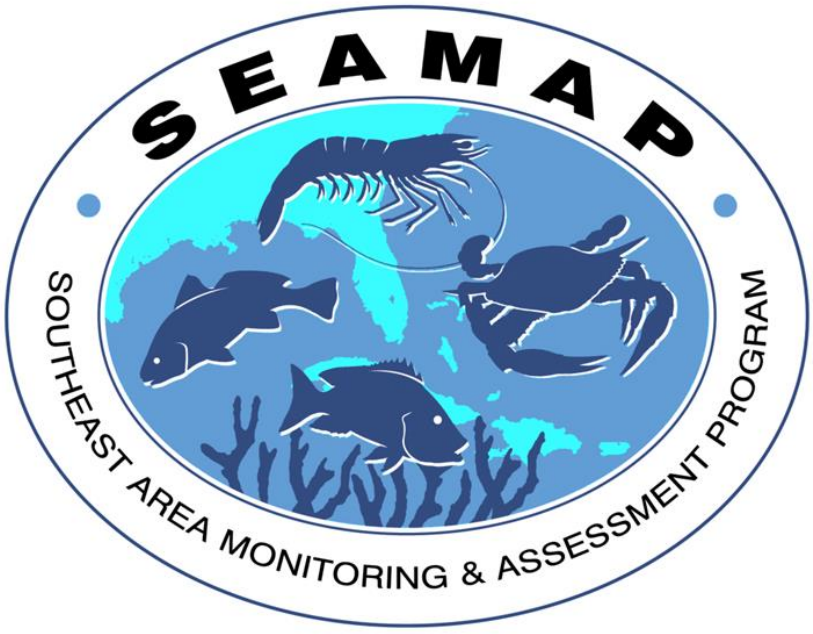
2021-2025 SEAMAP Management Plan



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

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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 2.9 billion pounds of seafood worth almost $1.7 billion[1]. In the same year, recreational anglers across all three regions landed at least 213 million pounds of fish[2]. Recreational fishing is a growing industry in the SEAMAP region, where over 130 million angler trips were taken in 2018[3].

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, survey costs continue to increase, especially given the need for new data to

[1] Fisheries of the US 2018

[2] Fisheries of the US 2018 (excludes Texas and Louisiana).

[3] Fisheries of the US 2018.

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 35 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	Roger Pugliese	Matthew Kammann
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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), Sarah Murray (ASMFC), and Edgardo Ojeda (UPRSGCP) for their work as coordinators; Dr. Roy Crabtree and Dr. Clay Porch 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 Dr. 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.

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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)
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SEAMAP COLLABORATIONS

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

ABBREVIATIONS AND ACRONYMS

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

EXECUTIVE SUMMARY

The SEAMAP 2021-2025 Management Plan provides a statement of current goals, management policies, and procedures for all SEAMAP components and partnerships. The plan also serves as a reference on SEAMAP history and accomplishments, and detailed priorities for future activities. The Management Plan complements the SEAMAP 2021-2025 Strategic Plan, which provides a prioritized list of future project activities to maintain and expand current activities if additional funding is available.

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.

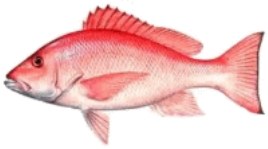
SEAMAP organization and management procedures and policies, fully described in Chapter 2, are structured to facilitate the implementation of the above roles. These policies and procedures include responsibilities of each member agency, development of planning documentation, and policies for program funding 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 Allowable Catch Limits (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).

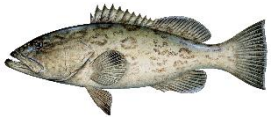
Determining population size structures, abundances, and necessary life history information for (SEDAR) stock assessments of a variety of fish, crustaceans, mollusks, and other species (Caribbean, Gulf and Atlantic Reef Fish Surveys, Gulf and South Atlantic Trawl Surveys).

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 and Spawning Special Management Zones 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.

Contributing to the assessment of the Deepwater Horizon oil spill impacts in the Gulf of Mexico by providing the primary baseline data in the Natural Resource Damage Assessment, as well as data used to identify species that were likely to be impacted (SEAMAP-Gulf Trawl and Plankton surveys).

The most compelling argument to continue funding is SEAMAP's ability to respond to recent and ongoing critical demands for data and information, such as those listed above, that only the program can provide. 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 2021-2025 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.

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1 SEAMAP MISSION

1.1 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 South Atlantic Fishery Management Council (SAFMC) and Gulf of Mexico Fishery Management Council (GMFMC) have both developed lists of research and monitoring needs in response to the MSRA mandate for federal Regional Fishery Management Councils to develop prioritized research plans (GMFMC's Updated List of Fishery Monitoring and Research Priorities for 2020-2024; the SAFMC's Research and Monitoring Section of FEP II includes the SAFMC Research and Monitoring Priorities (2020-2025)). These priorities 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) 2018 Research Priorities and Recommendations to Support Interjurisdictional Fisheries Management identifies numerous needs for information on its managed South Atlantic species that may be fulfilled through SEAMAP. Specific examples of fisheries for which SEAMAP data are now being used to reach management decisions include red snapper, Atlantic bluefin tuna, king mackerel, brown shrimp, white shrimp, pink shrimp, blacktip shark, yellowedge grouper, greater amberjack, gag grouper, red grouper, gray triggerfish, and Spanish mackerel in the Gulf of Mexico; red drum, red snapper, vermilion snapper, black sea bass, scamp, red porgy, spot, Atlantic croaker, southern flounder, and Atlantic menhaden in the South Atlantic; and queen conch, spiny lobster, yellowtail snapper, whelk, parrotfish, red hind, snapper/groupers, and pelagic game fish 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 SEDAR 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). The 2021-2025 SEAMAP Strategic Plan provides proposed activities 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.

1.2 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:

- Conduct routine surveys and special studies, as needed, of regional resources and their environments
- Obtain, process, and archive, as appropriate, biological specimens and samples
- Obtain data, such as environmental and bottom-mapping data, from other agencies and organizations in order to plan and conduct SEAMAP activities
- Develop partnerships with governmental and non-governmental organizations to improve acquisition of fishery-independent data for the Southeast region
- Collect data on priority species to support stock assessments and other evaluations
- 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:

- Develop and evaluate sampling systems and procedures needed for SEAMAP surveys and special studies
- Standardize and calibrate sampling systems and procedures used in SEAMAP surveys and special studies
- Sponsor special workshops and symposia to help evaluate or plan sampling strategies, design, or methods
- Cooperatively plan activities with representatives of foreign governments
- Work with existing partner state and federal surveys to identify areas of overlap as well as deficiencies in sampling and data
- 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
- 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:

- 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
- 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
- Conduct periodic coordinated external reviews of specific management, administrative, and technical elements of the program to ensure that critical data needs are being met
- 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:

- 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
- Establish data handling and processing protocols for all SEAMAP data
- Compile and maintain a computerized directory of SEAMAP monitoring activities, including data summaries and inventories by gear, species, species-group, and geographic areas
- Create geographic information systems (GIS) and metadata products for priority species' abundance, distribution (by life stage), and habitat (such as EFH) served through an internet mapping application
- Coordinate and integrate, when feasible, the SEAMAP data management support systems (Gulf of Mexico, South Atlantic, Caribbean) with non-SEAMAP databases
- Make data and results from analyses available to stock assessment teams in an accessible format in support of assessing the status of the resources
- Coordinate and document SEAMAP administrative functions, information dissemination, the SEAMAP data management systems, archiving centers, and data collection by SEAMAP participants
- 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
- Maintain partnerships with governmental and non-governmental organizations to improve dissemination and utilization of SEAMAP fishery-independent and ecological data
- Propose multispecies analyses that could directly inform EBFM approaches

2 PROGRAM ORGANIZATION AND MANAGEMENT

2.1 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 summarized below and discussed in more detail later in the document:

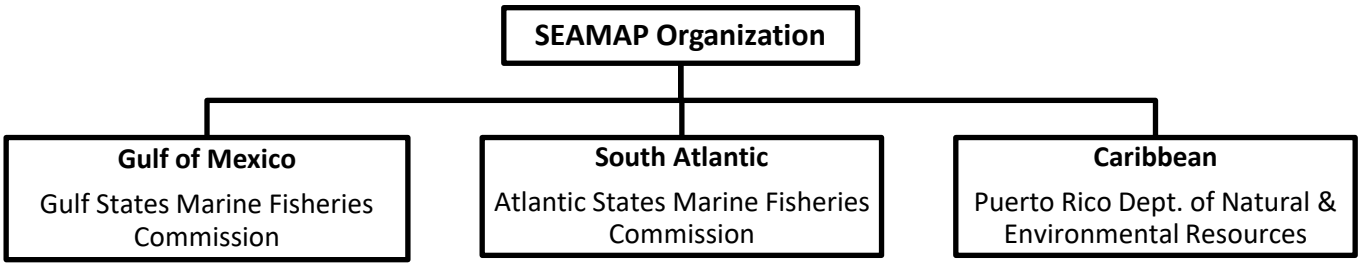
Operations

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

Management

- Program and operations planning and administration
- Program evaluation

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



- Alabama Dept. of Conservation & Natural Resources
- Florida Fish & Wildlife Conservation Commission
- Louisiana Dept. of Wildlife & Fisheries
- Mississippi Dept. of Marine Resources/Gulf Coast Research Laboratory
- Texas Parks & Wildlife Dept.
- NMFS Southeast Fisheries Science Center
- Gulf of Mexico Fishery Management Council

- Florida Fish & Wildlife Conservation Commission
- Georgia Dept. of Natural Resources
- North Carolina Dept. of Environment & Natural Resources
- South Carolina Dept. of Natural Resources
- NMFS Southeast Fisheries Science Center
- South Atlantic Fishery Management Council
- US Fish & Wildlife Service, South Atlantic Fisheries Coordination Office

- University of Puerto Rico Sea Grant College Program
- Virgin Islands Dept. of Planning & Natural Resources
- NMFS Southeast Fisheries Science Center
- US Fish & Wildlife Service
- Caribbean Fishery Management Council

2.2 PROGRAM COMPONENT STRUCTURE

2.2.1 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 NMFS 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.

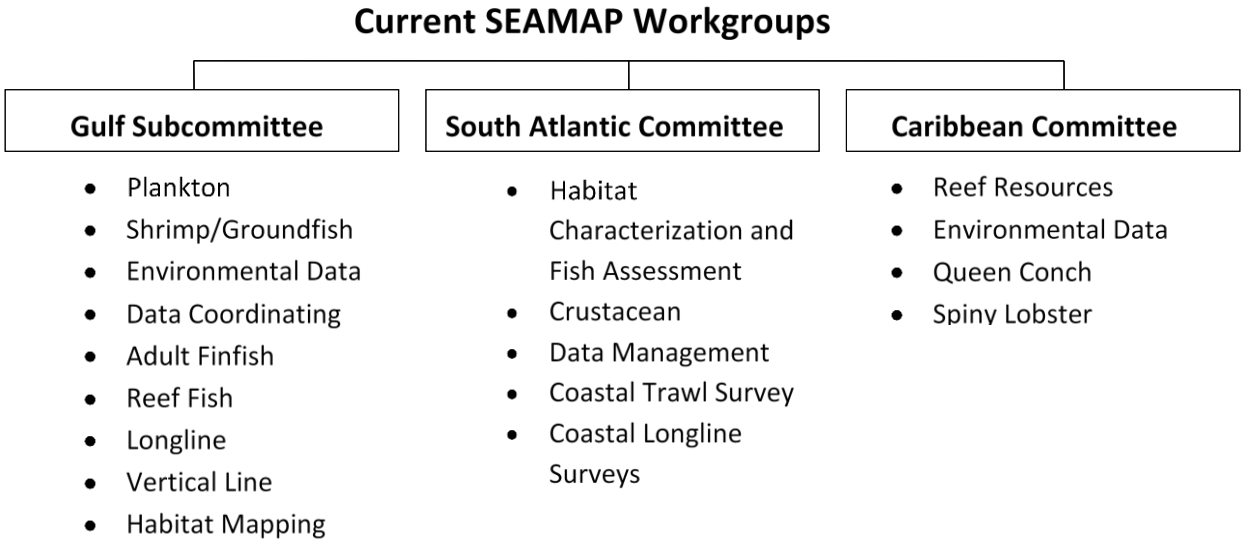
In addition to the standing management agency (GSMFC), management body (TCC), and subcommittee, workgroups are established by the Subcommittee as needed to address specific issues. Workgroups are not standing committees, but are formed to accomplish specific objectives and are disbanded upon completion. The Plankton, Shrimp/Groundfish, Environmental Data, Data Coordinating, Reef Fish, Longline, Vertical Line, Habitat Mapping, and Adult Finfish Workgroups are all currently functioning in the Gulf component.

2.2.2 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.

2.2.3 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.



2.3 PROGRAM RESPONSIBILITIES

2.3.1 Management Agency Responsibilities

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

Administrative services rendered by each management agency include:

- Provide budget information to the SEAMAP committee;
- Coordinate SEAMAP meetings;
- Coordinate and schedule workshops;
- Administer funds associated with SEAMAP activities;
- Administer guidance of the coordinators;
- Supervise clerical personnel;
- Affirm committee representatives;

- Evaluate management personnel and facilities annually; and
- 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:

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

2.3.2 Committee Organization and Responsibilities

Each program component is managed by its respective SEAMAP committee (Gulf Subcommittee, South Atlantic Committee, and 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:

- Determine regional fishery-independent data needs that can be met by SEAMAP activities;
- Plan activities to meet identified data needs;

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

2.3.3 Coordinator Responsibilities

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

- Work closely with the committee chair in all aspects of program coordination, administration, and operation;
- Implement plans and program directives developed by the committee and approved by the management body;
- Coordinate committee meetings and recommend appropriate agendas;
- Serve as information liaison between the committee and the oversight agency, participants, and organizations interested in SEAMAP activities;
- Submit preliminary administrative budget recommendations and assist the committee with preparation of the budget;

- Prepare or supervise preparation of selected SEAMAP publications;
- Distribute approved SEAMAP information in accordance with committee policies and procedures;
- Assist in representing the program to the community through public educational activities;
- Assist in the identification of regional needs that can be satisfied by SEAMAP activities;
- Maintain a file of all reports and publications which relied on SEAMAP data or SEAMAP specimens, and provide an annual listing to the committee; and
- Prepare the annual report to the oversight body.

2.3.4 Workgroup Organization and Responsibilities

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

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

Members of 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.

2.3.5 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.

2.3.6 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.

2.3.7 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:

1. 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.
2. 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.
3. 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.

4. 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.
5. If approved by the appropriate management body, the principals will submit a SEAMAP proposal through the National Oceanic and Atmospheric Administration (NOAA) for funding.
6. 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.
- National Coral Reef Monitoring Program (NCRMP)
- Puerto Rico Coral Reef Monitoring Program (PRCRMP)
- USVI Coral Reef Monitoring Program (USVICRMP)

2.3.8 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 NMFS 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 has been serving as the coordinating entity for the SEAMAP-Caribbean Program. Some queen conch survey and quality control including preliminary data analysis providing close professional help to the program, has been conducted by the Department of Marine Sciences. The University of the Virgin Islands (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 USVI 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).

2.4 PLANNING DOCUMENTATION

Three levels of planning documents are used in SEAMAP: the five-year plan, annual reports, 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 joint annual report. 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.

2.5 PROGRAM FUNDING AND BUDGET MANAGEMENT

2.5.1 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)
2016	$1,781,296	$1,418,999	$452,872	$659,901	$4.313
2017	$1,769,178	$1,409,346	$449,791	$655,410	$4.283
2018	$1,956,840	$1,558,838	$497,502	$724,931	$4.738
2019	$,1950,274	$1,553,608	$495,832	$722,499	$4.722
2020	$1,981,466	$1,578,456	$503,762	$734,054	$4.798

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

While SEAMAP's Congressional appropriation had increased since 2013, the amount available for collecting valuable fishery-independent data had up to 2018 actually decreased for a variety of reasons. Taxes and assessments on SEAMAP's budget constituted almost 16% of the total SEAMAP appropriation in FY2018, while taxes and assessments were only 5% in FY2014. In 2018 Headquarters administrative assessments were dropped. Regardless, SEAMAP has still had to secure other funding sources to help gather critical fishery-independent data. State partners have also contributed approximately $500,000 to SEAMAP data collection activities. These external funding sources cannot continue to support future SEAMAP sampling. 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.

2.5.2 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.

2.5.3 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.

2.5.4 Budget Planning

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

1. The committees develop the activities and statement of work for the coming year in advance of the joint meeting.

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.

2.6 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.

2.6.1 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.

2.6.2 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. The last comprehensive 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.

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
- Establishing and monitoring Spawning Special Management Zones
- Analyzing multispecies temporal changes as a product for EBFM evaluations.

3.1 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.

3.1.1 GULF OF MEXICO RESOURCE SURVEYS

3.1.1.1 Spring Plankton Survey

Objectives

The SEAMAP-Gulf 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-Gulf 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 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 water color) are collected at all stations. Right bongo and neuston samples collected from SEAMAP-Gulf stations are transshipped to the Polish Sorting and Identification Center. Left bongo samples are archived at the SEAMAP-Gulf Invertebrate Plankton Archiving Center. The SEAMAP-Gulf 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		
2020	Bluefin Tuna	X			ICCAT Stock Assessment	https://www.iccat.int/en/assess.html

3.1.1.2 Bottom Longline Survey

Objectives

The 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 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. 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. 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 scombrus*) #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		
2018	Blacktip Shark	X	X		SEDAR Stock Assessment	http://sedarweb.org/sedar-29u

3.1.1.3 Vertical Longline Survey

Objectives

The primary purpose of the SEAMAP-Gulf 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

Participating 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.

3.1.1.4 SEAMAP-Gulf Reef Fish Survey

Objectives

The primary purpose of the SEAMAP-Gulf 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

The reef fish video survey was initiated by the NMFS Pascagoula lab in 1992 and targeted primarily high-relief reef habitats along the shelf break. These efforts were expanded in 2006 by surveys conducted by the NMFS Panama City lab targeting shallow reef habitats on the northeast Gulf of Mexico shelf, and in 2008 by surveys conducted by FWRI targeting shelf and shelf-break reef habitats across the West Florida Shelf. All surveys targeted natural reef habitats, and utilized stereo baited remote underwater video (S-BRUV) arrays to provide data on relative abundance, size, and habitat composition of reef fish, and associated habitats. Collection of fish for life history studies were conducted opportunistically as time and funding allowed.

In 2020, all three surveys were integrated into a new survey design under the Gulf Fishery Independent Survey of Habitat and Ecosystem Resources (G-FISHER). This new survey, which utilized S-BRUV arrays baited with a combination of squid and Atlantic mackerel, incorporated a stratified-random survey design where effort was allocated among eighteen spatial strata and eighteen habitat strata, including the addition of nine artificial reef habitat strata. All survey efforts were restricted to reef habitats that had been identified and characterized via side-scan or multibeam sonar and classified via habitat type (artificial or natural), relative relief (low, medium, or high relief), and scale of the individual reef feature (small, medium, or large). Approximately 2,000 stations are selected to be sampled annually. These efforts are supported

by additional funding beyond that provided by SEAMAP. Associated environmental data collected at each site typically includes salinity, temperature, depth, and dissolved oxygen, and may include measures of transmissivity and fluorescence.

Optimization of Present Sampling

The SEAMAP-Gulf Reef Fish Survey could be optimized through development of automated image analysis, which would the time required to provide data for assessment. In addition, funding to support fish collections for life history would enhance the collection of otoliths/spines for ageing, stomach contents for trophodynamics analysis, and reproductive histology. 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		
2016	Almaco Jack	X	X		SEDAR 49 Stock Assessment	http://sedarweb.org/sedar-49
2016	Lesser Amberjack	X	X		SEDAR 49 Stock Assessment	http://sedarweb.org/sedar-49
2016	Snowy Grouper	X	X		SEDAR 49 Stock Assessment	http://sedarweb.org/sedar-49
2016	Speckled Hind	X	X		SEDAR 49 Stock Assessment	http://sedarweb.org/sedar-49
2016	Yellowmouth Grouper	X	X		SEDAR 49 Stock Assessment	http://sedarweb.org/sedar-49
2018	Gray Snapper	X	X		SEDAR 51 Stock Assessment	http://sedarweb.org/sedar-51
2018	Red Snapper	X	X		SEDAR 52 Stock Assessment	http://sedarweb.org/sedar-52
2019	Red Grouper	X	X		SEDAR 61 Stock Assessment	http://sedarweb.org/sedar-61
2019	Yellowtail Snapper	X	X		SEDAR 64 Stock Assessment	http://sedarweb.org/sedar-64
2020	Vermilion Snapper	X	X		SEDAR 67 Stock Assessment	http://sedarweb.org/sedar-67

3.1.1.5 Summer Shrimp/Groundfish Survey

Objectives

The SEAMAP-Gulf Summer Shrimp/Groundfish Survey began in 1982, takes place during June and July every year, and samples approximately 360 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 objectives are to monitor size and distribution of penaeid shrimp during or prior to migration of brown shrimp from bays to the open Gulf, aid in evaluating the "Texas Closure" management measure of the GMFMC Shrimp FMP, and provide information on shrimp and groundfish stocks across the northern Gulf of Mexico from inshore waters to 60fm.

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-Gulf 42-ft trawl net. Trawls are towed perpendicularly to the depth contours for 30 minutes. 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 50 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		
2018	Gray Snapper	X	X		SEDAR 51 Stock Assessment	http://sedarweb.org/sedar-51
2018	Red Snapper	X	X		SEDAR 52 Stock Assessment	http://sedarweb.org/sedar-52
2009-2019	White, Brown, and Pink	X	X		Shrimp Stock Assessment	http://www.galvestonlab.sefsc.noaa.gov/publications/
2019	Red Grouper	X	X		SEDAR 61 Stock Assessment	http://sedarweb.org/sedar-61
2020	Vermilion Snapper	X	X		SEDAR 67 Stock Assessment	http://sedarweb.org/sedar-67

Data have been incorporated into several Atlantis-GOM and Ecopath with Ecosim ecosystem models to determine the biomass of each species present in the model area.[4][5][6] Data has also been incorporated into a large monitoring database to develop fish and invertebrate spatial distributions to support ecosystem models.[7]

3.1.1.6 Fall Plankton Survey

Objectives

The SEAMAP-Gulf 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-Gulf 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 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

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[4] Ainsworth, C.H., C.B. Paris, N. Perlin, L.N. Dornberger, W.F. Patterson III, E. Chancellor, S. Murawski, D. Hollander,K. Daly, I.C. Romero, F. Coleman, and H. Perryman. 2018. Impacts of the Deepwater Horizon oil spill evaluated using an end-to-end ecosystem model. PLOS One. https://doi.org/10.1371/journal.pone.0190840

[5] Chagaris, D.D., W.F. Patterson, and M.S. Allen. 2020. Relative Effects of Multiple Stressors on Reef Food Webs in the Northern Gulf of Mexico Revealed via Ecosystem Modeling. Frontiers in Marine Science. Vol. 7:Article 513. https://doi.org/10.3389/fmars.2020.00513

[6] de Mutsert, K. J. Steenbeek, K. Lewis, J. Buszowski, J.H. Cowan Jr., and V. Christensen. 2016. Exploring effects of hypoxia on fish and fisheries in the northern Gulf of Mexico using a dynamic spatially explicit ecosystem model. Ecological Modeling 331:142-150.

[7] Grűss, A., H.A. Perryman, E.A. Babcock, S.R. Sagarese, J.T. Thorson, C.H. Ainsworth, E.J. Anderson, K. Brennand, M.D. Campbell, M.C. Christman, S. Cross, M.D. Drexler, J.M. Drymon, C.L. Gardner, D.S. Hanisko, J. Hendon, C.C. Koening, M. Love, F. Martinez-Andrade, J. Morris, B.T. Noble, M.A. Nuttall, J. Osborne, C. Pattengill-Semmens, A.G. Pollack, T.T. Sutton and T.S. Switzer. 2018. Monitoring programs of the U.S. Gulf of Mexico: inventory, development and use of a large monitoring database to map fish and invertebrate spatial distributions. Reviews in Fish Biology and Fisheries. 2018. 25 pp.

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		
2018	Red Snapper	X			SEDAR 52 Stock Assessment	http://sedarweb.org/sedar-52
2019	King Mackerel	X	X		SEDAR 38 Update King Mackerel Assessment	https://sedarweb.org/sedar-38
2020	Vermilion Snapper	X			SEDAR 67 Stock Assessment	http://sedarweb.org/sedar-67

3.1.1.7 Fall Shrimp/Groundfish Survey

Objectives

The SEAMAP-Gulf 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 330 stations annually. Vessels sample waters out to 60ftm with trawls 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-Gulf 42-ft trawl net. The objectives of the survey are to sample the northern Gulf of Mexico to determine abundance and distribution of demersal organisms from inshore waters to 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		
2018	Red Snapper	X	X		SEDAR Stock Assessment	http://sedarweb.org/sedar-52
2009 - 2019	White, Brown, and Pink	X	X		Shrimp Stock Assessment	http://www.galvestonlab.sefsc.noaa.gov/publications/
2019	King Mackerel	X	X		SEDAR 38 Update King Mackerel Assessment	https://sedarweb.org/sedar-38

3.1.2 SOUTH ATLANTIC RESOURCE SURVEYS

3.1.2.1 Coastal Trawl Survey

Objectives

The objective of the Coastal Trawl Survey is to provide spatial and temporal data on resident and transient fish, crustaceans, and other species inhabiting shallow coastal ocean off the Southeastern US. Collected information 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 in April-May, July-August, and October-November between Cape Hatteras, North Carolina and Cape Canaveral, Florida. Between 102 and 112 stations (4.6 to 9.1m depth) are sampled each season. Sampling is done with a pair of 22.9m mongoose-type Falcon trawls, with tickler chains, and without TEDs or bycatch reduction devices (BRDs). Sampling is conducted during daylight hours and trawls are towed for 20 minutes. Contents of each net is processed independently. All finfish, elasmobranchs, crustaceans, and cephalopods are sorted to species or genus, counted, and weighed. Additional length and weight data are recorded, and age structures and reproductive tissues are collected from selected priority species. Note that due to stagnating or reduced funding there have been discussions about adjusting the sampling strategy, which may result in sampling two, rather than three seasons each year.

Optimization of Present Sampling

This survey currently uses the SCDNR owned Research Vessel *Lady Lisa* as its sole sampling platform. This vessel had been fully utilized by various surveys, but lack of funding has halted several studies in recent years. It may be 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		
2016	Bluefish	x	x	x	ASMFC Benchmark Assessment	http://www.asmfc.org/fisheries-science/stock-assessments
2016	Weakfish	x	x	x	ASMFC Benchmark Assessment	http://www.asmfc.org/fisheries-science/stock-assessments
2016-2020	Atlantic Menhaden	x	x	x	ASMFC Stock Assessments	http://www.asmfc.org/fisheries-science/stock-assessments
2016-2020	Penaeid Shrimp	x	x		SC-DNR Fisheries Management	
2016-2020	Atlantic Croaker and Spot	x	x		ASFMC Assessment Review and "Traffic Light" Analysis	http://www.asmfc.org
2016-2020	Bluefish, Weakfish, Atlantic Croaker, Spot, Spanish Mackerel, and Horseshoe Crab	x			ASMFC compliance Reports	http://www.asmfc.org
2017	Atlantic Croaker	x	x		ASMFC Benchmark Assessment	http://www.asmfc.org/fisheries-science/stock-assessments
2017	Southern Flounder	x	x		NCDMF Southern Flounder assessment	
2018	Horseshoe Crab	x	x	x	Horseshoe Crab Stock Assessment	http://www.asmfc.org/fisheries-science/stock-assessments
2018	Bluefish	x	x	x	NEFSC Bluefish Update Stock assessment	https://nefsc.noaa.gov/
2018-2019	Atlantic Menhaden	x	x	x	SEDAR 69 Atlantic Menhaden Benchmark Assessment	https://sedarweb.org/sedar-69
2019	King Mackerel	x	x	x	SEDAR 38 Update King Mackerel Assessment	https://sedarweb.org/sedar-38
2016-2020	Various species		x	x	Diet information for Ecopath/Ecosim modelling for SAFMC coordinated modeling efforts	https://safmc.net/fishery-ecosystem-plan-ii-south-atlantic-ecosystem/

Coastal Trawl Survey data are supporting continued development of South Atlantic Ecopath with Ecosim model.[8] An initial list of species where collection of diets will significantly enhance the model are provided in Section 2.1.5 of the Review Report for the 2019 South Atlantic Ecopath with Ecosim Model.

3.1.2.2 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 associated river systems. 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 primary objectives of the survey are to monitor the distribution, relative abundance, and size composition of fish, shrimp, and crabs in the survey area and how they vary temporally and spatially. This data is used to ascertain fishery-independent estimates population size and mortality, identify nursery areas, determine if catch rates are correlated with indices of juvenile abundance, and monitor movement out of nursery areas.

Survey Design

During June and September each year, 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 30 ft demersal mongoose trawls over a two-week period, usually the second and third week of each month. Stations sampled are randomly selected from the following strata: Pungo River, Neuse River, Pamlico River, Pamlico Sound east of Bluff Shoal (≥3.6m), Pamlico Sound east of Bluff Shoal (<3.6m), Pamlico Sound west of Bluff Shoal (≥3.6m), and Pamlico Sound west of Bluff Shoal (≥3.6m). The randomly drawn stations are optimally allocated among strata based upon all previous June or September sampling to provide the most accurate abundance estimates. Catches from both nets are combined to comprise a single sample to reduce variability. All captured species are sorted, enumerated, and weighed. Economically and environmentally important species are measured. Environmental data is recorded at each station.

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.

[8] https://safmc.net/download/Briefing%20Book%20SSC%20Oct%202019/A12_Update_on_Construction_of_SA_Ecopath_Model_Diet_Matrix.pdf

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental /Habitat		
2017	Spot	X	X		ASMFC 2017 Spot Stock Assessment Peer Review	http://www.asmfc.org/uploads/file/59c2b9edSpotAssessmentPeerReviewReport_May2017.pdf
2017	Atlantic Croaker	X	X		ASMFC 2017 Atlantic Croaker Stock Assessment Peer Review	http://www.asmfc.org/uploads/file/59c2ba88AtlCroakerAssessmentPeerReviewReport_May2017.pdf
2018	Blue Crab	X	X	X	NCDMF Stock Assessment of the North Carolina Blue Crab (Callinectes sapidus), 1995–2016	http://portal.ncdenr.org/c/document_library/get_file?uuid=0c228bdc-d11b-440e-b1e7-ef9cbf0cb249&groupId=38337
2019	Southern Flounder	X	X		NC Stock Assessment of Southern Flounder in the South Atlantic, 1989-2017	https://files.nc.gov/ncdeq/Coastal%20Management/4-StockAssessmentReportSouthernFlounder-2019-Jan-v3.pdf
2019	Weakfish	X	X		ASMFC Stock Assessment Overview	http://www.asmfc.org/uploads/file/5df29fd92019WeakfishAssessmentOverview_Nov2019.pdf

3.1.2.3 SEAMAP-SA 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 populations of important species in some of the most heavily fished habitats off the southeastern US. Sampling locations are reef sites from 15m to about 300m, depths between Cape Hatteras, NC, and the area off St. Lucie Inlet, FL. The main gear types used are chevron traps, short bottom longline, and rod and reel, and oceanographic variables (mostly temperature, salinity, and depth) are measured using a CTD (see MARMAP 2009, SAFIMP 2010, Reichert et al. 2011 for gear details). Sampling occurs from late April to

early October using the SCDNR Research Vessel *Palmetto*. Sampling sites are randomly selected from a universe of confirmed live-bottom reef habitat locations.

The primary gear is the chevron trap, which are baited arrowhead shaped fish traps (1.5m x 1.7m x 0.6m). They are generally deployed at depths less than 100m and soaked for approximately 90 minutes. Each trap is equipped with two underwater video cameras located on top of the trap and facing opposite directions. The cameras provide information on habitat, visibility, trap behavior (e.g. movement), and relative abundance for species seen around the traps. Video data are provided to SEFIS for examination and analyses. Sampling in habitats at depths greater than ~ 75m in areas with considerable vertical relief is done primarily using short bottom longline gear. This gear consists of a 25.6m ground line with 20 gangions with non-offset circle hooks baited with whole squid, and the soak time is approximately 90 minutes. In addition, rod and reel gear with a variety of tackle and bait is used to collect samples for diet studies and additional life history information, particularly for species with low catches in traps and on longlines.

All fish caught during sampling are identified and measured on board and a total weight by species is determined. Additional samples, including otoliths and reproductive tissues, are taken from managed priority species, stored, and further processed in the SC DNR Reef Fish laboratory to determine age, reproductive parameters, diet, etc.

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-SA 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 (http://ocean.floridamarine.org/safmc_dashboard/), 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		
2014-2016	Gray Triggerfish	x	x	x	SEDAR 41	https://sedarweb.org/sedar-41
2014-2016	Red Snapper	x	x	x	SEDAR 41	https://sedarweb.org/sedar-41
2016-2020	Red Snapper	x	x		Updates to the Council	www.SAFMC.net
2016-2020	Various Reef Fish Species	x	x	x	SSC, Council, and Advisory Panel (Annual) Updates	www.SAFMC.net
2016-2020	Various Reef Fish Species	x	x	x	Updates to SAFMC SSC to assist with ABC recommendations	www.SAFMC.net
2016-2017	Blueline Tilefish	x	x	x	SEDAR 50	https://sedarweb.org/sedar-50
2016-2017	Red Grouper	x	x	x	SEDAR 53	https://sedarweb.org/sedar-53
2017-2018	Vermilion Snapper	x	x	x	SEDAR 55	https://sedarweb.org/sedar-55
2016-2018	Black Sea Bass	x	x	x	SEDAR 56	https://sedarweb.org/sedar-56
2018-2020	Greater Amberjack	x	x	x	SEDAR 59	https://sedarweb.org/sedar-59
2018-2020	Red Porgy	x	x	x	SEDAR 60	https://sedarweb.org/sedar-60
2020-2021	Golden Tilefish	x	x	x	SEDAR 66	https://sedarweb.org/sedar-66
2019-2021	Scamp	x	x	x	SEDAR 68	https://sedarweb.org/sedar-68
2020-2021	Red Snapper	x	x	x	SEDAR 73	https://sedarweb.org/sedar-73
2020-2021	Gag	x	x	x	SEDAR 71	https://sedarweb.org/sedar-71
2020-2021	Snowy Grouper	x	x	x	SEDAR 36 - Update	https://sedarweb.org/sedar-36
2016-2020	Various species		x	x	Diet information for Ecopath/Ecosim modelling for SAFMC coordinated modeling efforts	https://safmc.net/fishery-ecosystem-plan-ii-south-atlantic-ecosystem/

Data supporting continued development of South Atlantic Ecopath with Ecosim model.[9] An initial list of species where collection of diets will significantly enhance the model are provided in Section 2.1.5 of the Review Report for the 2019 South Atlantic Ecopath with Ecosim Model.

3.1.2.4 State Coastal Longline Surveys

South Carolina Coastal Longline Survey

Objectives

The objective of this project is to conduct a multi-species (target species adult red drum and coastal sharks) survey in the Southeast region. Adult red drum (otoliths, reproductive tissues, and genetic samples) as well as coastal shark (depending on external funding: genetics, life history, guts and muscle) 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 Southeast region with GA DNR and NC DMF partners.

Survey Design

The coastal longline survey is conducted following a stratified random design in Winyah Bay, Charleston Harbor, St. Helena Sound and Port Royal Sound, all in SC. Sampling in each of the four strata is conducted during August 1 – September 15, September 16 – October 31, and November 1 – December 15. Locations within each stratum are randomly selected resulting in approximately 30 stations per time period, per stratum. The sampling gear is a bottom longline deployed from the SC DNR owned R/V *Silver Crescent*. It consists of a 617m long 272 kg test monofilament mainline. 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. Gear soak times are 30 minutes and the collected fish are measured, sexed (sharks), and tagged (selected species) before release. Red drum are tagged with external dart tags and internal PIT tags. Fin clip are collected from all red drum and some other species to identify stocked fish and determine population structure. Coastal sharks of all life stages are tagged with external tags provide by the NMFS Apex Predator Program. Red drum are randomly sacrificed (30 - 50 fish per stratum/season) and various samples are taken for multiple investigations, including otoliths, reproductive tissues, and DNA.

Optimization of Present Sampling

In early survey years, catch per unit effort (CPUE) data were analyzed to maximize potential encounters with target species (red drum and coastal sharks). Areas with low CPUE of these species were eliminated, and productive areas were expanded to include more sampling locations. We have continued discussions with technical monitors to attempt to standardize the SCDNR and GADNR longline surveys.

[9] https://safmc.net/download/Briefing%20Book%20SSC%20Oct%202019/A12_Update_on_Construction_of_SA_Ecopath_Model_Diet_Matrix.pdf

North Carolina Coastal Longline Survey

Objectives

The North Carolina Coastal Longline survey provides necessary information to develop 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 biological information and age structures provides information on size at age, recruitment, genetic composition, age structures of stock, and much more. Fishery-independent surveys allow determination of CPUE, which is necessary to determine population size and trends in abundance.

Survey Design

The study occurs within the Pamlico Sound, divided into twelve regions ranging from Gull Island to the mouth of the Neuse River. A stratified-random sampling design based on prior NC DMF red drum sampling is used to select 72 random samples between mid-July and mid-October annually. Additional non-random exploratory samples may be made during the study period in Pamlico Sound and also in the nearshore waters of the Atlantic Ocean from Ocracoke to Cape Hatteras. All captured individuals are recorded at the species level and measured. 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, stomach contents, 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.

Sampling is conducted using bottom longline gear during nighttime hours starting no earlier than an hour before sunset. Samples are conducted with a 1,500m mainline with gangions placed at 15m intervals (100 hooks/set). 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. All soak times are standardized to 30 minutes. In order to maintain consistency, all samples are made in the vicinity of the 1.8m depth contour with sample depths ranging from 1.2 to 4.6m.

Optimization of Present Sampling

The NC Coastal 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 primary objective of the Georgia Coastal Longline Survey is to provide a fishery-independent index of abundance for adult red drum and coastal shark species.

Survey Design

Sampling consists of a stratified random sampling design based on spatial strata: inshore (sounds, estuaries), nearshore (0-3 nm) and offshore (3-12 nm). From June through December, 35 longline sets are conducted during each four 6-week sampling period (Jun 16-Jul 31, Aug 1-Sep 15, Sep 16-Oct 31, Nov 1-Dec 15) in southern Georgia waters. Strata weights are adjusted during the sampling season (more heavily inshore and nearshore Jun 15-Sep 15; more heavily offshore Sep 16-Dec 15) to account for the distributional shift of adult red drum. Sampling gear consists of an ~926 m long, 2.5 mm monofilament main line supporting 60 branchlines. Branchlines are 0.7 m long, 1.6 mm monofilament, equipped with a single 15/0 depressed barb circle hook, baited with cut mullet. Soak times are 30 minutes measured from second anchor deployed to first anchor retrieved. All catch is processed to the species level. Red drum are landed, processed for standard morphometrics and, if viable, tagged with dart and PIT tags and released. Sharks are processed for sex, life stage, and morphometric data. Sharks > 1.5 m remain in the water to ensured safe handling and therefore are not weighed. Sharks < 1.5 m are tagged with Roto tags on the first dorsal, while those > 1.5 m are tagged with stainless steel dart tags, when possible. Shark tags are supplied by National Marine Fisheries Service's Apex Predator Program and the tagging data are managed as part of their cooperative tagging database.

Optimization of Present Sampling

Species encountered by this survey will be checked for telemetry and conventional tags released by GADNR and other researchers. Red drum may be opportunistically implanted with acoustic tags in conjunction with ongoing state research projects. Information from tagging encounters and efforts can provide information about mortality and movement for management plans and stock assessments. GADNR is in the process of purchasing a new vessel to perform the longline survey. The new vessel will potentially improve the efficiency of survey operations.

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	Envir./ Habitat		
2016-2020	Red Drum	x	x	x	SCDNR red drum management	
2017	Red Drum	x	x	x	State Specific Assessment	
2017	Red Drum				ASMFC 2017 Red Drum Stock Assessment	http://www.asmfc.org/uploads/file/58b5c1eaRedDrumAssessmentOverview_Feb2017.pdf
2017-2019	Sandbar Shark	x	x	x	SEDAR 54 HMS Sandbar Shark	https://sedarweb.org/sedar-54
2019-2020	Blacktip Shark	x	x	x	SEDAR 65 Blacktip Shark Benchmark	https://sedarweb.org/sedar-65
2020	Coastal sharks		X		Tagging life history	https://www.nefsc.noaa.gov/nefsc/Narragansett/sharks/tagging.html

3.1.3 CARIBBEAN RESOURCE SURVEYS

3.1.3.1 SEAMAP-C 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. As part of the life history information, high definition videos are analyzed and gonads samples of species are collected, from the reef fish surveys at insular platform of Puerto Rico and the USVI to provide information on the reproduction**.** In addition, data from reef fish surveys have been used to analyze multispecies trends of fish assemblages associated with coral reef. This information is key for the construction of ecosystem-based models, which in turn are the foundational stones for an effective EBFM.

Survey Design

The SEAMAP-C 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 usually 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 has been conducted using three sampling gear types at each station: A) video camera (a 2 GoPro Hero4 Silver camera array), B) a 100ft bottom longline (50 #9 circle hooks) and C) a 2-hook handline (one #9 “J” and one #9 circle hook). Each sample gear has been deployed at the same station area, but at least 50 m 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. Most of the data is entered in real-time into NOAA Fisheries’ SEAMAP-C Data Management System. The software SCS and Sellit will be used, once they become available and functional to enter the data collected in PR and the USVI.

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. In Puerto Rico all 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 has been 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. Otoliths are sent to Dr. Shervette at the College of Charleston, University of South Carolina.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental /Habitat		
2019	Tropical Reef Fisheries Systems	X			Ecosystem Based Quantitative Models	https://www.lenfestocean.org/en/research-projects/new-effort-to-inform-an-ecosystem-approach-to-managing-us-caribbean-fisheries
1999 - 2019	Entire Fish Assemblage	X			Integrative analyses and visualization of SEAMAP-C data in Puerto Rico and the US Virgin Islands	In Progress
1999 - 2019	Fish Communities	X		X	EBFM FEP	In Progress

3.1.3.2 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. Lately, the objective of collecting this information has gained importance, since the PRDNER/FRL data indicates that,

after Hurricane María, apparently this species has been less reported in recent landings. 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, since the queen conch (*Lobatus gigas*) 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 50,000 pounds per district, and is not harvested during its annual closed season, July 1 to September 30.

Originally, a visual census survey that utilizes a transect survey methodology was used, as designed by Freidlander *et al*. (1994). New pilot method designed by Appeldoorn and Cruz-Motta, discussed and accepted in the 2019 Seamap-C Committee Meeting will be in use for the next surveys. 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. Most of the work will be performed 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. A differential Global Positioning System (GPS) unit will be tied to the divers' safety buoy, towed by one of the divers. The other diver will carry the compass to follow a fixed direction for a set period. A camera (GoPro) will be set on each scooter to record the entire transect surveyed with a resolution of 720 p and 30 frames per second. This design and associated sampling is considered a pilot survey and it is expected that the resulting data will be used to propose a complete conch survey the following year.

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 millimeter and adult age is estimated to one of the four relative age classes (newly mature, adult, old adult, and very old adult).

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.

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		
1999 - 2019	Queen Conch	X	X	X	Management Plan	https://caribbeanfmc.com/fishery- management/fishery-management-plans

3.1.3.3 Spiny Lobster Survey

Objectives

The spiny lobster constitutes the most economically important commercial fishery species in Puerto Rico and the USVI, since lobsters sell for much more per pound than fish, which drives the economic importance. The objective of the SEAMAP-C Spiny Lobster Survey is to determine the spatial and temporal variations in stock abundance. It was done for pueruli and juvenile spiny lobsters. Currently this methodology plans to focus on the adult lobster population, 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 were also monitored using artificial shelters, called “casitas,” and the modified Witham model pueruli collectors were constructed to monitor pueruli settlement. The lobsters’ casitas were sampled once every month between the full and new moons. Aiming to study reef recruitment of juveniles and adults, a new methodology was designed to be used during the next years.

To provide additional information on Spiny Lobster's life history, the ageing will be included in the surveys by using the technique of growth readings on the 'ossicles' hard parts.

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. To provide additional optimization on future Spiny Lobsters studies, the ageing will be included in the surveys by using the technique of growth readings on the 'ossicles' hard parts.

Recent Data Uses

Year	Species/ Complex	Data Used			Product Type/Name	Reference or Link
		Abundance /Biomass	Life History	Environmental /Habitat		
1999 - 2019	Spiny Lobster	X	X	X	Management Plan	https://caribbeanfmc.com/fishery-management/fishery-management-plans

3.1.4 SPECIMEN ARCHIVING

3.1.4.1 Gulf

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

Just as SEAMAP-Gulf provides a level of consistency in sampling within Gulf waters, individual states can provide a framework for the expansion of SEAMAP-Gulf 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-Gulf 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.

3.1.4.2 South Atlantic

Collection, cataloguing, and archiving voucher specimens from surveys is important and SEAMAP-SA funds used to 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 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 collected and preserved representative specimens from numerous habitats throughout the Southeast, documenting several range extensions for Atlantic species. Since many specimens are too large to be stored whole, SERTC has an image library containing photographs of fresh or frozen specimens of species collected by 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.

Given the limited available funding, SERTC support was been reduce to minimal levels to maintains the existing collections only. It is expected that direct funding to SERTC will cease in this 5-year period and the archiving of specimens is likely to be folded into the individual survey program activities.

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 or spines as a result of calibration studies (e.g. red porgy, vermillion snapper, and gray triggerfish) or to provide additional information such as edge types to determine the calendar age of fish (e.g., vermillion snapper, red snapper, and black sea bass). 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.

3.1.4.3 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 C for more details on specimen archiving in the different SEAMAP regions.

3.1.5 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 D.

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.

3.1.5.1 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-Gulf Data Manager prior to entry into the system. Verified SEAMAP-Gulf data are available conditionally to all requesters, although the highest

priority is assigned to SEAMAP-Gulf participants. More information about SEAMAP-Gulf 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-Gulf 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.

3.1.5.2 SEAMAP-South Atlantic Data Management System

Data management duties and funding for the SEAMAP-SA have been administered through the SC DNR since 2007, with support from NC DMF, GA DNR, and FWRI. 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 full version of the SEAMAP-SA Oracle Database came online in 2014. Since then, the system has been improved and data are accessible through customizable data queries to end-users. Data from the Coastal Trawl Survey, the Pamlico Sound Survey, the Coastal Longline Surveys, and the Reef Fish Survey 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.

In 2018, SCDNR data management staff began collaborating with the Southeast Coastal Ocean Observing Regional Association (SECOORA) and Axiom Data Science to test the feasibility of migrating the SEAMAP-SA online database to the SECOORA Data Portal. The SECOORA portal historically housed oceanographic and meteorological data and limited biological data sets. Their portal, however, has much more advanced end-user capabilities to explore and summarize and combine data sets across surveys and programs that is not feasible in the current SEAMAP-SA Oracle system. Based on a pilot project funded by SECOORA using SEAMAP-SA Reef Fish Survey data, Axiom Data Science was able to recreate the functionality of the current Oracle system and increase the quality of the end-user experience using their pre-existing data processing tools. In addition, this pilot improved on the structure of the SEAMAP-SA database with the addition of several fields not available before, but was not able to address the addition of all data and code tables. Based on the structure of the pilot, all SEAMAP-SA surveys currently available through the Oracle database can be incorporated into the SECOORA portal. Survey metadata has been

standardized to Darwin Core as part of the pilot and updates and tutorials for the SECOORA portal will be added to seamap.org. Once the SECOORA portal for SEAMAP-SA data is fully operational and the migration is complete, the SCDNR portal will be disabled.

The SEAMAP-SA Data Management System includes a website (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-SA and ASMFC. Input from the other SEAMAP-SA partners (NCDMF, GADNR, and FWRI) is incorporated in the form of annual survey data transmission to SC DNR, annual cruise reports and other related documents as well as assistance with website enhancements to ASMFC. Data will continue to be updated and improvements to the data provision workflow 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.

3.1.5.3 SEAMAP-Caribbean Data Management System

The data collected by each Caribbean component is handled by the respective island and sent to the SEAMAP-C Database Manager at NMFS. A new database format was provided in 2009. All the information gathered by SEAMAP-C 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.

4 APPENDICES

A. SEAMAP Committees Membership 2020

(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
JILL 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
ADAM POLLACK, 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
JARED FLOWERS, Georgia Department of Natural Resources, Coastal Resources Division
SARAH MURRAY, 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

NICOLE ANGELI, Virgin Islands Department of Planning and Natural Resources/Division of Fish and Wildlife
MATTHEW KAMMANN, Virgin Islands Department of Planning and Natural Resources Division of Fish and Wildlife. *Chair*
JUAN JOSE CRUZ-MOTTA, Puerto Rico Sea Grant College Program / University of Puerto Rico Department of Marine Sciences
RICHARD S. APPELDOORN, Independent consultant
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 contractor
EDWIN MUÑIZ, 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

B. 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.

Fishing Year	Federal Funding	Fishing Year	Federal Funding
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.

Survey	Initial Year of Operation
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
SEAMAP-Gulf 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 (GCRL) in Ocean Springs, Mississippi. This archiving center maintains the unsorted bongo samples that are not sent to the Polish sorting center. Additionally, the sorted and identified invertebrates (shrimp, crab, lobster and cephalopods) from the Poland assessed samples, are returned to GCRL for long-term archiving. A database was created to manage and track the archived data stored in this location.

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 SEAMAP-Gulf 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-Gulf held a trawl workshop in March 2019 where state and federal SEAMAP partners reviewed trawling protocols, discussed gear specifications, reviewed data entry and QA/QC procedures, and reviewed species identifications. The group also discussed recent taxonomic changes and how to handle historical species identifications when taxonomists have now determined that what we thought was one species could actually be two to three species that look very similar. SEAMAP partners have been conducting crew exchanges the past few years to assure that all SEAMAP trawling operations were being conducted consistently amongst all partners. The workshop continued those efforts to make consistency in trawling operations a top priority.

In March 2020, a Reef Fish Survey workshop was conducted to discuss the transition of the reef fish survey to a unified design where effort is allocated among spatial and habitat strata. As part of these efforts, recommendations were also developed to transition to a common set of video annotation protocols among all survey partners.

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.

Survey	Initial Year of Operation
North Carolina Pamlico Sound Trawl Survey	FY 1987
Coastal Trawl Survey	FY 1989
SEAMAP-SA 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–SA 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 SEAMAP-SA Reef Fish Survey. In 2013, the SEAMAP-SA database became publicly 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 SEAMAP-SA 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 Atlas[10] and the South Atlantic Fisheries map viewer[11]. In addition, the SAFMC has highlighted SEAMAP's role in supporting the move to ecosystem-based

[10] http://ocean.floridamarine.org/safmc_atlas

[11] http://ocean.floridamarine.org/sa_fisheries/

management in the region through the South Atlantic Habitat and Ecosystem Homepage[12]. 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, 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

[12] http://safmc.net/ecosystem-management/mapping-and-gis-data

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.

Survey	Initial Year of Operation
Queen Conch Survey	FY 1990
SEAMAP-C Reef Fish Survey	FY 1992
Spiny Lobster Survey	FY 1996
Habitat Surveys	FY 2017

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 (*Lobatus 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 SEAMAP-C 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 initiated and continued during a 12-month no-cost extension that was requested and granted for completing all studies ending March 31, 2017.

The five-years sampling cycle 2016 – 2021 originally proposed to have Reef Fish Monitoring surveys on years 1, 2, 4 and 5, while the conch and lobster surveys would be conducted in the third year. Reef Fish surveys encompassed the use of: 1) hand lines, 2) longline fishing and 3) videos recording for habitat description and reef fish abundance estimations. Posteriorly, the Caribbean Committee decided to modify the Statement of Work (SOW) for the 3rd year (FY 18-19) to conduct Reef fish sampling instead of conch & lobster, which was moved to the fourth year. New sampling protocols for reef fish, conch and lobster surveys have been improved for this period to increase the data quality acquisition for management use. During this five-year cycle (2016 – 2021), several environmental events affected the continuity of the proposed surveys. Hurricanes Irma and María (September/2017) affected the normal life including all samplings in Puerto Rico and in the USVI. This situation was worsened with the occurrence of a series of earthquakes in PR which started in January 2020, followed by a worldwide Pandemic with the Coronavirus, causing a total lock down on both districts, Puerto Rico and the US Virgin Islands

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).

C. SEAMAP Specimen Archiving

Curators

The SEAMAP curators are responsible for the maintenance of selected collections of ichthyoplankton, invertebrate organisms, unsorted plankton samples, and stomach contents, gonads, or otoliths collected during SEAMAP survey operations. The SEAMAP-Gulf Ichthyoplankton Archiving Center stores sorted ichthyoplankton samples and is located at the Florida Fish and Wildlife Research Institute, St. Petersburg, Florida. The SEAMAP-Gulf 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 is located at the University of Southern Mississippi Gulf Coast Research Laboratory in Ocean Springs, MS. This center houses the identified invertebrates (shrimp, crab, lobster and cephalopods) from the Poland assessed samples that have been returned to GCRL for long-term archiving, as well as the unsorted "backup" station samples and sorted larval invertebrate specimens. 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:

- Maintain collections in a manner consistent with approved policies and procedures,
- Receive authorized specimens and their accompanying information, and catalog these materials,
- Process user requests and provide specimens and/or information in accordance with the approved policies and procedures,
- Maintain information on specimen requests, and
- 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.

Specimens sent to the Plankton Sorting and Identification Center in Sczcecin, Poland are separated to ichthyoplankton and other plankton fractions. Ichthyoplankton fractions are sorted to at least 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, including those collected by SEAMAP-SA surveys, 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.

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. In most cases, the archiving center will cover cost of shipping to the loan recipient, whereas the requesters cover the cost of return shipping. 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, or modified (unless fully destroyed) 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 eight 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.

D. 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	Summarizes information on fisheries research survey activities, personnel, facilities, and gear, and is updated annually for distribution to regional fisheries organizations.
Directory	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.