FY2007 and FY2008, allowing SEAMAP-Gulf to expand several existing surveys and start new fishery-independent surveys. Historically, the Summer and Fall Shrimp/Groundfish Surveys sampled offshore waters from the Florida/ Alabama state line to the U.S./Mexican border. With the increased funding, Florida was able to start participating in these surveys. Abundance and distribution information of demersal species on the west Florida shelf was a priority data need for fishery management. The Summer and Fall Shrimp/Groundfish Surveys now extend down into south Florida waters.

A Winter Plankton Survey took place five times from 1983 to 2006. Larval abundance data for winter spawning fish (grouper, mullet, and menhaden) was identified as a priority data need in the Gulf of Mexico. An abbreviated survey was begun in 2007 with full surveys conducted in 2008 and 2009. The Winter Plankton Survey is now scheduled as a biannual survey for the northern Gulf of Mexico.

NOAA, US Dept. of Commerce

The Spring Plankton Survey targets larval Atlantic bluefin tuna. Unfortunately, Atlantic bluefin tuna larvae are concentrated along oceanographic fronts and eddies and the survey design did not maximize the likelihood of capturing them. Increased funding allowed additional sampling directly targeting larvae across these oceanographic fronts and eddies, resulting in much better data on bluefin tuna in the Gulf of Mexico.

The SEAMAP Inshore Longline Survey began in 2007. This nearshore survey complements an existing long-term fishery-independent survey conducted by NMFS, by targeting sharks and finfish within the shallow waters of the north central Gulf of Mexico. The objectives of the survey are to collect information on coastal shark and finfish abundances and distribution with a 1-mile longline and to collect environmental data.

Alabama began the SEAMAP Vertical Longline Survey in 2010. While the SEAMAP Inshore Longline Survey and the NMFS Bottom Longline Survey capture sharks and finfish over mud or sand bottoms, the longlines are too long to adequately sample around hard bottom, coral reefs, or artificial reef areas. Therefore, Alabama began a vertical longline survey to better assess reef fish abundance in their artificial reef zones. Otoliths and fecundity information are also gathered on captured specimens.

The SEAMAP Winter Shrimp/Groundfish Survey began in 2009 as a trial survey to determine if a winter trawl survey was feasible in the northern Gulf of Mexico. Weather can be more unpredictable in the winter. Three

states currently participate in the survey and an analysis of the data collected will begin shortly to determine if it is providing data or species that are not currently captured in the fall and summer trawl surveys.

International Activities

SEAMAP has frequently interacted with Mexico's National Institute of Fisheries, which is the research agency of SEPESCA, the country's Ministry of Fisheries. A major cooperative event was the SEAMAP-SEPESCA meeting in Mexico City during August 1986, attended by representatives of the Gulf of Mexico and South Atlantic components and SEPESCA scientists and administrators. Participants presented information on research and data collection activities of common interest, such as king mackerel, red drum, shrimp, and ichthyoplankton.

SEAMAP and SEPESCA have also worked closely under the NMFS' MEXUS-Gulf Program for cooperative Mexican-U.S. research, especially in assessing the abundance and distribution of Gulf of Mexico ichthyoplankton. The SEAMAP-Gulf of Mexico Ichthyoplankton Atlases display results of these surveys, with collected samples identified cooperatively by both the U.S. and Mexican personnel. Mexican scientists have also participated in SEAMAP shrimp surveys and gear technology cruises, in order to establish standardized methodologies for monitoring and assessing Gulf of Mexico resources.

Atlantic States Marine Fisheries Commission

Workshops

In order to facilitate coordination of surveys and information exchange among participants and other involved organizations, SEAMAP periodically sponsors workshops and symposia. In September 2010, SEAMAP-Gulf of Mexico held a fishery-independent data needs workshop. Items discussed at the workshop included potential sampling gears, statistical and survey design, and potential costs associated with the proposed surveys. Attendees were from agencies and universities along the Gulf of Mexico that had experience in managed species stock assessments, ecosystem-based management, and designing and implementing fishery-independent sampling programs. Outcomes from the workshop will be used to help guide future SEAMAP sampling in the Gulf of Mexico.

History of SEAMAP-South Atlantic Accomplishments

SEAMAP-South Atlantic was formally established in October 1983 under the auspices of the ASMFC South Atlantic State/Federal Fisheries Management Board. The first year of operations was FY 1985.

The Coastal Survey was initiated as a pilot project in 1986, and the sampling strategy was finalized and implemented in 1989. The survey is a fishery-independent study designed to monitor the distribution and

abundance of coastal species in the South Atlantic Bight and to measure associated environmental parameters in nearshore coastal waters. That project continues today as a long-term survey and constitutes the largest component and highest priority activity in the South Atlantic program. Sampling was standardized in 1990, and a 10-year trawl report was completed in December 2000 summarizing species composition, regional species assemblages, and trends in distribution and abundance of 27 priority species. In January 2001, the sampling design was changed based on the results of an external program review. Offshore strata were discontinued, and additional stations were added to inshore strata for all three (spring, summer, and fall) cruises to reduce variability in the abundance estimates for target species. The objectives of the survey are to collect data on size, abundance, distribution, and seasonality of target finfish and decapod crustaceans; record species composition, biomass, and abundance to assess latitudinal and seasonal fluctuations; and collect data on size, sex, and gonadal condition of white, pink, and brown shrimp. Otolith, gonad, and stomach samples are taken on selected species for additional life history and diet data.

The Pamlico Sound Survey has been carried out since FY1984. This seasonal (spring and fall) trawl survey is designed to provide a long-term fishery-independent database on the distribution, relative abundance, and size composition of estuarine fish and decapod crustacean target species for the waters of Pamlico Sound. The survey was initially designed to provide a long-term fishery-independent database for the waters of the Pamlico Sound, eastern Albemarle Sound, and the lower Neuse and Pamlico Rivers. However, in 1989, the Albemarle Sound component was eliminated from the sampling area and the survey is now called the Pamlico Sound Survey.

The Cooperative Winter Striped Bass Tagging Cruise has been carried out since FY1988. This cruise trawls night and day in the Atlantic Ocean off the North Carolina Outer Banks processing catch (counting, measuring, sexing and additional weighing, tagging and/or sampling for some species, and implantation of sonic tags on others) for several species of fishes (primarily Atlantic striped bass, but also Atlantic sturgeon and spiny dogfish) and invertebrates.

A pilot bottom mapping study focusing on South Atlantic hard bottom areas and reefs was completed in FY 1986. Funding for the bottom mapping project resumed in FY 1992. Also that year, the SEAMAP-South Atlantic Bottom Mapping Work Group began an intensive effort to establish a regional database that includes the location and characteristics of hard bottom resources throughout the South Atlantic Bight. From FY1998 through FY 2001, the Florida Marine Research Institute (FMRI) reproduced and refined the three Bottom Mapping Reports, compilations of North Carolina through Florida data, into a single product on a CD-ROM readable on any desktop PC. The work group also added to this project by compiling deepwater (200-2000m) data in a spatial database. The Florida Fish and Wildlife Research Institute (FWRI-previously FMRI), SC DNR, University of North Carolina – Wilmington, and Harbor Branch Oceanographic Institute collaborated to synthesize data on habitat distributions for water depths between 200 and 2000 m within the U.S. EEZ, extending from just south of the Virginia/North Carolina border to the Florida Keys. The resulting deepwater bottom habitat GIS is compatible with the GIS data originally built for the shelf project (*Distribution of Bottom Habitats on the Continental Shelf from North Carolina through the Florida Keys*). SEAMAP bottom mapping data and associated GIS information have been incorporated into the South Atlantic Habitat and Ecosystem Internet Mapping Server[13] and an Arc Service for South Atlantic EFH[14]. In addition, the SAFMC is highlighting the role of the

[13] http://ocean.floridamarine.org/efh_coral/ims/viewer.htm

SEAMAP program in supporting the move to ecosystem-based management in the region through the South Atlantic Habitat and Ecosystem Homepage[15]. Both are tools supporting the development of a FEP for the South Atlantic Region and the importance of SEAMAP and need for expansion to support the move to ecosystem management. Also, sections on fisheries and life history of penaeid and deepwater shrimp in the FEP were updated by the Crustacean Workgroup.

SEAMAP-South Atlantic received increased funding in FY 2008. With these funds, the Bottom Mapping Work Group was restructured to include habitat considerations and fish characterization. The Bottom Mapping, Fish Habitat and Characterization Work Group helped identify and develop new survey priorities to address high priority management needs. In the summer of 2008, SEAMAP-South Atlantic used some of these funds to support their proposal to complement and expand MARMAP sampling to address high priority needs for over-fished species in the snapper-grouper complex. The primary objective is to enhance the fishery-independent reef fish data collected by MARMAP by increasing sampling in underrepresented regions of the sampled area. In addition, expansion of offshore site sampling through SEAMAP will result in more complete coverage and address identified shortfalls of the MARMAP sampling regime.

The increased funding also helped to support a juvenile gag ingress study. Between 1995 and 1998, methods and techniques were developed by MARMAP to establish a monitoring program to provide an annual index of juvenile gag abundance to predict future year class strength. That study employs Witham collectors, which were determined to be the most effective method for sampling ingressing reef fish larvae and other fish postlarvae. Additionally, samples are taken for diet studies targeting several reef fishes.

In 2008, the SEAMAP-South Atlantic Bottom Mapping, Fish Habitat and Characterization Work Group initiated support for a project to sample the adult red drum population from North Carolina to Florida to develop a better understanding of abundance, distribution, and age composition of the stock. These surveys contribute to the understanding of adult red drum populations along the Southeastern Atlantic coast by expanding the currently available data, thereby allowing for more effective and responsible management of the stock. Information derived from these surveys can also be used for coastal shark assessments in the South Atlantic.

Special Studies

Although long-term data series are the foundation of the program, SEAMAP is also involved with special resource and environmental studies that are important to the region and may enhance survey information.

- ***Age, growth, and histology*** of specimens collected in the Coastal and Reef Fish Surveys to provide vital biological information needed for fisheries management (FY 2001 – present).

Workshops

The following workshop was co-led by several SEAMAP South Atlantic Committee members and resulted in the founding of the SouthEast Fishery-Independent Survey (SEFIS), a SEAMAP partner survey. In addition, habitat data and several ongoing SEAMAP surveys were useful in guiding the design efforts.

[14] http://ocean.floridamarine.org/SAFMC_EFH/
[15] http://map.mapwise.com/safmc/Default.aspx

- ***South Atlantic Fishery Independent Monitoring Workshop - 2009***
  On November 17-20, 2009, a workshop sponsored by the SAFMC and NOAA Fisheries was held at the SEFSC in Beaufort, North Carolina to develop recommendations for the design of a multispecies fishery-independent survey(s) focused on species in the South Atlantic snapper grouper complex. The objectives of the workshop were to develop a design for evaluation of fish population responses to management actions, and to provide useful (e.g., characterized by annual coefficients of variation <20%) spatiotemporal indices of abundance, length frequency, and age distributions, including information on variance, for as many species as possible within the snapper grouper complex. This information is to be used in pending action in multiple Amendments to the Snapper Grouper FMP and for incorporation into population assessments. In addition, and given available funding, data can be utilized in ecosystem approaches to fisheries management (e.g., species composition, including non-targeted species, and identification of trophic linkages). To accomplish the overall objective, workshop participants developed survey recommendations under three categories: survey gear, statistical design, and life-history data collection.

History of SEAMAP-Caribbean Accomplishments

In FY 1988, a SEAMAP Caribbean Committee was established administratively under the guidance and supervision of the Caribbean Fishery Management Council (CFMC). Initial efforts toward establishing a long-term SEAMAP monitoring program in this area were oriented towards environmental monitoring and ichthyoplankton and pelagic longline fishery studies. The operational phase began in 1988 with plankton sampling, followed by longline monitoring in 1989.

The SEAMAP-Caribbean committee recognized long-term monitoring of reef resources as its most important priority, and between FY 1989 and 1992, procedures for conducting Reef Resource Surveys were developed. In FY 1991, a three-year sampling cycle of a Reef Resources Survey was started, including sampling by hand line and fish traps in waters off Puerto Rico and the U.S. Virgin Islands (USVI), extending into St. Croix in FY 1994 and 2000 and to St. John, USVI in FY 1999. From FY 1992-2002, a fishery-independent survey of reef fish populations using traditional fishing gears (traps and hooks & line) was carried out in St. Croix and St. John. In FY 2004, SEAMAP-Caribbean started another cycle of reef fish surveys. Puerto Rico began trap and hook-and-line surveys that continued into FY 2005, allowed by supplemental SEAMAP funds received in FY 2004. These funds also supported the investigation and completion of the SEAMAP-Caribbean USVI trap and hook-and-line database. The USVI delayed start of these surveys until a new research vessel could be purchased. In FY 2005, funds for a new research vessel were approved and the purchase process started. A new vessel was purchased and arrived in late May 2007. In 2007, trap and hook-and-line surveys were once again conducted in St. Thomas/St. John and St. Croix.

In FY 1990, 1995, and 2001, SEAMAP-Caribbean conducted surveys to determine the relative abundance of the queen conch (*Strombus gigas*) resources around the USVI and Puerto Rico. These surveys were joint ventures between the USVI Division of Fish and Wildlife and the National Park Service, as well as between the Puerto Rico Department of Natural and Environmental Resources and the University of Puerto Rico, Mayagüez Campus.

In FY 1996 and 1997, SEAMAP-Caribbean examined the spatial and temporal variation of lobster pueruli settlement in coastal waters adjacent to St. Thomas, USVI. Puerto Rico conducted a similar study, which was completed in 1998. In FY2002, pueruli lobster settlement and juvenile lobster attractor surveys were conducted in the US Caribbean.

In FY 2003, whelk surveys were conducted in the US Caribbean. These surveys were completed around Puerto Rico and on all three islands of the USVI.

In FY 2006, a five-year cycle started in Puerto Rico and the USVI in which the queen conch, lobster, reef fish, parrot fish, and yellowtail snapper surveys were undertaken for one year each, using the standardized methodology established in the early years of the SEAMAP Caribbean Program. The studies were conducted to provide information requested by the SEDAR stock assessment evaluation. Data collected has also been used in evaluating and planning any proposed fishing regulations for Caribbean waters.

In 2008, SEAMAP received an increase in funding that allowed Puerto Rico and the USVI to expand sampling. In Puerto Rico, the shallow water reef fish, yellowtail, and lane snapper's surveys were expanded to include the east and south coasts of Puerto Rico. In the USVI, additional funding allowed an expansion of sampling to St. Croix for these surveys. A couple of special projects were included in both areas, regarding collection of information of spawning aggregations in Puerto Rico and collection of gonads of three important species of parrotfish in the USVI.


SEAMAP-Caribbean

To assess queen conch (*Stombus gigas*) resources around the USVI, 144 conch underwater scooter transect surveys were completed for St. Thomas and St. Croix between 2008 and 2010. The conch study was concluded in FY 2010 and the final report was submitted in December 2010.

Lobster pueruli surveys were completed during FY 2008 and 2009 in St. Thomas and St. Croix and during FY 2009 in Puerto Rico. Puerto Rico also conducted a second component to this study in FY 2008 during which seven lobster larvae collectors were deployed. The final report for this portion of the study is currently in preparation.

In FY 2009, fishery-independent hook-and-line surveys were conducted for reef fish and yellow tail snapper in Puerto Rico off the west coast. Similar surveys were conducted in FY 2010 for reef fish and yellow tail snapper in St. Thomas/St. John. Due to staff shortages, an 18-month no-cost extension was requested and granted for the SEAMAP project cycle allowing St. Croix to delay their hook-and-line surveys until 2011. The final component of this five-year study looked at the reproductive cycles of three species of parrotfish. During FY 2010, parrotfish sampling was conducted in St. Thomas/St. John and St. Croix; this study is currently on-going. In FY 2010, a five year project proposal was submitted to conduct additional parrotfish reproductive surveys, conch and lobster surveys, reef fish hook-and-line surveys, deepwater snapper surveys and yellowtail surveys in waters surrounding the USVI. These studies will commence in FY 2011.

Special Studies

- ***Histology*** of specimens collected in reef fish, yellowtail, and lane snapper's survey provide vital biological information needed for fisheries management (FY 2003 – present, Puerto Rico).
- ***Gonad collection*** of three parrotfish gonads to assess spawning reproduction through macroscopic examination (FY 2008 – present, USVI).
- ***Characterization of spawning aggregations using a Remote Operated Vehicle (ROV)*** **-** a tiger grouper spawning aggregation site off the east coast of Puerto Rico is documented using a ROV.

International Activities

The SEAMAP-Caribbean component has established close working relationships with other Caribbean nations in an effort to assess recruitment patterns common to the entire Caribbean Basin. Information has been exchanged to develop the SEAMAP-Caribbean Directory of Fishery-Independent Activities, and it is expected that cooperative surveys may be conducted in association with the British Virgin Islands and the Dominican Republic in the near future.

RESOURCE SURVEYS

Resource surveys encompass both short and long-term surveys of fisheries resources and their environments. Although it is the long-term databases that form the foundation of SEAMAP, the program has flexibility to accommodate short-term data requests within the overall long-term program. For example, SEAMAP can provide data in response to addressing emergency resource information needs without impacting the program's long-term database. Surveys by each program component reflect distinct regional needs and priorities; however, survey operations in one geographic area often provide information useful to researchers in all three regions. For instance, the South Atlantic program's bottom mapping will be useful in SEAMAP-Gulf gear calibration efforts, while plankton and environmental surveys in the Gulf program have set the standards for the entire region's much-needed long-term database. Due to the diverse scope and target species involved in the SEAMAP's survey operations, activities are discussed here by geographic region.

GULF OF MEXICO RESOURCE SURVEYS

Spring Plankton Survey

Objectives

The SEAMAP Spring Plankton Survey began in 1982, with the objectives of collecting ichthyoplankton samples in offshore waters of the Gulf of Mexico for estimates of the abundance and distribution of Atlantic bluefin tuna larvae, and collecting environmental data at all ichthyoplankton stations.

Survey Design

Plankton samples are taken with standard SEAMAP bongo and neuston samplers. The bongo sampler consists of two conical 61 cm nets with 333-micron mesh. Tows are oblique, surface to near bottom (or 200 m), and back to surface. A mechanical flow meter is mounted off-center in the mouth of each bongo net to record the volume of water filtered. Volume filtered ranges from approximately 20 to 600 m^3, but is typically 30 to 40 m^3 at the

shallowest stations and 300 to 400 m^3 at the deepest stations. A single or double 2x1 m pipe frame neuston net, fitted with 0.947 mm mesh netting, is towed at the surface with the frame half-submerged for 10 minutes. Samples are taken upon arrival on station regardless of time of day. At each station, either a bongo and/or neuston tow are made. In addition, hydrographic data (surface chlorophylls, salinity, temperature, and dissolved oxygen from surface, mid-water and near bottom, and Forel-ule color) are collected at all stations. Right bongo and neuston samples collected from SEAMAP stations are transshipped to the Polish Sorting and Identification Center. Left bongo samples are archived at the SEAMAP Invertebrate Plankton Archiving Center. The SEAMAP Spring Plankton Survey usually samples approximately 150 stations every year during the April and May time period.

Optimization of Present Sampling

The Spring Plankton Survey can be optimized by sampling across oceanographic fronts and eddies associated with the Loop Current to sample for Atlantic bluefin tuna larvae. Atlantic bluefin tuna larvae tend to congregate along the boundaries of oceanographic fronts and eddies. The current Spring Plankton Survey design is based upon a grid system that may or may not coincide with an oceanographic front or eddy. Additional days to sample across oceanographic fronts and eddies would allow directed sampling in areas where Atlantic bluefin tuna larvae are more likely to be encountered, therefore providing better data for stock assessments.

Inshore Longline Survey

Objectives

The SEAMAP Inshore Longline Survey began in 2007, complementing an existing long-term fishery-independent longline survey currently conducted by NMFS. The SEAMAP Inshore Longline Survey targets coastal shark and finfish species within the shallow waters of the north central Gulf of Mexico. The objectives of the survey are to collect information on coastal shark and finfish abundances and distribution with a 1 mile longline and to collect environmental data.

Survey Design

All species are measured, tagged, and returned to the water alive when possible. The survey uses a stratified random design that is stratified by depth zone. The longline gear consists of 1 mile of 426 kg test monofilament mainline with 100 baited (*Scomber scomber*) #15/0 circle hooks with 3.7 m gangions of 332 kg test monofilament. A hydraulic longline reel is used for setting and retrieving the mainline. Radar high-flyers with bullet buoys are used to mark the longline locations. The mainline is weighted down at either end, as well as the midpoint, and set for 1 hour. Approximately 100 stations are sampled each year from March through October in inshore waters from Alabama to south Texas. The data are used in stock assessments for coastal sharks and finfish.

Vertical Longline Survey

In 2010, Alabama started a new SEAMAP Vertical Longline Survey to sample reef fish over artificial reefs and other areas. A total of 12 grids are fished each sampling trip. Two structure and two non-structure areas are randomly chosen and equally allocated across three depth strata. Vertical longline reels are randomly baited with either Atlantic mackerel or squid with a soak time of five minutes. Fish may be retained and processed for age and fecundity. All fish are sacrificed for otoliths at stations deeper than 60 m. In water depth less than 60 m, stations may be assigned as tag and release or collection sites. Alabama completed 213 sets in 2010. Louisiana

will join the SEAMAP Vertical Longline Survey in 2011 and NMFS will conduct vertical longline sampling on the west Florida shelf in 2011 using the same gear and protocols. Data are used in reef fish stock assessments and provide estimates of natural mortality, fishing mortality, and abundance estimates.


NURC/UNCW and NOAA/Flower Garden Banks National Marine Sanctuary

Reef Fish Survey

Objectives

The primary purpose of the SEAMAP Reef Fish Survey, which began in 1992, is to assess relative abundance and compute population estimates of reef fish found on natural habitat in the Gulf of Mexico.

Survey Design

Video cameras are used during the survey since they enable the measurement of length frequencies. Each stereo camera contains paired black-and-white video stereo still cameras along with a color mpeg camera in a cylindrical pressure housing. Four of these are mounted in a camera array and are positioned orthogonally with the center of the camera mounted 51 cm above the bottom of the array. A chevron fish trap that measures 1.83 x 1.83 x 0.75 meters with 3.81-cm mesh is used to capture fish for ageing and other life history studies. Both the fish trap and camera array are baited with squid. The camera array is allowed to soak on the bottom for 30 minutes, and the fish trap soaks for one hour. The hard bottom database from which sampling sites for this survey are chosen was developed in the following manner:

- Areas of natural reef habitat from Brownsville, Texas to the southern tip of Florida (at 81°00' W longitude and 24°02' N latitude) and between 9 and 110 m water depth are first inscribed on navigation charts, then divided into 10 by 10 nautical mile blocks (primary sample units).
- Each block is subdivided into 100-m^2, secondary sample units that are numbered and initially classified as being “reef” or “non-reef” and then entered into a database.
    - Prior to the survey, blocks are selected from this database in the eastern and western Gulf with probability proportional to the number of “reef” sample units within a block.
    - Within each selected block, 100 sample sites are randomly selected.
- During the survey, each selected block is occupied for one 24-hour period, where night hours are devoted to ship’s echo sounder surveys of up to 100 sites and daytime hours to trap/video sampling.
    - Each potential sample site surveyed at night is either given a final determination as being a reef site or not based on echo patterns, vertical relief, and other characteristics.
    - Up to eight actual “reef” sites are then randomly selected for sampling during that day. Trap/video sampling begins one hour after sunrise and ends one hour before sunset.

Trap soak time is one hour. During the spring and summer months, NMFS samples approximately 350 stations for reef fish throughout the Gulf of Mexico, while Florida started sampling an additional 150 reef sites on the west Florida shelf in 2009. Associated environmental data collected at each site usually includes profiles of salinity, temperature, and surface chlorophyll, and may include profiles of dissolved oxygen, light transmittance, and fluorescence.

Summer Shrimp/Groundfish Survey

Objectives

The SEAMAP Summer Shrimp/Groundfish Survey began in 1982, takes place during June and July every year, and samples approximately 500 stations from the U.S./Mexican border to south Florida. Data from the survey are used in evaluating the abundance and size distribution of penaeid shrimp in federal and state waters to assist in determining opening and closing dates for commercial fisheries; evaluating and plotting the size of the hypoxic zone off of Louisiana; assessing shrimp and groundfish abundance and distribution and their relationship to such environmental parameters as temperature, salinity, and dissolved oxygen; and providing juvenile abundance indices for red snapper stock assessments. The Survey has three objectives: (1) to monitor size and distribution of penaeid shrimp during or prior to migration of brown shrimp from bays to the open Gulf; (2) to aid in evaluating the "Texas Closure" management measure of the GMFMC Shrimp FMP; and (3) to provide information on shrimp and groundfish stocks across the northern Gulf of Mexico from inshore waters to 50 fm.

Survey Design

The sampling sites are chosen using a random design with proportional allocation by bottom area within shrimp statistical zones throughout the Gulf of Mexico. Trawl stations sampled by NMFS, Florida, Alabama, Mississippi, and Louisiana are made with a standard SEAMAP 40-ft net, and Texas samples with a 20-ft net. Trawls are towed perpendicularly to the depth contours for 30 minutes except for Texas, which tows for 10 minutes parallel to the depth stratum. Ichthyoplankton samples and environmental data are also taken during the survey. All *Litopenaeus setiferus*, *Farfantepenaeus aztecus*, and *Farfantepenaeus duorarum* are separated from the trawl catch at each station. Total count and weight by species are recorded for each station. A sample of up to 200 shrimp of each species from every trawl is sexed and measured to obtain length-frequency information. Estimated total numbers are derived from the total weights of those processed. Other species of fishes and invertebrates are identified, enumerated, and weighed. Weights and individual measurements of selected species, other than commercial shrimp, are also recorded.

Jeff Rester, Gulf States Marine Fisheries Commission

Optimization of Present Sampling

The Summer Shrimp/Groundfish Survey can be optimized by extracting otoliths to age fish, performing dietary analysis to determine trophic interactions, and examining reproductive stage from fish currently captured in normal survey operations. This information would provide a wealth of data that could be used for current fisheries management, understanding predator/prey interactions, and support the development of ecosystem-based fisheries management.

Fall Plankton Survey

Objectives

The SEAMAP Fall Plankton Survey began in 1984 and takes place every August and September in waters of the northern Gulf of Mexico. Approximately 200 stations are sampled each year. The objective of the survey is to collect ichthyoplankton samples with bongo and neuston gear for the purpose of estimating abundance and defining the distribution of eggs, larvae, and small juveniles of Gulf of Mexico fishes, particularly king and Spanish mackerel, lutjanids, and sciaenids.

Survey Design

Plankton samples are taken with standard SEAMAP bongo and neuston samplers. The bongo sampler consists of two conical 61-cm nets with 333-micron mesh. Tows are oblique, surface to near bottom (or 200 m) and back to surface. A mechanical flow meter is mounted off-center in the mouth of each bongo net to record the volume of water filtered. Volume filtered ranges from approximately 20 to 600 m^3, but is typically 30 to 40 m^3 at the shallowest stations and 300 to 400 m^3 at the deepest stations. A single or double 2x1 m pipe frame neuston net fitted with 0.947 mm mesh netting is towed at the surface with the frame half-submerged for 10 minutes. Samples are taken upon arrival on station regardless of time of day. At each station, either a bongo and/or neuston tow are made depending on the specific survey. In addition, hydrographic data (surface chlorophylls, salinity, temperature, and dissolved oxygen from surface, midwater and near bottom, and Forel-ule color) are collected at all stations.

Optimization of Present Sampling

The Fall Plankton Survey can be optimized by using a 1-meter Multiple Opening and Closing Net Environmental Sensing System (MOCNESS) to sample the vertical distribution of fish larvae by sampling at discrete depths in the water column. A Methot fish trawl can also be used to sample the size fraction of fishes that are underrepresented in bongo and neuston samples.

Fall Shrimp/Groundfish Survey

Objectives

The SEAMAP Fall Shrimp/Groundfish Survey began in 1985 and is currently conducted from south of Tampa, Florida to the U.S./Mexican border. Data from the survey are used in evaluating the abundance and size distribution of penaeid shrimp in federal and state waters to assist in determining opening and closing dates for commercial fisheries; assessing shrimp and groundfish abundance and distribution and their relationship to such environmental parameters as temperature, salinity, and dissolved oxygen; and providing juvenile abundance indices for red snapper stock assessments.

Survey Design

The survey collects samples at over 500 stations annually. Vessels sample waters out to 60 fm with trawls and plankton nets in addition to environmental sampling. The sampling sites are chosen using a random design with proportional allocation by bottom area within shrimp statistical zones throughout the Gulf of Mexico. Trawl stations sampled by NMFS, Florida, Alabama, Mississippi, and Louisiana are made with a standard SEAMAP 40-ft trawl net, and Texas samples with a 20-ft trawl net. The objectives of the survey are to sample the northern Gulf of Mexico to determine abundance and distribution of demersal organisms from inshore waters to 60 fm; obtain length-frequency measurements for major finfish and shrimp species to determine population size structures; collect environmental data to investigate potential relationships between abundance and distribution of organisms and environmental parameters; and collect ichthyoplankton samples to determine relative abundance and distribution of eggs and larvae of commercially and recreationally important fish species. NMFS, Mississippi, and Louisiana vessels collect ichthyoplankton data with bongo and/or neuston nets at sample sites occurring nearest to half-degree intervals of latitude/longitude.

Optimization of Present Sampling

The Fall Shrimp/Groundfish Survey can be optimized by extracting otoliths to age fish, performing dietary analysis to determine trophic interactions, and examining reproductive stage from fish currently captured in normal survey operations.

Winter Shrimp/Groundfish Survey

The SEAMAP Winter Shrimp/Groundfish Survey began in 2009 with approximately 125 stations sampled in February annually off Alabama, Louisiana, and Texas. Stations are chosen randomly and vessels from Louisiana and Alabama use a standard SEAMAP 40-foot trawl, while Texas vessels use a 20-foot trawl. Protocols from the other trawl surveys are used to collect environmental and biological data. Data uses are the same as the other trawl surveys.

Optimization of Present Sampling

The Winter Shrimp/Groundfish Survey can be optimized by extracting otoliths to age fish, performing dietary analysis to determine trophic interactions, and examining reproductive stage from fish currently captured in normal survey operations.

Winter Plankton Survey

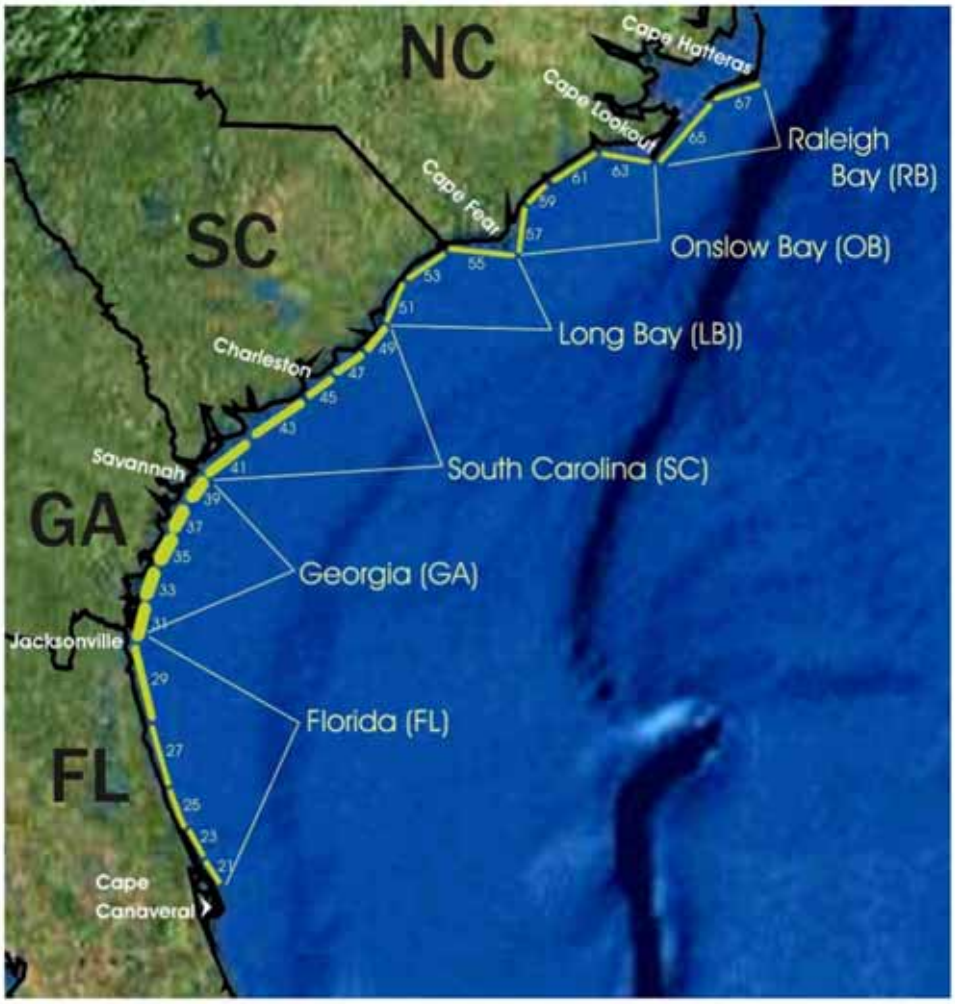
The SEAMAP Winter Plankton Survey began in 1983, but because of budget limitations, only took place sporadically until 2007. The survey was conducted in 2007, 2008, and 2009, and will now take place every other year during February and March. Approximately 150 stations are sampled throughout the northern Gulf of Mexico for ichthyoplankton. The objectives of the survey are to assess the occurrence, abundance and geographical distribution of the early life stages of winter spawning fishes from the mid-continental shelf to deep Gulf waters; measure the vertical distribution of fish larvae by sampling at discrete depths in the water column using a 1-meter Multiple Opening and Closing Net Environmental Sensing System (MOCNESS); and sample the size fraction of fishes that are underrepresented in bongo and neuston samples using a juvenile (Methot) fish trawl. The data are used in stock assessments for many species of reef fish.

SOUTH ATLANTIC RESOURCE SURVEYS

Coastal Survey in the South Atlantic

Objectives

Commercial fisheries in the South Atlantic are dominated by the shrimp fishery. Additionally, king and Spanish mackerel, Atlantic menhaden, bluefish, blue crabs, herrings, jacks, horseshoe crabs, most sciaenids, and numerous forage species spend part or most of their early life in shallow shrimp trawling grounds in the South Atlantic. These species have immense commercial and recreational value and form the basis of many of the principal South Atlantic fisheries. Current state surveys are directed primarily at shrimp and are sufficient for some basic management needs; however, the coordinated and standardized SEAMAP Coastal Survey provides fishery and ecological data covering the entire region. Community level data are applicable to management and monitoring of all sampled species.



Strata sampled by the SEAMAP-SA Coastal Survey. (Strata are not drawn to scale)

Survey Design

The SEAMAP Coastal Survey uses a trawl to sample shallow waters of the South Atlantic from 3-5 fathoms from Cape Canaveral, Florida to Cape Hatteras, North Carolina. Gear and survey procedures are standardized to ensure quality data with a synoptic view of the relative abundance and distribution of the stocks.

Optimization of Present Sampling

The Coastal Survey currently uses all of the available time on the research vessel, R/V *Lady Lisa*. Any substantial increase in the scope of work would require an additional vessel and crew. It is possible that the following could be done on a limited basis without additional funding:

- Live and preserved water samples from a subset of Coastal Survey stations for habitat monitoring
- Water quality (chlorophyll, DO, contaminants)

- Algae samples
- Plankton samples
- Bottom grabs/bottom characterization. Bottom mapping inferred bottom type from species associations. A physical characterization of bottom type of SEAMAP Coastal Survey stations would supplement existing bottom mapping data.

North Carolina Pamlico Sound Trawl Survey

Objectives

The Pamlico Sound survey provides a long-term fishery-independent database for the waters of the Pamlico Sound, and the lower Neuse and Pamlico Rivers in North Carolina. Data collected from the survey provide juvenile abundance indices and long-term population parameters for interstate and statewide stock assessments of recreationally and commercially important fish stocks. The Pamlico Sound survey objectives are to:

- Determine and monitor the distribution, relative abundance and size composition of fish, shrimp, and crabs in the survey area and how they vary temporally and spatially
- Provide data to ascertain fishery-independent estimates of mortality and population size to compare to commercial fishery samples and landings data
- Determine which species utilize (and to what extent) the sound during their early life development and identify nursery areas for those species (e.g., *Cynoscion* spp., *Paralichthys dentatus*, etc.)
- Determine if catch rates of various species are correlated with indices of juvenile abundance derived from the juvenile trawl survey
- Determine if species distributions are correlated with each other or with some other measured parameter(s)
- Monitor the movement of organisms out of the nursery area and into the open waters of the Pamlico Sound where they are available for commercial exploitation

Survey Design

Annually, 52-54 randomly selected stations (grids- one-minute by one-minute grid system equivalent to one square nautical mile) are trawled for 20 minutes using double rigged demersal mongoose trawls over a two week period, usually the second and third week of the month in both June and September. Stations sampled are randomly selected from four different strata based upon depth and geographic location.

Optimization of Present Sampling

The Pamlico Sound survey could be optimized to collect stomachs of sampled fish species during the survey. Diet analysis of sampled fish species could provide insight into predator-prey interactions, as well as an additional resource for multi-species and ecosystem management approaches for Pamlico Sound. Collection of information (e.g., life history, tagging) from other species captured in the survey could be used to address additional data needs.

SEAMAP Reef Fish Survey

Objectives

In the summer of 2008, SEAMAP-South Atlantic received funds to be able to support its proposal to complement and expand MARMAP sampling to address high priority needs for overfished species in the snapper-grouper complex. The primary objective was to enhance the fishery-independent reef fish data collected by MARMAP by increasing sampling in underrepresented regions of the sampled area. In addition, expansion of offshore site

sampling through SEAMAP will result in more complete coverage and address identified shortfalls of the MARMAP sampling regime. The reef fish project has yielded a variety of areas with live bottom that previously were not monitored by MARMAP.

Survey Design

From 2008 through 2010, sampling was conducted between April and November using the *R/V Palmetto*. The area sampled was between an area 30nm south west of Cape Look-out, North Carolina and 10nm east of St. Lucie, Florida. Sampling with chevron traps and vertical long lines was conducted during daylight hours, while hook and line, bathymetric, and video collections were made during both day and night-time hours. Surveys to identify live bottom habitat were done using a variety of sources and methods such as traps, hook-and-line bathymetry, and under water video. Abundance, biomass, and length-frequency data of the collected fish were obtained. Selected species were worked up to obtain life history samples such as otolith, gonads, stomach contents, etc.

During the completed sea days, the program identified additional natural reef habitat, sampled marine protected areas (MPAs), collected samples for diet analysis (see section below), and surveyed potential sampling areas for red snapper. Starting in the 2011 sampling season, many of the new live bottom areas will be included in the routine sampling and data will be included in analyses. A classification scheme was developed based on the chevron trap photos. The results will assist in further refining habitat characterization in a consistent manner. In addition, the trap photos were used to develop an index of relative abundance for lionfish.


NOAA/Florida Keys Marine Sanctuary

The gag grouper ingress study established collaborations with partners at GA DNR and NC DMF. As of 2010, samples are collected in 15 sites in the vicinity of Beaufort, NC; Wilmington, NC; Georgetown, SC; Charleston, SC; Beaufort, SC; Savannah, GA; and Brunswick, GA. New sites in Wilmington and Savannah were added in 2009, and sample locations in Brunswick were added in 2010; a possible future monitoring site is Jacksonville, FL. Ingress monitoring uses Witham collectors; floats off the bottom collectors are anchored in shallow tidal waters from March through June each year. Since gag become fully recruited to commercial fishing gear at age four or five, the survey will re-examine data collected in earlier years to investigate a link between juvenile abundance and the year class strength and/or commercial landings.

Optimization of Present Sampling

Optimization of fishery-independent sampling is through the direct collaboration between the SEAMAP, MARMAP, and SEFIS programs to complement and more effectively cover depths including shallow, shelf, and deepwater habitats. In addition, the expansion of the SEAMAP allowed the increase in sample frequency and range north and south to better cover managed species distribution.

State Red Drum Longline Surveys

North Carolina Red Drum Longline Survey

Objectives

The North Carolina Red Drum Longline survey provides SEAMAP participants, ASMFC, and NMFS with the resources necessary to develop a fishery-independent index of abundance for adult red drum to be used in future stock assessments. Tagging of red drum captured during the survey allows for additional information on migratory behavior and stock identification. Collection of age structures provides insight on escapement rates from specific cohorts and provides a means to evaluate the age structure of the adult population. Fishery-independent surveys allow for determination of CPUE, which is necessary to determine population size and trends in abundance. Age structure of the spawning stock permits the estimation on the level recruitment (escapement) into the spawning population. Additionally, better estimates of escapement and age composition allow for comparison of the findings with the recommended spawning potential ratio (SPR). The red drum long line survey objectives are to:

- Conduct fishery-independent longline sampling on adult red drum to develop information on CPUE;
- Collect biological information (size, sex etc.) and samples (otoliths, gonads, muscle, fin clips, etc.) from sub-samples of the red drum catch in order to determine size at age, recruitment to the spawning population, mercury contamination, and genetic composition of the stock;
- Tag adult red drum for the collection of migratory and stock identification data; and,
- Disseminate results to the ASMFC and NMFS for inclusion in stock assessments

Optimization of Present Sampling

The red drum longline survey could be optimized by providing additional life history information on red drum. Collection of diet data as part of the survey could provide needed information on red drum, as such information is largely nonexistent, as well as to provide information on predator-prey relationships to enhance available data needed to continue to move towards multi-species and ecosystem management. Collection of information (e.g., life history, tagging) from other species captured in the survey could be used to address additional data needs.

South Carolina Adult Red Drum Longline Survey

Survey Design

In 2007, South Carolina changed the adult red drum longline survey from sampling index stations primarily in Charleston Harbor to a random design that covered the coast (Winyah Bay, Charleston Harbor, and Port Royal Sound). The survey utilizes three time periods during each season; during each time period (July – December) each of the three strata are sampled equally. Locations within each stratum are randomly selected (with replacement) resulting in approximately 30 stations per time period, per stratum. Locations (approximately 50 - 100 locations/stratum) have been selected based on historical sites that produced red drum catches, angler information, and habitat that is similar to areas that have historically held adult red drum.

Bottom longline sets are made from the *R/V Silver Crescent*, a 50-foot, shallow draft vessel equipped with two, longline reels. The 617 m long groundlines of the fishing gear are constructed of 600 # test monofilament. Stop sleeves are placed on the groundline at 30 m intervals to prevent gangions from sliding into one another. Clip-on, monofilament gangions (2.5 mm diameter stainless steel longline clip with 4/0 swivel, 0.5 m of 200# test monofilament and a 15/0, Mustad tuna circle hook) are spaced at 15.2 m intervals resulting in 40 hooks per set. Hooks are baited with striped mullet, Atlantic mackerel, or other readily obtainable baitfish. The sets are anchored and buoyed at each end. Since the primary emphasis is on obtaining red drum in good condition for tagging, gear soak times are short (30 minutes).


South Carolina Dept. of Natural Resources

After bringing the captured red drum and sharks onboard, the hook is removed and fish are measured (FL and TL mm), sexed (sharks), and tagged (selected species). Red drum are tagged with external tags (Hallprint nylon dart tags) and internal tags (PIT tags), allowing for long-term identification of a recaptured fish even though they may have shed the external tag. A fin clip is collected from each fish for genetic analysis to identify individual fish. Juveniles of coastal sharks are tagged with Rototags supplied by the NMFS Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) project. Large coastal sharks (> 1 m FL) are tagged with "M tags" (stainless steel dart), supplied by the NMFS Cooperative Shark Tagging Project.

Red drum are randomly sacrificed (30 - 50 fish in each stratum/season) and various samples are taken for multiple investigations (otoliths for age, gonads for sex and maturity, and tissue for genetic analysis).

Optimization of Present Sampling

Before the 2010 sampling season, CPUE data were analyzed in order to maximize potential encounters with red drum. Areas that had not produced any red drum over the first three years of the survey were eliminated, and productive areas were expanded to include more sampling locations. As the survey collects more data, further analysis may allow for other opportunities to streamline sampling, such as assigning sample locations by choosing more "inshore" or "nearshore" stations depending on the seasonal movement of adult red drum. Collection of samples during surveys is useful even if there is not funding available to process these samples immediately. Other institutions may be able to cooperatively process these samples without much added effort or expense. For example, SC DNR has been involved in processing reproductive tissue samples from the North Carolina Adult Red Drum Survey. Furthermore, researchers have been preserving stomachs with the intention of future processing; taking these samples while processing adult red drum takes little extra effort but creates a catalog of useful samples for future investigation. Researchers have also been involved in the collection of tissue and blood samples from coastal shark species. These samples have been used in genetic studies for determination of population structure and investigations of hormone levels in order to characterize reproductive strategies. These cooperative efforts take little extra time during the survey, but they can be very beneficial in future stock assessments.

Georgia Red Drum Longline Survey

Objectives

The red drum longline survey was initiated as a pilot project in 2005 with funds provided by the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). The primary objective is to develop state-specific sampling protocols to provide a fishery-independent index of abundance for adult red drum that could be used in stock assessment efforts. SEAMAP funding for the survey began in 2009 and is now the primary funding source.

Survey Design

The survey is a stratified random sampling design based on proximity to shore: nearshore (0-3 nm), and offshore (3-12 nm). General sampling locations focus in areas historically associated with high probabilities of encounter. Sampling is conducted monthly between April and December, during which twenty-five sets are performed monthly in Georgia and ten sites off Florida's northeast coast (September to December only). Sampling is proportionately allocated across strata to account for temporal shifts in the population as offshore migration occurs. Starting in 2010, an inshore estuary strata was added in Georgia. These sites are selected on the estuary side of barrier islands, inlets, and ocean going channels and proportionally sampling in a similar manner as other strata.

The sampling gear consists of a main line approximately 926 m in length, made of 2.5 mm monofilament, containing 60 gangions/branchlines. Gangions/branchlines will be 0.7 m in length, 1.6 mm monofilament, equipped with a single 15/0 or 12/0 circle hook (30 of each). Soak times are 30 minutes in duration, measured from the time when the second anchor is deployed to when the first anchor is retrieved.

All catch is processed at the species level. All red drum are landed and processed for standard morphometrics and genetic material (fin clip) while viable animals are tagged with conventional and PIT tags and released. Mortalities are processed further for sex and gonadal development information, and otoliths extracted for age determination. Annually or periodically, a subsample of red drum may be sacrificed to estimate the adult stock

age composition. Target species are landed and processed for standard morphometrics and released, while certain non-target species may be tagged with conventional tags prior to release.

Data collected at each station includes gear deploy and retrieve times, average depth, position at each end of the main line, and a standard suite of physio-chemical data, collected at bottom and surface, including temperature, salinity, and dissolved oxygen. Physio-chemical profiles of the water column may be collected.

Optimization of Present Sampling

Original site selection was derived from angler and red drum biologists' expertise associated with nearshore sandbars in the fall. These sites have proven difficult to sample with a research vessel of 1.5 m draft, and consequently few red drum have been captured. However, the inshore strata (behind barrier islands and sound channels) and offshore artificial reef strata have proven successful. Future efforts will emphasize these areas with a progressive allocation of effort towards offshore sampling as the season progresses.

To maximize the efforts of this survey, otoliths, gut contents, and fin clips will be collected from all sacrificed animals, as well as fin clips and tags on all released specimens. Students from Savannah State University's Marine Science Program are conducting graduate work on red drum reproductive life history. A partnership has been established with the University of North Florida (Dr. Jim Gelsleichter) to collect blood samples from, and externally place tags on, select shark species to examine the genetic composition of the populations and examine species movements and habitat preferences.

CARIBBEAN RESOURCE SURVEYS

Reef Fish Monitoring (Expanded)

Objectives

The most important resources in the Caribbean identified to be monitored are the queen conch, spiny lobster, and the shallow water reef fishes. Due to the amount of funds available to undertake the surveys of these species, it was decided to monitor these resources in a five year cycle, as follows: reef fish for three years, queen conch one year, and spiny lobster one year.

SEAMAP-Caribbean

The reef fish survey began in 1992 officially as a SEAMAP survey in Puerto Rico. The

objective of the survey is to establish reef fish abundance and provide data on species of interest to improve their stock assessment. Until 2004, sampling was conducted using two gears: hook-and-line and fish traps. In the most recent five-year cycle (started in 2006), the survey was modified to sample reef fish with hook and line for a year. The next two years targeted two specific species, yellowtail and lane snapper, lacking critical data (effort and abundance) for their stock assessments. The reef fish survey methodology was not appropriate to capture these species in meaningful amounts. In 2009, sampling of yellowtail snapper was conducted for a year, followed by the lane snapper survey. The additional funds received starting in 2009 allows Puerto Rico to expand the sampling to other coasts besides the west coast.

Another important activity undertaken through the reef fish sampling is spawning aggregation monitoring. The goal is to acquire baseline data for four spawning aggregation sites identified on the west coast based on acoustics surveys and traditional knowledge. One of the objectives is to establish periodicity and site fidelity of various fish species to spawning aggregation sites. There are a number of red hind spawning aggregations that have been targeted for the past eighteen years on the west coast. Those areas are known to be used by several species for reproduction. Future work may involve documenting spawning activity by other species, such as using ROV technology to characterize a tiger grouper (*Mycteroperca tigris*) spawning aggregation located in the east coast.

Survey Design

In all the reef fish surveys, data on sexual maturation of each individual is recorded, which is being used to determine spawning season and size of 50% population maturation for species that have enough samples. Samples are also provided for the reproduction program established at the Fisheries Research Laboratory (FRL) for some of the species under study by this program. Data is also being used to determine the precision of sex determination between macroscopic or microscopic/histological sexing. All individuals are macroscopically sexed and gonads are photographed, removed, and preserved for histological sexual determination. Comparison between macroscopic and microscopic sex is performed. This information is going to be used as a guide to determine the sexual maturation for different species, to increase the precision on sexing the individuals. Some samples are provided to external researchers at the national level for different purposes, such as genetics studies, age and growth, and reproduction.

Queen Conch Survey

The objective of the queen conch survey is to determine the spatial and temporal variations in stock abundance within the territorial sea of Puerto Rico and the U.S. EEZ, using a transect survey methodology designed by Freidlander et al., 1994. The survey is conducted every five years in Puerto Rico starting in 1995. This mollusk has been under management in the U.S. Caribbean since 1997, when the Queen Conch FMP was established. Data provided by the queen conch surveys has served to manage these resources in Puerto Rico and the USVI. At the present time, this survey is the only source of monitoring, as total harvest is prohibited in federal waters. The survey is also of great importance in the evaluation of the catch quotas implemented in USVI. In Puerto Rico, data collected through this survey was used to implement management measures that include minimum size, catch quota, and a closed season. This is a visual census survey that is conducted around the Puerto Rico Island and includes the Culebra, Vieques, and Mona Islands. In the USVI, it is carried out in St. Thomas (recently added) and St. Croix.

Spiny Lobster Survey

The spiny lobster constitutes the most important commercial species in Puerto Rico due to its economic value. The CFMC established an FMP in 1985 to protect the resource within the U.S. Caribbean, and currently, both the USVI and Puerto Rico governments protect this species through a set of compatible regulations with the CFMC. The SEAMAP-Caribbean Committee evaluated the options to monitor these resources and decided to implement a pueruli settlement survey. The first survey was conducted for a masters degree thesis (Monterrosa, 1991) from which the methodology was adopted, the second was in 1996, and the third in 2003. The most recent survey was conducted in 2008.

For the 2003 and 2008 surveys, two separate studies were completed - monitoring of pueruli settlement and monitoring of juvenile lobster in artificial shelters. Modified Witham model pueruli collectors were constructed to monitor the pueruli settlement. Juveniles were sampled using shelters consisting of concrete block reefs designed by Cruz et al (1995). An index of annual abundance was calculated as the mean of the number of juveniles caught per shelter per month, providing an index of the relative strength of abundance for the entire area (Cruz et al., 1995).

SPECIMEN ARCHIVING

Gulf

The SEAMAP Ichthyoplankton Archiving Center houses SEAMAP-collected specimens of fish eggs and larvae that have been identified by the Polish Sorting and Identification Center. All data are managed in an Access database system, which minimizes mistakes, eliminates coding errors, and allows for much faster data entry. Over 388,664 lots of specimens have been catalogued to date representing 19 taxonomic orders, 130 families, 236 genera, and 245 species.

The SEAMAP Invertebrate Plankton Archiving Center (SIPAC) manages planktonic invertebrates from sorted sample collections and backup plankton collections obtained during SEAMAP surveys. The number of samples currently catalogued in the SIPAC collections is 6,120. Several thousand samples were lost in Hurricane Katrina in 2005, with some of these archived samples

NOAA/US Dept. of Commerce

being replaced by plankton samples previously sorted for fish larvae and archived at the Sea Fisheries Institute in Gdynia, Poland.

Just as SEAMAP provides a level of consistency in sampling within Gulf waters, individual states can provide a framework for the expansion of SEAMAP surveys through procedures and protocols established for long-term monitoring efforts. For instance, Florida currently processes otoliths and stomach contents for fish collected through its inshore monitoring program and have developed sound methodologies for the collection and processing of those samples. As fishery management needs continue to grow, age estimates determined from otolith annular counts and trophic dynamics data obtained from gut content and stable isotope analyses will be vital to assess factors affecting managed fish stocks and associated ecological conditions. As SEAMAP progresses in the future and expands to include more ecosystem-based components in its data collection process, coordination with Florida and other knowledgeable entities would be advisable, as procedures are developed to address those needs.

South Atlantic

With the continuing collection of specimens, both in terms of collected samples as well as diet items, it is important that voucher specimens of collected species are catalogued and archived. SEAMAP-South Atlantic funds help support SERTC, which has been largely responsible for these reference collections in the South Atlantic. SERTC is located in the Marine Resources Research Institute (SC DNR) in Charleston, South Carolina. This facility has developed a curated collection of marine and estuarine animals from the South Atlantic Bight and is maintaining a searchable library based on taxonomic peer-reviewed literature. Through the use of collaborations with other labs and museums, SERTC has collected and preserved representative specimens from numerous habitats throughout the Southeast, documenting several range extensions for Atlantic species. An integral part of this collection is obtaining voucher specimens of all non-indigenous species observed during SEAMAP-South Atlantic survey cruises and preparing distributional summaries to the USGS non-indigenous aquatic species database managers. Since many specimens are too large to be stored whole, SERTC is planning on initiating construction of an image library containing photographs of fresh or frozen specimens of all species collected on SEAMAP-South Atlantic Surveys. SERTC can also play a role in preparing graphical and informational content for webpages that describe the biodiversity of fauna collected during the SEAMAP-South Atlantic Surveys.


C. Michelle Willis

To address SEAMAP-South Atlantic goals, SERTC is presently concentrating work on stomach content analysis and deciding on level of identification necessary as well as variables to measure: prey numbers, lengths,

weights, or volumes. Facilities at SERTC may also serve as a potential sample processing facility for age and growth collections generated through research by SEAMAP components.

Archiving and storage of otoliths and gonadal tissues has proven to be essential for high quality fish stock assessments. For example, recent stock assessments required re-examination of otoliths to provide additional information such as edge types to determine the calendar age of fish (e.g., SEDAR 17 vermilion snapper, SEDAR 24 red snapper, and SEDAR 25 black sea bass and golden tilefish). In addition, these samples provide material for laboratory calibrations and training. Increasingly, genetic techniques are available that can utilize material obtained from stored otoliths to address important population issues such as changes in life history parameters and dynamics as a result of fishing pressure and other factors affecting fish populations. Otolith and gonad samples collected by the SEAMAP-South Atlantic (and MARMAP) reef fish program and coastal survey provide a unique historical data set that has increasingly been utilized for such studies. SEAMAP-South Atlantic (and MARMAP) will continue to archive these samples to make them accessible for future use.

Proper storage and archiving of stomach samples is an important part of the quality control process as they are used to provide a reference collection and create an historical record of diet items. Recently, some progress has been made in extracting DNA from formalin stored samples, which means that the catalogued historical samples may become increasingly important. Analysis has been or can be used to identify or confirm morphological identification of diet items and conduct ecological and population dynamic studies of both the predator and prey. This information is increasingly used in support of ecosystem based resource management.

Caribbean

In 2009, Puerto Rico started to collect and process the gonads of all reef fish captured with the purpose of determining the sexual maturation of each individual. The data are being used to determine spawning season and size of 50% population maturation. Also, samples are provided to the reproduction program established at the Fisheries Research Laboratory (FRL) for some of the species under study by this program. FRL has a modern facility to perform histological analysis that is used to provide much needed information on reproduction of fisheries resources.

Data on sex is also being used to determine the precision of sex determination between macroscopic or microscopic/ histological sexing. All individuals are macroscopically sexed and gonads are photographed, removed, and preserved for histological sexual determination. Comparison between macroscopic and microscopic sex is performed. This is going to be used as a guide to determine the sexual maturation for different species, which might help increase the precision on sexing the individuals macroscopically. Providing samples to other programs within the FRL helps to improve the data needed to evaluate the species of importance in our fisheries. Furthermore, costs are reduced in getting the samples and the processing of the gonads.

In sampling conducted in the early 1990's, otoliths were collected and archived. A number of species' otoliths were aged and these data are available for the use of interested parties. Some samples are provided to external researchers at the national level for different purposes, such as genetics studies, age and growth, and reproduction.

See Appendix H for more details on specimen archiving in the different SEAMAP regions.

DATA MANAGEMENT AND INFORMATION DISSEMINATION

Biological and environmental data from SEAMAP surveys are included in the SEAMAP Information System which is composed of each region's data management systems. Data may be obtained from each region's data manager by specific request. Information on data may be obtained from SEAMAP participants, published reports, and through the Internet at www.seamap.org and www.gsmfc.org/seamap.html. More detailed information on data management in each region is also available at these websites. Investigators who use SEAMAP data may publish their results with the understanding that SEAMAP is acknowledged for supplying the data. A bibliography of these publications along with documents published by SEAMAP may be found on www.seamap.org and www.gsmfc.org/seamap.html.

In order to promote participation in SEAMAP and utilization of the program database, SEAMAP information is distributed in the form of reports and data summaries to interested parties. Products resulting from SEAMAP activities may be divided into two basic categories: data sets and program information. Data sets include both digital and analog data, as well as directories of specimen collections. Program information is defined as those communications that are released to current and prospective participants, cooperators, investigators, or other interested agencies or persons. This information may be produced in a number of different types of documents, described in Appendix I. GIS products and data summaries would be useful for resource managers and would facilitate feedback to the research program regarding management needs. Creating a SEAMAP data webpage on the Internet facilitates the use and accessibility of SEAMAP data, in addition to a central Internet site for SEAMAP to include easy access to information about SEAMAP meetings. Available reports would improve links to universities and other interested persons and result in increased participation due to more extensive and timely dissemination of the information.

Jeff Rester, Gulf States Marine Fisheries Commission

While each regional component's data management system currently operates independently, the long-term goal is for an integrated SEAMAP Information System that crosses the regional component boundaries. However, this vision cannot be met without first having functional data management systems that address each region's data management needs. NMFS could still provide an important coordination function in this regard. An ancillary future data objective is to ensure that all SEAMAP data handling tasks are addressed within the

framework of the component data management system. Current activities that should be addressed when resources are available include data management aspects of specimen and image archiving.

SEAMAP-Gulf Data Management System

Biological and environmental data from all SEAMAP-Gulf of Mexico surveys are included in the SEAMAP Information System, managed by GSMFC in conjunction with NMFS. Raw data are edited by the collecting agency and verified by the SEAMAP Data Manager prior to entry into the system. Verified SEAMAP data are available conditionally to all requesters, although the highest priority is assigned to SEAMAP participants. More information about SEAMAP data can be found at www.gsmfc.org/seamap.html.

In 2008, GSMFC began maintaining and developing the SEAMAP database. The data are maintained in relational databases. The GSMFC has developed several tools that allow users to visualize and map SEAMAP data from the Gulf of Mexico over the Internet. Users are now able to download the entire SEAMAP-Gulf of Mexico dataset for their use and querying. Verifying new data and detection of invalid legacy data has improved significantly, and standardized methods of data submissions have improved reliability and turnaround time of data availability.

In order to promote participation in SEAMAP and utilization of the SEAMAP database, information is distributed in the form of reports and data summaries to interested parties. Data summaries include real-time data reports during the Summer Shrimp/Groundfish Surveys, SEAMAP-Gulf of Mexico biological and environmental atlases, and SEAMAP-Gulf of Mexico directories. Cruise reports, quarterly reports, and annual reports are also prepared and distributed and available online.

Investigators who use SEAMAP data may publish their results with the understanding that SEAMAP is acknowledged for supplying the data. A bibliography of SEAMAP related publications may be found on www.seamap.org and www.gsmfc.org/seamap.html.

SEAMAP-South Atlantic Data Management System

Data management duties and project funding for the SEAMAP-South Atlantic have been administered through the SC DNR since 2007. The SEAMAP-South Atlantic Data Management Work Group was formed to oversee this transition and is responsible for creating the SEAMAP-South Atlantic Data Management System. This system is a web-based information system that facilitates data entry, error checking, data extraction, dissemination, and summary of fishery-independent data and information for all ongoing SEAMAP-South Atlantic surveys and special studies. The SEAMAP-South Atlantic Data Management Work Group envisions the data system as a relational database for simultaneous access to a number of fishery-independent data programs including, but not limited to, SEAMAP Coastal Survey, the NC DMF Pamlico Sound Trawl Survey, the adult red drum (*Sciaenops ocellatus*) longline surveys, the augmented MARMAP complement survey, and eventually the SEAMAP Cooperative Winter Tagging Cruise. In 2010, the group began converting data to an ACCESS database for eventually translation to an Oracle database.

The SEAMAP-South Atlantic Data Management System will include a website, www.SEAMAP.org, to view cruise reports, state contacts, and to access summarized datasets and appropriate project metadata. The SEAMAP-South Atlantic Management Guidance Plan can be found there as well. This website is hosted through an agreement with ASMFC and supported at SC DNR. In addition, spatial presentations of SEAMAP and other South

Atlantic fishery-independent data will be available through a developing regional GIS Service managed by FL FWRI for SAMFC.

SEAMAP-Caribbean Data Management System

The data collected by each Caribbean component is handled by each island and sent to the SEAMAP Database Manager in NMFS. A new database format was provided in 2009. All the information gathered by SEAMAP is distributed in the form of reports and data summaries to interested parties. The data is also provided in digital form to managers and researchers.

APPLICATION OF SEAMAP DATA

It is ultimately the analysis and application of SEAMAP data, particularly to fisheries management, that demonstrates the vitality of the program. SEAMAP has developed a distinguished record for supporting stock assessments, and its role is almost certain to grow as survey/sampling time series lengthen and new surveys are brought on line. A few of the most important applications to date are:

- Determining year-to-year trends in abundance
- Setting seasonal openings
- Evaluating existing management actions
- Evaluating proposed management actions
- Designation of essential fish habitat and EFH areas of particular concern
- Estimating and monitoring bycatch
- Obtaining basic biological data
- Supporting marine spatial management
- Baseline resource for damage assessment
- Baseline species and habitat distribution information for environmental assessments and impact statements
- Establishment and monitoring of marine protected areas

Application of SEAMAP Data – By Region

GULF OF MEXICO

Spring Plankton Survey

Data from the Spring Plankton Survey are used to calculate the abundance and distribution of Atlantic bluefin tuna larvae that are used in stock assessments. Data have also been used in response to the Deepwater Horizon oil spill to determine the larval fish that were likely to be affected by the spill.

Inshore Longline Survey

The data are used in stock assessments for coastal sharks and finfish.

Vertical Longline Survey

Data from this survey are used in reef fish stock assessments and provide estimates of natural mortality, fishing mortality, and abundance estimates. Some fish are retained and processed for age and fecundity. All fish are sacrificed for otoliths at stations deeper than 60 m.

Reef Fish Survey

Relative abundance data are collected on reef fish on natural habitat in the Gulf of Mexico. These data are used in stock assessments to assess reef fish relative abundance and compute population estimates. Fish captured in fish traps are sacrificed for ageing and other life history studies. Data from the survey have been used in stock assessments for red snapper, gray triggerfish, gag grouper, and red grouper.

Summer Shrimp/Groundfish Survey

Data from the Summer Shrimp/Groundfish Survey are used in evaluating the "Texas Closure" management measure of the GMFMC's Shrimp FMP. Environmental data are used in analyzing the size of the hypoxic zone off Louisiana each summer. Data from the survey are used in the king mackerel stock assessment to estimate shrimp trawl bycatch. Plankton data collected during the Summer Shrimp/Groundfish Survey are used in the king mackerel stock assessment as a larval index.

Fall Plankton Survey

Data provide a larval index for king mackerel, gray triggerfish, and red snapper that are used in stock assessments. Data from the Fall Plankton Survey are used in estimating the abundance and distribution of eggs, larvae, and small juveniles of Gulf of Mexico fish, particularly king and Spanish mackerel, lutjanids, and sciaenids. Data have also been used in defining EFH for penaeid shrimp, Spanish mackerel, king mackerel, vermilion snapper, and red snapper.

Fall Shrimp/Groundfish Survey

Data from the survey are used in evaluating the abundance and size distribution of penaeid shrimp in federal and state waters to assist in determining opening and closing dates for commercial fisheries and assessing shrimp and groundfish abundance and distribution and their relationship to such environmental parameters as temperature, salinity, and dissolved oxygen. Juvenile abundance indices have been used in gray triggerfish and red snapper stock assessments. Data were also used to estimate shrimp fishery bycatch in the red snapper stock assessment.

Winter Shrimp/Groundfish Survey

Data uses are the same as the other trawl surveys.

Winter Plankton Survey

The Winter Plankton Survey captures larval abundance data on winter spawning fish such as grouper, mullet, and menhaden. The Winter Plankton Survey also uses a Multiple Opening and Closing Net Environmental Sensing System (MOCNESS) to sample discreet depths to provide information on where larval fish and zooplankton are located within the water column. This information is important when trying to determine impacts of LNG facilities that would use large volumes of water. Since the Winter Plankton Survey only began a few years ago and it takes several years for the samples to be sorted and identified, the data have not yet been

used in stock assessments. The data will be used in stock assessments for several winter spawning species in the future.

SOUTH ATLANTIC

Coastal Survey

- Data on SEAMAP priority species were used in stock assessments and FMP specifications setting by various state and federal agencies, including SC DNR, NC DMF, GA CRD, GA DNR, MA DMF, SEFSC[16], and ASMFC[17].

- SEAMAP CPUE information was used in Shrimp Amendment 6 to define the status of pink, brown, and white shrimp. As a result, the *Report to Congress* includes the status of shrimp species based on the definitions in Shrimp 6. The *Report to Congress* now has quarterly updates, which uses seasonal shrimp densities from the SEAMAP trawl surveys.

- SEAMAP historical database used for habitat characterization, ecosystem modeling, species distribution, associations and diversity by the SAFMC.

- SEAMAP historical data included in creating a spatial multispecies model at the University of Miami.

- SEAMAP Coastal Survey data are used to adjust and coordinate seasonal shrimp fishery openings in South Carolina and Georgia. SEAMAP trawl surveys provide a unique capability for specimen collection at known times and locations over wide geographic areas. This capability is invaluable for genetic studies for stock identification, which is a critical part of the stock assessment process and extremely useful for providing information on early life age and growth. Studies relying on this SEAMAP capability include investigations of king mackerel, Spanish mackerel, bluefish, cobia, amberjack, red snapper, vermilion snapper, red drum, sea basses, butterfish, croaker, weakfish, and several other groundfish species.

Pamlico Sound Survey

Data collected from the Pamlico Sound Survey is essential in the development of long-term juvenile abundance indices to monitor the status of fish stocks along the south Atlantic coast, critical to the development of stock assessments. Long-term size and juvenile abundance indices for collected species in the Pamlico Sound Survey allow SEAMAP-South Atlantic participants to monitor changes in growth, mortality, and abundance of the stocks. With the development of long-term juvenile indices in the Pamlico Sound, it may also be possible to determine if factors other than fishing (e.g., temperature, salinity) may affect recruitment of a given species. Monitoring of the associated environmental factors may give early insight to possible changes in future stock size. Data showing simultaneous changes in the abundance of several species that cannot be correlated with a change in fishing effort may indicate a change in the environment and reflect the health of the aquatic system.

North Carolina Adult Red Drum Survey

This survey primarily provides a relative index of abundance for adult red drum for use as a tuning index for stock assessments. Additionally, collection of biological information for red drum provides data on age structure, sex ratios, maturity, and stock structure. Over time, trends in abundance, along with information on age

[16] SEDAR 2008. SEDAR 17 Stock Assessment Report for South Atlantic Spanish Mackerel. http://www.sefsc.noaa.gov/sedar/download/S17%20SM%20SAR%201.pdf?id=DOCUMENT

[17] ASMFC and SEDAR 2010. Benchmark Stock Assessment of Atlantic Croaker. http://www.asmfc.org/speciesDocuments/southAtlanticSpecies/atlanticcroaker/stockAssmtReports/atlanticCroaker2010BenchmarkStockAssessment.pdf

structure, will provide a means to evaluate the effectiveness of management regulations. Red drum tagged and released during the survey provides additional information on migration patterns and stock structure.

South Carolina Adult Red Drum Survey

Data on adult red drum is maintained in an ACCESS database and is provided to scientists conducting red drum stock assessments. Year-class representation (as determined by otolith ages) in adult red drum stocks is extremely useful to managers in determining escapement of juveniles into the adult population. This is an important gauge of effectiveness of management strategies (bag and size limits). Information from small and large coastal shark species is sent to the COASTSPAN or NMFS Cooperative Shark Tagging Program at the conclusion of each sampling period for inclusion in their long-term database. The survey's data has proven useful in various population assessments of coastal sharks and has been provided to SEDAR assessments planned for review in 2011 and 2012.

South Carolina Dept. of Natural Resources

Georgia Adult Red Drum Survey

Ageing data from the survey can be used in future stock assessments for red drum. In addition, tagging information can be used to determine migration patterns and habitat preferences. Non-target species, such as coastal sharks, are very abundant in the survey, and data for these species may be of value in future coast-wide stock assessments. Tagging information for shark species is shared with the COASTSPAN and NMFS Cooperative Shark Tagging Program for inclusion to their long-term database. Furthermore, several graduate research projects have been developed in cooperation with the survey, including habitat preferences and fecundity of small coastal sharks.

CARIBBEAN

Managers have a continuing need for current data, and long time series of data are necessary to describe population trends; explain responses to environmental factors and regulatory programs; and predict stock abundance, recruitment, and yield. Many fishery management and research agencies share the responsibility for

marine resources in Puerto Rico and the USVI, but no single agency has the fiscal or physical capability to support regional surveys throughout the range of these resources. Therefore, the Cooperative SEAMAP-Caribbean Program provides the information needed by the CFMC and the governments of Puerto Rico and the USVI to identify, implement, and measure the effectiveness of fishery management needs and to implement plans to protect and restore the fishing stocks to support viable productive recreational and commercial fisheries for their territorial waters.

SEAMAP-Caribbean has provided fishery-independent baseline data on queen conch, lobster, and reef fish stocks in the USVI and Puerto Rico to fisheries managers through the Caribbean region, enhancing the usefulness of the data, minimizing the costs, and increasing the accessibility of information.

Outreach materials such as two SEAMAP-Caribbean full color posters entitled “SEAMAP-Caribbean in Puerto Rico” and “SEAMAP-Caribbean in the Virgin Islands”, handouts, and brochures have been produced. The educational material summarizes the main studies performed by the program in each Caribbean region. Its main objective was to generate awareness of the importance of SEAMAP-Caribbean sampling. The material was also produced to promote conservation-based and management initiatives, and to encourage the use of the fisheries independent long-term data collected by the program for these purposes. The posters have been used in several fisheries workshops for fishermen, and also as handouts for the general public. Educational brochures on conch, whelk, lobster, and reef fish were produced to complement the posters’ information.

CHAPTER 4. EXPANDING SEAMAP ACTIVITIES

The numerous applications of SEAMAP data are a testament to the importance of maintaining and expanding SEAMAP activities. SEAMAP constitutes an ideal mechanism for developing needed fishery-independent data sets for management. It is an example of a state/federal partnership that has been very successful despite limited funding and personnel. SEAMAP is a cost-effective program in which participants contribute funding, expertise, sampling platforms and gear, and data. One factor contributing to the program's success is the high degree of cooperation and participation of SEAMAP members in working toward program regional priorities as opposed to individual priorities. A unique aspect of this program is its flexibility to respond to critical information needs without affecting base survey activities. For example, SEAMAP results were used during development of MPAs established in Amendment 14 to the South Atlantic Snapper Grouper FMP and in the early stages of the development of conservation areas established by the SAMFC Comprehensive Ecosystem Based-Management Amendment 1.

SEAMAP surveys provide a unique capability for specimen collection at known times and locations over wide geographic areas. This capability is invaluable for determining the age structure of populations, estimating reproductive parameters (e.g., size and age at maturity and transition in hermaphrodites, sex ratios) and genetic studies for stock identification. All are critical parts of the stock assessment process and extremely useful for providing information on changes in life history parameters as a result of fishing pressure and changes in the environment and species composition.

In the stock assessment process, SEAMAP-based abundance indices are now routinely used both as stand-alone indices of abundance and as criteria for "tuning" stock assessment models. Key applications in the stock assessment process have been Atlantic menhaden (South Atlantic Trawl Surveys), bluefin tuna (Gulf Plankton Surveys), bluefish (South Atlantic Trawl Surveys), cobia (Gulf Trawl Surveys), king mackerel (Gulf Trawl and Plankton Surveys), Spanish mackerel (Gulf and South Atlantic Trawl Surveys), red snapper (Gulf Trawl and Plankton Surveys), red drum (Gulf Plankton Surveys), red hind (Caribbean Reef Resources Surveys), shrimp (Gulf and South Atlantic Trawl Surveys), striped bass, kingfish, and weakfish (South Atlantic Trawl Surveys). In addition, there is great potential for expanding SEAMAP to collect data on stocks that are not well covered by current surveys, such as adding other survey methods to existing surveys. As fish stocks fluctuate in response to natural conditions and human actions (i.e., changes in fish abundance, survival, and recruitment), scientific information regarding marine fish populations is needed by managers on a continuous basis.

There is potential for increased use of ongoing SEAMAP data collection for fisheries management, especially as the SEAMAP resource surveys continue to grow into longer time-series of fishery-independent data. The shrimp/groundfish trawl survey in the Gulf of Mexico currently includes 29 years of data, the South Atlantic Coastal Survey currently includes 20 years of data, and the Caribbean Reef Resources Survey was established in FY 1991 with a five-year sampling cycle. In addition to providing regional, long-term, fishery-independent data for stock assessments and FMPs, SEAMAP data sets also provide valuable baseline trends of fishery stocks. These long-term baseline trends have the potential to provide fisheries managers with valuable information to assess the impacts of a tragedy such as the Deepwater Horizon oil spill in the Gulf of Mexico or other environmental perturbations.

The South Atlantic Coastal Trawl Survey and reef fish monitoring (in concert with the MARMAP and SEFIS programs) provide immediate input and feedback regarding the effectiveness of fisheries management regulations. SEAMAP data are used by a number of states for setting seasonal openings for the shrimp fisheries (Texas, South Carolina, and Georgia). In the evaluation of ongoing programs, SEAMAP-Gulf trap videos have been used to judge the effectiveness of various types of artificial reef materials for their stability (structurally and geographically), biofouling community succession, and fish biomass and diversity. In situations where catch is limited and fishing is restricted, therefore reducing the availability of catch data, fishery-independent data are of even greater importance and may be the only source of information for characterizing stocks. Expanding SEAMAP activities can provide for even greater application for evaluating management actions.

The problem of obtaining adequate scientific information for management decisions will likely increase in the future as management moves towards alternative approaches, such as property-rights-based management (including individual transferable quotas or catch shares), habitat-based management, multi-species management, and ecosystem management. Fishery-independent data collection programs such as SEAMAP can provide the scientific information needed for alternative approaches. SEAMAP surveys record data on the distribution of fish both geographically and within environmental variables such as temperature and salinity, which is the first step in defining environmental limits in essential habitats utilized by each species of fish. For example, SEAMAP data are already being used to identify the distribution of important bottom habitat in the South Atlantic region and, based on this information, management measures are being adopted that will protect coral and allow rock shrimp trawling to continue. Using SEAMAP data, SAFMC has developed alternative management options to protect coral areas from rock shrimp trawling, define essential fish habitat, and investigate marine protected areas. The nearshore trawl surveys may have a new use in the realm of coastal wind farm development for identifying low and high impact areas when citing farms.

Lack of increased funding is the major impediment for developing data sets necessary for meeting the evolving information needs for fisheries management. With the wide range of jurisdictions, laws, regulations, and available resources involved in collecting fisheries data and managing fisheries, a cooperative program operating on a regional basis and including appropriate parties at the state, interstate, and federal level is a necessity. SEAMAP's cooperative state/federal programs for collecting, managing, and disseminating fishery-independent data in the Southeastern U.S. are important for meeting the objectives of existing and potential state, interstate, and federal fishery management plans. Without this critical scientific information, management would be hard-pressed to develop measures for maximizing habitat protection and conservation of fish stocks while fishing at optimal levels.

The three SEAMAP committees discussed potential future SEAMAP activities for 2011-2015 during the joint program meeting held in August 2010. Each of the three regional components developed a list of activities that would implement changes according to the following priorities:

I. Maintain existing programs at current level and develop to full utilization

II. Expand current projects to collect additional data on existing platforms

III. Develop new fishery independent data collection programs

With regard to future activities, the SEAMAP Joint Committee supports priorities that restore and maximize ongoing program activities prior to implementation of any new fishery-independent data collection efforts. The

projects are designed specifically to rebuild and expand upon existing SEAMAP data collection activities and as such, will continue to have a high benefit to cost ratio. Within each priority, the following proposed projects are not presented in order of importance, and all cost estimates are based on current rates (January 2011).

I. MAINTAIN EXISTING PROGRAMS AT CURRENT LEVEL AND DEVELOP TO FULL UTILIZATION

SEAMAP activities have been greatly restored with recent funding in the past five years. The following items and money are required to maintain this new baseline and to bring SEAMAP to full utilization, with support for baseline operations to meet high priority needs.

(Increase of $2,487,500/year)

I. Gulf of Mexico

(Increase of $1,350,000/year)

Expanded Trawl Surveys on the West Florida Shelf

In 2008, Florida began participating in the SEAMAP Summer and Fall Shrimp/Groundfish Surveys. Its sampling coverage ranged from just south of Tampa Bay to Pensacola on the west Florida continental shelf. Due to limited funds in 2011, this survey will be cut back to once a year. Funding is needed to continue the survey twice a year and also to expand the coverage of the survey to south Florida. This expansion will allow additional information to be collected on shrimp and fish stocks where they have historically not been sampled on a regular basis. ($550,000 annually)

Expanded Reef Fish Trap/Video Sampling

SEAMAP surveys of reef fish using traps and stationary camera arrays have been conducted on natural hard bottom habitat along the shelf break since the 1990s and long-term funding is in place. Additional surveys of shallow hard-bottom reef habitat in the Panama City region began in 2004 and in mid-peninsular Florida in 2008 and are only funded through 2010. Additional funding is required to continue these existing surveys, expand these surveys into regions where fishery-independent surveys of managed reef fish are lacking, and target critical habitat types that are excluded from current surveys (e.g., artificial reefs). ($800,000 annually)

I. South Atlantic

(Increase of $939,500/year)

SERTC

Currently, SERTC is partially funded by SEAMAP. Since other funding sources for the program have fallen away, an increase in funding is needed for SERTC to continue, and possibly expand activities for this important program. With sufficient funding, SERTC can fulfill a critical role in supporting SEAMAP activities. With the continuing collection of specimens, both in terms of collected samples and diet items, the SEAMAP coastal survey and reef fish survey will continue to add representative specimens of invertebrate and fish species to the SERTC reference collections. These reference collections will be computerized and searchable for appropriate use and housed in the SERTC program at the MRRI. SETRC

will play an increasing role in aiding with the identification of unknown taxa, validating provisional field identifications of specimens collected during cruises, and expanding the taxonomic scope of the SERTC collection. ($81,000 to partially support SERTC)

Vessels

The research vessel used by the SEAMAP–South Atlantic Coastal Survey is the R/V *Lady Lisa*. The R/V *Lady Lisa* is a cypress planked vessel that is no longer being built due to the downturn in the shrimp trawling industry. Therefore, options for the future include the repair and refit of the R/V *Lady Lisa* or the purchase of a different style of vessel, either fiberglass or steel hulled. The R/V *Lady Lisa* has undergone a considerable amount of rework and the replacement of beams and planks. This work is ongoing and expensive, necessitating increases in vessel charges.

SEAMAP (and MARMAP) Reef Fish Surveys conduct research in the field aboard the R/V *Palmetto*, which is already about seven years past her projected life expectancy. Ongoing repairs allow continued operation of the R/V *Palmetto,* but at some point, she will be deemed un-safe for sea duty. At that time, it will be necessary to purchase a new research vessel, estimated to cost $5M - $10 M. See Appendix J for vessel specifications.

SEAMAP-South Atlantic Coastal Survey

The Cooperative Winter Tagging Cruise has been conducted since 1988 and would benefit greatly from having a dedicated federal research vessel for SEAMAP use stationed in the mid- or south Atlantic. All cruises from 1988 through 2010 were conducted on federal research vessels, including three NOAA vessels (*Albatross IV, Chapman,* and *Oregon II*) and a National Science Foundation research vessel (*Cape Hatteras*). Any dedicated vessel time would be needed during the months of January and February to coincide with the presence of migratory striped bass, Atlantic sturgeon, spiny dogfish, and other species on the winter grounds off the Virginia and North Carolina's Outer Banks.

Cooperative Winter Tagging Cruise

The Cooperative Winter Tagging Cruise was established by the ASMFC and partners (MD DNR, NC DMF, SEFSC, and USFWS, NERO, and SERO) in 1987 and has been conducted from 1988 through 2010. The costs of the cruise are provided through in-kind contributions of staff, equipment, and supplies by the principal partners and through the provision of ship time by NOAA (NMFS and/or Marine Operations). In recent years, funding for vessel time has been provided by NMFS Headquarters. Those funds have been used to provide the R/V *Cape Hatteras* as the platform for the cruise. Establishing a line item in the SEAMAP budget for continuing the cruise under the existing protocols would cost approximately $217,000 (assumes 14 days of ship time at $15,500 per day). If the NOAA vessel R/V *Oregon II* were to

become available for the work, the estimated funding required would be approximately $240,000 (assumes 14 days of ship time at $10,000 per day, plus 10 days transit time also at $10,000 per day; however, it should be noted that since the *Oregon II* pulls two nets, it provides twice the effort per tow. These cost estimates are subject to change.

Data Management

SEAMAP-South Atlantic data management has operated at level funding since 2008, but has continued to advance the data management system each year (principally with grant rollover funds). To maintain its current level of achievements with annual rising operational, personnel, and cost of living expenses, SEAMAP-SA data management estimates a budget increase of $8,000 yearly to the proposed 2011 level, to address ongoing data management.

Work Groups (Crustacean and Coastal Survey)

1. Continued funding is needed to support biennial meetings for Crustacean Work Group, in conjunction with the Coastal Survey Work Group, to allow enhanced dissemination of information on crustacean and other resource monitoring and management efforts throughout the region. Increased interactions will foster more regional cooperative research. ($6,000/ 2 yr)
2. Continued monitoring of disease outbreaks such as hematodinium (crabs) and black gill (shrimp), bioinvasions of exotic decapod crustaceans, e.g., *Penaeus monodon,* and to encourage research efforts to document and ascertain the causes.
3. Membership will participate in regional research and management activities including Amendment 8 of SAFMC Shrimp Management Plan and University of Maryland blue crab population modeling efforts for the Atlantic coast.

Bottom Mapping and Species Characterization

1. Existing inshore (<200m) bottom mapping information presented in the original effort constitutes essential fish habitat for snapper grouper. While updated species information collected through SEAMAP and MARMAP have been used in management and presentation through the regional IMS and Arc Services, the use of species and habitat information has not been worked up to expand the amount of known distribution of bottom habitat in the region. SEAMAP and MARMAP data is available in compatible formats with data access through a single system. GIS of all fishery-independent programs will be served through the Fisheries ArcGIS Service of the SAFMC which will provide a platform for distribution. ($7,000/yr)
2. Existing and updated SEAMAP/MARMAP and Pamlico Sound Survey data will be used to develop regional maps of general species distribution. ($3,500/yr)
3. With base funding in 2010 transitioning to more fully support the red drum surveys, sample days were dropped from the SEAMAP snapper grouper sampling. Cost to reinstate those sample days and increase to a level and area coverage recommended by the South Atlantic Fishery-Independent Monitoring Program (SAFIMP) to provide appropriate coverage for defensible stock assessment of snapper grouper species nearshore, shelf and deepwater would be $17,000.
4. Address SAFIMP recommendation for sampling coverage by expanding sampling days trap/bottom longline necessary to cover the range of inshore offshore, north and south, approximately 50 days. ($495,000 to cover equipment, personnel and operating costs, not including vessel costs)

Increase gag sampling

The current gag sampling range is Beaufort, North Carolina through Brunswick, Georgia. The SEAMAP-South Atlantic Gag Ingress Study is looking to expand the sampling area to better cover the range of gag juveniles, by including the Jacksonville area (1 site), the upper North Carolina coastal region (1 site), and possibly find a sampling area between Wilmington and Beaufort (1 site). Options are being discussed within the North Carolina, Georgia, and Florida agencies. The cost for this expansion is estimated to be about $15-20,000 per sampling site, totaling $45-60,000, plus 6 months of an extra staff member under the SEAMAP Reef Fish Program to assist with managing this expansion at a cost of $25,000 (including fringe and indirect).

I. Caribbean

(Increase of $990,000/5 years)

Currently, SEAMAP-Caribbean surveys queen conch populations, spiny lobster pueruli settlement, and trap and hook-and-line catches, done on a five year cycle. In the USVI, one year focuses on conch, one year on lobster, two years on St. Thomas/St. John trap and hook-and-line, and one year on St. Croix trap and hook-and-line. For Puerto Rico, in addition to the one year conch and one year lobster surveys, there are three years of trap and hook-and-line surveys. In 2003-2004, whelk surveys were substituted for one of the St. Croix and Puerto Rico trap and hook-and-line survey years.

Sampling efforts have been scaled back significantly for all SEAMAP-Caribbean surveys. Level funding over the last several years, coupled with inflation and rising project costs, have resulted in dramatic reductions in overall sampling effort. Maximum effort is needed to increase funding so that initial sampling efforts can be maintained.

Conch Surveys

The level of effort for conch surveys has decreased over the last few decades. Without an adequate sample size, results may not be statistically valid. Funding should be increased so that adequate sampling can be completed to be statistically valid. The proposed budget is $120,000/year, once every five years (USVI), and $120,000/year, once every five years (Puerto Rico).

Lobster Surveys

The level of effort for lobster pueruli surveys has decreased over the last few decades. Without an adequate sample size, results may not be statistically valid. Funding should be increased so that adequate sampling can be completed to be statistically valid. Proposed budget is $120,000/year, one year every five years (USVI) and $120,000/year, one year every five years (Puerto Rico).


SEAMAP-Caribbean

Trap and Hook & Line Surveys

The level of effort for fishery-independent trap and hook and line surveys have decreased over the last few decades. Without an adequate sample size, results may not be statistically valid. Funding should be increased so that adequate sampling can be completed to be statistically valid. Proposed is budget $150,000/year, three years every five years (USVI) and $160,000/year, one year every five years (Puerto Rico).

II. EXPAND CURRENT PROJECTS TO COLLECT ADDITIONAL DATA ON EXISTING PLATFORMS

(Increase of $2,750,727/year)

II. Gulf of Mexico

(Increase of $1,010,000/year)

Otolith Processing

Age and growth data are invaluable when conducting stock assessments for managed fish, especially those data collected from fishery-independent surveys that target a much broader size-range than fishery-dependent surveys. In addition, the emerging field of otolith microchemistry has exhibited increasing utility in recent years to examine connectivity among various life history stages as well as discern the relative contribution of presumed estuarine and near shore nurseries to the fishery. Most fishery-independent surveys have the ability to provide a large quantity of material for the examination of age/growth and otolith microchemistry; however, any substantial increase in the amount of material collected would rapidly exceed processing capabilities of existing age and growth facilities. Funds are requested to support expansion of one or two otolith processing laboratories in the Gulf of Mexico. This will ensure that collected otoliths and spines are sectioned and aged in a timely manner, as well as foster the application of otolith microchemistry techniques in assessing recruitment dynamics and connectivity of spatially explicit life history stages for managed fish. ($500,000 annually)

Dietary Analysis

In recent years, momentum has been gathering to move towards an ecosystem-based approach to assessing and managing fisheries resources. However, the utility of this approach has been severely

compromised by the lack of sufficient trophodynamic data. To better understand predator/prey dynamics, trophic interactions, and to support the development of ecosystem-based fisheries management, it is essential to conduct analyses of gut contents. As with age and growth analyses, gut contents can readily be collected from existing fishery-independent surveys at little to no additional cost. Identifying and quantifying gut contents is a time intensive process that requires specialized skills, so funds are requested for the establishment of a diet analysis lab in the Gulf of Mexico. Stable isotope analysis offers an alternative to gut content analysis and involves using a mass spectrophotometer to identify the isotopic signature from fish tissue. Variations in isotopic concentrations can be applied to the food web to draw direct inferences regarding diet and trophic level. ($350,000 annually)

Reproductive Histology

Reproductive data (e.g., fecundity, size/age at maturity, spawning frequency, and periodicity) are essential when conducting stock assessments for managed fish. As with age and growth and dietary analyses, biological material can be readily obtained from fishery-independent surveys. Reproductive analyses, which include the preparation and interpretation of histology slides, require specialized skills, so funds are requested for the establishment of a reproductive biology lab in the Gulf of Mexico. ($160,000 annually)

II. South Atlantic

(Increase of $1,148,227)

SERTC

Support SERTC for full functioning (see above). ($155,000/year)

Diet Lab Manager

Hire a diet lab manager to oversee stomach processing the day-to-day functioning of the MARMAP/SEAMAP stomach processing lab. ($40,000, plus $14,000 fringe and $13,612 indirect, for a total of $67,612)

Data Analyst

The SEAMAP Coastal Survey and reef fish monitoring data have become increasingly important for SEDAR and other stock assessments, investigating the effect of management decisions and evaluating the possible effect of proposed regulations. SEAMAP staff has been participating in the stock assessment process (SEDAR workshops, etc.). Information for stock assessments and in support of resource management has been requested in specific formats, summaries and analysis results, placing an increasing demand on senior staff. A full time PhD level position is needed to assure continued high quality analyses of the data in support of fisheries management. ($50,000 plus $17,500 in fringe and $17,150 in indirect costs totaling $84,650)

Data Management

The SEAMAP-South Atlantic data management system could require expansion to address new data sets or analytical needs that arise with expanded SEAMAP surveys. There is a likelihood of the need to take advantage of technological advances, as well as expanding to include database aspects such as species diet analysis, an image library of sampled species, and egg and larvae samples into the comprehensive

SEAMAP-South Atlantic data management system. An estimated budget increase of $60,000 for SEAMAP-South Atlantic data management would be needed to provide the ability to expand the current operations in 2011 to an expanded level.

SEAMAP-Cooperative Winter Tagging Cruise

Cooperative Winter Tagging Cruise to a Cooperative Winter Survey

To convert the existing Cooperative Winter Tagging Cruise to a Cooperative Winter Survey would require little if any additional cost, if the existing study area and priority species are retained. Given that the cruise makes multiple tows throughout the study area (Cape Lookout, North Carolina and north to Cape Charles, Virginia), a designated subset of stations could be collectively designated as stations to be sampled each year, constituting a survey. These could be developed using the existing cruise database and evaluated by the ASMFC Atlantic Striped Bass Technical Committee and/or Atlantic Striped Bass Stock Assessment Subcommittee to determine the utility of any derived index for use in the striped bass stock assessment. A similar exercise can be conducted to develop a set of Atlantic sturgeon survey stations, based on the existing database of Atlantic sturgeon captures. If it was desired to expand the scope of any survey beyond the existing cruise study area boundaries, additional vessel time and funding would be required, using the formula provided in Section I.

Bottom Mapping

Managed areas offshore of SEAMAP-South Atlantic states, of specific concern to fishery managers, include MPAs, deepwater coral HAPCs, and other bathymetric features or unique benthic habitats that warrant specific characterization due in part to their unique habitat characteristics or importance as essential fish habitats for managed species (see Appendix K, Figure 1 for existing managed areas). Bottom mapping priorities and objectives vary at both the state and management council levels (at least 20 offshore areas are identified in the South Atlantic Habitat and Ecosystem IMS website[18]). Bottom

[18] http://ocean.floridamarine.org/efh_coral/ims/viewer.htm

mapping initiatives conducted under SEAMAP would build from previous efforts to expand coverage of known benthic habitats to essentially begin filling the gaps along depth contours (current coverage is shown in Figures 2 in Appendix K). Offshore habitat can be subdivided in the following depth strata to capture target species and significant habitat distribution: nearshore, inshore, shelf, shelf break, golden tilefish and wreckfish habitat. These areas align with the species sampling strata recommended in the SAFIMP workshop. Further review of existing habitat and mapping information and species associated will provide the opportunity to direct sampling to expand and complete mapping habitat north and south between known habitats and in managed areas.

Bottom mapping is best accomplished with use of side-scan (generally for shallower depths) or multi-beam sonar systems (generally for deeper depths). For areas of interest within 50 – 200 m bottom depths and utilizing a multi-beam system on a vessel moving at 10 knots, during a 24-hour period of survey operations with a bottom resolution swath width of 200 m, 24 n. mi.^{2} of bottom can be mapped.

Considering the age of the primary SEAMAP vessel of opportunity for conducting operations (R/V *Lady Lisa*), and the cost to purchase sonar equipment and retrofit a vessel, the most practical and cost effective means for conducting bottom mapping would be to charter a bottom mapping service. A low-end estimate for bottom mapping services is $12,000/survey day with upper estimates of $20,000/survey day, depending on the survey platform and system/product requirements. For bottom mapping charter costs (overhead costs may be a factor), 25 sea days of bottom mapping could be accomplished for $300,000 and would provide approximately 600 n. mi^2 of bottom mapping coverage. In general, the final data product would include raw and processed multibeam sonar data in ArcVIEW and ASCII formats, metadata describing survey methods, and processed image files. (Cost is $300,000)

The newer NOAA fisheries research vessels (NOAA Ships *Pisces* and *Henry Bigelow* in the Atlantic) are equipped with the Simrad ME70 multibeam sonar capable of mapping the bottom. A new South Atlantic Reef Fish Survey (SEFSC) was initiated in FY 2010 and will continue in FY 2011. Bottom mapping using the ME70 will be conducted as part of this survey.

Acoustic Doppler Current Profiler

An Acoustic Doppler Current Profiler will allow estimates of the current speed and direction (corrected for vessel speed and direction) throughout the water column. This knowledge is important in decisions for safe deployment and without the risk of losing gear. In addition, the ocean current data can be provided to other (SEAMAP) programs and researchers to improve sampling efficiency and enhancement and ground-truthing of oceanographic modeling efforts in the region (e.g., SECOORA efforts). (Cost of an ADCP is $25,500)

Multi-beam Equipment

Multi-beam equipment can provide information on bottom relief and habitat type. Various vessels utilized by SEAMAP surveys cross the southeast region on a regular basis. During transit (or during sampling, depending on the survey) multibeam equipment could be used to obtain bottom habitat information that would otherwise not become available unless additional targeted cruises are conducted. Besides the cost of the equipment, an additional crew member on the research cruises is needed to operate and maintain the equipment and assure proper data collection. Extra costs would be

associated with post sampling data analysis, but this can be done in collaboration with academic or federal partners. The advantage of integrating the field activities is that there is no need for additional cruises, which would otherwise come at a considerable additional cost. (The cost of a multibeam unit is estimated to be around $350,000, the extra field staff would be $40,500 in salaries plus $14,175 in fringe, $13,790 in indirect costs, totaling $68,465)

Early Life Stage Sampling; Support Ongoing Collaborator Subregional Ichthyoplankton Surveys

Long-term ichthyoplankton surveys are operated out of the NOAA Beaufort, North Carolina Laboratory and the Belle W. Baruch Institute for Marine and Coastal Sciences in Georgetown, South Carolina. In combination with a long-term ichthyoplankton survey in New Jersey operated by Rutgers University, these fixed-site collection programs offer the potential for combined, large-scale assessments of changes in larval recruitment patterns over space and time, with implications ranging from fishery applications (developing recruitment indices for use in stock assessments) to assessing impacts of climate change.

The NOAA Beaufort (NC) Ichthyoplankton Survey

The Beaufort Inlet sampling program at the NOAA Beaufort Laboratory is the longest consecutive ichthyoplankton sampling program along the U.S. East Coast. Bridgenet sampling at Pivers Island represents a 26-year time series of larval fish ingress through Beaufort Inlet, North Carolina. Fall/winter spawned larvae of ~100 species are sampled weekly from mid-November through April/May at the Pivers Island Bridge. Research efforts using these data include examining the link between estuarine ingress, juvenile abundance, adult abundance, and climate variability for a variety of estuarine-dependent fish species along the U.S. East Coast. Operational indices of larval abundance have been used as tuning indices for stock assessments of southern flounder (NC DMF 2008). Ingress densities for other species could serve similar needs in stock assessments (American eel, Atlantic croaker, striped mullet) or as fish community indicators of climate variability or anthropogenic impacts. Catch and densities are available for 1986-2004. The sampling is ongoing and performed by volunteers, but sample processing from 2007-present is currently unfunded. ($19,000/year)

C. Michelle Willis

North Inlet-Winyah Bay NEER Ichthyoplankton Survey

Collections of larval fishes and more that 45 zooplankton (invertebrate) taxa have been made in North Inlet estuary, South Carolina since the survey's inception in 1981. Based out of the Belle W. Baruch Institute for Marine and Coastal Sciences in Georgetown, South Carolina,, the survey samples biweekly and year-round. Replicated collections with 365 and 153 micron nets have provided insights into seasonal and interannual patterns of occurrence for fishes and crustaceans of economic importance. They have also provided an understanding of the factors that influence early life stages of fishes and other planktonic species. Impacts of climate variability on the timing of larval production of resident species and the timing of ingress of ocean-spawned larvae have been demonstrated. This program, supported by multiple, non-permanent sources, constitutes the longest comprehensive estuarine zooplankton time series on the East Coast. Recent comparisons of patterns, associations, and trends for ichthyoplankton between the North inlet and Beaufort surveys have provided a unique understanding of their dynamics at the regional (South Atlantic Bight) scale. ($18,000/year)

Red Drum Surveys Standardization

Currently, there are three SEAMAP-South Atlantic projects that could be expanded with regards to objectives and management usefulness: the bottom longline surveys for North Carolina, South Carolina, and Georgia. At present, the three state programs have marginal similarities with regards to survey design, gear, and bait, in particular in comparison with the NMFS time series (1995 to present) for annual bottom longline effort conducted offshore in both the Atlantic and Gulf of Mexico. Provided sampling and gear protocols were uniform between SEAMAP states and the NMFS project, a number of positive benefits would be realized:

- Increased applicability for developing a multi-species time series for management purposes
- Provided sampling time periods were not confined (day versus night sampling) and gear was standardized there would be fewer sources of potential survey bias and improved comparability between surveys
- Improved usefulness for geospatial applications provided sampling was randomly allocated and geographically unrestricted within state waters
- Time-series comparability with SEAMAP-Gulf of Mexico partners that are currently following NMFS protocols (Texas, Mississippi, and Alabama)

A gear and survey design comparison experiment would be needed in order to compare each state's existing bottom longline time series to a SEAMAP-unified time series. Comparison studies can be incorporated by including "test sets" during existing surveys as an initial starting point during the 2011-2015 5-yr SEAMAP-South Atlantic effort. The Bottom Mapping and Fish Habitat Characterization and Assessment Work Group have discussed standardization and would work to develop some comparison studies and associated costs (expanding surveys geographically, following NMFS protocol). A complete set of longline gear, provided a reel is available, would cost about $1500/100-hook set. That does not include vessel fuel or man power, which would have to be calculated by each group.

II. Caribbean

(Increase of $592,500)

Lobster Surveys

Pueruli lobster studies have been on-going for several decades. However, results have not been useful in the lobster assessment or in making management decisions. At the SEDAR 8 meeting, it was suggested that timed diver surveys be included as part of a long-term monitoring program for lobsters. It was also suggested that pueruli lobster survey protocols could be refined to better catch relative peaks in settlement. Lobster pueruli surveys have been geographically limited due to budget constraints, but should beexpanded to the whole of the U.S. Caribbean. Proposed additional budget is $120,000/year, once every two years (USVI) and $150,000/year, once every two years (Puerto Rico) to include other coasts around Puerto Rico.


Clemson University

Conch Surveys

Diver surveys of conch have been on-going for several decades. However, during recent CFMC meetings, the validity of the protocol used was raised. It would be appropriate to assess the current protocol and refine it as necessary so that statistically valid data are collected that can be used as the basis for stock assessment and management. Proposed additional budget is $120,000/year, once every two years (USVI) and $150,000/year, once every two years (Puerto Rico).

Trap and Hook & Line Surveys

At the recent SEDAR 8 meeting, the limitations of the SEAMAP-Caribbean trap and hook-and-line survey data were revealed as stock assessment scientists attempted to assess key stocks of fish. It would be appropriate to assess the current protocols and refine them as necessary so that statistically valid data are collected that can be used as the basis for stock assessment and management use. Trap and hook-and-line surveys have been geographically limited due to budget constraints. Surveys need to be expanded to the whole of the U.S. Caribbean. Proposed additional budget is $150,000/year, on an annual basis (USVI) and $175,000/year, on an annual basis (Puerto Rico).

Reproductive Histology

Reproductive data (e.g., fecundity, size/age at maturity, spawning frequency, and periodicity) are essential when conducting stock assessments for managed fish. As with age and growth and dietary analyses, biological material can be readily obtained from fishery-independent surveys. Reproductive analyses, which include the preparation and interpretation of histology requires specialized skills, so funds are requested for the expansion of activities undertaken by the reproductive biology lab in Puerto Rico to process the samples gathered at the USVI. ($160,000 annually)

III. DEVELOP NEW FISHERY-INDEPENDENT DATA COLLECTION PROGRAMS **($4,465,000/year)**

These items include new fishery-independent surveys for data that is needed on a regional basis and is not sufficiently collected now. Specific survey methodology will be determined at the time of survey design with known funding.

III. Gulf of Mexico

(Increase of $1,600,000)

Vertical Longline Reef Fish Sampling

Surveys of demersal fish using bottom longlines have been conducted throughout the Gulf of Mexico since the mid-1990s. However, this survey explicitly avoids reef habitat, so managed reef fish are generally underrepresented in the catch. Additional funding is required to implement a complimentary hooked-gear survey using either a shortened bottom longline or a vertical longline that is capable of targeting reef habitat, thus providing much needed data and biological material for larger reef fish. ($700,000/yr)

Seasonal Trawl Surveys

SEAMAP in the Gulf of Mexico currently undertakes Gulf-wide trawl surveys in the Summer and Fall. Trawl sampling in the Winter and Spring is very limited, and seasonal trawl surveys were identified as a data need for shrimp and groundfish at a recently held fishery independent data collection workshop. Data would provide information on spawning periodicity of brown shrimp, abundance information on shrimp and groundfish, and gut contents for ecosystem-based management. ($900,000/yr)

III. South Atlantic

(Increase of $2,355,000/year)

Pelagic Survey

Currently, there is no fishery-independent survey to monitor pelagic fish such as mackerels, dolphin, wahoo, and (offshore) bluefish in the Southeast region, all of which are of considerable importance for commercial and recreational fisheries. Several of these species have undergone SEDAR stock assessments and the need for fishery-independent data was identified. A pelagic survey would require initiating a new monitoring effort since it would require sampling the pelagic environment using specific gear (pelagic long line and acoustic equipment). This cannot be done in a consistent manner during any

of the current SEAMAP-South Atlantic monitoring efforts, and a new effort would require new funding. The level of funding would depend on the level of effort and geographic area covered, but is estimated to be between $500,000-$750,000/year if an appropriate survey vessel is available.

Regional (Ichthyo) Plankton Surveys

The initial concept for SEAMAP-South Atlantic included a plankton survey. Larval distribution of fish and crustacean species remains largely unknown. Such a survey, which was recommended as part of an optimal fishery-independent sampling strategy in South Atlantic waters (SAFIMP)[19], might be run as a stand-alone project standardized among researchers regionally or associated with the trawl survey. The lower tiers (phyto- and non-ichthyo-zooplankton) should also be considered. ($500,000/yr)

Develop Nearshore Live Bottom Surveys

Most studies of "live bottom" habitats have been conducted seaward of the ten-fathom line off the Carolinas and Georgia. Biologists acknowledge that substantial live bottom areas exist inside of ten fathoms and are important fishing grounds for recreational fishermen. These areas provide habitat for black sea bass, red drum, weakfish, and others. A combined live-bottom mapping and finfish trapping program could identify and categorize these poorly-known habitats. These nearshore habitats are at risk to channel-deepening projects, dredge material disposal, and heavy fishing pressure. Include purchase of passive mapping system, e.g., towfish. ($475,000/yr)

Regional channel net survey

As recommended and described in SAFIMP (2009), a survey using moored channel nets in inshore waters (channels) characterized by high tidal flow and located near inlets could be effective in monitoring egress (from inshore to oceanic waters) of estuarine-dependent species such as spot, croaker, black sea bass, and gag grouper. These surveys could be performed by researchers or in cooperation with commercial channel netters, who typically target penaeid shrimp, and could be used to develop annual juvenile abundance indices for focal species. Costs would be dependent on the geographical scale and temporal replication of the surveys, which would need to occur at different times of the year depending on focal species. ($50,000/yr for pilot studies)

Crustacean

($410,000/year)

- Coordinate a cooperative blue crab tagging project and stock identification (DNA analysis). Expansion of the program to encompass Florida's Northeast coast looking at the links between northeast Florida and regional (Southeast Atlantic) blue crab stocks. Currently there is no active monitoring program that this could accompany, therefore costs would increase the project cost by one technician and boat time for Florida. (FL cost $35,000/year includes tags, PCR (polymerase chain reaction) time, and a ½ year technician). Blue crab tagging study looking at movement patterns of blue crabs in Georgia and the adjacent waters. (GA cost $50,000/year includes 1 Marine Technician, boat fees, and tagging fees)

[19] SAFIMP. 2009. Final report: South Atlantic fishery independent monitoring program workshop. In: Willams EH, Carmichael J (eds), Beaufort, NC, 85 pp.


Atlantic States Marine Fisheries Commission

- Investigation into the incidence of viral and parasitic diseases using qPCR in the Southeastern U.S. hard-shell and soft-shell blue crab fishery (Florida to North Carolina) would be a five-year study involving collaborations with colleagues at the University of Maryland Center for Environmental Science. Cost would include 1 technician, sample collection/travel, and processing for samples from North Carolina to Florida. ($75,000/ year)
- Coordination of cooperative shrimp tagging studies and regional testing of gear modification that reduce bycatch (FFEs, BRDs, and degradable crab pots materials). ($40,000/yr of project for tags, gear, ½ year salary for biologist; assuming state vessel time donated similar to shrimp tagging effort in 1986-87 or work on existing platforms)
- Investigation into factors contributing to increase/decline in black gill observed in penaeid shrimp stocks in the Southeast. ($60,000 minimum for 1 technician, boat fees, sample collection, and processing, etc.)
- Investigating the population dynamics of the introduced exotic species *Penaeus monodon* (black tiger shrimp) population in northeastern Florida with focus on the Indian River Lagoon population. ($50,000 per year for five years for technician, DNA analysis, boat time, and supplies)
- Golden crab fishery-independent deepwater monitoring using video to aid in documenting habitat and presence of smaller, pre-recruit golden crabs that may enter traps but are not retained because of mesh size. ($50,000/year pilot study for cooperative fisherman/university-graduate student or part time biologist)
- Other efforts might include the continuation of crustacean components for SAFMC ECOPATH model and monitoring of royal red shrimp management/assessment efforts. ($25-50,000/year)

Artificial Reefs

Each coastal state (North Carolina to Florida) conducts some type of artificial reef program. The purpose/objective of these programs may include: increased reef fish habitat; enhancement of fishing and diving opportunities; provide socio-economic benefit to coastal communities; and/or create reef research opportunities. Materials are highly variable, including, but not limited to: concrete rubble, pre-fabricated structures, subway cars, military vehicles, and steel vessels of various shapes and sizes. Fully evaluating the performance of these materials and quantifying the success of these reefs is difficult and not always accomplished. Projects should be developed to assess deployment methods, materials, and performance of artificial reefs as they pertain to the primary objectives listed above.

Invasive species

Development and implementation of a survey program to detect and monitor invasive species could save the region a great amount of time and expense later. Invasive species can take hold very rapidly, especially if not detected early. ($70,000/yr)

Whelk Surveys

The conch/whelk fishery from North Carolina to Georgia is poorly understood and it is believed the population is in decline. These species are caught in commercial quantities in crab and whelk pots and crab/conch trawls. In addition, there is little known about the hand retrieval harvest (both commercial and recreational) along the beaches. A trawl survey can be conducted to gather information on abundance, size, age, and maturity. ($50,000/yr)

Develop Assays

Explore techniques to develop assays to quickly evaluate diseased organisms' concentrations in local waters and impacted (e.g., oil spill) methodologies. ($50,000/yr for pilot studies)

III. Caribbean

(Increase of $510,000)

Whelk

In 2003-2004, whelk surveys were substituted for one of the St. Croix and Puerto Rico trap and hook-and-line survey years, providing the first U.S. Caribbean-wide information on this species. These surveys should be continued on a periodic basis. Recommended additional studies on whelk should include conducting reproduction and maturity studies. The capture of specimens at two to four week intervals over a calendar year can help determine the period of maximal spawning activity, in which some type of gonadal index to examine this can be used. Data should also be collected on shell length, height, total weight, and tissue/ weight relationships. Proposed additional budget is $120,000/year, once every three years (USVI) and $120,000/year, once every three years (Puerto Rico).

Priority Fish Species

At the recent CFMC meeting, priority fish species (yellowtail snapper, lane snapper and parrotfish in the USVI) were identified for seasonal closures. Information on these fish species is extremely limited, and it would be appropriate to develop fishery-independent data collection programs so that future management can be based on data, rather than subjective opinions. Proposed additional budget is $150,000/year, on an annual basis (USVI), and $180,000/year, on an annual basis (Puerto Rico).

Lobster

Within the life cycle of the Caribbean spiny lobster, there are several life stages before reaching adulthood. Thus far, the planktonic larval stage and the benthic juvenile stage have both been studied; however, SEAMAP has not conducted any studies looking at lobster adulthood. These studies would not only offer information on potential existing juvenile stocks, but help tie in the larval settlement data USVI and Puerto Rico have collected over the past decade (settlement-recruitment relationship studies). Data can be collected either by visual swim surveys or use of baited traps. Estimated cost would be $50,000-$75,000, if the methodology involves a small team of researchers and volunteers to perform timed search sampling methods at pre-selected sites. Use of baited traps would cost $100,000/year once every two years.

APPENDIX A . 2011 SEAMAP COMMITTEES

(check www.seamap.org for current membership)

SEAMAP-Gulf of Mexico Committee

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APPENDIX B. SAFMC RESEARCH PRIORITIES 2011-2015

SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL – RESEARCH AND MONITORING PRIORITIZATION PLAN FOR 2010

Introduction

The 2006 Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA) directs the federal Regional Fishery Management Councils to develop a prioritized research plan for annual submission to the Secretary of Commerce. The following research and monitoring needs for 2011-2015 were developed by the SAFMC in fulfillment of that requirement.

Highlighted Issues for 2011-2015

- The SAFMC requests that NMFS annually provide SAFE reports including complete landings and discard information, and estimates of OFL and MSY for all managed stocks, for use in setting annual specifications (including ABC, ACL, and ACT) and evaluating AMs as required in the MSRA.
- The SAFMC recommends that obtaining accurate fishery information providing increased spatial resolution for landings, discards, and effective effort remain a top priority for NOAA fisheries.
- The SAFMC recommends that efforts continue to improve recreational fisheries data collection, with increased emphasis on improving the precision of estimates for the many stocks in the snapper-grouper complex with extremely high PSEs.
- The SAFMC recommends adequate funding for the fishery independent monitoring program as described in the report of the joint SAFMC-SEFSC Fishery Independent Monitoring Program Workshop.
- The SAFMC recommends increased monitoring of discarding during seasonal and area closures.
- The SAFMC recommends that NMFS provide an annual progress report detailing efforts to implement the research recommendations noted in annual Council Research and Monitoring Reports. This report should be provided by June 1 of each year for consideration as the Council develops its annual research prioritization.

SAFMC Prioritized Research Recommendations for 2011-2015

Research and monitoring priorities are recommended that will enable the SAFMC to manage the resources under its jurisdiction in a manner consistent with the requirements of the MSRA.

1. Provide annual SAFE Reports for all FMPs and managed stocks that include estimates of MSY and OFL, landings and discards by fishery sector, evaluations of current management, and summarized findings of any recent research activities.
2. Implement adequate fishery and population monitoring programs by 2015. Details of the information needed by fishery are provided in Appendix 1 (in original publication), and the managed stocks in monitoring and assessment priority order are provided in Appendix 2 (included below).
    a. Collect basic fishery information and population statistics for all managed stocks.
    b. Collect additional biological and survey information necessary to develop age-based quantitative stock assessments for those stocks which comprise the bulk of the fishery.
    c. Initiate comprehensive fishery-independent surveys to provide measures of abundance for all remaining managed stocks.

3. Resolve data collection and dissemination issues that burden constituents, create availability delays, and impede access by the Council and its technical bodies to the information required for adequate management by 2015.
    a. Fully implement the data collection standards developed through ACCSP and ensure all data are provided to ACCSP in a timely basis.
    b. Resolve data confidentiality issues that prevent dissemination of basic landings information to the SAFMC and its SSC.
    c. Eliminate duplicative data collection programs and adopt electronic reporting.
4. Evaluate the effectiveness, with regard to preventing overfishing and restoring overfished stocks, of current MPAs and other closed areas by 2015.

Priority Stocks

SAFMC Primary Data Collection Species

vermilion snapper	red snapper	snowy grouper
tilefish	red grouper	black grouper
scamp	black sea bass	gag grouper
greater amberjack	white grunt	yellowtail snapper
gray triggerfish	mutton snapper	red porgy
wreckfish	king mackerel	Spanish mackerel
Spadefish	Sheepshead	dolphin
spiny lobster	golden crab	spiny lobster

Expanded Data Elements for Primary Species

- Representative sampling, adequate to support quantitative age-based stock assessments, by season, fishery, and area, of length, age, sex, and weight for landed & discarded fish
- Fishery-dependent survey derived measures of population abundance.
- Timely and up-to-date life history research: rates of growth, mortality, maturity, fecundity; movements, migrations, and stock structure evaluations

SAFMC Secondary Data Collection Species

blueline tilefish	wahoo	yellowedge grouper
speckled hind	shrimp	tomtate
Warsaw grouper	cobia	hogfish
Goliath grouper	Scup	

Additional Data Elements for Secondary Species

- Fishery-dependent survey derived measures of population abundance
- Evaluation of life history traits: rates of growth, mortality, maturity, fecundity; and movements, migration, and stock structure evaluations.

APPENDIX C. GMFMC RESEARCH PRIORITIES 2010-2014

To facilitate the preparation of this updated list of priorities, help was sought from Dr. Ponwith and her staff at the SEFSC. The rationale for seeking their assistance was to help us identify research that was currently being conducted and/or likely to be conducted by their office on topics or subjects that were previously included in our response in 2008 regarding research priorities. With these items so identified, this Updated List becomes more streamlined, more directed and avoids including research priorities made redundant by the current effort of the NMFS or various state research agencies. What follows is an emended and revised version of the previous 2008 List of Fishery Research and Socio–Economic Priorities for 2010-2014 with changes reflecting input from our Scientific and Statistical Committee, Gulf Council members and our staff. It also is emended with the exclusion of those research priority activities currently or presently underway by the SEFSC or other research institutions.

As per the request from NOAA/NMFS, the research priorities indicated below are ranked and labeled by the priority code that follows:

Priority Codes:
A: Highest Priority – Stocks designated as overfished AND overfishing
B: 2nd Priority – Stocks designated as overfished OR overfishing
C: 3rd Priority – Stocks with SEDAR assessments scheduled but not classified A or B
D: Everything else (Not yet prioritized) (Criteria is needed to prioritize non-SEDAR recommendations)

The following list of research priorities is organized in three main sections:

I. Priorities associated with broad, multi-purpose research and monitoring programs aimed at collecting a variety of data for a number of species prioritized and listed below.

1. **Fishery-independent Sampling:** Expand the Gulf-wide, fishery–independent monitoring program to enhance our capacity to associate fisheries data with: environmental data, habitat quality and abundance, and physical oceanographic parameters. Moreover, the expanded fisheries-independent sampling effort should be coincidental to enhanced physical and biological sampling that allows development of a long-term time series of chlorophyll/phytoplankton and zooplankton biomass from areas of concern such as the Mississippi River plume. **Priority Code: A**
2. **Fishery-Dependent Surveys:** Enhance existing recreational (for-hire and private/rental sectors) and commercial fishery dependent sampling programs. Specifically, improve temporal/spatial coverage (ideally Gulf-wide and potentially including international fisheries such as Mexico), increase collection of hard parts and tissues to support life history studies and catch-at-age analyses. A goal would be to develop and implement an effective, efficient, and meaningful electronic data reporting system for all sectors of the fishing community. In addition, observers should be employed as part of the reef fish effort to obtain in situ information as to correct species identification, especially with regard to gag and black grouper designations. **Priority Code: A**
3. **Estimation of Discards:** Develop methods and research/monitoring programs to evaluate the magnitude and impacts of dead discards (both commercial and recreational), and develop practical methods for minimizing catch-and-release/discard mortality. The estimation of the total number of discards requires a broad systematic expansion of fishery observer programs, in some cases by adding observer personnel and in others (e.g., small or unsafe vessels) by use of innovative technologies (e.g., cameras). This needs

to be done for all components of the commercial and for-hire industry as well as the recreational sector. Directed research and evaluation efforts should be implemented toward resolving hypotheses associated with the viability of catch-and-release efforts in deeper areas of the EEZ. **Priority Code: A**

4. **Large-scale Tagging Program:** Develop a large-scale tagging program (conventional dart tags, PIT tags, telemetry, and genetic tagging methods) to better quantify fishing mortality rates, movements, and improve estimates of natural mortality. **Priority Code: C**
5. **Discard Mortality Changes:** Determine changes in regulatory discards or catch-and-release fishing of target species and subsequent changes in discard mortalities resulting from changes in fishermen's behavior due to changes in common management tools such as seasonal closures, area closures, industry quotas, trip limits, minimum size limits, etc. This research recommendation is similar to research recommendation number 4 under Economic and Socio-cultural Recommendations (below), except that the emphasis is on how the changes in fishermen's behavior affects discard mortality rates rather than how supply and production functions are affected. **Priority Code: A**

II. Priorities associated with individual species or specific research topics.

Each species listed in this section has identified research needs provided by SEDAR workshop panels. Each species is assigned a priority code as indicated below. In some cases research needs for each species are to be addressed by the broad-based research and monitoring programs described in Section I above. Additional research needs are listed individually under each species when applicable. In general, however, research should be directed toward estimating natural mortality among all managed species. A slightly modified priority code scheme is used to rank the research priorities associated with individual species or research topics below.

1. **Gulf of Mexico Red Snapper** – **Priority Code: A**
   - Research to clarify the magnitude and timing of density-dependent compensation in juveniles by estimating survival (age-0 and age-1) at different densities of juvenile abundance.
   - Research is recommended to estimate (independently of any stock assessment) changes in catchability by gear over time.
2. **Gulf of Mexico Greater Amberjack** - **Priority Code: A**
3. **Gulf of Mexico Gray Triggerfish** - **Priority Code: B**
   - More aging studies in addition to Wilson et al. (1995) and W. Ingram (2001) including radiocarbon dating or mark-recapture with staining to verify annulus formation in spines.
4. **Gulf of Mexico Gag** – **Priority Code: A**
   - Additional research on the number, location and persistence of spawning aggregations should be obtained and presented in future assessments to identify essential habitat.
   - Research and develop a suitable method to correct species misidentification between black and gag grouper on a trip by trip basis.
   - Research should be conducted to quantify changes in catchability over time and to determine a more appropriate level and degree of increasing catchability.
   - Continue genetics research to determine connectivity among different regions.
   - Improved spatial depth related mortality including ages of fish throughout the Gulf of Mexico should be collected.
   - Environmental factors (when possible) should be considered in future index standardization procedures, particularly for spawner-recruit relations.
   - The mature sex ratio needs to be observed, from which it may also be possible to calculate information about male fertility and the number of sperm required for successful fertilization
   - Develop methods to evaluate the impact of natural events such as red tide in modeling instantaneous natural mortality (M) and the overall assessment.
   - Research a two-gender growth model that explicitly addresses maturation (protogynous hermaphrodite gender change differences in growth).
5. **Yellowedge Grouper** – **Priority Code: C**
   - Early life history information for juveniles, such as abundance.

- Adult habitat and distribution.
- Spawning behavior, aggregations, and locations are needed.

6. **Tilefishes** – **Priority Code: C**
   - Catchability of the dominant males during spawning.
   - All basic biological and fishery data to improve ability to assess both Tilefish (Golden Tilefish) and Blueline (Gray) Tilefish
7. **Goliath Grouper** – **Priority Code: C**
   - Research and monitoring the demographics and stock structure of the population (historical Gulf wide range vs current south Florida), particularly age composition, could provide valuable information (as it has for red drum in the Gulf of Mexico).
   - Obtaining and quantifying information on historical abundance, perhaps via old logbooks.
   - Additional research on stock structure and quantification of sources of mortality (accidental or illegal harvest, etc.).
   - Research on abundance and distribution in mangroves over several years, documenting changes in available nursery habitat and annual variation (goliath grouper spend their first 6-7 years in mangrove areas - sometimes attaining as much as 50 lbs).
   - Evaluate whether goliath grouper change sex.
8. **Gulf of Mexico Red Grouper** – **Priority Code: C**
   - Develop methods to evaluate the impact of natural events such as red tide in modeling instantaneous natural mortality (M) and the overall assessment.
   - Continue studies on fecundity and spawning frequency and incorporate a spatial-temporal design to improve estimates of reproductive potential by age. Additional studies should include collection of spawning pattern to better understand and discriminate between annual asynchrony in spawning (skipped spawning) and seasonal asynchrony in spawning.
   - Research a two-gender growth model that explicitly addresses maturation (protogynous hermaphrodite gender change differences in growth).
   - Study and quantify temporal and spatial changes in catchability rate, including when natural events such as red tide occur.
9. **South Atlantic/Gulf of Mexico Yellowtail Snapper** – **Priority Code: C**
   - Continued research and development on the reef visual census before use as a fishery-independent abundance index.
10. **Vermilion Snapper** – **Priority Code: C**
11. **Black Grouper** – **Priority Code: C**
    - The priority of black grouper could change after the 2009 assessment.
12. **Hogfish** – **Priority Code: D**
    - Note: The 2004 SEDAR 6 assessment was not accepted, and will not be redone until 2013.
13. **Atlantic and Gulf of Mexico King Mackerel** – **Priority Code: D**
    - Western Gulf king mackerel catches need to be aged for use in age length key analyses.
    - Field studies are needed to develop or improve batch fecundity, spawning frequency, and age specific fecundity estimates, including size and age at maturity.
    - More studies on stock mixing such as analyzes of otolith shape and microchemistry.
    - Data from Mexican catches need to be obtained and quantified for better identification of eastern and western stock components with increases in international cooperation and collaboration.
14. **Red Drum** – **Priority Code: D**
    - Evaluate feasibility of experimental commercial fishery for adult red drum in offshore areas to obtain information on status of stock and ability to sustain a fishing mortality on adults.

III. Ecosystem-Based Management Recommendations

The short-term goal is to develop predictive ecosystem models to project fisheries productivity, assess uncertainty in stock assessments, improve single-species management, and evaluate impacts of proposed

management actions from an ecosystem perspective. The long-term goal is to develop data and methods to conduct integrated ecosystem assessments (IEAs)for the Gulf of Mexico as described in NOAA Technical Memorandum NMFS-NWFSC-92 (Integrated Ecosystem Assessments, June 2008), and to provide the necessary information to effectively adapt management to mitigate the ecological, social and economic impacts of major shifts in the productivity of living marine resources.

1. **Data Collection Priorities:**

A. **Data Mining, Compilation, Processing and QC/QA** – **Priority Code: A**

- Human Components (social and economic inputs), including land use, land cover change LULC driven by coastal and upper watershed development could affect salinity and nutrient inputs in the coastal waters.
- Biotic Components (coastal habitat, coral, algal/zooplankton, fishery, etc.).
- Ecosystem Components (ecosystem services, nutrient cycling, ecosystem management, ecosystem restoration, marine spatial planning)
- Physical Components (GIS database development/mapping of habitat, climatology, geographic and oceanographic variables.

B. **Establishing Ecological Relationship, Linkages and Network** – **Priority Code: B**

- Habitat Mapping, Quality Assessment, Species Utilization and Alterations.
- Community Structure/Fish Assemblage Analysis and Resilience.
- Analysis of Ecosystem Network and Interactions.
- Development of Leading Ecological Indicators (akin to the FATE [Fisheries and the Environment] initiative), i.e.,
  - **Biological indicators** as leading and performance indicators derived from the analysis of (1) fish recruitment, distribution and migration, (2) ecosystem community structure, (3) annual fish growth patterns from length-at-age data (e.g., otoliths), (4) fishery production and other mortalities, and (5) primary and secondary production.
  - **Physical indicators** derived from a combination of data sources, including (1) satellite / remote sensing, *in situ* oceanographic measurements, and (2) large-scale atmospheric and oceanic fields (both time series and derived products).
  - **Assessment** methodologies to assess the potential socio-economic impact of an ecosystem based fisheries management plan.

2. **Ecosystem Model Development**: - **Priority Code: B**

A. **Goal is to develop predictive models for ecosystem assessment and to project/forecast fish productivity based on:**

- Anthropogenic factors (e.g., current and planned fishing activities, coastal developments)
- Physical habitat and natural forcing events (e.g., hurricanes, ocean features, short-term climatic changes/ENSO events, dry/wet years, etc.)
- Trophic dynamics / networks, ocean productivity, interaction with protected species and introduction of invasive species
- Habitat availability and quality, etc.
- Long-term climate change and its relationship with the interaction of anthropogenic factors, physical habitat, trophic dynamics and habitat availability.

B. **The suggested approach is to develop models to conduct IEAs as discussed in NOAA Technical Memorandum NMFS-NWFSC-92. The methodology for using such models should follow five steps:**

- **Scoping**. Identify management objectives, articulate the ecosystem to be assessment, identify ecosystem attributes of concerns, and identify stressors relevant to the ecosystem being examined.
- **Indicator Development.** Researchers develop and test indicators that reflect the ecosystem attributes and stressors specified in the scoping process. Specific indicators are dictated by the problem at hand and must be linked objectively to decision criteria.
- **Risk Analysis.** This analysis is hierarchical in approach and moves from a comprehensive, but initially qualitative analysis, through a more focused and semiquantitative approach, and finally to a highly focused and fully quantitative approach. The goal of these risk analyses is to fully explore the

susceptibility of an indicator to natural or human threats, as well as the ability of the indicator to return to its previous state after being perturbed.

- **Overall Ecosystem Assessment.** Results from the risk analysis for each ecosystem indicator are then integrated in the assessment phase of the IEA. The assessment quantifies the overall status of the ecosystem relative to historical status and prescribed targets.
- **Evaluation.** The final phase of the IEA evaluates the potential of different management strategies to influence the status of the ecosystem.

Descriptive Models - to provide snapshot pictures of the ecosystem (e.g., Ecopath)
"Nowcasting"/"Forecasting" Models (e.g., Multispecies Virtual Population Analysis (MSVPA), Very Large Individual Based Models (IBMs), and Agent-Based Models) – to provide useful interface with stock assessment/fishery management and provide a space of possibilities for policy/decision-making.

- o Components of Ecosystem Forecasting
  - Review and evaluation of current tools
  - Tool development and model tuning
  - Tool application and evaluation
- o Components of Ecosystem Monitoring
  - Data and communication portal development
  - Continuing need assessment for EBM
  - Climate change

- Identifying opportunities and strategies for collaborative management of resources that are outside of the jurisdiction of NOAA Fisheries but impact fishery stocks (e.g., freshwater inflows, non-point source pollution, loss of habitat such as marshes, etc.).
- Develop methods to incorporate other significant stakeholders (i.e., municipalities, authorities and state governments) into the ecosystem management process.
- Develop fishery management strategies other than restricting catch or marine reserves.
- Identify environmental justice issues relate to ecosystem management.

3. **Continue Monitoring and Research on Marine Protected Areas**: **Priority Code: B**

A. As "microcosm" for ecosystem modeling, ground truthing, and analysis.
B. As natural "experimental control" to assess effects of fishery management (biological, ecological, and human/social effects).
C. To help sustain the fishery.

5-Year Research Time Schedule:

Ecosystem Research Components	Duration (Years)				
	1	2	3	4	5
Data Mining, Compilation, Processing and QC/QA	xxxx	xxxx			
Establishing Ecological Relationships		xxxx	xxxx		
Tool Assessment and Development	xxxx	xxxx	xxxx		
Model Development and Tuning			xxxx	xxxx	
Tool and Model Application/Evaluation				xx	xxxx
Monitoring of Marine Protected Areas	xxxx	xxxx	xxxx	xxxx	xxxx

IV. Economic and Socio-cultural Recommendations

Below are recommendations from the Socioeconomic Panel for the Gulf Council's five-year research plan with regard to social and economic priorities. The recommendations are offered in order of prioritization:

1. **Estimate the effect of proposed management alternatives on the benefits of recreational fishing.** Estimate suitable recreational benefit functions and participation rates, by fishery and mode of fishing (private boats, charter boats, head boats) to evaluate the economic effects of regulations for recreational fisheries, such as

(but not necessarily limited to) minimum size limits, bag limits, quotas, seasonal closures and marine reserves. Economic effects include changes in economic surpluses (consumer surplus for fishermen, producer surplus for charter and head boats), levels of fishing effort and catch, and switching behavior among target species and other forms of recreational activities in response to regulation.

2. **Development of regional input-output models and the data needed to make them operational.** Economic impact models characterize the linkages between industries in regional economies, and can be used to estimate the effects of fishery regulations or environmental events such as major hurricanes or red tides as they ripple through state and regional economies for all sectors of the fishery. A research priority is to make them operational by conducting an economic survey of fishing-related businesses to quantify the linkages between them. Fishing-related businesses include suppliers of inputs to fishermen and marketing channels for commercially landed fish. The data collection should focus on revenues, expenditures, employment data and firm characteristics. These data become the inputs to regional impact models that calculate the direct and indirect effects of changes in allowable harvests or environmental events on employment and income.
3. **Development of methodologies to accurately assess the cumulative economic and social impacts of individual fishing quotas on Gulf fisheries.**
4. **Estimate fishing behavioral models, including effort supply and production functions for the commercial and for-hire sectors.** Specific attention should be given to species targeting behavior, seasonal and spatial decisions. The intent of this research is to determine how fishermen change their fishing patterns and strategies regarding how, when and where to fish, and what species to target in response to changes in common management tools such as seasonal closures, area closures, industry quotas, trip limits, minimum size limits, etc. This includes switching behavior among fishing activities as well as the rates at which boats enter or exit the fishery.
5. **Survey of engagement and dependence in marine fisheries.** Collect data about basic socio-demographic characteristics of commercial and recreational fishermen, and other indicators of their levels of engagement and dependence on marine fisheries. For commercial fishermen, these indicators include information about the proportions of their household incomes derived from marine fisheries. For recreational fishermen, these indicators include information about how often they participate in marine fishing compared to other recreational activities. Develop a comprehensive survey of individuals throughout the Gulf of Mexico, and then repeat the survey periodically to provide a series of snapshots over time so that the evolution of engagement and dependence in marine fisheries can be studied and understood. This should be accompanied by an update to census, landings, and permit data included in fishing community profiles with questions on the survey pertaining to the community and fisher's connection to the community and fishing sector.
6. **Develop quantitative models for evaluating social and economic impacts of allocation or reallocation schemes.**
7. **The identification of all ecosystem stakeholders.**
8. **An assessment of the relationship between the ecosystem/fisheries and these stakeholders (i.e. how the actions of these various stakeholders impact the fishery and, conversely how changes in the state of the ecosystem/fishery will impact them)**
9. **The social and economic impacts of ecosystem management on the various categories of stakeholders**; research to satisfy National Standard 8 of the Magnuson Stevens Act in regard to the impact of an ecosystem approach to fishing communities.
10. **The development of social and economic indicators.**
11. **Need for a historical framework that integrates the array of relevant human activities to ecosystem management in a way that is meaningful.**
12. **Develop methods to assess land-use changes and the impact of land-use change on marine ecosystems.**

APPENDIX D. ASMFC RESEARCH PRIORITIES

2009 ASMFC Critical Research Needs in Support of Interjurisdictional Fisheries Management—Subset of South Atlantic species

American Eel

- Formulate a coastwide fishery-independent sampling program for yellow and silver American eels using standardized and statistically robust methodologies.
- Investigate: fecundity, length, and weight relationships for females throughout their range; growth rates for males and females throughout their range; age and maturity data.

American Shad/River Herring

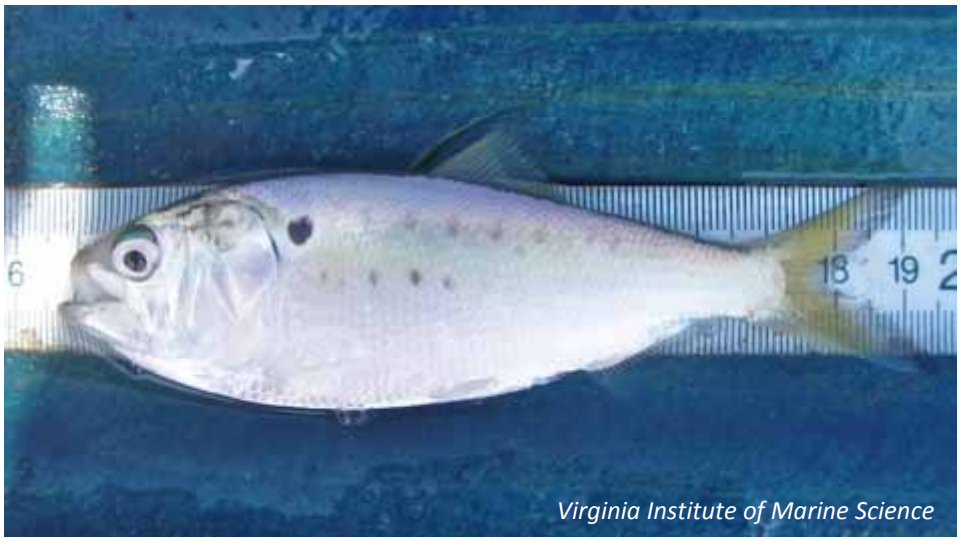
- Conduct population assessments on river herring, and biosampling, particularly in the south.
- Continue to assess current aging techniques for American shad and river herring, using known age fish, scales, otoliths, and spawning marks.

Atlantic Croaker

- Develop fishery-dependent and independent size, age and sex specific relative abundance estimates to monitor long term changes in croaker abundance.
- Conduct stock identification research on croaker (otolith microchemistry, tagging, genetics).

Atlantic Menhaden

- Develop and improve fishery-independent estimates of adult abundance at age on a coast-wide scale to replace or augment the existing pound net index. Aerial survey has been discussed, perhaps in cooperation with the menhaden industry using spotter pilots.
- Develop and test methods for estimating size of recruiting year-classes of juveniles using fishery-independent survey techniques. State seine indices are used for juvenile abundance indices, but there is a need to update information on stream productivity for combining across state surveys for a coastwide index.



Virginia Institute of Marine Science

Atlantic Striped Bass

- Continue in-depth analysis of migrations, stock compositions, etc. using mark-recapture data (ongoing, e.g., Cooperative Winter Tagging Cruise).

Bluefish

- Initiate winter fishery-dependent, independent sampling of offshore populations.

Coastal Sharks

- Better identify and quantify the use of Essential Fish Habitat and nursery areas for shark species found along the Atlantic Coast of the U.S. Continue and expand long term shark monitoring programs to assess population status, and trends in demographic parameters.
- Conduct smooth dogfish assessment.

Red Drum

- Support fishery-independent sampling of sub-adult and adult red drum in each state from Virginia to Florida. The purpose of this survey would be to: 1) verify escapement to the spawning population; 2) provide an index of recruitment to age-1; 3) provide an estimate of the biomass of adult red drum.
- Continue tagging studies to determine stock identity, inshore/offshore migration patterns and mortality estimation.

Spanish Mackerel

- Develop fishery-independent methods to monitor stock size of Atlantic Spanish mackerel (consider aerial surveys used in south Florida waters).
- Evaluate weight- and especially length-at-age, including updated conversion equations (e.g., gutted to whole weight) and sampling of age-0 fish.
- Increase biological sampling, especially hard parts for aging, from states with landings.

Spiny Dogfish

- Conduct a coastwide tagging study to explore stock structure, migration, and mixing rates.
- Standardize age determination along the entire East coast. Conduct an aging workshop for spiny dogfish, encouraging participation by NEFSC, NCDMF, Canada DFO, and other interested agencies, academia and other international investigators with an interest in dogfish aging (US and Canada Pacific Coast, ICES).

Spot

- Develop fishery-dependent, independent size- and sex-specific relative abundance estimates.
- Develop cooperative coastwide spot juvenile indices to clarify stock status.
- Compile life history information, to include maturation and fecundity studies.

Spotted Seatrout

- Initiate fishery-independent surveys of spotted seatrout, especially for juvenile abundance indices. Review of existing data and programs. States should conduct routine fishery-independent surveys using entanglement gear to generate annual indices of abundance for use in regional stock assessments.
- Collect the necessary biological data to be able to conduct stock assessments and to assist in drafting fishery management plans.

Summer Flounder

- Continue fishery-independent surveys and expand existing surveys to capture all sizes and age classes in order to develop fishery-independent catch-at-age and CPUE.
- Collect otoliths more comprehensively, for all components of the catch-at-age matrix, on a continuing basis for fish larger than 60 cm (~7 years) to help estimate stock productivity.

Weakfish

- Conduct spatial and temporal analysis of the fishery-independent survey data. Assess the impact of the variability of the surveys in regards to gear, time of year and geographic coverage on the use of the surveys as stock indicators.
- Identify stocks and determine coastal movements and the extent of stock mixing, including characterization of stocks in over-wintering grounds (e.g., tagging).

SEAMAP-Cooperative Winter Tagging Cruise

APPENDIX E – SEDAR SCHEDULE

SEDAR Assessment Projects

as of May 23, 2011

SEDAR Benchmark and Standard Assessments

SEDAR	SPECIES & JURISDICTION	Year	TYPE
1	SAFMC red porgy	2002	Benchmark
2	SAFMC vermilion snapper & black sea bass	2003	Benchmark
3	SAFMC & GMFMC yellowtail snapper Review ASMFC Atlantic menhaden & croaker	2003	Benchmark
4	SAFMC tilefish & snowy grouper	2004	Benchmark
5	SAFMC & GMFMC king mackerel	2004	Benchmark
6	SAFMC & GMFMC goliath grouper & hogfish	2004	Benchmark
7	GMFMC red snapper	2004	Benchmark
8	CFMC yellowtail snapper & spiny lobster Review FL spiny lobster	2005	Benchmark
9	GMFMC vermilion snapper, greater amberjack & gray triggerfish	2005	Benchmark
U	SAFMC black sea bass	2005	Update
10	SAFMC & GMFMC gag grouper	2006	Benchmark
11	HMS large coastal sharks	2006	Benchmark
12	GMFMC red grouper	2006	Benchmark
U	SAFMC red porgy	2006	Update
13	HMS small coastal sharks	2007	Benchmark
14	CFMC yellowfin grouper, mutton snapper & queen conch	2007	Benchmark
15	SAFMC greater amberjack & red snapper FL FWC mutton snapper Review	2007	Benchmark
U	SAFMC vermilion snapper	2007	Update
16	SAFMC & GMFMC king mackerel	2008	Benchmark
17	SAFMC Spanish mackerel & vermilion snapper	2008	Benchmark
18	Atlantic red drum	2009	Benchmark
19	SAFMC & GMFMC black grouper, SAFMC red grouper	2009	Benchmark
U	GMFMC gag, red grouper, red snapper	2009	Update
20	ASMFC menhaden & croaker Review	2010	Benchmark
21	HMS sandbar, dusky & blacknose sharks	2010	Benchmark
22	GMFMC yellowedge grouper & tilefish	2010	Benchmark
23	FWC Goliath grouper	2010	Benchmark
24	SAFMC red snapper	2010	Benchmark
U	FL FWC Spiny lobster	2010	Update
U	GMFMC greater amberjack	2010	Update

25	SAFMC black sea bass and golden tilefish	2011	Standard
26	CFMC silk snapper, parrotfish, and queen snapper	2011	Benchmark
27	FWC Yellowtail Snapper and Gulf Menhaden Review	2011	Benchmark
U	Gulf Vermillion Snapper and Gray Triggerfish	2011	Update
28	GoM and SA Cobia and Spanish Mackerel	2012	Benchmark
29	SAFMC white grunt	2012	Benchmark
30	CFMC blue tang, white grunt, queen triggerfish	2012	Benchmark
31	GMFMC red snapper	2012	Standard
32	HMS Shark TBD	2012	TBD
33	FL FWC Mutton Snapper	2012	Standard
U	SAFMC vermilion snapper and red porgy	2012	Update

SEDAR Methods and Procedures Workshops

Number	Year	Topic
1	2008	Indices Development and Evaluation
2	2008	Evaluating and Modeling Catchability
3	2009	Caribbean Data Review
4	2010	Evaluating Assessment Uncertainty
5	2012	SEDAR Assessment Framework Approaches

For detailed schedule and workshop information please look under the specific SEDAR workshop at http://www.sefsc.noaa.gov/sedar/.

APPENDIX F – SEAMAP-SA COLLABORATIONS

SEAMAP in combination with other fishery-independent data will be drawn on to identify regional distribution of habitat and species useful to each of the above regional efforts. The following highlights the opportunity for SEAMAP to be the entity providing data or directly collaborating with these organizations in production of regional products or tools.

Governor's South Atlantic Alliance

The Alliance provides regional guidance and resources to address broader habitat and ecosystem conservation goals of the States and regional partners. The initial focus areas include, Healthy Ecosystems, Working Waterfronts, Clean Coastal and Ocean Waters and Disaster-Resilient Communities. SEAMAP addresses the focus area of Healthy Ecosystems by providing species and habitat data. This goal seeks to ensure the sustainability of the diverse array of coastal and marine environments vital to the ecological and economic stability of the region by: enhancing and supporting ecosystem-based management of regional biological resources; improving ecosystem structure and function by developing and applying sound scientific data to support habitat conservation, enhancement, and restoration; increasing the understanding of the scope and scale of the region's human and natural resources; and developing communication networks, research frameworks, and outreach/education.

Southeast Coastal Regional Ocean Observing Association (SECOORA)

SECOORA approved a strategic priorities plan in 2010 (SECOORA 2010) which sets forth a guiding vision to protect people, conserve marine environments and enhance the coastal economy. The Priorities plan focuses on addressing four initial themes; ecosystems, living marine resources and water quality; marine operations; and climate change. Cooperation with SEAMAP partners will be important to guide, direct and integrate with priority needs for observation and modeling to support fisheries oceanography and integration into stock assessment process through SEDAR. Initial products already under development bring together biological and oceanographic data to support active research conducted by SEAMAP, to enhance fishery operations, to support model development and assessment of fish stocks and enhance characterization of benthic and pelagic habitat.

Southeast Aquatic Resource Partnership (SARP)

SARP, covering both South Atlantic and Gulf States and adjacent marine environments, developed the Southeast Aquatic Habitat Plan (SARP 2008) present watershed conservation restoration targets directly addressing habitat, water quality, and water quantity conservation needs identified by SEAMAP partners. Information from or collaboration with SEAMAP partners will help the organization characterize and prioritize fish habitat restoration and conservation efforts intended to increase the viability of fish populations and fishing opportunity. This enhances States conservation of marine habitat and management of species as well as Essential Fish Habitat for designated by the South Atlantic Council. The partnership is also developing a prioritization tool for marine and inland habitat. SEAMAP can provide and collaborate on the use of data to refine this prioritization effort especially as it applies to estuarine dependant species (e.g., gag, red drum, Spanish mackerel) or prey (e.g., menhaden, shrimp, crabs pinfish) they depend on.

South Atlantic Landscape Conservation Cooperative (SALCC)

Landscape Conservation Cooperatives (LCCs) are applied conservation science partnerships focused on a defined geographic area that informs on-the-ground strategic conservation efforts at landscape scales. LCC partners include DOI agencies, other federal agencies, states, tribes, non-governmental organizations, universities and others. The scope of the SALCC encompasses both land and ocean components and SEAMAP has the opportunity to provide information on species and habitat that may be affected by climate change. In addition, with the resources being brought to bear with the developing regional Southeast Climate Science Center, collaborations with SEAMAP are envisioned to mutually build a better understanding of linkages between land and sea and the long-term impact of climate change on habitat and Southeast species.

APPENDIX G. SEAMAP HISTORY

Budget

For the first three operational years (FY 1982-1984), SEAMAP received no federal programmatic funding. For these years, programmatic activities were supported through existing state and federal resources. Dedicated federal programmatic funding for SEAMAP began in FY 1985 at approximately $1 million and continued at that level through 1991. In FY 1992, funding was increased to $1.4 million and decreased to $1.37 million, $1.32 million, and $1.34 million in FY 1993, 1994, and 1995 respectively. SEAMAP funding decreased again in FY 1996 to $1.2 million, and was funded at that level through FY 2000. During FY 2001, the SEAMAP budget was increased to a total of $1.4 million and remained at that level in 2002 and 2003. The budget increased again in 2004 to $1.75 million but then was reduced to 1.67 million by rescission. The FY 2005 budget was reduced back to $1.385 million dollars and was funded at that level again for FY 2006. In FY 2007, the entire SEAMAP received $4,369,000 as the Gulf and NMFS were allocated an additional amount partly in response to Hurricane Katrina, while the South Atlantic and Caribbean were level funded that year. In FY 2008, SEAMAP received $4,387,608 that was allocated proportionally amongst the components. In FY 2009 and 2010, SEAMAP received $5,090,065 each year.

Fiscal Year	Gulf of Mexico 41.3%	South Atlantic 32.9%	Caribbean 10.5%	NMFS 15.2%	TOTAL (millions)
2005	$612,430	$357,387	$185,000		$1.385
2006	$612,430	$383,981	$143,132		$1.385
2007	$2,500,755	$383,981	$143,749	$1,340,515	$4.369
2008	$1,812,082	$1,443,523	$460,699	$671,304	$4.388
2009	$2, 068,331	$1,647,653	$525,847	$848,234	$5.090
2010	$2, 068,331	$1,647,653	$525,847	$848,234	$5.090

Joint Activities

A joint workshop for data management work groups from the Gulf and South Atlantic components was held in FY 1985. Results of the workshop included approval for development of a new data management system design in FY 1986. By FY 1987, the requirements report for the new data management system, Data Management System Requirements Document for Gulf and South Atlantic, 1987, was published. Integration of this new system began in FY 1988.

In 1987 a passive gear assessment workshop was sponsored by the joint components of SEAMAP and the University of Puerto Rico Sea Grant College Program to investigate gear alternatives in areas where trawling is not suitable or may not be preferred.

One of the most important administrative events for FY 1988 was the completion of an external program review. The review was conducted by a four-member review panel, including representatives from NMFS, the National Sea Grant College Program Office, the New Jersey Marine Science Consortium, and Auburn University. The review consisted of a comprehensive evaluation of SEAMAP relative to goals and objectives outlined in the

operations plans of the Gulf and South Atlantic components. The review panel completed a written report of their findings and recommendations on October 1, 1987. Recommendations of the review panel were discussed at the joint meeting of SEAMAP components in January 1988, and a final slate of recommendations for the program was endorsed. Preparation of the 1990-1995 joint five-year plan for all three SEAMAP components was an important recommendation of the review report. Preparation of SEAMAP joint five-year plans continues to be an integral part of SEAMAP.

SEAMAP-Gulf

The first SEAMAP component, SEAMAP-Gulf, was implemented in the Gulf of Mexico region in December 1981, under guidelines formulated by the GSMFC TCC and described in the SEAMAP Strategic Plan. The GSMFC is responsible for coordinating and administering the SEAMAP-Gulf component. Initial operations were designed to implement the coordination, standardized collection, management, and dissemination of data from fishery-independent surveys conducted in the Gulf of Mexico during the summer of 1982. These surveys included the first annual summer shrimp/groundfish bottom trawl survey, along with the first year of annually collected environmental and plankton data.

With the onset of data collection, compilation of data began for annually produced documents such as SEAMAP marine directories (regional listings of fisheries research facilities and survey plans in the Gulf of Mexico) and SEAMAP atlases (summaries of survey results and data). Distribution of "near real-time data" was initiated, and weekly computer plots and data listings were produced for managers, researchers, industry, and the general public. Additionally, expert work groups drawn from state research agencies, universities, NMFS, and other research centers were established to accomplish specific tasks, including planning and coordinating surveys, data reports, and other SEAMAP functions.

During the second operational year of SEAMAP-Gulf (FY 1983), the SEAMAP Information System and SEAMAP Ichthyoplankton Archiving Center were established. The SEAMAP Information System was established at the Stennis Space Center in Stennis Space Center Station, Mississippi, as the primary management system for all SEAMAP generated data. The SEAMAP Ichthyoplankton Archiving Center was established at the Florida Fish and Wildlife Research Institute in St. Petersburg, Florida, for the archiving of all sorted SEAMAP-collected ichthyoplankton. Specimens archived from SEAMAP cruises were made available for use by interested agencies and researchers. To assist in the coordination of data collection, a calibration workshop on trawling gear was sponsored by SEAMAP in FY 1983, with the results published as workshop proceedings. Additional highlights for FY 1983 included the initiation of an annual spring plankton cruise in the Gulf of Mexico, and the initiation of the South Atlantic component of SEAMAP. Initial SEAMAP-Gulf activities established the basic framework for the current program in the Gulf of Mexico, South Atlantic, and Caribbean regions.

During FY 1984, the Gulf component conducted a plankton survey of coastal and continental shelf waters in August targeting king mackerel larvae and collected data on ichthyoplankton during a winter plankton survey. Also in FY 1984 the Gulf component established an annual fall plankton survey of coastal shelf waters targeting the larvae of king and Spanish mackerel and red drum. In FY 1985, the Gulf component continued winter plankton sampling and also began three special studies, including (1) an evaluation of shipboard weighing procedures, (2) gear investigations for a squid/butterfish fishery and a coastal herring fishery, and (3) location of trawlable concentrations of these species. A trawl survey of outer continental and shelf edge waters was

conducted to assess stocks of squid and butterfish in the Gulf of Mexico during FY 1985 (July and August) and FY 1986 (May and June).

Also during FY 1985, advances were made in both data management and specimen archiving. The SEAMAP Ichthyoplankton Archiving Center acquired a computer system and a second archiving center was added. The SEAMAP Invertebrate Plankton Archiving Center (SIPAC) was established at the Gulf Coast Research Laboratory in Ocean Springs, Mississippi, to store and catalog unsorted "backup" samples and selected samples sorted for larval penaeid shrimp, blue crab, stone crab, lobster, squid and other invertebrates.

In FY 1986, to add to its continuing annual summer shrimp/groundfish resource survey, the Gulf component began a fall shrimp/groundfish survey, which mainly targeted groundfish. This activity was built on the NMFS fall groundfish survey, conducted since 1972. In addition, the declining status of red drum in the Gulf of Mexico prompted the red drum work group and other scientists to collaboratively produce a cooperative three year plan for red drum research in the Gulf. Reporting of planning, progress, results, and evaluation of red drum research have continued to be managed by SEAMAP-Gulf.

Fiscal year 1987 activities included the continuation of long-term resource monitoring surveys in the Gulf, with the addition of a short-term special study on the distribution of shortfin squid. The resource monitoring surveys continued through FY 2000, including a new Spring Reef Fish Survey begun in FY 1992 to assess the relative abundance and to compute population estimates of reef fish in the Gulf region. In addition, in FY 1984, FY 1985, FY 1993 and FY 1996 winter plankton surveys were conducted in the open Gulf of Mexico.

Due to continued level funding since FY 1992, the SEAMAP-Gulf component has concentrated efforts on continuing core surveys. These surveys are the Spring and Fall Plankton Surveys, Summer and Fall Shrimp/Groundfish Surveys, and the Reef Fish Survey.

SEAMAP-South Atlantic

SEAMAP-South Atlantic (SEAMAP-SA) was formally established in October 1983 under the auspices of its management body, the SAB of the ASMFC. An operations plan was developed during FY 1984 and published in October 1984 as the SEAMAP South Atlantic Operations Plan: 1986-1990.

The first year of operations for the South Atlantic component was FY 1985, and included a spring benthic resources survey. Objectives and procedures for a bottom mapping project, and protocol for the calibration of shallow water trawling procedures in the South Atlantic were also developed. In FY 1986, preliminary investigations on gear and calibration were conducted to provide the basis for development of a long-term monitoring trawl survey for the South Atlantic area. A pilot bottom mapping study focusing on south Atlantic hard bottom areas and reefs was also completed in FY 1986.

During FY 1987 and 1988, the second and third years of the three-year preliminary trawl survey study was completed. Also completed in FY 1988 were the North Carolina Calico Scallop Survey, the annual Pamlico/Albemarle Sound Survey, and the annual Winter Striped Bass Tagging Cruise. Although a full hard bottom study was scheduled to begin in FY 1988, lack of funding prevented implementation of the first element in this study until FY 1992.

The Shallow Water Trawl Survey sampling strategy was finalized and implemented in 1989. That project continues through today as a long-term survey and continues to be the largest component and highest priority activity in the South Atlantic program. Continued data collection efforts in FY 1989 through FY 1991 included benthic invertebrate characterization, the Pamlico/ Albemarle Sound Survey, and the Winter Striped Bass Tagging Cruise.

Funding for the bottom mapping project resumed in FY 1992. The work group developed a database format designed for easy incorporation into GIS or other mapping software. In FY 1993, the workgroup initiated a search for existing data sources, and captured more than 8,000 records. By FY 1995, several bottom mapping reports were completed on the initial pilot program and hard bottom distribution off South Carolina, Georgia, and North Carolina (Appendix B) totaling more than 23,900 records.

During FY 1994, the ASMFC convened a Workshop on the Collection and Use of Trawl Survey Data for Fisheries Management. SEAMAP-SA members participated with SEAMAP-SA providing some funding for the workshop. A report of the workshop proceedings was published in December 1994.

In FY 1995, the SEAMAP-SA Committee was asked by NMFS to undertake a coordination role for developing finfish bycatch estimates in the South Atlantic shrimp fishery. The SEAMAP-SA Committee formed the Shrimp Bycatch Working Group, consisting of sixteen members with expertise in shrimp bycatch research and management from appropriate state and federal agencies. The working group's charge was to guide data identification and summarization, evaluate estimation methods, and review final estimates of bycatch removals by the South Atlantic shrimp fisheries. Technical support was provided by NMFS in conducting the specific analyses requested by the working group. A final report was completed in April 1996.

Florida was funded for capture of bottom mapping data in FY 1996, and completed a report on hardbottom mapping off the coast of Florida in FY 1997 (Appendix B). In FY 1998, the first South Atlantic Bight Hardbottom Mapping CD-ROM was produced as a compilation of the North Carolina through Florida data, formatted in GIS and searchable in a visual format by the Florida Marine Research Institute.

During FY 1999, the Bottom Mapping Work Group revised the CD to produce version 1.1, and began discussing improved data access and interactive mapping on the Internet. A cooperative effort with the Coastal Sciences Center (CSC) allowed posting of that data as an information layer on the CSC web site. FY 1999 also concluded ten years of standardized data collection for the shallow water trawl program, marking the maturity of the data set and solidly establishing its utility in fisheries stock assessments.

In FY 2000, the Bottom Mapping Work Group developed a summary hardcopy document to accompany the CD. The CD has been broadly distributed to scientist, natural resource managers, fishermen, consultants, environmental groups, and others. The Shallow Water Trawl Work Group produced a 10-year summary report, and 13 years of data from the winter striped bass tagging cruise data was used to analyze beach replenishment "borrow" areas. The Pamlico/Albemarle Sound survey was continued for the 13th year, and plans were made to update the database format to Oracle. In FY 2001, the Bottom Mapping Work Group developed a list of issues necessary to create deepwater protocols and future work group priorities. The 2001-2005 SEAMAP Management Plan was also developed.

During FY 2002, the Crustacean Work Group held a symposium in conjunction with the Southeast Estuarine Research Society (SEERS). The symposium focused on “Management, Monitoring, and Habitat Considerations for Crustacean Fisheries in the Southeastern United States”. The meeting provided a means for technical information exchange between scientists working for both academic and management purposes. The Bottom Mapping Work Group began to create protocols to convert existing data on deepwater bottom habitats into a standard format as phase 1 of a project to extend the bottom mapping GIS product from the 200 to 2,000 meter (m) depth contour. Phase 2 of the project was also underway to create an annotated, searchable bibliography of deepwater bottom type data sources.

In FY 2003, the SEAMAP Data Management Work Group developed a plan to update the NMFS data structures to contain the full extent of data collected by the trawl survey. They also met jointly with the Northeast Area Monitoring and Assessment Program (NEAMAP) Data Management Work Group to share information on data structures and various methods to build a fisheries independent data warehouse. The Crustacean Work Group met to discuss state harvest information on blue crabs and shrimp. The Crustacean Work Group sponsored a shrimp symposium at The Crustacean Society Meeting (June 2-5, 2003 in Williamsburg, VA). Presentations and discussion focused on disease, transport, genetic variability, and population status. The Bottom Mapping Work Group finalized a three-phase approach to compile existing deepwater (200-2000 m) bottom characterization data from existing data sets, and appointed a subcommittee to develop the protocols for data transformation. The Bottom Mapping Work Group and Deepwater Subcommittee worked on defining the deepwater habitat characterization, and the types of data for which transformation protocols would need to be developed (Phase I). The subcommittee also approved the completion of a data source compilation document titled "Summary of Seafloor Mapping and Benthic Sampling Conducted in 200-2000 m, from North Carolina through Florida" (Phase II).

During FY 2004, a report entitled “The Status of the Blue Crab (*Callinectes sapidus*) on the Atlantic Coast” was produced. This document is a report of Blue Crab Symposium convened by the Crustacean Society and a Blue Crab Workshop convened by the ASMFC’s SEAMAP Crustacean Work Group, both in 2003. The Data Management Committee continued working with NMFS to update the SEAMAP data management system and worked on the development of the SEAMAP.org website. The Bottom Mapping Work Group began work on Phase III of the deep-water habitat mapping project, working with the South Atlantic Fishery Management Council to map bottom habitat in deepwater regions (200-2000 m).

SEAMAP data and associated GIS have been incorporated into the South Atlantic Habitat and Ecosystem Internet (http://ocean.floridamarine.org/efh_coral/ims/viewer.htm) and Essential Fish Habitat Service (http://ocean.floridamarine.org/safmc_EFH/). In addition, the South Atlantic Council highlights the role of the SEAMAP program in supporting spatial fisheries management and the move to ecosystem-based management in the region through the South Atlantic Habitat and Ecosystem Homepage (http://www.safmc.net/ecosystem/Home/EcosystemHome/tabid/435/Default.aspx). These tools supported the development of a Fishery Ecosystem Plan for the South Atlantic Region and the importance of SEAMAP and need for expansion to support the move to ecosystem-based management.

In FY 2005, the Data Management Committee continued working with NMFS to update the SEAMAP data management system. A new SEAMAP logo was produced and the SEAMAP.org website went online. The Bottom Mapping Work Group continued to work on Phase III of the deep-water habitat mapping project. The 2006-2010 SEAMAP Management Plan was also produced.

SEAMAP-Caribbean

In FY 1988, a SEAMAP Caribbean Committee was established administratively under the guidance and supervision of the Caribbean Fishery Management Council. Initial efforts toward establishing a long term SEAMAP monitoring program in this area were directed toward ichthyoplanktonic studies, pelagic longline, and environmental monitoring. Initiation of the operational phase began in 1988 with plankton sampling. The effort was a cooperative venture involving the NOAA vessel DELAWARE II, SEAMAP-Caribbean members, and representatives of the British Virgin Islands. During FY 1989 a cruise of the NOAA vessel R/V OREGON to the Caribbean was utilized to monitor the longline catches around the U.S. Virgin Islands.

The SEAMAP-Caribbean committee recognized long-term monitoring of reef resources as its most important priority. During FY1989-1992, procedures for conducting a Reef Resource Survey were developed. Efforts toward establishing and beginning sampling were inhibited by the lack of funding to the operational part of the SEAMAP-Caribbean component. In FY1991, a three-year sampling cycle of a Reef Resources Survey was started, including sampling by hand line and fish traps in waters off Puerto Rico and the U.S. Virgin Islands. In FY1994, the Reef Resources Survey was extended to include the area of St. Croix. Although relying on more conventional sampling gears, some data have also been collected by the U.S. Virgin Islands Division of Fish and Wildlife using underwater cameras. In FY1999, a Reef Resources Survey was carried out south of St. John, USVI that included sampling by hand line and fish traps. In FY2000, the Reef Resources Survey was extended to include the area of St. Croix. In FY2004, SEAMAP-Caribbean began another cycle of reef fish surveys. Puerto Rico began trap and hook-and-line surveys that continued into FY2005. The US Virgin Islands delayed start of these surveys until a new research vessel could be purchased. In late FY2005 additional funds for the vessel were obtained and a request for bids for the new vessel was initiated. Supplemental SEAMAP funding (in FY2004) allowed Puerto Rico to increase trap and hook-and-line survey trips during FY2005. These funds also supported the investigation and completion of the SEAMAP-C US Virgin Islands trap and hook-and-line database.

In FY1990, SEAMAP-Caribbean conducted a survey to determine the relative abundance of the queen conch (*Strombus gigas*) resources around the U.S. Virgin Islands. The methodology to be used in this survey is a modification of previous surveys undertaken in the U.S. Virgin Islands (Woods and Olsen, 1983 and Boulon, 1987). Additional conch surveys were conducted in 1995. These surveys were a joint venture between the U.S. Virgin Islands Division of Fish and Wildlife and the National Park Service (which supported the St. Thomas portion of the study), as well as between the Puerto Rico Department of Natural and Environmental Resources and the University of Puerto Rico, Mayagüez Campus. In FY2001, conch surveys were again conducted in the US Caribbean. These surveys included the all of Puerto Rico and the three main islands of the US Virgin Islands. Diver scooter surveys were completed.

APPENDIX H – SEAMAP SPECIMEN ARCHIVING

Curators

The SEAMAP curators are responsible for the maintenance of selected collections of ichthyoplankton, invertebrate organisms, stomach contents and duplicate plankton samples collected during SEAMAP survey operations. The SEAMAP Ichthyoplankton Archiving Center stores sorted ichthyoplankton samples and is located at the Florida Fish and Wildlife Research Institute, St. Petersburg, Florida. The SEAMAP Ichthyoplankton Archiving Center curator and curatorial assistant are Florida state employees whose positions are supported by SEAMAP funds. The curator and curatorial assistant receive administrative support from the Florida Fish and Wildlife Research and direction from the joint committees. The SEAMAP Invertebrate Plankton Archiving Center (SIPAC) houses unsorted "backup" station samples and sorted larval invertebrate specimens, and is located at Gulf Coast Research Laboratory, Ocean Springs, Mississippi. The SIPAC curator and curatorial assistant are employees of Gulf Coast Research Laboratory, whose positions are partially supported by SEAMAP funds. Administrative support and supervision are received from the Gulf Coast Research laboratory and joint committees. The Southeastern Regional Taxonomic Center (SERTC) stores sorted post-larval (non-planktonic) invertebrate samples and is located at the Marine Resources Research Institute in Charleston, SC. SEAMAP Coastal Survey staff maintain the stomach sample collection with assistance from the SERTC. SERTC staff are all state of South Carolina employees supported in whole or in part by SEAMAP funds.

The SEAMAP curators maintain SEAMAP specimens and samples in the most efficient and effective manner, processing specimen requests and insuring archiving and loans are carried out in accordance with the approved policies and procedures outlined in the SEAMAP Shipboard Operations Manual. Specific responsibilities of the curators include:

- Maintain collections in a manner consistent with approved policies and procedures
- Receive authorized specimens and their accompanying information, and catalog these materials
- Process user requests and provide specimens and/or information in accordance with the approved policies and procedures
- Maintain information on specimen requests
- Assist the coordinators in the preparation of each annual report and reviews of the specimen archiving component of SEAMAP

Archiving Procedure

Specimen collectors are classified in the same categories as data collectors, which include SEAMAP participant and SEAMAP cooperator. Collected specimens are classified as ichthyoplankton, invertebrate zooplankton, or phytoplankton. Collections are preserved and processed aboard ship in accordance with the SEAMAP Operations Manual for Collection of Data. Primary collections are shipped to the NMFS Miami Laboratory where data sheets are completed and reviewed. The samples are then packaged and forwarded to the Polish sorting center. Backup collections are shipped to SIPAC where they are stored.

With the concurrence of the affected SEAMAP committee, some plankton samples may be sorted by other organizations, with the sorted samples returned to the appropriate archiving center. Currently, ichthyoplankton

samples are collected and sorted by the Louisiana Department of Wildlife and Fisheries and results are sent to the archiving centers. Furthermore, should a requirement to collect specific samples for a specific purpose arise, the requesting organization may sort, archive, and even destroy certain samples, depending upon agreements established with the affected committee.

Specimens sent to the Plankton Sorting and Identification Center in Sczcecin, Poland are separated to ichthyoplankton and other plankton fractions. Ichthyoplankton fractions are sorted to the family level and returned to the SEAMAP Ichthyoplankton Archiving Center, where they are catalogued and stored. Currently, all ichthyoplankton archiving information is maintained on a local data base at the SEAMAP Ichthyoplankton Archiving Center. The sorted and unsorted invertebrate fractions are returned to SIPAC and accessioned. All invertebrates are archived and data maintained in a computerized data management system.

A collection of invertebrate (excluding zooplankton) and fish specimens is maintained by the SERTC. With the exception of some cnidarians and a number of formalin-fixed specimens that were collected prior to the inception of the SERTC program, the samples in the SERTC invertebrate collection are preserved in 95% ethanol. Preservation in 95% EtOH is an acceptable procedure for storing tissues that are expected to be useful for DNA extraction. Through this preservation process, SERTC provides material to molecular systematists upon request. A software package called Specify, which was developed by the Informatics Biodiversity Research Center (IBRC) at the University of Kansas, is used to manage a database of the catalogued collections of the SERTC program. The Specify software allows modification to the taxonomic hierarchy of the Integrated Taxonomic Information System (ITIS), providing SERTC the ability to incorporate up-to-date taxonomic information into the database. Currently, 67% of the SERTC invertebrate database is accessible through a portal of the Global Biodiversity Information Facility (GBIF). Queries of the database can provide detailed collection for each lot of specimens contained in the SERTC collection. To date, 2050 records of occurrence (520 species and 49 additional taxa that are identified at a level higher than species) can be viewed at the GBIF website.

Implementation of the SEAMAP Data Management System will improve information management for both archiving centers by allowing user site access to the entire SEAMAP data base at each archiving center. All station information will be readily available to the curators. Specimen data will be entered directly to the SEAMAP data base at the archiving centers. In addition, all archiving information stored on the Data Management System will be readily available to SEAMAP participants.

Specimen Loan

All specimen requests will be directed to the SEAMAP curators. Requests will be processed in accordance with the annual SEAMAP operations plan. The curator will send a Specimen Loan Agreement Form to the requestor, requiring the following information:

1. Name of requestor and associate investigators using specimens;
2. Affiliation and address of requestor;
3. Required date of receiving loan and probable length of use;
4. Purpose of specimen use, including identification of contracts or grants associated with such use;
5. Intended publication format (journal, report, etc.) for project; and
6. Copy of grant, grant proposal, or contract indicating proposed use of SEAMAP data or specimens, if applicable.

This form will also contain notification of charges associated with processing and handling the specimen loan. Except in unusual cases approved by the committee, all costs of shipping specimens should be borne by the requesters. This form will also notify the requestor of the procedure to be used in referencing SEAMAP as the source of specimens in any presentation, report, or publication resulting from their use. Procedures for handling and maintaining loan specimens will be included on this form. Normally, all sorted, unmodified specimens will be returned to the archiving center. When examination of SEAMAP specimens by a recognized expert in marine fish taxonomy leads to re-identification of larval specimens, these changes will be incorporated into the SEAMAP Data Management System. The curator will advise the requestor to provide the appropriate SEAMAP coordinator with two copies of each report and publication which relied on SEAMAP specimens. A bibliography of reports generated from SEAMAP data will be published in the SEAMAP Annual Report. The requestor will be advised to treat all received specimens in a professional manner, precluding redistribution of the specimens to other parties without prior approval by the committee.

Specimen requests will normally be handled in the order received. In the event of personnel or funding limitations, priorities for specimen requests will be assigned as follows: SEAMAP participant, SEAMAP cooperator, SEAMAP investigator, and non-SEAMAP investigator. Questions relating to adjustments in priorities, costs, and use of specimens will be forwarded to the coordinators and committees for resolution.

APPENDIX I. SEAMAP DOCUMENTS

A bibliography of SEAMAP reports, as well as reports utilizing SEAMAP data, may be found on www.seamap.org and www.gsmfc.org/seamap.html. SEAMAP information may be produced in a number of different types and formats:

Annual Reports Prepared by the coordinators and committees. These reports summarize and, to some extent, evaluate survey operations, data management, administration, and information dissemination activities. Annual reports also offer a financial statement, listing of official SEAMAP publications, listing of data requests and publications that relied on SEAMAP data, a proposed budget, and recommendations for SEAMAP activities to be conducted the following year. Annual reports are distributed to management bodies and funding agencies to be used in evaluating the performance of SEAMAP.

Cruise Plans Provide agencies and organizations with advance notice of intended surveys. These brief notices detail scheduled sampling activities and describe itineraries of vessels participating in the surveys. Cruise plans are distributed upon approval by the appropriate committee.

Public Relations Communications Newspaper and journal articles, and interagency reports that may be helpful in fulfilling the program's goals and objectives.

Newsletters Have been used to provide agencies and organizations with advance notice of intended SEAMAP surveys. These brief notices detail scheduled sampling sites and activities, and describe the itineraries of vessels participating in the surveys.

Quick Reports Issued periodically during survey operations. The reports contain information such as shrimp catch rate, satellite transmission of chlorophyll concentrations, and surface temperatures that may be useful to scientists, management agencies, and the fishing industry. The reports are prepared for the committee under the supervision of the SEAMAP data manager and are distributed by the coordinator to persons responding to periodic SEAMAP data summary use questionnaires and others expressing a desire to receive these reports.

SEAMAP Atlas Summarizes annual ichthyological, shrimp/groundfish, and environmental data collected on cruises. Atlases are joint products of two or more work groups under the supervision of the coordinator, and are distributed to participants, cooperators, investigators, and interested fisheries research organizations.

SEAMAP Marine Directory Summarizes information on fisheries research survey activities, personnel, facilities and gear, and is updated annually for distribution to regional fisheries organizations. The directory was previously prepared for SEAMAP by NMFS personnel, but is now be under the supervision of the SEAMAP coordinator.

Special Reports Supervised by the committee and prepared to provide timely information that fulfills the program's goals and objectives. These may include descriptions of standard sampling protocols and gears, results of gear comparisons, workshop proceedings, etc. Special reports will be available to state agencies, universities, and other researchers concerned with collecting data that will be compatible with those of SEAMAP organizations.

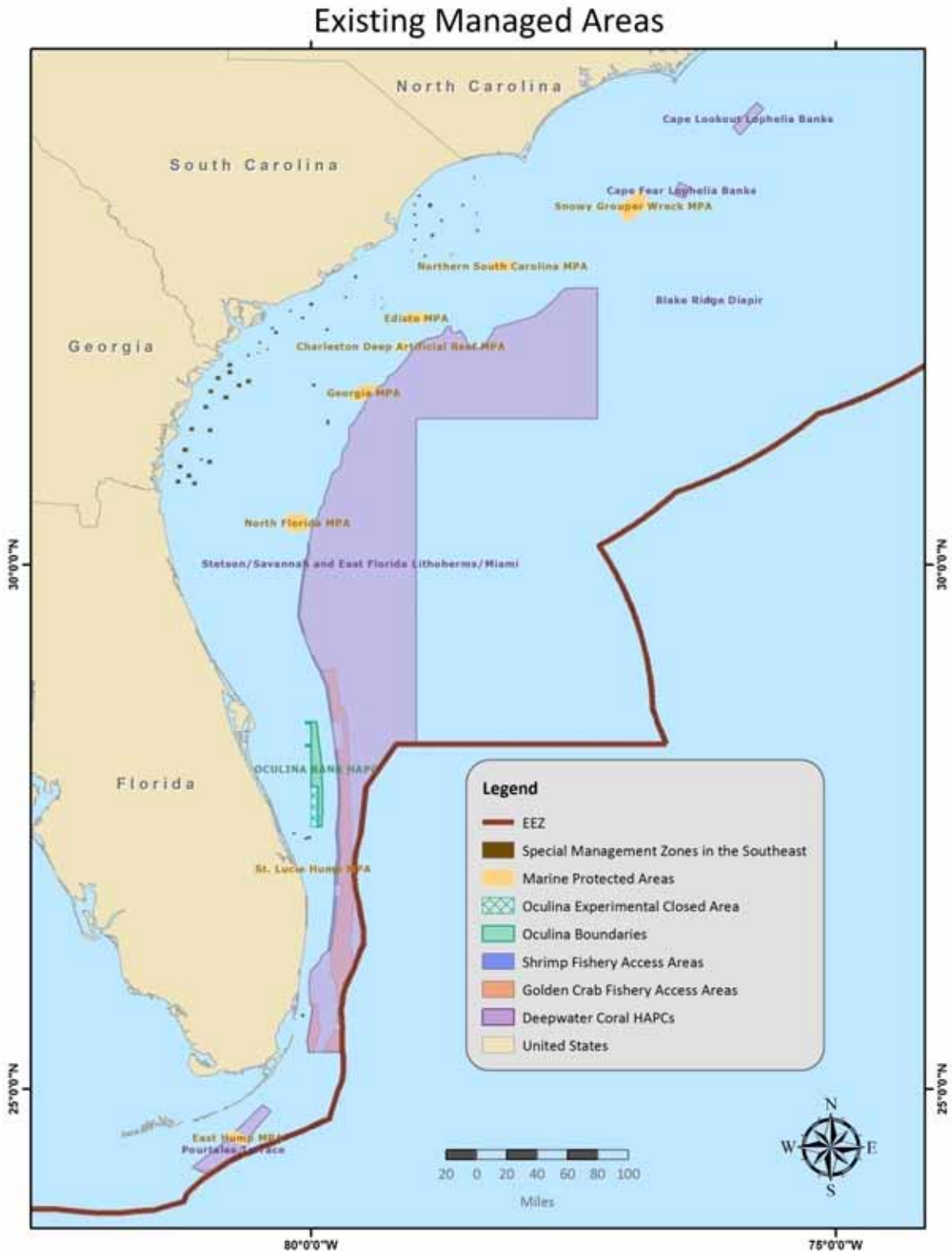
APPENDIX J. RESEARCH VESSEL SPECIFICATIONS, SOUTH ATLANTIC

The SEAMAP-SA Reef Fish Survey and Coastal Survey are relying entirely on the use of the *R/V Palmetto* and *R/V Lady Lisa*, two research vessels owned by SC-DNR. Both vessels are critical for the fishery-independent sampling in the Southeast region. As indicated in Chapter 4, priority level I, both vessels are old (e.g., the *R/V Palmetto* is 7 years past its expected life span) and therefore are subject to increasing maintenance costs and will likely need to be replaced in the near future. Without vessel replacement, the fishery-independent sampling in the region will be in jeopardy. To investigate replacement options and funding, information as to the type of research vessel needed for sampling is provided below.

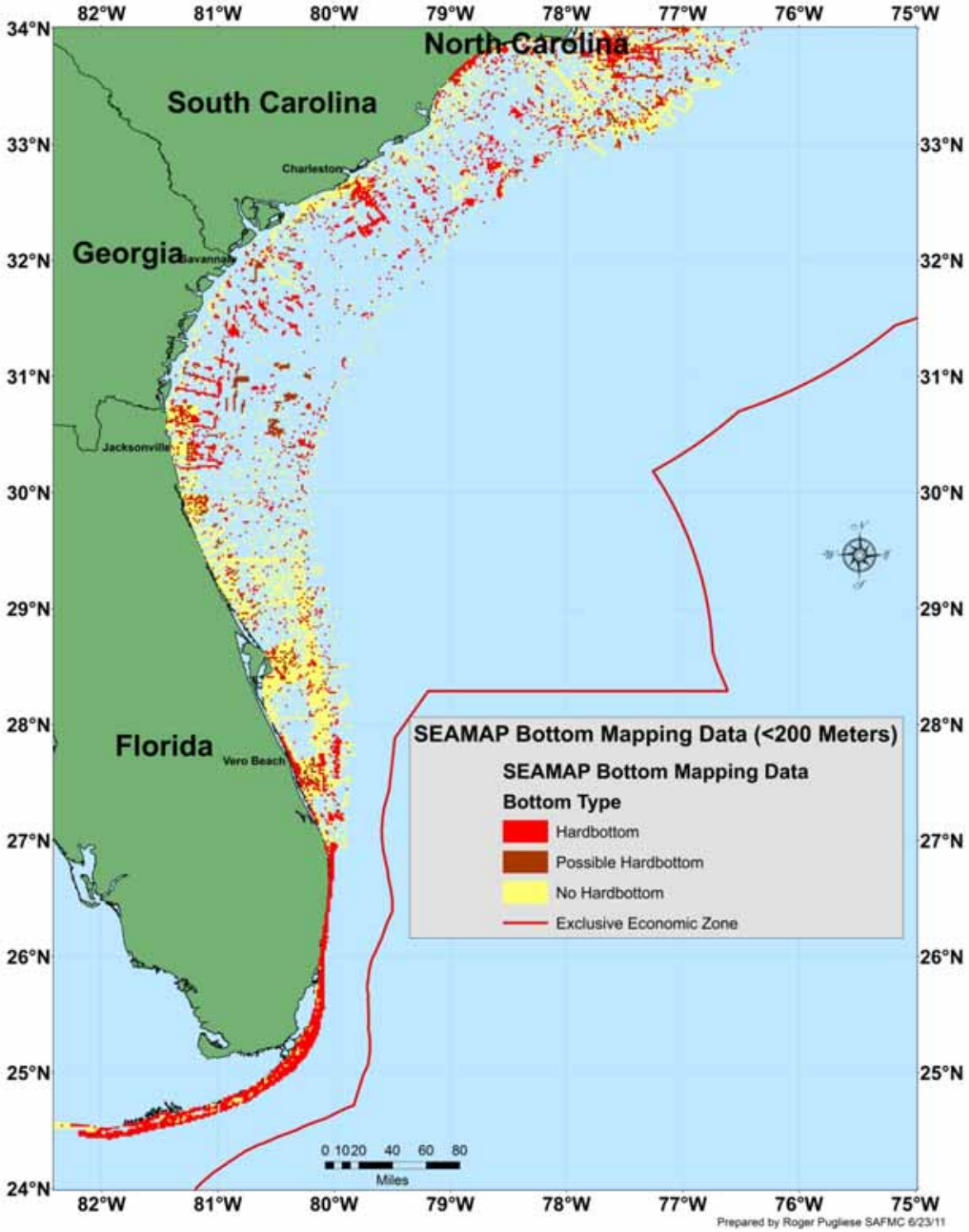
	R/V Lady Lisa	R/V Palmetto
Description of Vessel	St. Augustine, Double-Rigged, Wooden Hull Trawler. Built in 1979.	110' Steel Hull. Built in 1982 by Collier Ship Building, Inc.
Registered Hull Length	LOA - 75', Water line - 72', Beam - 21', Draft - 8'.	LOA - 110', (98.8' water line), Breadth - 26', Draft - 7.5'.
Gross Tonnage	105 Tons	
Engine(s) Type & Size	Caterpillar 3412-ST Diesel, 415 HP. Single screw.	2-Detroit 16V71S diesel engines.
Registration Number	SC 004 BA	Documented - R/V Palmetto (645736)
Number of Crew	2-Licensed Captains, 1-Contract (part time) cook. The Scientific Parties supply sufficient personnel to assemble or rig and operate their own gear, not less than 2 able bodied deckhands.	2-Licensed Captains, 2-Engineers, 1-Deckhand, 1-Contract (part time) cook. The Scientific Parties supply sufficient personnel to assemble or rig and operate their own gear, not less than 2 able bodied deckhands. Scientific personnel are not permitted to operate heavy deck equipment.
Types of Usage	Research: Coastal out to 100 miles, using hydrographic gear, trawls hook and line, plankton nets, grabs, traps and SCUBA. All operations involving SCUBA fall under the MRD Scientific Diving the Division Diving Safety Officer.Policy and must be approved by	Research: Coastal out to 150 miles, using longline gear, hydrographic gear, hook and line, plankton nets, grabs, traps and SCUBA. All operations involving SCUBA fall under the MRD Scientific Diving Policy and must be approved by the Division Diving Safety Officer.
Navigational Range Limits	Coastal out to 150 miles, from Cape Hatteras, NC to the Southern tip of Florida.	Coastal out to 150 miles, from Cape Hatteras, NC to the Southern tip of Florida.
Hull Value		Market Value: $425,000, Replacement Value: $850,000
Most Recent Survey Report		December 1995

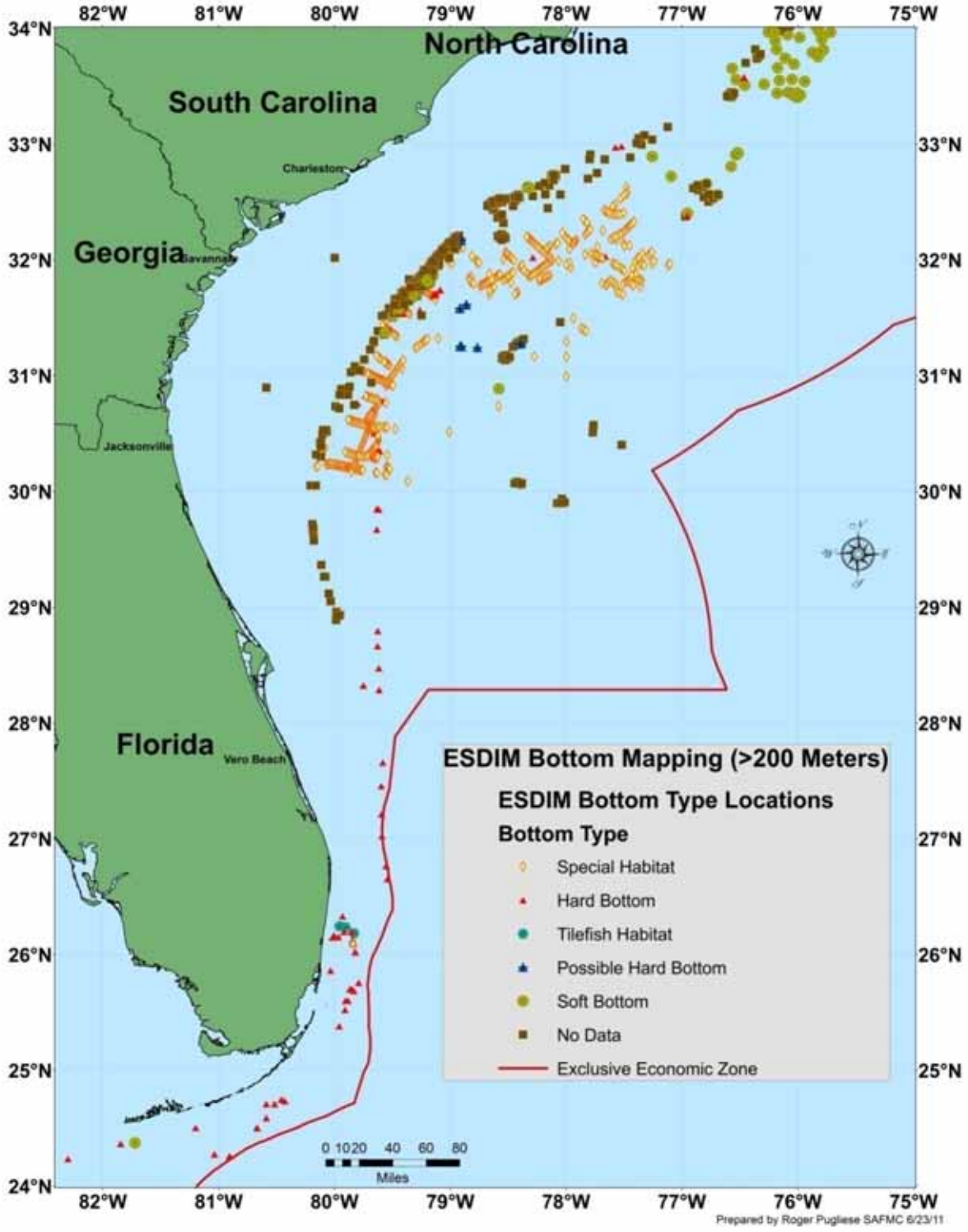
APPENDIX K. SOUTH ATLANTIC BOTTOM MAPPING PRIORITY AREAS

Figure 1. Existing managed areas



Figures 2 a & b. SEAMAP Bottom mapping data <200m and Earth System Data and Information Management (ESDIM) Bottom mapping data




82°W
81°W
80°W
79°W
78°W
77°W
76°W
75°W
34°N
33°N
32°N
31°N
30°N
29°N
28°N
27°N
26°N
25°N
24°N
North Carolina
South Carolina
Georgia
Florida
Charleston
Savannah
Jacksonville
Vero Beach
ESDIM Bottom Mapping (>200 Meters)
ESDIM Bottom Type Locations
Bottom Type
Special Habitat
Hard Bottom
Tilefish Habitat
Possible Hard Bottom
Soft Bottom
No Data
Exclusive Economic Zone
0 10 20 40 60 80
Miles
Prepared by Roger Pugliese SAFMC 6/23/11

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