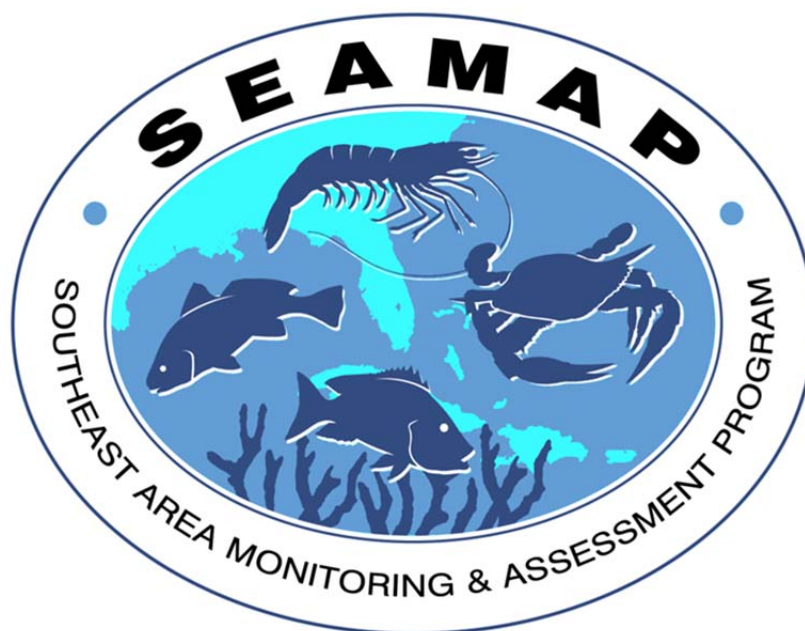


2016-2020 MANAGEMENT PLAN



**COLLECTION, MANAGEMENT, AND DISSEMINATION OF
FISHERY-INDEPENDENT DATA FROM THE WATERS OF THE
SOUTHEASTERN UNITED STATES**

**Prepared by
Shanna Madsen, Atlantic States Marine Fisheries Commission
South Atlantic SEAMAP Committee
Gulf of Mexico SEAMAP Committee
Caribbean SEAMAP Committee**

**Prepared for
Caribbean SEAMAP Committee
South Atlantic State-Federal Fisheries Management Board,
Atlantic States Marine Fisheries Commission
Technical Coordinating Committee, Gulf States Marine Fisheries Commission**

**Funding for preparation of this plan was provided by the U.S. Department of
Commerce, NOAA, National Marine Fisheries Service under Cooperative Agreement
Number NA16NMF4350112.**



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 2015, in the South Atlantic and Gulf region alone, commercial fishers landed over 1.6 billion pounds of seafood worth almost \$1 billion¹. In the same year, recreational anglers across all three regions landed at least 105 million pounds of fish². Recreational fishing is a growing industry in the SEAMAP region, where over 4.2 million U.S. recreational anglers³ took over 38 million fishing trips in 2015⁴.

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, requires 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 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. Concomitantly,

¹ Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division [11/7/2016] <https://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings/index>

² Sum weight of harvest A+B1.

³ Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division. [11/7/2016] <http://www.st.nmfs.noaa.gov/st1/recreational/queries/>

⁴ Sum MRIP Trips in Mode Area.

survey costs continue to increase, especially given the need for new data to assess the status of emerging fisheries and transition to ecosystem-based fishery management. 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.

Ted Switzer
Chair
SEAMAP-Gulf of Mexico

Roger Pugliese
Chair
SEAMAP-South Atlantic

Jonathan Brown
Chair
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 workgroups. The committees would like to thank all of the workgroup members for their efforts. In addition, the committees would like to thank the following: Jeff Rester (GSMFC), Shanna Madsen (ASMFC), and Edgardo Ojeda (UPRSGCP) for their work as coordinators; 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 Eric Hoffmayer 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.

SEAMAP COORDINATING AGENCIES



Eric Hoffmayer- SEAMAP Program Manager
NOAA / NMFS Mississippi Laboratory
P.O. Box 1207
Pascagoula, MS 39568-1207

Phone: (228) 762-4591
Fax: (228) 769-9200
www.nmfs.noaa.gov



SEAMAP South Atlantic Coordinator
Atlantic States Marine Fisheries Commission
1050 N. Highland St., Suite 200 A-N
Arlington, VA 22201

Phone: (703) 842-0740
Fax: (703) 842-0741
www.asmfc.org



SEAMAP Gulf Coordinator
Gulf States Marine Fisheries Commission
2404 Government Street
Ocean Springs, MS 39564-0726

Phone: (228) 875-5912
Fax: (228) 875-6604
www.gsmfc.org



SEAMAP Caribbean Coordinator
University of Puerto Rico
Sea Grant College Program
UPRM P.O. Box 9011
Mayagüez, PR 00681

Phone: (787) 832-3585
Fax: (787) 265-2880
<http://seagrantspr.org/>

SEAMAP Partners

Alabama Department of Conservation and Natural Resources (ADCNR)
Florida Fish and Wildlife Research Institute (FWRI)
Georgia Department of Natural Resources (GA DNR)
Gulf Coast Research Laboratory (GCRL)
Gulf of Mexico Fishery Management Council (GMFMC)
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 (SAFMC)
South Carolina Department of Natural Resources (SC DNR)
Texas Parks and Wildlife Department (TPWD)
US Fish and Wildlife Service (USFWS)
Puerto Rico Department of Natural and Environmental Resources (PR-DNER)
U.S. Virgin Islands Department of Planning and Natural Resources (USVI-DPNR)
Caribbean Fishery Management Council (CFMC)
University of Puerto Rico, Sea Grant College Program (UPRSGCP)

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

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

ABBREVIATIONS AND ACRONYMS

ACL	annual catch limits	NOAA	National Oceanic and Atmospheric Administration
AM	accountability measures	PR	Puerto Rico
ASMFC	Atlantic States Marine Fisheries Commission	PR-DNER	Puerto Rico Department of Natural and Environmental Resources
BRD	bycatch reduction device	SAB	South Atlantic State-Federal Fisheries Management Board
CFMC	Caribbean Fishery Management Council	SAFIMP	South Atlantic Fishery-Independent Monitoring Program workshop
COASTSPAN	Cooperative Atlantic States Shark Pupping and Nursery	SAFMC	South Atlantic Fishery Management Council
CPUE	catch per unit effort	SC DNR	South Carolina Department of Natural Resources
CSC	Coastal Sciences Center	SEAMAP	Southeast Area Monitoring and Assessment Program
DOC	Department of Commerce	SEAMAP-C	Southeast Area Monitoring and Assessment Program-Caribbean
EEZ	exclusive economic zone	SEAMAP-SA	Southeast Area Monitoring and Assessment Program-South Atlantic
EFH	essential fish habitat	SECOORA	Southeast Coastal Ocean Observing Regional Association
FMP	fishery management plan	SEDAR	SouthEast Data, Assessment, and Review
FSCS	Fisheries Scientific Computer System	SEFIS	SEFSC Southeast Fishery-Independent Survey (SEFIS)
FRL	Fisheries Research Laboratory (Caribbean)	SEFSC	Southeast Fisheries Science Center
FWRI	Florida Wildlife Research Institute	SERFS	Southeast Reef Fish Survey
GA DNR	Georgia Department of Natural Resources	SERO	Southeast Regional Office (NOAA Fisheries)
GIS	Geographic Information System	SERTC	Southeastern Regional Taxonomic Center
GMFMC	Gulf of Mexico Fishery Management Council	USFWS	U.S. Fish and Wildlife Service
GSMFC	Gulf States Marine Fisheries Commission	USVI-DPNR	U.S. Virgin Islands Department of Planning and Natural Resources
GSMFC-TCC	Gulf States Marine Fisheries Commission-Technical Coordinating Committee	UPRSGCP	University of Puerto Rico Sea Grant College Program
HMS	highly migratory species		
LNG	liquefied natural gas		
MARMAP	Marine Resources Monitoring, Assessment and Prediction Program		
MSRA	Magnuson-Steven Fishery Conservation and Management Reauthorization Act		
NC DMF	North Carolina Division of Marine Fisheries		
NFWF	National Fish and Wildlife Federation		
NMFS	National Marine Fisheries Service (also referred to as NOAA Fisheries)		

EXECUTIVE SUMMARY

The SEAMAP 2016-2020 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, and detailed 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 U.S. Fish and Wildlife Service (USFWS), and the National Marine Fisheries Service (NMFS) jointly plan and conduct surveys of economically important fish and shellfish species and the critical habitats that support them.

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 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 databases. Additional roles of SEAMAP are to document long- and short-term needs for fishery-independent data to meet 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 (1981), SEAMAP-South Atlantic (1983), and SEAMAP-Caribbean (1988). Each SEAMAP component operates independently, planning and conducting surveys specific to the 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 and in answering important ecological questions, 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, and Atlantic Reef Fish Surveys; Gulf 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 and 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 of fish, crustaceans, mollusks, and other species (Caribbean, Gulf and Atlantic Reef Fish Surveys, Gulf and South Atlantic Trawl Surveys).



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 (Gulf and South Atlantic Trawl Surveys).



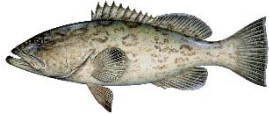
Surveying hypoxia in the Gulf of Mexico that continues to threaten the marine resources of Louisiana and adjacent states (Summer Trawl Survey).



Estimating finfish bycatch in the shrimp fisheries of the Gulf and South Atlantic, supporting bycatch reduction device regulations.



Evaluating community structure and trophic interactions in the various regions to assist in development of ecosystem models and support the transition to ecosystem-based management.



Collecting bottom habitat and snapper grouper species information, supporting designation of essential fish habitat and the establishment of deepwater marine protected areas in the South Atlantic.



Contributing 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. They are prioritized 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 FY2015 for SEAMAP was \$5,125,000 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. Operate existing programs at full utilization:** In recent years, SEAMAP activities have been impacted by stagnating and declining funding to the core surveys. SEAMAP activities have been reduced across sea days and stations while entire survey components have been eliminated. Additionally, survey costs will continue to increase over time. In order to bring SEAMAP activities back to full utilization, funding will need to be restored and increased.
- II. Expand current projects to collect additional data on existing platforms:** 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:** Additional identified priorities include fishery-independent surveys targeting adult finfish, plankton, crustaceans, identification/mapping of existing live bottom and other essential fish habitat

(EFH), 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 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. Additionally, SEAMAP plankton data served as the sole data source when investigating 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 assessments 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 2016-2020 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.

TABLE OF CONTENTS

PREFACE	i
ACKNOWLEDGMENTS	iii
SEAMAP COORDINATING AGENCIES	iv
SEAMAP Partners	v
SEAMAP Collaborations	v
ABBREVIATIONS AND ACRONYMS	vi
EXECUTIVE SUMMARY	2
TABLE OF CONTENTS	6
Chapter 1. SEAMAP MISSION	8
INTRODUCTION	8
PROGRAM MISSION AND GOALS	10
Chapter 2. PROGRAM ORGANIZATION AND MANAGEMENT	14
PROGRAM ORGANIZATION	14
Program Component Structure	15
Program Responsibilities	17
Program Coordination	22
PLANNING DOCUMENTATION	25
PROGRAM FUNDING AND BUDGET MANAGEMENT	25
Program Funding	25
Budget Policies	26
Budget Priorities	27
Budget Planning	27
PROGRAM REVIEW AND EVALUATION	28
Regional Program Evaluation	29
External Reviews	29
Chapter 3. SEAMAP ACCOMPLISHMENTS	30
RESOURCE SURVEYS	30
GULF OF MEXICO	31
SOUTH ATLANTIC	40
CARIBBEAN	50
SPECIMEN ARCHIVING	54
DATA MANAGEMENT AND INFORMATION DISSEMINATION	56
Chapter 4. EXPANDING AND MAINTAINING SEAMAP ACTIVITIES	59
I – OPERATE EXISTING PROGRAMS AT FULL UTILIZATION	60
I – Gulf of Mexico	60
I – South Atlantic	60
I – Caribbean	63
II – EXPAND CURRENT PROJECTS TO COLLECT ADDITIONAL DATA ON EXISTING PLATFORMS	63
II – Gulf of Mexico	63
II – South Atlantic	65
II – Caribbean	68
III – DEVELOP NEW FISHERY INDEPENDENT DATA COLLECTION PROGRAMS	69
III – Gulf of Mexico	69
III – South Atlantic	70
III – Caribbean	73
APPENDIX A – SEAMAP Committees Membership 2015	75
APPENDIX B – SAFMC Research Priorities 2015-2019	76
APPENDIX C – GMFMC Research Priorities 2015-2019	79
APPENDIX D – ASMFC Research Priorities 2013	89
APPENDIX E – SEDAR Schedule	91

APPENDIX G – SEAMAP Specimen Archiving.....	103
APPENDIX H – Documents Produced by SEAMAP	106
APPENDIX I – Bottom Mapping Priority Areas	108

Chapter 1. SEAMAP MISSION

INTRODUCTION

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

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 do 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 2015-2019 (Appendices 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 priority snapper-grouper species. The Atlantic States Marine Fisheries Commission's (ASMFCs) 2013 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, blacktip shark, yellowedge grouper, greater amberjack, gag grouper, red grouper, grey triggerfish, and Spanish mackerel in the Gulf of Mexico; rock shrimp, red drum, Atlantic croaker, red snapper, black sea bass, spot, southern flounder, and Atlantic menhaden in the South Atlantic; and queen conch, spiny lobster, yellowtail snapper, whelk, parrotfish, and red hind in the Caribbean (see "Recent Data Uses" sections 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. SEAMAP data have been used in SEDAR stock assessments and assessment updates for over 30 species, including snappers, groupers, sea bass, menhaden, and sharks (see Appendix E for assessment schedule).

All directives, policies, and procedures presented in this SEAMAP five-year plan, and subsequent annual operations plans, supersede those set forth previously. Also included in this plan are descriptions of resource surveys and their data uses (Chapter 3) as well as proposed activities (Chapter 4) that restore the surveys which have impacted by decreased and stagnant funding as well as build upon the existing base program and, as such, will be dependent on the availability of additional funding.

Since its establishment, SEAMAP has developed datasets 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 (FMPs) and EFH 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 for use by the SAFMC to define EFH. 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.

PROGRAM MISSION AND GOALS

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 commercial and recreational fishing industries, 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.

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

Gathering and disseminating information are long-term goals of SEAMAP, as fisheries management is a dynamic function which continually requires 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 a long-term time series of data.

No single fishery management agency has the resources to meet the objectives of existing state, interstate, and federal FMPs 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 FMP development in the southeast region.

Goal 1: Collect and analyze data on economically and ecologically important species and their essential habitats to support stock assessments and management needs with emphasis on ecosystem-based management data requirements

Objectives:

- X Conduct routine surveys and special studies, as needed, of regional resources and their environments
- X Obtain, process, and archive, as appropriate, biological specimens and samples
- X Obtain data, such as environmental and bottom-mapping data, from other agencies and organizations in order to plan and conduct SEAMAP activities
- X Develop partnerships with governmental and non-governmental organizations to improve acquisition of fishery-independent data for the Southeast region
- X Collect data on priority species to support stock assessments and other evaluations
- X Collect information on species habitat use at different life stages to support evaluation and refinement of Essential Fish Habitat and Habitat Areas of Particular Concern designations

Goal 2: Optimize fishery-independent survey activities and enhance coordination between surveys in the region

Objectives:

- X Develop and evaluate sampling systems and procedures needed for SEAMAP surveys and special studies
- X Standardize and calibrate sampling systems and procedures used in SEAMAP surveys and special studies
- X Sponsor special workshops and symposia to help evaluate or plan sampling strategies, design, or methods
- X Cooperatively plan activities with representatives of foreign governments

- X Work with existing partner state and federal surveys to identify areas of overlap as well as deficiencies in sampling and data
- X Develop an annual operations plan for each SEAMAP component (Gulf, South Atlantic, Caribbean) consistent with budget and operational constraints that considers data needs of the region
- X Sponsor individual and joint meetings of the SEAMAP components to cooperatively plan and evaluate activities

Goal 3: Identify and prioritize long- and short-term needs for fishery-independent data to meet current and future critical management and research needs

Objectives:

- X Maintain and develop new partnerships with governmental and non-governmental organizations to increase knowledge of fishery-independent and associated ecological data needs for the Southeast region
- X Serve as liaisons in various governmental and non-governmental organizations and committees to gain a more comprehensive understanding of data needs in the Southeast region
- X Conduct periodic coordinated external reviews of specific management, administrative, and technical elements of the program to ensure that critical data needs are being met
- X Develop a 5-year management plan for SEAMAP that makes recommendations on how to expand current or create new surveys to fill gaps in the data requirements for species assessments or management

Goal 4: Maximize the accessibility and coordination of fishery-independent survey data

Objectives:

- X Design, implement, upgrade, and maintain SEAMAP data management systems that can be used to store information used to assess and monitor selected living marine resources and associated environmental and habitat factors and ensure that SEAMAP data are protected and archived
- X Establish data handling and processing protocols for all SEAMAP data
- X Compile and maintain a computerized directory of SEAMAP monitoring activities, including data summaries and inventories by gear, species, species-group, and geographic areas
- X Create geographic information systems (GIS) and metadata products for priority species' abundance, distribution (by life stage), and habitat (such as essential fish habitat) served through an internet mapping application

- X Coordinate and integrate, when feasible, the SEAMAP data management support systems (Gulf of Mexico, South Atlantic, Caribbean) with non-SEAMAP databases
- X Make data and results from analyses available to stock assessment teams in an accessible format in support of assessing the status of the resources
- X Coordinate and document SEAMAP administrative functions, information dissemination, the SEAMAP data management systems, archiving centers, and data collection by SEAMAP participants
- X 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
- X Maintain partnerships with governmental and non-governmental organizations to improve dissemination and utilization of SEAMAP fishery-independent and ecological data

Chapter 2. PROGRAM ORGANIZATION AND 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

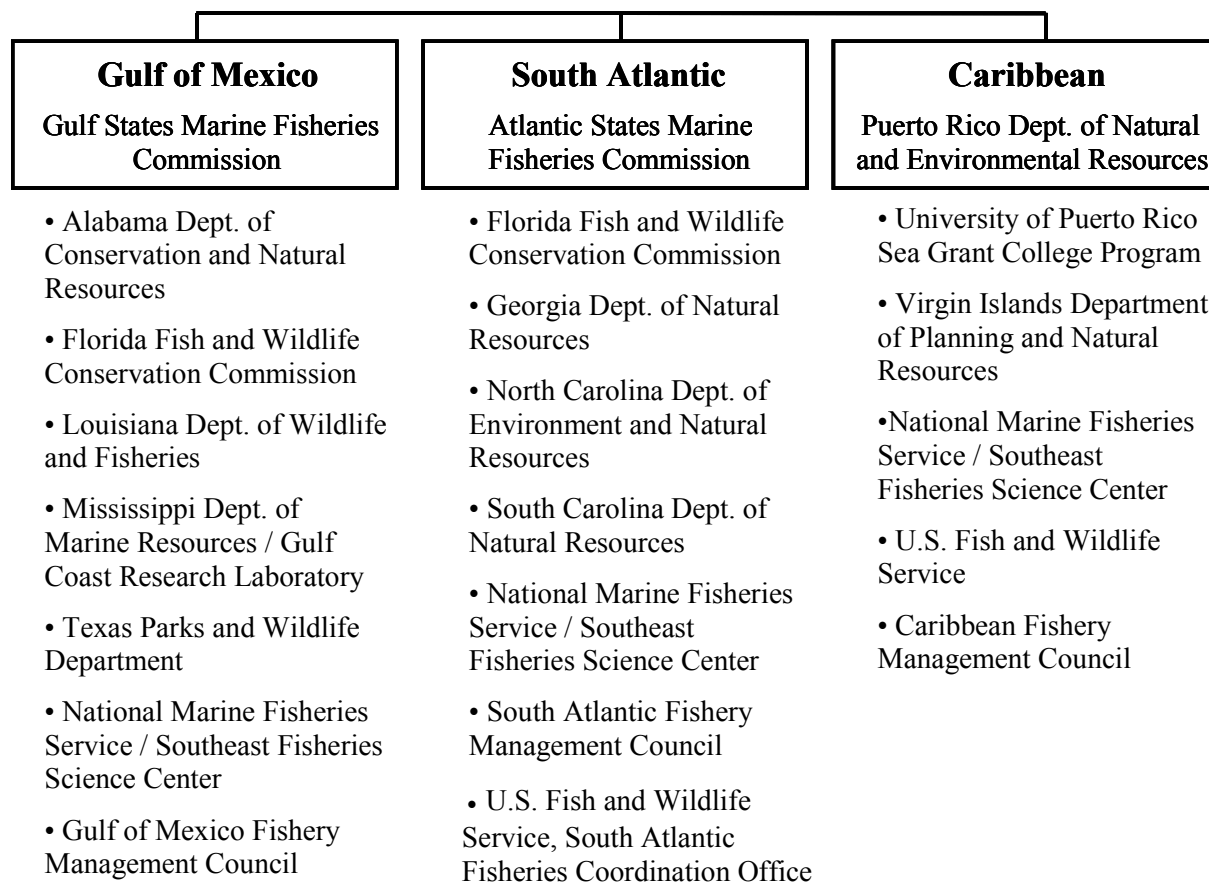
- X Resource surveys
- X Sampling gear assessment and standardization
- X Data management
- X Dissemination of SEAMAP-derived information
- X Survey methodology workshops

Management

- X Program and operations planning and administration
- X Program evaluation

The activities for each element are performed by the structural bodies of each component, which are also similar in organization.

SEAMAP Organization



Program Component Structure

SEAMAP-Gulf

SEAMAP-Gulf of Mexico (SEAMAP-Gulf) is administered by the SEAMAP Subcommittee of the Gulf States Marine Fisheries Commission's Technical Coordinating Committee (GSMFC-TCC). The committee membership consists of one representative from each of the five participating Gulf states and representatives from the Gulf States Marine Fisheries Commission (GSMFC) 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 Subcommittee. The coordinator is employed on a yearly basis, subject to review by the subcommittee, subcommittee chair, and executive director.

In addition to the standing management agency (GSMFC), management body (TCC), and subcommittee, workgroups are established by the Subcommittee as needed to address specific issues. Workgroups 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, Longline, Vertical Line, and Adult Finfish Workgroups are all currently functioning in the Gulf component.

SEAMAP-South Atlantic

SEAMAP-South Atlantic (SEAMAP-SA) 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-SA are reviewed 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-SA 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-SA coordinator, an employee of the ASMFC, funded wholly or in part by SEAMAP. The SEAMAP-SA coordinator receives assistance from the ASMFC office and technical guidance from the committee. Workgroups may be established in addition to the standing management agency (ASMFC), management body (SAB), and committee (SEAMAP-SA Committee). Current workgroups established by the committee include the Data Management, Habitat Characterization and Fish Assessment, and the Crustacean Workgroups. The Coastal Trawl Survey and the Coastal Longline Survey Workgroups provide guidance to their respective surveys.

SEAMAP-Caribbean

SEAMAP-Caribbean (SEAMAP-C) is administered currently by the University of Puerto Rico Sea Grant College Program (UPRSGCP). Due to differences in political entities, the SEAMAP-C 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 (PR-DNER), U.S. Virgin Islands Department of Planning and Natural Resources (USVI-DPNR), UPRSGCP, USFWS, SEFSC, and the Caribbean Fishery Management Council (CFMC). The SEAMAP-C 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. Workgroups may be established in addition to the committee. Currently, the Reef Resources Workgroup coordinates the sampling strategies of reef fish, spiny lobster, queen conch, whelk, habitat assessment, and bottom mapping.

Current SEAMAP Workgroups

Gulf Subcommittee	South Atlantic Committee	Caribbean Committee
<ul style="list-style-type: none"> • Plankton • Shrimp/Groundfish • Environmental Data • Data Coordinating • Adult Finfish • Reef Fish • Longline • Vertical Line 	<ul style="list-style-type: none"> • Habitat Characterization and Fish Assessment • Crustacean • Data Management • Coastal Trawl Survey • Coastal Longline Surveys 	<ul style="list-style-type: none"> • Reef Resources • Environmental Data • Queen Conch • Spiny Lobster

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:

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

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:

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

Committee Organization and Responsibilities

Each program component is managed by its 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 South Atlantic, Gulf, and Caribbean SEAMAP committees, and may serve an unlimited number of one-year terms. 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:

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

- X Work closely with the committee chair in all aspects of program coordination, administration, and operation;
- X Implement plans and program directives developed by the committee and approved by the management body;
- X Coordinate committee meetings and recommend appropriate agendas;
- X Serve as information liaison between the committee and the oversight agency, participants, and organizations interested in SEAMAP activities;
- X Submit preliminary administrative budget recommendations and assist the committee with preparation of the budget;
- X Prepare or supervise preparation of selected SEAMAP publications;
- X Distribute approved SEAMAP information in accordance with committee policies and procedures;
- X Assist in representing the program to the community through public educational activities;
- X Assist in the identification of regional needs that can be satisfied by SEAMAP activities;
- X Maintain a file of all reports and publications which relied on SEAMAP data or SEAMAP specimens, and provide an annual listing to the committee; and
- X Prepare the annual report to the oversight body.

Workgroup Organization and Responsibilities

Workgroups are established by a committee to address specific issues or accomplish specific objectives. Directives to a workgroup may include:

- X Plan approved surveys;
- X Evaluate surveys;
- X Generate an appropriate sampling design;
- X Develop a data format compatible with the SEAMAP Data Management System;
- X Estimate costs and related needs associated with SEAMAP activities in accordance with a specific schedule;

X Develop a schedule for processing collected data and samples and recommending persons or agencies that will be responsible for accomplishing this work.

Members of workgroups are appointed by the respective committee and are generally not members of that committee. Members may be drawn from universities, state and federal marine resource agencies, and the fishing industry in order to obtain the best scientific advice. Workgroup leaders may be elected by the workgroup or appointed by the committee at the committee's discretion. When elected, leaders are subject to approval by the committee and are responsible for preparing a written report to the respective committee after each workgroup meeting. Upon the completion of specific tasks assigned to the workgroup by its appointing committee, the workgroup may be disbanded by the committee or, depending upon the objectives assigned to the workgroup, 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 ensuring proper program documentation by the respective components, especially cooperative agreements and cooperative agreement amendments. These documents must be complete, accurate, and submitted on time 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 is essential to the cooperative approach of the program. Cooperators include persons or organizations actively involved in SEAMAP operations, such as workgroup 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 workgroups, 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 workgroups. As cooperators, university investigators are often invited to officially participate in functions of SEAMAP, such as committee and workgroup 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 the commercial and recreational fishing industries 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 workgroups or state/interstate fisheries managers) identify a topic of concern where data are either missing or insufficient for stock assessment and/or fishery management purposes.
- The appropriate SEAMAP workgroup(s) discusses the issue and begins developing methods to address 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 workgroup 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 ongoing projects. If approved, the 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 the National Oceanic and Atmospheric Administration (NOAA) for funding.
- Once established, the survey principals will provide annual updates. If the survey is long-term, it may undergo occasional peer review to ensure data collection methods and sampling remain 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

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: Fisheries Independent Monitoring

Mississippi Department of Marine Resources: Fisheries Independent Monitoring

Gulf Coast Research Laboratory: Fisheries Independent Monitoring

Louisiana Department of Wildlife and Fisheries: Fisheries Independent Monitoring

Texas Parks and Wildlife Department: Fisheries Independent Monitoring

Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute (FWRI): Fisheries Independent Monitoring

South Carolina Department of Natural Resources (SC DNR): Fisheries Independent Monitoring.

Collaborations

The coordinated efforts of data collection and management are invaluable for providing stock assessment teams and resource managers with consistent high quality data. Centralized data management also provides an efficient quality control mechanism and can serve as a vehicle to easily update data when new information becomes available. 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. Through the input the program receives on fishery-independent sampling from multiple state agencies' collaborations with federal agencies, SEAMAP programs represent partnerships in the truest sense of the word. As SEAMAP surveys are implemented and methodologies approved by the committees and workgroups of each component, those surveys 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 of Mexico, SEAMAP's partnership with the states of Florida, Alabama, Mississippi, Louisiana, and Texas has led 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 datasets 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 enables efficient data integration.

In the South Atlantic, SEAMAP's mission is carried out as a cooperative effort between USFWS, NOAA Fisheries, SAFMC, 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 were carried out entirely by the SC DNR MARMAP Program, until SEAMAP-SA began cooperative efforts in 2009 via the Habitat Characterization and Fish Assessment Workgroup. Beginning in 2010, the Southeast Fishery Independent Survey (SEFIS) was established at the NOAA Beaufort Laboratory (NC) to work cooperatively with MARMAP and SEAMAP-SA Reef Fish Surveys to enhance fishery-independent sampling efforts in South Atlantic waters. SEAMAP-SA and SEFIS have adopted many of the MARMAP sampling protocols and staff were cross-trained in sampling methods, sample processing, and data management. This comprehensive approach means that new data can be integrated into the long-term dataset without compromising the integrity of the existing information and analyses. Currently, the three reef fish surveys (MARMAP, SEAMAP-SA, and SEFIS) are integral partners in the fishery-independent data collection for the snapper/grouper management complex in the Southeast region, now called the Southeast Reef Fish Survey (SERFS). Relative abundance (index) and life history information acquired through these monitoring efforts are an essential part of the assessment process. Data and analyses are provided to various stock assessment teams and South Atlantic partner staff have participated in assessment workshops and contributed to the assessment reports. Data from the reef fish survey has been included in the SEAMAP-SA Oracle database and made available to third parties such as NMFS assessment teams, academic institutions, and state agencies.

In the Caribbean, the SEAMAP fisheries independent sampling program has been made possible thanks to an effective partnership among the US Virgin Islands and Puerto Rico districts, represented by the VI DPNR/DFW, and the PRDNER. Special collaboration has been received from the PR-Fisheries Research Laboratory during all the PR reef fish and the VI parrotfish gonads samples processing for the reproduction analysis. The University of Puerto Rico's Sea Grant College Program as the coordinator of the Caribbean Program. Some queen conch survey has been conducted by the Department of Marine Sciences and quality control including preliminary data analysis providing close professional help to the program. The UVI has also been providing collaboration to SEAMAP-C during the hydroacoustic Spawning Aggregations surveys conducted at two of the main fish SPAG's known at the USVI, the MCD and the Hind Bank. Clear sampling protocols have been produced for both PR and VI districts through close collaboration of NMFS and the CFMC. SEAMAP-C has been collaborating with the University of South Carolina (MARFIN) while providing fish hard parts for age and growth studies of several reef fish species, and with the Virginia Institute of Marine Sciences providing parrotfish samples.

SEAMAP constituent groups are also developing cooperative efforts with groups such as the Southeast Coastal Ocean Observing Regional Association (SECOORA) to obtain oceanographic

data and multi-beam bottom mapping and habitat data that can be linked to species' distribution data. SEAMAP is positioned to provide information on the distribution, status, and habitat of the South Atlantic to regional partners in collaborations and to support ecosystem-based management and marine spatial planning. Developing partnerships in the region include, but are not limited to, SECOORA, South Atlantic Landscape Conservation Cooperative, and regional fish habitat partnerships including the Southeast Aquatic Resource Partnership and the Atlantic Coastal Fish Habitat Partnership (ACFHP).

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 workgroups, 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)
2010	\$2,068,331	\$1,647,653	\$525,847	\$848,234	\$5.090
2011	\$2,068,352	\$1,641,091	\$508,688	\$838,816	\$5.082
2012	\$1,987,969	\$1,577,049	\$488,837	\$998,561	\$5.052
2013	\$1,827,372	\$1,455,703	\$464,586	\$676,968	\$4.425

2014	\$2,003,011	\$1,595,619	\$509,240	\$742,036	\$4.850
2015	\$1,808,677	\$1,440,811	\$459,833	\$670,043	\$4.379

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. Please see Appendix F for a full history of the SEAMAP budget.

While SEAMAP's Congressional appropriation has increased since 2013, the amount available for collecting valuable fishery-independent data has actually decreased for a variety of reasons. Taxes and assessments on SEAMAP's budget now constitute almost 16% of the total SEAMAP appropriation. Taxes and assessments were only 5% in FY2014. SEAMAP has used other funding sources to help gather critical fishery-independent data, but these external funding sources cannot continue to support future SEAMAP sampling. Several states in the Gulf of Mexico have received National Fish and Wildlife Federation (NFWF) grants from NFWF's Gulf Environmental Benefit Fund related to the 2010 Deepwater Horizon oil spill. These SEAMAP partners use the grants to supplement SEAMAP funding and add days at sea to existing SEAMAP surveys or to wholly participate in surveys where SEAMAP funding limitations do not allow them to participate. NFWF supports approximately \$4 million in SEAMAP related fishery-independent data collection in the Gulf of Mexico. Over the next several years, NFWF grants will be running out and future data collection will be lost unless SEAMAP receives increased funding. State partners have also contributed approximately \$500,000 to SEAMAP data collection activities. With limited state budgets, state partners cannot continue to support SEAMAP in this way. These budget constraints have impacted days at sea, the number of stations sampled, and therefore the amount of fishery-independent data collected. In addition, with increasing vessel and personnel costs each year, even level funding leads to cuts in data collection.

	FY2013	FY2014	FY2015	FY2016
Congressional Appropriation	\$4,779,000	\$5,117,000	\$5,125,000	\$5,125,000
Amount to SEAMAP	\$4,424,629	\$4,849,906	\$4,379,364	\$4,313,068

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.

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, workgroups, 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 ageing structures, gonads, and stomachs for diet);
- (6) Special surveys;
- (7) Unsorted specimen archives; and
- (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 review. 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, workgroups, 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 application of SEAMAP data by each resource survey.

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 online. A few of the most important applications to date are:

- Determining year-to-year trends in abundance
- Setting seasonal openings and allowable biological catch levels
- Evaluating existing management actions
- Evaluating proposed management actions
- Designating essential fish habitat and habitat areas of particular concern
- Estimating and monitoring bycatch
- Obtaining basic biological data
- Supporting marine spatial management
- Providing a baseline resource for damage assessment
- Providing baseline species and habitat distribution information for environmental assessments and impact statements
- Establishing and monitoring marine protected areas

RESOURCE SURVEYS

Resource surveys encompass both short- and long-term surveys of fisheries resources and their environments. Although long-term databases 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 to address 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. Following each survey description, a chart of recent data uses is provided. This list is by no means intended to be exhaustive, but recent SEAMAP data applications are highlighted.

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 abundance and distribution estimates 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 61cm nets with 333-micron mesh. Tows are oblique, surface to near bottom (or 200m), 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 600m³, but is typically 30 to 40m³ at the shallowest stations and 300 to 400m³ at the deepest stations. A single or double 2x1m pipe frame neuston net, fitted with 0.947mm 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, as they tend to congregate along these boundaries. 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 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.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2014	Bluefin Tuna	x	x		ICCAT Stock Assessment	https://www.iccat.int/en/Assess.htm
2014	Skipjack Tuna	x	x		ICCAT Stock Assessment	https://www.iccat.int/en/Assess.htm

Bottom Longline Survey

Objectives

The Inshore Bottom Longline Survey began in 2007, complementing an existing long-term fishery-independent longline survey currently conducted by NMFS. The Bottom 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

Sampling occurs during three seasons: spring (April-May), summer (June-July), and fall (August-September). Sampling is conducted in waters defined by the 3-10m depth contour. NMFS Statistical Zones are used as guides to ensure effective distribution of sampling effort. Stations are proportionally allocated and randomly distributed within the 3-10m depth contour in each statistical zone based on the proportion of those depths present. Since the 3-10m depth strata is smaller in some statistical zones relative to other statistical zones, each statistical zone is allocated at least two stations during each season in order to ensure adequate sampling coverage. Partners usually survey the stations that occur off their state boundaries for each season. All species are measured, tagged, and returned to the water alive when possible. The longline gear consists of 1 mile of 426kg test monofilament mainline with 100 baited (*Scomber scomber*) #15/0 circle hooks with 3.7m gangions of 332kg 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. The data are used in stock assessments for coastal sharks and finfish.

Optimization of Present Sampling

The Bottom Longline 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.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2012	Blacktip Shark	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-29
2013	Sharnose Shark	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-34-final-stock-assessment-report-atlantic-sharnose-shark

Vertical Longline Survey

Objectives

The primary purpose of the SEAMAP Vertical Longline Survey is to characterize the spatial and temporal distribution, indices of abundance, and age and size distribution of commercially and recreationally important reef fish species by habitat type and depth strata in the coastal waters of the Gulf of Mexico and the adjoining EEZ. Fishery-independent data characterizing population dynamics of fish assemblages on non-structured and structured bottom habitats (e.g. natural hard bottom and artificial structures) in offshore waters are also obtained.

Survey Design

All partners use three 22ft backbones containing ten 18in gangions outfitted with either an 8/0, 11/0 or 15/0 circle hook (each backbone has only one hook size), and terminating in a 10lb lead weight. Three bandit reels deploy the gear simultaneously on or near a reef structure and, once locked in at depth, are allowed to fish for 5 minutes. All bandit reels then retrieve the lines simultaneously. Catch data are collected once the lines are on board. Environmental data is collected upon completion of fishing at each station. Stations are randomly selected within three depth zones (10-20m, 20-40m, and from 40-150m) with effort allocated among five habitat types.

Optimization of Present Sampling

The Vertical Line 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.

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 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 51cm above the bottom of the array. A chevron fish trap that measures 1.76m x 1.52m x 0.61m; 28cm throat diameter; 3.81cm vinyl-clad 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 40 minutes, and the fish trap soaks for 60 minutes. 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 110m 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 100m², 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 NMFS Panama City started sampling an additional 75 stations in the Florida panhandle in 2005, and 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.

Optimization of Present Sampling

The Reef Fish 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.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2005	Red Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-7
2006	Vermillion Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-09-stock-assessment-report-gulf-mexico-vermillion-snapper
2006	Greater Amberjack	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-09-stock-assessment-report-gulf-mexico-greater-amberjack
2006	Gray Triggerfish	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-09-stock-assessment-report-gulf-mexico-gray-triggerfish
2006	Gag Grouper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-10-stock-assessment-report-gulf-mexico-gag-grouper
2006	Red Grouper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-12
2008	Mutton Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-15a
2013	Red Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-31
2014	Gag Grouper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-33-stock-assessment-report-gulf-mexico-gag-grouper
2014	Greater Amberjack	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-33-stock-assessment-report-gulf-mexico-greater-amberjack
2015	Red Grouper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-42
2015	Gray Triggerfish	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-43
2016	Vermillion Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-45
ongoing	Almaco Jack, Lane Snapper, Lesser Amberjack, Snowy Grouper, Speckled Hind	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-49

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 400 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 60ftm.

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 40ft trawl net.

Trawls are towed perpendicularly to the depth contours for 30 minutes. 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.

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 in current fisheries management, understanding predator/prey interactions, and developing ecosystem-based fisheries management.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2005	Red Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-7
2006	Vermillion Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-09-stock-assessment-report-gulf-mexico-vermilion-snapper
2006	Gray Triggerfish	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-09-stock-assessment-report-gulf-mexico-gray-triggerfish
2007	Small Coastal, Atlantic Sharpnose, and Bonnethead Sharks	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-13
2011	Blacknose Shark	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-21-final-stock-assessment-report-hms-gulf-mexico-blacknose-shark
2013	Red Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-31
2013	Atlantic Sharpnose Shark	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-34-final-stock-assessment-report-atlantic-sharpnose-shark
2015	Smoothhound Sharks	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-39-final-stock-assessment-report-hms-gulf-mexico-smoothhound-shark-complex
2015	Red Grouper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-42
2013	Spanish Mackerel	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-28-stock-assessment-report-gulf-mexico-spanish-mackerel
2014	King Mackerel	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-38-final-stock-assessment-report-gulf-mexico-king-mackerel
2015	Gray Triggerfish	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-43
2016	Vermillion Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-45
ongoing	Lane Snapper, Wenchman	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-49
2009-2016	White, Brown, and Pink Shrimp	x	x		Shrimp Stock Assessment	http://www.galvestonlab.sefsc.noaa.gov/publications/

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 61cm nets with 333-micron mesh. Tows are oblique, surface to

near bottom (or 200m) 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 600m³, but is typically 30 to 40m³ at the shallowest stations and 300 to 400m³ at the deepest stations. A single or double 2x1m pipe frame neuston net fitted with 0.947mm 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.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2005	Red Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-7
2006	Vermillion Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-09-stock-assessment-report-gulf-mexico-vermillion-snapper
		x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-09-stock-assessment-report-gulf-mexico-gray-triggerfish
2009	King Mackerel	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-16
2013	Red Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-31
2014	King Mackerel	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-38-final-stock-assessment-report-gulf-mexico-king-mackerel
		x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-45

Fall Shrimp/Groundfish Survey

Objectives

The SEAMAP Fall Shrimp/Groundfish Survey began in 1985 and is currently conducted from South 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 350 stations annually. Vessels sample waters out to 60ftm 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 40ft 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 60ftm; obtain length-frequency measurements for major finfish and shrimp species to determine population size structures; and collect environmental data to investigate potential relationships between abundance and distribution of organisms and environmental parameters.

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 of captured fish.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2005	Red Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-7
2006	Vermillion Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-09-stock-assessment-report-gulf-mexico-vermillion-snapper
2006	Gray Triggerfish	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-09-stock-assessment-report-gulf-mexico-gray-triggerfish
2007	Small Coastal Sharks	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-13
2007	Atlantic Sharpnose, and Bonnethead Sharks	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-13
2011	Blacknose Shark	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-21-final-stock-assessment-report-hms-gulf-mexico-blacknose-shark
2013	Red Snapper	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-31
2013	Atlantic Sharpnose and Bonnethead Sharks	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-34-final-stock-assessment-report-atlantic-sharppnose-shark
2015	Smoothhound Sharks	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-39-final-stock-assessment-report-hms-gulf-mexico-smoothhound-shark-complex
2013	Spanish Mackerel	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-28-stock-assessment-report-gulf-mexico-spanish-mackerel
2014	King Mackerel	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-38-final-stock-assessment-report-gulf-mexico-king-mackerel
2015	Gray Triggerfish	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-43
ongoing	Wenchman	x	x		SEDAR Stock Assessment	http://sedarweb.org/sedar-49
2009-2016	White, Brown, and Pink Shrimp	x	x		Shrimp Stock Assessment	http://www.galvestonlab.sefsc.noaa.gov/publications/

Winter Plankton Survey

The SEAMAP Winter Plankton Survey began in 1983, but because of budget limitations, only took place sporadically until 2007. An abbreviated survey was begun in 2007 with full surveys

conducted in 2008, 2009, 2012, 2013, and 2015. The surveyIt will now take place every other year during February and March to sample approximately 150 stations 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 Trawl Survey

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 and invertebrate 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 Trawl Survey provides fishery and ecological data covering the entire region. The objective of the Coastal Trawl Survey is to provide special and temporal data on resident and transient fish, crustaceans, and other species inhabiting shallow coastal zones off the Southeastern US. This data includes community level data, relative abundance, length compositions, and life history information for use in stock assessments and management.

Survey Design

Sampling cruises are conducted seasonally: spring (April-May), summer (July-August), and fall (October-November) in established strata between Cape Hatteras, North Carolina (35° 13.2'N) and Cape Canaveral, Florida (28° 30.0'N). Between 102 and 112 (based on available funding for sea days) stations between 4.6 and 9.1m depth contours are sampled each season. The number of stations are allocated annually to each stratum was determined by Optimal Allocation Analysis. Seasonal effort ranged from 2-7 stations per stratum. Stations are randomly drawn from a pool of known stations and sampling is conducted during daylight hours.

Operations at each site include collections with paired 22.9m mongoose-type Falcon trawls, with tickler chains, which are towed for 20 minutes bottom time without TEDs or bycatch reduction devices (BRDs). Contents of each net are processed independently. All finfish, elasmobranchs, crustaceans, cephalopods are sorted to species or genus, counted, and weighed. Large or complex catches are randomly subsampled by weight. If large numbers of individuals of a species are present, only 30 to 60 randomly selected individuals are measured. Additional data from selected priorities are recorded. Abundance, biomass, and length-frequency data are recorded using electronic measuring boards. With each trawl collection, oceanographic and meteorological data and wave height are recorded.

Optimization of Present Sampling

This survey currently uses the SC DNR owned Research Vessel *Lady Lisa* as its sole sampling platform. This vessel is fully utilized by various surveys, and only the minimal number of stations (112) were sampled in 2016 to achieve full regional coverage. Lack of funding has halted many studies in recent years. However, it is possible to collect additional samples, such as water quality, algae, and bottom samples, at marginal additional cost.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2012	King Mackerel	x	x	x	SEDAR 38 Benchmark Stock	http://sedarweb.org/sedar-38
		x			SAFMC Management actions	www.safmc.net
2012	Spanish Mackerel				SEDAR 28 Assessment	http://sedarweb.org/sedar-28
					SAFMC Management actions	www.safmc.net
2005-2016	White, Brown, and Pink Shrimp	x	x	x	State Fishing Regulations	
		x	x	x	SEDAR procedural Workshop (2014)	http://sedarweb.org/
2015 and 2016	Bluefish	x	x		ASMFC Benchmark Stock Assessment	http://www.asmfc.org/fisheries-science/stock-assessments
2014	Menhaden	x		x	ASMFC stock assessment	http://www.asmfc.org/fisheries-science/stock-assessments
		x		x	SEDAR 20 Assessment	http://sedarweb.org/sedar-20
		x		x	SEDAR 40 Assessment	http://sedarweb.org/sedar-40
					SAFMC Management actions	www.asmfc.org
2014-2015	Smooth dogfish	x	x	x	SEDAR 39 benchmark Assessment	http://sedarweb.org/sedar-39
2010	Atlantic Croaker	x		x	SEDAR 20 Assessment	http://sedarweb.org/sedar-20

North Carolina Pamlico Sound Trawl Survey

Objectives

The Pamlico Sound Trawl survey provides a long-term fishery-independent database for the waters of the Pamlico Sound and the lower Neuse, Pamlico, and Pungo 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 North Carolina Division of Marine Fisheries (NC DMF) 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 nursery areas and into the open waters of Pamlico Sound where they are available for commercial exploitation.

Survey Design

Annually, 54 randomly selected stations (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 the following strata: Pungo River, Neuse River, Pamlico River, Pamlico Sound east of Bluff Shoal ($\geq 3.6\text{m}$), Pamlico Sound east of Bluff Shoal ($< 3.6\text{m}$), Pamlico Sound west of Bluff Shoal ($\geq 3.6\text{m}$), and Pamlico Sound west of Bluff Shoal ($\geq 3.6\text{m}$).

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.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2013	Summer Flounder	x			ASMFC Summer Flounder Stock Assessment	http://www.asmfc.org/uploads/file/55107122SummerFlounderBenchmarkStockAssessment_SAW_SARCS7_2013.pdf
2011	Summer Flounder	x			NEFSC Summer Flounder Stock Assessment	http://www.asmfc.org/uploads/file/2011SummerFlounderAssessment.pdf
2014	Atlantic Croaker	x			ASMFC Addendum II to Amendment I to the ISFMP for Atlantic croaker	http://www.asmfc.org/uploads/file/540a1c4eCroaker_AddendumII_Aug2014.pdf
2013	Southern Flounder	x	x		NC Southern Flounder FMP Amendment 1	http://portal.ncdenr.org/c/document_library/get_file?uuid=912b88d1-f297-4eab-8306-fbff2356d345&groupId=38337
2015	Kingfish	x	x		NC Kingfish FMP Information Update	http://portal.ncdenr.org/c/document_library/get_file?uuid=32f86d2b-aea6-4f4e-9d54-4ed687383a96&groupId=38337
2013	Blue Crab	x			NC Blue Crab FMP Amendment 2	http://portal.ncdenr.org/c/document_library/get_file?uuid=d8d67440-525e-4e42-a67f-297db5bbf879&groupId=38337
2016	Blue Crab	x			Revision to Amendment 2 to the NC Blue Crab FMP	http://portal.ncdenr.org/c/document_library/get_file?uuid=db2462c9-886b-432c-a3d2-17606e8e73af&groupId=38337
2016	Weakfish	x	x		ASMFC Benchmark Stock Assessment	http://www.asmfc.org/uploads/file/5751b3db2016WeakfishStockAssessment_PeerReviewReport_May2016.pdf
2016	Spot	x	x		ASMFC Benchmark Stock Assessment (in progress)	
2016	Atlantic Croaker	x	x		ASMFC Benchmark Stock Assessment (in progress)	

SEAMAP Reef Fish Survey

Objectives

The objective of the SEAMAP-SA Reef Fish Survey, coordinated with MARMAP and SEFIS sampling efforts into the broader SERFS, is to collect and provide abundance and life-history information on reef fish species for use in stock assessments, research, and management decisions.

Survey Design

Sampling is aimed at monitoring population levels of important species in depths to about 250m with (chevron) traps and hook-and-line gear. These depths are the most heavily exploited habitat for fish populations off the southeastern U.S. Sampling locations are reef sites between Cape Hatteras, NC, and the area off St. Lucie Inlet, FL. Three main gear types are used: chevron trap, short bottom longline, and personal hook-and-line. In addition, oceanographic variables (mostly temperature, salinity, and depth) are measured using a CTD, and underwater video cameras and a

fathometer are used to investigate new reef habitat. Occasionally, reconnaissance traps and longlines are deployed to investigate potential reef habitat (see MARMAP 2009, SAFIMP 2010, Reichert et al. 2011 for gear details). Sampling occurs from May through September, with occasional additional sampling in April and October. Sampling sites are randomly selected from a universe of known stations in live bottom habitats. Sampling sites are selected with a minimum distance of 200m between sites to avoid effect of gear proximity on catches. The overall sampling universe is based on information from MARMAP visual underwater television studies, MARMAP catch records, other research projects, and information from commercial fishermen and recreational anglers. The primary gear is the chevron trap, which is generally deployed at depths less than 100m. Chevron traps are baited arrowhead shaped fish traps (maximum dimensions of 1.5m x 1.7m x 0.6m.; 0.91m³ volume), constructed of 35mm x 35mm square mesh plastic-coated wire (see details in Collins 1990, MARMAP 2009, Williams and Carmichael 2009, Reichert et al. 2011). The traps are tethered individually to a polyball buoy and a hi-flyer and the soak time is approximately 90 minutes. The traps were generally deployed in sets of six; each trap attached to its own surface polyball and hi-flyer buoy and not connected to any other trap. Currently, each trap is equipped with two underwater video cameras located on top of the trap facing opposite directions. The cameras provide information on habitat, visibility, trap behavior (e.g. movement), and most importantly, data on relative abundance for species seen around the traps. The latter information is used to develop additional indices of relative abundance. Video data are provided to SEFIS for examination and analysis. Occasionally, cameras are placed inside the trap or above the trap to study fish behavior inside and around the traps.

Monitoring the abundance of fishes on reef habitats at depths greater than ~ 90m in areas with considerable vertical relief is done primarily using a short bottom longline gear. The short bottom longline consists of 25.6m ground line with 20 twenty gangions with non-offset circle hooks at intervals of approximately 1.2m. Upon deployment, this ground line is tethered to the surface with a line attached to a polyball buoy and a hi-flyer buoy. The hooks are baited with whole squid and the soak time is approximately 90 minutes. The short bottom longlines are also generally deployed in sets of six, with each longline attached to its own surface polyball and hi-flyer buoy. This gear has been deployed exclusively from the R/V *Palmetto*. Short bottom longlines are also used to investigate areas of (possible) live bottom habitat as “reconnaissance longlines.”

In addition to the above mentioned gears, rod and reel sampling is used to collect samples for diet studies and additional life history information, particularly for species with low catches in traps and on longlines. Gear type and tackle have varied. Oceanographic variables (mainly temperature, salinity, and depth) are measured using a CTD while a set of chevron traps or bottom longlines is soaking. In addition to the reconnaissance trap and longline deployments, new bottom habitat is investigated using an underwater video and/or fathometry (echo sounding). Areas are investigated based on information from other projects, commercial fishermen, recreational anglers, charts, and other sources. If live bottom habitat is identified using video or fathometry, reconnaissance traps or longlines may be deployed to investigate catches and habitat further.

All fish caught during sampling are processed on board following standard processing procedures. The Length-Frequency workup consists of identifying all fish caught during gear

deployment (trap or longline), determining the total weight of all fish of each species in each sample, and measuring the length of all individual fish. Priority species are retained for life-history work-up. These species include black sea bass, gag, scamp, *Epinephelus* groupers, snapper species, red porgy, grunts (*Haemulon* spp.), tilefishes, gray triggerfish, and several other species. The onboard life-history work-up consists of weighing and measuring individual fish, and removing otoliths, gonadal tissues, and possibly other tissues such as stomach and intestinal tract (for diets studies), and DNA samples. The life-history samples are stored and further processed in the SC DNR Reef Fish laboratory to determine age, reproductive parameters, diet, etc.

Between 2009 and 2015, a gag grouper ingress study was conducted in collaboration with partners at GA DNR and NC DMF. Samples were collected in 15 sites in the vicinity of Beaufort, NC; Wilmington, NC; Georgetown, SC; Charleston, SC; Beaufort, SC; Savannah, GA; and Brunswick, GA. Ingress monitoring uses Witham collectors anchored in shallow tidal waters from March through June of 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 year class strength and/or commercial landings. As a result of declining funding, the Gag ingress study was halted after the July of 2015 sampling season.

Optimization of Present Sampling

The survey has been optimized through direct collaboration within SERFS (between the SEAMAP-SA, MARMAP, and SEFIS programs) to complement and effectively cover depths including shallow, shelf, and deepwater habitats. All sampling activities are coordinated and planned in consultation with SC DNR and SEFSC partners, and annual planning meetings are held prior to each sampling season. SEAMAP funding has resulted in increased annual reef fish sample sizes and sampling coverage and allowed longline surveys to resume after they were halted in 2014 due to a significant funding cut to the MARMAP program. All data are incorporated in the SEAMAP-SA database and available for online queries and data download. The data are also used for the SAFMC's mapping service (add website link), research by third parties, stock assessments, and management.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2016	Red Grouper	x	x	x	SEDAR 53 Standard Assessment	http://sedarweb.org/sedar-53
		x	x	x	SEDAR 19 Assessment	http://sedarweb.org/sedar-19
2013-2017	Blueline Tilefish	x	x	x	SEDAR 50 Benchmark Assessment	http://sedarweb.org/sedar-50
		x	x	x	SEDAR 32 Benchmark Assessment	http://sedarweb.org/sedar-32
2009-2016	Red Snapper	x	x	x	SEDAR 41 Benchmark Assessment	http://sedarweb.org/sedar-41
		x	x	x	SEDAR 24 Benchmark Assessment	http://sedarweb.org/sedar-24
		x	x	x	Various peer reviewed papers	
2013-2016	Gray Triggerfish	x	x	x	SEDAR 41 Benchmark Assessment	http://sedarweb.org/sedar-41
		x	x	x	SEDAR 32 Benchmark Assessment	http://sedarweb.org/sedar-32
		x	x	x	Various peer reviewed papers	
2013	Snowy Grouper	x	x	x	SEDAR 36 Standard Assessment	http://sedarweb.org/sedar-36
2009-2016	Black Sea Bass	x	x	x	SEDAR 25 and update Assessment	http://sedarweb.org/sedar-25
		x	x	x	Various peer reviewed papers	
2009-2016	Tilefish	x	x	x	SEDAR 25 and update Assessment	http://sedarweb.org/sedar-25

State Coastal Longline Surveys

South Carolina Coastal Longline Survey

Objectives

The overall objective of this project is to conduct adult red drum and coastal shark surveys in the SE region. Adult red drum samples (otoliths, reproductive tissues, and genetic samples) are collected and processed to describe the population in the southeast. Regional collaboration is aimed at efforts to optimize planning and survey design in the SE region with Georgia (GA DNR) and North Carolina (NC DMF) partners.

Survey Design

The adult red drum longline survey is conducted following a random design that covered the coast (Winyah Bay, Charleston Harbor, St. Helena Sound and Port Royal Sound). Sampling in each of the four strata is conducted during three time periods (August 1 – September 15, September 16 – October 31, November 1 – December 15). 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) were selected based on historical information and pilot studies. The gear used for this study is a bottom longline deployed from the SC DNR owned R/V *Silver Crescent*. The longline gear consists of a 617m long monofilament groundline. Forty clip-on, monofilament gangions with baited hooks are placed at 15.2m intervals. 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).

Fish caught on the lines are measured, sexed (sharks), and tagged (selected species) before release. Red drum are tagged with external dart tags and internal PIT tags, allowing for long-term identification of recaptured fish even if they shed the external tag. A fin clip is collected for genetic analysis to identify stocked fish and determine population structure. Juveniles of coastal sharks and large coastal sharks are tagged with external tags. Red drum are randomly sacrificed (30 - 50 fish per 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, catch per unit effort (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. This has already streamlined our survey design.

Collection of samples during surveys is useful even, if funding is not available to process the samples immediately, since the archived material forms a valuable resource for potential future studies, and other institutions may be able to cooperatively process these samples without much added effort or expense. For example, SC DNR has previously processed reproductive tissue samples from the North Carolina Adult Red Drum Survey. Furthermore, researchers have been preserving stomachs for 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 collecting tissue and blood samples from coastal shark species. These samples have been used in genetic studies to determine population structure and investigate 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.

North Carolina Coastal 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 a means to evaluate the age structure of the adult population. Fishery-independent surveys allow determination of CPUE, which is necessary to determine population size and trends in abundance. Age structure of the spawning stock permits estimation of recruitment (escapement) level into the spawning population. Additionally, better estimates of escapement and age composition allow for comparison of the findings with the recommended spawning potential ratio. The red drum longline 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 subsamples 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.

Survey Design

This study employs a stratified-random sampling design based on area and time. Sampling is conducted using bottom longline gear during nighttime hours starting no earlier than an hour before sunset. On average, a total of four sets are made per night. All stratified-random sampling occurs within the Pamlico Sound, which is divided into twelve similarly sized regions ranging from Gull Island to mouth of the Neuse River. This is based on prior NC DMF red drum sampling to optimize sampling efficiency. Each region is sampled six times between mid-July and mid-October, annually, and additional non-random exploratory samples may be made during the study period near coastal inlets. Red drum are tagged with internal and external tags and released to identify migratory patterns, while a subset of red drum taken are processed for sex, maturity, and age data. Coastal shark species are identified by species and sex and are measured and tagged according to Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) survey procedures.

Longlines are set and retrieved using a hydraulic reel. Ground lines consist of 227kg (500lb) test monofilament. Samples are conducted with a 1,500m mainline with gangions placed at 15m intervals (100 hooks/set). Stop sleeves are placed at 30m intervals in order to aid in accurate hook spacing and to prevent gangions from sliding down the ground line and becoming entangled when large species are encountered. Terminal gear are clip-on, monofilament gangions consisting of a 2.5mm diameter stainless steel longline clip with a 4/0 swivel. Leaders on gangions are 0.7m in length and consist of 91kg (200lb) monofilament rigged with a 15/0 Mustad tuna circle hook. Hooks are baited with readily available baitfish (striped mullet is the primary bait and longline squid is the first alternative). Sets are anchored and buoyed at each end. Anchors consist of a 3.3kg window sash weight, though multiple weights are used in high current areas. All soak times are standardized and kept as close to 30 minutes as logistically possible, measured from the last hook set to the first hook retrieved. Short soak times were designed to minimize bait loss, ensure that the red drum were tagged in good condition, and to minimize negative impacts to any endangered species interactions. The SAS procedure PLAN is used to randomly select a sampling grid within each region (SAS Institute, 1985). Each of the two samples taken originate from a selected grid. In order to maintain consistency, all samples are made in the vicinity of the 1.8m depth contour with sample depths typically ranging from 1.2 to 4.6m in depth. Physical and environmental conditions, including surface and bottom water temperature (oC), salinity (ppt) and dissolved oxygen (mg/L), are recorded for each longline sample. Bottom composition and sediment size are recorded in the instances where they can be ascertained. Location of each sample is noted by recording the beginning and ending latitude and longitude.

All individuals captured are processed at the species level and are measured to the nearest millimeter for either fork or total length according to the morphology of the species. Hook

location and species condition (alive or dead) are also recorded. Live red drum and selected shark species are tagged and released. Selected red drum species are retained and taken to the lab for otolith removal and sex determination. For sacrificed fish, stomach contents are removed and frozen. Each prey item in the stomach is later identified to the most detailed taxonomic level possible, enumerated, and weighed. A fin clip is removed for later genetic processing from all red drum captured. All fin clips are sent to SC DNR for further processing and analysis.

Optimization of Present Sampling

The red drum longline survey could be optimized by providing additional life history information on red drum. Collecting diet data as part of the survey could provide needed information which is largely nonexistent, including information on predator-prey relationships to enhance available data for the development of 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.

Georgia Coastal Longline Survey

Objectives

The red drum longline survey was initiated as a pilot project in 2006 with supplemental funds provided by the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). The primary objective was 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: estuary, nearshore (0-3nm), and offshore (3-12nm). General sampling locations focus in areas historically associated with high probabilities of encounter. Sampling is conducted monthly between May 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, the 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 sampled in a similar manner as other strata.

The sampling gear consists of a main line approximately 926m in length, made of 2.5mm monofilament, containing 60 gangions/branchlines. Gangions/branchlines are 0.7m in length, 1.6mm monofilament, and 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. At the request of the SEAMAP committee, attempts have been made to standardize sampling with the other southeast partners to ensure compatibility of data for stock assessments. With this in mind, beginning in 2016 all hooks are 15/0 baited with mullet to coincide with South Carolina's sampling protocol.

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 are extracted to determine age. 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 1.5m 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. As collaborative sampling opportunities present themselves, sampling could be augmented to collect biological information from red drum and other abundant non-target species.

Recent Data Uses (for all Coastal Longline Surveys, NC, SC, GA)

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2013	Bonnethead Shark	x	x	x	SEDAR 34 Standard Assessment	http://sedarweb.org/sedar-34
2013	Sharnose Shark	x	x	x	SEDAR 34 Standard Assessment	http://sedarweb.org/sedar-34
2010	Sandbar Shark	x	x	x	SEDAR 21 Assessment	http://sedarweb.org/sedar-21
2010	Dusky Shark	x	x	x	SEDAR 21 Assessment	http://sedarweb.org/sedar-21
2010	Blacknose Shark	x	x	x	SEDAR 21 Assessment	http://sedarweb.org/sedar-21
2009-2015	Red Drum	x	x	x	SEDAR 44 and ASMFC stock assessment	http://sedarweb.org/sedar-44
		x	x	x	SEDAR 18 Assessment	http://sedarweb.org/sedar-18
					Various peer Reviewed papers	

CARIBBEAN RESOURCE SURVEYS

Reef Fish Survey

Objectives

The objective of the SEAMAP-C Reef Fish Survey is to collect and provide abundance and life-history information on reef fish species for use in stock assessments, research, and management decisions.

Survey Design

The reef fish survey officially began in 1992 as a SEAMAP survey in Puerto Rico. Until 2004, sampling was conducted using two gears: hook-and-line and fish traps. The use of fish traps ceased in 2006, and hook-and-line is now the primary gear used for this survey. In 2016, the reef fish survey was revamped and expanded to include video and bottom longline to complement the hook-and-line gear.

For each five-year funding cycle, reef fish survey sampling occurs in years 1, 2, 4, and 5. Reef fish survey sample site selection includes a two-factor random stratified sampling design based on depth and benthic habitat type within the 50 ftm contour of Puerto Rico and the U.S. Virgin Islands (St. Thomas/St. John and St. Croix). A total of 200 stations are conducted by Puerto Rico, about 100 off each the east and west coasts, and 140 stations will be sampled off the U.S. Virgins Islands, about 70 stations off each of the St. Thomas/St. John and St. Croix islands.

Sample collection is conducted using three sample gear types at each station: video camera (a 2 GoPro Hero4 Silver camera array), a 300ft bottom longline (100 #9 circle hooks) and a 4-hook handline (two #9 circle and two #6 circle hooks). Each sample gear is deployed at the same station area, but at least 50m apart to avoid interaction of different gear types. For all samples, all pertinent station data is recorded and fish length, sex, and gonadal condition is determined from each specimen collected. The majority of the data is entered in real-time into NOAA Fisheries' SEAMAP Data Management System using SCS and Sellit software.

In all reef fish surveys, data on sexual maturation of each individual is recorded and used to determine spawning season and size of 50% population maturation. 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 compare the relative precision of macroscopic and 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 used as a guide to determine the sexual maturation for different species, and to increase the precision of sexing individuals.

Optimization of Present Sampling

In addition to the reproductive data already collected during this survey, the SEAMAP-C Reef Fish Survey can be optimized by extracting otoliths to age fish and performing dietary analysis to determine trophic interactions. This information would provide a wealth of data that could be used for current fisheries management, understanding predator/prey interactions, and supporting development of ecosystem-based fisheries management.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2005	Yellowtail Snapper	x			SEDAR 8 Assessment	http://sedarweb.org/sedar-8
2011	Silk Snapper	x	x		SEDAR 35 Assessment	http://sedarweb.org/sedar-35
2014	Red Hind	x	x		SEDAR 26 Assessment	http://sedarweb.org/sedar-26

Queen Conch Survey

Objectives

The objective of the SEAMAP-C Queen Conch Survey is to determine the spatial and temporal variations in stock abundance within the territorial seas of Puerto Rico, the USVI, and respective EEZs for use in stock assessments, research, and management decisions. The survey is also of great importance to evaluate 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.

Survey Design

The survey has been conducted every five years in Puerto Rico and USVI starting in 1995. This survey is the only source of monitoring, as queen conch is restricted in federal waters, and can only be harvested within the EEZ of the USVI, so long as it meets the minimum size limit of 9" length or 3/8" lip thickness, does not exceed the ACL of 50,000lbs per district, and is not harvested during its annual closed season, July 1 to September 30.

Currently, this is a visual census survey that utilizes a transect survey methodology designed by Freidlander et al. (1994). The survey is conducted in state and federal waters around Puerto Rico, including the Islands of Culebra, Vieques, and Mona. In the USVI, it is conducted in St. Thomas, St. John, and St. Croix. A minimum of 100 stations are targeted in Puerto Rico and USVI during the queen conch closed season (July 1-September 30). The divers estimate conch abundance and density along the transect line for a maximum survey time of 45 minutes. In addition to counting all conch, depth, habitat type (e.g. sand, coral, hard ground, gorgonians, seagrass, and algal plains), start and end time, and time at each habitat change is recorded. The length of each individual conch is measured to the nearest centimeter and adult age is estimated to one of the four relative age classes (newly mature, adult, old adult, and very old adult).

Optimization of Present Sampling

The SEAMAP-C Queen Conch Survey can be optimized by also recording the number of other important species such as spiny lobster, snappers, and groupers. This information would provide a wealth of data that could be used for current fisheries stock assessments. Additionally, the SEAMAP-C Queen Conch survey design will be re-evaluated this cycle to ensure the best data is being collected for future stock assessments. Anecdotal evidence of conch spawning aggregations known locally as 'conch volcanos' occur throughout the region, and efforts to identify these areas would be critical to properly managing this species.

Known issues with assessing queen conch populations are their burrowing behavior, and unknown habitat of their first year class. There is not a clear methodology description on sampling burrowed conch, however, sample sites should be expanded beyond the standard transect sites surveyed each period so that additional sites are surveyed, which may include those associated with age class one. Additionally, preferred habitat for queen conch is seagrass meadows. These habitats could be sampled more heavily than others. More so, the non-native species, *Halophila stipulacea*, may be displacing native seagrasses and associated queen conch. Better understanding the interaction between this non-native seagrass and queen conch could be studied.

Lastly, to account for queen conch aggregations, a sampling design such as manta tow could be used to identify aggregation location. Then the standard transect survey or a density assessment based on Stoner and Waite, 1990 could be conducted upon the aggregations.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2007	Queen Conch	x	x		SEDAR 14 Assessment	http://sedarweb.org/sedar-14

Spiny Lobster Survey

Objectives

The spiny lobster constitutes the most economically important commercial fishery species in Puerto Rico. The objective of the SEAMAP-C Spiny Lobster Survey is to determine the spatial and temporal variations in stock abundance of pueruli and juvenile spiny lobsters within the territorial seas of Puerto Rico, the USVI, and respective EEZs for use in stock assessments, research, and management decisions.

Survey Design

The first SEAMAP-C Spiny Lobster Survey was conducted in 1996 using pueruli settlement collectors, and occurs every five years. Starting in 2003, juvenile spiny lobsters are also monitored using artificial shelters and the modified Witham model pueruli collectors are constructed to monitor pueruli settlement. These two sampling techniques have continued to present.

In Puerto Rico and USVI, up to 56 modified Witham pueruli collectors are constructed and deployed at seven stations at two depths (9-12m and 18-24m). The collectors are sampled once a month for twelve months between the new and the full moon phases. All pueruli and juvenile spiny lobster are enumerated from each collector. The following data is recorded at each station: date, time, lunar phase, latitude and longitude (station number), pueruli stage and/or juvenile stages, count and identify fish captured within the collectors, salinity, turbidity, and temperature.

In addition to the pueruli collectors, lobster casitas (concrete blocks) are deployed at six sites along the southwest coast of Puerto Rico and off St. Thomas and St. Croix on flat substrate between 2 to 20m. Ten juvenile lobster casitas are deployed at each site, 30m apart in a straight line. Lobster casitas are sampled once every month between the full and new moons. All juvenile spiny lobsters are collected, enumerated, and measured in carapace length.

Optimization of Present Sampling

The SEAMAP-C Spiny Lobster survey could be optimized by providing additional information on other fishery important species that are collected on the pueruli settlement collectors or in the casitas.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental/ Habitat		
2005	Spiny Lobster		x		SEDAR 8 Assessment	http://sedarweb.org/sedar-8

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.

The SEAMAP Invertebrate Plankton Archiving Center manages planktonic invertebrates from sorted sample collections and backup plankton collections obtained during SEAMAP surveys.

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 has developed sound methodologies to collect and process 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 and expands to include more ecosystem-based components in its data collection process, coordination with Florida and other knowledgeable entities would be advisable in developing procedures 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-SA funds help support Southeastern Regional Taxonomic Center (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 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-SA 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 plans to initiate construction of an image library containing photographs of fresh or frozen

specimens of all species collected on SEAMAP-SA 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-SA Surveys.

To address SEAMAP-SA goals, SERTC started concentrating work on stomach content analysis in 2010. SERTC currently provides assistance with identification of prey items, as well as variables to measure diet such as prey numbers, lengths, weights, or volumes. Facilities at SERTC serve as a sample processing facility for diet studies. SERTC also produced an identification guide for Trawl Survey diet studies and is currently working on a similar guide for reef fish species prey items.

Archiving and storing otoliths and gonadal tissues has proven to be essential for high quality fish stock assessments. For example, some 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. Genetic techniques are increasingly becoming 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-SA Reef Fish Survey (and MARMAP and SEFIS) and the SEAMAP-SA Coastal Trawl Survey provide a unique historical sample archive that has increasingly been utilized for such studies. SEAMAP-SA will continue to archive these samples to make them accessible for future use. Otoliths and spines are stored dry in small envelopes, most commonly in boxes. Reproductive tissues are stored blocked in paraffin wax. Slides produced from all samples are stored in each program's lab. All physical specimens are archived in accordance with each program's data management scheme.

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. 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, which supports development of ecosystem-based resource management.

Caribbean

In 2009, Puerto Rico began collecting and processing gonads of all captured reef fish to determine the sexual maturation of each individual. The data are used to determine spawning season and size of 50% population maturation. Also, samples are provided to the reproduction program established at the FRL for some species under study there. The FRL performs histological analysis to provide much needed information on reproduction of fisheries resources.

The relative precision between macroscopic and microscopic/histological sexing is also being explored. All individuals are macroscopically sexed and gonads are photographed, removed, and preserved for histological sexual determination. The macroscopic and microscopic sex determination is then compared, which may increase the precision of sexing the individuals macroscopically. Providing samples to other programs within the FRL helps improve the data needed to evaluate important species, and reduces costs of obtaining samples and processing 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 to interested parties. Some samples are provided to external researchers at the national level for various purposes, such as genetics studies, age and growth, and reproduction.

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

DATA MANAGEMENT AND INFORMATION DISSEMINATION

Biological and environmental data from SEAMAP surveys are managed at the regional level. 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: datasets and program information. Datasets include both digital and analog data, as well as directories of specimen collections. Program information is defined as communications released to current and prospective participants, cooperators, investigators, or other interested agencies or persons. This information may be produced in a number of document types, described in Appendix H.

While each regional component's data management system currently operates independently, the long-term goal is to develop an overall SEAMAP Information System that crosses the regional component boundaries. NMFS could provide an important coordination function in this regard. 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 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.

SEAMAP-Gulf 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, and users are able to download the entire SEAMAP-Gulf dataset. Verification of new data and detection of invalid legacy data has improved significantly, and standardized methods of data submission have improved reliability and turnaround time of data availability.

Data summaries distributed to interested parties include real-time data reports during the Summer Shrimp/Groundfish Surveys, SEAMAP-Gulf biological and environmental atlases, and SEAMAP-Gulf directories. Cruise reports, quarterly reports, and annual reports are also distributed and are available online.

SEAMAP-South Atlantic Data Management System

Data management duties and funding for the SEAMAP-SA have been administered through the SC DNR since 2007. The SEAMAP-SA Data Management Workgroup was formed to oversee the SEAMAP-SA Data Management System, 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-SA surveys and special studies. The first full version of the SEAMAP-SA Oracle Database came online in 2014. Since then, the system has been improved and data are accessible for outside data queries. Data from the SEAMAP-SA Coastal Trawl Survey, the NC DMF Pamlico Sound Trawl Survey, the Coastal Longline Surveys, and the Reef Fish Survey (SERFS) can now be accessed through the online data portal. In 2015, three ichthyoplankton datasets were added to the system. In the future, additional datasets such as the Cooperative Winter Tagging Cruise will be considered for inclusion. Analysts from several stock assessments, managers, and researchers have accessed the online data for queries that were used directly in stock assessments, for management, and in research projects.

The SEAMAP-SA Data Management System includes a website (www.SEAMAP.org) to view cruise reports and state contacts and to access summarized datasets and appropriate project metadata. The SEAMAP-SA Data Management Guidance Plan was morphed into a User Guide, a Data Manager Guide, a Data Provider Guide, and a Metadata Guide. the website is hosted and supported by SC DNR through an agreement with SEAMAP and ASMFC. Data will continue to be updated and improvements will be made under the guidance of the Data Management Workgroup. FWC-FWRI is using ArcGIS for Server to visualize the SEAMAP-SA GIS data via a web map service. The map service provides details for the map layers, spatial reference, geographic extent, and other supporting information. The map service is accessible through a variety of clients, including ArcMap, ArcExplorer, Google Earth, and web mapping applications.

The SAFMC Fisheries (http://ocean.floridamarine.org/sa_fisheries/) application provides an enhanced suite of online tools to support the surveys of the SEAMAP-SA database. This application will help achieve the goal of providing users access to view, query, and download GIS data in a user-friendly, web-enabled environment. The primary benefits of this approach include:

- Provide access to information through one location, allowing managers and researchers to search, view, and acquire SEAMAP-SA GIS data from across the region.
- Facilitate the sharing of information by consolidating research efforts and making data easily accessible online.
- Store information geographically so scientists and managers can identify gaps for planning future research efforts.

SEAMAP-Caribbean Data Management System

The data collected by each Caribbean component is handled by the respective 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.

Chapter 4. EXPANDING AND MAINTAINING SEAMAP ACTIVITIES

In the stock assessment process, SEAMAP-based abundance indices now are used routinely 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 and South Atlantic Trawl Surveys and Gulf Plankton Surveys), Spanish mackerel (Gulf and South Atlantic Trawl Surveys), red snapper (Gulf Trawl and Plankton Surveys), red drum (Gulf Plankton Surveys and Coastal Longline Surveys), red hind (Caribbean Reef Resources Surveys), shrimp (Gulf and South Atlantic Trawl Surveys), striped bass, kingfish, weakfish, spot, and croaker (South Atlantic Coastal Trawl Survey). In addition, there is great potential for expanding SEAMAP to collect data on stocks that are not well covered by current surveys (example, cannonball jellyfish - *Stomolophus meleagris* in the South Atlantic), expanding life history sample collection for species currently encountered, or 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 continually needed by managers.

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. In addition to providing regional, long-term, fishery-independent data, SEAMAP datasets also provide valuable baseline trends of fishery stocks. These long-term baseline trends can be used 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 Survey provide immediate feedback regarding the effectiveness of fisheries management regulations. For example, SEAMAP data are used by Texas, South Carolina, and Georgia to set seasonal openings for the shrimp fisheries. SEAMAP-Gulf trap videos have been used to judge the effectiveness of various types of artificial reef materials for their structural and geographical stability, biofouling community succession, and fish biomass and diversity. Where catch is limited and fishing is restricted, making catch data unavailable, 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 demand for adequate scientific information 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.

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. For example, SEAMAP data are used to identify the bottom habitat distribution in the South Atlantic region to adopt management measures to 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 EFH, 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.

The three SEAMAP committees regularly discuss future SEAMAP activities, and each developed a list of activities that would implement changes according to the following priorities:

I. Operate existing programs at full utilization

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

III. Develop new fishery-independent data collection programs

The SEAMAP Joint Committee supports priorities that restore and maximize ongoing program activities over the implementation of any new fishery-independent data collection efforts. Lack of adequate funding is the major impediment for maintaining and expanding surveys. In recent years, the level funding and loss of funding has led many of the components to reduce sampling and these reductions are reflected within Tier I of this list. The Committee notes that surveys not included in Tier I currently are at risk of being added in the near future should funding remain level or decrease further. The projects below 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 and all cost estimates are based on current rates (August 2016).

I – OPERATE EXISTING PROGRAMS AT FULL UTILIZATION

In recent years, SEAMAP activities have been impacted by stagnating and declining funding to the core surveys. The following items and funding are required to maintain these baseline survey activities or bring SEAMAP to full utilization.

I– Gulf of Mexico

(Increase of \$550,000/year)

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 was cut back to once a year. Funding is needed to continue the survey twice a year. This 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)

I– South Atlantic

(Increase of \$662,500/year and \$75,000 once)

Coastal Trawl Survey

Due to reduced funding and increased cost of the survey, (see Budget in Chapter 2) in particular as a result of the new Fair Labor Standard Act, current funding levels will not

allow the continuation of three sampling seasons each year. We considered reducing the number of stations, but unless this reduction is in the northernmost and southernmost area, the cost reduction would be marginal, relative to the large loss in data and geographic coverage. We are currently investigating the effect of dropping one of the sampling seasons on data and analyses for assessments etc., which can be considerable. Maintaining the current sampling efforts (3 seasons, 112 stations per season) would require additional funding of ≈\$100,000 annually.

Reef Fish Survey and Bottom Mapping

SEAMAP-SA contributes 40% to 45% of the SCDNR Reef Fish Survey components (SEAMAP-SA and MARMAP), and about 20% of total current funding for the regional Reef Fish Survey (SERFS). The Reef Fish Survey has seen considerable funding reductions over the years, most significantly through reduced funding for MARMAP. In addition to increases in vessel cost per sea day, and increases in personnel and other costs, this has led to a reduction in sea days, the halting of the short and long bottom long-line surveys in 2012 and the gag ingress study in 2015. Due to incidental funding, mostly as a result of the need for data for deep water snapper/grouper species, the long line surveys were, partially resumed in 2014.

A full utilization of the Reef Fish Survey will require:

1. Restoring sampling effort to at least 50 sea day per year (25 each for MARMAP and SEAMAP-SA). Required funding: \$ 62,000 annually (~6.5 seadays). It's important to realize that the current reef fish survey is, and can only be, conducted in collaboration with MARMAP (funding between \$600K and 850K annually in recent years) and SEFIS (SEFSC program with funding of about \$1,300K - \$1,500K annually).
2. Restoring the longline surveys as laid out in the SAFIMP and Longline Workshop Reports (See Carmichael et al. 2009 and Carmichael et al. 2016). Participants in this workshop, as well as the SAFMC and others, have recognized the importance of a comprehensive fisheries independent deep water snapper grouper survey. Data for these species are lacking and funding reductions over time have reduced, and in several years eliminated, the sea days available for the long line survey. This would require 10 additional sea days for the R/V Palmetto and 15 sea days for the R/V Lady Lisa. Required funding \$ 100,000.
3. Funding to process all life history samples (in particular the otoliths and reproductive tissues) and keeping up with this processing the samples within one year after collection. This will allow the survey to respond to the frequent and unexpected changes in the stock assessment schedules and provide critical information to all assessments. Required funding one time funding of \$75,000 and subsequent \$30,000 annually.
4. The gag ingress study was halted in 2015 as a result of funding cuts. Evaluation of the cost/benefits of resuming this study is needed, and if resumption is considered, this study should become part of a comprehensive larval and juvenile fish survey plan. Full restoration of a multi-state juvenile ingress study at the level of the 2015 efforts is expected to require \$150,000 annually.

Coastal Longline Surveys

Coastal Longline Survey are designed to provide a long-term fishery independent database on the distribution, relative abundance, catch per unit effort, size distribution and age composition of red drum along the South Atlantic coast. Additionally, the

surveys provide information on the relative abundance, size distribution, sex, and maturity of multiple species of small and large coastal sharks.

North Carolina: Unless additional funding is available, there will be a reduction in the number of North Carolina longline days and a reduction of an equivalent amount of data for stock assessments. This means that there is no support to sample the full number of sampling sites per week (72 samples). One week of sampling (8 samples) would need to be omitted and precision in estimates would be reduced. The survey needs restoration of \$6,500 annually to maintain current sampling efforts. (\$6,500 annually)

South Carolina: To return to the historical breakdown of funding to this survey (75% federal, 25% state funded) the survey would require a restoration of \$39,000 (based on FY17 levels). (\$39,000 annually)

Georgia: SEAMAP presently covers 55% the costs to fund this survey May to December (8 months, 44 sea days). GADNR has offset the annual costs for years with a combination of state and other federal fund sources to cover personnel services and vessel maintenance. However, these funds continue to be cut and can no longer support 8 months (44 sea days) of sampling. The total FY16 cost for this survey was \$140,560 (SEAMAP portion was \$77,276). In the future, sampling will need to be reduced to address these shortfalls and may include: reducing the number of months sampled; reducing sampling periodicity to every six weeks (similar to SC); or eliminating a sampling season (May to August – impacts shark sampling, or September to December impacts red drum sampling). (~\$63,000 annually)

Data Management

To maintain the current level of data management, which would include uploading new survey data annually, and minimum maintenance of the data base, an increase in operating costs of \$10,000 is needed to cover increases in staff and other costs. Additional funds are also essential for standard database maintenance, application refinements, additional queries, bug correction or programming errors that have been discovered within the structure of the database or associated extraction reports. Furthermore, for other partner data management staff, reduced SEAMAP funding has been temporarily offset by outside funding sources. Fully restored funding is necessary to ensure the crucial database support for these critical database aspects. (\$30,000 annually)

SERTC

SERTC funding has been severely reduced in recent years. This has significantly affected the support for diet studies in the SEAMAP-SA surveys at SCDNR. To restore SERTC support for the surveys would require a minimum of \$82,000 annually, which is roughly the FY14 requested funding level for SERTC through SEAMAP-SA. Note that this would restore activities to fully support for SEAMAP-SA activities, in particular the Coastal Trawl Survey and the Reef Fish Survey. Specifically, the will allow SERTC to once again support the diet studies, curating the SEAMAP-SA biological reference collection, maintain and expand the computerized and searchable literature, and some minor outreach activities (such as publishing diet and other identification guides, etc.). (\$82,000 annually)

I – Caribbean

(Increase of \$790,000/once every five years)

Sampling efforts have been scaled back significantly for all SEAMAP-C 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. The last review of the program by the program manager includes the recommendation to conduct all the surveys, reef fish, queen conch and lobster, every year. Other recommendations are to increase the number of sample stations. In order to fully implement these recommendations, an increase in funding is necessary.

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, once every five years (USVI) and \$120,000/year, once every five years (Puerto Rico).

Hook and Line Surveys

The level of effort for fishery-independent 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 budget is \$150,000/year, once every five years (USVI) and \$160,000/year, once every five years (Puerto Rico).

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

II – Gulf of Mexico

(Increase of \$6,150,000/year)

Expanded Reef Fish Video and Vertical Line Sampling

SEAMAP surveys of reef fish using 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. 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). Current funding only allows vertical line sampling off Alabama, Louisiana, and Texas during the Vertical Line Survey. The Vertical Line Survey collects much needed information on red snapper and other reef fish. Additional funds are needed to expand the Vertical Line Survey across the Gulf of Mexico. (\$3,300,000 annually)

Expanded Bottom Longline Survey

The Bottom Longline Survey is currently conducted in water depths of 3 to 10m across the Gulf of Mexico. Funding limitations do not allow sampling in deeper waters during the three seasons that the Bottom Longline Survey is conducted. Many managed species do not inhabit the currently sampled area. Increased funding would allow sampling across the Gulf of Mexico out to water depths of approximately 100m. (\$1,300,000 annually)

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 nearshore 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

Though management is moving toward an ecosystem-based approach, its utility 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, gut contents analysis is essential. 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 to establish a diet analysis lab in the Gulf of Mexico. This lab would focus on integration of traditional gut content analyses with genetic barcode identification of unidentifiable prey items to the lowest possible taxonomic level, as well as the addition of stable isotope analyses to more broadly define predator-prey relationships. Inclusion of genetic barcoding techniques for more discrete prey identification allows for finer resolution of specific trophic interactions, thereby enhancing the utility for ecosystem-based models. 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. (\$700,000 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, 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. (\$350,000 annually)

II – South Atlantic

(Increase of \$730,000 annually and \$410,000 once)

Coastal Trawl Survey

After an initial increase in life history study activities in 2009/2010, these studies have gradually been reduced as a result of available funding. However, age information, reproductive parameters, and other data such as diet composition in fish and black gill disease in shrimp, are critical for stock assessment and management decisions. As the samples are being collected as part of the ongoing survey, the cost of obtaining this important information is mostly in processing on-board and in the laboratory. The additional cost to the Coastal Trawl Survey of collecting and processing of relevant life history information for key managed species is expected to be \$50,000, mostly in staff cost and some supplies.

Reef Fish Survey

If activities under “Tier I” are realized, the R/V Palmetto will be fully utilized and further expansion of activities may require additional vessels. However, life history studies (in particular diet studies) and additional data acquisition equipment are an expansions that can be made without additional vessel time and will greatly enhance data collection, especially in the areas of oceanographic and bottom habitat characterization and ecosystem based assessment and management. Reef Fish diet studies were mostly halted in 2015 due to funding. Resuming these studies would require minimal field effort. Costs would mostly be in supporting staff to examine the sample and analyze the data and some supplies. One biologist would allow processing and samples of 2-6 species each year, depending on the number of samples collected for each species, each year. The collected species would rotate on a set schedule to collect and update diet composition for most managed species over time (estimated costs \$80,000 annually, including fringe, overhead, and supplies).

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 ocean current data can be used in the survey and 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). It is also important in decisions for safe gear deployment and reducing the risk of losing gear. The cost of purchase and installation of an ADCP is \$60,000)

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 (either towed or

on independently operated under water vehicles) 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, a possible 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 dependent on the type of gear/vehicle (estimated \$350,000), and the extra field staff would be \$80,000 incl. fringe and indirect)

Bottom Mapping

Managed areas offshore of SEAMAP-South Atlantic states, of specific concern to fishery managers, include Marine Protected Areas (MPAs), deepwater coral HAPCs, Spawning Special Management Zones 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 I, Figures 1-7 for existing managed areas). Bottom mapping priorities and objectives vary at both the state and management council levels (at least 20 managed areas are identified in the South Atlantic Habitat and Ecosystem Atlas⁵). Bottom 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 Figure 7. in Appendix I). Offshore habitat has been subdivided into 10 depth strata to capture target species and significant habitat distribution evaluate mapped and characterization accomplished to date and focus future mapping on priority needs for management. These areas were identified for a baseline of the South Atlantic Mapping Strategy being developed as a supporting tool for the SAFMC Fishery Ecosystem Plan II. 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 can be accomplished with use of side-scan (generally for shallower depths) or multi-beam sonar systems (generally for deeper depths). For areas within 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.

Using SEAMAP/MARMAP vessels of opportunity, SCDNR/SAFMC is developing regional partnerships investigating purchase or lease new technology such as an AUV (e.g., Submarine by Ocean Arco) to be used in conjunction with existing operations. For bottom mapping costs, 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

⁵ <http://safmc.net/habitat-and-ecosystems/safmc-habitat-and-ecosystem-atlas/>

formats, metadata describing survey methods, and processed image files. (\$300,000 annually)

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. The NMFS SEFSC Southeast Fishery-Independent Survey (SEFIS) group typically has ~ 30 days at sea each year in the South Atlantic region on the NOAA ship *Pisces*, during which mapping efforts occur at night (trap-video surveys occur during the day). SEFIS mapping efforts typically result in ~ 250 km² of newly mapped areas each year.

Pamlico Sound Survey

The Pamlico Sound Survey began in March 1997 and initially covered the months of March, June, September, and December. The December, leg of the cruise was discontinued in 1990, and the March portion was discontinued in 1991. This decision was made because it was felt that limited data was being collected during winter months and effort would be better allocated towards other projects. However, recent Pamlico Sound Survey annual reports have recommended adding an additional leg of the cruise at the end of July/beginning of August to increase temporal coverage. Adding additional cruises would increase the amount, and temporal distribution of biological data collected including length frequency and age data. Expanded sampling may also be useful in producing more accurate indices of abundance for target species and potentially for species not currently targeted. In addition, reinitiating sampling during the winter would begin a baseline of winter estuarine habitat use by species as ranges shift due to environmental changes. Approximately \$25,000 are budgeted each year to cover expenses for the June and September cruises. Adding two additional months would double this figure while adding one would require an additional \$12,500. (\$25,000 annually)

Coastal Longline Surveys

The longline surveys were initiated in 2006 as part of ACFCMA supplemental funding with the primary objective to monitor the adult population of red drum as they move offshore in the fall. The survey has also proven to be very success at monitoring several shark species with SEAMAP data from SC and GA being used in stock assessments. Presently, SCDNR conducts their survey from August 15th to December 15th with three six-week sampling periods. In order to assess multiple shark species populations, it will be necessary to add an additional sampling period (July 1 – August 14th) into expanding Georgia's longline sampling, which presently samples monthly from May to December. (\$15,000 annually)

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 diet study data, an image library of sampled species, the winter tagging cruise, and bottom habitat information into the comprehensive SEAMAP-South Atlantic data management system. An estimated budget increase of \$80,000 for SEAMAP-South Atlantic data management would be needed to accommodate these expansions. (\$80,000 annually)

SERTC

Over the years there has been a significant increase in the collection and use of genetic samples by SEAMAP-SA surveys at SCDNR. The cataloguing and curating these samples and making them available for third parties has been largely unfunded. Given the current expertise, this would be a task the SERTC is uniquely qualified for. The annual cost would be \approx \$75,000 and \$100,000 including a (part-time) salary for a biologist and supplies for curation. (\$100,000 annually)

II – Caribbean

(Increase of \$835,000/year, plus \$540,000/once every two years)

Lobster Surveys

Pueruli lobster studies have been ongoing 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 be expanded to the entire 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.

Conch Surveys

Diver surveys of conch have been ongoing 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).

Hook-and-Line Surveys

At the SEDAR 8 meeting, the limitations of the SEAMAP-C 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 annually (USVI) and \$175,000 annually (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 at \$175,000 annually, and for samples gathered at Puerto Rico \$335,000 annually.

III – DEVELOP NEW FISHERY INDEPENDENT DATA COLLECTION PROGRAMS

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 \$2,750,000/year)

Reef Fish Hooked-Gear Survey

In recent years, the Gulf SEAMAP Reef Fish Survey using video cameras has expanded to include shallower waters of the Florida Panhandle and West Florida Shelf. While this survey provides valuable data on relative abundance and size composition of numerous managed reef fishes, additional fishery-independent effort is required to provide life history data (e.g., age, sex, reproductive state). Existing sampling programs initially relied on the use of chevron traps, although these gears have largely been discontinued due to their extreme species and size selectivity. More recently, a Gulf SEAMAP Vertical Line Survey was developed to target primarily red snapper occupying high relief habitats (e.g., artificial reefs), although preliminary results indicate that this survey is not as effective on low-relief habitats, or at capturing bottom associated reef fish such as groupers. Accordingly, a complementary hooked gear approach is required to provide valuable relative abundance and life history data on low relief, natural reef habitats throughout the northern Gulf of Mexico. Funding is needed to develop and expand a standardized, repetitive hooked gear survey collaboratively with input from commercial and recreational fishers. This survey involves repetitively deploying a series of two-hook bottom rigs outfitted with varying hook sizes (e.g., 8/0, 11/0, and 15/0) fished on the bottom for a set period of time. Preliminary results indicate that this approach results in higher catch rates and greater statistical power for many reef fish. (\$750,000 annually)

Synoptic Life History Surveys

The accurate assessment of managed fisheries stocks often requires life history data that cannot be provided from ongoing fishery-independent surveys alone. Of particular importance are size- or age-specific estimates of fecundity and fraction of the population capable of spawning through time, which can be used to improve the accuracy of estimated annual stock reproductive potential, and sex ratios of hermaphroditic species such as groupers. To be most useful, these life history data require systematic (e.g., monthly) synoptic sampling covering the full spatial distribution and spawning season of the species of interest. Species vary with respect to both spawning season and susceptibility to various fishing techniques, so sample collection will likely require species- or guild-specific survey methods; however, because estimated life history parameters are unlikely to change quickly, only periodic (e.g., every 5 – 10 years) sampling would be required. Target species or guilds would be determined based on upcoming stock assessment schedules and most critical life history data needs. (\$1,000,000 annually)

Habitat Mapping

Managed offshore areas of concern to fishery managers include MPAs, deepwater coral, HAPCs, and other bathymetric features or unique habitats that warrant characterization due in part to their importance as EFH for managed species. Habitat mapping surveys utilize remote sensing technologies to identify and describe features of the sea floor and habitats that reside on it. Mapping used in conjunction with fishery-independent surveys will allow ecosystem models to describe the interactions of species or multi-species complexes with a variety of habitats or bottom types. Mapping is best accomplished with use of side-scan in shallower depths or multi-beam sonar systems in deeper waters. (\$1,000,000 annually for approximately 700 km² mapped)

III – South Atlantic

(Increase of \$2,364,000/year and \$320,000 once)

Pelagic Survey

Currently, there is no fishery-independent survey to monitor pelagic fish such as mackerels, dolphin, wahoo, and other species 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 clearly identified in the research recommendations. A pelagic survey would require initiating a new monitoring effort since it would require gear specific to the pelagic environment (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. This new survey could potentially be done in collaboration with the fishing industry. (750,000 annually)

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)⁶, might be run as a stand-alone project standardized among researchers regionally or associated with the trawl survey. The lower tiers (phyto- and non-ichthy-zooplankton) should also be considered. (\$500,000/yr).

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,

⁶ SAFIMP. 2009. Final report: South Atlantic fishery independent monitoring program workshop. In: Williams EH, Carmichael J (eds), Beaufort, NC, 85 pp.

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 Bridgenet Ichthyoplankton Sampling Program

Initiated in 1986, the Beaufort Bridgenet Ichthyoplankton Sampling Program (BBISP) at the NOAA Beaufort Laboratory represents a multi-decade time series of larval fish ingress through Beaufort Inlet, North Carolina. Fall/winter spawned larvae are sampled weekly from mid-November through April/May at the Pivers Island Bridge. As of 2016, more than 868,000 larval fish from > 100 taxa have been identified from BBISP samples, including multiple species of recreational and management importance [e.g., Atlantic croaker (*Micropogonias undulatus*), spot (*Leiostomus xanthurus*), summer and southern flounder (*Paralichthys dentatus* and *lethostigma*, respectively), American eel (*Anguilla rostrata*), Atlantic menhaden (*Brevoortia tyrannus*) and striped mullet (*Mugil cephalus*)]. 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, spot, summer flounder) or as fish community indicators of climate variability or anthropogenic impacts. Catch and densities are available for 1986-2013. The sampling is ongoing and performed by volunteers, but sample processing from 2013-present is currently unfunded. (\$29,000 annually including data uploads to SEAMAP database)

North Inlet-Winyah Bay, SC Ichthyoplankton Survey

Collections of larval fishes and more than 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, University of South Carolina in Georgetown, 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. The collections 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 appears to be the longest, comprehensive zooplankton time series from Atlantic and Gulf estuaries. Along with other multi-decadal time series from North Carolina and New Jersey, South Carolina ichthyoplankton data through 2013 are now available at <http://www.seamap.org/seamapDatabase.html>. The survey and associated short-term studies have been supported by multiple, non-permanent sources over the decades including the North Inlet- Winyah Bay NERR. Additional funds are necessary to sustain the collection program and sample processing. (\$35,000 annually including data uploads to SEAMAP database)

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)

Stock Structure Studies

Several state fisheries agencies and university researchers in the South Atlantic region conduct tagging studies of fish, sea turtles, and marine mammals to better understand movements, migrations, and geographic population structure. A variety of acoustic and conventional physical tags have been deployed on species ranging from red drum, cobia, striped bass, and sturgeon. Applying tagging study results to stock identification, stock assessments, and other products for fisheries management can be challenging because individual studies are often 1) limited in temporal and geographic scale, and 2) inhibited by inconsistencies between research groups in data storage and sharing capabilities. Presently, the southeast has several acoustic arrays located off the Georgia, South Carolina, and Florida coast extending from the shoreline out to approximately 12 miles. These arrays have proven effective at capturing the migratory behavior of many species including Atlantic Sturgeon, Lemon Sharks, Bull Sharks, White Sharks, Red Drum, Black Drum, and Tripletail. Expansion of these arrays could include additional array transects to fill in gaps off north Georgia (Savannah region), north Florida (Jacksonville region) and North Carolina, in addition to providing funding for maintenance and tagging supplies. SEAMAP, in conjunction with the ASMFC Interstate Tagging Committee, could expand evaluations of tag types and protocols in conjunction with ongoing SEAMAP surveys. Funds could be allocated to complete and maintain strategically placed ocean acoustic gates in order to track migration across states. Given its experience with developing the SEAMAP_SA database in Oracle, its Data Management Work Group could evaluate the various tagging projects data schemas and databases and recommend best data processes, and data sharing considerations in order to enhance the use of tagging study results to answer stock structure and other fisheries management questions. (\$300,000 initially, divided between the three states and \$225,000 divided between each state annually for subsequent maintenance)

Cooperation of the SE Regional Estuarine Trawl Surveys

There are several trawl surveys conducted in the southeast that SEAMAP has identified as partners or potential partners. These surveys all have a long time-series that can provide information for Commission managed species. Additionally, SEAMAP's Crustacean Committee would greatly benefit from data sharing from many of these surveys. Ultimately, these data can be shared within the SEAMAP data portal for broader use. Costs per survey (or state) would be similar to that for the Pamlico Sound Trawl Survey (\$50,000) to provide QA/QC, management, and uploading of the data to the portal. Surveys may include:

State	Agency and Survey
NC	NCDMF Anadromous Trawl Survey (Program 100)
	NCDMF Estuarine Trawl Survey (Program 120)
SC	SCDNR Crustacean Monitoring Trawl Sampling

- FL FWC Fishery Independent Monitoring (FIMS)
- GA GADNR Ecological Monitoring Trawl Survey (EMTS)
- GADNR Juvenile Trawl Survey (JTS)

Crustacean Assessments

A regional crustacean stock assessment would improve management coordination between states and inform crustacean status throughout the region. If there is an issue in one state, it may be an indication of an issue in the larger population as a whole. SEAMAP SA proposes to coordinate a regional South Atlantic blue crab and/or shrimp stock assessment, incorporating fisheries-dependent and independent data as well as environmental data (\$10,000 per species for one data workshop and assessment workshop, \$20,000 total). The SEAMAP Crustacean Workgroup recommends investigating the feasibility of a comprehensive fishery independent golden crab survey, possibly in collaborations with the industry (\$150,000/year) to monitor this species which has only a limited entry trap fishery, operating off the coast of Florida. (\$150,000 annually, \$20,000 once)

III – Caribbean

(Increase of \$270,000/once every three years; \$400,000 annually; and \$100,000/once every two years)

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 \$150,000/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. Other species under management by the CFMC through annual catch quotas and data is needed to evaluate those resources. Proposed additional budget is \$180,000 annually (USVI), and \$220,000 annually (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 – SEAMAP Committees Membership 2015

(check www.seamap.org for current membership)

SEAMAP-Gulf of Mexico Committee

CHLOE DEAN, Louisiana Department of Wildlife and Fisheries

JOHN FROESCHE, Gulf of Mexico Fishery Management Council

READ HENDON, Mississippi Department of Marine Resources/Gulf Coast Research Lab,

JOHN MARESKA, Alabama Department of Conservation and Natural Resources, *Chair*

FERNANDO MARTINEZ-ANDRADE, Texas Parks and Wildlife Department

TED SWITZER, Florida Fish and Wildlife Conservation Commission

BUTCH PELLEGRIN, National Marine Fisheries Service, Pascagoula Laboratory, MS

JEFF RESTER, Gulf States Marine Fisheries Commission, *Coordinator*

SEAMAP-South Atlantic Committee

PATRICK CAMPFIELD, Atlantic States Marine Fisheries Commission

PATRICK GEER, Georgia Department of Natural Resources, Coastal Resources Division

WILSON LANEY, U.S. Fish & Wildlife Service, South Atlantic Fisheries Coordination Office

SHANNA MADSEN, Atlantic States Marine Fisheries Commission, *Coordinator*

ROGER PUGLIESE, South Atlantic Fishery Management Council, *Chair*

TINA UDOUJ, Fish and Wildlife Research Institute, FL

TODD KELLISON, National Marine Fisheries Service, Beaufort Laboratory, NC

MARCEL REICHERT, South Carolina Department of Natural Resources

KATY WEST, North Carolina Department of Environment and Natural Resources

SEAMAP-Caribbean Committee

RUTH GOMEZ, Virgin Islands Department of Planning and Natural Resources/Division of Fish and Wildlife

JONATHAN E. BROWN, Virgin Islands Department of Planning and Natural Resources
Division of Fish and Wildlife, University of the Virgin Islands. *Chair*

RICHARD APPELDOORN, Puerto Rico Sea Grant College Program / University of Puerto Rico Department of Marine Sciences

GRACIELA GARCÍA-MOLINER, Caribbean Fishery Management Council

MIGUEL ROLON, Caribbean Fishery Management Council

RICARDO LOPEZ, Puerto Rico Department of Natural and Environmental Resources

VERONICA SEDA, Puerto Rico Department of Natural and Environmental Resources

AIDA ROSARIO, Emeritus Puerto Rico Department of Natural and Environmental Resources

EDWIN MUÑIZ, U.S. Fish and Wildlife Service

ANA M. ROMÁN, U.S. Fish and Wildlife Service

EDGARDO OJEDA SERRANO, University of Puerto Rico/Sea Grant College Program,
Coordinator

RUPERTO CHAPARRO, University of Puerto Rico Sea Grant College Program

WALTER INGRAM /ERIC HOFFMAYER, NOAA / SEFSC

APPENDIX B – South Atlantic Research and Monitoring Prioritization Plan for 2015-2019

This document provides summarized research needs identified by the South Atlantic Council. Additional details on items listed here are available in a separate document: “SAFMC Research and Monitoring Plan Source Document”.

I. Short term, time dependent Research needs for stock assessments to be conducted in 2017-2018

- 2016 Update process assessment for Blueline Tilefish. The following items are needed by July 1, 2016:
 - Age validation, reader comparison and calibration
 - Fecundity evaluation including specimens under 18”
 - Stock identification
 - Discard mortality estimates
- 2017 Benchmark assessments for Scamp and Gray Snapper. The following items are needed by February 1, 2017:
 - Determine stock structure
 - Age validation, reader comparison and calibration
 - Discard mortality estimate
- 2017 Update process assessment of Vermilion Snapper. The following items are needed by July 1, 2017:
 - Update growth models incorporating age-0 fish
- 2017 Update process assessment for Greater Amberjack. The following items are needed by July 1, 2017:
 - Age validation, reader comparison and calibration
 - Discard mortality estimates
- Develop annual abundance indices for all managed stocks adequately sampled by the expanded Southeast Reef Fish Survey (SERFS), including methods to merge indices including new sampling with those based on pre-SERFS MARMAP efforts, by January 1, 2017 for use in stock assessment and management evaluations

II. Short Term Needs for Spawning Special Management Zones to be addressed in the next 5 years.

- Document spawning of priority species in the snapper and grouper complex within the proposed Spawning SMZs.

- Complete multi-beam surveys of the Spawning SMZs.

III. Short Term Needs for MPA monitoring to be addressed within the next 5 years.

- Maintain annual monitoring to collect data inside and outside the MPAs to characterize MPAs and enable comparison to reference sites. Identify fish population demographics (e.g. size and age structure, sex ratio, species use of habitat by life stage, spawning activities, etc.) within and adjacent to the MPAs.
- Characterize spawning areas for deepwater snapper and grouper species within the MPAs. Other priority species if identified to spawn within the MPA will also be characterized.
- Complete multibeam surveys of the MPAs.
- Evaluate the sampling program of the SAFMC MPAs. The evaluation should review data on compliance, species abundance, and diversity, and determine if current sampling targets are sufficient.
- Evaluate the effectiveness of current closed areas in achieving management objectives.
- Develop methods for incorporating the impacts of MPA on management actions and stock status.

IV. Long Term Needs to be addressed within the next 5 years.

- Conduct stock identification studies for white grunt. Results required by mid-2019 for use in a benchmark stock assessment in 2020.
- Obtain life history traits for all managed species, including von Bertalanffy growth parameters and maturity and reproductive rates.
- Evaluate the cumulative economic and social impacts of existing regulations on the multi-species snapper-grouper fishery in the South Atlantic.
- Develop management strategies to reduce discard mortality in the multi-species snapper- grouper fishery.
- Develop direct age validation techniques for deepwater and shallow water snapper grouper species.
- Provide an evaluation of the independent survey and biological sampling information available for all SAFMC managed stocks that are currently unassessed. This evaluation should document past sampling intensity and current sampling targets and provide guidance on the type of stock assessments feasible given currently available data.
- Conduct tagging studies of snapper-grouper complex species, including the Gulf and SA regions, to evaluate movements between regions.
- Reproductive biology work on red grouper, and other shallow water groupers,

to determine latitudinal variation in spawning periodicity and habits.

V. Specific Monitoring Priorities

- Increase funding for fisheries independent monitoring in the South Atlantic. Specific needs include:
 - Restoring MARMAP funding to a minimum of \$850,000 annually.
 - Funding MARMAP sufficiently to support reinitiating long bottom longline sampling that provides the only abundance information for deepwater stocks such as Tilefish.
 - Maintaining funding for SEAMAP at levels sufficient to support long-term fishery independent survey operations.
 - Providing funding for the MPA/SMZ monitoring needs noted above.
- Monitor the mixing rates of Gulf and South Atlantic king mackerel. Mixing rates may change over time and should therefore be regularly evaluated, although annual monitoring may not be necessary.
- Implement a monitoring and research program to address issues relevant to ecosystem management. Topics include trophic interactions, food preferences, predator-prey relationships, and ecosystem connectivity.

VI. Specific Reporting Requests

- Annual SAFE reports that provide stock status including OFL and MSY, an evaluation of the management program including whether ACLs were met or AMs triggered and addressing reasons for such, results of independent fisheries monitoring, complete landings and discard losses in weight and numbers of fish, fishery dependent monitoring statistics, and measures of effort and economic value for all managed stocks by June 1 of each year.
- Annual Report on the SEFIS program addressing sampling effort and findings for assessed species, by October 1 of each year.
- Annual progress report, at the June Council meeting, detailing efforts to implement the research recommendations noted in annual Council Research and Monitoring Reports.
- Direct appropriate SEFSC staff to meet with the SSC at its Spring meeting each year when SAFMC research priorities are reviewed, to increase interaction and communication between the SSC and agency scientists.

APPENDIX C – GMFMC Research Priorities 2015-2019

The following list of research and monitoring priorities is organized in four main sections: broad multi-purpose research, monitoring, and survey programs; fish biology and stock status concerns; social, cultural, and economic concerns; and ecosystem considerations. The first section contains recommendations for research, monitoring, and survey programs, socioeconomic issues, and ecosystem-based management concerns. Additional priorities for socioeconomics are in **Section III**, and those for ecosystem management are in **Section IV**.

As per the request from NOAA/NMFS, the research and monitoring priorities indicated in **Section I** are ranked and labeled using the following priority code:

Priority Codes:

A: Highest Priority – Surveys to meet critical needs for stock assessments and management.

B: 2nd Priority – Surveys to improve indices of abundance, life history, or human dimension data that compliments priority A.

C: 3rd Priority – Surveys to characterize stocks or parameters for assessments.

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

- a. **Fishery-Independent Sampling:** Expand Gulf-wide, fisheries-independent monitoring programs to enhance the capacity to associate fisheries data with: environmental data, habitat quality and abundance, and physical oceanographic parameters. Particular emphasis should be placed on the expansion and enhancement of the SEAMAP Reef Fish Video Survey, the NMFS Panama City Laboratory Reef Fish Video Survey, and the SEAMAP Groundfish Trawl Survey in the eastern Gulf of Mexico. Additional Gulf-wide vertical, bottom longline, video, visual, and larval survey efforts are needed to better inform stock-recruit relationship determination efforts in stock assessments. Moreover, expanded sampling efforts should be implemented to enhance physical and biological sampling that allows development of long-term time series of physical, biological, and chemical oceanographic data for use in future ecosystem-based modeling approaches. **Priority Code: A**
- b. **Fishery Monitoring and Research – Socioeconomic Parameters:** Develop a longitudinal human dimensions study to examine and monitor change over time among recreational and commercial fishermen and communities, including a comprehensive survey of individuals (or fishermen panel studies) throughout the Gulf of Mexico which should be repeated periodically (e.g., as an add-on survey to MRIP, for the recreational sector). By providing a series of snapshots over time, change can be studied, understood, and applied to management. In addition to basic socio-demographic characteristics of commercial and recreational fishermen (such as age, gender, income, boat ownership, fishing mode, and experience), additional components to evaluate include:

- Angler attitudes, motivations and satisfaction, management preferences, attitudes toward catch and release, expenditures, and perceptions of resource health.
 - Survey of engagement and reliance/dependence on marine fisheries. For commercial fishermen, indicators include information about the proportions of their household incomes derived from marine fisheries. For recreational fishermen, indicators include information about how often they participate in marine fishing compared to other recreational activities.
 - Census of employees at fish dealers and processors.
 - Census of captains and crew of reef fish and CMP commercial permitted vessels.
 - Census of captains and crew of federally permitted for-hire vessels.
 - Update census, landings, and permit data included in fishing community profiles.
 - Identify potential populations of Environmental Justice concern.
- Priority Code A

c. **Fishery-Dependent Monitoring and Sampling:** Enhance existing recreational (forhire and private/rental components) and commercial fishery-dependent sampling programs. Specifically, improve temporal/spatial coverage (ideally Gulf-wide and potentially including international fisheries such as Mexico), distribution of ex-vessel prices by size class, increase collection of hard parts and tissues to support life history studies and catch-at-age analyses, particularly for data-poor stocks. Develop and implement an effective and efficient electronic data reporting system for the recreational components of the fishing community, specifically the charter for-hire vessels. **Priority Code: A**

d. **Estimation of Bycatch:** To improve stock assessments, more comprehensive species identification and abundance information for reef fish and coastal migratory pelagics impacted by shrimp trawl bycatch. Continue collecting information on bycatch from reef fish and coastal migratory pelagic fisheries for all vertical line and bottom longline gear types in order to disseminate practical methods for minimizing bycatch. Observers and observer coverage continues to be a critical part of effort monitoring, shrimp trawl bycatch estimation, and interactions with endangered species and fishing gears playing an important role for *in situ* data collection and validation, discard mortality estimates, and catch-per-unit-effort estimations. **Priority Code: A**

e. **Estimation of Discards:** Develop research and monitoring programs to evaluate the magnitude and effects of discard mortality rates (both commercial and recreational), and disseminate practical methods for minimizing mortality. The estimation of the total number of discards requires a continued expansion of fishery observer programs, in some cases by adding observer personnel and in others (small or unsafe vessels) by use of innovative technologies (cameras, phone/tablet applications). This needs to be done for all components of the commercial and for-hire industries and the private recreational sector. **Priority Code: A**

f. **Ecosystem-Based Management – Data Collection Priorities:** As the Council moves toward incorporating an ecosystem-based approach to management, the following data collection and analyses are needed.

A. Data Needs

- Human Components (social and economic inputs), including land use and environmental change.
- Simulation or prioritization exercise for changes in fishing behaviors (such as changes in response to stock size, regulation, profitability).
- Biotic Components (coastal habitat, coral, algal/zooplankton, fishery, etc.).
- Ecosystem Components (valuation of ecosystem services, nutrient cycling, ecosystem management, ecosystem restoration, marine spatial planning).
- Physical Components (GIS database development/mapping of habitat, climatology, geographic and oceanographic variables). **Priority Code B**

B. Ecological Relationships, Linkages and Networks

- Habitat Mapping, Quality Assessment, Species Utilization and Alterations
- Community Structure/Fish Assemblage Analysis and Resilience
- Analysis of Ecosystem Network and Interactions
- Monitoring and Research on Marine Protected Areas
- Development of biological and physical indicators including:
 - fish recruitment, distribution, and migration;
 - ecosystem community structure;
 - annual fish growth patterns from length-at-age data; ○ fishery production and other mortalities; ○ primary and secondary production;
 - invasive species (e.g., lionfish, orange cup coral, Asian tiger prawns) distribution, and interactions and effects;
 - remote sensing and oceanographic measurements;
 - large-scale atmospheric and oceanic fields (both time series and derived products); and
 - climate and environmental variability.
- Development of social and economic indicators including assessment methodologies for the potential social and economic effects of an ecosystem-based fisheries management plan. **Priority Code B.**

g. **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 related to research recommendation number 4 under Economic and Socio-cultural Recommendations, 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: B

h. **Episodic Mortality Events:** Determine effects of episodic mortality events on specific species and groups. Examples of known events include red tide (2005, 2014), atypical weather conditions (2010 cold weather period), and the Deepwater Horizon MC 252 oil spill (2010). Develop metrics for incorporating the effects of such events into abundance index calculations (e.g., 2005 red tide input into models as a discard fleet). Work towards refining predictive abilities to generally estimate the potential effects of such events in the future. **Priority Code: B**

i. **Large-scale Tagging Program:** Continue support of large-scale tagging programs (conventional dart tags, PIT tags, telemetry, and genetic tagging methods) aiming to better quantify fishing mortality rates, movements, and improve estimates of natural mortality. **Priority Code: C**

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

Each species listed in this section has identified research needs provided by SEDAR workshop panel recommendations or peer-reviewed literature and is assigned a priority code as indicated below. Priority was given to species currently in a rebuilding plan. This list includes some species jointly assessed across the Gulf and South Atlantic Council's jurisdiction, but is not a comprehensive list of all species managed by the Gulf Council. 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.

The research and monitoring priorities indicated in **Section II** are ranked by the priority code that follows:

Priority Codes:

A: Highest Priority – Stocks designated as overfished AND undergoing overfishing or in critical need of an assessment.

B: 2nd Priority – Stocks designated as overfished OR undergoing overfishing or in need of an assessment.

C: 3rd Priority – Stocks with SEDAR assessments scheduled but not classified A or B. **D:** Not yet prioritized – Criteria needed to prioritize non-SEDAR recommendations

1. Gulf of Mexico Red Snapper – Priority Code: A

- Research to characterize the effects of the Deepwater Horizon MC 252 oil spill is recommended to better inform episodic mortality estimates for future stock assessments.
- Continued research is recommended to estimate the use and effect of artificial reef structures in the Gulf of Mexico on red snapper population abundance, age and length composition, and spatial distribution.

- Research on the ecological effects of population expansion in the eastern Gulf of Mexico focusing on interactions with other species such as gag and vermilion snapper.

2. Gulf of Mexico Greater Amberjack - Priority Code: A

- Additional age and growth studies using validation methods such as mark-recapture to verify annuli and size-at-age composition.
- Continued work on reproductive biology including size of females at maturity using consistent techniques Gulf-wide.
- Continued work on discard mortality Gulf-wide comparing the use of artificial versus live baits using consistent techniques.

3. Gulf of Mexico Gray Triggerfish - Priority Code: A

- Additional aging studies that possibly include radiocarbon dating or mark-recapture with staining to verify annuli formation in spines.
Studies on the catchability of the dominant males during spawning season when they are in harem groups and potential reproductive limitations if the dominant males are removed.
- Movement studies, particularly during the spawning season, to better understand spawning behaviors. For example, it is unknown whether fish return to particular reef sites during the spawning season.

4. Gulf of Mexico Gag - Priority Code: B

- Additional research on the number, location, and persistence of spawning aggregations should be obtained and presented in future assessments to identify essential habitat.
- Continue genetics research to determine connectivity among different regions.
- Environmental factors (when possible) should be considered in future index standardization procedures, particularly for spawner-recruit relationships regarding the 2014 red tide event.
- 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. Methods to estimate “skip spawning” by female gag should also be further investigated.
- Continue studies to evaluate the efficacy of marine reserves located on the west Florida shelf (i.e., Madison-Swanson and Steamboat Lumps) focusing on sex ratios and movement inside and outside the reserves.

5. Hogfish - Priority Code: B

- Improve data collection techniques that focus on the three stock nature of hogfish in the southeastern United States; specifically, fishery-dependent sampling methodologies that would intercept landed fish to achieve better estimates of age and length observations.

- Continue improving fishery-independent survey design to better estimate indices of abundance, particularly for juveniles.
- Continue studies on reproductive behavior and contribution of males to the spawning potential of the stocks.

6. Tilefishes - Priority Code: B

- Studies on the 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. South Atlantic/Gulf of Mexico Goliath Grouper - Priority Code: C

- Better geographic information on indices of abundance outside the State of Florida (historical Gulf-wide range versus south Florida).
- Research and monitoring of stock structure of the population, particularly age composition and close-kin genetic analyses.
- Obtaining and quantifying information on historical abundance, perhaps via old logbooks.
- Additional research and quantification of sources of discard mortality including illegal harvest.

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.
- Research on the number, location, and persistence of spawning aggregations in the Gulf of Mexico.
- Evaluate the level of toxins such as methylmercury in adults.

8. Gulf of Mexico Red Grouper - Priority Code: C

- Continue studies on fecundity and spawning frequency by age.
- Incorporate a spatial-temporal design to improve estimates of reproductive potential and spawning patterns to better understand and discriminate between annual asynchrony in spawning (skipped spawning) and seasonal asynchrony in spawning.

9. South Atlantic/Gulf of Mexico Yellowtail Snapper -Priority Code: C

- Continue research and development on the reef visual census before use as a fishery-independent abundance index.
- Studies on discard mortality comparing the use of circle hooks versus J-hooks.

10. Vermilion Snapper - Priority Code: C

- Early life history information for juveniles, such as size and age at recruitment to benthic habitat.
- Reproductive behavior, productivity, and habitat association are needed.

- Movement and diet studies are an important part of understanding this species role within the ecosystem in the Gulf of Mexico. Predator-prey and competitive interactions with red snapper will be critical as the Council moves forward with ecosystem-based management.

11. Yellowedge Grouper - Priority Code: C

- Continued studies on early life history information for juveniles.
- Adult distribution and associated habitat.
- Studies on spawning aggregations, reproductive behavior, and locations.

12. South Atlantic/Gulf of Mexico Black Grouper - Priority Code: C

Note: The priority of black grouper could change after the 2014 update assessment • Juvenile habitat associations and size and age of recruitment.

- Identify locations of spawning aggregations, reproductive behavior, and associated habitat.

13. Atlantic and Gulf of Mexico King Mackerel - Priority Code: C

- Field studies are needed to develop or improve batch fecundity, spawning frequency, and age specific fecundity estimates.
- Continued studies on stock mixing including mark-recapture efforts and analyses 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: C

- Studies are needed to determine age composition for spawning red drum in federal waters.
- Indices of abundance are needed to provide abundance estimates of the adult stock, with consideration given to mark-recapture and/or close-kin analyses.
- Implement a Gulf-wide tagging program with 20,000 tags and 30 satellite tags.

15. Royal Red Shrimp - Priority Code: D

- Habitat and distribution of adults and, to the extent possible, juveniles.
- Reproductive patterns of adults such as spawning seasons and productivity.
- Research to characterize the effects of the Deepwater Horizon oil spill on distribution and populations.

Research and monitoring priorities indicated in **Sections III and IV** are ranked and labeled using the following priority codes:

Priority Codes:

A: Highest Priority – Critical research and data needs for socio-economic analyses.

B: 2nd Priority – Supplementary data collection and research needs. **C:**
3rd Priority – Longer term data needs and research efforts.

III. Economic and Socio-cultural Recommendations

Over the next 5 years and beyond, fishery management challenges will increasingly pertain to the social environment resulting in social and economic effects. Addressing socio-economic issues such as maximizing fishing opportunities under finite quotas and allocating scarce resources among competing user groups requires a better understanding of the human environment.

(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, headboats) 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 headboats), levels of fishing effort and catch, and switching behavior among target species and other forms of recreational activities in response to regulation. **Priority Code: A**

(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. **Priority Code: A**

(3) Development of methodologies to accurately assess the cumulative economic and social impacts of individual fishing quotas on Gulf of Mexico fisheries. **Priority Code: A**

(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 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 and the rates at which boats enter or exit the fishery. **Priority Code: A**

(5) Continue the development of social and economic indicators, such as those employing factors of vulnerability and resilience. **Priority Code: A**

(6) Evaluate the social and economic impacts of ecosystem management on the various categories of stakeholders to satisfy National Standard 8 of the Magnuson-Stevens Act in regard to the impact of an ecosystem approach on fishing communities. **Priority Code: A**

(7) Develop quantitative models for evaluating social and economic impacts of allocation or reallocation schemes. Evaluate the appropriateness of various incentive-based instruments for the management of recreational fisheries and assess their socio-economic effects. **Priority Code: B**

(8) Identify all ecosystem stakeholders and assess the relationship between the ecosystem/fisheries and these stakeholders (i.e., how the actions of these various stakeholders affect the fishery and conversely how changes in the state of the ecosystem/fishery will affect stakeholders). Develop a historical framework that integrates the array of relevant human activities to ecosystem management in a way that is meaningful. **Priority Code: B**

(9) Develop methods to assess land-use changes and the impact of land-use change on vulnerable human populations and marine ecosystems. **Priority Code: C**

IV. Ecosystem-Based Management Recommendations

The short-term goal is the continued development of 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, and to provide the necessary information to effectively adapt management to mitigate the ecological, social, and economic impacts of major shifts in the productivity and mortality of living marine resources.

Ecosystem Model Development: - Priority Code: C

The development of an ecosystem model uses the ranking for the previous three sections' priorities, because this item builds upon the previous data collection and research needs outlined above.

Develop predictive models for ecosystem assessment and to project/forecast fish productivity based on:

- A suggested approach is to develop models to conduct IEAs as discussed in NOAA Technical Memorandum NMFS-NWFSC-92
- 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)
- Trophic dynamics/networks, ocean productivity, interaction with protected species and introduction of invasive species
- Habitat availability and quality
- Long-term climate change and its relationship with the interaction of anthropogenic factors, physical habitat, trophic dynamics and habitat availability
- Descriptive Models - to provide a snapshot of the ecosystem (e.g., Ecopath/Ecosim, Atlantis)
- “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. Components of Ecosystem Forecasting include: Review and evaluation of current tools; tool development and model tuning; and tool application and evaluation. Components of Ecosystem Monitoring include: Data and communication portal development; continuing assessment need for EBM; and incorporating climate change
- Identifying opportunities and strategies for collaborative management of resources that are outside the jurisdiction of NOAA Fisheries but affect fishery stocks (e.g. freshwater inflows, non-point source pollution, human dimensions, loss of habitat such as marshes)
- Develop methods to incorporate other significant stakeholders (i.e., municipalities, authorities and state governments) into the ecosystem management process
- Identify environmental justice issues related to ecosystem management

APPENDIX D – ASMFC Research Priorities 2013

2013 ASMFC Critical Research Needs in Support of Interjurisdictional Fisheries Management—Subset of South Atlantic species

American Eel

- Develop a coastwide sampling program for yellow and silver stage American eels using standardized and statistically robust methodologies.
- Develop standardized sampling gear, habitat, and ageing methods and conduct intensive age and growth studies at regional index sites to support development of reference points and estimates of exploitation.

American Shad/River Herring

- Develop demersal and pelagic trawl CPUE indices of offshore river herring biomass.
- Conduct population assessments on river herring, particularly in the south.

Atlantic Croaker

- Expand fishery-independent surveys and subsample for individual weights and ages, especially in the southern range.
- Continue monitoring juvenile croaker populations in major nursery areas.
- Develop coastwide juvenile croaker indices to clarify stock status.

Atlantic Menhaden

- Develop a coast wide, fishery-independent index of adult abundance at age to replace or augment the existing Potomac River pound net index used in the assessment model. Possible methodologies include an air spotter survey or an industry-based survey with scientific observers on board collecting the data. In all cases, a sound statistical design is essential (involve statisticians in the development and review of the design; some trial surveys may be necessary).
- Investigate interannual maturity variability via collection of annual samples of mature fish along the Atlantic coast.

Atlantic Striped Bass

- Develop a refined and cost-efficient, fisheries-independent coastal population index for striped bass stocks.

Bluefish

- Initiate fisheries-independent sampling of offshore populations of bluefish during the winter months.

Coastal Sharks

- Develop a stock wide fishery-independent monitoring program in state coastal waters for dusky sharks that includes annual samples of length and age frequencies.

Red Drum

- Conduct fishery-independent sampling of sub-adult and adult red drum (age 4 and older) in each state from Virginia to Florida.
- Refine maturity schedules for northern and southern stocks. Conduct studies on size, age, and spatial specific fecundity.

Spanish Mackerel

- Collect and analyze fishery-independent data for adult Spanish mackerel.
- Utilize recently developed genetic techniques to investigate the stock structure of Spanish mackerel. Microsatellite information should be explored to consider both stock identity and internal population structure.
- Collect Spanish mackerel maturity data from both regions and both sexes from specimens approximately 275 mm FL and lower to be staged via histological methods.

Spiny Dogfish

- Continue to analyze the effects of environmental conditions on survey catch rates.
- Standardize age determination along the entire East coast.
- Conduct a coastwide tagging study to explore stock structure, migration, and mixing rates.
- Standardize age determination along the entire East Coast. Conduct an ageing workshop for spiny dogfish, encouraging participation by NEFSC, NCDMF, Canada DFO, other interested agencies, academia, and other international investigators with an interest in dogfish ageing.

Spot

- Develop cooperative coastwide spot juvenile indices to clarify stock status.
- Continue monitoring long-term changes in spot abundance, growth rates, and age structure.
- Continue monitoring juvenile spot populations in major nursery areas.

Spotted Seatrout

- Develop state-specific juvenile abundance indices.
- Initiate fishery-independent surveys of spotted seatrout.
- Emphasis should be placed on collecting the necessary biological data to be able to conduct stock assessments and to assist in drafting fishery management plans.

Summer Flounder

- Collect information on overall fecundity for the stock, both egg condition and production, as a better indicator of stock productivity.
- Continue fishery-independent surveys and expand existing surveys to capture all sizes and age classes in order to develop independent catch-at-age and CPUE should focus on YOY and the southern region.

Weakfish

- Monitor weakfish diets over a broad regional and spatial scale.

APPENDIX E – SEDAR Schedule (September 2016)

*Years after 2018 should be considered preliminary and subject to change

2017	SAFMC, GMFMC & MAFMC	Blueline Tilefish	Benchmark
	SAFMC	Black Sea Bass	Standard
	GMFMC	Gray Snapper	Benchmark
	GMFMC	Red Snapper	Standard
	FL FWCC	Black Grouper	Benchmark
	HMS	Sandbar Shark	Standard
	CFMC	Spiny Lobster, Puerto Rico	Standard
	CFMC	Life History	Workshop
	SEDAR	Stock ID & Meristics	Workshop
2017/18	SAFMC	Red Snapper, Red Grouper, Blueline Tilefish, Black Sea Bass	MRIP Revision
	GMFMC	Gag, Greater Amberjack, Vermilion Snapper	MRIP Revision
2018	SAFMC & GMFMC	Scamp & Yellowmouth Grouper	Research Track
	SAFMC	Cobia	Research Track
	SAFMC	Greater Amberjack & Red Porgy	Standard
	GMFMC	Gray Triggerfish & Red Grouper	Standard
	SAFMC & GMFMC	King Mackerel	Research Track
	CFMC	Queen Trigger, Puerto Rico & St. Croix	Standard
	HMS	Gulf Blacktip Shark	Update
	GSMFC	Gulf Menhaden	SEDAR Review
2019	SAFMC	Spanish Mackerel	Standard
	SAFMC	Snowy Grouper	Standard
	HMS	Atlantic Blacktip Shark	Benchmark
	SEDAR	Shark Stock ID & Meristics	Workshop
	ASMFC	Atlantic Menhaden	SEDAR Review
2020	SAFMC & GMFMC	Scamp	Operational
	SAFMC	Cobia	Operational
PROPOSED			
2018	FL FWCC	Yellowtail Snapper	Benchmark
2019	GMFMC	Spanish Mackerel, Yellowedge Grouper, Tilefish, Red Drum, Cobia, Lane Snapper	Standard
	FL FWCC	Hogfish & Mutton Snapper	Update
2020	SAFMC	Red Snapper & Red Grouper	Update
	SAFMC	Gag & Tilefish	Standard
	GMFMC	Greater Amberjack, Gag, Speckled Hind, Red Snapper, Snowy Grouper	Standard

APPENDIX F – SEAMAP History

Birth of the Five-Year Management Plan

The first SEAMAP Strategic Plan was published in January 1981, and 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 subsequent operational plans, including the SEAMAP Gulf of Mexico Operations Plan: 1985-1990 and the SEAMAP South Atlantic Operations Plan: 1986-1990. The five-year SEAMAP Management Plans (1990-1995, 1996-2000, 2001-2005, 2006-2010, 2011-2015, and 2016-2020) provide conceptual framework for all three SEAMAP components.

Budget

For the first three operational years (FY 1982-1984), SEAMAP received no federal programmatic funding and was supported only through existing state and federal resources. Dedicated federal programmatic funding for SEAMAP began in FY 1985 at approximately \$1 million. For most of its history, SEAMAP has been level-funded with small periodic increases, though a notable increase was observed in response to Hurricane Katrina in FY 2007. This event served to boost funding considerably in the following years, to over \$5 million by FY 2009.

<u>Fishing Year</u>	<u>Federal Funding</u>	<u>Fishing Year</u>	<u>Federal Funding</u>
FY 1982-1984	None	FY 2001-2003	\$1.4 million
FY 1985-1991	\$1 million	FY 2004	\$1.67 million*
FY 1992	\$1.4 million	FY 2005-2006	\$1.385 million
FY 1993	\$1.37 million	FY 2007	\$4.37 million**
FY 1994	\$1.32 million	FY 2008	\$4.39 million
FY 1995	\$1.34 million	FY 2009-2010	\$5.09 million
FY 1996-2000	\$1.2 million		

*The budget in FY 2004 was initially set at \$1.75 million, but was reduced to \$1.67 million by rescission.

**SEAMAP-Gulf and NMFS were allocated additional funding in FY 2007 in response to Hurricane Katrina, while the SEAMAP-SA and SEAMAP-C remained level-funded.

Joint Activities

The Gulf and South Atlantic components met jointly for the first time in October 1984. The components decided to meet annually and publish a joint annual program report, beginning in FY 1985, in order to review and document their activities.

In FY 1985, the Gulf and South Atlantic data management workgroups held a joint workshop, where they approved the 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, and the new system was integrated in FY 1988.

In FY 1987, SEAMAP and the UPRSGCP sponsored a passive gear assessment workshop to investigate gear alternatives in areas where trawling is not suitable or may not be preferred.

An external program review was completed in FY 1988, 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. The recommendations were discussed at the SEAMAP joint meeting 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.

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. Initial operations were designed to coordinate, standardize collection, manage, and disseminate data from fishery-independent surveys conducted in the Gulf of Mexico during the summer of 1982. These initial activities established the basic framework for the current program in the Gulf of Mexico, South Atlantic, and Caribbean regions. A table of SEAMAP-Gulf surveys is included below.

<u>Survey</u>	<u>Initial Year of Operation</u>
Summer Shrimp/Groundfish Survey	FY 1982
Spring Plankton Survey	FY 1982
Winter Plankton Survey	FY 1983
Fall Plankton Survey	FY 1984
Fall Shrimp/Groundfish Survey	FY 1985
Reef Fish Survey	FY 1992
Bottom Longline Survey	FY 2007
Vertical Longline Survey	FY 2010

With the onset of data collection in 1982, staff began compiling data 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 workgroups 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.

The Summer Shrimp/Groundfish Survey began in FY 1982, sampling offshore waters from the Florida/Alabama state line to the U.S./Mexican border. With increased funding in subsequent years, Florida was able to begin participating in this survey, and it now extends down into south Florida waters. The Spring Plankton Survey also began in FY 1982 to target larval Atlantic bluefin tuna, but the initial survey design did not maximize likelihood of capture due to the concentration of Atlantic bluefin tuna larvae along oceanographic fronts and eddies. Increased

funding in later years allowed additional sampling to directly target larvae across these areas, resulting in improved data on bluefin tuna in the Gulf of Mexico.

FY 1983 marked the second operational year of SEAMAP-Gulf, and the establishment of the SEAMAP Information System and SEAMAP Ichthyoplankton Archiving Center. 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, to archive all sorted SEAMAP-collected ichthyoplankton specimens archived from SEAMAP cruises, which were made available for use by interested agencies and researchers. In FY 1985, the SEAMAP Ichthyoplankton Archiving Center acquired a computer system, and a second archiving center was added. Both marked advances in data management and specimen archiving. The second center, the SEAMAP Invertebrate Plankton Archiving Center, 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.

The Winter Plankton Survey also began in FY 1983, and occurred five times until 2006 (FY 1984, 1985, 1993 and 1996) in the open Gulf of Mexico. An abbreviated survey took place in 2007, and full surveys were conducted in 2008, 2009, 2012, 2013, and 2015. The Winter Plankton Survey is now scheduled as a biannual survey for the northern Gulf of Mexico.

During FY 1983, the Gulf component conducted a plankton survey of coastal and continental shelf waters in August, targeting king mackerel larvae and collecting 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 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).

In addition to its annual Summer Shrimp/Groundfish Survey, SEAMAP-Gulf began a Fall Shrimp/Groundfish Survey in FY 1985, 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 workgroup 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. A short-term special study on the distribution of shortfin squid was added to the activities of FY 1987. A spring Reef Fish Survey was initiated in FY 1992 to assess the relative abundance and compute population estimates of reef fish in their natural habitat in the Gulf of Mexico.

Funding for SEAMAP has seen a considerable increase beginning in FY 2007 and FY 2008, allowing SEAMAP-Gulf to expand several existing surveys and start new fishery-independent surveys. New surveys include the Bottom Longline Survey, initiated in 2007 to collect coastal shark and finfish abundances and distribution in Gulf of Mexico shallow waters. The SEAMAP Vertical Longline Survey is another recent addition, initiated in FY 2010 by Alabama to complement the SEAMAP Bottom Longline Survey and the NMFS Bottom Longline Survey. Where the longlines of these surveys are too long to adequately sample around hard bottom, coral reefs, or artificial reef areas, the Vertical Longline Survey better assesses reef fish abundance. Louisiana began vertical line sampling around oil and gas platforms and artificial reefs in 2011.

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. SEAMAP and SEPESCA met for a major cooperative event in Mexico City in August 1986. The meeting was attended by representatives of SEAMAP-Gulf and SEAMAP-SA as well as 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 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.

Workshops

To coordinate surveys and information exchange among participants and other involved organizations, SEAMAP periodically sponsors workshops and symposia. In FY 1983, a calibration workshop on trawling gear was sponsored by SEAMAP. This workshop was intended to assist in coordinating and standardizing data collection. Results were published as workshop proceedings.

In September 2010, SEAMAP-Gulf 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 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. Workshop outcomes are used to guide SEAMAP sampling in the Gulf of Mexico.

SEAMAP-South Atlantic

SEAMAP-SA was formally established in October 1983 under the auspices of its management body, the ASMFC SAB. An operations plan was developed and published in FY 1984, entitled

SEAMAP South Atlantic Operations Plan: 1986-1990. A table of SEAMAP-SA surveys is included below.

<u>Survey</u>	<u>Initial Year of Operation</u>
North Carolina Pamlico Sound Trawl Survey	FY 1987
Coastal Trawl Survey	FY 1989
SEAMAP Reef Fish Survey	FY 2009
State Coastal Longline Surveys (NC, SC, GA)	FY 2006

Operations for SEAMAP-SA began in FY 1985, including a spring benthic resources survey, development of objectives and procedures for a bottom mapping project, and development of a calibration protocol for shallow water trawling procedures in the South Atlantic.

In FY 1986, a pilot project for the Coastal Trawl Survey began with preliminary investigations on gear and calibration. The three-year preliminary study continued during FY 1987 and was completed in FY 1988. The Coastal Trawl Survey sampling strategy was finalized and implemented in 1989, standardized in 1990, and an external program review in 2001 led to changes in the sampling design. This project continues today as a long-term survey and constitutes the largest component and highest priority activity in the South Atlantic program. 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 and at an annual cost of \$30,000 or more. This work is ongoing and expensive, necessitating increases in vessel charges. Irrespective of the maintenance the age of the vessel will require vessel replacement in the near future at an expected cost of well over \$1,000,000.

The Pamlico Sound Survey has been carried out annually since FY 1987. 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 1990, the Albemarle Sound component was eliminated from the sampling area.

In FY 1995, the SEAMAP-SA Committee was asked by NMFS to coordinate development of finfish bycatch estimates in the South Atlantic shrimp fishery. The SEAMAP-SA Committee formed the Shrimp Bycatch Workgroup, which consisted of sixteen members from appropriate state and federal agencies with expertise in shrimp bycatch research and management. The workgroup guided data identification and summarization, evaluated estimation methods, and reviewed 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 workgroup. A final report was completed in April 1996.

FY 1999 concluded ten years of standardized data collection for the shallow water trawl program, marking the maturity of the dataset and solidly establishing its utility in fisheries stock

assessments. The Shallow Water Trawl Workgroup produced a 10-year summary report in FY 2000.

In FY 2003, the SEAMAP Data Management Workgroup developed a plan to update the NMFS data structures to contain the full extent of data collected by the Coastal Trawl Survey. The SEAMAP data management system underwent updates throughout 2004 and 2005 in collaboration with NMFS, and the Data Management Committee concurrently developed the SEAMAP.org website. A new SEAMAP logo was produced and the SEAMAP.org website went online in FY 2005. The SEAMAP website also includes general links, information, and documentation (surveys, reports, metadata, and special studies) for SEAMAP-SA programs. In 2008, development of an Oracle database for public access of SEAMAP-SA data began. The Oracle database is constructed to provide access to “normalized data” for a number of fishery independent programs including, but not limited to, SEAMAP Coastal Survey, the NCDMF Pamlico Sound trawl survey, the Coastal Longline Surveys, and the Reef Fish Survey. In 2013, the SEAMAP-SA database became publically available for data exploration and extraction via the ASMFC maintained www.seamap.org site and the SCDNR maintained based Oracle relational database (www.dnr.sc.gov/seamap).

ASMFC’s SAB initiated a Coastal Longline Survey in 2006 to gather information on adult red drum populations emigrating from estuaries, using ACFCMA funding. The project was designed to sample from North Carolina to Florida to develop a better understanding of abundance, distribution, and age composition of the stock and allow for more effective and responsible management. Derived information is also used for coastal shark assessments in the South Atlantic. Collaborating partners are North Carolina DMF, South Carolina DNR, and Georgia DNR.

SEAMAP-SA received increased funding in FY 2008. That summer, SEAMAP-SA used some of these funds to complement and expand MARMAP reef fish sampling. This addressed 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, particularly in shallow and offshore areas. The increased funding also helped to support reef fish life history studies not consistently supported in previous years. These include a monitoring program developed between 1995 and 1998 by MARMAP to provide an annual index of juvenile gag abundance in estuaries. Future year class strength can be predicted by surveying for juvenile gag ingress to estuaries. That study employed Witham collectors, which are an effective method for sampling ingressing reef fish larvae and postlarvae. Additionally, samples are taken for diet studies targeting several reef fishes. As a result of declining funding, the Gag ingress study was halted after the 2015 sampling season. The Reef Fish Survey conducts research in the field primarily aboard the R/V Palmetto, which is over a decade past her projected life expectancy. Issues related to the advancing age of this research vessel has been documented extensively in SEAMAP management plans and reports, and various other documents over the years. In the fall of 2015, SCDNR invested significant funds (close to \$1,000,000) on a major renovation of the R/V Palmetto. Given the age of the vessel, this renovation was well overdue and was critical for the safe and efficient functioning of the vessel. The renovation included replacing the engines, generators, shafts and propellers, and repairing external and internal hull plating and structures. The renovation was completed in the

spring of 2016 and the vessel is operating more fuel efficient and at a slightly faster vessel speed. Above all, it is expected that sampling operations will be significantly more efficient as reduction in lost sea days due to vessel maintenance and equipment failure issues are expected to be diminished.

Bottom Mapping Study

Objectives and procedures for a bottom mapping project were formulated in FY 1985, and by FY 1986, a pilot study focusing on hard bottom areas and reefs in the South Atlantic was completed. Although a full study was scheduled to begin in FY 1988, lack of funding prevented implementation of the first element in this study until FY 1992. When funding resumed in FY 1992, the SEAMAP-SA Bottom Mapping Workgroup developed a database format designed for easy incorporation into GIS or other mapping software. The regional database includes the location and characteristics of hard bottom resources throughout the South Atlantic Bight.

In FY 1993, the workgroup initiated a search for existing data sources, and captured more than 8,000 records in the first year. By FY 1995, several bottom mapping reports were completed off the coasts of South Carolina, Georgia, and North Carolina. Florida was funded in FY 1996 to create a hardbottom mapping report by FY 1997. By FY 1998, the Florida Marine Research institute received enough data to create a GIS formatted Bottom Mapping Report encompassing North Carolina through Florida on a distributable CD. During FY 1999, the Bottom Mapping Workgroup 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 website. In FY 2000, the Bottom Mapping Workgroup developed a summary hardcopy document to accompany the CD. The report was completed in FY 2001. The CD has been broadly distributed to scientists, natural resource managers, fishermen, consultants, environmental groups, and others.

In FY 2001, the Bottom Mapping Workgroup developed a list of issues necessary to create deepwater protocols and future workgroup priorities. They developed a three-phase approach to compile existing deepwater (200-2000m) bottom characterization data from existing datasets and extend the bottom mapping GIS product from the 200 to 2,000m depth contour. Phase 1 began in FY 2002; in order to convert existing data on deepwater bottom habitats into standard format, the Bottom Mapping Workgroup and Deepwater Subcommittee defined deepwater habitat characterization and the types of data for which transformation protocols would need to be developed. The subcommittee also approved the completion of a data source compilation document of deepwater bottom type data sources, titled "Summary of Seafloor Mapping and Benthic Sampling Conducted in 200-2000m, from North Carolina through Florida" (Phase II). In FY 2004, the Bottom Mapping Workgroup began work on Phase III of the deep-water habitat mapping project, working with the SAFMC to map bottom habitat in deepwater regions (200-2000m).

SEAMAP-SA received increased funding in FY 2008. With these funds, the Bottom Mapping Workgroup was restructured to include habitat considerations and fish characterization. The new Habitat Characterization and Fish Assessment Workgroup helped identify and develop new survey priorities to address high priority management needs.

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 2000m within the U.S. EEZ, extending from just south of the Virginia/North Carolina border to the Florida Keys. SEAMAP bottom mapping data and associated GIS information have been incorporated into the South Atlantic Habitat and Ecosystem Atlas⁷ and the South Atlantic Fisheries map viewer⁸. In addition, the SAFMC has highlighted SEAMAP's role in supporting the move to ecosystem-based management in the region through the South Atlantic Habitat and Ecosystem Homepage⁹. These tools support the development of a Fishery Ecosystem Plan for the South Atlantic Region and convey the importance of SEAMAP involvement and expansion in order to move toward ecosystem management.

Workshops

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

During FY 2002, the Crustacean Workgroup 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.

In FY 2003, the SEAMAP Data Management Workgroup met jointly with the Northeast Area Monitoring and Assessment Program (NEAMAP) Data Management Workgroup to share information on data structures and various methods to build a fishery-independent data warehouse.

Also in FY 2003, the Crustacean Workgroup met to discuss state harvest information on shrimp. They sponsored a shrimp symposium at the Crustacean Society Meeting (June 2-5, 2003 in Williamsburg, Virginia), focusing on disease, transport, genetic variability, and population status.

Finally in FY 2003, the Crustacean Society convened a Blue Crab Symposium, and the ASMFC's SEAMAP Crustacean Workgroup convened a Blue Crab Workshop. A report entitled “The Status of the Blue Crab (*Callinectes sapidus*) on the Atlantic Coast” was produced in FY 2004 as a result of these meetings.

The South Atlantic Fishery Independent Monitoring Workshop was held in November 2009 to develop recommendations for the design of one or more multispecies fishery-independent surveys focused on species in the South Atlantic snapper grouper complex (see Carmichael et al,

⁷ http://ocean.floridamarine.org/safmc_atlas

⁸ http://ocean.floridamarine.org/sa_fisheries/

⁹ <http://safmc.net/ecosystem-management/mapping-and-gis-data>

2010 for details). The workshop was sponsored by the SAFMC and NOAA Fisheries and held at the SEFSC in Beaufort, North Carolina.

In January 2015, SEAMAP-SA survey leads met with NEAMAP and other Atlantic coast state survey leads at a Catch Processing Workshop. The goals of this workshop were to facilitate communication and collaboration among Atlantic coast fishery-independent surveys, discuss methodologies surrounding catch-processing for each individual survey, identify areas where further standardization among surveys could be feasible, and identify future sampling needs.

SEAMAP-Caribbean

In FY 1988, a SEAMAP Caribbean Committee was established under the administrative guidance and supervision of the CFMC. Initial efforts toward establishing a long term SEAMAP-C monitoring program in this area were oriented towards environmental monitoring and ichthyoplankton and pelagic longline fishery studies. A table of SEAMAP-C surveys is included below.

<u>Survey</u>	<u>Initial Year of Operation</u>
Queen Conch Survey	FY 1990
Reef Fish Survey	FY 1992
Spiny Lobster Survey	FY 1996

The operational phase of SEAMAP-C began in 1988 with plankton sampling, a cooperative venture involving the NOAA vessel DELAWARE II, SEAMAP-C members, and representatives of the British Virgin Islands. During FY 1989, a cruise of the NOAA vessel R/V OREGON to the Caribbean monitored longline catches around the U.S. Virgin Islands (USVI).

The SEAMAP-C committee recognized long-term monitoring of reef resources as its most important priority. Over FY 1989-1992, procedures were developed for a Reef Resource Survey, but efforts toward implementation were inhibited by a lack of funding for SEAMAP-C operations. In FY 1991, a three-year sampling cycle of a Reef Resources Survey was initiated, using funding sources external to SEAMAP, including sampling by hand line and fish traps in waters off Puerto Rico and the USVI. This extended to St. Croix in FY 1994 and 2000 and to St. John, USVI in FY 1999. Some data for the Reef Resources Survey have also been collected by the U.S. Virgin Islands Division of Fish and Wildlife using underwater cameras.

In FY 2004, SEAMAP-C began another cycle of reef fish surveys. Puerto Rico began trap and hook-and-line surveys that continued into FY 2005, enabled by supplemental SEAMAP funds received in FY 2004. These funds also supported the investigation and completion of the SEAMAP-C USVI trap and hook-and-line database. The USVI delayed these surveys until a new research vessel could be purchased; funding was approved in FY 2005, and a new vessel arrived in May 2007. In FY 2007, trap and hook-and-line surveys were once again conducted in St. Thomas/St. John and St. Croix. In 2015, a new vessel for Puerto Rico was approved and is in the process of procurement.

In FY 1990, SEAMAP-C conducted its first survey to determine the relative abundance of the queen conch (*Strombus gigas*) resource around the USVI. Its methodology is modified from previous surveys undertaken in the USVI (Woods and Olsen, 1983 and Boulon, 1987). Since then, this survey has been conducted in FY 1995, 2001, 2003, 2007 and 2013 as a joint venture between the USVI Division of Fish and Wildlife, the National Park Service (which supported the St. Thomas portion of the study), the PR-DNER, and the University of Puerto Rico, Mayagüez Campus. The survey covers all of Puerto Rico and the three main islands of the USVI. The most recent FY 2013 queen conch survey in Puerto Rico included 46 sites sampled for a total of 37.45 hectares (ha; transect areas ranged from 0.3ha at site 5 to 3.97ha at site 11). Survey areas included the west and southwest coasts of Puerto Rico. In FY 2008 and 2010, 144 underwater scooter transect surveys were completed for St. Thomas and St. Croix to assess queen conch resources around the USVI, and the final report was submitted in December 2010.

In FY 1996, 1997, 2004, 2009 and 2015, SEAMAP-C examined the spatial and temporal variation of spiny lobster pueruli settlement in coastal waters adjacent to St. Thomas, USVI. Puerto Rico completed a similar study in 1998. In FY 2004, 2009, and 2015, pueruli lobster settlement and juvenile lobster attractor surveys were conducted in the US Caribbean.

In FY 2003, six sets of ten artificial shelters, or “casitas,” made of concrete blocks were deployed at various sites on the west coast platform of Puerto Rico. These casitas are used to monitor the settlement of juvenile spiny lobsters.

Spiny lobster pueruli surveys were completed in FY 2008 and 2009 in St. Thomas and St. Croix and in FY 2009 in Puerto Rico. In FY 2008, Puerto Rico deployed seven spiny lobster larvae collectors, conducting an additional component to this study. Off the west coast of Puerto Rico, twenty-four modified Witham collectors are used as artificial habitat for pueruli settlement at six stations. The collectors are deployed at different depths, at mid-water and close to the bottom. Once this monitoring project is completed, the Witham collectors will be removed to avoid interaction with boaters and protected species.

In FY 1998, SEAMAP-C began benthic mapping studies of the USVI and Puerto Rico shelf using side-scan sonar. In FY 2003, whelk surveys were conducted 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, parrotfish, yellowtail snapper, and lane snapper surveys were undertaken for one year each, using the standardized methodology established in the early years of the SEAMAP-C Program. The studies were conducted to provide information requested by the SEDAR stock assessment evaluation. Collected data has also been used in evaluating any proposed fishing regulations for US Caribbean waters.

In FY 2008, within the first five-year cycle, SEAMAP received increased funding which allowed expansion of some of these surveys. In Puerto Rico, the shallow water reef fish, yellowtail, and lane snapper surveys were expanded to include the east and south coasts, and in the USVI, sampling was expanded include St. Croix. Several special projects were included, regarding gonad collection of three important parrotfish species in the USVI, and data collection on

spawning aggregations in Puerto Rico. Also in Puerto Rico, gonad samples were collected and evaluated histologically for all samples of reef fish, yellowtail, and lane snapper. Histological analysis of species is an ongoing part of the reef fish survey in Puerto Rico and the continued collaboration between the Puerto Rico FRL Reproduction Program and SEAMAP-C.

In FY 2009, fishery-independent hook-and-line surveys were conducted for reef fish and yellowtail snapper in Puerto Rico off the west coast. Similar surveys were conducted in FY 2010 for reef fish and yellowtail snapper in St. Thomas/St. John. Due to staff shortages, an 18-month no-cost extension was requested and granted for the SEAMAP-C project cycle, allowing St. Croix to complete their hook-and-line surveys in 2011. The final component of this five-year study used the gonads collected from three parrotfish species to study their reproductive cycles. During FY 2010, parrotfish sampling was conducted in St. Thomas/St. John and St. Croix.

In FY 2011, the next five-year funding cycle began in Puerto Rico and USVI, repeating the same species rotation and methodology used in the previous cycle. In the USVI, a new survey was included for monitoring deepwater snapper species. Though the FY 2011 five-year funding cycle was initiated in Puerto Rico and the USVI, little was accomplished in the USVI between FY 2011 and 2016 as a result of severe staff shortages due to the retirement of several senior staff, high turn-over of biologists, and the need for a deep seafaring vessel in St. Croix. Regardless of these limitations, several studies have been initiated and will continue during a 12-month no-cost extension that was requested and granted for completing all studies ending March 31, 2017.

Special Studies: Highlights

- Histology of specimens collected in reef fish, four parrotfish species, and yellowtail and lane snapper surveys have provided vital biological information needed for fisheries management from FY 2003 to present in Puerto Rico.
- Gonad collection of four parrotfish species were macroscopically sexed and staged for reproductive condition in FY 2008 and 2016 in the USVI.
- Reef fish spawning aggregations were characterized using DSG hydroacoustic dataloggers in the USVI and Puerto Rico.

International Activities

The SEAMAP-C 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-C Directory of Fishery-Independent Activities, cooperative surveys may be conducted in association with the British Virgin Islands and the Dominican Republic in the near future.

To facilitate survey coordination and information exchange among participants and other involved organizations, SEAMAP-C periodically sponsors workshops and symposia. In 1995, the Caribbean Community Secretariat (CARICOM) sponsored a workshop on spiny lobsters and queen conch in Jamaica (CFRAMP 1997). Resulting recommendation included establishment of pueruli collectors and juvenile artificial shelters (Cruz and Auil-Marshalleck 1997).

APPENDIX G – 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 houses unsorted "backup" station samples and sorted larval invertebrate specimens, and is located at Gulf Coast Research Laboratory, Ocean Springs, Mississippi. The Invertebrate Plankton Archiving Center 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 SERTC stores sorted post-larval (non-planktonic) invertebrate samples and is located at the Marine Resources Research Institute in Charleston, South Carolina. 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:

- X Maintain collections in a manner consistent with approved policies and procedures,
- X Receive authorized specimens and their accompanying information, and catalog these materials,
- X Process user requests and provide specimens and/or information in accordance with the approved policies and procedures,
- X Maintain information on specimen requests, and
- X Assist 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 the Invertebrate Plankton Archiving Center 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 Szczecin, 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 database at the SEAMAP Ichthyoplankton Archiving Center. The sorted and unsorted invertebrate fractions are returned to the Invertebrate Plankton Archiving Center 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, 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 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, 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. 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 Global Biodiversity Information Facility website.

Implementation of the SEAMAP Data Management System improves information management for both archiving centers by allowing user site access to the entire SEAMAP database at each archiving center. All station information is readily available to the curators. Specimen data is entered directly to the SEAMAP database at the archiving centers, and all archiving information stored on the Data Management System is readily available to SEAMAP participants.

Specimen Loan

All specimen requests are directed to the SEAMAP curators to be processed in accordance with the annual SEAMAP operations plan. The curator sends 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 also contains notification of charges associated with processing and handling the specimen loan. Except in unusual cases approved by the committee, all costs of shipping specimens are borne by the requesters. This form also notifies 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 are included on this form. Normally, all sorted, unmodified specimens are 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 are incorporated into the SEAMAP Data Management System. The curator must 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 are published in the SEAMAP Annual Report. The requestor is 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 are normally handled in the order received, but in the event of personnel or funding limitations, priorities for specimen requests are assigned as follows: SEAMAP participant, SEAMAP cooperator, SEAMAP investigator, and non-SEAMAP investigator. Questions relating to adjustments in priorities, costs, and use of specimens should be forwarded to the coordinators and committees for resolution.

APPENDIX H – Documents Produced by SEAMAP

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.
Cruise Reports	Provide an overview of cruise activities (time at sea, staff at sea, gear used), collection information (sampling locations, number of gear deployments, number and species of organisms collected, specimens kept for analysis), and data (summaries, CPUE, etc.).
Public Relations Communications	Newspaper and journal articles and interagency reports that may be helpful in fulfilling the program's goals and objectives.
Newsletters	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 workgroups 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 I – Bottom Mapping Priority Areas

Source for spatial layers presented in Appendix K: SAFMC Digital Dashboard–
(http://ocean.floridamarine.org/safmc_dashboard/).

Figure 1. Existing Managed Areas- Deepwater Snapper Grouper Marine Protected Areas

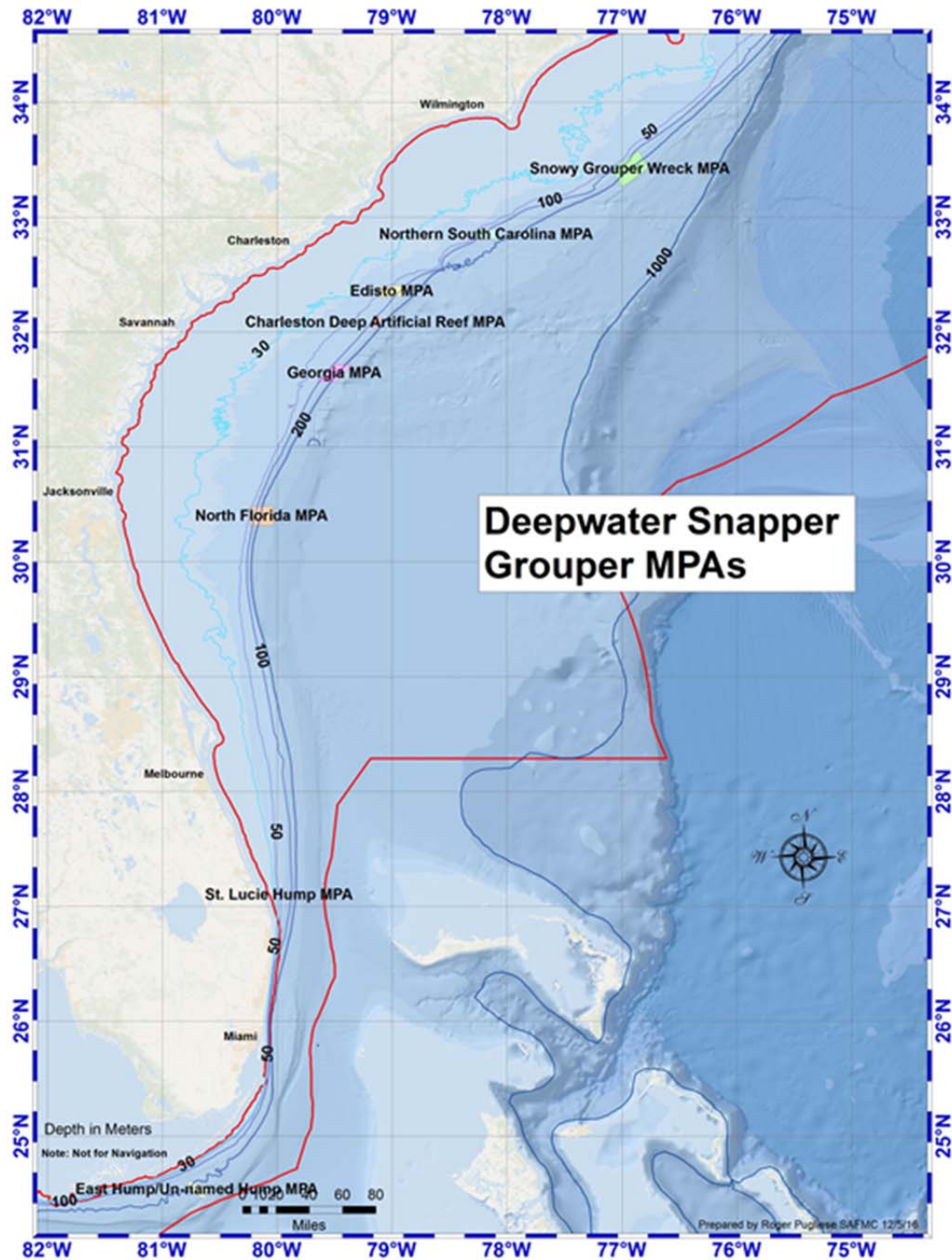


Figure 2. Existing Managed Areas- Oculina Bank Coral Habitat Area of Particular Concern and Oculina Experimental Closed Area.

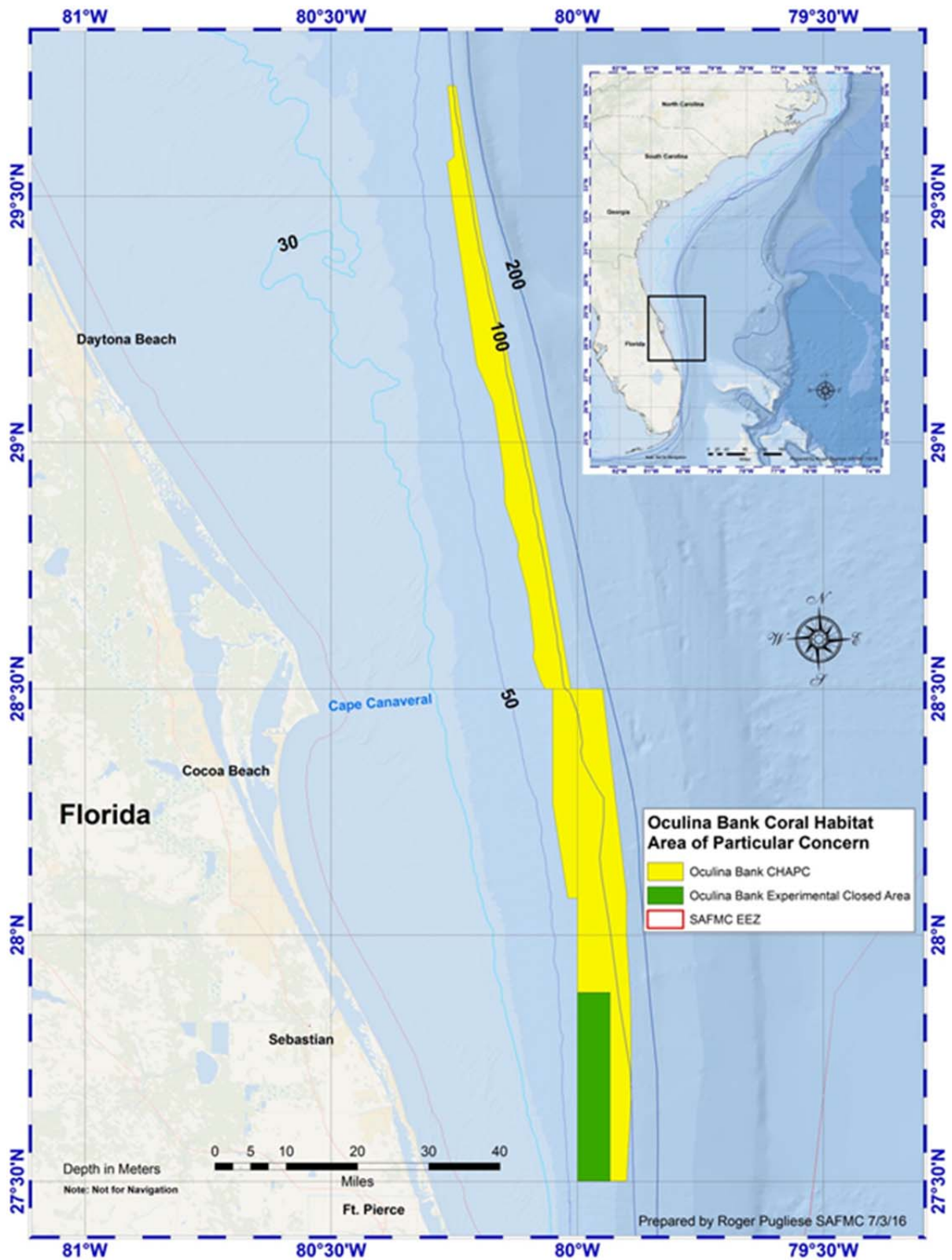


Figure 3. Existing Managed Areas- Deepwater Coral Habitat Area of Particular Concern.

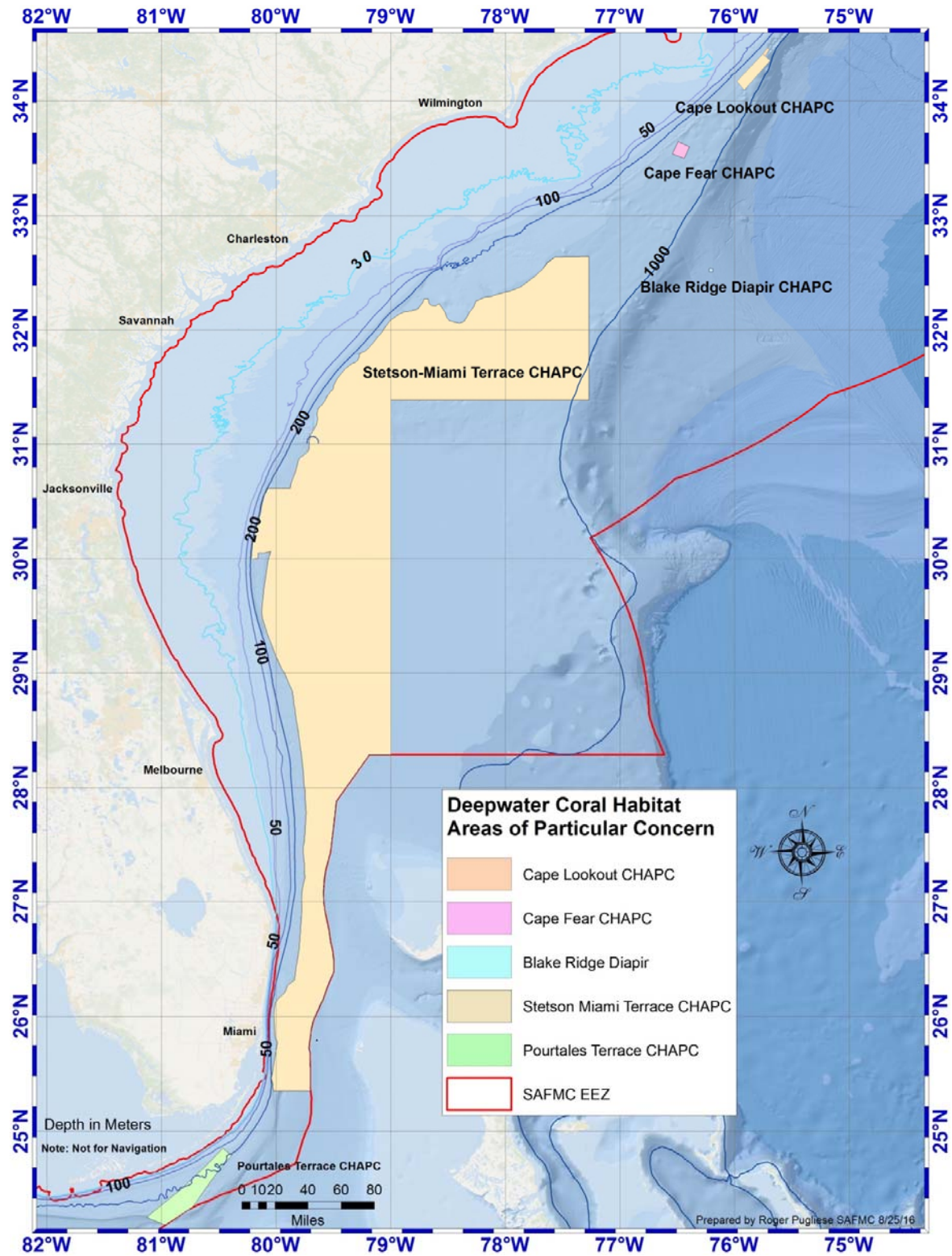


Figure 4. Snapper Grouper Spawning Special Management Zones (SMZs) off South Carolina.

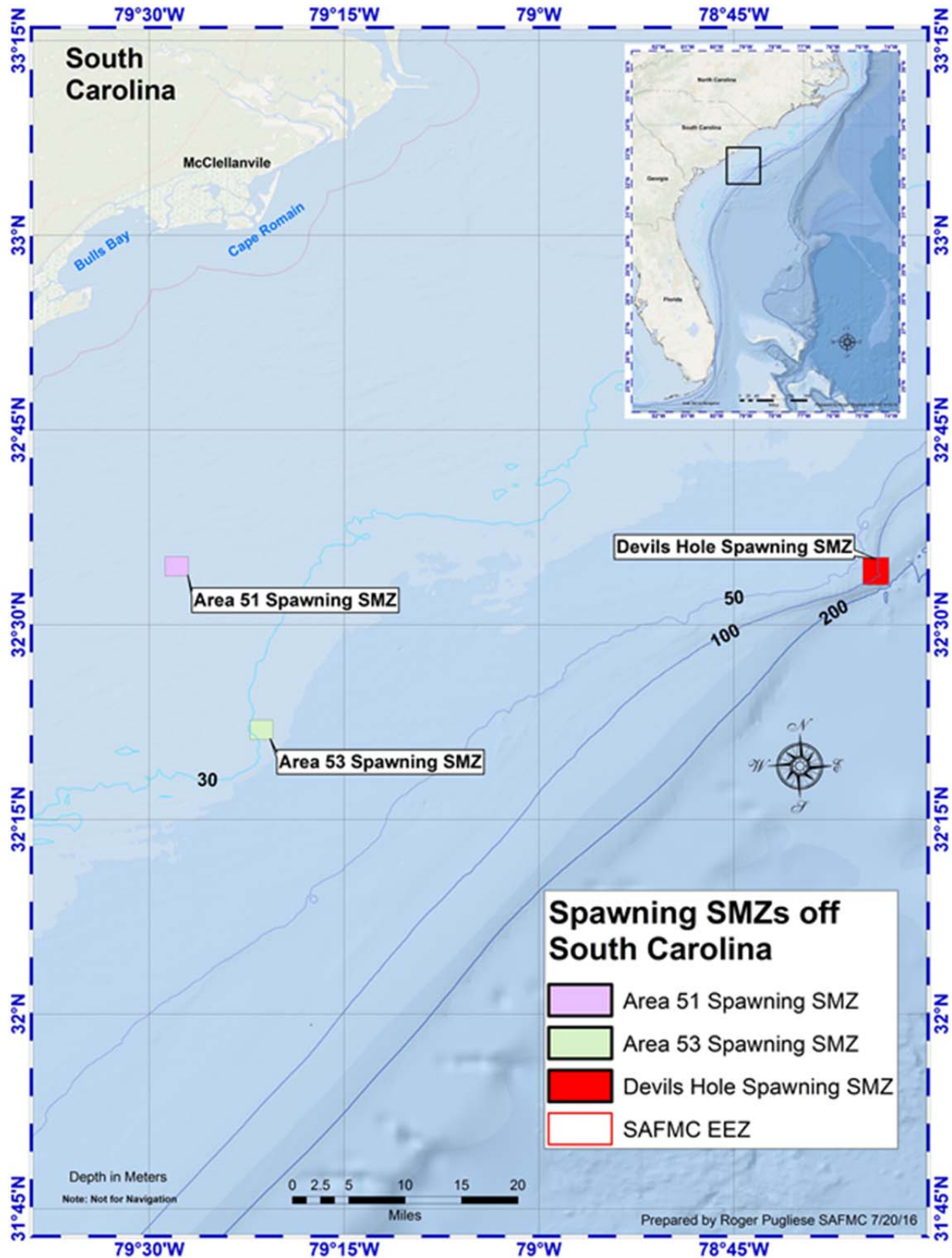


Figure 5. Snapper Grouper Spawning Special Management Zones (SMZs) off North Carolina.

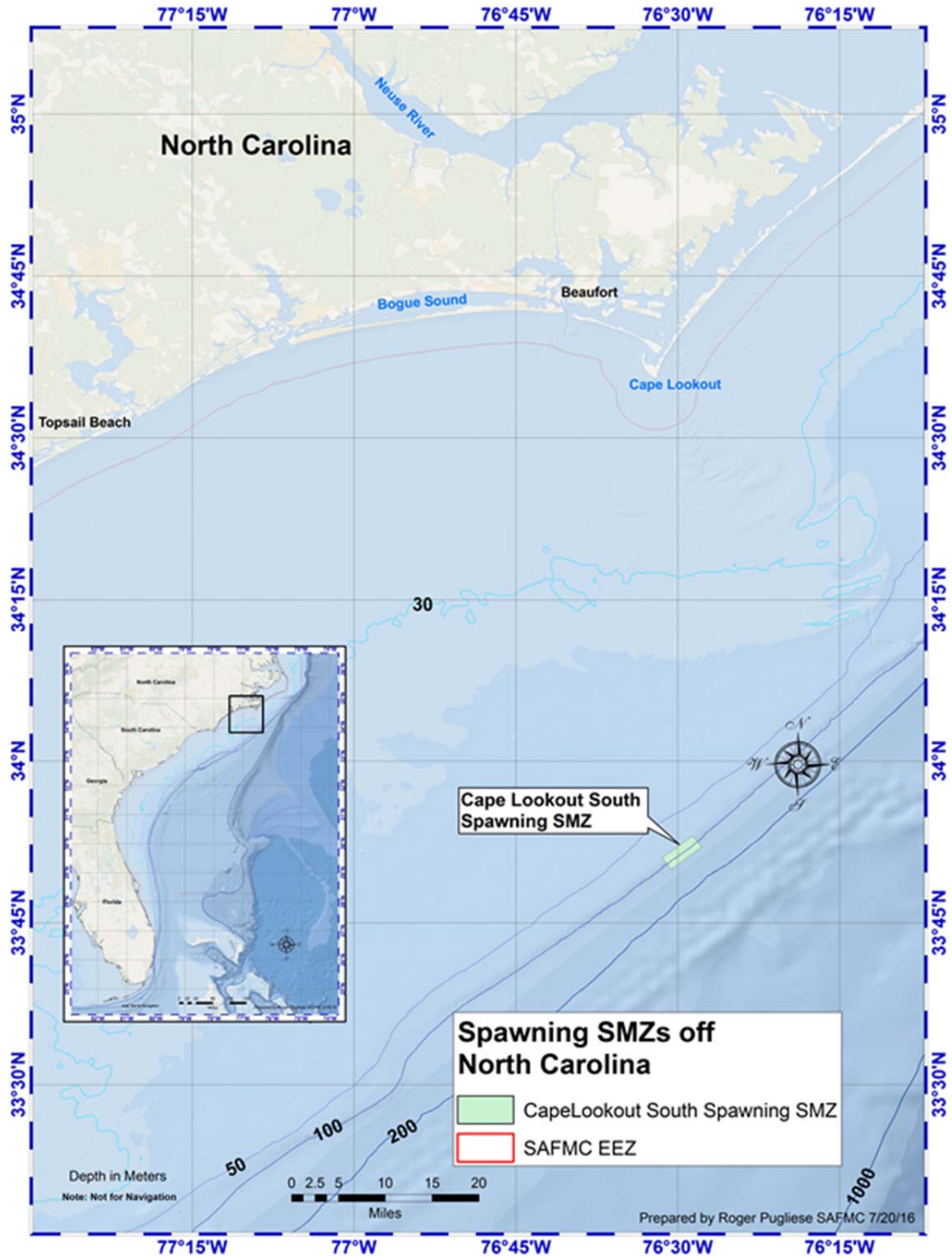


Figure 6. Snapper Grouper Spawning Special Management Zones (SMZs) off Florida East Coast.

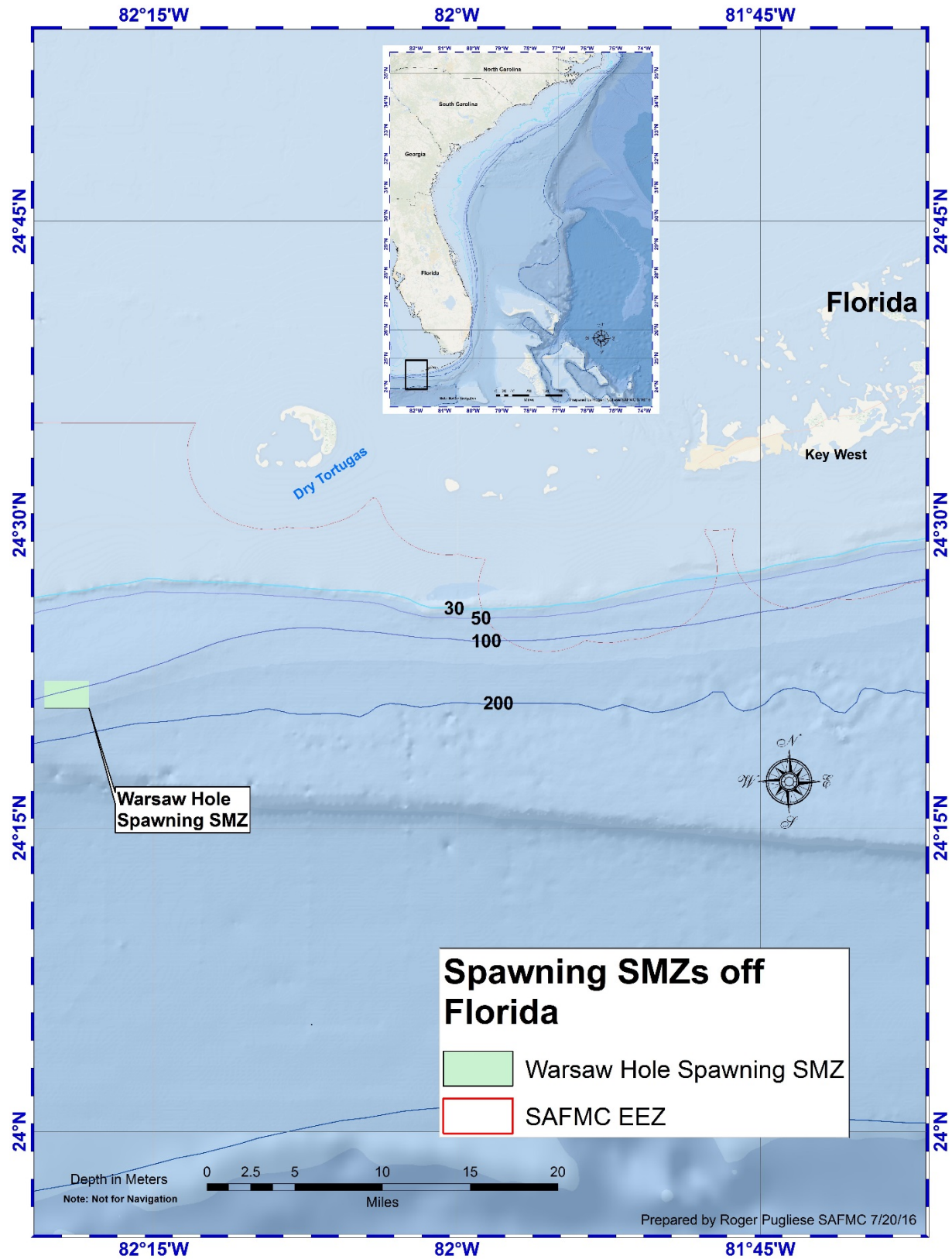


Figure 7. Habitat Zones and SEAMAP Bottom mapping data - Developing SA Mapping Strategy SAFMC FEP II.

