DRAFT

Programmatic Environmental Assessment

for

Fisheries and Ecosystem Research Conducted and Funded

by the

Southeast Fisheries Science Center

April 2016

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LIST OF ACRONYMS AND ABBREVIATIONS

%	percent
μPa	micro Pascal
ACA	Atlantic Coastal Fisheries Cooperative Management Act
ACFCMA	Atlantic Coastal Fisheries Cooperative Management Act
ACL	Annual Catch Limit
ADCNR	Alabama Department of Conservation & Natural Resources
ADCP	Acoustic Doppler Current Profiler
ALWTRP	Atlantic Large Whale Take Reduction Plan
ARA	Atlantic Research Area
ASBTBTS	Atlantic Striped Bass Tagging Bottom Trawl Survey
ASDGS	American Shad Drift Gillnet Survey
ASMFC	Atlantic States Marine Fisheries Commission
ATCA	Atlantic Tuna Conventions Act
ATGTRS	Atlantic Trawl Gear Take Reduction Strategy
BEAR	Benthic Ecosystems Assessment Research
BiOp	Biological Opinion
BDTRP	Bottlenose Dolphin Take Reduction Plan
BMC	Birds of Management Concern
BRD	Bycatch Reduction Device
BTS	Bottom Trawl Survey
BSE	bay, sound, and estuarine
CFMC	Caribbean Fishery Management Council
CEQ	Council on Environmental Quality
CETAP	Cetacean and Turtle Assessment Program
CFMC	Caribbean Fishery Management Council
CFR	Code of Federal Regulations
cm	centimeter
cm^2	square centimeter
CO_2	carbon dioxide
CRA	Caribbean Research Area
CS LME	Caribbean Sea LME
CSA	Central and Southwest Atlantic
CTD	Conductivity, Temperature, Depth
CTS	Coastal Trawl Survey
CZMA	Coastal Zone Management Act
DAS	days-at-sea
dB	decibels
DMAs	Dynamic Management Areas
DISL	Dauphin Island Sea Laboratory
DPEA	Draft Programmatic Environmental Assessment

DPS	Distinct Population Segment
EA	Environmental Assessment
ESA	Endangered Species Act
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EMTS	Ecological Monitoring Trawl Survey
EO	Executive Order
ESA	Endangered Species Act
FAME	Fisheries Assessment, Monitoring, and Ecology
ft	foot, feet
FFWCC	Florida Fish & Wildlife Conservation Commission
FMP	Fishery Management Plan
FMUs	Fishery Management Units
FONSI	Finding of No Significant Impact
FPC	Field Party Chief
FR	Federal Register
F/V	Fishing Vessel
FSU/CML	Florida State University Coastal & Marine Laboratory
FWCA	Fish and Wildlife Coordination Act
FWC	Fish and Wildlife Conservation Commission
GCRL	Gulf Coast Research Lab
GDNR	Georgia Department of Natural Resources
GOM	Gulf of Mexico
GOM LME	Gulf of Mexico Large Marine Ecosystems
GOMRA	Gulf of Mexico Research Area
GMFMC	Gulf of Mexico Fishery Management Council
GULFSPAN	Gulf of Mexico Shark Pupping & Nursery
HAPC	Habitat Area of Particular Concern
HMS	highly migratory species
hr(s)	hour, hours
Hz	hertz
IBBEAM	Integrated Biscayne Bay Ecological Assessment and Monitoring
IJA	Inter-jurisdictional Fisheries Act
in	inch
IR	Infrared
ITA	incidental take authorization
ITSs	incidental take statements
ICCAT	International Commission for the Conservation of Atlantic Tunas
IHA	Incidental Harassment Authorizations
IMO	International Maritime Organization

IWC	International Whaling Commission
JSTS	Juvenile Stage Trawl Survey
kg	kilogram
kHz	kilohertz
km	kilometers
km^2	square kilometers
kts	knots
L	liter
LDWF	Louisiana Department of Wildlife & Fisheries
LME	Large Marine Ecosystems
LNG	Liquified Natural Gas
LOA	Letters of Authorization
LOF	List of Fisheries
m	meter
m^2	square meter
MAB	Mid-Atlantic Bight
MARMAP	Marine Resources Monitoring, Assessment, and Prediction
MAFMC	Mid-Atlantic Fishery Management Council
MARPOL	International Convention for the Prevention of Pollution from Ships
M&SI	mortality and serious injury
MBES	multi-beam echosounder
MBTA	Migratory Bird Treaty Act
MDMR	Mississippi Department of Marine Resources
mm	millimeter
MML	Mote Marine Laboratory
MMOs	Marine Mammal Observers
MMPA	Marine Mammal Protection Act
MPA	Marine Protected Area
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSY	maximum sustainable yield
mt	metric ton
N/A	Not available or not applicable
NAO	NOAA Administrative Order
NCDENR	North Carolina Department of Environmental and Natural Resources
NEFSC	Northeast Fisheries Science Center
NE LME	Northeast U.S. Continental Shelf LME
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
nm	nautical mile
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act

NMS	National Marine Sanctuary
NOAA	National Oceanic and Atmospheric Administration
OMAO	NOAA Office of Marine and Aviation Operations
OPR	Office of Protected Resources
OSP	optimum sustainable population
PBR	Potential Biological Removal
PCB	polychlorinated biphenyl
PIT	Passive Integrated Transponder
PLTRP	Pelagic Longline Take Reduction Plan
PR-DNER	Puerto Rico Department of Natural and Environmental Resources
PSO	Protected Species Observers
PTS	permanent threshold shift
R/V	Research Vessel
RecFIN	Recreational Fisheries Information Network
RFFAs	Reasonably Foreseeable Future Actions
ROV	Remotely Operated Vessel
SAFMC	South Atlantic Fishery Management Council
SARs	stock assessment reports
SCDNR	South Carolina Department of Natural Resources
SEDAR	Southeast Data Assessment and Review
SEAMAP	Southeast Area Monitoring and Assessment Program
SEFIS	Southeast Fishery-Independent Survey
SEFSC	Southeast Fisheries Science Center
SE LME	Southeast U.S. Continental Shelf LME
SHPO	State Historic Preservation Office
SMAs	Seasonal Management Areas
SWL	Scientific Watch Leader
mi^2	square mile(s)
SRPs	Scientific Research Permits
TBD	to be determined
TEDs	turtle excluder devices
TEWG	Turtle Export Working Group
TNASS	Trans-North Atlantic Sighting Survey
TPWD	Texas Parks & Wildlife Department
TRPs	Take Reduction Plans
TTS	Temporary Threshold Shift
U.S.	United States
USC	United States Code
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

USVI-DFW	United States Virgin Islands - Division of Fish and Wildlife (Department of Planning and Natural Resources)
UNOLS	University-National Oceanographic Laboratory System
USA/DISL	University of South Alabama Dauphin Island Sea Laboratory
USM/GCRL	University of Southern Mississippi Gulf Coast Research Lab
UV	ultraviolet
UWF	University of West Florida
UME	Unusual Mortality Event
VIMS	Virginia Institute of Marine Science
yr	year

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EXECUTIVE SUMMARY

CHAPTER 1 – INTRODUCTION AND PURPOSE AND NEED

The federal government has a responsibility to conserve and protect living marine resources in waters of the United States (U.S.), also referred to as federal waters. These waters generally lay 3 to 200 nautical miles (nm) from the shoreline, and comprise an area known as the Exclusive Economic Zone (EEZ)[1]. The National Oceanic and Atmospheric Administration (NOAA) has the primary responsibility for managing marine finfish and shellfish, certain marine mammal species, sea turtles in marine waters, and their habitats. Within NOAA, the National Marine Fisheries Service (NMFS) has been delegated primary responsibility for the science-based management, conservation, and protection of living marine resources within the U.S. EEZ.

NMFS is fundamentally a science-based agency, with its primary mission being the stewardship of living marine resources through science-based conservation and management. So central is science-based management to NMFS fishery management efforts, it is listed among the ten National Standards set forth in the Magnuson-Stevens Fishery Conservation and Management Act (MSA): "(2) Conservation and management measures shall be based upon the best scientific information available." (16 United States Code [U.S.C.] §§ 1801-1884).

This Draft Programmatic Environmental Assessment (DPEA) evaluates both a primary and a secondary federal action under the National Environmental Policy Act (NEPA). The purpose and need for the primary action is to continue fisheries research activities conducted and funded by the Southeast Fisheries Science Center (SEFSC) to produce scientific information necessary for the management and conservation of living marine resources in the Atlantic Ocean, Gulf of Mexico, and the Caribbean Sea around Puerto Rico and the U.S. Virgin Islands. This research promotes both the recovery of certain species and the long-term sustainability of these resources. It also generates social and economic opportunities and benefits from their use. The information developed from these research activities is essential to the development of a broad array of fisheries, sea turtle, marine mammal, and ecosystem management actions taken not only by NMFS, but also by other federal and state authorities. Each of the research activities requires one or more scientific research permits and the issuance of these permits is a part of the primary federal action covered under this NEPA review. The secondary action is the issuance of proposed regulations and subsequent Letters of Authorization (LOA) under Section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA) of 1972, as amended (MMPA; 16 U.S.C. 1361 et seq.) that would govern the unintentional taking of small numbers of marine mammals incidental to SEFSC fisheries research activities.

Fisheries Science Centers

In order to direct and coordinate the collection of scientific information needed to make informed fishery conservation and management decisions, NMFS established six Regional Fisheries Science Centers (FSC)[2] each a distinct organizational entity and the scientific focal point within NMFS for region-based federal fisheries-related research in the U.S.

[1] An Exclusive Economic Zone is an area over which a nation has special rights over the exploration and use of marine resources.

[2] Northeast FSC, Southeast FSC, Southwest FSC, Northwest FSC, Alaska FSC, and Pacific Islands FSC

The Fisheries Science Centers conduct primarily *fisheries-independent* research studies[3] but may also participate in *fisheries-dependent* and *cooperative* research studies. This research is aimed at monitoring fish stock recruitment, survival and biological rates, abundance and geographic distribution of species and stocks, and providing other scientific information needed to improve our understanding of complex marine ecological processes and promote the NMFS strategic goal of ecosystem-based fisheries management.

Southeast Fisheries Science Center Research Activities

The SEFSC is the research arm of NMFS in the Southeast region of the U.S. The SEFSC conducts research and provides scientific advice to manage fisheries and conserve protected species on living marine resources in marine and estuarine habitats of the Atlantic Ocean along the southeastern coast of the U.S.[4] the Gulf of Mexico, and the Caribbean Sea, including marine waters offshore from Puerto Rico and the U.S. Virgin Islands (Figure 1.1-2). Three regional Fishery Management Councils rely in part on data collected by the SEFSC. The South Atlantic Fishery Management Council (SAFMC), the Gulf of Mexico Fishery Management Council (GMFMC), and the Caribbean Fishery Management Council (CFMC) rely primarily on the SEFSC for fisheries independent research data for development of stock assessment reports and other management purposes (Figure 1.1-3). The SEFSC also provides research data and works cooperatively with numerous other domestic and international fisheries management organizations.

In addition to supporting fisheries management organizations, SEFSC generates and communicates scientific information to support the restoration of coastal rivers and estuaries, the recovery of protected species, the establishment of marine protected areas, the emergence of marine spatial planning, and to advance scientific understanding of the structure and function of marine ecosystems and the impacts of climate change on these systems.

The specimen archives collected during SEFSC research cruises include some of the world's preeminent collections of plankton, fish, marine invertebrates, and tissue samples for molecular genetics. Sample coverage from different coastal areas is unique in the world because of the long time-series and extensive area from which they have been sampled. These collection archives provide an important record of species diversity, community composition, genetic structure, and an extraordinary record of climate change and other human impacts for current and future studies.

NMFS has prepared this DPEA to evaluate several alternatives for conducting and funding these fisheries and ecosystem research activities as the primary federal action. NMFS is also evaluating a number of mitigation measures that may be implemented to reduce potential impacts on marine mammals as part of the analysis concerning the secondary action, compliance with the MMPA. Additionally, because the proposed fisheries and ecological research activities occur in areas inhabited by a number of marine

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[3] Fisheries-independent research is designed and conducted independent of commercial fishing activity to meet specific research goals, and includes research directed by NMFS scientists and conducted on board NOAA-owned and operated vessels or NOAA-chartered vessels. Fisheries-dependent research is research that is carried out in partnership with commercial fishing vessels. The vessel activity is not directed by NMFS, but researchers collect data on the commercial catch. Cooperative research programs are those where NMFS provides substantial support of the research through funding, equipment supply, or scientific collaboration but which are carried out by cooperating scientists (other agencies, academic institutions, commercial fishing-associated groups, or independent researchers) on board non-NOAA vessels.

[4] The Northeast Fisheries Science Center also conducts research along the U.S. Atlantic Coast and provides scientific information for some of the same fisheries management organizations as the SEFSC. There is some spatial overlap with research from the different centers own research programs and they work with some of the same research partners. The Northeast Fisheries Science Center has published a DPEA, covering the same type of authorization processes described for the SEFSC in this DPEA.

mammals, birds, sea turtles, and fishes listed under the Endangered Species Act (ESA) as threatened or endangered, this DPEA evaluates activities that could result in unintentional impacts on ESA-listed marine species.

CHAPTER 2 – ALTERNATIVES

The National Environmental Policy Act requires federal agencies to consider alternatives to a proposed federal action. The evaluation of alternatives under NEPA assists the decision maker in ensuring that any unnecessary impacts are avoided through an assessment of alternative ways to achieve the underlying purpose of the proposed action that may result in less environmental harm.

To warrant detailed evaluation under NEPA, an alternative must be reasonable and meet the stated purpose and need for the proposed actions (see Section 1.3). For this DPEA, NMFS has applied the following screening criteria to a range of alternatives to identify which ones should be brought forward for detailed analysis:

Screening Criteria

To be considered "reasonable" for purposes of this DPEA, an alternative must meet the following criteria:

- The action must not violate any federal statute or regulation.
- The action must be consistent with reasonably foreseeable funding levels.
- The action must be consistent with long-term research commitments and goals to maintain the utility of scientific research efforts, or consider no federal funding availability for fisheries research.

To maintain the utility of scientific research efforts, fisheries and marine ecosystem scientific research should address at least some of the following goals related to fisheries management:

- Methods and techniques should provide standardized and objective data consistent with or complementary to past data sets (time-series) in order to facilitate long-term trend analyses.
- Collected data should adequately characterize living marine resource and fishery populations and the health of their habitats.
- The surveys should enable assessment of population status and provide predictive capabilities required to respond to changing ecosystem conditions and manage future fisheries.
- Research on new methodologies to collect fisheries and ecosystem information (e.g. active and passive acoustic instruments and video surveys of benthic habitats in lieu of dredge gear or bottom trawls) and research oriented toward modifications of fishing gear to address bycatch or other inefficiencies should be conducted under experimental conditions sufficient to allow statistically valid comparisons with relevant alternatives.

NMFS evaluated each potential alternative against these criteria. Based on this evaluation, the No-Action/Status Quo Alternative and two other action alternatives have been identified as reasonable and are being carried forward for more detailed evaluation in this DPEA. NMFS will also evaluate a second type of no-action alternative that considers no federal funding for fisheries research activities. This will be called the No Research Alternative to distinguish it from the No-Action/Status Quo Alternative. The No-Action/Status Quo Alternative will be used as the baseline to compare all of the other alternatives.

Three of the alternatives include a program of fisheries and ecosystem research projects conducted or funded by the SEFSC as the primary federal action. Because this primary action is connected to a secondary federal action (also called a "connected action" under NEPA), to consider NMFS promulgation of regulations and subsequent issuance of LOAs under Section 101(a)(5)(A) of the MMPA for the incidental, but not intentional, taking of marine mammals, NMFS must identify as part of this evaluation under the MMPA "(t)he means of effecting the least practicable adverse impact on the species or stock and its habitat." As a result, NMFS will identify and evaluate a reasonable range of mitigation measures to minimize impacts to marine mammals that occur in SEFSC research areas. In addition, because this NEPA document will be used to initiate section 7 consultation under the ESA and for compliance with other conservation laws, each of which may recommend or require mitigation measures, the consideration of mitigation measures is extended to all protected species. These mitigation measures are considered as part of the identified alternatives in order to evaluate their effectiveness to minimize potential adverse environmental impacts. Protected species include all marine mammals, which are covered under the MMPA, all species listed under the ESA, and bird species protected under the Migratory Bird Treaty Act.

In addition, because the proposed research activities occur partially within the boundaries of National Marine Sanctuaries, and within areas identified as Essential Fish Habitat (EFH), this DPEA evaluates potential impacts to sanctuary resources and EFH as required under section 304(d) of the National Marine Sanctuaries Act and section 305(b)(2) of the MSA.

Alternative 1 - No-Action/Status Quo Alternative - Conduct Federal Fisheries and Ecosystem Research with Scope and Protocols Similar to Past Effort

The No-Action/Status Quo Alternative includes fisheries research using the same protocols as were implemented in the recent past (considered to be from 2008 through 2014 for the purposes of this DPEA). These federal research activities are necessary to fulfill NMFS mission to provide science-based management, conservation, and protection of living marine resources in the areas covered by the SEFSC. Under Alternative 1, the SEFSC would use the same scope of research as in recent years and with current mitigation measures for protected species.

Under the Status Quo Alternative, the SEFSC would administer, fund, and/or conduct a wide range of fishery-independent research and survey programs, as summarized in Table 2.2-1. These surveys generally use fishing gear to capture fish and invertebrates for stock assessment or other research purposes, and also include collection of plankton and oceanographic and acoustic data to characterize the marine environment. The main gear types of concern for potential interactions with protected species include bottom trawls, pelagic trawls (surface and mid-water), hook-and-line gears (bottom and pelagic longline gear, bandit reels, and rod and reel deployments), dredge gear, trammel nets, and gillnets. The scope of past research activities is considered as the basis for analysis of future activities under the Status Quo Alternative.

The Status Quo Alternative research activities include a suite of mitigation measures that were developed to minimize the risk of ship strikes and captures or injuries of protected species in fishing gear. The following mitigation measures have been implemented on all SEFSC surveys since at least the end of 2009, although many surveys implemented them earlier:

- Visual monitoring for protected species prior to and during deployment of gear;
- Gear is not set if marine mammals or other protected species are sighted from the vessel prior to deployment of trawl, longline, gillnet, or any other fishing gear that may pose a risk of interactions with protected species and if the animals appear to be at risk of interaction with the gear as determined by the professional judgment of the Field Party Chief (FPC), Scientific Watch Leader (SWL), and vessel captain. There are three basic options for the "Move-on Rule": gear deployment is delayed until the protected species have left the area, the research vessel is moved away from the protected species before gear deployment, or the sample station is canceled;
- If protected species are sighted before the gear is fully retrieved, the most appropriate response to avoid incidental take is determined by the professional judgment of the FPC or SWL in consultation with the officer on watch; and

- Use of Turtle Excluder Devices on all trawls longer than 55 minutes, consistent with commercial fishing regulations.

However, these mitigation measures may not be sufficient to reduce the effects of SEFSC fisheries research activities on marine mammals to the level of least practicable adverse impact, as required under the MMPA (see Alternative 2). Other mitigation measures as well as monitoring and reporting conditions may be required under the MMPA and ESA processes for the specified research activities conducted by the SEFSC.

Alternative 2 – Preferred Alternative - Conduct Federal Fisheries and Ecosystem Research (New Suite of Research) with Mitigation for MMPA and ESA Compliance

The Preferred Alternative includes a combination of research activities continued from the past and additional, new research surveys and projects as described in Table 2.3-1. Under this alternative, the SEFSC would apply to NMFS Office of Protected Resources (OPR)[5] to promulgate regulations governing the issuance of LOAs for incidental take of marine mammals under the MMPA. OPR would consider these activities and mitigation measures and determine whether it should promulgate regulations and issue LOAs as appropriate to the SEFSC. If regulations are promulgated and LOAs are issued, they would prescribe: the permissible methods of taking, a suite of mitigation measures intended to reduce the risk of potentially adverse interactions with marine mammals and their habitats during the specified research activities, and require monitoring and reporting that will result in increased knowledge of the species and of the level of taking.

In addition, the SEFSC will use to DPEA to initiate ESA section 7 consultations with NMFS Southeast Regional Office (and U.S. Fish and Wildlife Service) for species that are listed as threatened or endangered. These consultations will result in the development of one or more Biological Opinions (BiOps) that state the opinions of the agencies as to whether or not the primary and secondary federal actions are likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The BiOps may contain incidental take statements that may include reasonable and prudent measures along with implementing terms and conditions intended to minimize the number and impact of incidental takes of ESA-listed species during SEFSC research activities and monitoring and reporting requirements.

The Preferred Alternative also includes the same suite of mitigation measures as the Status Quo Alternative to reduce the risk of adverse interactions with protected species. The SEFSC considers the current suite of monitoring and operational procedures to be necessary to avoid adverse interactions with protected species and still allow the SEFSC and its cooperating research partners to fulfill their scientific missions. However, some mitigation measures such as the move-on rule require judgments about the risk of gear interactions with protected species and the best procedures for minimizing that risk on a case-by-case basis. Ship captains, FPCs, and SWLs are charged with making those judgments at sea. They are all highly experienced professionals but there may be inconsistencies in how those judgments are made across the range of research surveys conducted and funded by the SEFSC. In addition, some of the mitigation measures described in the Status Quo Alternative could also be considered “best practices” for safe seamanship and avoidance of hazards during fishing (e.g., prior surveillance of a sample site before setting trawl gear). At least for some of the research activities considered in this DPEA, especially those conducted by cooperative research partners, explicit links between the implementation of these best practices and their usefulness as mitigation measures for avoidance of protected species have not been formalized and clearly communicated with all scientific parties and vessel operators. In the case of at least

[5] Permits and Conservation Division, Incidental Take Program

some of the cooperative research projects funded through the SEFSC, scientific procedures and data reporting protocols have been specified in contracts with cooperating research partners but specific procedures to avoid or report interactions with protected species have not been incorporated into contracts. The SEFSC therefore proposes a series of improvements to its protected species training, awareness, contracting, and reporting procedures under the Preferred Alternative. The SEFSC expects these new procedures will facilitate and improve the implementation of the mitigation measures described under the Status Quo Alternative and will reduce the effects of SEFSC fisheries research activities on marine mammals to the level of least practicable adverse impact, as required under the MMPA.

- Under the Preferred Alternative, the SEFSC will initiate a process for its FPCs, SWLs, scientists, and vessel captains and crew to communicate with each other about their experiences with protected species interactions during research work with the goal of improving decision-making regarding avoidance of adverse interactions. There are many situations where professional judgment is used to decide the best course of action for avoiding protected species interactions before and during the time research gear is in the water. The intent of this new training program would be to draw on the collective experience of people who have been making those decisions, provide a forum for the exchange of information about what went right and what went wrong, and try to determine if there are any rules-of-thumb or key factors to consider that would help in future decisions regarding avoidance practices. The SEFSC would coordinate not only among its staff and vessel captains but also with those from its research partners, other NMFS Fisheries Science Centers, the NMFS Southeast Regional Office, and other institutions with similar experience.
- The SEFSC will implement the use of a Protected Species Safe Handling and Release Manual (Appendix D). The manual includes topics such as current mitigation measures, decision-making factors for avoiding take, procedures for handling and releasing protected species caught in research gear, and reporting requirements. Review and discussion of the manual would be conducted by the SEFSC on a regular basis and updates would be distributed to SEFSC and partner scientists.
- The SEFSC will require that a minimum of two members of the scientific party participating on each field survey (both SEFSC and research partners) receive formal training through NMFS Highly Migratory Species/Protected Species Safe Handling, Release, and Identification Workshop (http://www.nmfs.noaa.gov/sfa/hms/compliance/workshops/protected_species_workshop/index.html) or other similar workshops. This workshop is designed to teach protected species identification as well as proper techniques for safe handling and release of entangled or hooked protected species, such as sea turtles, marine mammals, and smalltooth sawfish.
- For all SEFSC and partner research projects, mitigation measures are included in the written cruise instructions. In addition, informational placards and reporting procedures will be reviewed and updated as necessary for consistency and accuracy. Many research cruises already include pre-sail review of protected species protocols for participating scientists and crew but the SEFSC will require pre-sail briefings to be conducted before all research cruises, including those conducted by research partners.
- NOAA Fisheries has established a formal incidental take reporting system, the Protected Species Incidental Take (PSIT) database, requiring that incidental takes of protected species be reported within 48 hours of the occurrence. The PSIT generates automated messages to agency leadership and other relevant staff to alert them of the event and notify them that updated information describing the circumstances of the event was inputted into the database. The SEFSC developed a PSIT reporting form and instructions (Appendix D) for use during all of its fisheries and ecosystem research activities and will require all SEFSC and research partners to use this form

for reporting incidental takes of all protected species. The form includes information about the interaction, biological information, gear and any mitigation measures in place. The information collected can then be reviewed and used to determine if additional mitigation measures are necessary for that survey or gear type.

- The SEFSC will incorporate specific language into its contracts that specifies training requirements, operating procedures, and reporting requirements for protected species that will be required for all surveys conducted by research partners, including those conducted on chartered vessels.

Alternative 3 - Modified Research Alternative – Conduct Federal Fisheries and Ecosystem Research (New Suite of Research) with Additional Mitigation

Under Alternative 3, the SEFSC would conduct and fund the same scope of fisheries research as described in the Preferred Alternative and would include all of the same mitigation measures considered under the Preferred Alternative. Under this alternative, the SEFSC would also apply for authorizations under the MMPA for incidental take of protected species during these research activities and initiate section 7 consultations regarding ESA-listed species. The difference between Alternative 3 and the Preferred Alternative is that Alternative 3 includes a number of additional mitigation measures derived from a variety of sources including: (1) comments submitted from the public on potential mitigation of commercial fisheries impacts, (2) discussions within NMFS OPR as part of the proposed rulemaking process under the MMPA, and (3) a literature review of past and current research into potential mitigation measures. These measures include changes to visual monitoring methods for protected species (e.g., dedicated Protected Species Observers and technological methods to improve detection under poor visibility conditions), operational restrictions on where and when research may be conducted, and adoption of alternative methodologies and equipment for sampling. This Alternative is not considered as an “all or nothing” proposition; one or more of the additional mitigation measures may be considered for implementation during the MMPA and ESA consultation processes.

The SEFSC regularly reviews its procedures and investigates options for incorporating new mitigation measures and equipment into its ongoing survey programs. Evaluating new mitigation measures includes assessing their effectiveness in reducing risk to protected species, but measures must also pass safety and practicability considerations, meet survey objectives, allow survey protocols to remain compatible with previous data sets, and be consistent with the purpose and need for SEFSC research activities. Some of the mitigation measures considered under Alternative 3 (e.g., no night fishing or broad spatial/temporal restrictions on research activities) would not allow survey protocols to remain consistent with previous data sets and would essentially prevent the SEFSC from collecting data required to provide for fisheries management purposes under the MSA. Some research surveys necessarily target fish and invertebrate species that are preyed upon by protected species with an inherent risk of interactions during these surveys. The SEFSC acknowledges the inherent risk of these surveys and it has implemented a variety of measures to help mitigate that risk. However, the experimental design of many surveys includes the need to sample “hotspots” of marine life, which often include protected species drawn to concentrations of fish and invertebrates. If these surveys could not sample in areas rich in marine life, as indicated by the presence of marine mammals and sea turtles, even if the protected species did not appear to be at risk of interaction with the research gear, the sampling results would not accurately reflect the variability in abundance for different fish and invertebrate species and the ability of the SEFSC to provide the “best available” scientific data for fisheries management purposes would be compromised. This type of ecological information is also important to agencies and other institutions concerned about the health of the marine environment important to the protected species themselves. The SEFSC currently has no viable alternatives to collecting the data derived from these surveys that meet the research objectives described under Purpose and Need. As a result, NMFS does not propose to implement potential mitigation measures that would preclude continuation of these surveys, such as the elimination of night surveys or use of trawl gear.

The connected federal action covered under this DPEA is the issuance of regulations and subsequent LOAs for incidental takes of marine mammals under the MMPA, which requires NMFS to consider a reasonable range of mitigation measures that may reduce the impact on marine mammals among other factors. As described above, some of these measures could prevent the SEFSC from maintaining the scientific integrity of its research programs. These measures would normally be excluded from consideration in the DPEA for not being consistent with the purpose and need (Chapter 1). However, these additional mitigation measures would likely be considered during the MMPA rulemaking process and/or ESA section 7 consultation and are therefore analyzed in this DPEA.

Alternative 4 - No Research Alternative - No Fieldwork for Federal Fisheries and Ecosystem Research Conducted or Funded by SEFSC

Under the No Research Alternative, no direct impacts on the marine environment would occur from the primary or secondary federal actions. The SEFSC would no longer conduct or fund fieldwork for the marine fisheries and ecosystem research considered in the scope of this DPEA. This moratorium on fieldwork would not extend to research that is not in scope of this DPEA, such as directed research on marine mammals and ESA-listed species covered under separate research permits and NEPA documents. NMFS would need to rely on other data sources, such as fishery-dependent data (i.e., harvest data) and state or privately supported fishery-independent data collection surveys or programs to fulfill its responsibility to manage, conserve and protect living marine resources in the U.S. Under this alternative, organizations that have participated in cooperative research programs may or may not continue their research efforts depending on whether they are able to secure alternative sources of funding. Any non-federal fisheries research would occur without NMFS funding, direct control of program design, or operational oversight. It is unlikely that these non-NMFS fisheries research surveys would be compatible with the time-series data NMFS has collected over many years, which is the core information supporting NMFS science and management missions and vital to fishery management decisions made by NMFS, the Fishery Management Councils and other marine resource management institutions, leading to greater uncertainty for fishery and other natural resource management decisions.

CHAPTER 3 – AFFECTED ENVIRONMENT

Chapter 3 presents baseline information on the marine environment affected by SEFSC research activities. This information is not intended to be encyclopedic but to provide a foundation for the analysis of environmental impacts of the alternatives and the cumulative effects analysis. Sources of additional information are incorporated by reference.

The marine environment affected by SEFSC research surveys includes sections of four Large Marine Ecosystems (LMEs), including the Southeast U.S. Continental Shelf LME, Northeast U.S. Continental Shelf LME, Gulf of Mexico LME, and Caribbean Sea LME (Sherman et al. 1996). However, SEFSC fisheries research activities may also be conducted in offshore areas that lie outside of the coastal LME boundaries. There are many areas with special designations to protect various resources and are subject to various levels of conservation and management under a variety of authorities. Classifications of these special resource areas include Essential Fish Habitat, fisheries closure areas, and designated Marine Protected Areas including National Marine Sanctuaries.

There are thousands of finfish and shellfish species that occur within the SEFSC research areas. Descriptions or lists are provided for ESA-listed species (Atlantic sturgeon, Gulf sturgeon, shortnose sturgeon, largetooth sawfish, smalltooth sawfish, and scalloped hammerhead shark), species targeted by commercial fisheries and subject to SEFSC research assessments, highly migratory species, and other species caught frequently in SEFSC surveys.

Marine mammal species that occur in the SEFSC research area are listed in Table 3.2-4 including greater than 30 species of cetaceans (whales, dolphins, and porpoise) and West Indian manatee. All of these species are federally protected under the MMPA regardless of where they occur. Six large whale species are listed as endangered under the ESA. Information is presented on marine mammal acoustics and functional hearing ranges for several groups of marine mammals. Marine mammals rely on sound production and reception for social interactions (e.g., reproduction and communication), to find food, to navigate, and to respond to predators.

Three ESA-listed bird species occur in the SEFSC research area. Other common species in these areas that are susceptible to entanglement in fishing gear are listed. All species likely to occur in the U.S. EEZ are protected by the Migratory Bird Treaty Act.

Five species of sea turtles regularly occur within the SEFSC research areas, all of which are listed as endangered or threatened under the ESA. Sea turtles are susceptible to damage of onshore nesting habitat, exploitation of eggs, and interactions with research, sport, and commercial fisheries.

There are seven species of ESA-listed invertebrates in the SEFSC research area (elkhorn, staghorn, rough cactus, pillar, lobed star, mountainous star, and boulder star coral) and one ESA-listed species of marine plant (Johnson's seagrass). The SEFSC conducts substantial research and provides stock abundance and distribution information for management of several commercially valuable invertebrates, including white shrimp and brown shrimp.

Several components of the social and economic environment are summarized. A number of commercial fisheries harvest marine fish and invertebrates in the waters of the U.S. Atlantic, Gulf of Mexico, and Caribbean Sea. Complex associations exist between the fishing industry, fisheries management processes, and the social well-being of many communities. Recreational fisheries also play an important role in the well-being of individuals and communities. These fisheries and communities receive scientific and economic benefits from the SEFSC research activities as they contribute to the scientific management of sustainable fisheries. Information is also presented on the basic operating costs of the SEFSC (approximately $60-66 million annually) and average costs for conducting SEFSC research programs. These expenses include funds for ship time, fuel and supplies, crew, charter vessels, and other logistic support, which directly and indirectly benefits communities on the U.S. Atlantic coast.

CHAPTER 4 – ENVIRONMENTAL EFFECTS

As indicated earlier, NMFS is fundamentally a science-based agency, with its primary mission being the stewardship of living marine resources through science-based conservation and management. Of the four alternatives evaluated in this DPEA, three alternatives maintain an active research program (Status Quo, Preferred, and Modified Research Alternatives) that clearly enables collection and development of additional scientific information, and one alternative (No Research) does not. In NMFS view, the inability to acquire scientific information essential to developing robust fisheries management measures that prevent overfishing and rebuild overfished stocks would ultimately imperil the agency's ability to meet its mandate to promote healthy fish stocks and restore the nation's fishery resources. The scientific information provided by fisheries research programs also allows NMFS to address potential effects of climate change and ocean acidification. Long-term, consistent fisheries and ecosystem research programs contribute substantially to developing effective and timely fisheries management actions and assists in meeting international treaty obligations.

The following discussion summarizes the direct and indirect impacts by resource area associated with the alternatives evaluated in Chapter 4 of this DPEA. The effects of the alternatives on each resource category were assessed using an impact assessment criteria table to distinguish between major, moderate, and minor effects within the context of each resource category. The analysis shows that the potential direct and indirect impacts on the physical and biological environments under the three research alternatives are similar and would have minor to moderate adverse effects. The three research alternatives would also have minor to moderate beneficial effects on the social and economic environment of fishing communities by providing the scientific information needed for sustainable fisheries management and by providing funding, employment, and services. The similarity of impacts among the three research alternatives is due to the fact that the scope of research activities under these alternatives is similar; they differ primarily in the type of mitigation measures included for protected species. The No Research Alternative, in contrast, would eliminate the direct adverse effects of the research alternatives on the marine environment but would have minor to moderate adverse, indirect effects on several biological resources due to increasing uncertainty in future resource management decisions caused by the loss of scientific information on the marine environment from the SEFSC. The No Research Alternative was also considered to have minor to moderate adverse effects on the social and economic environment of fishing communities by having relatively minor to moderate economic impacts on various communities as well as long-term and widespread adverse impacts on sustainable fisheries management. Table ES-1 provides a summary of impact determinations for each resource by alternative.

Table ES-1 Summary of Environmental Effect Conclusions for Each Alternative

Topic	Alternative 1 (Status Quo)	Alternative 2 (Preferred)	Alternative 3 (Modified)	Alternative 4 (No Research)
Physical Environment	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Special Resource Areas	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Fish	Minor *adverse*	Minor *adverse*	Minor *adverse*	Moderate *adverse*
Marine Mammals	Minor to moderate *adverse*	Minor to moderate *adverse*	Minor to moderate *adverse*	Minor *adverse*
Birds	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*
Sea Turtles	Minor *adverse*	Minor *adverse*	Minor *adverse*	Moderate *adverse*
Invertebrates	Minor *adverse*	Minor *adverse*	Minor *adverse*	Moderate *adverse*
Social and Economic Environment	Minor to moderate *beneficial*	Minor to moderate *beneficial*	Minor to moderate *beneficial*	Moderate *adverse*

Physical Environment and Special Resource Areas

Under the three research alternatives, direct impacts to benthic habitats would occur through the use of several bottom-contact fishing gears (primarily trawl gears). The DPEA includes an analysis of the total footprint of SEFSC-affiliated research on benthic habitat, including EFH, the effects of which are considered small in magnitude, primarily short-term in duration, and localized in geographic scope. An analysis is presented on the proportion of research sampling and biomass removals made within National Marine Sanctuaries in the Atlantic and Gulf of Mexico. The numbers of samples taken within Flower Garden Banks, Florida Keys, and Gray's Reef National Marine Sanctuaries and the removals of fish and invertebrates for scientific purposes are relatively small and would have temporary and minor adverse effects on each Sanctuary.

Under the No Research Alternative, there would be no direct impacts on the physical environment or special resource areas from federal fisheries and ecosystem research. However, the loss of scientific information generated by SEFSC research would contribute to greater uncertainty about the effects of climate change and ocean acidification on Atlantic marine ecosystems as well as the status of biological resources in marine protected areas. Indirect effects on resource management agencies and conservation plans for protected areas would likely be adverse and minor in magnitude under the No Research Alternative.

Fish

The SEFSC conducts and funds stock assessment and habitat research for many commercially valuable and recreationally important fish species, providing the scientific basis for sustainable fisheries management. SEFSC research also provides critical information on oceanographic conditions and the status of other fish species that are not harvested but which play key roles in the marine food web, providing the scientific basis for NMFS goal of ecosystem-based management, as outlined in NOAA Fisheries Strategic Plan (NOAA 1997). Under the three research alternatives, relatively small impacts to fish populations are expected as a result of on-going research activities.

Mortality from captures in surveys is a potential impact for ESA-listed species but estimated levels of catch in SEFSC-affiliated fisheries research activities are small and considered minor to their respective populations. For most species targeted by commercial fisheries and recreational anglers, mortality due to research surveys and projects is much less than one percent of commercial and recreational Annual Catch Limits (ACL) and is considered to have minor adverse effects for all species. For a few species which do not have a large commercial market due to various market conditions or past overfishing, the research catch exceeds one percent of commercial catch but is still small relative to the population of each species and is considered minor. Proposed research projects that target stocks that are overfished or where overfishing is occurring are reviewed annually before research permits are issued to determine if they would conflict with rebuilding plans or present other conservation concerns. For highly migratory species (tunas, sharks, swordfish, and billfish) and species that are not managed under Fishery Management Plans (FMPs), research catch is also relatively small and considered to be minor for all species. Mortality for all species would be distributed across a wide geographic area rather than concentrated in particular localities. In contrast to these adverse effects on fish, SEFSC research also provides long-term beneficial effects on target species populations through its contribution to sustainable fisheries management. Data from SEFSC-affiliated research provides the scientific basis to reduce bycatch, establish optimal fishing levels, prevent overfishing, and recover overfished stocks.

Under the No Research Alternative, there would be no direct adverse impacts on fish from SEFSC fisheries research. However, the loss of scientific information for fisheries management could have long-term moderate adverse impacts on fish stocks through increasing uncertainty in fisheries management decisions, which could lead to underutilization of some stocks, potential overfishing on some stocks, uncertainty about the recovery of overfished stocks, and increasing uncertainty about the efficacy of fishing regulations designed to protect fish stocks and habitat from overfishing.

Marine Mammals

The primary direct effects of the three research alternatives on ESA-listed and non-listed marine mammals include behavioral responses to sound produced through the use of active acoustic sources (Level B harassment under the MMPA), incidental capture, entanglement, or hooking in fishing gear but released without serious injury (Level A harassment), and incidental capture, entanglement, or hooking resulting in serious injury or mortality. These all constitute takes of marine mammals under the MMPA. The potential for effects from ship strikes, contamination of the marine environment, and removal of marine mammal prey species was considered minor for all alternatives and species. The MMPA requires applicants for regulations and subsequent LOAs to estimate the number of each species of marine mammal that may be incidentally taken by harassment or serious injury/mortality during the proposed action. The SEFSC LOA application (attached to the DPEA as Appendix C) includes estimates of marine mammal takes in the SEFSC research area using the scope of research and mitigation measures described in the Preferred Alternative.

The LOA application combines estimated Level A harassment takes with serious injury or mortality takes because the severity of injury resulting from gear interaction cannot be predicted. The estimated take numbers are based on the historical capture of 11 bottlenose dolphins in SEFSC-affiliated research from 2002 through 2015. These 11 dolphins were from two stocks in the Gulf of Mexico and four stocks in the Atlantic. Past marine mammal captures have occurred using gillnets (one), mid-water trawls (two), bottom trawl (five), trammel nets (one), and bottom longline (one). Of the 11 animals captured or hooked, three were released alive.

For the coastal, bay, sound, and estuary stocks of bottlenose dolphins, including those that have been taken in research gear in the past, the LOA application uses a precautionary approach for estimating future takes, using the average annual number of animals caught in all gear types in the past 14 years (2002-2015), rounding up to the nearest whole number of animals, and multiplying by five to account for the five-year authorization period (MMPA regulations concerning incidental take of marine mammals, if promulgated, would likely be issued for a five-year period). The SEFSC and its research partners have a record of infrequent takes of bottlenose dolphins in fisheries research, such that the annual average take for the 2002-2015 period is well below one animal per year. Nevertheless, the historical record indicates that the potential exists to incidentally take a bottlenose dolphin in any of the previously listed gears in any given year. Therefore, the SEFSC estimates that at least one bottlenose dolphin could be taken in any given year and the take could occur in any of the gears. While it is not expected based on historical takes, bottlenose dolphins occur in groups and it is possible that a take request for only a small number of takes (e.g., five) could be exceeded in one or two trawl tows, trammel net sets, or gillnet sets if multiple animals were taken in a single set. Therefore, because of bottlenose dolphin propensity to travel in groups, the SEFSC increased the estimate to 10 for both the ARA and GOMRA in the event of multiple takes during one event. That is, 10 takes are requested for the ARA and 10 takes requested for the GOMRA over the five-year authorization period for all coastal, bay, sound, and estuary stocks; however, the potential takes requested for each stock will be restricted on a stock-by-stock basis. There are 17 stocks of bottlenose dolphins in the ARA, 36 stocks in the GOMRA, and one stock in the CRA. The SEFSC is only requesting takes from those stocks that overlap spatially with SEFSC and research partner fisheries research activities. For each of these stocks, the requested number of takes is either one or three animals over the five-year authorization period based on the size of the stock and the amount of research conducted within its range. Given the fact that bottlenose dolphins have been taken in five different research gear types in the past, the requests are made for takes in any of these gears.

The SEFSC considers this estimation method to be precautionary in that it likely overestimates the number of animals that could be caught in the future in order to ensure accounting for a maximum amount of potential take. The DPEA uses the estimated takes in the LOA application to assess the impacts on marine mammals. Given the likelihood that these are overestimates, the actual effects from injury, serious injury, or mortality could be substantially less than described.

Other species and stocks that have not been captured in the past have been included in the LOA application request for take authorization based on their incidental take in analogous commercial fisheries. The requests vary from one to four animals per stock in trawl and hook-and-line gears over the five-year authorization period. The SEFSC also includes a request for one “undetermined delphinid” in hook-and-line gear in each research area to account for the potential for an animal to be hooked but either free itself or be released before it could be identified.

Because the scope of research activities under the Status Quo Alternative is very similar to the Preferred Alternative, the estimated take numbers from the LOA application are used as part of the analysis of effects on marine mammals in all research areas under both alternatives.

The DPEA includes summary tables of the number of estimated Level A harassment/serious injury or mortality takes for each species affected in the SEFSC research area. One of the key elements of the effects analysis is to determine the adverse impact of takes on each species. The DPEA and LOA application compare estimated future takes for each species and stock with its Potential Biological Removal (PBR) as part of this impact determination. The MMPA defines PBR as, "...the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (OSP)." PBR was intended to serve as an upper limit guideline for fishery-related mortality for each species. Given the similarity of fisheries research to many commercial fisheries and the role research plays in supporting commercial fisheries, it is appropriate to assess the impacts of incidental takes for fisheries research in a similar manner.

PBR is used as one of the criteria for determining the level of adverse impacts on marine mammals in the DPEA. For the purposes of this analysis under NEPA, research-related incidental serious injury or mortality less than or equal to 10 percent of PBR for the marine mammal stock is considered minor in magnitude for the population. Serious injury or mortality between 10 percent and 50 percent of PBR is considered moderate in magnitude. Serious injury or mortality greater than or equal to 50 percent of PBR is considered major in magnitude.

For almost all stocks of marine mammals for which PBR has been determined and that are considered to have potential interactions with SEFSC fisheries research, the requested number of Level A harassment/serious injury and mortality takes would be less than 10 percent of their respective PBRs, even if the requested “undetermined delphinids” were assigned to each appropriate stock. These takes, if they occurred, would likely be rare or infrequent events, and would be considered to have overall minor adverse effects on the population of each species. The potential exceptions are for stocks with very small or unknown PBR values, i.e. several estuarine stocks of bottlenose dolphin and rough-toothed dolphin in the GOMRA, where the requested level of takes could be moderate in magnitude relative to PBR. Given the limited research effort in nearshore and estuarine areas, the small size of many stocks, and the mitigation measures in place for the research, the SEFSC considers the overall level of impact on these small stocks of marine mammals to be minor to moderate adverse.

The lack of recent population information for many bottlenose dolphin stocks and all stocks in the CRA prevents a quantitative assessment of the potential impact of requested takes for stocks with undetermined PBR. If new population estimates for one or more stocks of bottlenose dolphins are developed in the future, NMFS will consider the potential impacts of its ongoing fisheries research program and requested take authorizations on an adaptive management basis, including the potential for additional mitigation measures as necessary.

The Preferred Alternative includes the same suite of mitigation measures as currently implemented under the Status Quo Alternative, plus some additional training opportunities and reporting procedures intended to improve the implementation of existing protocols (see summaries of the alternatives in Chapter 2 above). The DPEA does not provide quantitative estimates of how these training opportunities and changes in protocol would decrease adverse interactions with marine mammals, which would be speculative, but states the SEFSC belief that actual impacts to marine mammals in the future will likely be less than described under the Status Quo Alternative.

Level B harassment takes are estimated based on the acoustic properties of sonars and other acoustic equipment used during research, calculations of the volume of water insonified to 160 decibels or more (NMFS current recommended threshold for Level B harassment from the active acoustic equipment considered in this DPEA), estimates of the densities of marine mammals in different areas, and a partitioning of species that typically do not dive deeper than 200 meters and those that do (which affects the size of the insonified area to which they may be exposed). The DPEA includes summary tables of the number of estimated Level B harassment takes by acoustic sources of each species affected in the SEFSC research area. It also includes a summary of an assessment of biological effects from SEFSC acoustic equipment used during research (Appendix C, Section 7). Output frequencies of some active acoustic sources (i.e., short range echosounders and Acoustic Doppler Current Profilers) are higher than the functional hearing ranges of marine mammals so no adverse effects are anticipated. Other acoustic sources operate at frequencies within the hearing range of one or more groups of marine mammals and may cause temporary and minor behavioral reactions such as swimming away from an approaching ship. None of the SEFSC acoustic equipment is likely to present risks of hearing loss or injury to any marine mammal.

The Modified Research Alternative includes the same scope of research in the SEFSC research area as the Preferred Alternative but considers a number of other potential mitigation measures that the SEFSC is not proposing to implement in its LOA application. These include a number of alternative methods for monitoring for protected species (e.g., use of dedicated Protected Species Observers and passive acoustic devices), gear modifications such as marine mammal excluder devices for trawl gear, and spatial/temporal restrictions on where and when research can occur. The SEFSC considers the suite of mitigation measures to be implemented under the Preferred Alternative to represent the most effective and practicable means to reduce the risk of adverse interactions with marine mammals during the conduct of its research program without compromising the scientific integrity of the research program. The potential direct and indirect effects of this alternative on marine mammals would be the same as described for the Preferred Alternative except for the potential of the additional mitigation measures to reduce Level A harassment/serious injury and mortality takes through gear interactions.

Scientists at the SEFSC regularly review their procedures to see if they can do their work more efficiently and with fewer incidental effects on the marine environment, including effects on marine mammals. However, any changes to operational procedures or the equipment used during surveys must also be considered from the standpoint of how they affect the integrity of the scientific data collected, the cost of implementing equipment or operational changes, and the safety of the vessel and crew. It would be speculative to quantify how much any one of these measures (or some combination of them) may reduce the risk of future takes relative to the Status Quo or Preferred Alternatives. The analysis provides a qualitative discussion of the potential for each additional mitigation measure to reduce takes and other effects on marine mammals as well as how each measure may affect practicability, time-series data integrity, and other aspects of the research survey work. One element of the Modified Research Alternative (e.g., use of Protected Species Observers) would offer mitigation advantages compared to the Status Quo Alternative but is addressed to some extent in the Preferred Alternative. Operational restrictions such as not allowing trawls to be set at night or in poor visibility conditions and spatial/temporal restrictions to avoid high densities of marine mammals would certainly reduce the risk of taking marine mammals. However, such restrictions would have a serious adverse impact on the ability of the SEFSC to collect certain kinds of research data and would have impacts to the cost and scope of research that could be conducted. Some concepts and technologies considered in the Modified Research Alternative are promising as a means to reduce risks to marine mammals and NMFS will evaluate the potential for implementation if they become more practicable.

Under the No Research Alternative, no direct adverse impacts to marine mammals from fisheries and ecological research (i.e., takes by gear interaction and acoustic disturbance) would occur. However, many of the SEFSC research projects that would be eliminated under this alternative contribute valuable ecological information important for marine mammal management, especially for ESA-listed species and species considered depleted under the MMPA. The loss of information on marine mammal habitats would indirectly affect resource management decisions concerning the conservation of marine mammals, especially as time went on and uncertainty about the status of the marine environment increased. There are too many unknown variables to estimate the specific effects this lack of information would mean to any particular stock of marine mammals but the No Research Alternative would likely have minor to moderate adverse effects for some species.

Birds

There have been few adverse interactions with seabirds during SEFSC research activities. Two brown pelicans have been caught on lines leading to bottom trawl gear (both mortalities) and two brown pelicans were hooked on longline gear but were released in good condition. There are no records of birds striking NOAA or partner vessels. While commercial fisheries have had adverse interactions with seabirds in the Southeast region, incidental take of seabirds in research gear is a rare event and would not result in any measurable changes to seabird populations. Under the Modified Research Alternative, the SEFSC would need to deploy streamer lines before longline gear is set to mitigate the risk of catching seabirds. The SEFSC is not proposing to add streamer lines to research longline gear under the Preferred Alternative but if seabird interactions with longline gear are documented in the future, the SEFSC will revisit whether use of streamer lines is warranted given the tradeoffs between the potential conservation benefit and operational and safety considerations. The adverse effects of the three research alternatives on seabirds are considered minor. Some SEFSC surveys take bird biologists on board when there is bunk space available to conduct transect surveys for bird distribution and abundance in the SEFSC research areas. This information is used by NMFS, the U.S. Fish and Wildlife Service, and other international resource management agencies to help with bird conservation issues and is considered to have indirect beneficial effects on the birds.

Under the No Research Alternative, the risk of direct adverse effects on seabirds from SEFSC research would be eliminated, but there could be potential long-term minor adverse impacts to seabirds because resource management authorities would lose ecological information about the marine environment important to seabird conservation.

Sea Turtles

There have been 455 sea turtles incidentally captured during SEFSC-affiliated research from 2010 through 2014, all but one of which have been released alive. The DPEA uses capture rate data from these historical takes, which occurred with different types of fishing gear (bottom trawls, longline gear, trammel nets, and gillnets), to estimate how many sea turtles may be captured given the estimated fishing effort under the three research alternatives. Future incidental captures of sea turtles in these gear types are certain, but it is likely that most of these turtles will be released in good condition because of the short tow and set durations of most SEFSC research activities and the presence of trained turtle-handling personnel on research crews. There is a potential for injury and mortality of sea turtles in research gear, especially with longline gears, but the estimated level of mortality, if it occurred, would be rare and small relative to overall population size for each species. The overall effects of the research alternatives on ESA-listed sea turtles would likely be small in magnitude, temporary or short-term in duration (except for the rare case of mortalities), limited to small geographic areas, and considered to have minor adverse effects on all species of sea turtles. However, the incidental capture of sea turtles by researchers also provides an opportunity to collect information on the physiological health of sea turtle populations and to tag individual turtles fitted with PIT and flipper tags. The collection of this scientific information on sea turtles has a beneficial effect on turtle management and potentially indirect benefits to sea turtle species.

As with seabirds and marine mammals, the No Research Alternative would eliminate the risk of direct adverse effects on sea turtles from SEFSC research. However, there could be minor to moderate adverse impacts due to the loss of ecological information important to sea turtle conservation. In addition, SEFSC-affiliated research on gears and fishing techniques that might reduce bycatch of sea turtles in commercial fisheries would not occur.

Invertebrates

The SEFSC conducts stock assessment and habitat research for several important invertebrate species (i.e., shrimps) and, similar to the situation described for commercially valuable fish species, the magnitude of mortality due to research sampling is small relative to commercial harvest limits. The footprint of bottom-contact gear used in research is also relatively small and impacts to benthic infauna and epifauna would be temporary. The SEFSC also conducts research using video camera technologies which is an important means for NMFS to monitor the recovery of benthic habitat and the efficacy of fisheries conservation measures. Under the three research alternatives, minor adverse impacts to invertebrates are expected from SEFSC research activities. SEFSC research is important for the scientific and sustainable management of these valuable fisheries, helping to prevent overfishing on the stocks.

Under the No Research Alternative, direct adverse impacts to invertebrates would be eliminated. However, the loss of stock assessment and marine environment information could indirectly result in moderate adverse effects on commercially targeted species through increasing uncertainty in the fishery management environment.

Social and Economic Environment

Under the three research alternatives, long term, beneficial impacts to the social and economic environment are expected from ongoing SEFSC fisheries and ecosystem research activities. SEFSC research provides important scientific information which is the basis for sustainable fisheries management for many valuable commercial and recreational fisheries along the U.S. Coast, which benefits commercial and recreational fisheries and the communities that support them. These industries have large economic footprints, generating billions of dollars’ worth of sales and thousands of commercial fishing-related jobs, and provide millions of people across the country with highly valued seafood. Millions of recreational fishers also participate and support fishing service industries. SEFSC fisheries research activities would also have minor to moderate beneficial impacts to the economies of fishing communities through direct employment, purchase of fuel, vessel charters, and supplies. Continued SEFSC fisheries research is important to build trust and cooperation between the fishing industry and NMFS scientists and fisheries managers.

The No Research Alternative would likely have minor to moderate adverse impacts on the social and economic environment through greater uncertainty in fisheries management, which could lead to more conservative fishing quotas (i.e., underutilized stocks and lost opportunity) or an increased risk of overfishing, followed by reductions in commercial and recreational fisheries harvests. The lack of scientific information would also compromise efforts to rebuild overfished stocks and monitor the effectiveness of no-fishing conservation areas. These impacts would adversely affect the ability of NMFS to comply with its obligations under the MSA. It would also eliminate research-associated federal spending on charter vessels, fuel, supplies, and support services in various communities. The No Research Alternative would also have long-term adverse impacts on the scientific information the SEFSC contributes to meet U.S. obligations for living marine resource management under international treaties.

CHAPTER 5 – CUMULATIVE EFFECTS

Cumulative effects are the net result of all past, present, and reasonably foreseeable future actions on the human environment over time. An individual action may have only minor or moderate impacts, but the cumulative effects of all actions may be major. NEPA requires an analysis of cumulative effects in order to alert decision makers to the full environmental consequences of a proposed action and its alternatives on resource areas of concern. This analysis looks at the overall cumulative impact and the contribution of fisheries research activities to the overall cumulative impact.

In terms of fisheries, understanding how the cumulative impacts from human activities and trends in the natural environment have influenced the marine environment over time is key to understanding the importance of NMFS role in fisheries management. The need for scientific information from SEFSC research activities is in large part the result of past actions that contributed to major adverse impacts on fish stocks from overfishing, pollution of coastal and ocean areas from accidental and intentional discharges, runoff of agricultural and industrial waste, and degradation of habitat from commercial fishing and dam construction, among other activities. Federal efforts within the last 40 years to reduce pollution, restore degraded habitats, and effectively manage commercial and recreational fishery harvests have reversed some of these trends. A number of important fishery stocks have been restored to healthy levels and others are in the rebuilding process.

Similarly, cumulative impacts from human activities and trends in the natural environment over time have contributed major adverse impacts to populations of marine mammals, sea turtles, and other marine species. As a result, the MMPA and ESA were enacted to help address specific conservation concerns and many human activities are subject to federal management measures to protect marine species and promote recovery of impacted populations.

Climate change and increase in ocean acidification have the potential to impact populations and distributions of many marine species. Fisheries research activities make an incremental contribution to these long-term, global environmental processes through the burning of fossil fuels. However, long-term, systematic marine research provides important scientific information on the changes and trends in marine ecosystems brought about by climatic and oceanic forces.

In addition to SEFSC research efforts, there are many current and reasonably foreseeable activities that may contribute to cumulative impacts on the marine environment, including: conservation efforts, commercial shipping, commercial and recreational fisheries, oil and gas and alternative energy development, military activities, coastal development projects, marine research activities by other agencies and institutions, and other human activities that contribute to global climate change. These actions can produce both adverse and beneficial impacts that directly and indirectly affect ocean resources managed by NMFS and the social and economic environment of fishing communities that rely on them.

This DPEA generally considers the contribution of the three research alternatives to the cumulative effects on given resources to be very similar and they are often discussed together. The contribution of the No Research Alternative to the cumulative effects on resources is quite different and is discussed separately.

As described in the Chapter 4 summary above, SEFSC research activities would have minor to moderate adverse effects on the various resource components of the physical and biological environments. Because SEFSC research activities involve such a small number of vessels compared to other vessel traffic and collect relatively small amounts of biomass compared to commercial and recreational fisheries, the contribution of the three research alternatives to cumulative adverse effects on fish, marine mammal, and other species and resource areas would be small under normal conditions. The proposed SEFSC scientific research activities will also have beneficial contributions to the cumulative effects on both biological and socioeconomic resources. The research alternatives contribute substantially to the science that feeds into federal fishery management measures aimed at rebuilding and managing fish stocks in a sustainable manner. It also contributes to understanding the nature of changes in the marine environment and adjusting resource management plans accordingly, and it helps meet international treaty research obligations. The research activities under the three research alternatives help alleviate adverse cumulative impacts on the biological and socioeconomic environments, resulting in long-term beneficial contributions to cumulative effects.

The No Research Alternative would not contribute to direct adverse effects on the marine environment (e.g., research catch of fish and incidental take of marine mammals) but would contribute indirect adverse effects on both the biological and socioeconomic environments based on the lack of scientific information to inform future resource management decisions.

OTHER SECTIONS

In addition to the chapters summarized above, the DPEA includes a description of the laws applicable to SEFSC research activities in Chapter 6, cited references in Chapter 7, and a list of persons and agencies consulted in Chapter 8. Appendix A provides a description of the fishing gear, other scientific instruments, and vessels used during SEFSC research activities. Appendix B includes tables and figures showing the seasonal distribution of research effort in the three SEFSC research areas. Appendix C is the SEFSC's application for promulgating regulations and issuing LOAs for incidental take of marine mammals under the MMPA from NMFS OPR. Appendix D contains handling and data collection procedures for marine mammals, sea turtles, and other protected species that are incidentally caught it SEFSC fisheries research activities; some of these procedures may not be implemented until after the SEFSC receives authorization for such incidental takes when the MMPA LOA and ESA consultation processes are completed.

CONCLUSION

Based on the analysis in this DPEA, NMFS has not identified any potential adverse environmental impacts that would rise to the level of "significant" under NEPA, thus triggering the requirement for an Environmental Impact Statement. NMFS will not make a final determination about significance until the close of the public comment period on the draft DPEA and it has received all the public comments. A final determination on whether potential impacts of the proposed action are significant will be made with consideration of public comments and will be published in the *Federal Register*.

1.1 NOAA'S RESOURCE RESPONSIBILITIES AND ROLE IN FISHERIES RESEARCH

The Federal government has a responsibility to protect living marine resources in waters of the United States (U.S.), also referred to as federal waters. These waters generally lay 3 to 200 nautical miles (nm) from the shoreline (those waters 3-12 nautical miles offshore comprise territorial waters and those 12-to-200 nautical miles offshore comprise the Exclusive Economic Zone [EEZ]), except where other nations have adjacent territorial claims. The U.S. government has also entered into a number of international agreements and treaties related to the management of living marine resources in international waters outside of the U.S. EEZ. To carry out its responsibilities over federal and international waters, Congress has enacted several statutes authorizing certain federal agencies to administer programs to manage and protect living marine resources. Among these federal agencies, the National Oceanographic and Atmospheric Administration (NOAA) has the primary responsibility for protecting marine finfish and shellfish species and their habitats. Within NOAA, the National Marine Fisheries Service (NMFS) has been delegated primary responsibility for the science-based management, conservation, and protection of living marine resources.

Within the area covered by this Draft Programmatic Environmental Assessment (DPEA), NMFS manages finfish and shellfish harvest under the provisions of several major statutes, including the Magnuson-Stevens Fishery Conservation and Management Act (MSA)[6], the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA)[7], the Atlantic Striped Bass Conservation Act[8], the Marine Mammal Protection Act (MMPA), the Endangered Species Act (ESA)[9], and the Atlantic Tuna Conventions Act (ATCA). Accomplishing the requirements of these statutes requires the close interaction of numerous entities in a sometimes complex fishery management process. In the NMFS Southeast Region, the entities involved include the Southeast Fisheries Science Center, NMFS Southeast Regional Office, NMFS Headquarters, the South Atlantic, Gulf of Mexico (GOM), and Caribbean Fisheries Management Councils, and international fisheries management organizations and commissions.

1.1.1 Fisheries Science Centers

Six Regional Fisheries Science Centers direct and coordinate the collection of scientific information needed to make fisheries management decisions[10] Each Fisheries Science Center is a distinct entity and is the scientific focal point for a particular region (Figure 1.1-1). The Southeast Fisheries Science Center (SEFSC) conducts research on living marine resources in marine and estuarine habitats of the Atlantic Ocean along the southeastern coast of the U.S., the Gulf of Mexico, and the Caribbean Sea, including marine waters offshore from Puerto Rico and the U.S. Virgin Islands (Figure 1.1-2). The SEFSC is headquartered in Miami, Florida and also includes six laboratory facilities in: Beaufort, North Carolina; Panama City, Florida; Pascagoula, Mississippi; Stennis, Mississippi; Lafayette, Louisiana; and Galveston, Texas (Figure 1.1-3).

6 16 U.S.C. §§ 1801-1884, (MSA 2007).

7 16 U.S.C. 5101-5109, (ACFCMA 1993).

8 16 U.S.C. 5151-5158, (ASBCA 1984).

9 16 U.S.C. §1531 et seq.

10 The six Regional Fisheries Science Centers are: 1) Northeast, 2) Southeast, 3) Southwest, 4) Northwest, 5) Alaska, and 6) Pacific Islands.

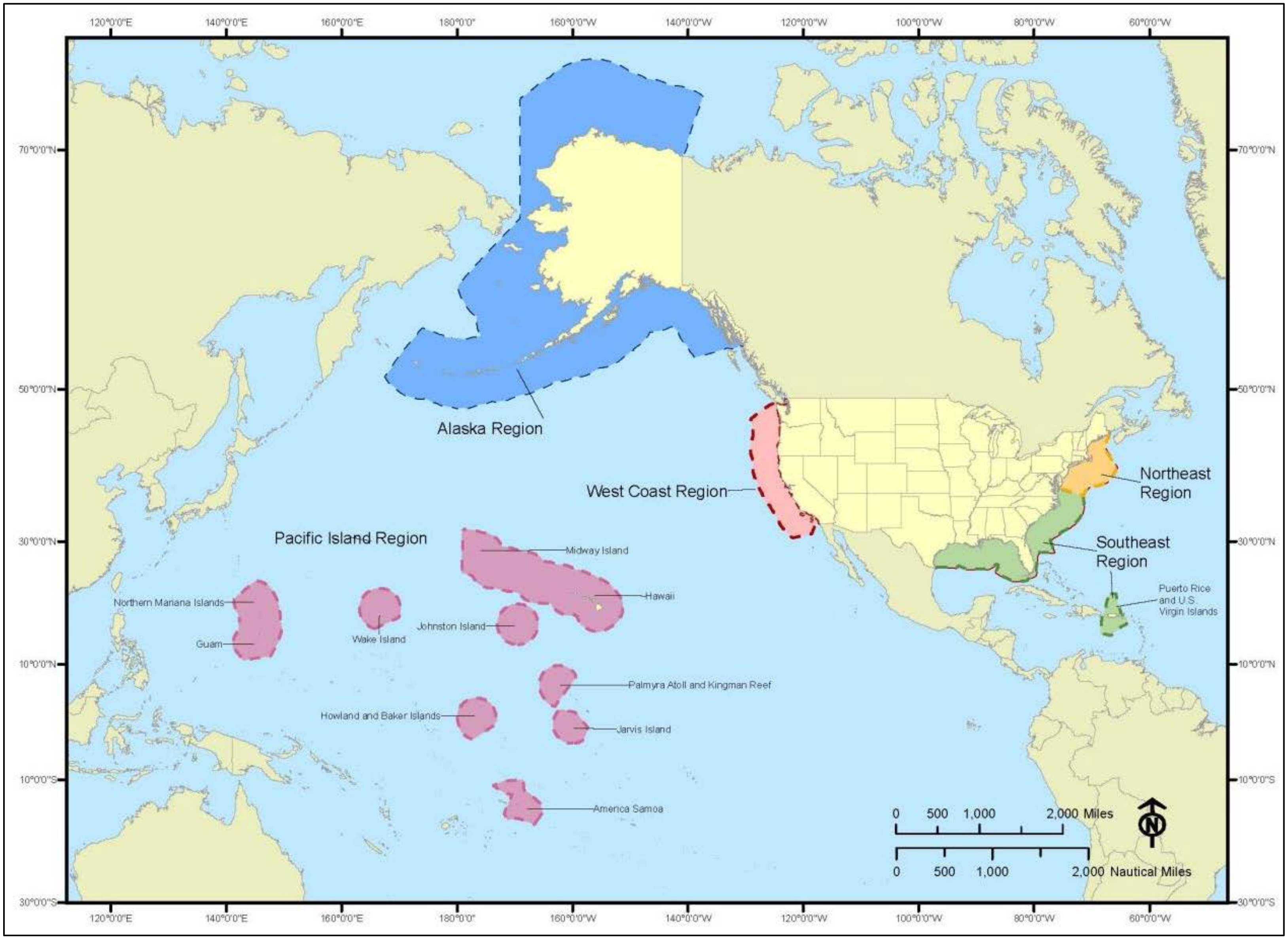

Figure 1.1-1 National Marine Fisheries Service Regions

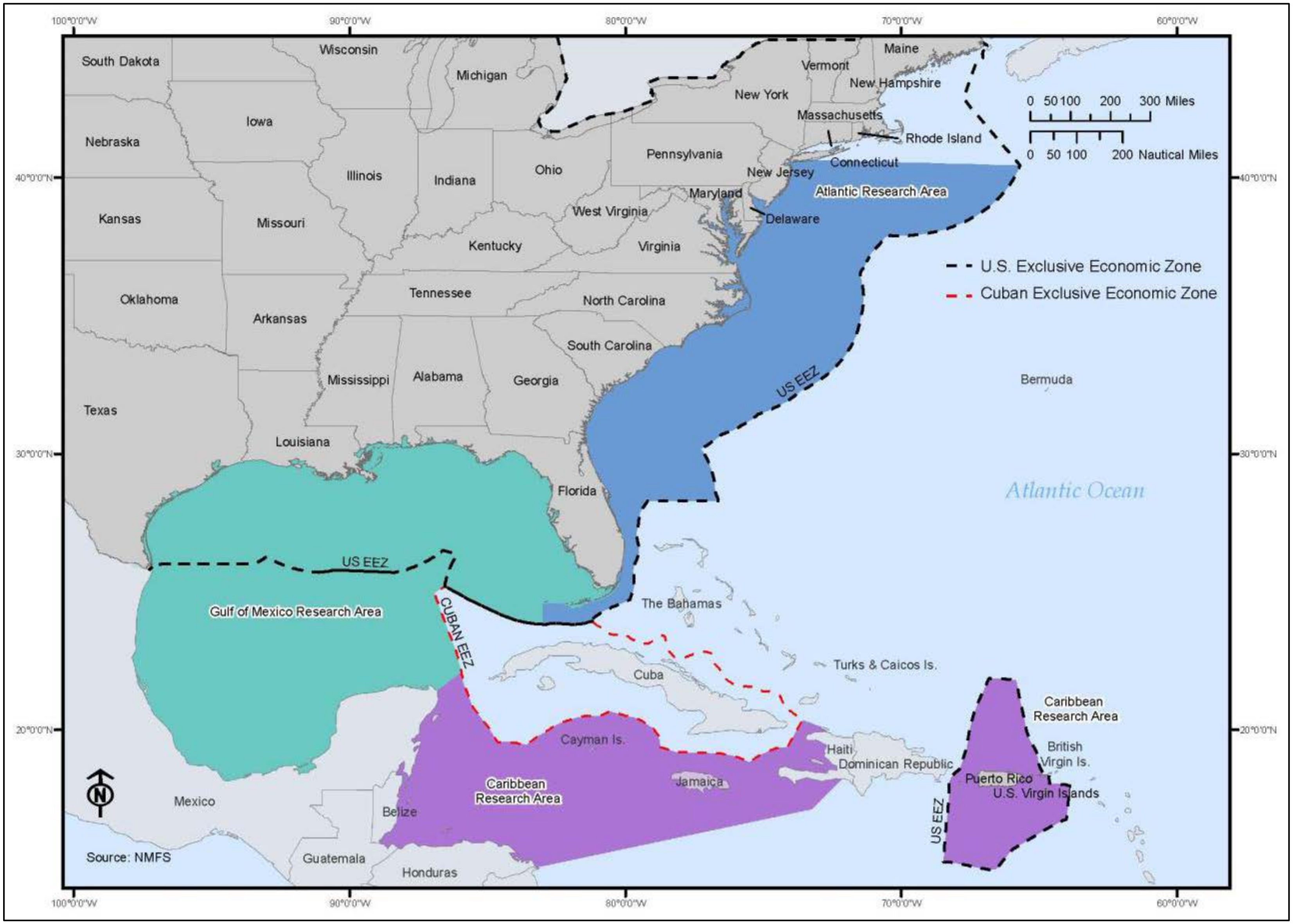

Figure 1.1-2 SEFSC Research Areas

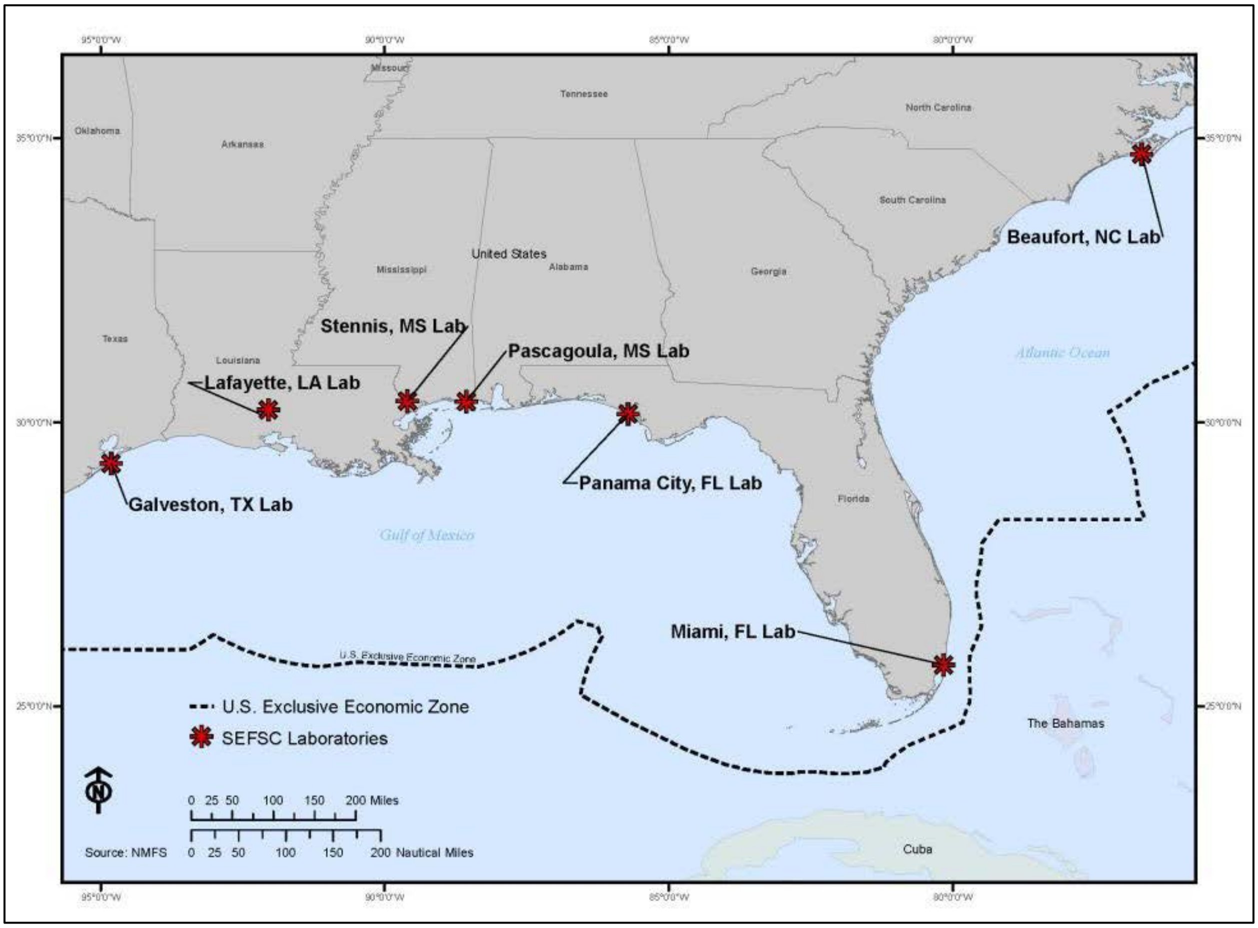

Figure 1.1-3 Southeast Fisheries Science Center Offices and Research Facilities

1.1.2 Fisheries Management Councils

In order to encourage a collaborative approach to fisheries management, the MSA established the nation's eight Regional Fishery Management Councils. The councils, which include fishing industry representatives, fishers, scientists, government agency representatives, federal appointees, and others, are designed to provide all resource users and managers a voice in the fisheries management process. Under the MSA, the councils are charged with developing Fishery Management Plans (FMPs) and management measures for the fisheries occurring within the EEZ adjacent to their constituent states. Data collected by fisheries science centers are often used to inform FMPs, as well as to inform other policies and decisions promulgated by the Fishery Management Councils. Such policies and decisions sometimes affect areas that span the jurisdictions of several Fisheries Management Councils (Figure 1.1-4), and make use of data provided by multiple fisheries science centers. Five councils are convened for the Atlantic Ocean (New England, Mid-Atlantic, South Atlantic, Gulf of Mexico, and Caribbean Fishery Management Councils), incorporating members of their respective states and territories. The South Atlantic Fishery Management Council (SAFMC), the Gulf of Mexico Fishery Management Council (GMFMC), and the Caribbean Fishery Management Council (CFMC) rely primarily on the SEFSC for fisheries independent research data for development of stock assessment reports and other management purposes.

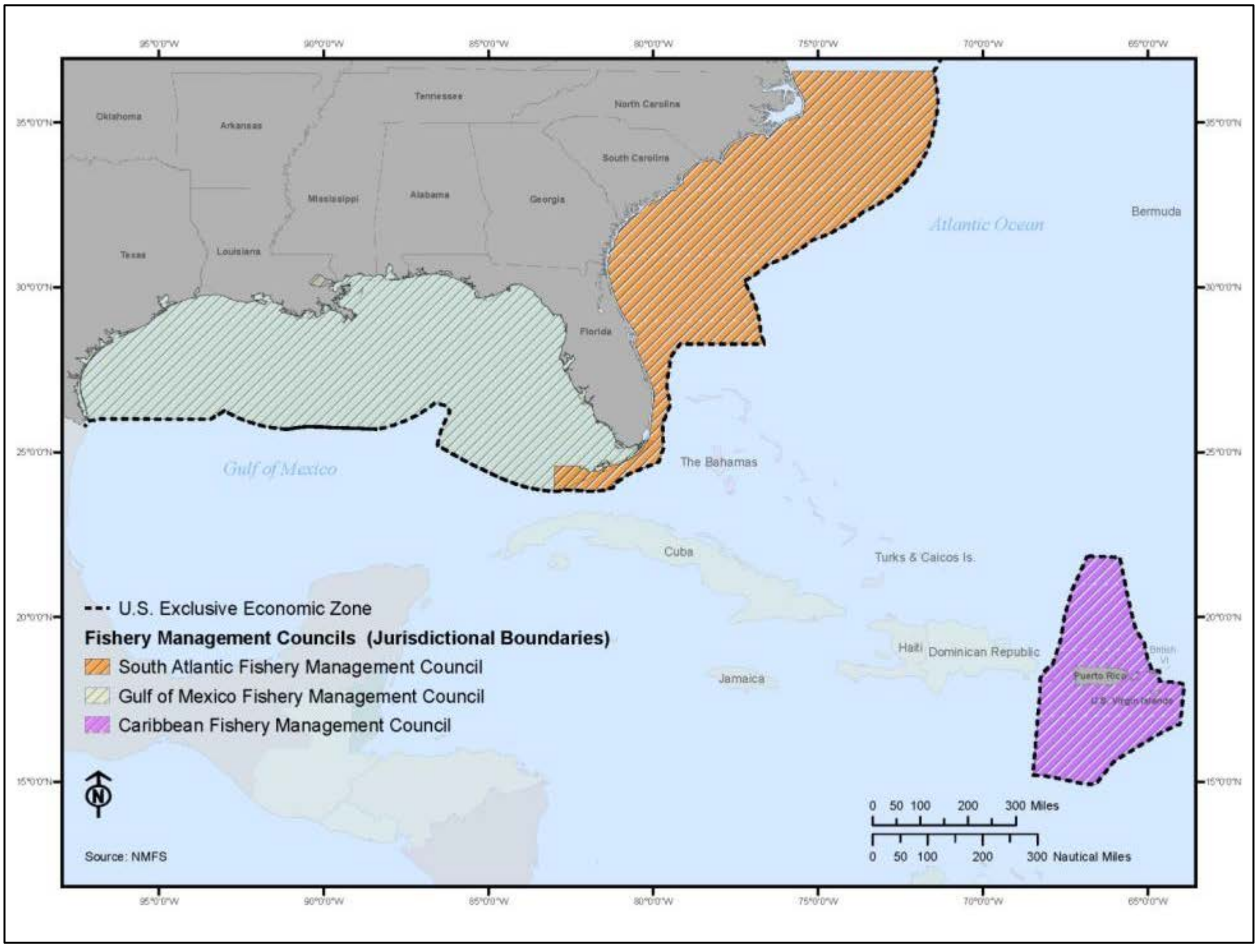

Figure 1.1-4 Fishery Management Council Jurisdictional Boundaries within the NMFS Southeast Region

1.1.3 Marine Fisheries Commissions

Three Interstate Marine Fisheries Commissions were chartered by Congress in recognition that fish do not adhere to political boundaries. Two of these cover species found in SEFSC research areas, the the Atlantic States Marine Fisheries Commission (ASMFC) and the GSMFC. The ASMFC was formed by the 15 Atlantic coast states in 1942. It exists to coordinate the conservation and management of nearshore fishery resources shared by member states through the creation of FMPs. For species that have significant fisheries in both state and federal waters (i.e., Atlantic herring, summer flounder, Spanish mackerel), the Commission works cooperatively with the Fishery Management Councils to develop FMPs.

1.1.4 International Fisheries Management Organizations

In addition to providing information to domestic fisheries management councils, the SEFSC provides scientific advice to support international fisheries councils, commissions, and conventions including the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the International Whaling Commission (IWC).

The ICCAT is an inter-governmental fishery organization responsible for the conservation of approximately 30 tunas and tuna-like species in the Atlantic Ocean and its adjacent seas. The organization was established in 1966 and formally entered into force in 1969. There are currently 48 contracting parties to ICCAT, including the U.S. Research undertaken through ICCAT includes biometry, ecology, and oceanography, with an emphasis on fishing impacts on stock abundance. ICCAT also compiles data on other fish species (mainly sharks) caught as bycatch during tuna fishing in the Convention area, and which are not investigated by other international fishery organizations. The Highly Migratory Species branch of the Sustainable Fisheries Division of the SEFSC participates in Atlantic billfish assessments under the auspices of the ICCAT. The SEFSC staff also coordinate the ICCAT Enhanced Research Program for billfish in the Western Atlantic Ocean and act as tagging coordinators for the U.S. delegation to ICCAT.

The IWC was established in 1946 under the International Convention for the Regulation of Whaling for the purpose of conserving whale populations and managing commercial and subsistence whaling efforts. In addition to its whaling management responsibilities, the IWC encourages, coordinates, funds, and publishes the results of scientific whale research. The IWC Scientific Committee includes many of the world's leading whale biologists and provides advice on management issues based on scientific research.

1.1.5 Role of Fisheries Research in Federal Fisheries Management

Fisheries managers use a variety of techniques to manage trust resources, a principal one being the development of FMPs. FMPs articulate fishery goals as well as the methods used to achieve those goals, and their development is specifically mandated under the MSA. The SEFSC provides scientific information and advice to assist with the development of FMPs prepared by the SAFMC, GMFMC, CFMC, and other agencies.

Through its Regional Fisheries Science Centers, NMFS conducts both *fisheries-dependent* and *fisheries-independent* research on the status of living marine resources and associated habitats, which aids in the development of FMPs. Fishery-dependent data are collected from commercial sources (vessel or dealer reports and fish dealerships) and recreational sources (individual anglers, party, or charter boats). Information is gathered on catch, effort and characteristics of the trip (i.e. target species, location, gear type, etc.). Often biological information (species, length, weight, and biological samples) are collected from the catch. In some cases, information is also gathered on fishing gear interactions with protected species (marine mammals, sea turtles, and sea birds), bycatch of non-target species, and discards – fish returned to the sea dead or alive. Fisheries-independent research is designed and conducted independent of commercial fishing activity to meet specific research goals. Surveys are specifically designed to follow consistent methods using the same gear for the duration of the survey in order to develop unbiased and independent indices of abundance. NMFS role in these activities varies and generally can be described as follows:

- Fishery-independent research directed by SEFSC scientists and conducted on board NOAA-owned and operated vessels or NOAA-chartered vessels.
- Fishery-independent research directed by cooperating research partners (other state and federal agencies, academic institutions, and independent researchers) conducted on board non-NOAA vessels. The SEFSC helps fund, staff, or analyze data for these types of research efforts.

In the Southeast Region, the SEFSC also conducts fisheries-dependent research through its Fisheries Statistics Division (see Section 1.2.1) that is carried out in partnership with commercial fishing vessels. The vessel activity is not directed by the SEFSC but researchers collect data directly from the commercial and recreational vessels both in port (via interviews, logbooks, and portside sampling) and at sea (via the Pelagic Observer Program). Incidental takes of marine mammals that occur during commercial fishing are covered under the MSA, MMPA, and ESA. Only the fishery-independent research activities conducted or funded by the SEFSC are programmatically evaluated within this DPEA (see Section 1.4).

1.2 SEFSC FISHERIES RESEARCH AREAS AND FACILITIES

The SEFSC is the research arm of NMFS in the Southeast Region. The SEFSC plans, develops, and manages a multidisciplinary program of basic and applied research to:

- Generate the scientific information necessary for the conservation and management of the region’s living marine resources.
- Inform management of the region's marine and anadromous fish and invertebrate populations to ensure they remain at sustainable and healthy levels. Responsibilities include maintaining healthy fish stocks for commercial and recreational fishing; sustaining ecosystem services; and coordinating with domestic and international organizations to implement fishery agreements and treaties.

SEFSC fishery-independent research efforts are divided among two research divisions that are tasked with different roles in collecting scientific information on living marine resources and the ecosystems that sustain them.

1.2.1 Protected Resources Division

The SEFSC Protected Resources Division receives broad programmatic guidance from the goals and objectives of the NOAA Strategic Plan, the 2007 NOAA Strategic Plan for Fisheries Research, and the 2015 Protected Species Board meeting to provide scientifically sound information and data sufficient to support ecosystem-based fishery conservation and management, recover and maintain protected species populations, and reduce conflicts that involve protected species. SEFSC scientists conduct research and provide scientific and technical advice to local, state, and federal management organizations, including Fishery Management Councils and the National Marine Sanctuary Program.

The Protected Resources Division develops, coordinates, and monitors marine mammals, sea turtles, early life history dynamics (fish), reef fish (Fisheries Assessment, Monitoring, and Ecology [FAME] Unit), coral (Benthic Ecosystems Assessment Research [BEAR] Unit), and the Ecosystem Investigations Unit. The Division manages research and assessment programs for marine mammals, sea turtles, and other protected marine species to meet agency responsibilities under the MMPA, ESA, and MSA, including monitoring and coordinating data collection from stranded protected species. It also manages biodiversity research programs related to marine community assemblages and management, rebuilding over-utilized and depleted fisheries resources, protecting key habitats, and maintaining marine diversity through, among other things, marine reserves and sanctuaries.

The research focus of the Protected Resources Division includes marine protected areas, coral reef ecosystems, essential fish habitat, habitat restoration, biological research to support stock assessments and management decisions, and fishery-independent assessments of the status of exploited and non-exploited species with emphasis on non-destructive technology.

1.2.2 Sustainable Fisheries Division

The Sustainable Fisheries Division conducts research to determine the distribution and abundance of living marine resources managed under the MSA and the ATCA. Fishery dependent and independent data are used to produce catch, effort, and life history information; estimate the current status of fishery stocks; provide assessment results to fishery management organizations; and to advise fishery management organizations on potential outcomes of implementing future fishery management options.

The Sustainable Fisheries Division includes the Highly Migratory Species (HMS) Branch and the Gulf of Mexico and Caribbean Species Branch. The HMS Branch is further divided into the HMS Fisheries Assessment Unit and the HMS Biology Unit. The Gulf of Mexico and Caribbean Species Branch includes the Gulf and Caribbean Fisheries Assessments Unit.

1.2.3 Cooperative Research

The SEFSC has a long history of collaborative research with state fisheries agencies and universities in the Southeastern U.S., including the Marine Resources Monitoring, Assessment and Prediction (MARMAP) Program which began in 1972 and the Southeast Area Monitoring and Assessment Program (SEAMAP) which began in 1981. Both MARMAP and SEAMAP are state-federal-university cooperative programs focused on the collection, management and dissemination of fisheries independent data in the South Atlantic (MARMAP and SEAMAP-South Atlantic), Gulf of Mexico (SEAMAP-Gulf) and Caribbean (SEAMAP-Caribbean). Both programs also provide essential information on abundance, distribution, life history, and habitat of commercially and recreationally important marine resources. Smaller collaborations are supported by the Anadromous Fish Conservation Act, Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA), the Interjurisdictional Fisheries Act (IJA) and NOAA's Highly Migratory Species Gulf of Mexico Shark Pupping and Nursery (GULFSPAN) Program. Funding for these programs is provided through Congressional appropriations with the majority of funds provided to state fisheries agencies and/or universities for the collection of information in state waters. SEAMAP also provides funds to the SEFSC for collection of information in federal EEZ waters. The use of federal funds to support data collection in both state and federal waters has provided long-term databases that support both state and federal stock assessments, as well as regional assessments for species that cross state and federal boundaries.

MARMAP is a cooperative fisheries project of the Marine Resources Research Institute and NOAA Fisheries. The program conducts reef fish assessment from Cape Lookout, North Carolina to Fort Pierce, Florida. While recent efforts of the South Carolina MARMAP program have concentrated on fishery-independent assessments of reef fish abundance and life history, the program began over 30 years ago as an ichthyoplankton and groundfish survey of shelf and upper slope waters from Cape Lookout to Cape Canaveral. MARMAP trawl and plankton data have been used to describe the seasonal distribution and abundance of groundfish and fish larvae throughout the region. Beginning in 1978, a variety of gear types, including fish traps, longlines, hook-and-line gear, and underwater visual census methods were initiated for assessing reef fish abundance. These methods were found to be useful in assessments of deepwater snowy grouper, blueline tilefish, blackfish, gag, groupers, and snappers. More recent collaborations with the SEFSC have been initiated to complement the MARMAP sampling in federal EEZ waters.

SEAMAP is composed of three organizational structures – SEAMAP-Gulf initiated in 1981, SEAMAP-South Atlantic initiated in 1983, and SEAMAP-Caribbean initiated in 1988. Surveys by each SEAMAP component reflect distinct regional needs and priorities; however, survey operations in one geographic area often provide information useful to researchers in all three regions. Each component operates independently, planning and conducting surveys and disseminating information in accordance with cooperatively established administrative policies and guidelines. Specific SEAMAP activities include collection of fisheries independent data through a variety of methods, including ichthyoplankton sampling, trawls, longlines, digital video camera arrays, and vertical line. Bottom mapping activities have been conducted in several SEAMAP programs and more recently acoustics data are being collected for bottom mapping and biomass estimations. SEAMAP data have supported assessments of many species in all three regions, including snappers, groupers, tilefish, gag, and many reef fish species.

The Anadromous Fish Conservation Act was signed in 1965 and authorizes the Secretary of Commerce to enter into cooperative agreements to protect anadromous and Great Lakes fishery resources. The Anadromous Fish Conservation Act projects in the Southeast Region are conducted to conserve, develop, and enhance anadromous fish and their habitat. Due to their complicated life histories and the many challenges to their survival, these species require special consideration. Collected information from this program is used to support management decisions at the state, interstate, and federal levels.

ACFCMA was signed into law in December 1993. The Act authorizes the Secretary of Commerce to provide financial assistance to support and enhance the development, implementation, and enforcement of effective interstate conservation and management of Atlantic coastal resources. It presents a new and innovative approach to coordinated management of coastal migratory fisheries along the U.S. Atlantic coast. ACFCMA provides a mechanism to ensure Atlantic coastal state compliance with mandated conservation measures in Atlantic States Marine Fisheries Commission-approved fishery management plans. All Atlantic coast states that are included in a Commission fishery management plan must comply with certain conservation provisions of the plan to avoid a Secretary of Commerce imposed moratorium in that state's waters for harvesting the species in question.

The IJA, signed in 1986, authorizes the Secretary of Commerce to appropriate funds to states for projects carried out to gather information and conduct activities that support management of U.S. multijurisdictional fisheries. These projects respond to fishery research, habitat, and law enforcement needs under the MSA, ACFCMA, Great Lakes Fisheries Commission's Strategic Plan, and the individual multijurisdictional state and interstate marine fisheries commission's fisheries management planning programs.

The GULFSPAN survey began in 2003 to examine the distribution and abundance of juvenile sharks in coastal areas. The ultimate intent of this survey is to further describe shark essential fish habitat (EFH). Data collected through this project are used in NOAA's Sustainable Fisheries Stock Assessment and Fisheries Evaluation (SAFE) report for Atlantic Ocean and Gulf of Mexico Highly Migratory Species. Results from this project are submitted yearly to NOAA's Highly Migratory Species Office. NOAA Fisheries Panama City Laboratory oversees the survey and several states participate and provide data.

1.3 PURPOSE AND NEED

Primary Action: This DPEA evaluates both a primary and secondary action under the National Environmental Policy Act (NEPA). The primary action is the proposed continuation of SEFSC fisheries and ecosystem research activities (as described above and in Section 2.2). The purpose of this action is to produce scientific information necessary for the management and conservation of domestic and international living marine resources in a manner that promotes both the recovery of certain species and the long-term sustainability and recovery of these resources and generates social and economic opportunities and benefits from their use. The information developed from these research activities is essential to the development of a broad array of fisheries, marine mammal, and ecosystem management actions taken not only by NMFS, but also by other federal, state, and international authorities. Each of the research activities requires one or more scientific research permits and the issuance of these permits is a part of the primary federal action covered under this NEPA review.

The ultimate goal of SEFSC fisheries and other research activities is to inform management of the region's marine and anadromous fish and invertebrate populations to ensure they remain at sustainable and healthy levels. In order to achieve this, the SEFSC needs to continue its research activities through a suite of programs that generate the scientific information necessary for the conservation and management of the region’s living marine resources.

Secondary Action: A secondary, related action — also called a “connected action” under NEPA (Sec. 1508.25) — is the issuance of proposed regulations and subsequent Letters of Authorization (LOA) under Section 101(a)(5)(A) of the MMPA (MMPA; 16 United States Code [U.S.C.] 1361 *et seq*.) that would govern the unintentional taking of small numbers of marine mammals incidental to the SEFSC fisheries and ecosystem research activities.

Section 101(a)(5)(A) and (D) of the MMPA direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review. Take, under the MMPA means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." The MMPA defines "harassment" as "any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].

Under the MMPA, any entity conducting activities that may result in the incidental take of marine mammals should request authorization for those incidental takes; this includes research programs conducted by the NMFS fisheries science centers. Because the SEFSC research activities have the potential to take marine mammals by Level A and B harassment, serious injury and/or mortality, the SEFSC is applying to NMFS for an incidental take authorization (ITA) for its fisheries and ecosystem research programs. Authorization for incidental takings shall be granted if NMFS finds that the taking "…will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses…" (where relevant) (50 Code of Federal Regulations [CFR] 18.27), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

The purpose of issuing ITAs is to provide an exemption to the take prohibition in the MMPA and to ensure that the action complies with the MMPA and NMFS's implementing regulations. ITAs may be issued as either: (1) regulations and associated LOAs under Section 101(a)(5)(A) of the MMPA; or (2) an Incidental Harassment Authorizations (IHAs) under Section 101(a)(5)(D) of the MMPA. An IHA can only be issued when there is no potential for serious injury and/or mortality or where any such potential can be negated through required mitigation measures. In this specific action, because there is a potential for lethal takes and takes that may result in serious injury that could lead to mortality, the SEFSC is requesting rulemaking and the issuance of LOAs for this action.

This DPEA analyzes the environmental impacts associated with authorizing the take of marine mammals incidental to fisheries research activities in the SEFSC area of responsibility. It also analyzes a reasonable range of mitigation alternatives that may be required if NMFS issues an MMPA authorization. The analysis of mitigation measures includes a consideration of benefits to the affected species or stocks and their habitat, and an analysis of the practicability and efficacy of each measure. This analysis of mitigation measures could potentially be used to support requirements pertaining to mitigation, monitoring, and reporting specified in the MMPA regulations and subsequent LOAs, if issued.

Further, because the proposed research activities occur in known habitat areas of species that are listed as threatened or endangered under the ESA, this DPEA evaluates potential impacts to ESA-listed species that may result from either the primary or secondary action. Likewise, because some proposed research activities occur partially within the boundaries of National Marine Sanctuaries, and within areas identified as Essential Fish Habitat (EFH), this DPEA evaluates potential impacts to sanctuary resources and EFH as required under section 304(d) of the National Marine Sanctuaries Act and section 305(b)(2) of the MSA respectively. The SEFSC intends to use this DPEA as the basis for consultations with the appropriate offices and agencies in compliance with these and other applicable laws (Table 1.6-1).

1.4 SCOPE AND ORGANIZATION OF THIS DPEA

In considering the proposed action, NMFS is responsible for complying with a number of federal statutes, regulations, and executive orders, including NEPA. As such, the purpose of the DPEA is to provide an environmental analysis to support the NMFS proposal to continue the research activities under all such legal requirements and to encourage and facilitate public involvement in the environmental review process.

Under NEPA, an Environmental Assessment (EA) is prepared to determine if any significant environmental impacts are likely to be caused by a proposed action. If the EA does not identify significant impacts, a Finding of No Significant Impact (FONSI) is prepared to document the decision maker's determination and to approve the proposed action. If at any time during preparation of the EA it appears that significant impacts would result from the proposed action, the agency would halt development of the EA and begin preparation of an Environmental Impact Statement (EIS) to more thoroughly evaluate the potential impacts and potential ways to reduce or mitigate those impacts. Thus, while the DPEA objectively evaluates the full extent of potential impacts of a proposed action (from minor to major, adverse or beneficial, short-term to long-term – see discussion below), the FONSI provides the decision maker's rationale with regard to the significance of those impacts.

This DPEA provides a programmatic-level assessment of the potential impacts on the biological and human environments associated with the proposed SEFSC research programs. A programmatic approach is used when initiating or reevaluating a federal program for NEPA compliance. It takes a broad look at issues and alternatives (compared to documents for a specific project or action), and provides a baseline for future management actions. Programmatic documents are often intended to provide NEPA compliance for management and other activities over a certain period before a formal review is again initiated.

This DPEA assesses not only the potential direct and indirect impacts of the alternatives presented to the physical, biological and socioeconomic systems in the SEFSC area of responsibility, but also the potential impacts of the management processes that are used to monitor the health of the resources, develop plans to manage the resources to balance recovery goals and socioeconomic goals, and ensure the sustainability of the resources and affected fishing communities.

The chapters that follow describe the proposed research activities and potential alternatives considered (Chapter 2), the affected environment as it currently exists (Chapter 3), the probable direct and indirect consequences on the human environment that may result from the implementation of the proposed research activities and their alternatives (Chapter 4), and the potential contribution to cumulative impacts from the proposed activities and their alternatives (Chapter 5).

The scope of this DPEA covers research activities conducted by the SEFSC or its research partners that:

- Contribute to fishery management and ecosystem management responsibilities of NMFS under U.S. law and international agreements.
- Take place in marine waters of the Atlantic Ocean off the coast of the U.S., Gulf of Mexico, and Caribbean, including waters surrounding the U.S. Virgin Islands and Puerto Rico.
- Involve the transiting of these waters in research vessels, the deployment of fishing gear and scientific instruments into the water in order to sample and monitor living marine resources and their environmental conditions, and/or use active acoustic devices for navigation and remote sensing purposes.
- Have the potential to interact adversely with marine mammals and protected species of fish, sea turtles, birds, and invertebrates. However, the research activities covered under this DPEA involve only *incidental* interactions with protected species, not *intentional* interactions with those species. The primary focus of this DPEA is on fisheries-related research but several other types of ecosystem surveys are also included because they deploy fishing gear and other instruments similar to those used in fisheries research in order to monitor the environment important to protected species and therefore involve the same potential risks of incidental interactions with protected species.
- The DPEA covers both short-term and long-term SEFSC fisheries research projects of limited size and magnitude and where cumulative effects are deemed negligible. Therefore, information within the DPEA would inform the issuance of a scientific research permit to conduct SEFSC

fisheries research. However, any information not included in this programmatic DPEA may need to be captured in a supplemental EA.

This DPEA does NOT cover:

- Directed research on protected species, such as studies involving intentional capture of marine mammals or sea turtles for tagging and tissue sampling, or other intentional takes under the MMPA or ESA which require directed scientific research permits. Directed research on protected species is covered by other environmental review processes and consultations under applicable regulations.
- The potential effects of research conducted by scientists in other NMFS Fisheries Science Centers.
- Other activities of the SEFSC that do not involve the deployment of vessels or gear in marine waters, such as evaluations of socioeconomic impacts related to fisheries management decisions, taxonomic research in laboratories, fisheries enhancements such as hatchery programs, and educational outreach programs.
- Implementation of the Pelagic Observer Program. The impacts of the Pelagic Observer Program are considered under FMP NEPA processes.
- Other fisheries research programs conducted and funded by other agencies, academic institutions, non-governmental organizations, and commercial fishing industry research groups.

In the future, additional research activities may propose to use methods that were not considered in the evaluation of impacts in this DPEA. Some of these proposed projects may require further environmental impact assessment or satisfaction of other consultation, approval, or permitting requirements before being allowed to proceed. In particular, proposed projects that may impact NMFS trust resources and require permits under the ESA, MSA, NMSA, or the MMPA may require individual NEPA analyses and decisions tiered off this DPEA. Under NEPA, tiering refers to development of subsequent NEPA analyses that incorporate by reference and build on prior NEPA analyses. A programmatic NEPA approach is especially conducive to NEPA tiering. As the details of any such studies are presently unavailable, they cannot be assessed here. After new projects are sufficiently well defined and their potential environmental consequences are better understood, specific impacts will be evaluated as necessary. If the proposed new research activities are not within or similar to the range of alternatives addressed in the programmatic document and may have adverse environmental impacts that are not within the scope of the analysis in this DPEA, additional NEPA review would be required.

In developing this DPEA, NMFS adhered to the procedural requirements of NEPA; the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and NOAA's procedures for implementing NEPA[11]

The following definitions will be used to characterize the nature of the various impacts evaluated with this EA:

Short-term or long-term impacts. These characteristics are determined on a case-by-case basis and do not refer to any rigid time period. In general, short-term impacts are those that would occur only with respect to a particular activity or for a finite period. Long-term impacts are those that are more likely to be persistent and chronic.

[11] NOAA Administrative Order (NAO) 216-6, Environmental Review Procedures for Implementing the National Environmental Policy Act.

Direct or indirect impacts. A direct impact is caused by a proposed action and occurs contemporaneously at or near the location of the action. An indirect impact is caused by a proposed action and might occur later in time or be farther removed in distance but still be a reasonably foreseeable outcome of the action. For example, a direct impact of erosion on a stream might include sediment-laden waters in the vicinity of the action, whereas an indirect impact of the same erosion might lead to lack of spawning and result in lowered reproduction rates of indigenous fish downstream.

Minor, moderate, or major impacts. These relative terms are used to characterize the magnitude of an impact. Minor impacts are generally those that might be perceptible but, in their context, are not amenable to measurement because of their relatively minor character. Moderate impacts are those that are more perceptible and, typically, more amenable to quantification or measurement. Major impacts are those that, in their context and due to their intensity (severity), have the potential to meet the thresholds for significance set forth in CEQ regulations (40 CFR 1508.27) and, thus, warrant heightened attention and examination for potential means for mitigation to fulfill the requirements of NEPA.

Adverse or beneficial impacts. An adverse impact is one having adverse, unfavorable, or undesirable outcomes on the manmade or natural environment. A beneficial impact is one having positive outcomes on the man-made or natural environment. A single act might result in adverse impacts on one environmental resource and beneficial impacts on another resource.

Cumulative impacts. CEQ regulations implementing NEPA define cumulative impacts as, "Impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." (40 CFR 1508.7) Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time within a geographic area.

The proposed SEFSC research activities are not reasonably expected to result in the spread or introduction of non-indigenous species. The research involves movement of vessels between water bodies. However, ballast water management and other discharge processes for NOAA and charter vessel operations are bound by federal laws, regulations and Executive Orders (EO) that are in place in order to prevent or minimize the potential for spread or introduction of non-indigenous species, including the Clean Water Act, National Invasive Species Act, Nonindigenous Aquatic Nuisance Prevention and Control Act, and EO13112. The proposed SEFSC research activities are also not expected to result in impacts to public health or safety. These issues are not considered further in this assessment.

1.5 PUBLIC REVIEW AND COMMENT

Public participation is a cornerstone of the NEPA process. In preparing EAs, federal agencies must involve environmental agencies, applicants, and the public to the extent practicable (40 CFR Sec. 1501.4 [b]). Following guidance for public review of EAs in NOAA Administrative Order (NAO) 216-6 (Sections 5.02b.1 and 5.03e.2), this DPEA and the associated LOA application will be available for public review on the internet and notice of the availability of the DPEA will be published in *Federal Register*. Public comments received on this DPEA will be addressed in the Final PEA.

1.6 REGULATORY REQUIREMENTS

NMFS is the lead federal agency for the proposed research activities evaluated in this DPEA. These activities trigger a broad range of regulatory compliance processes because they may cause adverse impacts to public trust resources that are regulated by various statutes and contribute to reducing impacts caused by other activities, such as fishing, that are also regulated by those same statutes. Chapters 4 and 5 assess the impacts of the research activities on protected species and habitat. Because the research activities are necessary for NMFS to carry out its regulatory mandates, Chapters 4 and 5 also describe potential impacts to NMFS ability to effectively monitor and manage fishery resources under the alternatives evaluated. Descriptions of these statutory requirements are provided in Chapter 6, "*Applicable Laws*."

Table 1.6-1 presents a brief summary of some of these applicable laws. This information is provided to aid the reader in understanding the material presented later in the DPEA and is not intended to be a complete listing of all statues, orders or regulations applicable to the proposed action and alternatives.

Table 1.6-1 Applicable Laws and Treaties

Law	Description
National Environmental Policy Act (NEPA)	Requires federal agencies to evaluate potential environmental effects of any major planned federal action and promotes public awareness of potential impacts by requiring federal agencies to prepare an environmental evaluation for any major federal action affecting the human environment.
Magnuson-Stevens Fishery Conservation and Management Act (MSA)	Authorizes the U.S. to manage fishery resources in an area from a state's territorial sea (extending 3 nm from shore) to 200 nm off its coast (termed as the EEZ). Includes 10 national standards to promote domestic commercial and recreational fishing under sound conservation and management principles, and provide for the preparation and implementation of fishery management plans (FMPs).
Marine Mammal Protection Act (MMPA)	Prohibits the take of marine mammals in U.S waters and by U.S. citizens on the high seas and the importation of marine mammals and marine mammal products into the U.S. Allows, upon request, the "incidental," but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in specified activities.
Endangered Species Act (ESA)	Provides for the conservation of endangered and threatened species of fish, wildlife, and plants throughout all or a significant portion of their range, and the conservation of the ecosystems upon which they depend. Administered jointly by NMFS and the USFWS.
Migratory Bird Treaty Act (MBTA)	Protects approximately 836 species of migratory birds from any attempt at hunting, pursuing, wounding, killing, possessing, or transporting any migratory bird, nest, egg, or part thereof, unless permitted by regulations.
Fish and Wildlife Coordination Act (FWCA)	Requires USFWS and NMFS to consult with other state and federal agencies in a broad range of situations to help conserve fish and wildlife populations and habitats in cases where federal actions affect natural water bodies.
National Marine Sanctuaries Act (NMSA)	Authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities as national marine sanctuaries. Section 304(d) of the NMSA requires interagency consultation between the NOAA Office of National Marine Sanctuaries (ONMS) and federal agencies taking actions that are "likely to destroy, cause the loss of, or injure a sanctuary resource."
Atlantic Tuna Conventions Act (ATCA)	Authorizes the promulgation of regulations, as may be necessary and appropriate, to implement conservation and management recommendations adopted by the International Commission for the Conservation of Atlantic Tunas (ICCAT).
National Historic Preservation Act (NHPA)	Section 106 requires review of any project funded, licensed, permitted, or assisted by the federal government for impact on significant historic properties.
Executive Order (EO) 12989, Environmental Justice	Directs federal agencies to identify and address disproportionately high and adverse effects of federal projects on the health or environment of minority and low-income populations to the greatest extent practicable and permitted by law.
Executive Order 13158, Marine Protected Areas	The purpose of this order is to strengthen and expand the Nation's system of marine protected areas (MPAs). It encourages federal agencies to use science-based criteria and protocols to identify and prioritize natural and cultural resources in the marine environment that should be protected to secure valuable ecological services and to monitor and evaluate the effectiveness of MPAs. Each federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions. To the extent permitted by law and to the maximum extent practicable, each federal agency, in taking such actions, shall avoid harm to the natural and cultural resources that are protected by an MPA.
Coastal Zone Management Act (CZMA)	Encourages and assists states in developing coastal management programs. Requires any federal activity affecting the land or water use or natural resources of a state's coastal zone to be consistent with that state's approved coastal management program.

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2.1 INTRODUCTION

The CEQ is responsible for the development and oversight of regulations and procedures implementing NEPA. The CEQ regulations provide NEPA procedural requirements that apply to all federal agencies (40 CFR Part 1500). NOAA has also prepared environmental review procedures for implementing NEPA, NAO 216-6 (NAO 216-6). Section 5.03b of NAO 216-6 states: "An Environmental Assessment [EA] must consider all reasonable alternatives, including the preferred action and the no action alternative."

To warrant detailed evaluation by the NMFS, an alternative must be reasonable[12] and meet the purpose and need (see Section 1.3). Screening criteria are used to determine whether an alternative is reasonable and should be considered further or whether it is not reasonable to consider in detail in the DPEA. Section 2.6 describes potential alternatives that were considered but rejected because they do not meet the purpose and need of the proposed action.

Screening Criteria – To be considered 'reasonable' for the purposes of this DPEA, an alternative must meet the following criteria:

1. The action must not violate any federal statute or regulation.
2. The action must be consistent with reasonably foreseeable funding levels.
3. The action must be consistent with long-term research commitments and goals to maintain the utility of scientific research efforts, or consider no federal funding availability for fisheries research.

To maintain the utility of scientific research efforts, fisheries and marine ecosystem scientific research activities should address at least some of the following goals related to fisheries management:

1. Methods and techniques should provide standardized and objective data consistent with or complementary to past data sets (time-series) in order to facilitate long-term trend analyses.
2. Collected data should characterize living marine resource and fishery populations and the health of their habitats.
3. The surveys should enable assessment of population status and provide predictive capabilities required to respond to changing ecosystem conditions and manage future fisheries.
4. Research on new methodologies to collect fisheries and ecosystem information (e.g. active and passive acoustic instruments and video surveys of benthic habitats in lieu of dredge gear or bottom trawls), and research oriented toward modifications of fishing gear to address bycatch or other inefficiencies should be conducted under experimental conditions sufficient to allow statistically valid comparisons with relevant alternatives.

NMFS evaluated each potential alternative against these criteria and requirements. Based on this evaluation, the No-Action/Status Quo alternative and two other action alternatives were identified as reasonable and are carried forward for more detailed evaluation in this DPEA. NMFS also evaluates a second type of no-action alternative that considers no federal funding for fisheries research activities. This

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[12] "Section 1502.14 (NEPA) requires the EA/Environmental Impact Statement (EIS) to examine all reasonable alternatives to the proposal. In determining the scope of alternatives to be considered, the emphasis is on what is 'reasonable' rather than on whether the proponent or applicant likes or is itself capable of carrying out a particular alternative. Reasonable alternatives include those that are *practical or feasible from the technical and economic standpoint and using common sense*, rather than simply desirable from the standpoint of the applicant." (40 Questions) (emphasis added)

alternative is called the No Research Alternative to distinguish it from the No-Action/Status Quo Alternative.

The No-Action/Status Quo Alternative is used as the baseline for comparison of the other alternatives. Three of the alternatives include fisheries and ecosystem research projects conducted or funded by the SEFSC as the primary federal action. These three alternatives also include suites of mitigation measures intended to minimize potentially adverse interactions with protected species. Protected species include all marine mammals, which are covered under the MMPA, all species listed under the Endangered Species Act (ESA), and bird species protected under the Migratory Bird Treaty Act (MBTA).

The three alternatives involving research activities in the marine environment trigger marine mammal protection requirements under the MMPA. For this reason, NMFS must evaluate the alternatives to ensure that they would fulfill the purpose and need of NMFS issuing regulations and subsequent LOA under Section 101(a)(5)(A) of the MMPA to the SEFSC, which is the secondary federal action considered in this DPEA. The LOA, if issued, would provide an exception to the SEFSC from the take prohibitions for marine mammals under the MMPA, incidental to the conduct of the SEFSC's research activities, namely: (1) the issuance of an LOA for the take of marine mammals by Level A and Level B harassment, and by serious injury or mortality incidental to the SEFSC's conduct of research activities for a specified period; and (2) compliance with the MMPA which sets forth specific findings and prescriptions (e.g. no unmitigable adverse impact on the availability of a species or stock for subsistence uses, negligible impact on a species or stock, and mitigation, monitoring, and reporting requirements) that must be made in order for NMFS to issue an LOA. In order to authorize incidental take of marine mammals under the MMPA, NMFS must identify and evaluate a reasonable range of mitigation measures to minimize impacts to marine mammals to the level of least practicable adverse impact. A range of mitigation measures has been incorporated as part of the identified alternatives in order to evaluate their ability to minimize potential adverse environmental impacts. The efficacy and practicability of all potential mitigation measures are assessed in Chapter 4.

Further, because the proposed research activities occur in known habitat areas of species that are listed as threatened or endangered under the ESA, this DPEA evaluates potential impacts to ESA-listed species that may result from either the primary or secondary action. Likewise, because the proposed research activities occur partially within the boundaries of National Marine Sanctuaries, and within areas identified as EFH, this DPEA evaluates potential impacts to sanctuary resources and EFH as required under section 304(d) of the National Marine Sanctuaries Act and section 305(b)(2) of the MSA.

2.2 ALTERNATIVE 1 – NO-ACTION/STATUS QUO ALTERNATIVE - CONDUCT FEDERAL FISHERIES AND ECOSYSTEM RESEARCH WITH SCOPE AND PROTOCOLS SIMILAR TO PAST EFFORT

As discussed in Chapter 1, the SEFSC collects a wide array of information necessary to evaluate the status of fishery resources and the marine environment. SEFSC scientists conduct fishery-independent research onboard NOAA owned and operated vessels or on chartered vessels in the Atlantic Ocean, Gulf of Mexico (GOM), and Caribbean Sea. Under the Status Quo Alternative, the SEFSC would administer and conduct a wide range of fishery-independent and industry-associated research and survey programs as they have been in the recent past, as summarized in Table 2.2-1. Appendix A provides an illustrated description of the fishing gear and scientific instruments used during SEFSC research. Under this alternative, the SEFSC would continue to apply for section 10 directed research permits for the intentional take of ESA-listed species and Scientific Research Permits (SRPs) for research that will affect MSA species managed under FMPs.

2.2.1 SEFSC and Cooperating Research Partner Activities

Table 2.2-1 summarizes the fisheries research programs conducted or funded by the SEFSC. Some of these projects are funded, at least in part, by the SEFSC but are conducted by cooperative research partners as noted.

Table 2.2-1 Summary Description of Fisheries Research Surveys and Projects Conducted by SEFSC and Cooperating Research Partners under the Status Quo Alternative

See Appendix A for descriptions of the different gear types and vessels greater than 65 ft length. Vessels are described under the U.S. Coast Guard (USCG) classification system: USCG Class A: ≤ 16 ft; USCG Class I: 16 to <26 ft; USCG Class II: 26 to <40 ft; USCG Class III: 40 to 65 ft; USCG Small Research Vessel (>65 ft. and <300 gross tons); USCG Research Vessel (>65 ft. and >300 gross tons). Appendix B includes figures showing the spatial/temporal distribution of fishing gears used during SEFSC research. Mitigation measures are described in Section 2.2.1.

Abbreviations used in the table:	
ACFCMA	Atlantic Coastal Fisheries Cooperative Management Act
ADCP	Acoustic Doppler Current Profiler
BRD	Bycatch Reduction Device
CTD	Conductivity Temperature Depth
DAS	days at sea
EEZ	Exclusive Economic Zone
ft	foot, feet
Gag	Juvenile Grouper
GOM	Gulf of Mexico
GULFSPAN	Gulf of Mexico Shark Pupping & Nursery
HMS	Highly Migratory Species
hr(s)	hour(s)
IBBEAM	Integrated Biscayne Bay Ecological Assessment and Monitoring
in	inch
IJA	Inter-jurisdictional Fisheries Act
kg	kilograms
kHz	kilohertz
kts	knots
L	liter
m	meter
mm	millimeter
m^2	square meter
MARMAP	Marine Resources Monitoring, Assessment, and Prediction
MPA	Marine Protected Area
mi	miles
min	minutes
mm	millimeter
NA	Not Available or Not Applicable
nm	nautical miles
RecFIN	Recreational Fisheries Information Network
ROV	Remotely Operated Vehicle
R/V	Research Vessel
SEFIS	Southeast Fishery-Independent Survey
SEAMAP	Southeast Area Monitoring and Assessment Program
TBD	to be determined
TED	Turtle Excluder Device
US	United States
v	volt
yr	year
~	approximately
Cooperating research partners:	
ADCNR	Alabama Department of Conservation & Natural Resources
FFWCC	Florida Fish & Wildlife Conservation Commission
FSU/CML	Florida State University Coastal & Marine Laboratory
GDNR	Georgia Department of Natural Resources
LDWF	Louisiana Department of Wildlife & Fisheries
MDMR	Mississippi Department of Marine Resources
MML	Mote Marine Laboratory
NCDENR	North Carolina Department of Environmental and Natural Resources
NOAA	National Oceanic and Atmospheric Administration
PR-DNER	Puerto Rico Department of Natural and Environmental Resources
SCDNR	South Carolina Department of Natural Resources
SEFSC	Southeast Fisheries Science Center
TPWD	Texas Parks & Wildlife Department
USA/DISL	University of South Alabama Dauphin Island Sea Laboratory
USFWS	United States Fish and Wildlife Service
USM/GCRL	University of Southern Mississippi Gulf Coast Research Lab
USCG	United States Coast Guard
USVI-DFW	United States Virgin Islands - Division of Fish and Wildlife (Department of Planning and Natural Resources)
UWF	University of West Florida
VIMS	Virginia Institute of Marine Science

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
GULF OF MEXICO RESEARCH AREA							
Surveys Using Gillnet Gear							
HMS–GOM Shark Pupping & Nursery Survey (GULFSPAN), (SEFSC, FSU/CML, USM/GCRL, USA/DISL, UWF) * Under the Preferred Alternative, the survey component conducted by the USA/DISL is not continued but a new component conducted by Mote Marine Laboratories is added.	SEFSC component: Mid-water and surface gillnet survey designed to monitor juvenile shark populations in the coastal GOM. The intent of this survey is to support stock assessment and continue to describe and refine shark essential fish habitat as mandated by the MSA. The survey is led by the NOAA Fisheries Panama City Laboratory, SEFSC, and has Gulf Coast research institution collaborators in FL and MS.	SEFSC - FL Panhandle in St. Andrew Bay and St. Joseph Bay, 1-10 m depths	Annual Apr-Oct, 30 DAS, (approximately 4 days/month), daytime operations only	USCG Class I: R/V *Mokarran*, R/V *Pristis*	Set gillnet	A single gillnet, 600 ft long and 10 ft deep, consisting of six 100-ft long panels ranging in stretched mesh sizes from 3 to 5.5 inches in 0.5 in increments. The same size net is used for sampling in all areas by all institutions. The six panels are strung together and fished as a single gear (i.e., set); one end of each set is anchored and the opposite end is tied to the boat via a bridle. In depths greater than 10 feet (the depth of the net), the gear acts like a midwater gillnet - the lead line weighs enough to hold the floats under the surface of the water but not enough to sink the net completely. In depths less than 10 feet, the gear fishes the entire water column. Duration: 30-60 min, monitored continuously	SEFSC – 16-20 sets/month, up to 120 sets total
	Survey component conducted by USM/GCRL.	Mississippi Sound waters, 1-9 m depths	Annual Apr-Oct, 8 DAS (1/month), daytime operations only	USCG Class I: Small vessel	Set gillnet	Same as SEFSC gear	3 sets/month 21 sets total
	Survey component conducted by USA/DISL. *Participated from 2007-2012	Horn Island, MS through Pensacola, FL, state waters, 0.5-8 m depths	Annual Mar-Nov, 36 DAS (4/month), daytime operations only	USCG Class I: State vessel	Set gillnet	Same as SEFSC gear	10 sets/month, 90 sets total
	Survey component conducted by UWF. *Beginning in 2013	Perdidio Bay, Pensacola Bay, Choctawhatchee Bay, and Santa Rosa Sound, 1.5-6 m depths	Annual May-Sep, 10 DAS (2/month), daytime operations only	USCG Class I: State vessel	Set gillnet	Same as SEFSC gear except soak duration is 30 min	10 sets/month 50 sets total
	Survey component conducted by FSU/CML.	Northwest FL state waters, 0.7-7 m depths A) Apalachee Bay B) Alligator Pt.-Anclote Keys	Annual A) Jan-Dec, 12 DAS (1/month) B) June-July, 20 DAS, daytime operations only	USCG Class I: R/V *Naucrates*	Set gillnet	Same as SEFSC gear	74 sets/yr total A) 24 sets B) 50 sets
					Bottom Longline	Mainline length: ~1500 m (monofilament); 100 gangions/set; Hook size and type: 25 of each hook size 10/0, 12/0, 14/0, 16/0; Soak time: 1 hr	74 sets/yr total A) 24 total B) 50 total
IJA Coastal Finfish Gillnet Survey, (MDMR)	To sample and monitor finfish populations in MS waters for management purposes.	Mississippi Sound waters and estuaries; 0.2-2 m depths	Annual, Jan-Dec, 24 DAS, daytime operations only *Federal funding was suspended Sep 1, 2012 to Aug 31, 2013.	USCG Class I: Small vessel	Sinking gillnet	Single 750 ft long x 6 ft deep gillnet consisting of five 150 ft panels, each with stretch-mesh sizes 2, 2½, 3, 3 ½, and 4 inches, respectively; Duration: 1 hr	8 sets/month, 96 sets total

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
Smalltooth Sawfish Abundance Survey, (SEFSC)	The completion of the Smalltooth Sawfish Recovery Plan in 2009 brought a new phase of conservation for the U.S. Distinct Population Segment (DPS) of the smalltooth sawfish, *Prisits pectinata*. This survey monitors the abundance of juvenile smalltooth sawfish in coastal southwest FL, one of the most important regions for juveniles.	Ten Thousand Islands, FL backcountry region, including areas in Everglades National Park and Ten Thousand Island National Wildlife Refuge in 0.2-2 m depths	Annual, Mar-Nov, 56 DAS (6-7 DAS/trip), daytime operations only	USCG Class I: R/V *Pristis*	Set gillnet	Gillnets are 5 ft deep and either 100 or 200 ft long with mesh sizes either 3 or 4 inches, fished in depths of 0.2-1.0 m. Nets are anchored at both ends, and marked with surface buoys; only one net is fished at a time Duration: 1-4 hr Permit ESA-17787 outlines that nets are set close to or over shallow muddy mangrove lined shorelines. Nets must be checked every 30 minutes or immediately if any animal (sawfish or bycatch) is observed in the gear.	~20 sets/month, 180 to 200 sets total
Surveys Using Longline Gear							
Pelagic Longline Survey-GOM, (SEFSC) (See also effort conducted in the ARA)	This survey targets pelagic shark and finfish species, results of survey are used for stock assessments and to support Fishery Management Plans. Information is also obtained about their biology, distribution, movements, stock structure and status, and potential vulnerability to fishing pressure. Surveys involve catching sharks on pelagic longline gear, measuring, attaching various tags, and releasing them alive. Random survey site selection based on significant oceanic (Gulf Stream or loop currents), or bathymetric features (continental shelf edge). Fin fish are sampled for otoliths and gonads for biological information.	U.S. GOM	Intermittent, Feb-May, 30 DAS, 24 hour operations (set/haul anytime day or night)	USCG R/V: R/V *Oregon II*	Pelagic longline	Mainline length: 5 nm (4.0 mm diameter, 454 kg test monofilament); 100 gangions/set (2.0 mm diameter, 179 kg test); Hook size and type: 18/0 non-offset steel, 0.5 m length multi-strand leader (364 kg test), 50 bullet floats. Bait: Atlantic mackerel; Soak Time: 3 hr	100-125 sets
					CTD profiler	Duration: 10-20 min	100-125 casts
Shark and Red Snapper Bottom Longline Survey-GOM, (SEFSC) (See also effort conducted in the ARA)	This Gulf-wide survey targets shark and reef fish species, results of survey are used for stock assessments and to support Fishery Management Plans. Information is also obtained about their biology, distribution, movements, stock structure and status, and potential vulnerability to fishing pressure. Surveys involve catching sharks on longline gear, measuring, attaching various tags, and releasing them alive. Fin fish are sampled for otoliths and gonads for biological information.	Randomly selected sites from FL to Brownsville, TX between bottom depths 9 - 366 m	Annually, July-Sep, 60 DAS, 24 hour operations	USCG R/V: R/V *Oregon II*, R/V *Gordon Gunter*; USCG Small R/V: R/V *Caretta*, R/V *Gandy*	Bottom longline	Mainline length: 1 nm (4.0 mm diameter, 454 kg test monofilament); 100 gangions/set (3.0 mm diameter, 332 kg test monofilament); Hook size and type: 15/0 circle hook. Bait: Atlantic mackerel; Soak Time: 1 hr	175 sets
					CTD profiler and rosette water sampler	Duration: 5-15 min	175 casts
					Neuston and bongo effort if needed to augment SEAMAP plankton objectives	Neuston net: 1 x 2 m opening with 0.505 or 0.947 mm mesh; Tow speed: 1-2 kts Bongo towing frame consists of two cylindrical nets, each 61 cm in diameter, fine mesh nets (0.202 or 0.335 mm). Stationary.	0-20 tows
SEAMAP – GOM Bottom Longline Survey, (ADCNR, USM-GCRL, LDWF, TPWD)	These surveys target inshore shark and fin fish species in state waters of AL, MS, LA, and TX. Surveys follow the same basic protocols but are conducted by state agencies and institutions. Results of survey are used for stock assessments and to support Fishery Management Plans. Information is also obtained about fish biology, distribution, movements, stock structure and status, and potential vulnerability to fishing pressure. Surveys involve catching sharks and finfish on longline gear, measuring, attaching various tags (if the animal is in good condition), and releasing them alive. Fin fish are sampled for hard parts for biological information.	AL – MS Sound, Mobile Bay, and near Dauphin Island MS – MS Sound, south of the MS Barrier Islands, Chandeleur, and Breton Sound, and the area east of the Chandeleur Islands. LA – LA waters west of the MS River TX – near Aransas Pass and Bolivar Roads Ship Channel	Annually, Apr-May, June-July, Aug-Sep; AL – 8 DAS, day operations only MS – 16 DAS, day operations only LA – 24 DAS, day operations only TX – 10 DAS, day operations only	USCG Class III: R/V *E.O. Wilson*, R/V *Alabama Discovery* , R/V *Defender I*, R/V *Tom McIlwain*, R/V *Nueces*, R/V *SanJacinto;* USCG R/V: R/V *Blazing Seven*	Bottom longline	Mainline length: one nm (4.0 mm diameter, 454 kg test monofilament); 100 gangions/set (3.0 mm diameter, 332 kg test monofilament); Hook size and type: 15/0 circle hook. Bait: Atlantic mackerel; Soak Time: 1 hr	AL – 32 sets MS – 40 LA – 98 TX – 20
					CTD Profiler	Duration: 5-15 min	AL – 32 casts LA – 40
					Water quality and chemistry (YSI instruments, Niskin bottles, turbidity meter)	Duration: 5-15 min	MS – 40 casts TX – 20

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
Surveys Using Trawl Gear							
IJA Biloxi Bay Beam Trawl Survey, (MDMR)	Sample post-larval and juvenile fish and invertebrate species.	MS state waters in Biloxi Bay, 1-5 ft depths	Annually, Jan-Dec, 25 DAS, day operations only. *Federal funding was suspended Sep 1, 2012 to Aug 31, 2013.	USCG Class I: R/V *Grav I*, R/V *Grav II*, R/V *Grav IV*	Modified beam trawl	Net size: 5 ft wide beam trawl pulled by hand from vessel; Duration: ~20 min at target depth	11 trawls/month, 132 trawls total
IJA Inshore Finfish Trawl Survey, (MDMR)	To sample and monitor inshore finfish for management purposes.	MS state waters from Biloxi Back Bay, to approximately 2 miles south of the barrier islands outside of Dog Keys Pass, 5-25 ft depths	Annually, Jan-Dec, 12 DAS, day operations only. *Federal funding was suspended Sep 1, 2012 to Aug 31, 2013.	USCG Class I: R/V *Geoship*, small vessel	Otter trawl	Net size: 16 ft otter trawl (¾ in stretch nylon multifilament mesh, with a ¼ in mesh cod end); Tow speed 2.5 kts Duration: 10 min at target depth	72 trawls
IJA Open Bay Shellfish Trawl Survey, (TPWD)	Resource assessment survey to determine the status of shellfish populations for better management and harvest in coastal waters. A total of 20 samples are randomly selected and collected each month in four bay systems and 10 samples are collected each month in the lower Laguna Madre. All samples are collected within the bay systems using 20 ft trawls towed for 10 minutes.	TX state waters in Galveston, Matagorda, Aransas, and Corpus Christi Bays and the lower Laguna Madre, 3-30 ft depths	Annually, Jan-Dec, 120 DAS, day operations only. *Federal funding was suspended Sep 1, 2012 to Aug 31, 2013.	USCG Class I: small vessel USCG Class II: R/V *Trinity Bay*, R/V *Copano* Bay, R/V *RJ Kemp*	Otter trawl	Net size: 20-ft otter shrimp trawl (1½-inch-stretch nylon multifilament mesh), with 48-inch-long and 20-inch-wide trawl doors, constructed of ½-inch plywood with angle iron framework and iron runners; Tow speed 2.5 kts Duration: 10 min at target depth	90 trawls/month, 1080 trawls total
					Water quality and chemistry (YSI instruments, Niskin bottles, turbidity meter)	Duration: 5-15 min	
Oceanic Deep-water Trawl – GOM, (SEFSC)	Survey is conducted to sample mid-water (500-800 m) prey of marine mammals. Conducted in conjunction with Marine Mammal and Ecosystem Assessment Survey-GOM.	U.S. GOM waters >500 m deep	Intermittent due to funding, 20 DAS, 24 hour operations, *conducted in 2009 & 2010 and in the future as funding allows.	USCG R/V: R/V *Gunter*, R/V *Pisces*	High Speed Midwater Trawl, Aleutian Wing Trawl	>10 m opening, 2-3 m doors Tow speed: 2-3 kts at 500-800 m Duration: 1-3 hours at target depth	60 trawls (2-3 per day)
					CTD profiler and rosette water sampler	Duration: 60-90 min	60 casts
St. Andrew Bay Juvenile Reef Fish Trawl Survey, (SEFSC)	Examine the variation of snapper and grouper recruitment to seagrass beds in St. Andrew Bay, FL. Benthic trawling is conducted annually from spring through fall to assess changes in snapper and grouper densities over time at four locations within the bay. Targeted species include: lane snapper, gray snapper, and gag grouper and occasionally, red grouper. All fish caught are measured and then released alive. This research is used by the GMFMC to provide early life history information for gag grouper stock assessments, and demonstrates the value of seagrasses as essential fish habitat.	St. Andrew Bay, FL, up to 2 m depths	Annually, May-Nov, 28 DAS, day operations only, (one day/week)	USCG Class I: Boston Whaler	Benthic Trawl	Net size: 1 m wide x 25 cm high metal frame with 2 mm mesh bag; Tow speed: 3.1 kts Duration: 30 sec (measured 50 m distance)	13 trawls/ week, 24 weeks, 312 trawls total
Small Pelagics Trawl Survey, (SEFSC)	A resource assessment survey to complement the Fall Shrimp/Groundfish survey, and to monitor the abundance and distribution of small pelagics (scad, herring, butterfish, etc.) in the GOM.	U.S. GOM in depths of 50-500 m	Annually, Oct-Nov, 40 DAS, 24 hour operations	USCG R/V: R/V *Gordon Gunter*, R/V *Pisces*	High-opening bottom trawl	Net size: 90 ft high opening, 2-seam, bottom trawl with 2.8 m^2 steel "V" doors; Tow speed: 3.0 kts Duration: 30 min at target depth	150-200 trawls
					Bongo net	Tow speed: 0 Duration: 5-15 min	40-50 tows
					Neuston net	Tow speed: 1-2 kts Duration: 10 min	40-50 tows

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
					Simrad ME70 Multi-Beam echosounder	70-120 kHz	Continuous
					EK60 Multi-frequency single-beam active acoustics	18, 38, 70, 120, and 200 kHz	Continuous
					ADCP	333 kHz	Continuous
					CTD profiler and rosette water sampler	Duration: 8-20 min	250 casts
SEAMAP-GOM Shrimp/ Groundfish Trawl Survey, (SEFSC, FFWCC, ADCNR, USM/GCRL, LDWF, TPWD) TPWD ended participation in this survey in December 2014, only that portion of the survey will not be continued under the Preferred Alternative.	A resource assessment survey to monitor the abundance and distribution of benthic fauna in the U.S. GOM in state and federal waters at depths of 30-360 ft. The SEFSC and cooperating partner agencies from the five Gulf Coast states conduct the survey using consistent protocols, although there are some differences in gears and oceanographic instruments used. Sample sites are selected to complement the efforts of cooperating partners. Sampling occurs during day and night hours.	U.S. GOM from FL to Mexico in depths of 6-360 ft	Annually summer (June-July) and fall (Oct-Nov), effort evenly divided between seasons unless noted, all surveys have 24 hour operations (set/haul anytime day or night); SEFSC – 80 DAS FL – 20 DAS (summer only) AL – 6 DAS MS – 10 DAS LA – 10 DAS TX – 10 DAS	USCG Class II: R/V *Trinity Bay*, R/V *Copano Bay*, R/V *RJ Kemp* USCG Class III: R/V *A.E. Verrill*, R/V *Alabama Discovery*, R/V *Sabine Lake*, R/V *Nueces*, R/V *San Jacinto*, R/V *San Antonio*, R/V *Matagorda Bay* USCG R/V: R/V *Oregon II*, R/V *Tommy Munro*, R/V *Weatherbird II*, R/V *Pelican*, R/V *Blazing Seven*, R/V *Point Sur*	Otter trawl	Net size: 42-ft shrimp (otter) trawl (1½-inch-stretch nylon multifilament mesh) with 8 ft by 40 in wooden doors and chain brackets. TPWD uses 20 ft otter trawl Tow speed: 2.5 kts Duration: 30 min at target depth	Effort evenly divided between seasons unless noted. SEFSC - 345 trawls (summer), 325 (fall) FL – 160 (summer only) AL – 16-24 MS – 60 LA – 50 TX – 120 (summer), 80 (fall)
					Bongo net	Tow speed: 0 Duration: 5-15 min	SEFSC – 110 tows (summer), 75 (fall) LA – 14 MS - 12
					Neuston net	Tow speed: 1-2 kts Duration: 10 min	SEFSC – 115 tows (summer), 75 (fall) LA – 14 MS - 12
					CTD profiler and rosette water sampler TPWD uses YSI Datasonde 6600 v2-4 (dissolved oxygen, salinity and temperature)	Duration: 8-20 min	SEFSC – 395 casts (summer), 305 (fall) FL – 200 (summer only) AL – 20 MS – 81 LA – 50 TX – 160
SEFSC BRD Evaluations, (SEFSC)	Gear testing of various BRD designs for the shrimp fishery. Paired comparison conducted aboard a twin rigged shrimp vessel owned and operated by NOAA. Target shrimp catch and bycatch data collected from each net for each comparative tow.	State and federal nearshore and offshore waters off FL, AL, MS, and LA at depths of 10-35 m. Also Mississippi Sound at depths of 3-6 m.	Annually, May & Aug (one week/month), 14 DAS, night operations only	USCG Class III: R/V *Caretta*	Western jib shrimp trawls	Net size: Two 50 ft Western jib shrimp trawls with 8 x 40 in wooden doors; Tow speed: 2.5 kts Duration: 2 hrs or less [A]	20 paired trawls each season, 40 paired trawls total

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
SEFSC-GOM TED Evaluations, (SEFSC)	Gear testing of various TED designs for the shrimp fishery. Paired comparison conducted aboard a twin rigged shrimp vessel owned and operated by NOAA. TED installed in one trawl while the other is left with no TED. Target shrimp catch and bycatch data collected from each net for each comparative tow.	State and federal nearshore and offshore waters off FL, AL, MS, and LA at depths of 10-35 m. Also Mississippi Sound at depths of 3-6 m.	Annually, May, Aug, & Sep (one week/month), 21 DAS, day operations only	USCG Class I & II: NOAA small boats USCG Class III: R/V *Caretta*	Western jib shrimp trawls	Net size: Two 50 ft Western jib shrimp trawls with 8 x 40 in wooden doors; Tow speed: 2.5 kts Duration: 55 min at target depth	30 paired trawls per season, 90 paired trawls total
SEFSC Skimmer Trawl TED Testing, (SEFSC)	Gear testing of various TED designs for the skimmer trawl shrimp fishery. Paired comparison conducted aboard twin rigged skimmer trawl vessel owned and operated by NOAA. Target shrimp catch and bycatch data collected from each net for each comparative tow.	Conducted in Mississippi Sound, Chandeleur Sound, and Breton Sound at depths of 2-6 m.	Annually until 2016 (tentative depending on funding and need) May-Dec, 5-15 DAS/month, 60 DAS total, 24 hour operations	USCG Class III: R/V *Caretta*	Skimmer trawls	Two 19 ft, two seam skimmer trawls capable of fishing depths from 8 to 18 ft Tow speed: 2.5 kts Duration: 55 min	600 paired trawls
SEFSC Small Turtle TED Testing and Gear Evaluations, (SEFSC)	Testing various TED designs for the shrimp fishery utilizing the small turtle testing protocol and NOAA working divers. Two year old, hatchery raised, loggerhead sea turtles are used to evaluate the turtle exclusion rates of control and candidate TEDs.	State waters in St. Andrews Bay,FL	Annually, June, 21 DAS, day operations only	USCG Class III: R/V *Caretta*	Western jib shrimp trawls are utilized during TED evaluations	Net size: Two 50 ft Western jib shrimp trawls with 8 ft by 40 in wooden doors; Tow speed: 2.5-3.5 kts Duration: up to 75 min at target depth [A]	100 paired trawls
Surveys Using Other Gears							
IJA Biloxi Bay Seine Survey, (MDMR)	Conduct monthly seine sampling in Biloxi Bay estuary to provide diversity and abundance data on the juvenile life stage of estuarine-dependent species important to northern GOM fisheries.	MS state waters in Biloxi Bay, 1-5 ft depths	Annually, Jan-Dec, 25 DAS, day operations only. *Federal funding was suspended Sep 1, 2012 to Aug 31, 2013.	USCG Class I & II: R/V *Grav I*, R/V *Grav II*, R/V *Grav IV*, small vessel	Bag seine	50 ft bag seine with ¼ in bar mesh webbing, 6 ft deep lateral wings and 6 ft wide central bag. Set and pulled by hand Duration: up to 20 min	11 sets/month, 132 sets total
IJA Oyster Dredge Monitoring Survey, (MDMR)	Collect and analyze data on the condition of oyster reefs in MS to determine the number of live, marketable, and spawnable oysters. Evaluate the incidence of predators and competitors. Collect and analyze data on spat density and success in selected areas.	MS state waters, at commercially important oyster reefs: Pass Christian Complex, Pass Marianne Reef, Telegraph Reef and St. Joe Reef, in 5-15 ft depths	Annually, Jan-Dec, 12 DAS, day operations only. *Federal funding was suspended Sep 1, 2012 to Aug 31, 2013.	USCG Class I: R/V *Rookie* USCG Class II: R/V *Silvership*	Oyster dredge	9-tooth bar is ~ 20 in wide with teeth 4 in long and spaced 2 in apart Tow speed 2-3 kts Duration: 1 min	38 tows
IJA Shoreline Shellfish Bag Seine Survey, (TPWD)	Resource assessment survey to determine the status of shellfish populations for better management and harvest in coastal waters. Twenty samples are randomly selected and collected each month from five selected bay systems.	TX state waters in Galveston, Matagorda, Aransas, and Corpus Christi Bays and the lower Laguna Madre, 0-6 ft depths	Annually, Jan-Dec, 120 DAS, day operations only. *Federal funding was suspended Sep 1, 2012 to Aug 31, 2013.	N/A	Bag seine	60 ft long bag seine with 6 ft deep lateral wings (½ in stretch nylon multifilament mesh), with 6 ft wide central bag. Samples collected along the shoreline pulling an extended 60 ft bag seine (with an attached 40 ft spacing rope) for 50 ft. Area swept is 300 m^2. Soak time: 2-3 min	100 sets/month, 1200 total

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
Marine Mammal and Ecosystem Assessment Survey-GOM, (SEFSC)	Observational surveys are conducted to assess all cetacean species in U.S. EEZ waters, or to focus on the ecology of a selected group of species. Sampling protocols include transects to assess the distribution and abundance of cetaceans. Project operates with MMPA section 10 directed research permit for the intentional takes of marine mammals during research; incidental takes with active acoustic gear or other gear is not covered under the directed research permit and is the reason for including this research in the scope of the PEA.	Northern GOM	Every three years, June-Sep, 60 DAS, 24 hour operations	USCG R/V: R/V *Gordon Gunter*	CTD profiler and rosette water sampler	Duration: 30 min	60 casts
					Expendable bathythermographs		300 units
					ADCP	333 kHz	Continuous
					Simrad ME70 Multi-Beam echosounder	70-120 kHz	Continuous
					EK60 Multi-frequency single-beam active acoustics	18, 38, 70, 120, and 200 kHz	Continuous
					Passive acoustic arrays	Cables extend up to 600 m aft of the stern	Continuous
Northeast GOM MPA Survey, (SEFSC) Bandit reel gear was discontinued after 2013 and is not included under the Preferred Alternative.	The Madison-Swanson, Steamboat Lumps, and The Edges marine reserves on the West Florida Shelf were established to protect spawning aggregations of gag grouper, (*Mycteroperca microlepis*). Objectives are to document the relationship between habitat and species assemblages and track changes in reef fish abundance and distribution over time.	Madison-Swanson, Steamboat Lumps, and The Edges marine reserves on the West Florida Shelf	Annually, Feb-Mar, 60 DAS, day operations only	USCG Class III: R/V *Caretta*	4-camera array	The camera array contains 16 color cameras with paired black-and-white Video stereo cameras and a bait basket. The array is baited with squid, lowered to the bottom and attached to a float by line; Soak time: 30 min	100 – 200 deployments
					Bandit Reels (discontinued after 2013)	Vertical mainline with 10 gangions, either deployed or attached to the vessel; Hook size and type: 8/0 or 11/0 circle hook; Bait: mackerel; Soak time: 5-10 min	20 sets
					CTD Profiler	Duration: 5-20 min	100 – 200 casts
Panama City Laboratory Reef Fish (Trap/Video) Survey, (SEFSC)	Objectives include generating age-based annual indices of abundance of reef fishes; examining patterns in community structure, habitat associations, and regional catch, recruitment, demographics, and distribution. Sampling occurs on rocky reefs and live bottom in inner and mid-shelf waters (8-50 m) during daytime from 1 hr. after sunrise until 1 hr. before sunset using a stationary camera array at every site, followed with a chevron trap at every other site.	Destin, FL to Cedar Key, FL	Annually, May-Sep, 40 DAS, day operations only	USCG Class II: R/V *Harold B*, USCG Class III: R/V *Caretta* , R/V *Defender*, R/V *Apalachee*	4-camera array	The camera array contains 16 color cameras with paired black-and-white stereo cameras and a bait basket. The array is baited with Atlantic mackeral, set on the bottom, and attached to a float by ½ in line using 2:1 scope; Soak time: 30 min	200 deployments
					Chevron fish trap outfitted with one GoPro video camera.	Chevron trap is 6 x 6 ft with single 7.5 x 11.5 in oval opening and a bait basket. Traps are baited, deployed with a rope and attached float, and soaked for 90 minutes. A GoPro camera on the trap overlooks the entrance to the funnel.	100 sets
					CTD profiler	Duration: 1-4 min	200 casts
SEAMAP-GOM Finfish Vertical Line Survey, (ADCNR and LDWF) Preferred Alternative includes additional components conducted by USM/GCRL	A resource assessment survey to monitor the abundance and distribution of reef fish in AL waters and in LA waters west of the Mississippi River.	State and federal waters off Alabama at sampling depths from 60 to 500 ft and LA waters west of the Mississippi River across three depth strata (60-120 ft, 120-180 ft, and 180-360 ft). Stations are sampled during daylight hours.	AL: Annually, two intervals: spring (Apr/May) and summer (July-Sep), 10 DAS, day operations only LA: Annually, quarterly (20 stations sampled/depth strata/quarter), 24 DAS, day operations only	USCG Class III: R/V *Escape*, R/V *Lady Ann*, R/V *Defender I* USCG R/V: R/V *Blazing Seven*	Bandit gear	Bandit mainline 300-lb test, attached to end of mainline is a weighted, 24-ft section of 400-lb test clear monofilament (“backbone”); Ten gangions (200-lb test clear monofilament) are attached to the backbone; Hook size and type: one hook (either a 8/0, 11/0 or 15/0 Mustad 39960D) is attached to each gangion; Bait: Atlantic mackerel. Soak time: 5 min	AL: 120 sets per season, 240 sets total LA: 60 sets per quarter, 240 sets total

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
SEAMAP-GOM Offshore Plankton Survey, (LDWF)	Ichthyoplankton sampling occurs in the spring and fall in federal waters off the coast of LA to collect eggs and larvae. Samples are collected 24 hours a day.	Federal waters off the coast of LA	Annually, May and Sep, 8 DAS (4/season), 24 hour operations	USCG Class III: R/V *Acadiana* USCG R/V: R/V *Blazing Seven*, R/V *Point Sur*	Bongo net	Single frame with two 16 in cylindrical-conical nets; Tow speed: 1.5 kts Duration: < 30 min	25 tows
					Neuston net	3 ft x 6 ft opening, very small mesh (microns) Tow speed: 2 kts Duration: 10 min	25 tows
					CTD profiler	Duration: 10 min	20 casts
SEAMAP-GOM Plankton Survey, (ADCNR, LDWF, USM/GCRL)	Ichthyoplankton surveys are conducted to collect larvae for red drum, king mackerel and other species.	State and federal waters off the coast of AL, MS, LA, and FL. Three stations in AL state waters out to 360 ft depth. There are 9 fixed stations near Mobile Bay, AL, of which three are selected randomly.	AL: Annually, Aug-Sep, 2 DAS, day operations only LA: Annually, May, June, Sep, Oct, 10 DAS, day operations only MS/FL: Annually, May and Sep, 8 DAS, 24 hour operations	USCG Class III: R/V *A.E. Verrill*, R/V *Alabama Discovery*, R/V *Acadiana* USCG R/V: R/V *Blazing Seven*, R/V *Point Sur*	Bongo net	Single frame with two 16 in cylindrical-conical nets; Tow speed: 1.5 kts Duration: < 30 min	AL: 6 tows LA: 14 tows MS/FL: 20 tows
					Neuston net	3 ft x 5 ft opening, very small mesh (microns) Tow speed: 2 kts Duration: 10 min	AL: 6 tows LA: 14 tows MS/FL: 20 tows
					CTD profiler	Duration: 5-20 min	AL: 6 casts LA: 50 casts MS/FL: 20 casts
SEAMAP-GOM Plankton Survey, (SEFSC)	Assess the occurrence, abundance and geographical distribution of the early life stages of fishes. Describe the pelagic habitat of fish larvae through measurements of various physical and biological parameters. Map the distribution of fish eggs along the cruise track using a CUFES.	Coastal, shelf and open ocean waters of the GOM	Annually, Feb-Mar (winter), 30 DAS; Apr-May (spring), 60 DAS; Aug-Sep (fall), 36 DAS 24 hour operations	USCG R/V: R/V *Oregon II*, R/V *Gordon Gunter*, R/V *Pisces*	Bongo net	Single frame with two 61 cm cylindrical-conical nets, 0.202 or 0.335 mm mesh; Tow speed: 1.5 kts Duration: < 30 min	650 tows
					Neuston net	1 m x 2 m opening, 0.505 or 0.947 mm mesh Tow speed: 2 kts Duration: 10 min	650 tows
					MOCNESS	The 1 m x 1 m MOCNESS frame carries sensors and controls 6 to 20 nets. Sensors report conductivity (salinity), temperature, depth and volume filtered. Nets are 0.505 mm mesh. Tow speed: 2 kts Duration: < 60 min	378 tows
					Methot juvenile fish net	2.32 m x 2.24 m rigid aluminum frame outfitted with a 13.1 m long, 3 mm knotless mesh net. Tow speed: 3-4 kts Duration: < 60 min	126 tows
					CTD profiler and rosette water sampler	Duration: 30 min	756 casts
SEAMAP-GOM Reef Fish Monitoring, (FFWCC)	Objectives include monitoring relative indices of abundance of reef fishes, examining patterns in community structure, habitat associations, and regional catch, recruitment, demographics, and distribution through time.	West FL shelf from 26°N to Dry Tortugas, FL	Annually, July-Sep, 50 DAS, daylight hours only	USCG Class I & II: R/V *No Frills*, R/V *Gulf Mariner*, R/V *Sonic*, R/V *Johnson*, chartered fishing	2-camera array	Array is two Stationary Imaging System (SIS) units inside aluminum housing. Each SIS has one color video camera and two black-and-white stereo still cameras. Array is attached to a float by line; Soak time: 60 min	150 deployments

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
				vessels USCG Small R/V: R/V *Bellows*, R/V, R/V *Apalachee* USCG R/V: *Weatherbird*	Chevron fish trap	Chevron traps are 5.8 x 5 x 2 ft with 11 in diameter opening, 1.5 in vinyl-clad mesh; baited with Atlantic mackerel. Three traps are set at each station and each trap has a single vertical line (~2:1 scope) with a buoy attached (~2:1 scope) with a buoy attached Soak time: 90 min	300-450 sets
					CTD profiler	Duration: 5-15 min	300 casts
SEAMAP-GOM Reef Fish Survey, (SEFSC)	This survey targets reef fish species; results of survey are used for stock assessments and to support Fishery Management Plans. Information is also obtained about their biology, distribution, stock structure and status, and potential vulnerability to fishing pressure. Reef fish are sampled for hard parts for biological information.	Gulf-wide survey from Brownsville, TX to Key West, FL, in depths of 15-500 ft	Annually, Apr-Jul, 60 DAS, 24 hour operations on large vessels (cameras, traps, and bandit gear used in daytime only), daytime operations only on small vessels	USCG Class III: R/V *Caretta*, R/V *Gandy* USCG R/V: R/V *Pisces*, R/V *Oregon*	4-camera array	The camera array contains 16 color cameras with paired black-and-white Videre stereo cameras. The array is baited with squid, lowered to the bottom and attached to a float by line; Soak time: 30 min	400-600 deployments
					Chevron trap (discontinued use in 2013)	6 x 6 ft 'chevron' shaped trap with one 4 in entrance portal. Trap baited with squid or mackerel, weighted, submerged and fished on the bottom; Soak time: 1 hr	50-100 sets
					CTD Profiler	Duration: 5-20 min	400-600 casts
					Bandit Reels	Vertical mainline with 10 gangions, either deployed or attached to the vessel; Hook size and type: 8/0, 11/0, or 15/0 circle hook; Bait: mackerel; Soak time: 5 min	120 sets
					Acoustic Doppler Current Profiler	333 kHz	Continuous
					Simrad ME70 Multi-beam echosounder	70-120 kHz	Continuous
					EK60 Multi-frequency single-beam active acoustics	18, 38, 70, 120, and 200 kHz	Continuous
Surveys Using SCUBA Divers or Remotely Operated Vehicles (ROVs)							
FL/Dry Tortugas Coral Reef Benthic Survey, (SEFSC)	Survey includes scheduled-interval and episodic sampling of coral reef benthos to serve goals of protected species (coral) monitoring, coral reef, and habitat assessment.	Survey area encompasses federal and territorial waters from Dry Tortugas to Martin County, FL	Quarterly-annually, May-Oct, 100 DAS	USCG Class I & II: small vessels	SCUBA divers with measuring devices, cameras, and hand tools	Human divers collect benthic samples (algae and coral biopsies) and assess habitat	300 dives
IJA Oyster Visual Monitoring Survey, (MDMR)	Collect and analyze data on the condition of oyster reefs in MS to determine the number of live, marketable, and spawnable oysters; evaluate the incidence of predators or competitors and summarize the data. Collect and analyze data on spat density and success in selected areas.	MS state waters, 5-15 ft depths	Annually, Sep/Oct to Apr/May of following year, 12 DAS, day operations only. *Federal funding was suspended Sep 1, 2012 to Aug 31, 2013.	USCG Class I & II: R/V *Silvership*, R/V *Rookie*	SCUBA divers	SCUBA gear, 1 m squares All reef material and marine organisms obtained by sampling are analyzed on the boat and returned to the reef.	20 dives
Panama City Laboratory ROV Reef Fish Survey, (SEFSC) *Survey ended in 2011, not continued under the Preferred Alternative	Objectives include examining temporal and spatial patterns in abundance of exploited and non-exploited reef fishes, community structure, habitat associations, and size structure on a cross-shelf series of low relief (0.2-1.5 m) and high relief (up to 10 m) rocky reefs during daytime from 1 hr after sunrise until 1 hr before sunset	NE GOM, inner to mid-shelf off Panama City, FL, 25-50 m depths	Annually, Oct-Nov, 8 DAS, day operations only	USCG Class II & III: R/V *Harold B*, chartered dive vessel	Mini ROV	Mini ROV with color video camera and scaling lasers; 2-4 line transect surveys per reef followed by 30 min random search for cryptic and rare species and to collect size data using the scaling lasers.	17 deployments
					CTD profiler	Duration: 2-4 min	17 casts

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
Reef Fish Visual Census Survey – Dry Tortugas, (SEFSC)	Assess abundance and size of reef fishes, and characterize bottom habitat features	Dry Tortugas area in the GOM, <33m deep	Annually, May-Sep, 25 DAS, day operations only	USCG Class II & III: Chartered dive vessel	SCUBA divers with meter sticks, 30 cm rule and digital camera	Human divers visually collect data on the abundance and size of reef fish, and habitat features at randomly selected 15 m diameter plots	300 dives
Tortugas Ecological Reserve Survey, (SEFSC)	This survey employs scuba divers swimming 30 m replicate underwater transects to identify and count all species of snapper/grouper/other predators seen on the transect swim out, deploying a tape measure as they swim. Species of interest are counted to the limits of visibility.	Tortugas South Ecological Reserve, Florida Keys National Marine Sanctuary	Biennially, summer (June or July), 6 days, day and night 12 hour operations	USCG Class II & III: Chartered vessel	SCUBA divers, transect tape, clipboards/pencils	Human divers identify and count fish species seen on the transect swim	16 stations, each station done 2-3 times
ATLANTIC RESEARCH AREA							
Surveys Using Gillnets, Trammel Nets, or Fyke Nets							
ACFCMA American Eel Fyke Net Survey, (GDNR) *Survey ended after 2012 season, not continued under the Preferred Alternative	Collect young of year recruitment information on American eels entering Georgia's estuaries. Sampling begins in mid-December and continues for six consecutive weeks once the first pulse of migrating young of year eels is detected.	Altamaha Sound at two fixed sites in first order brackish water tributaries	Annually, Dec-Feb, 30 DAS, day operations only	No vessel. Sites assessable from shore.	Fyke nets	Wings 18.8 x 9 ft, 19 in diameter hoops, 37.6 ft headrope, 700 micron mesh, 1 in 2 checker board grate over net opening. Duration: 6 weeks	48 sets
					YSI 85 (Dissolved oxygen, salinity, temperature)	Duration: 5-15 min	48 casts
ACFCMA American Eel Fyke Net Survey, (SCDNR)	To monitor the ingress of elvers returning from the Sargasso Sea. This is evaluated by a fishery-independent data collection effort aimed at determining eel utilization and the abundance level of eel/elver recruitment to a single river. Sampling site is inland from the only area where elvers can be harvested commercially.	Goose Creek Reservoir or the Cooper River, near Charleston, SC, 1-7 ft depths	Annually, Feb-Apr, 32 DAS, day operations only	USCG Class A: John Boat - no motor, walk/wade to work net	Fyke net	Wings 18.8 x 9 ft, 19 in diameter hoops, 37.6 ft headrope, 700 micron mesh, 1 in 2 checker board grate over net opening. During the week, the end of the net is tied closed and sampled every 24 hours (i.e., once a day). No sampling occurs during the weekend and the net is untied to allow fish and eels to pass through. Duration: 8 weeks	1 station per day, 40 collections total
					Thermometer		32 casts
ACFCMA American Shad Drift Gillnet Survey, (SCDNR)	To demonstrate sustainability and determine spawning stock size. Fishery-independent data collection effort aimed at determining abundance and evaluating catch rates of adult American Shad in two major river systems in SC. All specimens are tagged and released.	Santee, Edisto, Waccamaw, Combahee Rivers, SC	Annual, Jan-Apr, (2-3 trips/week), 40 DAS, day operations only	USCG Class I: R/V *Bateau*, R/V *McKee Craft*	Drift gillnet	Single 5 in stretch mesh, no longer than 450 ft and 22 ft depth. The net is set adrift, constantly tended. Soak time: 20 min	4-5 sets/trip, 120 sets total
RecFIN Red Drum Trammel Net Survey, (SCDNR)	This survey targets red drum in SC. Results of survey are used for stock assessments and to support Fishery Management Plans. Information is also obtained about their biology, distribution, movements, stock structure and status, and potential vulnerability to fishing pressure. The study continues a long-term randomly stratified trammel net survey of SC estuaries that began in 1990.	Coastal estuaries and rivers of SC in depths of 6 ft or less along shoreline.	Annually, Jan-Dec, 120-144 DAS (14-18 days/month), day operations only	USCG Class I: Florida Mullet Skiffs	Trammel net	183 x 2.1 m trammel net fitted with a polyfoam float line and a lead core bottom line. Inner netting of 63.5 mm stretch-mesh sandwiched between a pair of outer panels of 355.6 mm stretched-mesh. Gear fished for approximately 10 min	1000 sets/ yr covering 225 stations/yr. Operates in 7-9 strata/month

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
Surveys Using Longline Gear							
HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Survey, (VIMS)	Fishery-independent survey designed to monitor the abundances of late-juvenile and adult shark species inhabiting the lower Chesapeake Bay and coastal waters off of Virginia since 1973. The data collected are used to inform a number of stock assessments, the program is considered one of the longest running fishery-independent survey efforts focused on the monitoring of shark abundances.	Chesapeake Bay and state and federal waters off Virginia	Annually, May-Oct (5 days/month), 30 DAS, day operations only	USCG Class III: R/V *Bay Eagle*	Bottom longline	Mainline length: 2,315 m (4.8 mm diameter tarred nylon) (anchored at each end and delineated at ends and every 20 gangions by a Norwegian buoy); 100-120 standard gangions/set; Hook size and type: 9/0 Mustad J-hook or 12/0 circle hook; Bait: Atlantic menhaden Soak time: 4 hrs	50 sets
					Hydrolab MS5 Sonde	Measures depth, temperature, salinity, dissolved oxygen concentration, and dissolved oxygen percent saturation.	50 casts
MARMAP Reef Fish Long Bottom Longline Survey, (SCDNR)	Bottom longline survey to monitor relative abundance and life history parameters of golden tilefish and other species that occur over soft (muddy) bottom habitat (tilefish grounds) in areas around 100 fathom depths.	South Atlantic Bight (between 27°N and 34°N, but mostly off GA and SC). Sampling occurs in federal waters. Depths from ~500 to 860 ft	Annually 1996-2012*, Aug-Oct, 10-20 DAS, day operations only *Halted in 2012 but will resume annually if funding obtained	USCG Small R/V: R/V *Lady Lisa*	Bottom longline	Mainline length: ~ 5,500 ft (weighted at both ends and a large surface float is attached to one end); 100 gangions/set (2 ft long, 200-lb test monofilament); Hook size and type: Mustad 14/0 non-stainless steel circle hook; Bait: whole squid; Soak time: 90 min	60 sets
					CTD profiler	Duration: 5-15 min	60 casts
MARMAP/SEAMAP-SA Reef Fish Survey, (SCDNR)	The objective is to collect fishery-independent data concerning species relative abundance, distribution, and habitat which provides valuable fishery information to managers, scientists, and students in the South Atlantic Bight region. Multiple gears are used to obtain life history samples of reef fishes (mostly species in the SAFMC snapper-grouper management complex), in particular age, reproductive and diet information. Bottom longlines are used to sample live bottom/reef area with considerable vertical relief, generally in waters deeper than 90 meters. Underwater video cameras investigate and verify bottom habitat.	South Atlantic Bight (between 27°N and 34°N)	Annually, year-round but primarily Apr-Oct, 70-120 DAS, day operations only	USCG R/V: R/V *Palmetto*	Chevron fish trap outfitted with two cameras	Chevron trap (1.7 x 1.5 x 0.6 m) with one video camera and one still camera; Bait: clupeids (e.g., menhaden); Soak time: 90 min	600 sets
					Bottom longline	Mainline length: 84 ft 20 gangions/set (2 ft long., 200-lb test monofilament), Mainline is weighted at both ends and a large surface float is attached to one end; Hook size and type: Mustad 14/0 non-stainless steel circle hook; Bait: whole squid. Soak time: ~90 min	200 sets
					Bandit reels	3/0 or 6/0 reels with Electramate motors. (30 lb and 50 lb test monofilament leaders respectively); 3 hooks per line; Hook size and type: non-stainless, non-offset circle hooks sizes 2/0-5/0, occasionally sizes up to 9/0 and non-offset J-hooks are used; Bait: squid and scad (*Decapterus* spp.); Soak times: 1-10 min/drop, with total fishing effort per bandit rig of ~15-90 min	400 sets
					CTD profiler	Duration: 5-15 min	300 casts

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
Pelagic Longline Survey-SA, (SEFSC) (See also effort conducted in the GOMRA)	This survey targets pelagic shark and fin fish species, results of survey are used for stock assessments and to support Fishery Management Plans. Information is also obtained about their biology, distribution, movements, stock structure and status, and potential vulnerability to fishing pressure. Surveys involve catching sharks on pelagic longline gear, measuring, attaching various tags, and releasing them alive. Random survey site selection based on significant oceanic (Gulf Stream or loop currents), or bathymetric features (continental shelf edge). Fin fish are sampled for hard parts for biological information.	Cape Hatteras, NC to Cape Canaveral, FL	Intermittent, Feb-May, 30 DAS, 24 hour operations	USCG R/V: R/V *Oregon II*	Pelagic Longline	Mainline length: 5 nm (4.0 mm diameter, 454 kg test monofilament); 100 gangions/set (2.0 mm diameter, 179 kg test); Hook size and type: 18/0 non-offset steel, 0.5 m length multi-strand leader (364 kg test), 50 bullet floats. Bait: Atlantic mackerel; Soak Time: 3 hr	100-125 sets
					CTD profiler	Duration: 10-20 min	100-125 casts
Shark and Red Snapper Bottom Longline Survey-SA, (SEFSC) (See also effort conducted in the GOMRA)	This survey targets shark and reef fish species, results of survey are used for stock assessments and to support Fishery Management Plans. Information is also obtained about their biology, distribution, movements, stock structure and status, and potential vulnerability to fishing pressure. Surveys involve catching sharks on longline gear, measuring, attaching various tags, and releasing them alive. Fin fish are sampled for hard parts for biological information.	Cape Hatteras, NC to Cape Canaveral, FL between bottom depths 9 - 183 m	Annually, July-Sep, 60 DAS, 24 hour operations	USCG Class III: R/V *Caretta* USCG R/V: R/V *Oregon II*, R/V *Gordon Gunter*;	Bottom longline	Mainline length: 1 nm (4.0 mm diameter, 454 kg test monofilament); 100 gangions/set (3.0 mm diameter, 332 kg test monofilament); Hook size and type: 15/0 circle hook. Bait: Atlantic mackerel; Soak Time: 1 hr	70 sets
					CTD profiler and rosette water sampler	Duration: 5-15 min	70 casts
					Neuston and bongo effort if needed to augment SEAMAP plankton objectives	Neuston net: 1 x 2 m opening with 0.505 or 0.947 mm mesh; Tow speed: 2 kts Duration: 10 min Bongo towing frame consists of two cylindrical nets, each 61 cm in diameter, fine mesh nets (0.202 or 0.335 mm). Stationary.	0-20 tows
SEAMAP-SA Red Drum Bottom Longline Survey, (NCDNR, SCDNR, GDNR)	Utilize proven fishery-independent methods to sample the adult red drum population to develop a better understanding of abundance, distribution and age composition of the stock, thereby allowing for more effective and responsible management of the stock. Tagging of red drum to gather information on migration and stock identification. A sub-sample of red drum is sacrificed for collection of biological information including age, reproductive activity, genetic composition of the stock, and stomach content analysis. Study conducted by three state cooperating agencies. Results made available to ASMFC, NMFS and members of the Red Drum Stock Assessment Committee for the red drum SEDAR.	NC: Pamlico Sound or in the nearshore waters of Ocracoke Inlet SC: Estuaries out to 10 miles in Winyah Bay, Charleston Harbor, St. Helena Sound, and Port Royal Sound GA: State and federal waters off the coast of GA and NE FL, (~ 32°05' N latitude to the north, 29°20'N latitude to the south, 80°30'W longitude to the east, and the coastline to the west.)	Annually NC: mid-July to mid-Oct (2 days/ week for 12 weeks), 24 DAS, 24 hour operations, primarily at night SC: Aug-Dec, day operations only 36 DAS GA: Apr-Dec (6 days/month), 54 DAS, day operations only	USCG Class II: 26 ft outboard USCG Class III: R/V *Marguerite*, R/V *Silver Crescent*	Bottom longline	Mainline length: 2,025-4,920 ft (500-660 lb test) (The mainline is weighted at both ends and large surface floats are attached to each end); Gangions 1.5-2 ft length, 200-275 lb test monofilament; NC: 100 hooks/set SC: 40 hooks/set GA: 60 hooks/set; Hook size and type: 15/0 Mustad tuna circle hook (0° offset) (GA may also use 12/0 circle hook, 0° offset, depressed barbs); Bait: readily available baitfish or squid (GA); Soak time: 30 min	NC: 75-100 sets total SC: 360 sets GA: 200-275 sets
					YSI (Dissolved oxygen, salinity, temperature)	Duration: 5-15 min	NC: 75-100 casts SC: 360 casts GA: 200-275 casts
Surveys Using Trawl Gear							
ACFCMA Ecological Monitoring Trawl Survey, (GDNR)	Trawl survey used to develop fishery-independent indices for Georgia's commercially and recreationally important crustaceans and finfish. Sampling occurs monthly year round in six of the nine sound systems and in state territorial waters	Georgia state waters out to three nm, 10-35 ft depths	Annually, Jan-Dec (7 days/month), 84 DAS, day operations only	USCG Class III: R/V *Anna*	Otter trawl	40 ft otter trawl (1 7/8 in stretch mesh), with 5 ft wooden doors and a tickler chain; Tow speed: 2.5 kts Duration: 15 min	42 trawls/month, 504 trawls total

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
	(0-3 nm.).				YSI 85 (Dissolved oxygen, salinity, temperature)	Duration: 5-15 min	504 casts total
ACFCMA Juvenile Stage Trawl Survey, (GDNR)	Trawl survey used to develop fishery-independent juvenile indices for Georgia's commercially and recreationally important crustaceans and finfish.	Creeks and rivers of three Georgia sound systems (Ossabaw, Altamaha, and St. Andrew)	Annually, Dec-Jan (3 days/month), 36 DAS, day operations only	USCG Class I: 19 ft Cape Horn; 25 ft Parker	Otter trawl	20 ft semi-balloon shrimp trawl net (1½ in stretch mesh), with 30 in wooden otter trawl doors and tickler chain; Tow speed: 2.5 kts Duration: 5 min	18 trawls/month, 216 trawls total
					YSI 85 (Dissolved oxygen, salinity, temperature)	Duration: 5-15 min	216 casts total
Atlantic Striped Bass Tagging Bottom Trawl Survey, (USFWS)	Cruise objective is to monitor, tag and release Atlantic migratory striped bass, as part of the ASMFC management program. Secondary objectives include tagging and release of other species: red drum, horseshoe crabs and spiny dogfish and winter skates. And opportunistically tag and release any incidentally encountered Atlantic sturgeon.	North of Cape Hatteras, NC, in state and federal waters, 30-120 ft depths	Annually, Jan-Feb, 14 DAS, 24 hour operations	USCG R/V: R/V *Oregon II*, R/V *Cape Hatteras*, R/V *Savannah*	65 ft high-opening bottom trawls	65 ft trawl net with 3.75 inch stretch nylon multifilament mesh cod end, up to two nets used simultaneously; Towing speed: 3 kts Duration: up to 30 min	200-350 trawls
Juvenile Sport Fish Trawl Monitoring in Florida Bay, (SEFSC)	This project surveys juvenile spotted seatrout and other sport fish as part of a monitoring and assessment program supporting the Comprehensive Everglades Restoration Project.	Florida Bay, FL	Annually, May-Nov, 35 DAS, day operations only	USCG Class I: R/V *Batou*	Otter trawl	11ft head rope; Tow speed: 4 kts Duration: 2 min	~500 trawls
SEAMAP-SA NC Pamlico Sound Trawl Survey, (NCDENR)	Trawl survey designed to monitor juvenile fish, shrimp, and crab abundance in Pamlico Sound and its bays and rivers. The survey is conducted to support stock assessments and management of finfish, shrimp, and crab species.	Pamlico Sound and the Pamlico, Pungo, and Neuse rivers in waters ≥6 ft deep	Annually, June and Sep, 20 DAS (10 days/month), day operations only	USCG Class III: R/V *Carolina Coast*	Otter trawl: paired mongoose-type Falcon bottom trawls	120-ft three-lead bridle with 34 ft footrope, 0.1875 in tickler chain, and 4 x 2 ft wooden doors. Codend is #30 twine with 1.5 in stretch mesh. Towing speed: 2.5 kts Duration: 20 min	54 trawls each month, 108 trawls total
					Ponar grab	Stationary sample of bottom sediment	54 casts each month, 108 total
					YSI 556 (Dissolved oxygen, salinity, temperature)	Duration: 5-15 min	54 casts each month, 108 total
					Secchi disk	Stationary soak at surface	54 casts each month, 108 total
SEAMAP-SA Coastal Trawl Survey, (SCDNR)	This survey provides long-term, fishery-independent data on the distribution and relative abundance of resident and transient fishes, elasmobranchs, decapod and stomatopod crustaceans, sea turtles, horseshoe crabs, and cephalopods that are accessible by high-rise trawls. Additional data recorded for priority species include measurements of length or width for all priority species, sex and individual weights for blue crab, sharks, and horseshoe crabs, and reproductive information on commercially important penaeid shrimp and blue crabs.	Cape Hatteras, NC to Cape Canaveral, FL in nearshore oceanic waters of 15-30 ft depth.	Annually, Apr-May (spring), July-Aug (summer), and Oct-Nov (fall), 60-65 DAS, day operations only	USCG Small R/V: R/V *Lady Lisa*	Otter trawl: paired mongoose-type Falcon bottom trawls	75-ft three-lead bridle with 86 ft head rope, 0.25 in tickler chain, and 10 ft x 40 in wooden chain doors. Codend is #30 twine with 1.625 in stretch mesh; Towing speed: 2.5 kts Duration: 20 min	300-350 trawls total, evenly divided between seasons
					SEABIRD electronic CTD	Duration: < 5 min	300-350 casts
SEFSC-SA TED Evaluations, (SEFSC)	Gear testing of various TED designs for the shrimp fishery. Paired comparison conducted aboard a twin rigged shrimp vessel owned and operated by University of Georgia. Directed sea turtle capture rate study with live feed video monitored TEDs installed in each trawl.	State and federal waters off Georgia and eastern FL	Annually, Nov-Apr, 10 DAS, 24 hour operations	USCG Class III: R/V *Georgia Bulldog*	Otter trawl: Mongoose shrimp trawls	Two 70 ft Mongoose shrimp trawls with 8 ft x 40 in wooden doors; Tow speed: 2.5 kts Duration: up to 4 hrs [A]	50 paired trawls

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
In-Water Sea Turtle Research (SCDNR)	This survey was initiated (permitted and funded) by NMFS in 2000 to conduct annual sampling to monitor the relative abundance, distributional patterns, demographic structure, and health of sea turtles in coastal waters of the SE U.S. Although the biological focus is primarily on sea turtles, all biota collected during the survey are identified and enumerated as appropriate.	Winyah Bay, SC to St. Augustine, FL in water depths of 15-45 ft	Annually, mid-May through late July to early Aug, 24-30 DAS, day operations only	USCG Class III: R/V *Georgia Bulldog* USCG Small R/V: R/V *Lady Lisa*	Paired flat net bottom trawls (NMFS Turtle Nets per Dickerson et al. 1995) with tickler chains	60 ft head-rope, 4-seams, 4-legs, and 2 bridles. Net body consisted of 4 in bar and 8 in stretch mesh, with top and sides made of #36 twisted nylon and bottom with #84 braided nylon twine. Cod end consisted of 2 in bar and 4 in stretch mesh. Tow speed: 2.8 kts Duration: 30 min	400-450 total trawls
Surveys Using Other Gears							
ACFCMA American Eel Pot Survey for Yellow-phase Eels, (GDNR)	Survey to monitor abundance of yellow-phase American eels as required under ASMFC's FMP for eels. Survey began in 2013 to replace research conducted by the ACFCMA American Eel Fyke Net Survey, (GDNR)	Georgia state waters in the Altamaha River System. Sampling is conducted during daylight hours. Depth ranges from 2 to 20 ft	Annually. Sampling monthly Nov-Apr. Based on water temp. 36 DAS (6 days/month), day operations only	USCG Class I: 19 ft Cape Horn, 18 ft skiff	Eel traps/pots with float	16 in by 20 in by 11in trap with ½ in by 1 in mesh. 3-2" openings to internal funnels. 1/8" inch nylon float line with a single bullet float (12" length). Majority are tied to limbs along river bank using 10-15 ft of float line depending on depth. A few pots (<5) are in the river, attached to up to 30 ft. of float line. Baited with horseshoe crabs and shrimp heads. Duration: 24-48 hr soak	30 stations (180 sets/month; 30 traps set each of 6 days)
Beaufort Bridgenet Plankton Survey, (SEFSC)	This is the longest consecutive ichthyoplankton ingress sampling program along the U.S. east coast (26 years). Fall/winter spawned larvae are collected during once-weekly sampling.	Pivers Island Bridge, NOAA Beaufort facility, Beaufort, NC	Annually, Nov-May (some years monthly Jan-Dec), night operations only	None	Plankton net	2 m^2 rectangular plankton net with 1 mm mesh, fitted with a flow meter. Duration: ~ 9 hr	20-52 tows
Environmental Influences on Pink Shrimp, (SEFSC) *Project conducted in 2012 & 2013 only, not continued under Preferred Alternative	This project collects pink shrimp in two coastal systems with contrasting environmental conditions and habitat and subjects them to in situ and exchanged locations (in shrimp cages) for comparison of survival and growth.	Florida Bay and Whitewater Bay, FL	Annually, June and Aug, 44 DAS (4 DAS collecting shrimp, 40 DAS tending cages), day operation only	USCG Class I: Small vessel	Miniature roller-frame trawl	0.5 m diameter mouth, 1 mm mesh; Tow speed: 5 kts Duration: 5 min	40 trawls
					Dip net	19 in diameter, ¼ in mesh	40 samples
					Bag seine	Two-part seine (1 mm mesh), main net is 5 x 16.5 ft with 5 ft PVC pole at each end and 4 in floats. Sock is 9 ft long and tapers from 50-10 in (closed cod end).	40 sets
					Shrimp cages	Each cage is 1.07 m in diameter and its benthic footprint is 0.899 m^2 surface area. Cage netting (2 mm mesh size) is supported vertically be three 1" PVC poles while its horizontal shape is maintained by two fiberglass hoops which are placed inside the netting at the top and mid-level of the cage and zip-tied to the vertical PVC supports. Cage height is 0.75 m, but deployed height is about 0.65.	4 cages in each of the two systems, 8 total
IBBEAM Project, (SEFSC)	This project surveys fish, epifauna (shrimp, crabs, and small fishes) and water temperature and salinity as part of a monitoring and assessment program supporting the Comprehensive Everglades Restoration Project.	Western shoreline of Biscayne Bay, FL	Annually, May-Oct (wet season) and Nov-Apr (dry season), 14 DAS, day operations only	USCG Class II & III vessels	Human divers	Mask and snorkel surveys along 60 m^2 belt-transects	100 dives
					Throw trap	Open-ended 1 m^2 aluminum box, 45 cm deep.	372 casts
Intraspecific Diversity in Pink Shrimp Survey, (SEFSC)	This project collects young pink shrimp for genetic analysis. Information on habitat and environmental conditions where juveniles are collected also noted. Adult pink shrimp will also be obtained from the Tortugas and Sanibel fisheries. The information will furnish information regarding the use of pink shrimp as an ecological indicator in South Florida ecosystem restoration projects affecting the quantity, quality, and timing of freshwater inflow to estuaries.	Florida Bay, Whitewater Bay, Fakahatchee Bay, Biscayne Bay, Sanibel shrimp fishery, Tortugas shrimp fishery	Annually, June-Aug, 16 DAS, day operations only	USCG Class I: R/V *Privateer*	Miniature roller-frame trawl	0.5 m diameter mouth, 1 mm mesh; Tow speed: 5 kts, Duration: 5 min	40 trawls
					Dip net	19 in. diameter, 0.25 in mesh	40 samples
					Bag seine	Two-part seine (1 mm mesh), main net is 5 x 16.5 ft with 5 ft PVC pole at each end and 4 in floats. Sock, located in center of net, is 9 ft long and tapers from 50-10 in (closed cod end).	40 sets

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
Marine Mammal and Ecosystem Assessment Survey-SA, (SEFSC)	Observational surveys are conducted to assess all cetacean species in U.S. Exclusive Economic Zone (EEZ) waters, or to focus on the ecology of a selected group of species. Sampling protocols include transects to assess the distribution and abundance of cetaceans. Project operates with MMPA section 10 directed research permit for the intentional takes of marine mammals during research but incidental takes with active acoustic gear or other gear is not covered under the directed research permit and is the reason for including this research in the scope of the PEA.	Southeastern U.S. Atlantic	Every three years, June-Sep, 60 DAS, 24 hour operations	USCG R/V: R/V *Gordon Gunter*	CTD profiler and rosette water sampler	Duration: 30 min	60 casts
					Expendable bathythermographs		300 units
					Acoustic Doppler Current Profiler	333 kHz	Continuous
					Simrad ME70 Multi-Beam echosounder	70-120 kHz	Continuous
					EK60 Multi-frequency single-beam active acoustics	18, 38, 70, 120, and 200 kHz	Continuous
					Passive acoustic arrays	Cables extend up to 600 m aft of the stern	Continuous
RecFIN Red Drum Electrofishing Survey, (SCDNR)	This survey targets red drum in SC. Results of survey are used for stock assessments and to support Fishery Management Plans. Information is also obtained about their biology, distribution, movements, stock structure and status, and potential vulnerability to fishing pressure. The study continues a long-term electrofishing survey of the upper estuaries that began in 2001.	Coastal estuaries and rivers of SC in depths of 6 ft or less in low salinity waters (0-12 ppt).	Annually, Jan-Dec, 60-72 DAS (5-6 days/month), day operations only	USCG Class I: Small vessels	18 ft elecrofishing boat	Electrofishing boat operating at ~3000 W pulsed direct current fishes for 15 minutes, The electric field is less than 20 ft around the electrofishing vessel. The boat drifts with the current or operates at idle speed along the river bank.	360 stations per year (30 sites/month)
St. Lucie Rod-and-Reel Fish Health Study, (SEFSC)	This project samples fish for the prevalence of externally visible abnormalities. Abnormality prevalence is an indicator of fish health and habitat quality. Most fish are released after screening for externally visible abnormalities. A small proportion is retained for histopathology.	Nearshore reef, inlet, and estuary of St. Lucie River, FL inlet system (Jupiter or Ft. Pierce, FL)	Annually, Jan-Dec, weekly, 156 DAS, day operations only	USCG Class I: Small vessels	Rodand-reel gear	Hook size and type: 10- or 17-lb test monofilament with a 1-ft monofilament leader and a No.7 Mustad hook; One line with one hook is fished at each station Bait: dead shrimp Soak time: 30 min	468 stations per year: 3/day x 3 day/wk
SEAMAP-SA Gag Ingress Study, (SCDNR)	Objective: to monitor ingress into estuarine nursery areas of juveniles of winter spawning commercially and recreationally important fish species, in particular gag (Mycteroperca microlepis), using juvenile fish collectors (Witham collectors).	In the vicinity of Swansboro, NC; Wilmington, NC; Georgetown, SC; Charleston, SC; Beaufort, SC; Savannah, GA; and Brunswick, GA	Annually, Mar-June, 100 DAS, day operations only	USCG Class I: Small vessels	Witham collectors	Witham collectors consist of air conditioner filter material folded over 18 x18 in PVC frame. Anchored with a single line and floated off the bottom in tidal creeks that are about 1 m deep at low tide. Collectors deployed ~ 100 ft apart.	15 sets (4 collectors at each set), 60 sets total
SEFIS (SEFSC)	Supplements and improves fishery-independent survey efforts for red snapper and other reef fish species in Atlantic waters using underwater video and chevron fish traps. SEFIS was established to work cooperatively with MARMAP/SEAMAP-SA to (1) increase sample sizes, (2) improve spatial coverage for the long-term reef fish trap survey, and (3) address potential gear efficiency limitations.	Cape Hatteras, NC, to St. Lucie Inlet, FL	Annually, Apr-Oct, 30-80 DAS, 24 hour operations (cameras & traps-daytime operations, acoustics anytime day or night)	USCG R/V: R/V *Nancy Foster*, R/V *Pisces*, R/V *Savannah*	Chevron fish trap outfitted with 2 high-definition video cameras.	6 x 6 ft trap with single 6 x 24 in oval opening; Bait: menhaden Soak time: 90 min	1200 deployments
					CTD profiler	Duration: 5-15 min	100-200 casts
					Simrad ME70 Multi-Beam echosounder	70-120 kHz	Continuous
					Multi-frequency single-beam active acoustics	18, 38, 120, and 200 kHz	Continuous
Surveys Using SCUBA Divers or Remotely Operated Vehicle (ROV)							
U.S. South Atlantic MPA Survey, (SEFSC)	ROV and acoustic mapping survey of five Marine Protected Areas off the southeast coast between Jacksonville, FL and Cape Fear, NC.	Jacksonville, FL to Cape Fear, NC on or near the continental	Annually, May-Aug, 14 DAS, 24 hour operations (ROV daytime operations, acoustics	USCG R/V: R/V *Pisces*,	ROV Phantom S2 vehicle with tether attached to CTD cable	Vehicle conducts visual transects over high relief bottom and stays within 5 m of bottom during survey.	10-40 deployments

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
		shelf edge at depths between 80 and 600 m	anytime day or night)	R/V *Nancy Foster*, R/V *Spree*	CTD profiler	Duration: 5-20 min	28 casts
					Simrad ME70 Multi-Beam echosounder	70-120 kHz	Every other night for 6-12 hrs
					EK60 Multi-frequency single-beam active acoustics	18, 38, 120, and 200 kHz	Every other night for 6-12 hrs
Reef Fish Visual Census Survey - Florida Keys/SE Florida Shelf, (SEFSC)	Assess abundance and size of reef fishes, and characterize bottom habitat features.	Florida Keys and SE Florida Shelf, <33 m deep	Annually, May-Sep, 25 DAS, day operations only	USCG Class I: R/V *Aldo Leopold*	SCUBA divers with meter sticks, 30 cm rule and digital camera	Human divers visually collect data on the abundance and size of reef fish, and habitat features at randomly selected 15 m diameter plots.	300 dives
CARIBBEAN RESEARCH AREA							
Surveys Using Other Gears							
Caribbean Plankton Recruitment Experiment, (SEFSC)	Develop fisheries-independent larval survey for commercial coral reef fish species in the U.S. Caribbean. Develop larval indices for snapper, parrot fish, and grouper, determine seasonal abundances, and population connections between islands and with the upstream sources.	Caribbean and Mexican waters	Bi-annually, Feb or June, 15 DAS, 24 hour operations	USCG R/V: R/V *Gordon Gunter*, R/V *Nancy Foster*	Bongo net	Bongo-towing frame consists of 2 circular frames, each 61 cm in diameter, connected by a central yoke to which the towing wire is attached; frame is fitted with 2 cylindrical-conical fine mesh nets. Tows are conducted from the surface down to 300 ft with samples collected approximately every 75 ft Duration: 5-15 min	75 tows
					MOCNESS	The 1 x 1 m MOCNESS holds nine 0.505 mm mesh nets, onducted at stations >75 m Duration: 30 min or less Tow speed: 1-2 kts	75 tows
					CTD profiler and rosette water sampler	Duration: 30 min	75 casts
Caribbean Reef Fish Survey, (SEFSC)	The objective is to determine the relative abundance of reef fish and elasmobranchs on the shelf waters of PR (PR) and U.S. Virgin Islands (USVI). Video cameras, fish traps, vertical lines and bottom longlines will be used during the cruise.	PR and USVI, continental shelf waters	Every two years, Mar-June, 40 DAS, 24 hour operations	USCG R/V: R/V *Pisces*, R/V *Oregon II*	Bandit Reels	Vertical mainline, deployed with buoy or attached to the vessel; 10 gangions/set; Hook size and type: 8/0 or 11/0 circle hook; Bait: mackerel; Soak time: 5 min	300 sets
					4-camera array	The camera array contains 16 color cameras with paired black-and-white Videre stereo cameras. The array is baited with squid, lowered to the bottom and attached to a float by line; Soak time: 30 min	400 deployments
					Chevron Traps	Chevron trap is 6 x 6 ft with 4 in diameter entrance, weighted, submerged and fished on the bottom: Bait: squid or mackerel; Soak time: 1 hr.	100 sets
					CTD profiler	Duration: 5-15 min	300 casts
					Simrad ME70 Multi-Beam echosounder	70-120 kHz	Continuous
					Acoustic Doppler Current Profiler	333 kHz	Continuous

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
					EK60 Multi-frequency single-beam active acoustics	18, 38, 70, 120, and 200 kHz	Continuous
Marine Mammal and Ecosystem Assessment Survey-C, (SEFSC)	Observational surveys are conducted to assess all cetacean species in U.S. EEZ waters, or to focus on the ecology of a selected group of species. Sampling protocols include transects to assess the distribution and abundance of cetaceans Project operates with MMPA section 10 directed research permit for the intentional takes of marine mammals during research but incidental takes with active acoustic gear or other gear are not covered under that permit and are the reason for including this research in the scope of the PEA.	U.S. Caribbean Sea	Every three years, June-Sep, 60 DAS, 24 hour operations	USCG R/V: R/V *Gordon Gunter*	CTD profiler and rosette water sampler	Duration: 30 min	60 casts
					Expendable bathythermographs		300 units
					Acoustic Doppler Current Profiler	333 kHz	Continuous
					Simrad ME70 Multi-Beam echosounder	70-120 kHz	Continuous
					EK60 Multi-frequency single-beam active acoustics	18, 38, 70, 120, and 200 kHz	Continuous
					Passive acoustic arrays	Cables extend up to 600m aft of the stern	Continuous
SEAMAP-C Finfish Rod-and-Reel Survey, (PR-DNER)	This survey targets lane snapper in the territorial waters of PR. Results of survey are used for stock assessments and to support Fishery Management Plans. Information is also obtained about their biology, distribution, movements, stock structure and status, and potential vulnerability to fishing pressure.	West and east coasts of PR in territorial and federal waters at 15-300 ft depths	Annually, Jan-Dec, 120 DAS, night operations only	USCG Class I & III: Three chartered vessels	Rod-and-reel gear	Rod-and-reel gear uses 80 lb test monofilament, 3 lines with 3 hooks per line are fished at each station; Hook size and type: #6 Mustad. Bait: squid; Soak time: 4 hrs.	120 stations (360 lines total)
SEAMAP-C Yellowtail Snapper Rod-and-Reel Survey, (PR-DNER)	This survey targets yellowtail snapper in the territorial waters of PR. Results of survey are used for stock assessments and to support Fishery Management Plans. Information is also obtained about their biology, distribution, movements, stock structure and status, and potential vulnerability to fishing pressure.	East, west, and south coasts of PR in territorial and federal waters at depths ranging from 15-300 ft	Annually beginning 2014, (4 sampling seasons), 120 DAS, night operations only	USCG Class I & III: Three chartered vessels	Rod-and-reel gear	Rod-and-reel gear uses 80 lb test monofilament, 3 lines with one hook per line are fished at each station; Hook size and type: #6 Mustad Bait: sardine; Soak time: 4 hrs	120 stations (360 lines total)
Surveys Using SCUBA Divers							
Caribbean Coral Reef Benthic Survey, (SEFSC)	Survey includes scheduled-interval and episodic sampling of coral reef benthos to serve goals of protected species (coral) monitoring, coral reef, and habitat assessment.	Federal and territorial waters around PR, USVI, and Navassa	Annual to triennial, May-Oct, 30 DAS, day operations only	USCG Class I & II: Small vessel <28 ft	SCUBA divers with measuring devices and hand tools	Human divers collect benthic samples (algae and coral biopsies), transect tapes, measurement rods, photography	300 dives
Reef Fish Visual Census Survey-U.S. Caribbean, (SEFSC)	Assess abundance and size of reef fishes and characterize bottom habitat features	PR and USVI waters < 100 ft deep	Annually, May-Sep, 25 DAS, day operations only	USCG Class I & II: Small vessel <24 ft	SCUBA divers with meter sticks, 30 cm rule and digital camera	Human divers visually collect data on the abundance and size of reef fish and habitat features at randomly selected 15 m diameter plots	300 dives
SEAMAP-C Queen Conch Visual Survey, (PR-DNER, USVI-DFW)	To assess the queen conch, Strombus gigas, resource within the territorial seas of the USVI, PR, and the contiguous EEZ. Results are used to support stock assessment and management of the fishery. Queen conch abundance and density will be estimated by visual census surveys conducted along predetermined compass headings by SCUBA divers using diver propulsion vehicles. There is no extraction and/or collection of queen conch.	PR and USVI territorial waters in 10-90 ft depths, some sampling occurs in federal waters	Annually, PR: July-Nov, 35 DAS USVI: June-Oct, 62 DAS, day operation only	USCG Class I & III: Three chartered vessels	SCUBA divers, SCUBA gear and underwater scooters	Human divers visually collect data on the abundance and density of queen conch.	PR: 100 dives USVI: 62 dives
SEAMAP-C Spiny Lobster Artificial Habitat Survey, (PR-DNER, USVI-DFW)	To assess juvenile spiny lobster, *Panulirus argus*, recruitment to artificial shelters within the territorial sea of the USVI, PR, and the contiguous EEZ. During each survey the number of juvenile lobsters will be counted within each shelter and carapace length will be determined to the nearest millimeter with a handheld caliper. There is no extraction and/or collection of the resource.	PR and USVI territorial waters in 6-90 ft depths	Annually, PR: Jan-Dec, 84 DAS USVI: Jan-Dec, 20 DAS, day operations only	USCG Class I & III: Three chartered vessels	Juvenile lobster artificial shelters	Shelters are composed of 16 cinder or breeze blocks, two levels of 8 blocks.	10 shelters, continuous deployment
					SCUBA divers, SCUBA gear and underwater scooters	Human divers visually collect data on the abundance of juvenile lobsters and measure carapace length.	PR: 60 dives USVI: 20 dives

A - Trawl projects designed to test bycatch reduction devices and TEDs for commercial fishing gear may have longer tow times (up to four hours). These exceptions to the short tow duration protocols are necessary to meet their research objectives. TEDs are used in nets that are towed in excess of 55 minutes as required by 50 CFR 223.206.

2.2.2 Mitigation Measures for Protected Species

The Status Quo Alternative is to perform fisheries and ecosystem research as it was conducted from 2008 through 2015, which consists of the research activities described in Table 2.2-1 (see also Appendix A for an illustrated description of different gear types used and Appendix B for a summary of the spatial/temporal distribution of research efforts). The Status Quo also includes mitigation measures that were developed and implemented in 2009 by the SEFSC in consultation with marine mammal and sea turtle scientists and other protected species experts and are currently implemented on SEFSC-affiliated surveys (e.g., monitoring methods and avoidance procedures). The SEFSC and its partners monitor and report if any seabird interactions occur but they have occurred only rarely and there are no specific mitigation measures in place to reduce seabird incidental takes.

For research conducted by cooperating partners, no specific mitigation measures were required under their current grants under the Status Quo Alternative, although they will be required under the Preferred Alternative. However, many of the research partners have voluntarily followed the same mitigation measures as the SEFSC. Research activities conducted by cooperating agencies and institutions that differ in protocols from those used by the SEFSC are noted in Table 2.2-1. Partner projects are also conducted by experienced researchers and fishermen using good seamanship and fishing practices to avoid hazardous situations (e.g., visual and sonar observations to look for commercial fishing gear or underwater obstacles prior to setting the research gear). If protected species had been seen during the reconnaissance period and were considered at risk of interaction with the gear, they would have been treated as a “hazard” and the sets would have been delayed or moved.

The procedures described here are based on protocols used during previous SEFSC-conducted research surveys and are the same whether the survey is conducted onboard a NOAA vessel or charter vessel. The SEFSC regularly reviews its procedures and investigates options for incorporating new mitigation measures and equipment into its ongoing survey programs. Evaluations of new mitigation measures include assessments of their effectiveness in reducing risk to protected species. Implementation of any such measures must also be subject to safety and practicability considerations, allow survey results to meet research objectives, and maintain compatibility with previous data sets.

Several SEFSC research activities included in this DPEA involve directed research on ESA-listed fish species (e.g., Smalltooth Sawfish Abundance Survey) or sea turtles (e.g., In-Water Sea Turtle Research). These projects have operated under ESA section 10 research permits issued by NMFS OPR and SEFSC will continue to apply for section 10 permits in the future. The intentional effects of the research activities on listed species has been and will continue to be assessed within the section 10 permit process and are not covered under this DPEA. The indirect or unintentional effects of that research on other resources are analyzed in this DPEA.

2.2.2.1 Ship Strikes

SEFSC-affiliated research vessels (NOAA vessels, NOAA chartered vessels, and research partner vessels) operating in the Atlantic adhere to several mitigation measures which were implemented to minimize the risk of vessel collisions with North Atlantic right whales. Other species also benefit from these measures. The compliance guide for the right whale ship strike reduction rule (NMFS 2008a) states that all vessels 65 feet in overall length or greater must slow to speeds of 10 knots or less in Seasonal Management Areas (SMAs). The Southeast U.S. SMA for right whale calving and nursery grounds ranges from southern Georgia to northern Florida in an area bounded to the north by latitude 31°27’N and by 29°45’N to the south and east to 80°51’36”W from November 15 through April 15. Mid-Atlantic SMAs include several port or bay entrances from northern Georgia to Rhode Island between November 1 and April 30. Dynamic Management Areas (DMAs) are temporary areas created around right whale sightings, the size of which depends on the number of whales sighted. Voluntary speed reductions may apply when no SMA is in effect.

When research vessels are actively sampling, cruise speeds are typically less than five knots, a speed at which the probability of collision and serious injury or mortality of large whales is low. When transiting between sampling stations, research vessels can travel at speeds of up to 14 knots but average 10 knots. However, when SEFSC vessels are operating in right whale SMAs, DMAs, or at times and locations when whales are otherwise known to be present, they operate at speeds no greater than 10 knots. In addition, SEFSC research vessel captains and crew watch for marine mammals while underway during daylight hours and take necessary actions to avoid them. There are currently no Marine Mammal Observers (MMOs) aboard the vessels dedicated to watching for marine mammals to minimize the risk of collisions, although the large NOAA research vessels (e.g., NOAA Ship *Pisces*) operated by the NOAA Office of Marine and Aviation Operations (OMAO), include one bridge crew dedicated to watching for obstacles at all times, including protected species. At any time during a survey or in transit, any bridge personnel that sights protected species that may intersect with the vessel course immediately communicate their presence to the helm for appropriate course alteration or speed reduction as soon as possible to avoid incidental collisions, particularly with large whales (e.g., North Atlantic right whales).

The Right Whale Early Warning System is a multi-agency effort that includes the SEFSC, the Florida Fish and Wildlife Conservation Commission (FWC), U.S. Coast Guard, U.S. Navy, and volunteer observers. Sightings of the critically endangered North Atlantic right whale are reported from aerial surveys, shipboard surveys, whale watch vessels, and opportunistic sources (U.S. Coast Guard, commercial ships, fishing vessels, and the general public). Whale sightings are reported in real time to the Right Whale Early Warning System network and information is disseminated to mariners within a half hour of a sighting. The program was designed to reduce collisions between ships and North Atlantic right whales by alerting mariners to the presence of the whales in near real time. All NOAA research vessels operating in North Atlantic right whale habitat participate in the Right Whale Early Warning System.

SEFSC staff and partners abide by all protection zone regulations and rules to protect manatees from vessel collisions and harassment in Florida inland waterways through vessel speed and operation restrictions (FWC 2014). The Florida Manatee Sanctuary Act, enacted in 1978, authorizes the FWC to regulate manatees, their habitat, and motorboat operation and speed in order to protect manatees from harmful collisions and harassment (FWC 2007). The Act declares the entire State of Florida a manatee "refuge and sanctuary." The Act also specifies numerous areas where FWC is authorized to regulate the operation and speed of motorboats and enables FWC to designate other areas of the state waters as being subject to regulation (FWC 2007). Definitions of zone types and boat speed regulations by county can be found in Rule Chapter 68C-22 of the Florida Administrative Code (FWC 2007). Additional authority to regulate boat speeds and establish boat speed zones to protect manatees in Florida lies with local municipalities and, on the federal level, the USFWS. In some areas, federal zones and state zones overlap, while in others there are only state or only federal zones (FWC 2007).

2.2.2.2 Take Reduction Plans

Incidental take of marine mammals in commercial fisheries has been and continues to be a serious issue in the Southeast region. In compliance with section 118 of the MMPA, NMFS has developed and implemented several Take Reduction Plans (TRPs) to reduce serious injuries and mortality of strategic marine mammal stocks that interact with certain commercial fisheries. Strategic stocks are those species listed as threatened or endangered under the ESA, those species listed as depleted under the MMPA, and those species with human-caused mortality that exceeds the Potential Biological Removal (PBR) for the species. The immediate goal of TRPs is to reduce serious injury and mortality for each species below PBR within six months of the TRP's implementation. The long-term goal is to reduce incidental serious injury and mortality of marine mammals from commercial fishing operations to insignificant levels approaching a zero serious injury and mortality rate, taking into account the economics of the fishery, the availability of existing technology, and existing state or regional fishery management plans. All SEFSC and partner surveys adhere to the relevant TRP requirements that are applicable to our research. Due to substantial differences between SEFSC research fishing practices (smaller gear size, spatial and temporal differences) and differences between scientific survey methodologies versus commercial fishing practices, the majority of SEFSC and partner scientific surveys fall below the requirements necessary to implement TRP regulations. Only the SEFSC MARMAP/SEAMAP-SA Reef Fish Survey (SCDNR) and SEFIS (SEFSC) surveys meet the requirements necessary to implement TRP regulations; both surveys abide by all the Atlantic Large Whale Take Reduction Plan (ALWTRP) requirements. If new surveys are added in the future, the SEFSC fisheries research programs would comply with the gear requirements and operational limits consistent with the TRPs.

The ALWTRP was developed to reduce serious injury and mortality of North Atlantic right, humpback, fin, and minke whales from Northeast/Mid-Atlantic lobster trap/pot, Atlantic blue crab trap/pot, Atlantic mixed species trap/pot, Northeast sink gillnet, Northeast anchored float gillnet, Northeast drift gillnet, Mid-Atlantic gillnet fishery, Southeastern U.S. Atlantic shark gillnet, and Southeastern Atlantic gillnet fisheries. A final rule was published in 1999 (64 Federal Register [FR] 7529) and numerous amendments and revisions have been made since. The ALWTRP is continually evolving as more is learned about why whales become entangled and how fishing practices can be modified to reduce entanglement risks (NMFS 2013b). The most recent revisions were finalized in May 2015 (80 FR 30367). Gear requirements vary by geographic area and date. Universal gear modification requirements and restrictions apply to all traps/pots and anchored gillnets, including: no floating buoy line at the surface; no wet storage of gear (all gear must be hauled out of the water at least once every 30 days); fishermen are encouraged, but not required, to maintain knot-free buoy lines; and all groundlines must be made of sinking line. Additional gear modification requirements and restrictions vary by location, date, and gear type. Additional requirements may include the use of weak links, and gear marking and configuration specifications. Detailed requirements may be found in the regional guides to gillnet and pot/trap gear fisheries available at http://www.greateratlantic.fisheries.noaa.gov/Protected/whaletrp/.

The intent of the Bottlenose Dolphin Take Reduction Plan (BDTRP) is to reduce serious injuries and mortalities of coastal bottlenose dolphins incidental to 13 Category I and II commercial fisheries, including gillnets, crab trap/pots, haul/beach seines, pound nets, stop nets, and purse seine gear (50 CFR 229.35). The following general requirements were implemented: spatial/temporal gillnet restrictions, gear proximity (fishermen must stay within a set distance of gear), gear modifications, for gillnets and Virginia pound nets, non-regulatory gear modifications for crab pots, and other non-regulatory conservation measures (71 FR 24776, April 26, 2006; 77 FR 45268, July 31, 2012; and 80 FR 6925, February 9, 2015). Currently, the SEFSC and research partners do not have any surveys that meet the requirements necessary to implement BDTRP regulations.

The Pelagic Longline Take Reduction Plan (PLTRP) addresses incidental serious injury and mortality of long-finned and short-finned pilot whales and Risso's dolphins in commercial pelagic longline fishing gear in the Atlantic. Regulatory measures include limiting mainline length to 20 nm or less within the Mid-Atlantic Bight (MAB) and posting an informational placard on careful handling and release of marine mammals in the wheelhouse and on working decks of the vessel (NMFS 2009a). Currently, the SEFSC uses gear that is only 5 nautical miles long and per PLTRP, uses the Pelagic Longline Marine Mammal Handling and Release Guidelines for any pelagic longline sets made within the Atlantic EEZ.

2.2.3 Mitigation Measures for Protected Species during Research with Bottom Trawl Gear

The SEFSC and research partners use a variety of bottom trawl gears for different research purposes. These trawl types include various shrimp trawls (otter, western jib, mongoose, Falcon), high-opening bottom trawls, and flat net bottom trawls (see Table 1-1 and Appendix A). All research activities conducted with these trawl gears follow the protocols described below. The SEFSC and its research partners also use modified beam trawls and benthic trawls pulled by hand that are not considered to pose a risk to protected species due to their small size and very short tow durations (see section 2.2.10).

2.2.3.1 Monitoring Methods

Prior to arrival on station, during operations, and during retrieval, the officer, crew members, and scientific party on watch visually scan for protected species during all daytime operations. Binoculars are used as necessary to survey the area while approaching and upon arrival at the station, during visual and sonar reconnaissance of the trawl line to look for potential hazards (e.g., commercial fishing gear, unsuitable bottom for trawling, etc.), while the gear is deployed and during haulback. If possible, trawl sampling is conducted prior to any other sampling (e.g., water quality, environmental parameters). However, some survey protocols require environmental data to be collected prior to deployment of the trawl. When that is the case, scientists and crew operating the CTD are also scanning the peripheral sampling area around the vessel for the presence of protected species. Monitoring occurs for approximately 15 minutes during the CTD cast. Once the CTD is complete, the trawl is deployed. If protected species are sighted prior to setting the trawl gear or at any time the gear is in the water, the bridge crew and Scientific Watch Leader (SWL) are alerted immediately. Environmental conditions (lighting, sea state, precipitation, fog, etc.) often limit the distance for effective visual monitoring of protected species.

2.2.3.2 Operational Procedures

"Move-on" Rule. If any protected species are sighted around the vessel before gear deployment, gear is not deployed unless those animals do not appear to be in danger of interactions with the gear (e.g., moving away from deployment site), as determined by the judgment of the Field Party Chief (FPC) or SWL. Strategies are based on the species encountered, their numbers and behavior, their position and vector relative to the vessel, and other factors. For instance, a whale transiting through the area and heading away from the vessel may not require any move, or may require only a short move from the initial sampling site, while a pod of dolphins gathered around the vessel may require a longer move from the initial sampling site or possibly cancellation of the station if the dolphins follow the vessel. The FPC or SWL may also elect to stay at the station site and monitor the area to see if the marine mammals leave the site. This decision is made at the FPC or SWLs discretion and often depends on the number of marine mammals present, distance to the next station, and environmental conditions.

If trawling operations have been delayed because of the presence of protected species, the vessel resumes trawl operations only when these species have not been sighted within 15 minutes or otherwise determined to no longer be at risk. This decision is at the discretion of the FPC or SWL and is dependent on the situation.

Once the trawl net is in the water, if protected species are sighted before the gear is fully retrieved, the most appropriate response to avoid incidental take is determined by the professional judgment of the FPC or SWL in consultation with the officer on watch. These judgments take into consideration the species, numbers, and behavior of the animals, the location of the animals relative to the gear, the status of the trawl net operation (net opening, depth, and distance from the stern), the time it would take to retrieve the net, and safety considerations for changing speed or course. In some situations, risk of adverse interactions may be diminished by continuing to trawl with the net at depth until the marine mammals and/or sea turtles have left the area before beginning haul-back operations. In other situations, swift retrieval of the net may be the best course of action. The appropriate course of action to minimize the risk of incidental take of protected species is determined by the professional judgment of the FPC or SWL based on all situational variables, even if the choices compromise the value of the data collected at the station.

Care is taken when emptying the trawl, including opening the cod end as close as possible to the deck of the checker (or sorting table) in order to avoid damage to protected species that may be caught in the gear but are not visible upon retrieval. The gear is emptied as quickly as possible after retrieval in order to determine whether or not protected species are present.

2.2.3.3 Tow Duration

In 2008, standard tow durations for bottom trawl surveys (Table 2.2-1) were reduced from 55 minutes to 30 minutes or less at targeted depth, excluding deployment and retrieval time. These short tow durations decrease the opportunity for curious marine mammals to find the vessel and investigate. Tow times are less than the 55 minute tow time restriction required for commercial shrimp trawlers not using turtle excluder devices (TEDs) (50 CFR 223.206). The resulting tow distances are typically one to two nautical miles or less, depending on the survey and trawl speed. Short tow times reduce the likelihood of capturing protected species and also minimize the risk of captured sea turtles drowning.

2.2.4 Mitigation Measures for Protected Species during SEFSC Conservation Engineering Trawl Research

Conservation engineering research conducted by the SEFSC is primarily carried out by the Harvesting Systems Unit at Mississippi Labs in Pascagoula, Mississippi. Independent research is conducted aboard NOAA small vessels, contracted state vessels, or contracted commercial vessels. The primary focus of the research is the development of sea turtle and finfish bycatch mitigation measures for commercial trawl fisheries. The majority of the work focuses on shrimp trawls with a variety of trawl designs used to conduct this research. This research is covered under a Section 10(a)(1)(A) permit for sea turtles; incidental captures are authorized for smalltooth sawfish (three over the five-year permit period) and Atlantic sturgeon (four per year).

2.2.4.1 Monitoring Methods

Conservation engineering trawl research surveys occur on small vessels with a limited number of scientists and crew. Before the net is set, while the net is being deployed, during the soak, and during haulback the scientists and crew monitor the waters around the vessel and maintain a lookout for protected species.

2.2.4.2 Operational Procedures

“Move-on” Rule. If protected species are sighted around the vessel before gear deployment, gear is not deployed unless those animals do not appear to be in danger of interactions with the gear, as determined by the judgment of the FPC or SWL. The vessel may be moved or gear deployment may be delayed until the animals no longer appear to be at risk of interaction with the gear.

If trawling operations have been delayed because of the presence of protected species, the vessel resumes trawl operations only when these species have not been recently sighted or otherwise determined to no longer be at risk. This decision is at the discretion of the FPC or SWL and is dependent on the situation.

Once the trawl net is in the water, if protected species are sighted before the gear is fully retrieved, the most appropriate response to avoid incidental take is determined by the professional judgment of the FPC or SWL in consultation with the vessel operator. These judgments take into consideration the species, numbers, and behavior of the animals, the location of animals relative to the gear, the status of the trawl net operation (net opening, depth, and distance from the stern), the time it would take to retrieve the net, and safety considerations for changing speed or course. In some situations, risk of adverse interactions may be diminished by continuing to trawl with the net at depth until the protected species have left the area before beginning haul-back operations. In other situations, swift retrieval of the net may be the best course of action. The appropriate course of action to minimize the risk of incidental take of protected species is determined by the professional judgment of the FPC or SWL based on all situational variables, even if the choices compromise the value of the data collected at the station.

Care is taken when emptying the trawl, including opening the cod end as close as possible to the deck of the checker (or sorting table) in order to avoid damage to protected species that may be caught in the gear but are not visible upon retrieval. The gear is emptied as quickly as possible after retrieval in order to determine whether or not protected species are present.

2.2.4.3 Tow Duration

Trawl projects designed to test bycatch reduction devices (BRDs) and TEDs for commercial fishing gear may have longer tow times (up to four hours). These exceptions to the short tow duration protocols are necessary to meet research objectives. TEDs are used in nets that are towed in excess of 55 minutes as required by 50 CFR 223.206. When research objectives prevent the installation of TEDs in all trawls used, tows will be no longer than 30 minutes unless specific fisheries regulations exist requiring tow time limits in lieu of TEDs. In these cases, tow time limits will match those set by regulations such as the skimmer trawl fishery which has a 55 min tow time limit.

2.2.4.4 Turtle Excluder Devices

SEFSC BRD Evaluations and SEFSC-SA TED Evaluations install TEDs in each trawl to mitigate for sea turtle interactions and any potential sturgeon or sawfish interactions.

SEFSC-GOM TED Evaluations and SEFSC Skimmer Trawl TED Testing use TEDs in one net and have 55 minute tow times. The SEFSC Small Turtle TED Testing and Gear Evaluations either use TEDs or leave the tailbag untied so that captured animals are able to escape.

2.2.4.5 Live Feed Video/sonar Trawl Monitoring

In some cases live feed video or sonar monitoring of the trawl is used in lieu of tow time limits. This mitigation measure is also used in addition to TEDs during some projects. Video or sonar feeds are monitored for the duration of the tow. If a TED is not installed in the trawl and a protected species is observed in the trawl then the tow is immediately terminated. If a TED is installed and a protected species (excluding marine mammals) is observed in the trawl then the individual is monitored for exclusion from the trawl through the TED. If the species observed is a marine mammal or the individual has trouble escaping through the TED opening, or the individual is lost from the video or sonar feed then the tow is immediately terminated.

2.2.4.6 Diver Monitored Trawls

During diver assisted gear evaluations (SEFSC Small Turtle TED Testing and Gear Evaluations), dive teams are deployed on the trawls while they are being towed. During this research, divers actively monitor the gear for protected species interactions and use emergency signal floats to notify the vessel if an interaction occurs. When the signal float is deployed the vessel terminates the tow and slows the gear down to a minimal forward speed of less than 0.5 knots, which allows divers to assist the protected species escape.

2.2.4.7 Skimmer Trawls

The SEFSC began using skimmer trawls in their TED testing in 2012. Skimmer trawls differ from most other trawls in that vessels push nets in shallow, nearshore waters as opposed to otter trawls that pull the nets and are not as limited by water depth. A skimmer trawl consists of an L-shaped frame constructed from metal pipe, which keeps the trawl mouth open. Skimmer frames keep the net on the bottom but are flexible to glide over obstacles. Skimmer trawls are fished from booms on either side of the vessel. Nets remain in the water in the fishing configuration while the codend is emptied; allowing fishers to more quickly retrieve the catch. Interactions with bottlenose dolphins in 2013 and 2014 resulted in additional mitigation measures required for skimmer trawls.

- Additional mitigation measures are implemented to reduce bottlenose dolphin takes for TED testing in skimmer trawls (Permit No. 16253-01; modified October 2014).
- Trawling must not be initiated when marine mammals, except dolphins or porpoises, are observed within the vicinity of the research, and the marine mammals must be allowed to either leave or pass through the area safely before trawling is initiated.
- Researchers must make every effort to prevent interactions with marine mammals. Researchers must be aware of the presence and location of these animals at all times as they conduct trawling activities.
- During skimmer trawl surveys, a minimum of two staff, one on each side (port/starboard) of the vessel, must inspect the gear every five minutes to monitor for the presence of marine mammals.
- Prior to retrieving the skimmer trawl tail bag, the vessel must be slowed from the active towing speed to 0.5-1.0 knots.
- If a marine mammal enters the net, becomes entangled or dies, researchers must:
  - Stop trawling activities and immediately free the animal
  - Notify the appropriate NMFS Regional Stranding Coordinator as soon as possible
  - Report the incident as specified in Condition E.2.
  - Permitted skimmer trawling activities will be suspended until the Permits Division has granted approval to continue research per Condition E.2.

2.2.5 Mitigation Measures for Protected Species during Research with Oceanic Deep-water Trawl Gear in Deep Water (500-800 meters deep)

2.2.5.1 Monitoring Methods

Additional mitigation measures are imposed on Oceanic Deep-water Trawl surveys due to the known potential for lethal interactions with mid-water trawl gear. Deep-water trawls also occur in oceanic waters where marine mammal species diversity is greatly increased. Oceanic species often travel in very large groups and are less likely to have prior encounters and experience with trawl gear than inshore bottlenose dolphins. Prior to arrival on station, during operations, and during retrieval, the officer, crew members, and scientific party on watch visually scan for protected species during all daytime trawling operations. Bridge binoculars are used as necessary to survey the area as far as environmental conditions (lighting, sea state, precipitation, fog, etc.) will allow. Additionally, at least 30 minutes prior to the planned start of putting the trawl net into the water, a scientist that is a trained protected species observer visually scans the waters surrounding the vessel for protected species. Designated crew also monitor for protected species while the gear is deployed. If any protected species are sighted by the bridge or deck crew prior to or after setting the gear, the bridge crew and/or FPC and SWL are alerted as soon as possible. Environmental conditions (lighting, sea state, precipitation, fog, etc.) often limit the distance for effective visual monitoring of protected species.

2.2.5.2 Operational Procedures

"Move-on" Rule. If protected species are sighted anywhere around the vessel (within two nautical miles) in the 30 minutes before gear deployment, gear is not deployed unless those animals do not appear to be in danger of interactions with the gear, as determined by the judgment of the FPC or SWL. The vessel may be moved or gear deployment may be delayed until the animals no longer appear to be at risk of interaction with the gear. Small moves within the sampling area can be accomplished without leaving the sample station. After moving on, if protected species are still visible from the vessel and appear to be at risk, the officer on watch may decide to move again or to skip the station. The officer on watch will consult with the FPC or SWL to determine the best strategy to avoid potential takes of these species. Strategies are based on the species encountered, their numbers and behavior, their position and vector relative to the vessel, and other factors. For instance, a whale transiting through the area and heading away from the vessel may not require any move, or may require only a short move from the initial sampling site, while a pod of dolphins gathered around the vessel may require a longer move from the initial sampling site or possibly cancellation of the station if the dolphins follow the vessel. In most cases, trawl gear is not deployed if protected species have been sighted from the ship in the previous 30 minutes unless those animals do not appear to be in danger of interactions with the trawl, as determined by the judgment of the FPC or SWL in consultation with the officer on watch. The efficacy of the "move-on" rule is limited during night time or other periods of limited visibility; research gear is deployed as necessary when visibility is poor, although operational lighting from the vessel illuminates the water in the immediate vicinity of the vessel during gear setting and retrieval.

During oceanic deep-water trawl surveys, trawl operations are usually the first activity undertaken upon arrival at a new station in order to reduce the opportunity to attract protected species to the vessel. The order of gear deployment is determined on a case-by-case basis by the FPC or SWL based on environmental conditions and sonar information at the sampling site. Other activities, such as water sampling or plankton tows, are conducted in conjunction with, or upon completion of, trawl activities.

Once the trawl net is in the water, the officer on watch, FPC or SWL, and/or crew standing watch continue to monitor the waters around the vessel and maintain a lookout for protected species as far away as environmental conditions allow (as noted previously, visibility can be limited for various reasons). If protected species are sighted before the gear is fully retrieved, the most appropriate response to avoid incidental take is determined by the professional judgment of the FPC or SWL, in consultation with the officer on watch. These judgments take into consideration the species, numbers, and behavior of the animals, the status of the trawl net operation (net opening, depth, and distance from the stern), the time it would take to retrieve the net, and safety considerations for changing speed or course. Most marine mammals have been caught during haul-back operations, especially when the trawl doors have been retrieved and the net is near the surface and no longer under tension. In some situations, risk of adverse interactions may be diminished by continuing to trawl with the net at depth until the protected species have left the area before beginning haul-back operations. In other situations, swift retrieval of the net may be the best course of action. The appropriate course of action to minimize the risk of incidental take of protected species is determined by the professional judgment of the FPC or SWL based on all situation variables, even if the choices compromise the value of the data collected at the station.

If trawling operations have been delayed because of the presence of protected species, the vessel resumes trawl operations (when practicable) only when these species have not been sighted within 30 minutes or are determined to no longer be at risk (e.g., moving away from deployment site). This decision is at the discretion of the FPC or SWL and is dependent on the situation.

Care is taken when emptying the trawl, including opening the cod end as close as possible to the deck of the checker (or sorting table) in order to avoid damage to protected species that may be caught in the gear but are not visible upon retrieval. The gear is emptied as quickly as possible after retrieval in order to determine whether or not protected species are present.

2.2.6 Mitigation Measures for Protected Species during Research with Bottom and Pelagic Longline Gear

2.2.6.1 Monitoring Methods

Prior to arrival on station, during operations, and during retrieval of the gear, the officer, crew members, and scientific party on watch visually scan for protected species during daytime operations. Binoculars are used as necessary to survey the area while approaching and upon arrival at the station, while the gear is deployed, and during haulback. Additional monitoring is conducted 15 minutes prior to setting the longline gear by members of the scientific crew that monitor from the back deck while baiting hooks. If protected species are sighted prior to setting the gear or at any time the gear is in the water, the bridge crew and SWL are alerted immediately. Environmental conditions (e.g., lighting, sea state, precipitation, fog, etc.) often limit the distance for effective visual monitoring of protected species. Additional monitoring, beginning 30 minutes prior to the arrival on station, occurs on pelagic longline surveys due to the known potential for leathal interactions with gear.

2.2.6.2 Operational Procedures

"Move-on" Rule. If protected species are sighted around the vessel before gear deployment, gear is not deployed unless those animals do not appear to be in danger of interactions with the gear, as determined by the judgment of the FPC or SWL. The vessel may be moved or gear deployment may be delayed until the animals no longer appear to be at risk of interaction with the gear. Strategies are based on the species encountered, their numbers and behavior, their position and vector relative to the vessel, and other factors. For instance, a whale transiting through the area and heading away from the vessel may not require any move, or may require only a short move from the initial sampling site, while a pod of dolphins gathered around the vessel may require a longer move from the initial sampling site or possibly cancellation of the station if the dolphins follow the vessel. The FPC or SWL may also elect to stay at the station site and monitor the area to see if the marine mammals leave the site. This decision is made at the FPC or SWLs disgression and often depends on the number of marine mammals present, distance to the next station and environmental conditions.

If longline operations have been delayed because of the presence of protected species, the vessel resumes longline operations only when these species have not been sighted within 15 minutes or otherwise determined to no longer be at risk. This decision is at the discretion of the FPC or SWL and is dependent on the situation.

Longline gear is always the first equipment or fishing gear to be deployed when the vessel arrives on station. Longline gear is set immediately upon arrival at each station.

If sea turtles or marine mammals are detected during setting operations or while the gear is in the water and are considered to be at risk (e.g., moving towards deployment site, displaying behaviors of potential interacting with gear, etc.), the FPC or SWL in conjunction with the officer on watch exercise professional judgment and discretion to avoid incidental take of these species with longline gear as described for trawl gear. Halting the setting operations and retrieval of set gear may be warranted. Haul-back may be postponed if the protected species are considered to be at risk. The species, number, and behavior of the protected species are considered along with the status of the ship and gear, weather and sea conditions, and crew safety factors. The FPC or the SWL uses professional judgment and discretion to minimize the risk of potentially adverse interactions with protected species during all aspects of longline survey activities.

Hooks vary in size depending on the target species but are typically 15/0 circle hooks for bottom longline gear and 18/0 circle hooks for surface or pelagic longline gear. No stainless steel hooks are used in the SEFSC surveys so that in the event the hook cannot be removed, it will corrode. Finfish bait (e.g., mackerel, striped mullet, spot) and non-offset circle hooks are used instead of J-hooks to reduce the incidental capture of sea turtles, with the following exceptions:

- The HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Survey (VIMS) has been conducted since 1973. The standard hook used throughout the time series has been a 9/0 J carbon-steel Mustad hook (7698BD). Given that this survey represents the world's longest-running, fishery-independent program designed to sample sharks, our preference has been to continue with use of this gear so as not to disrupt the time series of abundance data generated by this effort.
- The SEAMAP-SA Red Drum Bottom Longline Survey (GDNR) has used squid almost exclusively since 2007.
- The MARMAP Reef Fish Long Bottom Longline Survey (SCDNR) uses squid as bait.

All SEFSC bottom and pelagic longline sets are conducted with gear marked at both ends with buoys (Appendix A). Soak time is defined as the time the last highflyer enters the water to the time the first highflyer is retrieved. Setting and hauling the gear is not included in the soak time. Bottom longline sets have a one hour soak time while pelagic sets typically have a three hour soak time, with the following exceptions:

- The HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Survey (VIMS) standard soak time has been four hours since its inception in 1973.
- The MARMAP Reef Fish Long Bottom Longline Survey (SCDNR) and MARMAP/SEAMAP-SA Reef Fish Survey (SCDNR) longline gear is buoyed to the surface with a line and buoy on only one end. Bottom longline sets have a 90 minute soak time which was established in 1972.
- The SEAMAP-SA Red Drum Bottom Longline Survey (SCDNR) has a 30 minute soak time to keep red drum and coastal sharks in good condition for tag and release procedures.

In all pelagic longline sets, gear configuration allows a potentially hooked sea turtle or marine mammal the ability to reach the surface (i.e., gangions are 110 percent as long as the drop line depth).

SEFSC longline protocols specifically prohibit chumming (releasing additional bait to attract target species to the gear).

Per PLTRP, the SEFSC pelagic longline survey uses the Pelagic Longline Marine Mammal Handling and Release Guidelines for any pelagic longline sets made within the Atlantic EEZ.

2.2.7 Mitigation Measures for Protected Species during Research with Other Hook-and-Line Gear (Bandit Reel/Vertical Line Gear and Rod and Reel Deployments)

2.2.7.1 Monitoring Methods

Many hook-and-line surveys occur in conjunction with video monitoring surveys. When this occurs, the camera array is deployed first and soaks for 60 minutes. Scientists on duty monitor the site for protected species 15 minutes prior to deploying the bandit gear, while the gear is in the water, and during haulback. On dedicated hook-and-line only surveys, the officer, crew members, and scientific party on watch visually scan for protected species during all daytime operations. Binoculars are used as necessary to survey the area while approaching and upon arrival at the station, while the gear is deployed, during soak time, and during haulback. If any protected species are sighted by the scientific, bridge, or deck crew prior to setting the gear or at any time the gear is in the water, the bridge crew and FPC are alerted immediately. Environmental conditions (lighting, sea state, precipitation, fog, etc.) often limit the distance for effective visual monitoring of protected species.

2.2.7.2 Operational Procedures

"Move-on" Rule. If protected species are sighted around the vessel before gear deployment, gear is not deployed unless those animals do not appear to be in danger of interactions with the gear, as determined by the judgment of the FPC or SWL. The vessel may be moved or gear deployment may be delayed until the animals no longer appear to be at risk of interaction with the gear. Strategies are based on the species encountered, their numbers and behavior, their position and vector relative to the vessel, and other factors. For instance, a whale transiting through the area and heading away from the vessel may not require any move, or may require only a short move from the initial sampling site, while a pod of dolphins gathered around the vessel may require a longer move from the initial sampling site or possibly cancellation of the station if the dolphins follow the vessel.

Soak time is standardized to 5-10 minutes per gear deployment. Leftover bait is not discarded overboard while actively fishing. Tackle is inspected daily to avoid unwanted line breaks.

If protected species are detected during setting operations and are considered to be at risk, immediate retrieval or halting the setting operations may be warranted, as determined by the judgment of the FPC or SWL.

On the SEAMAP-GOM Reef Fish Survey (NMFS), if setting operations have been halted due to the presence of protected species, setting does not resume. The SEAMAP vertical line survey is piggy-backed onto the SEAMAP reef fish video survey, and only 50 percent of those video sites are subsampled, therefore the vessel simply moves to the next site rather than waiting.

On all other vertical line surveys if setting operations have been halted due to the presence of protected species, setting may or may not resume. In some cases fishing operations are delayed and the vessel resumes operations when animal(s) have not been sighted within 15 minutes or are determined to no longer be at risk. In other instances, the station is dropped or moved. This decision is at the discretion of the FPC or SWL and is dependent on the situation.

2.2.8 Mitigation Measures for Protected Species during Research with Gillnet and Trammel Net Gear

2.2.8.1 Monitoring Methods

Gillnet and trammel net research activities occur on small vessels with a limited number of scientists. Monitoring begins 15 minutes prior to deploying the gear. Before the net is set, while the net is being deployed, during the soak, and during haulback, the scientists monitor the net and waters around the net, maintaining a lookout for protected species.

2.2.8.2 Operational Procedures

Gear is fished in daylight hours only, primarily in shallow water. The RecFIN Red Drum Trammel Net Survey (SCDNR) is fished exclusively in shallow water.

Prior to setting the net, scientific crew members conduct a 360° visual scan of the peripheral sampling area for the presence of protected species. Gillnets and trammel nets are not deployed if protected species have been sighted on arrival at the sample site. The exception is for animals that, because of their behavior, travel vector or other factors, do not appear to be at risk of interaction with the gillnet/trammel net gear. For instance, a dolphin transiting through the area and heading away from the vessel may not require any move, or may require only a short move from the initial sampling site, while a pod of dolphins gathered around the vessel may require a longer move from the initial sampling site or a possible cancellation of the station. If protected species are observed in the vicinity of the vessel, deployment of sampling gear does not occur until the animal(s) have not been sighted within 15 minutes or are determined to no longer be at risk.

If protected species are not present, the gear is set and continuously monitored during the soak. If protected species are sighted during the soak and appear to be at risk of interaction with the gear, then the gear is pulled immediately. If fishing operations are halted, operations resume when animal(s) have not been sighted within 15 minutes or are determined to no longer be at risk, as determined by the judgment of the FPC or SWL. In other instances, the station is moved or cancelled.

Nets are checked for large holes and repaired regularly. Scientists use the minimum amount of line necessary to set the gear to ensure that there is limited floating line in the water which could entangle protected species.

On GULFSPAN and IJA Coastal Finfish (MDMR) gillnet surveys, gear soak time does not exceed one hour, excluding setting and hauling of gear. The net is monitored continuously and checked immediately if any disturbance is observed in the gear. If protected species are sighted during the soak and appear to be at risk of interaction with the gear, then the gear is pulled immediately. The site is then monitored for 15 minutes and the gear is set again if the animal(s) no longer appear at risk. This decision is at the discretion of the FPC and is dependent on the situation.

Smalltooth Sawfish Abundance Survey (SEFSC) has a one to four-hour soak time. Following protected species permit No. 17787, the net is monitored continuously and checked for catch every 30 minutes or immediately if any disturbance is observed in the gear. The RecFIN Red Drum Trammel Net Survey (SCDNR) uses a soak time of approximately 10 minutes, excluding setting and hauling of gear.

2.2.9 Mitigation Measures for Protected Species during Research with Electrofishing Gear

2.2.9.1 Monitoring Methods

Electrofishing surveys occur on small vessels with a limited number of scientists. Before the electrofishing vessel begins operating and while the vessel is electrofishing the scientific party monitors the waters around the vessel and maintains a lookout for protected species.

If protected species are seen within 50 meters of the station before electrofishing begins, electrofishing is delayed until the animal(s) moves out of the area. If the protected species does not move, the station is moved.

2.2.9.2 Operational Procedures

Electrofishing vessel operates with a 3000 watt pulsed direct current for 15 minutes. The electric field is less than 20 feet around the electrofishing vessel.

If protected species are seen within 50 meters of the vessel while it is electrofishing, electricity to the water is immediately turned off. No electrofishing is resumed until the animal has moved away. If it remains in the vicinity, the boat moves to a different location.

Once samples are processed, they are retained onboard until after all electrofishing is completed and discarded overboard between stations to avoid attracting protected species.

2.2.10 Plankton Nets, Fyke Nets, Bag Seines, Small-mesh Towed Nets, Oyster Dredges, Fish Traps, Oceanographic Sampling Devices, Video Cameras, ROV Deployments, and Chevron Traps

The SEFSC deploys a wide variety of gear to sample the marine environment during all of their research cruises, such as plankton nets, oceanographic sampling devices, video cameras, and ROVs. These types of gear are not considered to pose any risk to protected species because of their small size, slow deployment speeds, and/or structural details of the gear and are therefore not subject to specific mitigation measures. However, the officer on watch and crew monitor for any unusual circumstances that may arise at a sampling site and use their professional judgment and discretion to avoid any potential risks to protected species during deployment of all research equipment.

2.2.11 Handling Procedures for Incidentally Captured Individuals

2.2.11.1 Marine Mammals

Live or injured marine mammals are released from research gear and returned to the water as soon as possible with no gear or as little gear remaining on the animal as possible. Animals are released without removing them from the water if possible. Data collection is conducted in such a manner as not to delay release of the animal(s) and includes species identification, sex identification if genital region is visible, estimated length, disposition at release (e.g., live, dead, hooked, entangled, amount of gear remaining on the animal, etc.) and photographs. The SWL or scientists collect as much data as possible from hooked or entangled animals, considering the disposition of the animal; if it is in imminent danger of drowning, it is released as quickly as possible.

If a large whale is struck by a research vessel or entangled in fishing gear, the vessel will immediately call the U.S. Coast Guard (USCG) at VHF Ch. 16 and/or the appropriate Marine Mammal Health and Stranding Response Network for instructions. All entanglements (live or dead) and vessel strikes must be reported immediately to the NOAA Fisheries Marine Mammal Stranding Hotline at 1-877-433-8299.

2.2.11.2 Sea Turtles

Many of the research cruises conducted or funded by the SEFSC include personnel that have been trained and certified in proper handling techniques for sea turtles and are authorized to measure and tag incidentally caught sea turtles. Crews that have not been trained or authorized to tag turtles typically have experience with proper handling procedures for turtles through various training opportunities or training associated with commercial fishing. Any sea turtles caught on cruises with trained personnel on board are handled and resuscitated according to established procedures found at 50 CFR 223.206(d)(1) and described in the manual, "Careful Release Protocols for Sea Turtle Release with Minimal Injury" (NMFS SEFSC 2008b; Appendix D). Authorized scientific personnel will collect data and install tags in untagged animals. Data collection includes species identification, length, weight, sex, visible injuries, disposition at release (e.g., live, dead, hooked, entangled, amount of gear remaining on the animal, etc.), photographs, and the presence of Passive Integrated Transponder (PIT) tags or flipper tags (Appendix D). Researchers that have been trained and are competent in the SEFSC's standard collection protocols should collect tissue samples for genetic analysis if sampling gear is available. Samples must be collected in accordance with the methods described in the "Southeast Fisheries Science Center Sea Turtle Research Techniques Manual" (NMFS SEFSC 2008a; Appendix D). Trained researchers may also install PIT tags and/or flipper tags in animals that have not already been tagged. Captured turtles are quickly processed and released in accordance with established handling procedures (Appendix D).

SEFSC policy currently is to not retain dead sea turtles unless permitted to do so and at the request of other researchers or agencies. Pending the outcome of consultation undertaken pursuant to section 7 of the

ESA, sea turtle carcasses would be salvaged or biological data would be obtained from dead sea turtles in accordance with established regulations (50 CFR 223.206 and 222.310).

2.2.11.3 ESA-listed Fish

Live and injured Atlantic sturgeon, shortnose sturgeon, and smalltooth sawfish are handled in accordance with established handling procedures, which include immediate processing and release (see Appendix D for guidelines). Authorized scientific personnel will install PIT tags in animals that have not already been tagged. If the safety of the crew or the captured animal would be compromised by this data collection effort, however, the animal will be released as quickly as possible even if all requested data has not been collected. Biological Opinions on SEFSC and affiliated research programs have established requirements regarding proper procedures for dead ESA-listed fish.

2.3 ALTERNATIVE 2 – PREFERRED ALTERNATIVE - CONDUCT FEDERAL FISHERIES AND ECOSYSTEM RESEARCH (NEW SUITE OF RESEARCH) WITH MITIGATION FOR MMPA AND ESA COMPLIANCE

The Preferred Alternative is comprised of a combination of research activities continued from the past and additional, new research surveys and projects. Several surveys and projects described in Table 2.2-1 under the Status Quo Alternative will not be continued under the Preferred Alternative. Those surveys have been noted in Table 2.2-1 and include the following:

- One component of the HMS–GOM Shark Pupping & Nursery Survey, conducted by the University of South Alabama Dauphin Island Sea Laboratory (USA/DISL), will not be continued under the Preferred Alternative.
- One component of the SEAMAP-GOM Shrimp/ Groundfish Trawl Survey, conducted by the TPWD, will not be continued under the Preferred Alternative.
- Panama City Laboratory ROV Reef Fish Survey (SEFSC).
- ACFCMA American Eel Fyke Net Survey (Georgia Department of Natural Resources [GDNR]).
- Environmental Influences on Pink Shrimp research (SEFSC).

Several new surveys and project components have been added to the Preferred Alternative that were not included in the Status Quo Alternative; these projects are summarized in Table 2.3-1.

Under this alternative, the SEFSC would also apply for authorizations under the MMPA for incidental take of protected species during these research activities and initiate section 7 consultations regarding ESA-listed species. NMFS Headquarters Office of Protected Resources (OPR) would consider these activities and mitigation measures and determine whether it should promulgate regulations and issue LOAs as appropriate to the SEFSC. If regulations are promulgated and LOAs are issued, they would prescribe the permissible methods of taking; a suite of mitigation measures intended to reduce the risk of potentially adverse interactions with marine mammals and their habitats during the specified research activities; and require reporting that will result in increased knowledge of the species and the level of taking.

2.3.1 SEFSC and Cooperating Research Partner Activities

Table 2.3-1 Summary Description of Fisheries Research Surveys and Projects Conducted by SEFSC and Cooperating Research Partners under the Preferred Alternative

These surveys and projects are in addition to those described under the Status Quo Alternative in Table 2.2-1. Units of measurement are presented in the format data was collected. Abbreviations are the same as those in Table 2.2-1.

Survey Name (Research Agency)	Survey Description	General Area of Operation	Season, Frequency, Yearly Days at Sea (DAS)	Vessel Used	Gear Used	Gear Details	Number of Stations
GULF OF MEXICO RESEARCH AREA							
Surveys Using Gillnet Gear							
HMS–GOM Shark Pupping & Nursery Survey (GULFSPAN) A new component will be conducted by the Mote Marine Laboratory, joining components of this survey currently conducted by the SEFSC, FSU/CML, USM/GCRL, and UWF. The survey component conducted by USA/DISL under the Status Quo Alternative is discontinued.	Mid-water and surface gillnet survey designed to monitor juvenile shark populations in the coastal GOM. The intent of this survey is to support stock assessment and continue to describe and refine shark essential fish habitat as mandated by the MSA. The survey is led by the NOAA Fisheries Panama City Laboratory, SEFSC, and has Gulf Coast research institution collaborators in FL and MS. Under the Preferred Alternative, the survey component conducted by USA/DISL is discontinued. Only the new component conducted by the Mote Marine Laboratory is indicated in this row, the components conducted by the other research partners are as described in Table 2.2-1.	Research conducted by Mote Marine Laboratory in state waters of southwest FL within Pine Island Sound in the Charlotte Harbor estuary. Depth ranges 0.6-4.6 m depth.	Annually May-Sep, 15 DAS, daytime operations only	USCG Class I: State vessel	Set gillnet	Two types of gillnets are used: 1) Same net as SEFSC; and 2) monofilament 4.5" stretch mesh, 1200 ft x 10 ft. Both nets are anchored with two 25 lb Danforth anchors; surface floats are attached to the float line at 70 ft intervals terminating with a high flyer at each end.	16 sets/month (within two designated 10 km^2 grids), 80 sets total
Surveys Using Other Gear							
SEAMAP-GOM Finfish Vertical Line Survey (ADCNR, LDWF, USM/GCRL) New component conducted by USM/GCRL	A resource assessment survey to monitor the abundance and distribution of reef fish in waters off of MS. The components currently conducted by ADCNR and LDWF are as described in Table 2.2-1. Only the additional component conducted by USM/GCRL is described in this line.	Research conducted by USM/GCRL in state and federal waters off MS. Sampling depths 5-55 fathoms.	Annually, three intervals: Mar-Apr, May-June, and Sep-Oct, 12 DAS (4 days/season), day operations only	USCG Class III: R/V *Tom McIlwain*	Bandit gear	Bandit mainline (300-lb test), attached to weighted 24 ft section of 400-lb test clear monofilament (backbone). Ten gangions (200-lb test clear monofilament) attached to backbone and one hook is attached to each gangion. Hook size and type: 8/0, 11/0, or 15/0 Mustad 39960D circle hook; Bait: mackerel; Soak time: 5 min	15 stations/season - 45 stations total, 3 sets per station, 135 sets total
ATLANTIC RESEARCH AREA							
Surveys Using Trawl Gear							
Oceanic Deep-water Trawl Survey (SEFSC) *Planned but not yet funded	Survey is conducted to sample mid-water (500-800 m) prey of marine mammals	Southeastern U.S. Atlantic waters >500 m deep	Intermittent due to funding, 20 DAS, 24 hour operations (trawls may be set and retrieved day or night), *conducted in 2009 & 2010 and in the future as funding allows.	USCG R/V: NOAA ships	High Speed Midwater Trawl, Aleutian Wing Trawl	>10 m opening, 2-3 meter doors, Towing speed: 2-3 knots at 500-800 m depth Duration: 1-3 hours at target depth	60 trawls (2-3 per day)
					CTD profiler and rosette water sampler	Duration: 60-90 min	60 casts
CARIBBEAN RESEARCH AREA							
Surveys Using Longline Gear							
SEAMAP-C Lane Snapper Bottom Longline Survey, (PR-DNER)	This survey targets fin fish in the territorial waters of PR. Results of survey are used for stock assessments and to support FMPs. Information is also obtained about their biology, distribution, movements, stock structure and status and potential vulnerability to fishing pressure.	East, west, and south coasts of PR in territorial and federal waters at depths ranging from 15-300 ft.	Annually beginning July 2015, (summer, winter, fall, spring), 120 DAS (30 days/season), night operations only	USCG Class III: Two chartered vessels	Bottom longline	Mainline length: 300-ft (130-lb test monofilament), The mainline is weighted at both ends, 100 gangions/set (18 in of 20 lb test); Hook size and type: #10 circle hook; Bait: squid; Soak time: 45 min.	45 sets/season, 180 sets total

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2.3.2 Mitigation Measures for Protected Species

Under the Preferred Alternative, the SEFSC would apply for regulations and letters of authorization under the MMPA and the ESA for incidental take of protected species while conducting the suite of research activities described above. This process requires regulations and authorizations for incidental take of marine mammals under the MMPA and incidental take of protected species under the ESA. Under this alternative, the SEFSC is applying to NMFS Headquarters OPR requesting regulations governing the issuance of LOAs for incidental take of marine mammals under the MMPA. The OPR will make the necessary findings and, if appropriate, will promulgate regulations and issue LOAs to the SEFSC. The LOAs would prescribe mitigation measures intended to reduce the risk of potentially adverse interactions with marine mammals during the specified research activities.

In addition, both OPR and the SEFSC will use the DPEA to initiate ESA section 7 consultations with NMFS Southeast Regional Office (and U.S. Fish and Wildlife Service [USFWS], as appropriate) for species that are listed as threatened or endangered. These consultations, when completed, may result in the development of one or more BiOps that state the opinions of the services as to whether or not the federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. Non-jeopardy BiOps would contain incidental take statements (ITSs) for ESA-listed species that would authorize limited take and include reasonable and prudent measures along with implementing terms and conditions intended to minimize the impact of incidental take of ESA-listed species during SEFSC conducted and funded research activities covered in this DPEA.

Under the Preferred Alternative, the SEFSC would also continue to apply for section 10 directed research permits for the intentional take of ESA-listed species and SRPs for research that will affect MSA species managed under FMPs.

The Preferred Alternative includes the same suite of mitigation measures described in the Status Quo Alternative to reduce the risk of adverse interactions with protected species. The SEFSC considers the current suite of monitoring and operational procedures to be necessary to avoid adverse interactions with protected species and still allow the SEFSC and its cooperating partners to fulfill their scientific missions. However, some mitigation measures such as the move-on rule require judgments about the risk of gear interactions with protected species and the best procedures for minimizing that risk on a case-by-case basis. FPCs and SWLs are charged with making those judgments at sea; they are experienced professionals, however, there may be inconsistencies across the range of research surveys conducted and funded by the SEFSC in how those judgments are made. In addition, some of the mitigation measures described in the Status Quo Alternative could also be considered “best practices” for safe seamanship and avoidance of hazards during fishing (e.g., prior surveillance of a sample site before setting trawl gear). With respect to at least some of the research activities considered in this DPEA, especially those conducted by cooperative research partners, explicit links between the implementation of these best practices and their usefulness as mitigation measures for avoidance of protected species have not been formalized and clearly communicated with all scientific parties and vessel operators. In the case of at least some of the cooperative research projects funded through the SEFSC, scientific procedures and data reporting protocols have been specified in contracts with research partners but specific procedures to avoid or report interactions with protected species have not been incorporated into contracts.

The SEFSC therefore proposes a series of improvements to its protected species training, awareness, and reporting procedures under the Preferred Alternative. Additional mitigation measures will be considered for specific surveys. The SEFSC expects these new procedures will facilitate and improve the implementation of the mitigation measures described under the Status Quo Alternative. The enhanced mitigation measures included in the Preferred Alternative are anticipated to be sufficient for and required by NMFS under MMPA and ESA authorizations for the specified research activities affiliated with the SEFSC.

2.3.2.1 Judgment Consistency

Under the Preferred Alternative, the SEFSC will initiate a process for its FPCs, SWLs, scientists, and vessel captains and crew to communicate with each other about their experiences with protected species interactions during research work with the goal of improving decision-making regarding avoidance of adverse interactions. There are many situations where professional judgment is used to decide the best course of action for avoiding marine mammal interactions before and during the time research gear is in the water. The intent of this new training program would be to draw on the collective experience of people who have been making those decisions, provide a forum for the exchange of information about what went right and what went wrong, and try to determine if there are any rules-of-thumb or key factors to consider that would help in future decisions regarding avoidance practices. The SEFSC would coordinate not only among its staff and vessel captains and crew but also with those from other fisheries science centers, research partners, the Southeast Regional Office, and other institutions with similar experience.

2.3.2.2 Protected Species Training

Formalized training has not been required under the status quo conditions for all SEFSC researchers and research partners. All OMAO officers and SEFSC scientists are knowledgeable about the mitigation requirements of all take reduction and ship strike avoidance plans as well as general mitigation measures to avoid protected species incidental take and these protocols are described in written cruise instructions and safety placards posted on research vessels. Many scientists have also received varying levels of training through formal workshops and in-house presentations. In an effort to help standardize and further emphasize the importance of protected species information, the SEFSC will require that at a minimum, two members of the scientific party participating on each field survey (both SEFSC and research partner), have received, and will continue to receive, formal training through NMFS Highly Migratory Species/Protected Species Safe Handling, Release, and Identification Workshops (http://www.nmfs.noaa.gov/sfa/hms/compliance/workshops/protected_species_workshop/index.html) or other similar workshops. This workshop is designed to teach protected species identification as well as proper techniques for safe handling and release of entangled or hooked protected species, such as sea turtles, marine mammals, and smalltooth sawfish.

The SEFSC will implement the use of a Protected Species Safe Handling and Release Manual (Appendix D). The manual includes topics such as current mitigation measures, decision-making factors for avoiding take, procedures for handling and releasing protected species caught in research gear, and reporting requirements. Review and discussion of the manual would be conducted by the SEFSC on a regular basis and updates would be distributed to SEFSC and partner scientists.

2.3.2.3 Written Protocols

For all SEFSC and partner research projects, mitigation measures are included in the written cruise instructions. In addition, informational placards and reporting procedures will be reviewed and updated as necessary for consistency and accuracy. Many research cruises already include pre-sail review of protected species protocols for participating scientists and crew but the SEFSC will require pre-sail briefings to be conducted before all research cruises, including those conducted by research partners.

2.3.2.4 Contract Language

The SEFSC will incorporate specific language into its contracts that specifies training requirements, operating procedures, and reporting requirements for protected species that will be required for all surveys conducted by research partners, including those conducted on chartered vessels.

2.3.2.5 Monitoring

Monitoring for protected species is now a standard part of conducting fisheries research activities, particularly those that use gears (i.e., hook-and-line gear, longlines, trawls, and gillnet/trammel net gear) that are known to interact with protected species or that we believe have a reasonable likelihood of doing so in the future. If protected species are sighted in the area and are considered to be at risk of interaction with the research gear, then the sampling station is delayed, moved, or canceled. NOAA vessels are required to monitor interactions with protected species and report interactions to the Center Director. Similarly, there is a condition of grant and contract awards for monitoring of protected species takes.

2.3.2.6 Reporting

NOAA Fisheries has established a formal incidental take reporting system, the Protected Species Incidental Take (PSIT) database, requiring that incidental takes of protected species be reported within 48 hours of the occurrence. The PSIT generates automated messages to agency leadership and other relevant staff to alert them of the event and to notify them that updated information describing the circumstances of the event has been inputted into the database. The SEFSC will develop a PSIT reporting form and instructions for use during all of its fisheries and ecosystem research activities and require all SEFSC and research partners to use this form for reporting incidental takes of all protected species. The form will include information about the interaction, biological information, gear and any mitigation measures in place. The information collected can then be reviewed and used to determine if additional mitigation measures are necessary for that survey or gear type.

The SEFSC will coordinate with the local Southeast Regional Stranding Coordinator and the NMFS Stranding Coordinator for any unusual protected species behavior and any stranding, beached live/dead, or floating protected species that are encountered during field research activities. In addition, SEFSC staff provide reports to SEFSC leadership and to the Office of Protected Resources by event, survey leg and cruise. As a result, when marine mammals interact with the gear, whether killed or released alive, a report provided by the FPC or SWL will fully describe any observations of the animals, the context (vessel and conditions), decisions made and rationale for decisions made in vessel and gear handling. This report and any associated photographs from the incident will also be uploaded to the PSIT database. The PSIT and FPC or SWL reports represent not only valuable real-time reporting and information dissemination tools, but also serve as an archive of information that could be mined at later points in time to study why takes occur, by species, gear, etc. The circumstances of these events are critical in enabling SEFSC and the Office of Protected Resources to better evaluate the conditions under which takes are most likely to occur. We believe in the long term this will allow us to avoid some of these situations in the future.

2.3.2.7 Handling Procedures for Protected Species

SEFSC surveys and research partners that have a history of incidentally taking an average of one or more sea turtles, smalltooth sawfish, or listed sturgeon over a five-year period (indicated in BiOp SER-2009-7541) must ensure that at least one scientist on each scientific watch is trained to correctly handle and release that species. If the scientist has received training, is competent in the SEFSC's standard sampling protocols and is permitted to do so, they should safely tag and/or collect samples from incidentally taken sea turtles, smalltooth sawfish, and listed sturgeon. If seabird interactions are documented in the future, the SEFSC will revisit if it is necessary to develop and implement mitigation measures to reduce sea bird interactions.

Handling procedures for incidentally captured sea turtles would be the same under the Preferred Alternative as they are under the Status Quo Alternative.

For incidentally captured marine mammals, there is a difference in handling and data collection procedures between the Status Quo Alternative and the Preferred Alternative. Certain types of data are needed to evaluate the severity of marine mammal injuries, which has implications for marine mammal stock assessments and classification of takes for MMPA and ESA compliance purposes. The FPC or other designated scientists will receive training on the types of information needed to make injury determinations through the protocols and training described above. Captured live or injured marine mammals are released from research gear and returned to the water as soon as possible with no gear or as little gear remaining on the animal as possible. Animals are released without removing them from the water if possible. Data collection is conducted in such a manner as not to delay release of the animal(s). If the safety of the crew and captured animal will not be compromised, the scientific party will attempt to collect biological information from captured, live marine mammals before they are released, including species identification, sex identification (if genital region is visible), estimated length, disposition prior to release (e.g., describe how the animal was entangled/hooked in gear), and disposition at release (e.g., live, dead, hooked, entangled, amount of gear remaining on the animal, etc.), and photographs. Photos of dead marine mammals (and live if possible), should include an image of the left and right side of the dorsal fin to help determine stock ID and a picture of the nature of gear entanglement. Information should also describe whether the animal was seen prior to the entanglement, a description of its behavior, and any mitigation measures used and/or discretionary decisions made by the FPC or SWL, including a rationale for those decisions. This information will be recorded on standardized PSIT forms developed for this purpose. If personnel or animal safety would be compromised by this data collection effort, the animal is released as quickly as possible. In addition to gathering data on incidentally caught animals, the FPC or trained scientists would be required to remove as much gear as possible from an animal before release. Gear remaining on an animal has the potential to cause future entanglements and generally increases the chances that an injury will be serious. Human safety is paramount when considering whether and how to disentangle or dehook a protected species.

SEFSC staff will submit data on all captured animals to protected species experts at the appropriate NMFS Science Center who will use specific criteria to determine whether the injury is considered serious (i.e., more likely than not to result in mortality). If insufficient data has been collected for any reason, the experts may not be able to determine the severity of the injury. Therefore, it is important to train the FPC, SWL, and other designated scientists on all information necessary to make injury determinations that should be recorded on the PSIT form.

If a large whale is alive and entangled in fishing gear, the vessel will immediately call the U.S. Coast Guard at VHF Ch. 16 and/or the appropriate Marine Mammal Health and Stranding Response Network for instructions. All entanglements (live or dead) and vessel strikes must be reported immediately to the NOAA Fisheries Marine Mammal Stranding Hotline at 1-877-433-8299. Additional response, handling and sampling protocols are found in Appendix D.

2.3.2.8 Survey Specific Mitigation Measures

The SEAMAP-SA Coastal Trawl Survey conducted by the South Carolina Department of Natural Resources was responsible for five of the eleven marine mammal takes reported by the SEFSC. The SEFSC will form a working group consisting of SEFSC Harvesting Branch gear experts, SCDNR scientists, and SEFSC scientists to evaluate the survey’s methodology and fishing gear to determine if additional mitigation measures could be implemented to reduced marine mammal interactions. One specific mitigation measure which will be evaluated is the modification of the current lazy line to a line that is stiffer or thicker to reduce the possibility of marine mammal entanglements in the line.

2.3.3 Unknown Future SEFSC Research Activities

In addition to the activities identified above, the SEFSC may propose additional surveys or research activities within the timeframe covered by this programmatic analysis. Because of the annual cycle under which decisions to fund and/or conduct research are made, the SEFSC cannot identify in advance all the potential future activities that may take place in the near future. For purposes of this programmatic analysis, NMFS has examined the research activities that have occurred from 2008-2014, along with research activities planned to occur in the near future, and used this information as a proxy for future proposed research activities. Taken together, these activities comprise the actions evaluated within this DPEA under the Preferred Alternative.

In the future, as congressional appropriations and NMFS fisheries research budgets are established, the SEFSC will examine the proposed future research to determine if the activities are consistent with the scope of actions considered under the Preferred Alternative. To be considered 'within scope' under this DPEA, future proposals for specific research projects must be consistent with the gear types, spatial/temporal distribution of research activities, and types of effects analyzed within this document. If future research projects are not consistent with the type or scope of fisheries research activities analyzed in this DPEA, they may be subject to additional environmental review.

More specifically, the basic methodology used to evaluate any proposed future research activity will be as follows:

1. **Evaluate the activity to determine if it would be conducted within the geographic scope of the region evaluated in the DPEA.** The evaluation described in Chapter 4 of this DPEA is based on the historic spatial distribution of research surveys. Any future research activities proposed within the geographic areas described in Chapter 4 would pass this step of the evaluation. Any proposed research outside of those areas may require additional evaluation.
2. **Evaluate the seasonal distribution of the activity**. The activities evaluated in this DPEA are conducted throughout the year but certain surveys are only conducted in specific time frames/seasons. If a program was proposed that was similar in methodology to past surveys but significantly shifted the timing of research activities from what was analyzed in this DPEA, additional evaluation may be required.
3. **Evaluate the gear types proposed**. The gear types that were included in the analysis are described in Appendix A. If the proposed future research activity used the same or similar gear in the same manner analyzed in this DPEA, then the research activity would fall within the analysis conducted. The research activity would not have to exactly match the descriptions in this DPEA, because the same impacts would be expected from similar gear types and activities. For example, if a new side-scan sonar were to be deployed, but the signal strength and frequency were within the ranges evaluated for bottom sounding sonar evaluated in this DPEA, then the impacts would be similar because only the area swept by the sonar would be changing. If a new type of gear was to be deployed, or if a gear type was to be used in substantially different ways than described, environmental impacts not considered in this DPEA could result and additional NEPA analysis would be required.
4. **Evaluate the status of the resources that may be affected by the research.** The DPEA uses an average level of catch and bycatch as well as the frequency and nature of past interactions with various protected species to determine the impacts of research on marine resources. The DPEA considers the effects of past research on living marine resources based on their current or recent status in regards to population level or conservation concern. However, the status of those resources, e.g., fish stocks, varies over time and by fishery management region. If a future project proposes to conduct research on a fish or invertebrate stock that is overfished or depleted at the time, or if it would occur in areas and with gear that would likely result in substantial bycatch of overfished stocks, the potential effects of the proposed research project could be much greater than estimated in the DPEA and additional NEPA analysis would be required.

To reiterate, any proposed action 1) conducted in regional areas described in this DPEA, 2) during times of the year considered, 3) using gear types and methods generally equivalent to the methods evaluated, and 4) being directed at fish or invertebrate stocks that would not be affected substantially by the research, would be considered covered by the conclusions drawn in this DPEA. If future proposed research activities, projects, or programs are not consistent with the type or scope of fisheries research activities analyzed in this DPEA, they would be subject to additional NEPA evaluations.

2.4 ALTERNATIVE 3 – MODIFIED RESEARCH ALTERNATIVE - CONDUCT FEDERAL FISHERIES AND ECOSYSTEM RESEARCH (NEW SUITE OF RESEARCH) WITH ADDITIONAL MITIGATION

Under Alternative 3, the Modified Research Alternative, the SEFSC would continue fisheries research as described in Section 2.3 and Appendix A and would apply for authorizations of incidental take of protected species under the MMPA and the ESA. The Modified Research Alternative would include all of the same mitigation measures required by the MMPA and ESA authorization procedures as described for the Preferred Alternative. The difference between the Modified Research Alternative and the Preferred Alternative is that the Modified Research Alternative includes a number of additional mitigation measures derived from a variety of sources including: 1) comments submitted from the public on potential mitigation of commercial fisheries impacts, 2) discussions within NMFS as a part of the proposed rulemaking process under the MMPA, 3) discussions within NMFS as a part of ESA section 7 consultation processes, and 4) a literature review of past and current research into potential mitigation measures. This Alternative is not considered as an "all or nothing" proposition; one or more of the additional mitigation measures may be considered for implementation during the MMPA and ESA consultation processes.

The SEFSC regularly reviews its procedures and investigates options for incorporating new mitigation measures and equipment into its ongoing survey programs. Evaluating new mitigation measures includes assessing their effectiveness in reducing risk to protected species, but measures must also pass safety and practicability considerations, meet survey objectives, allow survey results to remain consistent with previous data sets, and be consistent with the purpose and need for SEFSC research activities (Section 1.3). Some of the mitigation measures considered in this alternative (e.g., no night fishing or broad spatial/temporal restrictions) would essentially prevent the SEFSC from collecting data required to provide for fisheries management purposes under the MSA. Some research surveys necessarily sample in habitats important to protected species with an inherent risk of interactions with protected species and sea turtles during those surveys. The SEFSC acknowledges the inherent risk of these surveys and it has implemented a variety of measures to mitigate that risk. The SEFSC currently has no viable alternatives to collecting the data derived from these surveys and does not propose to implement potential mitigation measures that would preclude continuation of these surveys, such as the elimination of research activities conducted at night or periods of poor visibility. An analysis of the potential efficacy and practicability of the additional mitigation measures considered in this alternative is presented in Sections 4.4 and 4.6.

The secondary federal action covered under this DPEA is the issuance of requested regulations and subsequent Letters of Authorization under Section 101(a)(5)(A) of the MMPA that would govern the unintentional taking of small numbers of marine mammals incidental to the SEFSC's research activities. In order to authorize incidental take of marine mammals under the MMPA, NMFS must identify and evaluate a reasonable range of mitigation measures to minimize impacts to marine mammals to the level of "least practicable adverse impact." As described above, some mitigation measures could prevent the SEFSC from maintaining the utility of ongoing scientific research efforts, and those mitigation measures would normally be excluded from consideration in the DPEA under screening criteria 3 (Section 2.1). However, such mitigation measures would likely be considered during the MMPA incidental take authorization process and/or ESA section 7 consultation and are therefore considered under the Modified Research Alternative in this DPEA.

2.4.1 Additional Mitigation Measures for Protected Species

2.4.1.1 Monitoring Methods

Visual observations (using bridge binoculars as needed) by the officer on watch, FPC, SWL, or other designated scientist, and crew standing watch are currently the primary means of detecting protected species in order to avoid potentially adverse interactions. However, there are other detection methods that have been used in commercial fisheries, naval exercises, and geotechnical exploration that could be considered. These additional types of detection methods would be used in specific circumstances, such as operating at night or in low visibility conditions.

- Visual surveillance by dedicated protected species observers. This measure would require the SEFSC to use trained protected species observers whose dedicated job is to detect the presence of protected species within the survey area and communicate their presence to ship operations personnel. Considerations include the use of dedicated protected species observers for all surveys or during trawl surveys of particular concern.
- Use of a live feed camera or underwater video system to monitor any interactions of protected species with trawl gear. Underwater video technology may allow the SEFSC to determine the frequency of interactions with trawl gear and to evaluate the effectiveness of a measure’s ability to mitigate injurious or lethal interactions.
- Use of passive acoustic monitoring for marine mammal vocalizations to aid in the detection of marine mammals present in the survey area and to implement appropriate modifications of trawl operations.
- Use of aircraft, unmanned aerial vehicles, or autonomous underwater gliders to provide additional detection capabilities.
- Use of infrared (IR) technologies to detect protected species.
- Use of night-vision devices to detect protected species.

2.4.1.2 Operational Restrictions

- Suspension of trawl operations. This measure would require the SEFSC to suspend trawl operations at night or during periods of low visibility (including fog and high sea state) to minimize interactions with protected species that would be difficult to detect by visual monitoring.
- Decoy vessels for longline projects. This measure would require use of a decoy research vessel playing pre-recorded longline fishing sounds to distract protected species away from the fishing grounds.

2.4.1.3 Acoustic and Visual Deterrents

- Use of excluder devices. This measure would require the SEFSC to use deterrents, such as acoustic pingers or recordings of predator vocalizations (e.g., killer whale) to deter interactions with trawl gear, or use visual deterrence techniques (e.g., lights, light sticks, reflective twine/rope) to reduce protected species interactions with the gear.

2.4.1.4 Gear Modifications

- This measure would require the SEFSC to use marine mammal and/or turtle excluder devices on all of its trawl nets that do not already use excluder devices or on a subset of those gears considered to have a high risk of protected species interactions. There are a number of excluder devices currently used in commercial trawl fisheries that may be adaptable to trawl nets used for research. The SEFSC would need to examine the alternatives for excluder devices for each type of net that would be deployed in areas and seasons where sea turtles and marine mammals could be at risk of capture and conduct analyses as to their compatibility with research objectives. Under this alternative, the SEFSC would integrate any such devices into their research trawl nets that prove practicable.

- Circle hooks and finfish bait. This measure would require the SEFSC to use large circle hooks (e.g., 18/0 or larger) and finfish bait for all of its longline surveys and projects in order to reduce incidental takes of sea turtles.
- Video sampling with an open cod end. The SEFSC would investigate the use of video cameras to identify fish and their encounter rates in lieu of a closed cod end on trawl surveys, which may take protected species as well as target fish. This approach could be appropriate for swept area surveys designed to determine the density of fish or verification of acoustic target identification. However, it would not be appropriate for surveys designed to determine the reproductive condition of adult fish or the growth rates of fish as these measurements require the dissection of specimens. Considerable insight and experience may be gained by experimenting with open cod end trawls and associated high-resolution, high-speed video cameras, particularly with real-time video feeds to the ship. In some cases this experience could lead to routine use of cameras instead of capture. In other situations the number of closed cod end trawls required for estimating vital rates could be reduced. While it would not be the primary objective, video camera data may also provide documentation of protected species interactions with trawl gear and may thus provide insight into the efficacy of other measures intended to reduce the interactions with protected species (e.g., excluder devices or chain mats).
- Streamer lines for longline projects. Under this measure, the SEFSC would deploy streamer lines before longline gear is set to mitigate the risk of catching seabirds. Deploying streamer lines on each side of the baited longline to discourage seabirds from diving on baited hooks has been proven effective in reducing seabird bycatch in some Pacific fisheries (Melvin et al. 2001).

2.4.1.5 Temporal or Geographic Restrictions

- Spatial/temporal restrictions. These are one of the most direct means of reducing adverse impacts to protected species. By reducing the overlap in time and space of the survey's footprint with known concentrations of protected species, the SEFSC may reduce the amount of incidental take of such species. This measure would require the SEFSC to identify areas and times that are most likely to result in adverse interactions with protected species (e.g., areas of peak abundance) and to avoid, postpone, or limit their research activity to minimize the risk of such interactions with protected species as long as such spatial/temporal restrictions do not conflict with the ability of the SEFSC to conduct scientifically valid surveys and to provide the best scientific information available for purposes of managing commercial fisheries. This may include limits on specific locations, physical or oceanographic features, biologically important times, and/or gear types.
- Avoidance of federal and state marine protected areas. This measure would disallow or restrict SEFSC trawl surveys in federal and/or state marine protected areas (Section 3.1.2.4).

2.5 ALTERNATIVE 4 – NO RESEARCH ALTERNATIVE - NO FIELDWORK FOR FEDERAL FISHERIES AND ECOSYSTEM RESEARCH CONDUCTED OR FUNDED BY SEFSC

Under the No Research Alternative the SEFSC would no longer conduct or fund fieldwork for the fisheries and ecosystem research considered in the scope of this DPEA in marine waters of the U.S. Atlantic Ocean, Gulf of Mexico, or Caribbean Sea. This moratorium on fieldwork would not extend to research that is not in scope of this DPEA, such as directed research on marine mammals and ESA-listed species covered under separate research permits and NEPA documents. NMFS would need to rely on other data sources, such as fishery-dependent data (e.g., harvest data) and state or privately supported fishery-independent data collection surveys or programs to fulfill its responsibility to manage, conserve and protect living marine resources in the U.S. Under this alternative, cooperative research partners may or may not continue their research efforts depending on whether they are able to secure alternative sources of funding. Any non-federal fisheries research would occur without NMFS funding, direct control of program design, or operational oversight. It is unlikely that these non-NMFS fisheries research surveys would directly continue the time-series data NMFS has collected over many years, which is the core information supporting NMFS science and management missions and vital to fishery management decisions made by the Fishery Management Councils, NMFS, and other marine resource management institutions, leading to greater uncertainty for fishery and other natural resource management decisions.

Currently, fisheries and marine ecological research is also being conducted or funded by the U.S. Navy, National Science Foundation, state agencies, other international agencies, and research institutes in the U.S. EEZ, sometimes with funding support from the SEFSC. However, much of the fisheries related research conducted by non-NMFS entities is generally confined to state waters and nearshore ocean areas and does not cover many fisheries topics currently investigated by the SEFSC. Under the No Research Alternative, it is unlikely that any of the state or other institutional research programs would be able to undergo the fundamental realignment of budgets and scientific programs necessary to maintain the level and continuity of information currently provided by the SEFSC. No agencies or other entities would likely conduct fisheries and ecosystem research to replace the research abandoned by the SEFSC under the No Research Alternative.

2.6 ALTERNATIVES CONSIDERED BUT REJECTED FROM FURTHER ANALYSIS

As stated previously, the alternatives evaluated in a DPEA must achieve the purpose and need of the proposed action without violating any of the applicable laws and regulations described in Chapter 6 and summarized in section 1.6. Other potential alternatives that do not satisfy the agency's purpose and need, or would not meet minimum environmental standards, are not considered reasonable and need not be carried forward for evaluation in a DPEA. The following alternatives were considered but rejected because they do not meet the purpose and need as stated in Section 1.3 or the screening criteria described in Section 2.1.

2.6.1 Sole Reliance on Commercial Fishery Data

One alternative that NMFS considered was to rely solely on commercial fisheries data such as catch per unit effort, seasonal and geographic distribution of harvests, and other harvest data to assess the status of commercially important stocks. This alternative was rejected from further analysis because it would not provide sufficient information on the age/size class structure of exploited fish stocks and would be insufficient to track fish population dynamics or provide other types of predictive capabilities required to manage the fisheries. This approach would also not meet the need to maintain a standardized, objective, and unbiased sampling approach provided by independent surveys.

Conclusion: This alternative does not meet screening criteria 1 or 3. It would not meet statutory obligations because directed research activities would not be conducted. It would not maintain scientific integrity of research programs because the results would not maintain the consistency of data with prior research efforts. For these reasons this alternative is not carried forward for detailed evaluation.

2.6.2 New Methodologies

Another alternative considered was to adopt other types of survey methodologies or develop new methodologies based primarily on their potential to eliminate or greatly reduce interactions with protected species or effects on habitat, as opposed to adopting new methods and gear for fisheries research purposes. Although NMFS continues to place a high priority on avoiding adverse interactions with protected species and is continually reviewing potential mitigation measures for research activities, the purpose and need for conducting fisheries research requires future sampling methodologies be consistent with past data sets to maintain long-term trend analyses for commercially fished and ecologically important species. NMFS is currently evaluating alternative sampling methods for fisheries and marine ecosystem research, some of which may reduce the potential for incidental takes of protected species or effects on benthic habitats. However, these new methodologies will be evaluated primarily for consistency with the purpose and need for fisheries and marine ecosystem research and whether they provide information that can build on and supplement past data sets.

Conclusion: This alternative did not meet screening criterion 3. It would not maintain scientific integrity of research programs because the results would not maintain the consistency of data with prior research efforts. Therefore, this alternative is not carried forward for detailed evaluation.

2.6.3 Alternative Research Program Design

In this alternative the types of research conducted would be revised to determine if alternative levels of a particular research would result in different levels of impacts. This alternative would emphasize minimizing potential adverse environmental impacts when designing research activities. Other factors, such as maximizing efficient use of scientific research funding and maintaining the integrity of long-term data sets, would not be considered in this approach.

Conclusion: This alternative was rejected because it would not meet screening criterion 3 and would intrude on inherently technical and scientific decisions. Therefore, this alternative is not carried forward for detailed evaluation.

3.1 PHYSICAL ENVIRONMENT

Southeast Fisheries Science Center's (SEFSC) fisheries and ecosystem research activities are conducted in the Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea. SEFSC research surveys occur both inside and outside the U.S. Exclusive Economic Zone (EEZ), and sometimes span across multiple ecological, physical, and political boundaries.

3.1.1 Large Marine Ecosystems

Large Marine Ecosystems (LMEs) are large areas of coastal ocean space. LMEs generally include greater than 200,000 square kilometers (km^2) of ocean surface area, and are located in coastal waters where primary productivity is generally higher than in open ocean areas. LME physical boundaries are based on four ecological criteria: bathymetry, hydrography, productivity, and trophic relationships. Based on these four criteria, 10 LMEs have been delineated for the coastal marine waters of the U.S., and a total of 64 distinct LMEs have been delineated around the coastal margins of the Atlantic, Pacific and Indian Oceans (Sherman et al. 2004). Figure 3.1-1 shows the world's LMEs as defined at www.lme.noaa.gov. Each color represents a distinct LME.

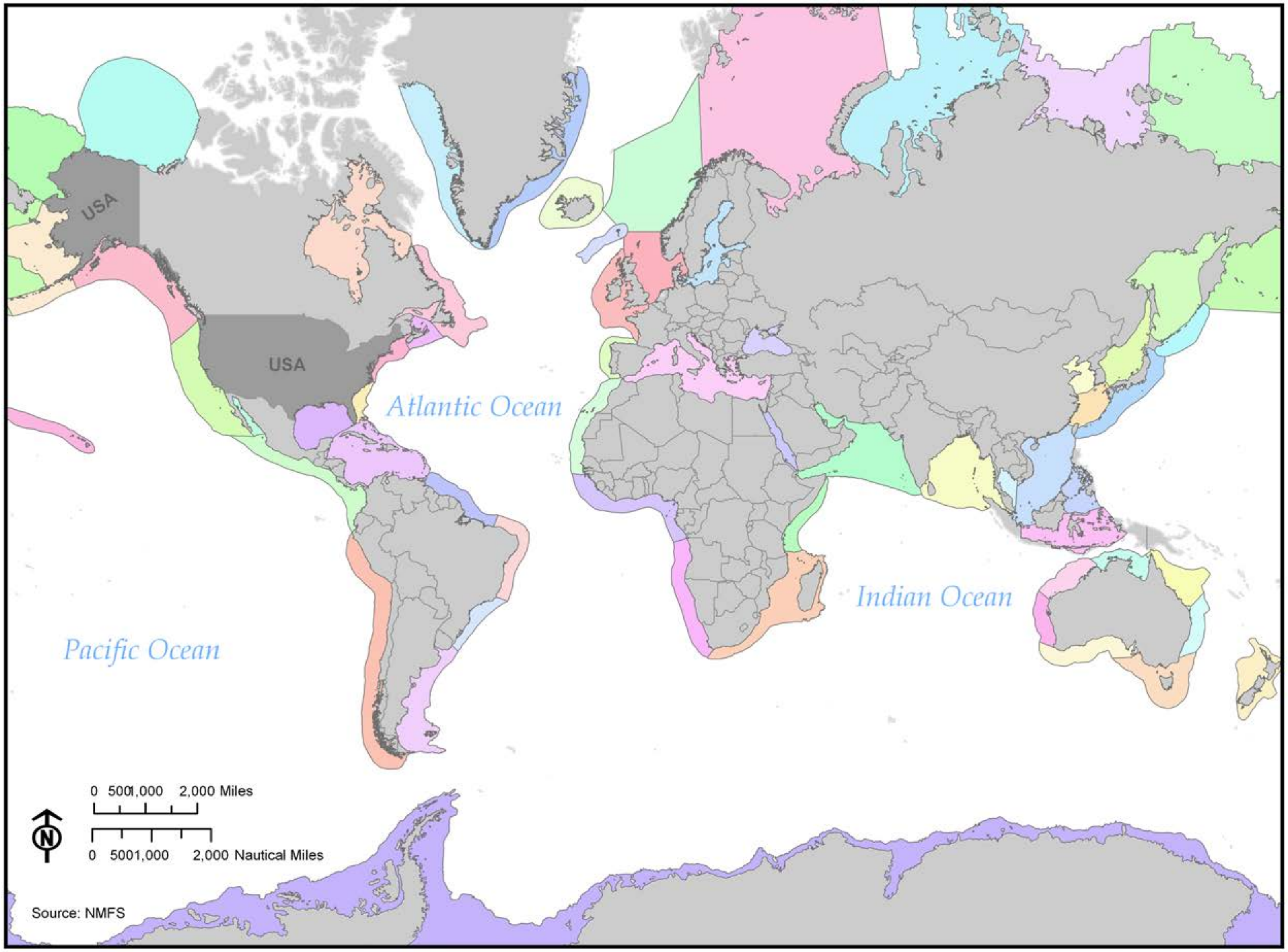

Figure 3.1-1 Large Marine Ecosystems of the World

Globally, LMEs are the source of 80 to 95 percent of the world's marine fish harvest, and are centers of economic activity for oil and gas, shipping, and tourism industries. The LME concept provides a practical framework for the application of ecosystem-based approaches to fisheries assessment and management, habitat restoration, and research on pollution and ecosystem health. The National Oceanic and Atmospheric Administration and National Marine Fisheries Service have implemented a management approach designed to improve the long-term sustainability of LMEs and their resources by using practices that focus on ensuring the sustainability of the productive potential for ecosystem goods and services. For more detailed information on the LME management concept and trends in ecosystem health, see *The UNEP* [United Nations Environmental Program] *Large Marine Ecosystem Report: A perspective on changing conditions in LMEs of the world's Regional Seas* (Sherman and Hempel 2008).

SEFSC fisheries research activities take place within four LMEs; The Northeast U.S. Continental Shelf LME (NE LME), the Southeast U.S. Continental Shelf LME (SE LME), the Gulf of Mexico LME, (GOM LME), and the Caribbean Sea LME (CS LME).

Within these LMEs, SEFSC's activities take place in three primary research areas: the Atlantic Research Area (ARA), the Gulf of Mexico Research Area (GOMRA), and the Caribbean Research Area (CRA), which are described in detail in the following sections. The research area boundaries are not the same as the LME boundaries; activities in the ARA occur out to the EEZ line which is beyond the SE LME boundary, while activities in the GOMRA and CRA cover only a portion the Gulf of Mexico (GOM) and CS LMEs.

Figure 3.1-2 shows the location and boundaries of these three research areas and the LMEs.

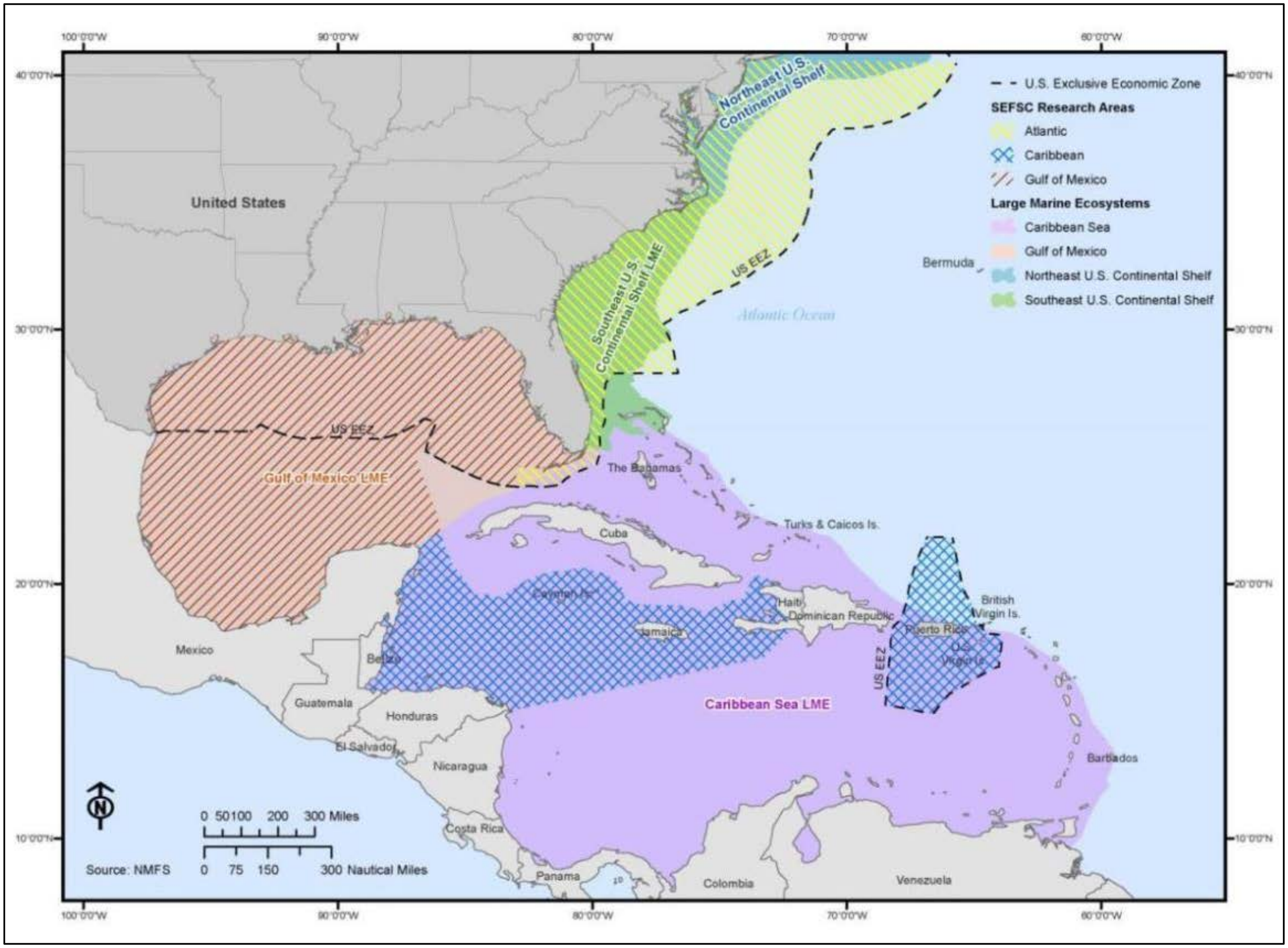

Figure 3.1-2 Large Marine Ecosystems and SEFSC Research Areas

All SEFSC fisheries research is conducted south of Virginia. The Marine Mammal and Ecosystem Assessment Survey extends north to New York and periodically outside of the U.S. EEZ in the GOMRA and CRA. The Caribbean Plankton Recruitment Experiment also periodically extends outside of the U.S. EEZ in the GOMRA and CRA.

3.1.1.1 Atlantic Research Area

The SEFSC conducts research in the SE LME and NE LME, both inside and outside the LME boundaries, at times beyond the EEZ zone. SEFSC fisheries research is only conducted south of Virginia. The Marine Mammal and Ecosystem Assessment Survey extends north to New York (Figure 3.1-2).

The SE LME extends from the Straits of Florida to Cape Hatteras, North Carolina in the Atlantic Ocean. It is characterized by its temperate climate. The LME has a surface area of about 300,000 km^2, of which 2.44 percent is protected. It contains 0.27 percent of the world's coral reefs and 18 estuaries and river systems (Sea Around Us 2007). It also contains many bays including the Albermale-Pamlico Sound, the second largest estuary in the nation, nearshore and barrier islands, freshwater and estuarine habitats and extensive coastal marshes that provide unique habitats for living marine resources (Aquarone 2009).

Adjacent to this LME, the warm, saline, northward flowing Gulf Stream is bounded by two fronts; the inshore Gulf Stream Front and the offshore Gulf Stream Front (see Figure 3.1-3). The inshore Gulf Stream Front extends over the upper continental slope and shelf break, approximately aligned with the 50-meter isobath (Atkinson and Menzel 1985), while the offshore Gulf Stream Front runs parallel to it approximately 100 kilometers (km) offshore. The Gulf Stream forms a semi-permanent offshore deflection near a deepwater bank southeast of Charleston, NC, called the 'Charleston Bump' at 31.5° north. The Mid-Shelf Front is aligned approximately with the 35-to-40 meter (m) isobaths. Other shelf fronts separate a mixture of water masses formed by wintertime cold air outbreaks, river discharge, tidal mixing and wind-induced coastal upwelling (Pietrafesa et al 1985, Belkin et al 2009).

The NE LME has a total area of approximately 115,831 square miles (mi^2), and is structurally very complex, with marked temperature changes, winds, river runoff, estuarine exchanges, tides and complex circulation regimes (See Figure 3.1-4). The Shelf-Slope Front is associated with a southward flow of cold, fresh water from the Labrador Sea. The Mid-Shelf Front follows the 50-m isobath (Ullman and Cornillon 1999). The Nantucket Shoals Front hugs the namesake bank/shaols along 20-30-m isobaths. The Wilkinson Basin Front and Jordan Basin Front separate deep basins from Georges Bank and Browns Bank (Mavor and Bisagni 2001). The Main Coastal Front and Cape Cod Front are seasonal fronts within this LME (Ullman and Cornillon 1999).

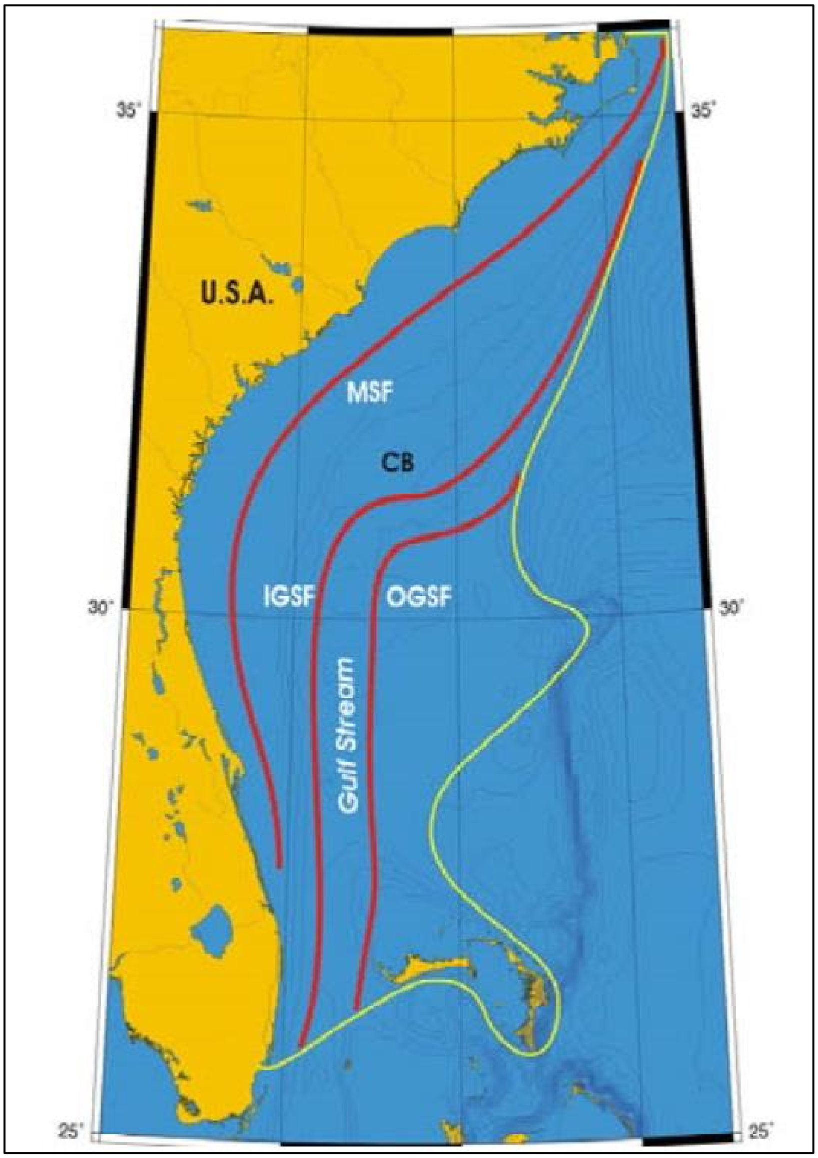

Figure 3.1-3 Fronts of the Southeast U.S. Continental Shelf LME

Notes: CB=Charleston Bump, IGSF=Inshore Gulf Stream Front, MSF=Mid-Shelf Front, OGSF=Offshore Gulf Stream Front. Yellow line=LME Boundary. After Belkin et al. (2009)

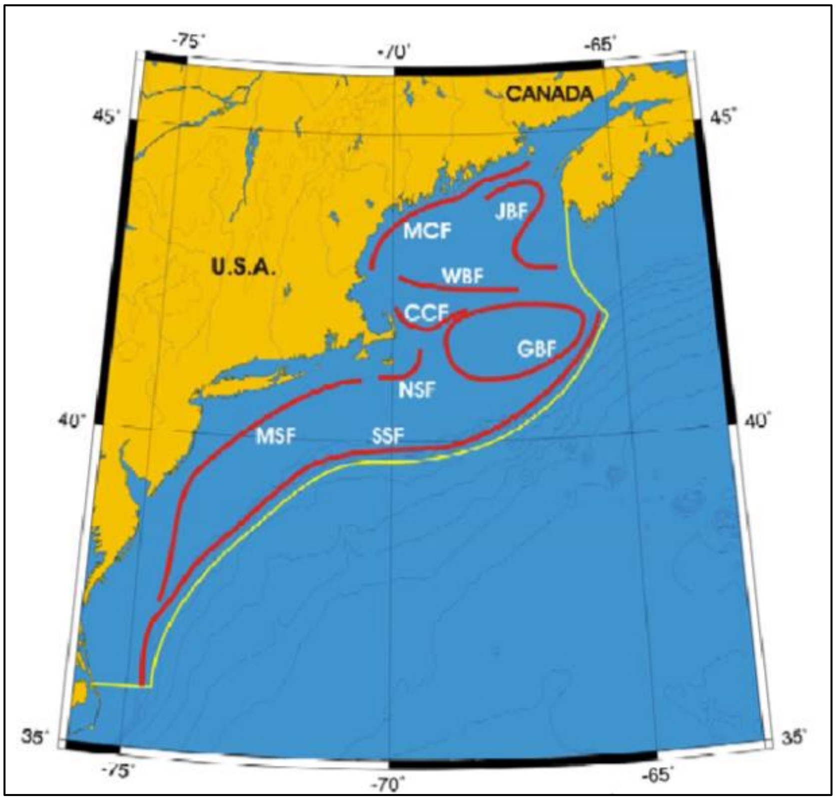

Figure 3.1-4 Fronts of the Northeast U.S. Continental Shelf LME

Notes: CCF=Cape Cod Front, GBF=Georges Bank Front, MCF=Main Coastal Front, MSF=Mid-Shelf Front, NSF=Nantucket Shoals Front, SSF=Shelf-Slope Front, Yellow line=LME boundary. After Belkin et al. (2009)

3.1.1.2 Gulf of Mexico Research Area

The SEFSC conducts fisheries research in portions of the GOM LME. The Marine Mammal and Ecosystem Assessment Survey and the Caribbean Plankton Recruitment Experiment periodically extend outside of the U.S. EEZ in the GOMRA (Figure 3.1-2).

The GOM LME is a deep marginal sea bordered by Cuba, Mexico, and the U.S. It is the largest semi-enclosed coastal sea of the western Atlantic, encompassing more than 1.5 million km^2, of which 1.57 percent is protected, as well as 0.49 percent of the world's coral reefs and 0.02 percent of the world's sea mounts (Sea Around Us 2007). The continental shelf is very extensive, comprising about 30 percent of the total area, and is topographically very diverse (Heileman and Rabalais 2009). Oceanic water enters this LME from the Yucatan channel and exits through the Straits of Florida, creating the Loop Current, a major oceanographic feature and part of the Gulf Stream System (Lohrenz et al. 1999) (see Figure 3.1-5). The LME is strongly influenced by freshwater input from rivers, particularly the Mississippi-Atchafalaya, which accounts for about two-thirds of the flows into the Gulf (Richards & McGowan 1989). Forty-seven major estuaries are found in this LME (Sea Around Us 2007). Important hydrocarbon seeps exist in the southernmost and northern parts of the LME (Richards and McGowan 1989). A major climatological feature is tropical storm activity, including hurricanes.

From December through March, two major oceanic fronts emerge over two shelf areas, the West Florida Shelf and Louisiana-Texas Shelf. The West Florida Shelf Front extends over the mid-shelf, whereas the Louisiana-Texas Shelf Front is located closer to the shelf break. Both fronts form owing to cold air outbreaks (Huh et al. 1978). Huge freshwater discharge from the Mississippi River Estuary and rivers of the Florida Panhandle contribute to the fronts' development and maintenance. Compared to these northern fronts, the Campeche Bank Shelf-Slope Front and Campeche Bank Coastal Front in the south are weak and unstable. The Loop Current Front is always present at the inshore boundary of the namesake front, best defined in winter.

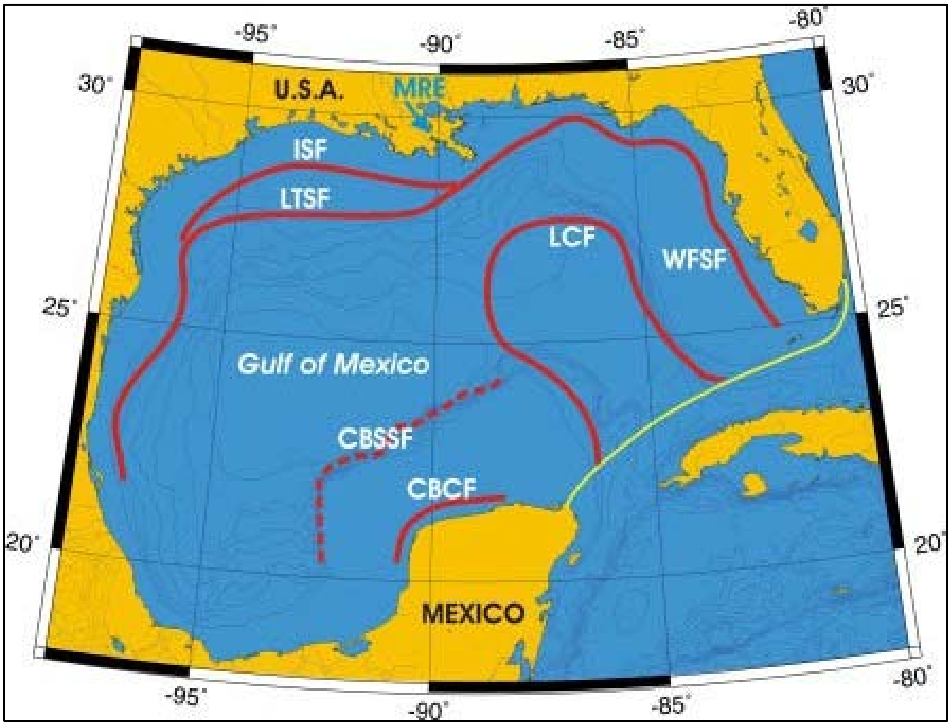

Figure 3.1-5 Fronts of the Gulf of Mexico LME

Notes: CBCF=Campeche Bank Coastal Front, CBSSF=Campeche Bank Shelf-Slope Front (most probable location), ISF=Inner Shelf Front, LCF=Loop Current Front, LTSF=Louisiana-Texas shelf Front, MRE=Mississippi River Estuary, WFSF=West Florida Shelf Front. Yellow line=LME boundary. After Belkin and Cornillon (2007)

3.1.1.3 Caribbean Research Area

The SEFSC conducts fisheries research in portions of the CS LME. The Marine Mammal and Ecosystem Assessment Survey and the Caribbean Plankton Recruitment Experiment periodically extend outside of the U.S. EEZ in the CRA (Figure 3.1-2).

The CS LME is a tropic sea bounded by North America (South Florida), Central and South America, and the Antilles chain of islands. The LME has a surface area of about 3.3 million km^2, of which 3.89 percent is protected (Heileman and Mahon 2009). It contains 7.09 percent of the world's coral reefs and 1.35 percent of the world's sea mounts (Sea Around Us 2007). The average depth is 2,200 m, with the Cayman Trench being the deepest part at 7,100 m. Most of the Caribbean islands are influenced by the nutrient-poor North Equatorial Current that enters the Caribbean Sea through the passages between the Lesser Antilles islands. A significant amount of water is transported northwestward by the Caribbean Current through the Caribbean Sea and into the Gulf of Mexico, via the Yucatan Current. Run-off from two of the largest river systems in the world, the Amazon and the Orinoco, as well as numerous other large rivers, dominates the north coast of South America (Muller-Karger 1993).

In the southern Caribbean Sea, oceanic fronts are generated by coastal wind-induced upwelling off of Venezuela and Columbia (see Figure 3.1-6). A 100-km long front separates the Gulf of Venezuela, likely caused by brackish water outflow from Lake Maracaibo and combined with coastal upwelling. Two shelf-break fronts off Cuba encompass two wide shelf areas off the southern Cuban coast. The Windward Passage Front between Cuba and Hispaniola separates the westward Atlantic inflow waters moving into the Caribbean in the western part of the passage from the Caribbean outflow waters heading eastward in the eastern portion of the passage. A 200-km long front in the Gulf of Honduras peaks during the winter, likely related to a salinity differential between the Gulf's apex and onshore waters caused by high precipitation in southern Belize (Heyman and Kjerfve 1999).

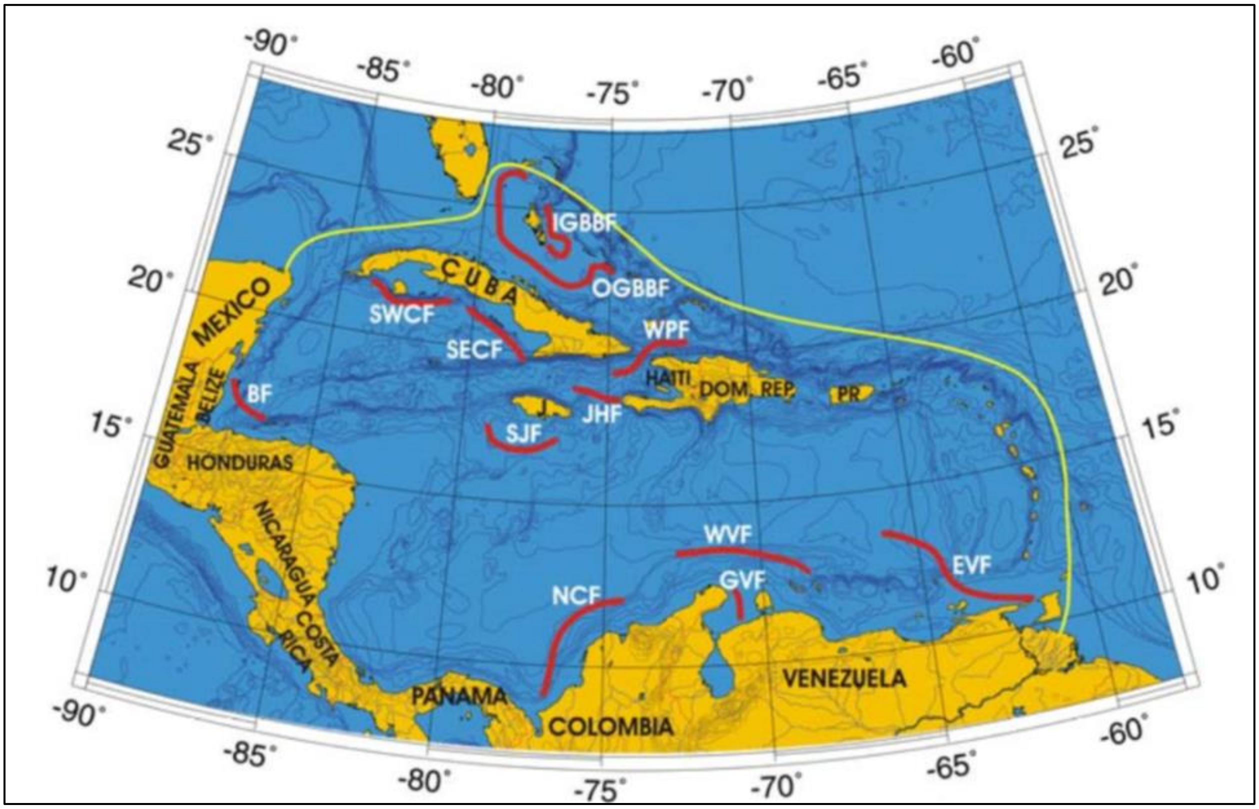

Figure 3.1-6 Fronts of the Caribbean Sea LME

Notes: BF=Belize Front, DOM.REP=Dominican Republic, EVF=East Venezuela Front, GFV=Gulf of Venezuela Front, IGBBF=Inner Great Bahama Bank Front, JHF=Jamaica-Haiti Front, NCF=North Colombia Front, OGBBF=Outer Great Bahama Bank Front, PR=Puerto Rico (U.S.), SECF=Southeast Cuba Front, SJF=South Jamaica Front, SWCF=Southwest Cuba Front, WPF=Windward Passage Front, WVF=West Venezuela Front, Yellow Line=LME boundary. After Belkin et al. (2009)

3.1.2 Special Resource Areas and Essential Fish Habitat

3.1.2.1 Essential Fish Habitat

Essential Fish Habitat (EFH) is comprised of the waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. 1802 sec. 3(10)). Regulatory guidelines explain that EFH should be sufficient to "support a population adequate to maintain a sustainable fishery and the managed species' contributions to a healthy ecosystem" (50 CFR 600, subpart J). EFH applies to federally managed species in both state and federal jurisdictional waters throughout the range of the species within U.S. waters. The designation of EFH by itself does not confer any protection of the areas from non-fishing or fishing impacts. Instead, it is a tool used by managers to reduce impacts and improve fisheries management. It is described and identified in FMPs that are developed by regional fisheries management councils. NMFS regional offices implement FMPs to facilitate long-term protection of EFH through conservation and management measures.

The EFH for a managed species is designated separately for each life stage: eggs, larvae (normally pelagic), juveniles, and adults (pelagic and/or demersal). In certain species EFH is also designated for spawning adults. Many species require different habitats for different life stages, which means that the EFH for a single species may cover a large geographic area. As a result, when taken over all species and all life stages, EFH occurs almost everywhere in the SEFSC research areas.

The areas in which SEFSC research surveys occur have been identified as including EFH for more than 300 fish and invertbrate species from 23 different FMPs (NOAA 2015c, Table 3.1-1). These species include those under the jurisdiction of the Mid-Atlantic Fishery Management Council (MAFMC), the South Atlantic Fishery Management Council (SAFMC), the Gulf of Mexico Fishery Management Council (GMFMC), and the Caribbean Fishery Management Council (CFMC), as well as highly migratory species (HMS) that are managed by the NMFS headquarters Office of Sustainable Fisheries HMS Division.

In areas where SEFSC research surveys occur, EFH has been identified for species within the following FMPs:

- Atlantic Research Area – Atlantic HMS; Atlantic Surfclam and Ocean Quahog; Atlantic Mackerel, Squid, and Butterfish; Bluefish; Coastal Migratory Pelagics; Coral; Dolphin Wahoo; Golden Crab; Shrimp; Spiny Lobster; Snapper Grouper; and Summer Flounder, Scup, and Black Sea Bass.
- Gulf of Mexico Research Area – Atlantic HMS; Coastal Migratory Pelagics; Coral; Red Drum; Reef Fish; Shrimp; and Spiny Lobster.
- Caribbean Research Area (Puerto Rico/U.S. Virgin Islands) – Atlantic HMS; Conch; Coral; Reef Fish; and Spiny Lobster.

As shown in Figures 3.1-7 through 3.1-10, the entire Caribbean Research Area is designated as EFH for species within the spiny lobster, reef fish, coral, and conch FMPs. Large areas of the ARA are EFH for coral, spiny lobster, shrimp, and golden crab, as well as species from the migratory pelagics, dolphin-wahoo, and Snapper Grouper FMPs. In the Gulf of Mexico a large area along the coast is designated as EFH for species from the reef fish, Coastal Migratory Pelagicsand red drum FMPs. The entire coastline is also EFH for shrimp, with smaller areas of golden crab and coral EFH along the west coast of Florida.

Detailed text descriptions and accompanying maps outlining EFH by species and life stage are included in various FMP documents, which are supplemented by information from the EFH source documents. Specifics on EFH for FMPs shown in Table 3.1-1 have not been reproduced here but a summary of EFH descriptions for them can be found online at http://sero.nmfs.noaa.gov/habitat_conservation/efh/index.html

Table 3.1-1 Species with Designated EFH in the SEFSC Research Areas

Fisheries Management Plan	Fisheries Management Jurisdictional Body	Number of Species in the FMP	Notes
Shrimp	SAFMC	5	Separate FMPs exist under the SAFMC and GMFMC
Red Drum	SAFMC	1	
Snapper Grouper	SAFMC	17	
Coastal Migratory Pelagics	SAFMC/GMFMC	3	Jointly managed by both Councils
Golden Crab	SAFMC	1	
Spiny Lobster	SAFMC	1	
Coral and Coral Reef	SAFMC	200+ Species	
Calico Scallop	SAFMC	1	
Dolphin-wahoo	SAFMC	3	
Summer Flounder, Scup, and Black Sea Bass	MAFMC	3	
Bluefish	MAFMC	1	
Atlantic Surfclam and Ocean Quahog	MAFMC	2	
Atlantic Mackerel, Squid, and Butterfish	MAFMC	4	
Spiny Dogfish	MAFMC	1	
Atlantic HMS	NMFS	49	
Swordfish	NMFS	1	
Billfish	NMFS	4	
Large Coastal Sharks	NMFS	22	
Pelagic Sharks	NMFS	10	
Coastal Migratory Pelagics	GMFMC	3	
Red Drum	GMFMC	1	
Reef Fish	GMFMC	32	
Shrimp	GMFMC	4	
Spiny Lobster	GMFMC	1	
Coral and Coral Reef	GMFMC	2	
Spiny Lobster	CFMC	3	
Queen Conch	CFMC	1	
Reef Fish	CFMC	137	Includes aquarium species
Coral and Coral Reef	CFMC	161	Includes aquarium species

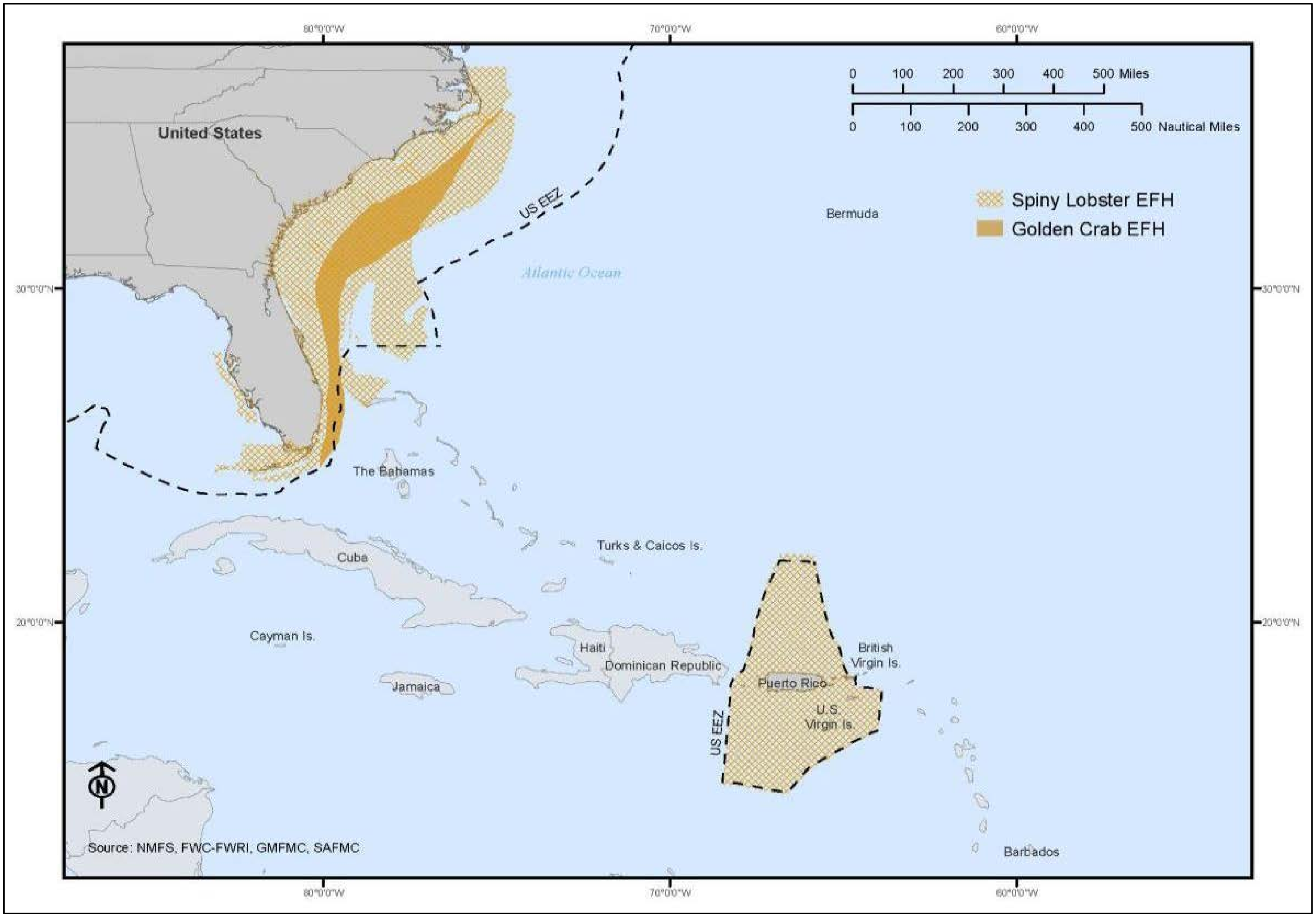

Figure 3.1-7 Essential Fish Habitat for Crab and Lobster

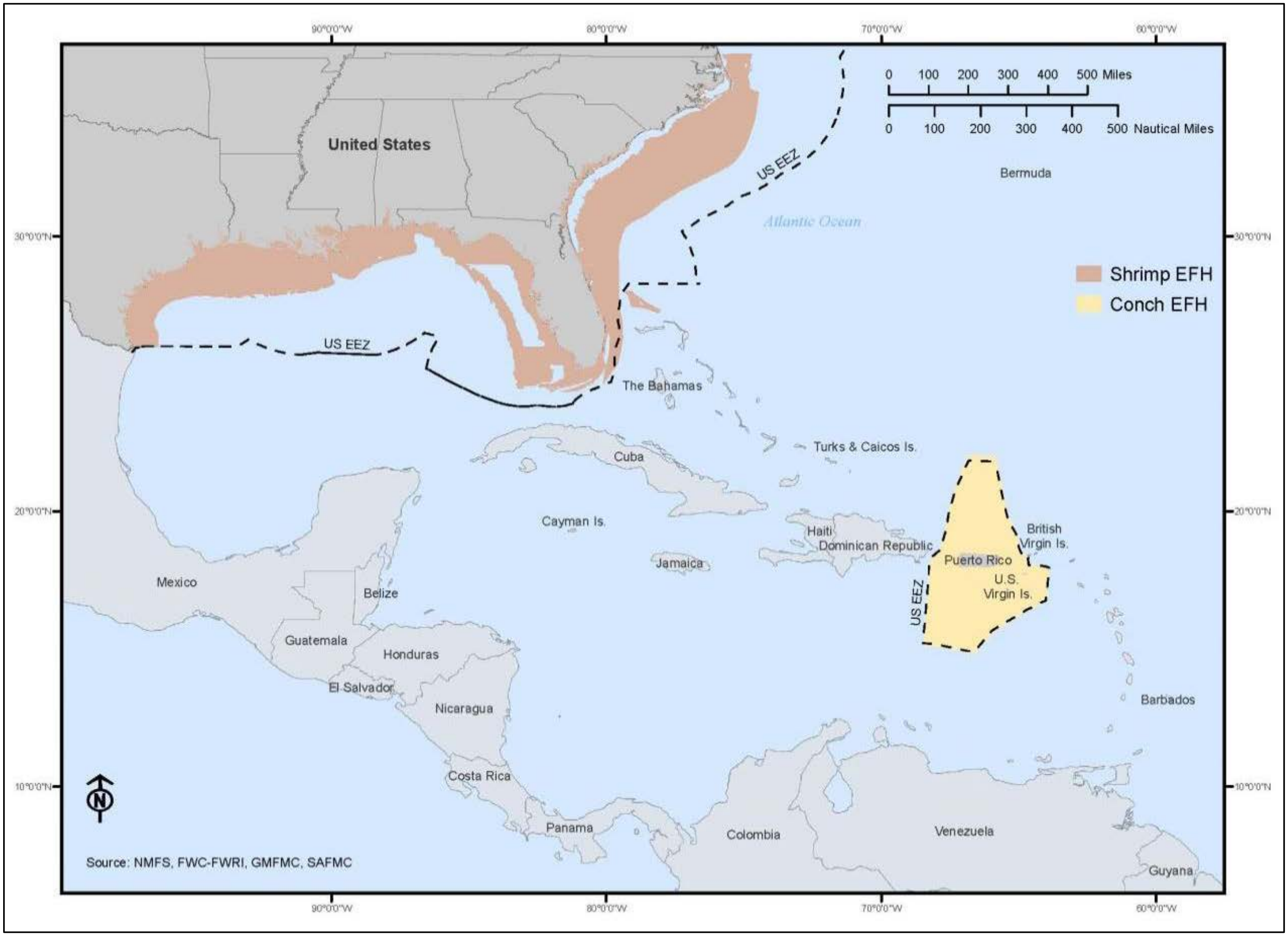

Figure 3.1-8 Essential Fish Habitat for Shrimp and Conch

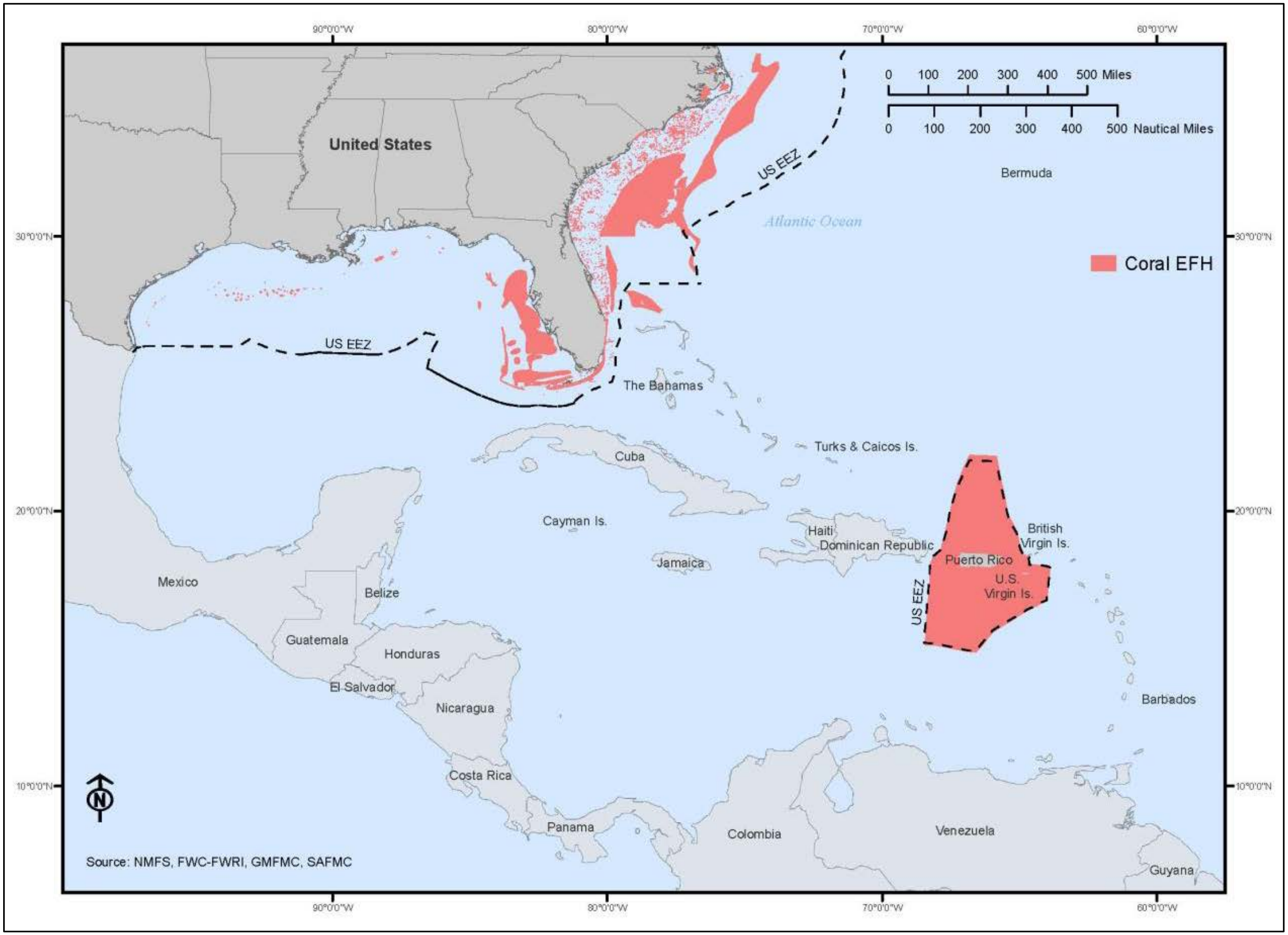

Figure 3.1-9 Essential Fish Habitat for Coral

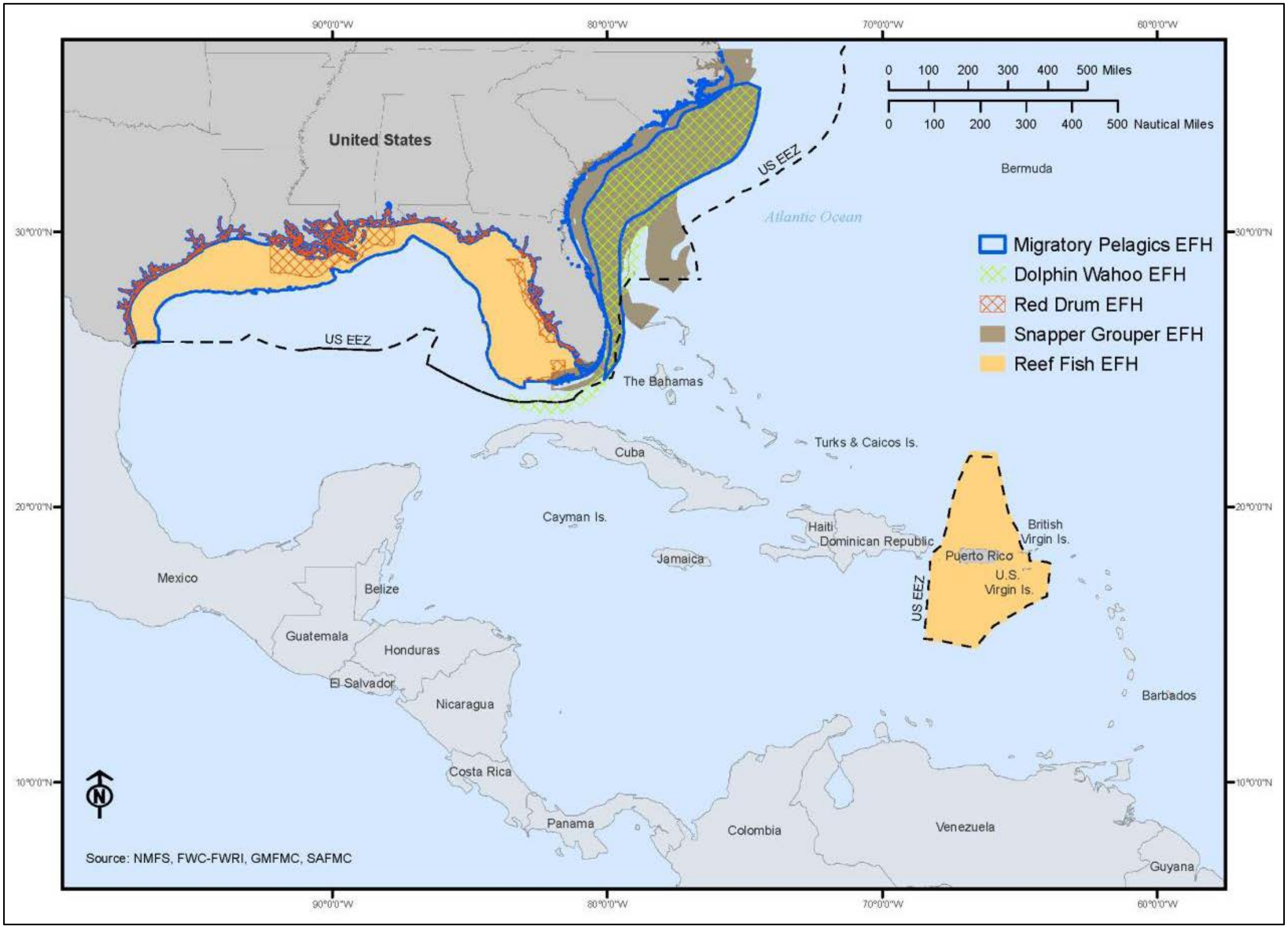

Figure 3.1-10 Essential Fish Habitat for Fish

3.1.2.2 Habitat Areas of Particular Concern

The EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act (50 CFR part 600), recommend that specific areas of habitat within EFH are identified as “habitat areas of particular concern.” Habitat Areas of Particular Concern (HAPC) are discrete subsets of EFH that provide important ecological functions or are especially vulnerable to degradation. Fishery management councils may designate a specific habitat area as a HAPC for one or more of the following reasons: the importance of the ecological function provided by the habitat, the extent to which the habitat is sensitive to human-induced environmental degradation, whether and to what extent development activities are or will be stressing the habitat type, and the rarity of habitat type.

The intended goal of identifying HAPC is to focus conservation efforts on the most important areas. While the HAPC designation does not trigger any specific regulatory process or confer any specific protection, it highlights certain habitat types that are of high ecological value. This designation is manifested in EFH consultations, during which NMFS can recommend protective measures for specific HAPCs.

Several fishery management councils have designated discrete habitat areas as HAPCs, while others have broadly designated all areas of a specific habitat type as HAPCs.

The South Atlantic, Gulf of Mexico, and Caribbean fisheries management councils have designated the HAPCs listed below in Table 3.1-2 and shown on Figure 3.1-11. HAPCs, like EFH, are subject to periodic reviews and may be modified over time.

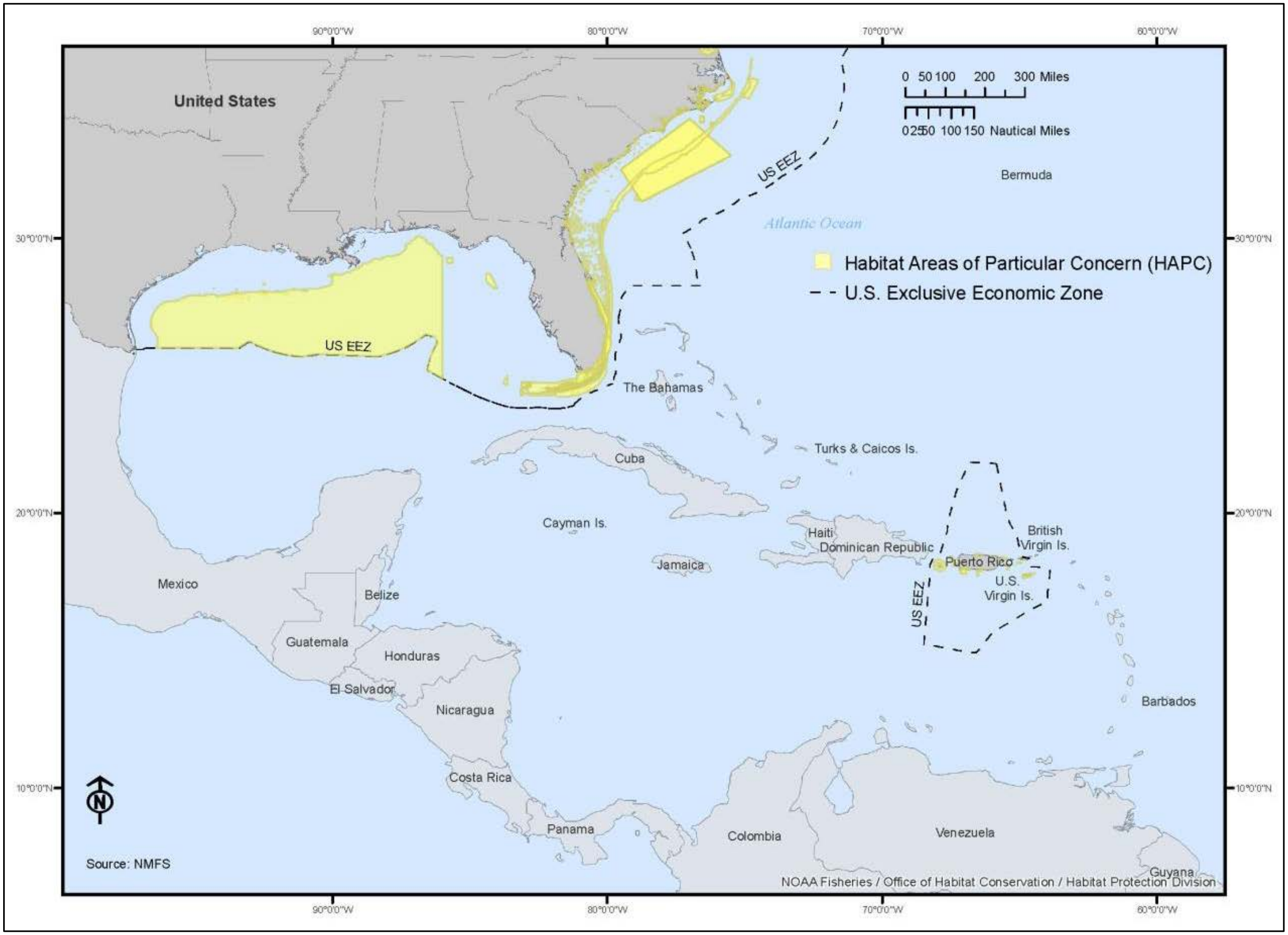

Figure 3.1-11 HAPCs in the SEFSC Research Areas

Table 3.1-2 Habitat Areas of Particular Concern

Atlantic Research Area	Gulf of Mexico Research Area	Caribbean Research Area	
North Carolina	**Florida**	Reef Fish - Spawning Habitats	Los Corchos Reef, Culebra
Big Rock	Madison-Swanson Marine Reserve	Coral Habitats	Desecheo Reefs, Desecheo
Bogue Sound	Tortugas North	**Puerto Rico**	
Pamlico Sound at Hatteras/Okracoke Islands	Tortugas South	Tourmaline Bank/Buoy 8	**St. Thomas**
Capes Hatteras, Fear and Lookout (sandy shoals)	Florida Middle Grounds	Abrir La Sierra Bank/Buoy 6	Hind Bank Marine Conservation District
New River	Pulley Ridge	Bajo de Sico	Grammanik Bank
The Ten Fathom Ledge		Vieques, El Seco	Reef Fish - Ecologically Important Habitats
The Point	**Texas/Louisiana Topographic Features (Reefs and Banks)**	Hacienda la Esperanza, Manatí	Southeastern St. Thomas, including Cas Key and the mangrove lagoon in Great St. James Bay
South Carolina	West Flower Garden Banks	Bajuras and Tiburones, Isabela	Saba Island/Perseverance Bay, including Flat Key and Black Point Reef
Broad River	East Flower Garden Banks	Cabezas de San Juan, Fajardo	
Charleston Bump	Stetson Bank	JOBANNERR, Jobos Bay	**St. Croix**
Hurl Rocks	29 Fathom Bank	Bioluminescent Bays, Vieques	Salt River Bay National Historical Park and Ecological Preserve and Marine Reserve and Wildlife Sanctuary
Georgia	MacNeil Bank	Boquerón State Forest	Altona Lagoon
Gray's Reef National Marine Sanctuary	Rezak Sidner Bank	Pantano Cibuco, Vega Baja	Great Pond South Shore Industrial Area
Florida	Rankin Bright Bank	Piñones State Forest	Sandy Point National Wildlife Refuge
Blake Plateau (manganese outcroppings)	Geyer Bank	Río Espiritu Santo, Río Grande	Mutton snapper spawning aggregation area east of St. Croix (Lang Bank)
Biscayne Bay Biscayne National Park	McGrail Bank	Seagrass beds of Culebra Island (nine sites designated as Resource Category 1 and two additional sites)	St. Croix Coral Reef Area of Particular Concern, including the East End Marine Park
Card Sound	Bouma Bank	Northwest Vieques seagrass west of Mosquito Pier, Vieques	Buck Island Reef National Monument
Florida Bay Florida Keys National Marine Sanctuary	Sonnier Bank	Luis Peña Channel, Culebra	South Shore Industrial Area Patch Reef and Deep Reef System
Jupiter Inlet Point	Alderdice Bank	Mona/Monito Islands	Frederiksted Reef System
Mangrove habitat	Jakkula Bank	La Parguera, Lajas	Cane Bay
Marathon Hump		Caja de Muertos, Ponce	Green Cay Wildlife Refuge
Oculina Bank		Tourmaline Reef	
Phragmatopoma (worm) reefs		Guánica State Forest	
The Wall		Punta Petrona, Santa Isabel	
		Ceiba State Forest	
		La Cordillera, Fajardo	
		Guayama Reefs	
		Steps and Tres Palmas, Rincón	

3.1.2.3 Closed Areas

The SAFMC, GMFMC, and CFMC have established prohibitions on the use of various gears within certain areas of the Atlantic, Gulf of Mexico, and Caribbean EEZ. The various commercial and recreational fishing closures are listed in Table 3.1-3 and depicted in Figures 3.1-12 through 3.1-14. Some closed areas are only implemented when necessary. Restrictions vary and include limited gear use, year-round closures, seasonal closures, and species-specific closures. Detailed information and precise legal definitions on the restrictions within closed areas can be found in 50 CFR, Part 622.

Table 3.1-3 Closed Areas in SEFSC Research Areas

Closed Areas	Location	Season	Gear Restrictions or Protection Measures	Reason/Purpose
ATLANTIC RESEARCH AREA				
***Oculina* Bank HAPC and Experimental Closed Area (36,569.276 square miles)**	Offshore FL	Year-round	In HAPC, no bottom longline, bottom trawl, dredge, or trap/pot gear; in experimental closed area, no fishing for snapper-grouper species	Protect deepwater corals; protect snapper-grouper complex species
Special Management Zones (51 sites)	Offshore SC, GA, and FL	Year-round	Restrictions vary; examples include prohibitions on powerhead, bottom longline, fish traps or pots, and hydraulic or electric reels	Protect snapper-grouper complex species
Allowable Octocoral Closed Area (171, 772.08 square miles)	Atlantic EEZ north of 28°35.1' N	Year-round	No harvest or possession of octocoral	Protect deep-water corals
Pelagic *Sargassum* area (161,658.597 square miles)	All EEZ waters south of 34° N and waters within100 nmi of the coast from 34° N to the NC/SC border	July 1-October 31	All *Sargassum* harvest prohibited in the closed area; elsewhere prohibited July-October, with catch limits and restrictions on mesh and frame size of nets	Protect *Sargassum* as habitat for sea turtles and essential fish habitat for snappers, groupers, and coastal migratory pelagic fishes
Longline closed areas	All waters south of 27°10' N, and waters north of 27°10' N where depth is <91 m (300 ft)	Year-round	No longline gear for snapper-grouper	Protect snapper-grouper complex species
Charleston Bump Area	Offshore NC and SC and Jekyll Island, GA	February 1-April 30	No pelagic or bottom longline gear	Protect juvenile swordfish and reduce bycatch
East Florida Coast Area	Offshore Jekyll Island, GA; FL east coast; Key West, FL	Year-round	No pelagic or bottom longline gear	Protect juvenile swordfish and billfishes
Florida Keys Spiny Lobster Trapping Closed Areas	Federal waters off the Florida Keys	August 6 – March 31	Spiny lobster trapping is prohibited	To protect ESA-listed corals from trap damage
GULF OF MEXICO RESEARCH AREA				
Closures of Gulf Shrimp to Reduce Bycatch	Offshore areas of AL, TX, LA, and MS	Varies from year to year	Trawling is prohibited if annual assessment of shrimp effort and red snapper bycatch levels indicate doing so is necessary	To reduce bycatch of red snapper
Edges	Offshore FL	January - April	All fishing is prohibited	To protect spawning aggregations of fish

Closed Areas	Location	Season	Gear Restrictions or Protection Measures	Reason/Purpose
Gulf EEZ – Bottom Trawl Weak Link Requirement	All EEZ waters in the Gulf of Mexico	Year-round	*Weak link.* A bottom trawl that does not have a weak link in the tickler chain may not be used to fish in the Gulf EEZ.	To minimize to the extent practicable adverse effects of fishing on essential fish habitat.
EEZ Portion of Tortugas North – Tortugas marine reserves HAPC	The Tortugas marine reserves HAPC	Year-round	Fishing for any species and anchoring by fishing vessels are prohibited.	To minimize to the extent practicable adverse effects of fishing on essential fish habitat.
East Flower Garden Banks HAPC	The East Flower Garden Banks HAPC	Year-round	Fishing with a bottom longline, bottom trawl, buoy gear, dredge, pot, or trap and bottom anchoring by fishing vessels are prohibited.	To minimize to the extent practicable adverse effects of fishing on essential fish habitat.
Madison and Swanson Sites	Offshore FL	November - April	All fishing is prohibited	To protect spawning aggregations of fish
McGrail Bank HAPC	The McGrail Bank HAPC	Year-round	Fishing with a bottom longline, bottom trawl, buoy gear, pot, or trap and bottom anchoring by fishing vessels are prohibited.	To minimize to the extent practicable adverse effects of fishing on essential fish habitat.
Pulley Ridge HAPC	The area of the HAPC bounded by rhumb lines connecting, in order, the listed points.	Year-round	Fishing with a bottom longline, bottom trawl, buoy gear, pot, or trap and bottom anchoring by fishing vessels are prohibited.	Pulley's Ridge contains a near pristine, deep water reefs characteristic of the coral reefs of the Caribbean Sea which are located in the southern quadrant of Pulley's Ridge.
Seasonal Closure of the Recreational Sector for Shallow-Water Grouper	Gulf of Mexico EEZ	February 1 – March 31	Bag limit for shallow-water grouper is zero	To protect Gulf of Mexico reef fish
Shrimp Fishery Texas Closure	Offshore TX	May 15 – July 15	Trawling (except for royal red shrimp beyond 100-fathom contour) is prohibited	To protect populations of shrimp
Shrimp/Stone Crab Separation Zones	Offshore FL	Varies by zone	Varies by zone	To separate shrimp trawling and stone crab trapping
Southwest Florida Seasonal Trawl Closure	Offshore southwest FL	January 1 – May 20	Trawling is prohibited	To protect shrimp species of southwest FL
Steamboat Lumps	Offshore FL	November - April	All fishing is prohibited	To protect spawning aggregations of fish
Stetson Bank HAPC	The Stetson Bank HAPC	Year-round	Fishing with a bottom longline, bottom trawl, buoy gear, pot, or trap and bottom anchoring by fishing vessels are prohibited.	To minimize to the extent practicable adverse effects of fishing on essential fish habitat.
Tortugas Shrimp Sanctuary	Offshore FL, northeast of Dry Tortugas	Varies by zone	Trawling is prohibited	To protect the Tortugas Shrimp Sanctuary

Closed Areas	Location	Season	Gear Restrictions or Protection Measures	Reason/Purpose
West Flower Garden Banks HAPC	The West Flower Garden Banks HAPC	Year-round	Fishing with a bottom longline, bottom trawl, buoy gear, dredge, pot, or trap and bottom anchoring by fishing vessels is prohibited.	To minimize to the extent practicable adverse effects of fishing on essential fish habitat.
CARIBBEAN RESEARCH AREA				
Red Hind Closure	EEZ west of Puerto Rico	December - February	Fishing or possession of red hind is prohibited	To protect populations of red hind
Red hind spawning aggregation areas	East of St. Croix and West of Puerto Rico	Year-round	Fishing with pots, traps, bottom longlines, gillnets or trammel nets is prohibited.	To protect spawning aggregation areas
Bajo de Sico (4,559 acres)	West of Puerto Rico	Year-round	Fishing with pots, traps, bottom longlines, gillnets or trammel nets is prohibited.	To protect reef fish
Mutton snapper spawning aggregation area (2,189 acres)	South of St. Croix	Year-round	Fishing with pots, traps, bottom longlines, gillnets or trammel nets is prohibited.	To protect populations of mutton snapper
Grammanik Bank closed area (373 acres)	South of St. Thomas	Year-round	Fishing with pots, traps, bottom longlines, gillnets or trammel nets is prohibited.	To protect all species of fish in Grammanik Bank
Hind Bank Marine Conservation District	South of St. Thomas	Year-round	Fishing for any species and anchoring activities by fishing vessels is prohibited.	To protect all species of fish in the Hind Bank Marine Conservation District

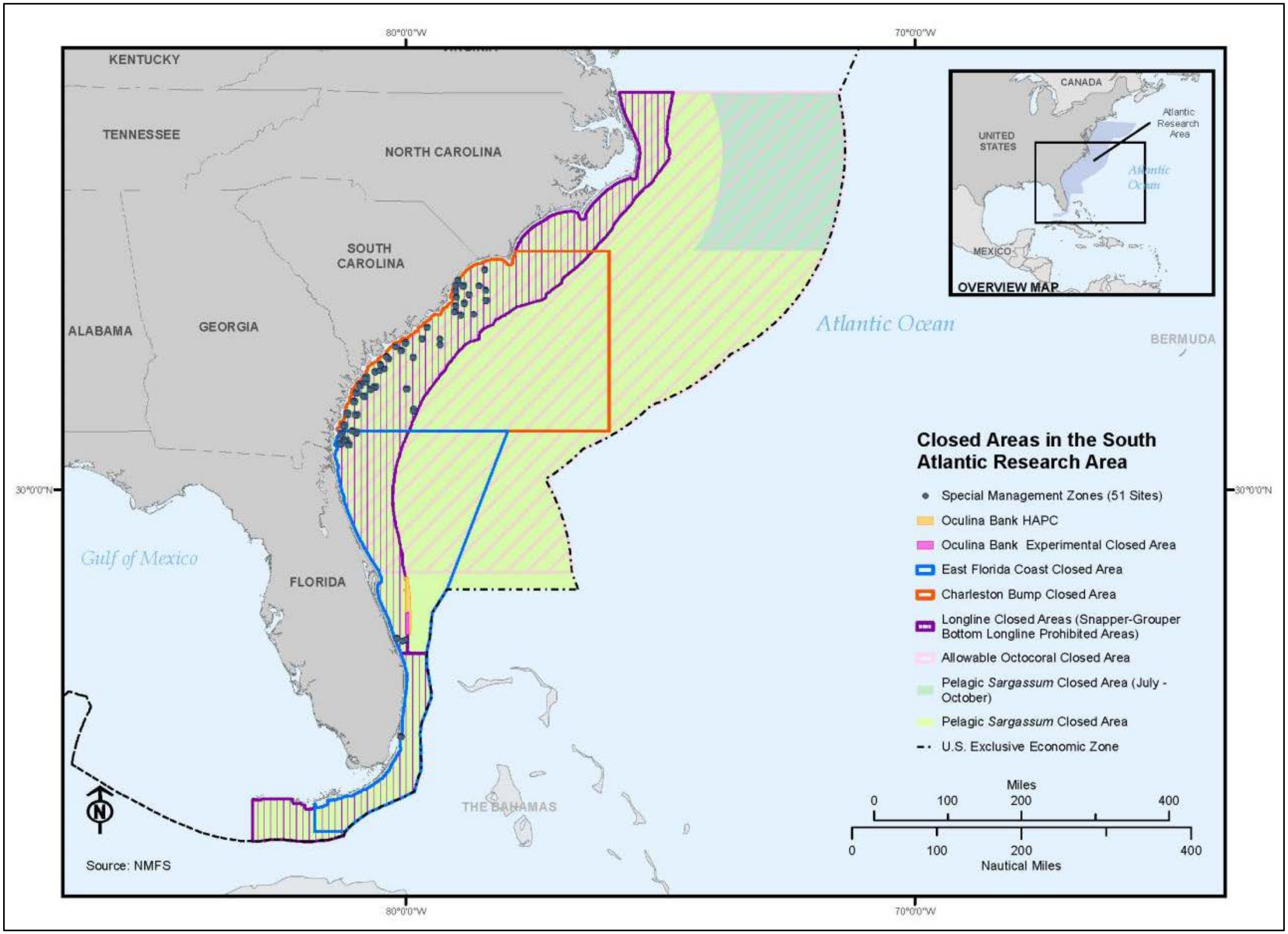

Figure 3.1-12 Closed Areas in the Atlantic Research Area

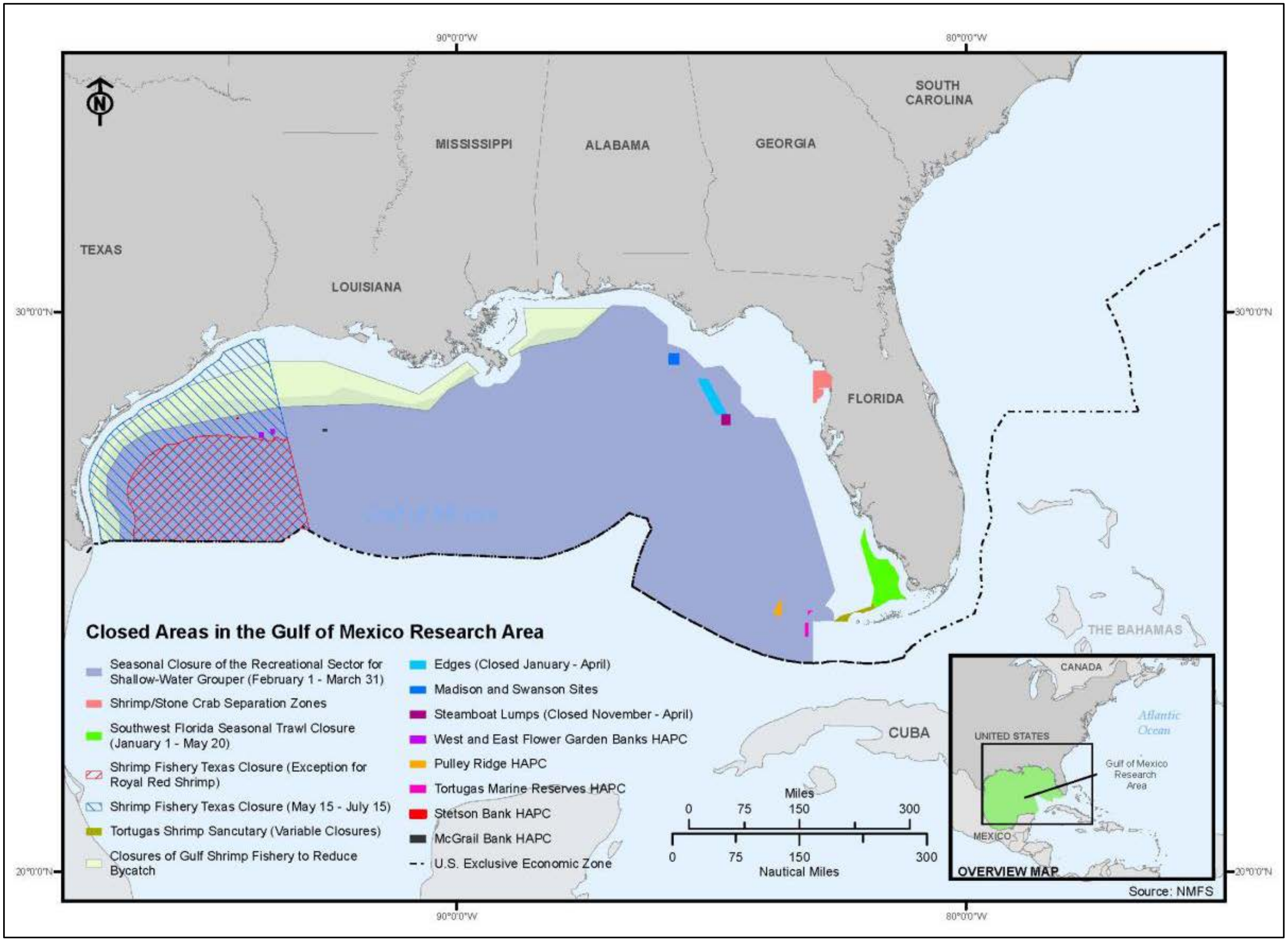

Figure 3.1-13 Closed Areas in the Gulf of Mexico Research Area

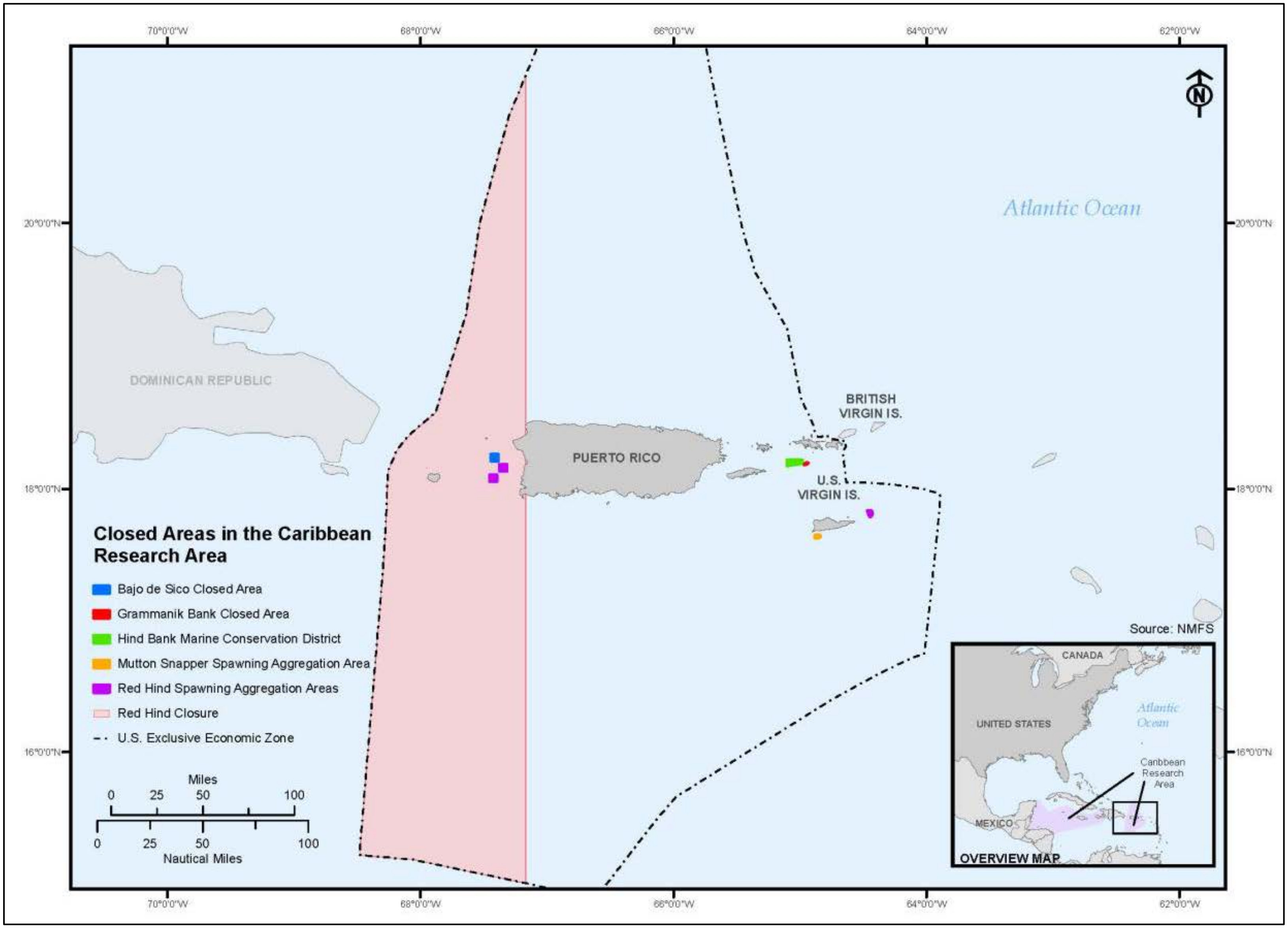

Figure 3.1-14 Closed Areas in the Caribbean Research Area

3.1.2.4 Marine Protected Areas

A Marine Protected Area (MPA) is defined by Executive Order 13158 as "any area of the marine environment that has been reserved by federal, state, tribal, territorial, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." They are a group of sites, networks, and systems established and managed by federal, state, tribal, and local governments. Most MPAs have legally established goals, conservation objectives, and intended purposes. MPAs generally address one or more of three areas of conservation focus:

Natural Heritage: established and managed wholly or in part to sustain, conserve, restore, and understand the protected area's natural biodiversity, populations, communities, habitats, and ecosystems; the ecological and physical processes upon which they depend; and, the ecological services, human uses and values they provide to this and future generations.

Cultural Heritage: established and managed wholly or in part to protect and understand submerged cultural resources that reflect the nation's maritime history and traditional cultural connections to the sea.

Sustainable Production: established and managed wholly or in part with the explicit purpose of supporting the continued extraction of renewable living resources (such as fish, shellfish, plants, birds, or mammals) that live within the MPA, or that are exploited elsewhere but depend upon the protected area's habitat for essential aspects of their ecology or life history.

The MPAs within the SEFSC research areas are shown below in Figure 3.1-15.

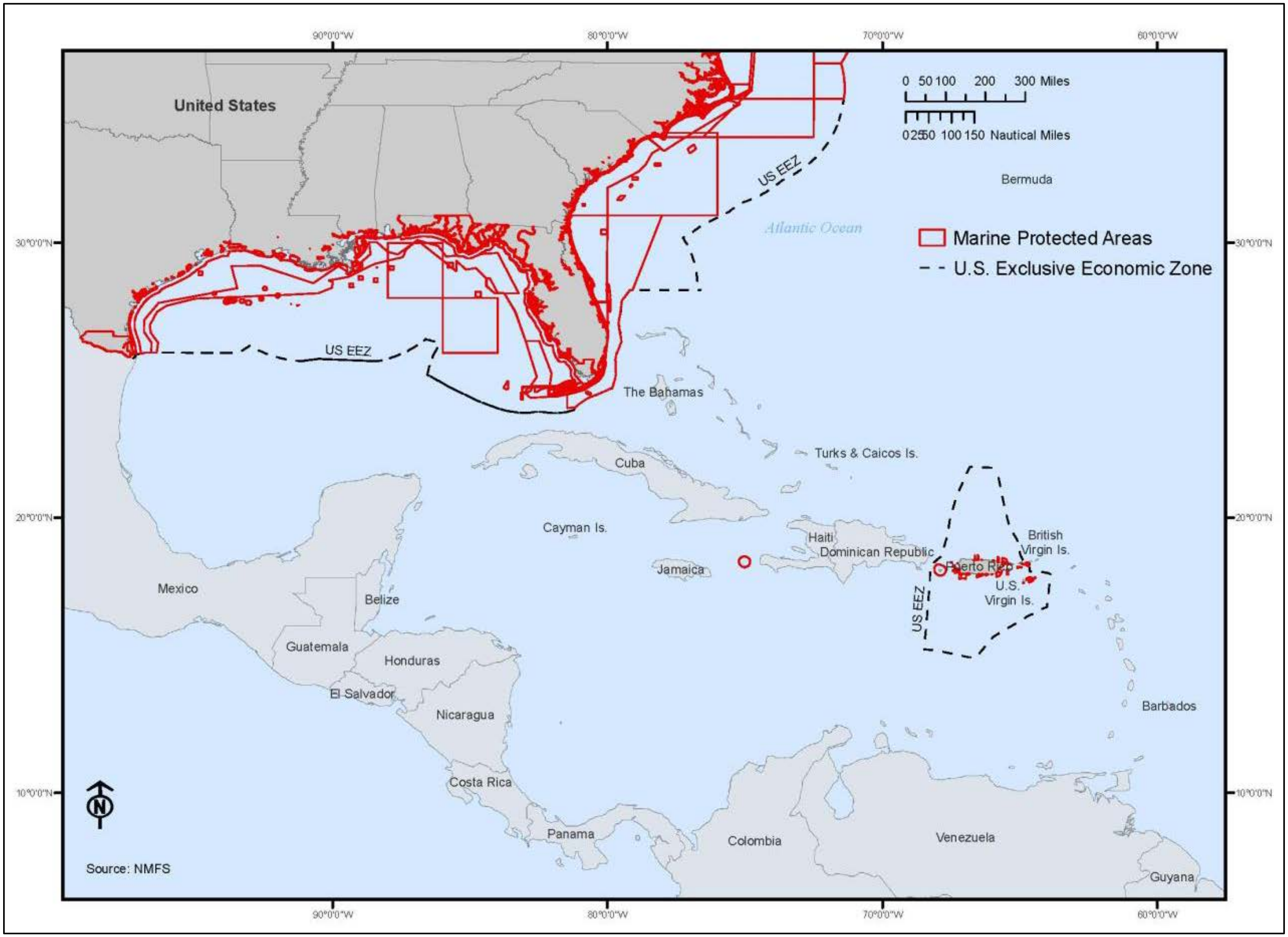

Figure 3.1-15 Marine Protected Areas in the SEFSC Research Areas

Atlantic Research Area

The South Atlantic Fisheries Management Council (SAFMC 2013) further defines MPAs within its jurisdiction as, “a network of specific areas of marine environments reserved and managed for the primary purpose of aiding in the recovery of overfished stocks and to ensure the persistence of healthy fish stocks, fisheries, and associated habitats. Such areas may include naturally occurring or artificial bottom and water column habitats, and may include prohibition of harvest on seasonal or permanent time periods to achieve desired fishery conservation and management goals.”

Eight deepwater MPAs have been established in the South Atlantic region through implementation of Amendment 14 to the Snapper Grouper Fishery Management Plan. The MPAs are designed to protect a portion of the long-lived, "deepwater" Snapper Grouper species such as snowy grouper, speckled hind, and blueline tilefish. Because the majority of these sites are designed to protect deepwater species, the Council will only prohibit bottom fishing while allowing fishermen to troll for pelagics such as tuna, mackerel, dolphin and billfish (SAFMC 2013).

The MPAs range in size from 2 by 4 nm to 10 by 15 nm. In addition to the seven areas that provide protection for natural habitat, the amendment creates a deepwater artificial reef MPA off the coast of Charleston, South Carolina.

- Snowy Wreck MPA
- Northern South Carolina MPA
- Edisto MPA and Charleston Deep Reef MPA
- Georgia MPA
- North Florida MPA
- St. Lucie Hump MPA
- East Hump MPA

Gulf of Mexico Research Area

The Gulf of Mexico is home to 295 MPAs that cover nearly 40 percent of Gulf of Mexico U.S. marine waters. The MPAs vary widely in purpose, legal authorities, managing agencies, management approaches, level of protection, and restrictions on human uses, but most are multiple use. Ninety-five percent of the MPA area in the Gulf is in federal waters, most of this is in fishery MPAs managed by the National Marine Fisheries Service with the Gulf of Mexico Fishery Management Council (National MPAs Center 2012).

Puerto Rico/U.S. Virgin Islands Research Area

There are 44 MPAs in the Puerto Rico/U.S. Virgin Islands Research Area; 10 in the Virgin Islands, and 34 in Puerto Rico (National MPAs Center 2012). Many of them contain significant natural resources such as fish spawning areas and threatened or endangered species, whose protection is essential for the effective conservation of coral reef ecosystems (Wusinich-Mendez and Trappe 2007).

Puerto Rico has two MPAs that are locally classified as marine reserves (Table 3.1-4). The Tres Palmas Marine Reserve is located in the municipality of Rincón, at the northwest corner of the main island of Puerto Rico. The Isla de Desecheo Marine Reserve comprises 0.5 nm around the Desecheo Island, which is an oceanic island located off the northwest coast of Puerto Rico. The island itself is a national wildlife refuge of the U.S. Fish and Wildlife Service.

Table 3.1-4 Marine Reserves in the Puerto Rico/U.S. Virgin Islands Research Area

Puerto Rico
Isla de Desecheo
Tres Palmas
U.S. Virgin Islands
Cas Cay/Mangrove Lagoon
Compass Point Pond
Frank Bay
Salt River Bay
St. James

In the U.S. Virgin Islands, there are three reserves located on the East End of St. Thomas, and St. Croix and St. John each have one (Table 3.1-4).

The Cas Cay/Mangrove Lagoon Marine Reserve and Wildlife Sanctuary was established to protect essential fish habitat for juvenile reef fish, lobsters, birds, and wetland plants and animals, and to support the restoration of these wildlife populations within the reserve.

The Compass Point Pond Marine Reserve and Wildlife Sanctuary was established to protect this important wildlife area on St. Thomas and to prevent any further degradation of the natural resources found within it.

The St. James, Frank Bay, and Salt River Marine Reserve and Wildlife Sanctuaries have focused marine resource conservation goals that aim to: contribute to commercially viable fishery resources by protecting a portion of their spawning stock; to preserve coral reefs and seagrass habitats for larval, juvenile, and adult fish and invertebrates, as well as endangered sea turtles and bird species; and, finally, to provide marine viewing areas for commercial dive operators, recreational divers, students, and researchers.

3.1.2.5 National Marine Sanctuaries

The National Marine Sanctuaries Act authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities as national marine sanctuaries. The National Marine Sanctuary System is intended to (A) improve the conservation, understanding, management, and wise and sustainable use of marine resources; (B) enhance public awareness, understanding, and appreciation of the marine environment; and (C) maintain for future generations the habitat, and ecological services, of the natural assemblage of living resources that inhabit these areas. Day-to-day management of national marine sanctuaries has been delegated by the Secretary of Commerce to NOAA's Office of National Marine Sanctuaries. The primary objective of the National Marine Sanctuaries Act is to set aside marine areas of special national significance for their permanent protection and to manage them as ecosystems to maintain their natural biodiversity and historical and cultural heritage, consistent with compatible uses. The National Marine Sanctuary System consists of 14 MPAs that encompass more than 150,000 mi^2 of marine and Great Lakes waters.

The areas where the SEFSC conducts research include three National Marine Sanctuaries (NMS): one in the ARA (Gray's Reef), and two in the Gulf of Mexico Research Area (Florida Keys and Flower Garden Bank) (Figure 3.1-16). There are no NMS in the Puerto Rico/U.S. Virgin Islands Research Area. Descriptions of each of the three sanctuaries are provided below and site-specific regulations applicable to each may be found in the National Marine Sanctuary Program Regulations.

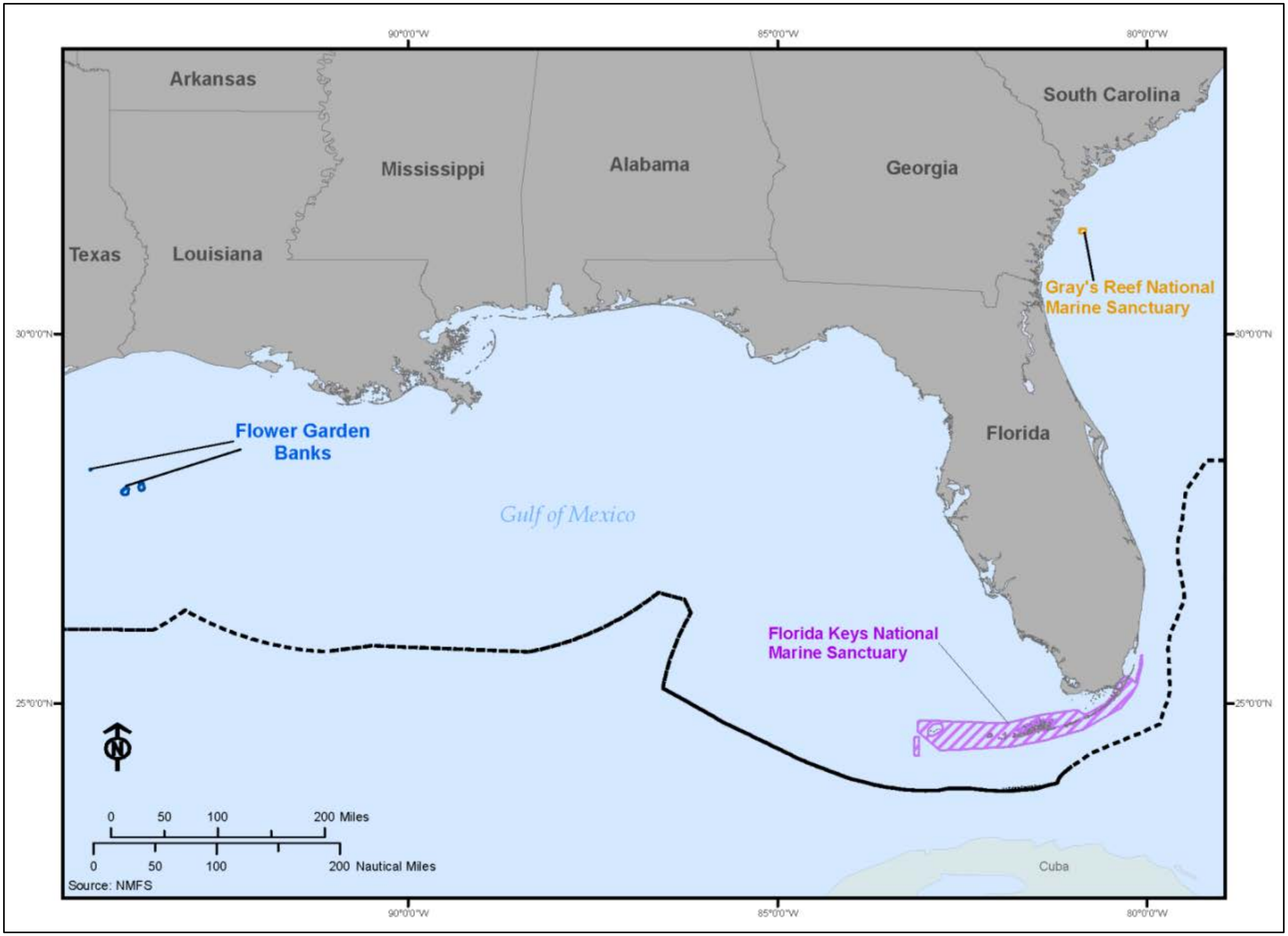

Figure 3.1-16 National Marine Sanctuaries in the SEFSC Research Areas

Gray's Reef

Gray's Reef National Marine Sanctuary off the coast of Georgia is one of the largest nearshore "live-bottom" reefs of the southeastern U.S. Gray's Reef was designated as a National Marine Sanctuary on January 16, 1981. It is approximately 22 mi^2. "Live bottom" is a term used to refer to hard or rocky seafloor that typically supports high numbers of large invertebrates such as sponges, corals and sea squirts. These spineless creatures thrive in rocky areas, as many are able to attach themselves more firmly to the hard substrate, as compared to sandy or muddy "soft" bottom habitats. Within the Gray's Reef National Marine Sanctuary there are rocky ledges with sponge and coral live bottom communities, as well as sandy bottom areas that are more typical of the seafloor off the southeastern U.S. coast.

Florida Keys

Florida Keys National Marine Sanctuary protects 3,840 mi^2 of waters surrounding the Florida Keys, from south of Miami westward to encompass the Dry Tortugas, excluding Dry Tortugas National Park. The shoreward boundary of the sanctuary is the mean high-water mark, essentially meaning that once you set foot in Keys waters, you have entered the sanctuary.

Within the boundaries of the sanctuary lie spectacular, unique, and nationally significant marine resources, from the world's third largest barrier reef, extensive seagrass beds, mangrove-fringed islands, and more than 6,000 species of marine life. The sanctuary also protects pieces of our nation's history such as shipwrecks and other archeological treasures.

Flower Garden Banks

Situated 70 to 115 miles off the coasts of Texas and Louisiana, the Flower Garden Banks sanctuary includes underwater communities that rise from the depths of the Gulf of Mexico atop underwater mountains called salt domes. The sanctuary protects three separate areas: East Flower Garden Bank, West Flower Garden Bank, and Stetson Bank. These banks are separated from each other by miles of open ocean ranging from 200 to 400 ft (61-122 m) deep, and each bank has its own set of boundaries.

Within the Caribbean region, but outside of the U.S. EEZ, the United Nations Educational, Scientific and Cultural Organization has established three World Heritage Sites: Sian Ka'an (Mexico), Belize Barrier Reef Reserve (Belize), and Pitons Management Area (Saint Lucia).

Sian Ka'an, located on the east coast of the Yucatán peninsula, is a biosphere reserve containing tropical forests, mangroves and marshes, as well as a large marine section intersected by a barrier reef. The Belize Barrier Reef Reserve is an outstanding natural system consisting of the largest barrier reef in the northern hemisphere, offshore atolls, several hundred sand cays, mangrove forests, coastal lagoons and estuaries. The system's seven sites illustrate the evolutionary history of reef development and are a significant habitat for threatened species, including marine turtles, manatees and the American marine crocodile. The Pitons Management Area is a 2,909-ha site near the town of Soufriere on Saint Lucia. It includes the Pitons, two volcanic spires rising side by side from the sea (770 m and 743 m high respectively), linked by the Piton Mitan ridge. The volcanic complex includes a geothermal field with sulphurous fumeroles and hot springs. Coral reefs cover almost 60 percent of the site's marine area.

While each World Heritage Site remains part of the legal territory of the state wherein the site is located, the United Nations Educational, Scientific and Cultural Organization considers it in the interest of the international community to preserve each site.

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 Fish

Thousands of finfish species occur within the three SEFSC research areas. This section of the DPEA provides baseline information for species important to the analysis of effects in Chapter 4; ESA-listed species, important target species caught in SEFSC survey efforts, and prohibited and highly migratory species.

3.2.1.1 Threatened and Endangered Fish Species

Six fish species with multiple Distinct Population Segments (DPS) are listed as threatened or endangered under the ESA in the SEFSC research areas (Table 3.2-1). The information presented in the following species accounts is primarily from the NOAA Fisheries Office of Protected Resources website (http://www.nmfs.noaa.gov/pr/species).

Table 3.2-1 Threatened and Endangered Fish Species Occurring in the SEFSC Research Areas

Common Name	Scientific Name	ARA	GOMRA	CRA	Federal ESA Status
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	x			Four endangered DPS (Carolina, South Atlantic, New York Bight, and Chesapeake Bay) and one threatened DPS (Gulf of Maine)
Gulf sturgeon	*Acipenser oxyrinchus desotoi*		x		Threatened
Largetooth sawfish	*Pristis pristis*		x		Endangered
Scalloped hammerhead shark	*Sphyrna lewini*	*	*	x	Threatened (Central & Southwest Atlantic DPS)
Shortnose sturgeon	*Acipenser brevirostrum*	x			Endangered
Smalltooth sawfish	*Pristis pectinata*		x		Endangered (U.S. DPS)

Source: http://www.nmfs.noaa.gov/pr/species
*Non-listed DPSs present.

Atlantic sturgeon

The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is an anadromous species distributed along the U.S. Atlantic coast. NMFS listed five distinct population segments of Atlantic sturgeon under the ESA in 2012; The Gulf of Maine DPS was listed as threatened while the New York Bright, Chesapeake Bay, Carolina, and South Atlantic DPSs were listed as endangered (77 FR 5880 and 77 FR 5914). The Carolina and South Atlantic DPSs are most common in the SEFSC ARA, especially in nearshore and estuarine waters, but all DPS could occur in marine waters of the Atlantic. Adults spawn in freshwater in the spring and early summer and migrate into estuarine and marine waters where they spend most of their lives. Subadults and adults live in coastal waters and estuaries when not spawning, generally in shallow (10-50 m depth) nearshore areas dominated by gravel and sand substrates. Long distance migrations away from spawning rivers are common.

Historically, Atlantic sturgeon were present in approximately 38 rivers in the U.S. from St. Croix, ME to the Saint Johns River, FL, of which 35 rivers have been confirmed to have had a historical spawning population. Atlantic sturgeon are currently present in approximately 32 of these rivers, and spawning occurs in at least 20 of them. The Altamaha River supports one of the healthiest Atlantic sturgeon populations in the Southeast, with over 2,000 subadults captured in research surveys in the past few years, 800 of which were 1-2 years of age. Studies have consistently found populations to be genetically diverse and indicate that there are about 10 populations that can be statistically differentiated.

Threats include historical overharvesting; bycatch; habitat degradation and loss from various human activities such as dredging, dams, water withdrawals, and other development; and habitat impediments including locks, dams, and ship strikes. (http://www.nmfs.noaa.gov/pr/species)

Gulf sturgeon

The Gulf sturgeon (*Acipenser oxyrinchus desotoi*), also known as the Gulf of Mexico sturgeon, is listed as threatened under the ESA throughout its range. Gulf sturgeon are found in river systems from Louisiana to Florida, in nearshore bays and estuaries, and in the Gulf of Mexico. Gulf sturgeon are "anadromous" fish, inhabiting coastal rivers from Louisiana to Florida during the warmer months, and migrating to the marine waters of the Gulf of Mexico and its estuaries and bays in the cooler months. Juvenile Gulf sturgeon stay in the river for about the first 2-3 years. Gulf sturgeon return to their natal stream to spawn. Riverine habitats where the healthiest populations of Gulf sturgeon are found include long, spring-fed, free-flowing rivers, typically with steep banks, a hard bottom, and an average water temperature of 60-72° F. Gulf sturgeon initiate movement up to the rivers between February and April and migrate back out to the Gulf of Mexico between September and November. Gulf sturgeon are bottom feeders and eat primarily macroinvertebrates including brachiopods, mollusks, worms, and crustaceans. All foraging occurs in brackish or marine waters of the Gulf of Mexico and its estuaries; sturgeon do not forage in riverine habitat. Gulf sturgeon migrate into rivers to spawn in the spring where spawning occurs in areas of clean substrate comprised of rock and rubble. Their eggs are sticky, sink to the bottom, and adhere in clumps to snags, outcroppings, or other clean surfaces.

Threats include historical overfishing, construction of water control structures such as dams and "sills", exacerbated habitat loss, dredging, groundwater extraction, irrigation, flow alterations, poor water quality, and contaminants, primarily from industrial sources. (http://www.nmfs.noaa.gov/pr/species)

Largetooth sawfish

The largetooth sawfish (*Pristis pristis*) includes the former species *P. microdon* and *P. perotetti*. This species listed as endangered under the ESA throughout its range (including the range of the species and populations formerly considered *P. microdon*, *P. perotetti*, and *P. pristis*). Largetooth sawfish are generally restricted to shallow (less than 33 ft [10 m]) coastal, estuarine, and fresh waters, although they have been found at depths of up to 400 ft (122 m) in Lake Nicaragua. They are often found in brackish water near river mouths and large bays, preferring partially enclosed waters, lying in deeper holes and on bottoms of mud or muddy sand. Like the smalltooth sawfish, they are highly mangrove-associated.

Largetooth sawfish occur in warm temperate to tropical waters in the Atlantic and Caribbean, and freshwater habitats in Central and South America and Africa. Historically, they occurred from the Caribbean and Gulf of Mexico south through Brazil, and in the U.S. they were reported in the Gulf of Mexico, mainly along the Texas coast and east into Florida waters. Historical occurrences in North America were much more limited than those of the related smalltooth sawfish, and were strictly confined to shallow nearshore, warm (greater than 64-86°F [18-30°C)]) temperate and tropical estuarine localities, partly enclosed lagoons, and similar areas. There are few reliable data available for this species, and no robust estimates of historic or current population size exist. However, available data indicate that the species' distribution has been greatly reduced, and that populations have declined dramatically.

Threats include entanglement in nets, lines, and trawls; bycatch in fisheries, though in some areas they have been directly targeted; and loss of habitat. Juvenile sawfish use shallow habitats with a lot of vegetation, such as mangrove forests, as important nursery areas. Many such habitats have been modified or lost due to development. The loss of juvenile habitat likely contributed to the decline of this species.

The lack of effective regulatory mechanisms internationally has likely contributed to their decline, as well as their restricted habitat and low rate of population growth. (http://www.nmfs.noaa.gov/pr/species)

Scalloped hammerhead shark

The scalloped hammerhead shark (*Sphyrna lewini*) is ESA threatened in its Central and Southwest Atlantic distinct population segment. Animals from this DPS will only occur in the Caribbean Research Area. This coastal pelagic species can also be found in ocean waters and occurs over continental and insular shelves and adjacent to deeper water. It has been observed close inshore and even entering estuarine habitats, as well as offshore to depths of 1000 m. Scalloped hammerhead sharks are found worldwide residing in coastal warm temperate and tropical seas in the Atlantic, Pacific, and Indian Oceans between 46°N and 36°S to depths of 1000 m.

Threats include targeted fisheries, shark fin trade, and bycatch. This species is highly desired for the shark fin trade because of its fin size and high fin ray count. They are caught in a variety of fisheries including artisanal and small-scale commercial fisheries, bottom longlines, offshore pelagic longlines, and gillnets. They are valuable in the international fin trade and are often used to make shark fin soup. (http://www.nmfs.noaa.gov/pr/species)

Shortnose sturgeon

Shortnose sturgeon (*Acipenser brevirostrum*) inhabit rivers and estuaries. They are anadromous fish, spawning in the coastal rivers along the east coast of North America from the St. John River in Canada to the St. Johns River in Florida. Shortnose sturgeon occur in most major river systems along the U.S. eastern seaboard. They prefer the nearshore marine, estuarine, and riverine habitat of large river systems. Shortnose sturgeon, unlike other anadromous species with overlapping distributions such as shad, do not appear to make long distance offshore migrations. They are benthic feeders, eating crustaceans, mollusks, and insects.

In the southern portion of their range, shortnose sturgeon are found in the St. Johns River in Florida; Altamaha, Ogeechee, and Savannah Rivers in Georgia; in South Carolina river systems that empty into Winyah Bay; and the Santee/Cooper River complex that forms Lake Marion.

No estimate of the historical population size of shortnose sturgeon is available. While the shortnose sturgeon was rarely the target of a commercial fishery, it often was taken incidentally in the commercial fishery for Atlantic sturgeon. In the 1950s, sturgeon fisheries declined on the east coast, which resulted in a lack of records of shortnose sturgeon. This led the USFWS to conclude that the fish had been eliminated from the rivers in its historic range (except the Hudson River) and was in danger of extinction because of pollution and overfishing, both directly and incidentally.

Threats include construction of dams; pollution of many large northeastern river systems; habitat alterations from discharges, dredging, or disposal of material into rivers; related development activities involving estuarine/ riverine mudflats and marshes; and, historically, commercial exploitation. (http://www.nmfs.noaa.gov/pr/species)

Smalltooth sawfish

The smalltooth sawfish (*Pristis pectinata*) is ESA endangered for the U.S. DPS and ESA proposed endangered for populations outside of the U.S. In the U.S., smalltooth sawfish are found around the peninsula of Florida, common only in the Everglades region at the southern tip of the state. NMFS designated critical habitat for the smalltooth sawfish in September 2009 (74 FR 45353). Historically, the U.S. population was common throughout the Gulf of Mexico from Texas to Florida, and along the east coast from Florida to North Carolina. Smalltooth sawfish inhabit the shallow coastal waters of tropical seas and estuaries throughout the world. They are usually found in shallow waters (less than 32 ft [10 m]), very close to shore over muddy and sandy bottoms. They are often found in sheltered bays, on shallow banks, and in estuaries or river mouths. They prefer warmer water temperatures of 22-28°C (71-82°F).

No accurate estimates of abundance trends over time are available, but available data, including museum records and anecdotal observations from fishers, indicate that the population has declined by about 95 percent. Threats include bycatch in various fisheries, especially in gillnets, and loss of juvenile habitat. Because adults can grow very large and potentially damage fishing gear or even pose a threat to fishermen, many incidentally captured sawfish are killed before removal from fishing gear, even if the fishermen have no interest in keeping them.

Juvenile sawfish use shallow habitats with a lot of vegetation, such as mangrove forests, as important nursery areas. Many such habitats have been modified or lost due to development of the waterfront in Florida and other southeastern states. The loss of juvenile habitat likely contributed to the decline of this species. (http://www.nmfs.noaa.gov/pr/species)

3.2.1.2 Target Species

For the purposes of this DPEA, target species are those fish which are managed under an FMP for commercial and recreational fisheries and are the subject of SEFSC research surveys for stock assessment purposes. Only species are listed that have had an average annual research catch over the last five years of at least 500 kilograms (kg) for the ARA and GOMRA or at least 20 kg for the CRA, and/or that are currently listed as overfished or subject to overfishing. Tables 3.2-2, 3.2-3, and 3.2-4 display the stock and management status of target species in the SEFSC research areas that are commonly caught in SEFSC and research partner surveys (annual average >500 kg).

For information on life history traits and habitat for target species, please see the Southeast Fisheries Science Center website at www.sefsc.noaa.gov/species/fish/.

Table 3.2-2 Target Fish Species in the Atlantic Research Area

Species are listed in alphabetical order. Only species with average annual research catch greater than 500 kilograms in SEFSC and research partner surveys or those that are overfished are listed.

Species	Scientific Name	Stock Status	Fishery Management Council	Fishery Management Plan (FMP)
Almaco jack	*Seriola rivoliana*	unknown	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region
Blueline tilefish	*Caulolatilus microps*	**overfishing** **overfished**	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region
Gray triggerfish	*Balistes cabriscus*	not overfishing unknown if overfished	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region
Great northern tilefish	*Lopholatilus chamaeleonticeps*	no overfishing not overfished	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region
Greater amberjack	*Seriola dumerili*	no overfishing not overfished	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region
Red Porgy	*Pagrus pagrus*	not overfishing **overfished**	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region
Red snapper	*Lutjanus campechanus*	**overfishing** **overfished**	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region
Scamp	*Mycteroperca phenax*	not overfishing unknown if overfished	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region
Snowy grouper	*Hyporthodus niveatus*	not overfishing **overfished** rebuilding	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region
Speckled hind	*Epinephelus drummondhayi*	**overfishing** unknown if overfished	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region
Porgy	*Stenotomus sp.*	unknown	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region
Warsaw grouper	*Epinephelus nigritus*	**overfishing** unknown if overfished	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region

Species	Scientific Name	Stock Status	Fishery Management Council	Fishery Management Plan (FMP)
White grunt	*Haemulon plumieri*	not overfishing unknown if overfished	SAFMC	Snapper-Grouper Fishery of the South Atlantic Region

Stock status information is based on the 2014 third quarter FSSI and Non-FSSI Stock Status Table. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

Table 3.2-3 Target Species in the Gulf of Mexico Research Area

Only species with an annual average catch of greater than 500 kilograms in SEFSC and research partner surveys are shown.

Species	Scientific Name	Stock Status	Fishery Management Council	Fishery Management Plan (FMP)
Goliath grouper	*Epinephelus itajara*	not overfishing unknown if overfished	GMFMC / SAFMC	Reef Fish Resources of the Gulf of Mexico
Gray triggerfish	*Balistes capriscus*	no overfishing **overfished** rebuilding	GMFMC	Reef Fish Resources of the Gulf of Mexico
Greater amberjack	*Seriola dumerili*	no overfishing **overfished** rebuilding	GMFMC	Reef Fish Resources of the Gulf of Mexico
Hogfish	*Lachnolaimus maximus*	unknown	GMFMC	Reef Fish Resources of the Gulf of Mexico
Red drum	*Sciaenops ocellatus*	no overfishing unknown if overfished	GMFMC	Red Drum Fishery of the Gulf of Mexico
Red snapper	*Lutjanus campechanus*	no overfishing **overfished** rebuilding	GMFMC	Reef Fish Resources of the Gulf of Mexico
Spanish mackerel	*Scomberomorus maculatus*	no overfishing not overfished	GMFMC / SAFMC	Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic
Snowy grouper	*Epinephelus niveatus*	unknown	GMFMC	Reef Fish Resources of the Gulf of Mexico
Speckled hind	*Epinephelus drummondhayi*	unknown	GMFMC	Reef Fish Resources of the Gulf of Mexico
Warsaw grouper	*Epinephelus nigritus*	unknown	GMFMC	Reef Fish Resources of the Gulf of Mexico

Stock status information is based on the 2014 third quarter FSSI and Non-FSSI Stock Status Table. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

Table 3.2-4 Target Species in the Caribbean Research Area

Species are listed in alphabetical order. Only species with average annual research catch greater than 20 kilograms are listed.

Species	Scientific Name	Stock Status	Fishery Management Council	Fishery Management Plan (FMP)
Blackfin snapper	*Lutjanus buccanella*	no overfishing not overfished **approaching overfished**	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Blue runner	*Caranx crysos*	no overfishing unknown if overfished	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Coney	*Cephalopholis fulva*	no overfishing unknown if overfished	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Dog snapper	*Lutjanus jocu*	no overfishingunknown if overfished	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Horse-eye jack	*Caranx latus*	no overfishing unknown if overfished	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Lane snapper	*Lutjanus synagris*	no overfishing unknown if overfished	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Mutton snapper	*Lutjanus analis*	no overfishing unknown if overfished	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Pluma	*Calamus pennatula*	unknown	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Puddingwife	*Halichoeres radiatus*	unknown	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Red grouper	*Epinephalus morio*	no overfishing **overfished** rebuilding	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Red hind	*Epinephelus guttatus*	no overfishing unknown if overfished	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Schoolmaster	*Lutjanus apodus*	no overfishing unknown if overfished	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands

Species	Scientific Name	Stock Status	Fishery Management Council	Fishery Management Plan (FMP)
Silk snapper	*Lutjanus vivanus*	no overfishing not overfished **approaching overfished**	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Vermilion snapper	*Rhomboplites aurorubens*	no overfishing not overfished **approaching overfished**	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Wenchman	*Pristomopoides aquilonaris*	no overfishing not overfished **approaching overfished**	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
White grunt	*Haemulon plumieri*	no overfishing unknown if overfished	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
Yellowtail snapper	*Ocyurus chrysurus*	no overfishing unknown if overfished	CFMC	Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands

Stock status information is based on the 2014 third quarter FSSI and Non-FSSI Stock Status Table. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

3.2.1.3 Prohibited Species and Highly Migratory Fish Species

Prohibited fish species

Prohibited species are those species caught as bycatch in commercial or recreational fisheries that cannot be retained under provisions of one or more FMPs, unless authorized by another applicable law. Prohibited highly migratory shark species include Atlantic angel, basking, bigeye sand tiger, bigeye sixgill, bigeye thresher, bignose, Caribbean reef, Caribbean sharpnose, dusky, Galapagos, longfin mako, narrowtooth, night, sand tiger, sevengill, silky, sixgill, smalltail, whale, and white. Other prohibited species include goliath grouper, Nassau grouper, red snapper, speckled hind, and Warsaw grouper in the South ARA; goliath grouper, nassau grouper, and red drum in the Gulf of Mexico Research Area; and blue parrotfish, goliath grouper, midnight parrotfish, Nassau grouper, and rainbow parrotfish in the Caribbean Research Area (www.sefsc.noaa.gov/species/fish/).

Highly migratory fish species

Highly migratory species (Table 3.2-5) are those fish species which migrate variable distances across oceans for feeding or reproduction, and have wide geographic distributions. These species are pelagic and are typically found both within the 200-mile EEZ and in open oceans, although some life history stages may occur in nearshore waters. HMS managed under the *Consolidated Atlantic Highly Migratory Species FMP* (NMFS 2006b) include: billfish (blue marlin, white marlin, sailfish, swordfish, longbill spearfish), sharks (basking, cow, hammerhead, mackerel, nurse, requiem, sandbar, sand tiger, thresher, whale), and tunas (Atlantic bigeye, Atlantic yellowfin, Atlantic albacore, Atlantic skipjack).

Table 3.2-5 Prohibited and Highly Migratory Species Caught in the SEFSC Research Areas

Species	Scientific Name	Catch Location by Research Area			Stock Status
		ARA	GOMRA	CRA	
BILLFISH					
Atlantic blue marlin	*Makaira nigricans*		x		overfishing overfished
Indo-Pacific sailfish	*Istiophorus platypterus*		x		-
Swordfish	*Xiphias gladius*		x		no overfishing (SA) not overfished (SA)
TUNA					
Bigeye tuna	*Thunnus obesus*		x		no overfishing (SA) not overfished (SA) rebuilding (SA)
***Yellowfin tuna**	*Thunnus albacares*		x		no overfishing (SA) not overfished (SA)
SHARKS					
Atlantic angel shark	*Squatina dumeril*	x	x		prohibited
***Atlantic sharpnose shark**	*Rhizoprionodon terraenovae*	x	x	x	no overfishing (SA) not overfished (SA)
Arrowhead dogfish	*Deania profundorum*		x		data collection only
Bigeye thresher	*Alopias superciliosus*		x		prohibited

Species	Scientific Name	Catch Location by Research Area			Stock Status
		ARA	GOMRA	CRA	
Bigeyed sixgill shark	*Hexanchus nakamurai*		x		prohibited
Bignose shark	*Carcharhinus altimus*	x	x	x	unknown prohibited
***Blacknose shark**	*Carcharhinus acronotus*	x	x	x	Overfishing (SA) overfished (SA) Unknown (GOM, CRA)
***Blacktip shark**	*Carcharhinus limbatus*	x	x		no overfishing (GOM) not overfished (GOM) unknown (SA)
Blue shark	*Prionace glauca*		x		not overfished
Bluntnose sixgill shark	*Hexanchus griseus*	x			prohibited
Bonnethead shark	*Sphyrna tiburo*	x	x		no overfishing not overfished
Bonnethead shark spp	*Sphyrna*		x		unknown
Bull shark	*Carcharhinus leucas*	x	x		unknown
Caribbean lanternshark	*Etmopterus hillianus*		x		data collection only
Caribbean reef shark	*Carcharhinus perezi*		x	x	unknown prohibited
Caribbean sharpnose shark	*Rhizoprionodon porosus*		x	x	unknown prohibited
Chain catshark	*Scyliorhinus retifer*		x		data collection only
Common thresher	*Alopias vulpinus*		x		prohibited
Cuban dogfish	*Squalus cubensis*		x	x	unknown
Dusky shark	*Carcharhinus obscurus*	x	x	x	**overfishing** **overfished**
Dusky smooth-hound	*Mustelus canis*	x	x		data collection only
Finetooth shark	*Carcharhinus isodon*	x	x		no overfishing not overfished
Narrowfin smooth-hound	*Mustelus norrisi*		x		data collection only
Great hammerhead shark	*Sphyrna mokarran*	x	x		unknown
Green lanternshark	*Etmopterus virens*		x		data collection only
Gulper shark	*Centrophorus granulosus*		x		data collection only
Kitefin shark	*Dalatias licha*			x	unknown
Lemon shark	*Negaprion brevirostris*	x	x		unknown
Night shark	*Carcharhinus signatus*		x		prohibited
***Nurse shark**	*Ginglymostoma cirratum*	x	x	x	unknown
Oceanic whitetip shark	*Carcharhinus longimanus*		x		unknown

Species	Scientific Name	Catch Location by Research Area			Stock Status
		ARA	GOMRA	CRA	
Roughskin dogfish	*Centroscymnus owstonii*		x		data collection only
Roughtail catshark	*Galeus arae*	x	x		data collection only
***Sand tiger shark**	*Carcharias taurus*	x			prohibited
***Sandbar shark**	*Carcharhinus plumbeus*	x	x	x	no overfishing overfished rebuilding
***Scalloped hammerhead shark**	*Sphyrna lewini*	x	x	x	**overfishing overfished**
Sharpnose sevengill shark	*Heptranchias perlo*		x		prohibited
Shortspine dogfish	*Squalus mitsukurii*	x	x		data collection only
Silky shark	*Carcharhinus falciformis*	x	x	x	unknown
Shortfin mako shark	*Isurus oxyrinchus*		x		no overfishing not overfished
Smooth hammerhead shark	*Sphyrna zygaena*	x			unknown
Spiny dogfish	*Squalus acanthias*	x			data collection only
Spinner shark	*Carcharhinus brevipinna*	x	x		unknown
***Tiger shark**	*Galeocerdo cuvier*	x	x	x	unknown
White shark	*Carcharodon carcharias*	x			prohibited

* Target Species

3.2.1.4 Other Fish Species

Hundreds of fish species have been caught during the course of SEFSC research that may not be subject to formal stock assessments or belong to one of the categories above. Table 3.2-6 includes species that have an average annual research catch over the last five years of at least 500 kg for the ARA and GOMRA or at least 20 kg for the CRA, but are not addressed under an FMP. Also included are shark and billfish species not listed in the HMS FMP and species managed under the Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic FMP.

Table 3.2-6 Other Species Caught in the SEFSC Research Areas

Only species with an annual average catch greater than 500 kilograms in the ARA/GOMRA and 20 kilograms in the CARA are shown.

Species	Scientific Name	Catch Location by Research Area		
		ARA	GOMRA	CRA
American Harvestfish	*Peprilus paru*	X		
Atlantic bumper	*Chloroscombrus chrysurus*	X	X	
Atlantic croaker	*Micropogonias undulatus*	X	X	
Atlantic cutlassfish	*Trichiurus lepturus*	X	X	
Atlantic menhaden	*Brevoortia tyrannus*	X		
Atlantic moonfish	*Selene setapinnis*	X		
Atlantic red herring	*Etrumeus teres*		X	
Atlantic stingray	*Dasyatis sabina*	X		
Banded drum	*Larimus fasciatus*	X		
Bluntnose stingray	*Dasyatis say*	X		
Bullnose ray	*Myliobatis freminvillei*	X		
Cownose ray	*Rhinoptera bonasus*	X		
Gulf butterfish	*Peprilus burti*		X	
Inshore lizardfish	*Synodus foetens*		X	
King snakeeel	*Ophichthus rex*		X	
Longspine porgy	*Stenotomus caprinus*		X	
Pinfish	*Lagodon rhomboides*	X	X	
Red drum	*Sciaenops ocellatus*	X		
Rough scad	*Trachurus lathami*		X	
Roughtail Stingray	*Dasyatis centroura*	X		
Sand seatrout	*Cynoscion arenarius*		X	
Silver seatrout	*Cynoscion nothus*	X	X	
Smooth butterfly ray	*Gymnura micrura*	X		
Southern kingfish	*Menticirrhus americanus*	X		
Southern stingray	*Dasyatis americana*	X		
Spiny butterfly ray	*Gymnura altavela*	X		
Spot	*Leiostomus xanthurus*	X	X	
Star drum	*Stellifer lanceolatus*	X		
Weakfish	*Cynoscion regalis*	X		
Wenchman	*Pristipomoides aquilonaris*		X	
SHARKS AND BILLFISH NOT ADDRESSED IN HMS FMP				
Gulf smooth-hound	*Mustelus sinusmexicanus*		X	
Indo-Pacific sailfish	*Istiophorus platypterus*		X	
Spined pygmy shark	*Squaliolus laticaudus*		X	
Taiwan gulper shark	*Centrophorus Niaukang*	X		

3.2.2 Marine Mammals

The marine mammal species listed in Table 3.2-7 occur in the areas frequented by the SEFSC research surveys in the ARA, GOMRA and the CRA. Extralimital and rarely sighted species are not included. All marine mammals are federally protected under the MMPA. In addition, four species of whales and one sirenian species in the SEFSC research areas are listed as endangered under the ESA, and five coastal stocks of bottlenose dolphins are considered depleted under the MMPA. The survey areas also encompass designated critical habitat for North Atlantic right whales and Florida manatees. Threatened and endangered species encountered in the SEFSC survey areas are described in Section 3.2.2.2. Non-ESA listed marine mammals for which takes are requested by SEFSC in the LOA Application (Appendix C) are described in section 3.2.2.3. Information provided here summarizes data on stock status, abundance, density, distribution and habitat, and auditory capabilities, as available in published literature and reports, including marine mammal stock assessments.

Table 3.2-7 Marine Mammal Species that Regularly Occur in the SEFSC Atlantic (ARA), Gulf of Mexico (GOMRA), and Caribbean (CRA) Research Areas

Species		ARA	GOMRA	CRA	ESA/MMPA Status[1]
Common Name	**Scientific Name**				
CETACEANS					
North Atlantic right whale	*Eubalaena glacialis*	X			Endangered
Humpback whale	*Megaptera novaeangliae*	X	X	X	Endangered[2]
Fin whale	*Balaenoptera physalus*	X	X		Endangered
Minke whale	*Balaenoptera acutorostrata*	X	X	X	-
Bryde's whale	*Balaenoptera edeni*		X		-
Sperm whale	*Physeter macrocephalus*	X	X	X	Endangered
Pygmy or dwarf sperm whale	*Kogia breviceps or K. sima*	X	X	X	-
Killer whale	*Orcinus orca*	X	X	X	-
Pygmy killer whale	*Feresa attenuata*	X	X	X	-
False killer whale	*Pseudorca crassidens*	X	X	X	-
Cuvier's beaked whale	*Ziphius cavirostris*	X	X	X	PR/USVI stock is strategic
Mesoplodont beaked whales	*Mesoplodon spp.*	X	X	X	-
Melon-headed whale	*Peponocephala electra*	X	X	X	-
Risso's dolphin	*Grampus griseus*	X	X	X	-
Short-finned pilot whale	*Globicephala macrorhynchus*	X	X	X	PR/USVI stock is strategic
Long-finned pilot whale	*Globicephala melas*	X			-
Short-beaked common dolphin	*Delphinus delphis*	X			-
Atlantic spotted dolphin	*Stenella frontalis*	X	X	X	PR/USVI stock is strategic
Pantropical spotted dolphin	*Stenella attenuata*	X	X	X	-
Striped dolphin	*Stenella coeruleoalba*	X	X	X	-

Species		ARA	GOMRA	CRA	ESA/MMPA Status[1]
Common Name	**Scientific Name**				
Fraser's dolphin	*Lagenodelphis hosei*	X	X	X	-
Rough-toothed dolphin	*Steno bredanensis*	X	X	X	-
Clymene dolphin	*Stenella clymene*	X	X	X	-
Spinner dolphin	*Stenella longirostris*	X	X	X	PR/USVI stock is strategic
Bottlenose dolphin (numerous stocks, see Table 3.2-9)[3]	*Tursiops truncatus*	X	X	X	varies
Harbor porpoise	*Phocoena phocoena*	X			
PINNIPEDS					
Harbor seal	*Phoca vitulina concolor*	X			
Gray seal	*Halichoerus grypus*	X			
SIRENIANS					
West Indian manatee[4]	*Trichechus manatus*	X	X	X	Endangered

1. Denotes ESA listing as either endangered or threatened, or MMPA listing as depleted. By default, all species listed under the ESA as threatened or endangered are also considered depleted under the MMPA. All marine mammal stocks are considered protected under the MMPA.

2. Humpback whales have been proposed for reclassification; see species account below.

3. There are 54 stocks of bottlenose dolphins in the SEFSC research areas (17 in the ARA, 36 in the GOMRA, 1 in the CRA). Refer to Table 3.2-9 for details.

3. Includes Florida and Antillean subspecies. Manatees are under the jurisdiction of the U.S. Fish and Wildlife Service.

3.2.2.1 Marine Mammal Acoustics and Hearing

Marine mammals rely on sound production and reception for social interactions (e.g., reproduction, communication), to find food, to navigate, and to respond to predators. General reviews of cetacean and pinniped sound production and hearing may be found in Richardson et al. (1995), Edds-Walton (1997), Wartzok and Ketten (1999), and Au and Hastings (2008). Several recent studies on hearing in individual species or species groups of odontocetes and pinnipeds also exist (e.g., Kastelein et al. 2009, Kastelein et al. 2013, Ruser et al. 2014). Interfering with these functions through anthropogenic noise could result in potential adverse impacts.

Southall et al. (2007) provided a comprehensive review of marine mammal acoustics including designating functional hearing groups. Assignment was based on behavioral psychophysics (the relationship between stimuli and responses to stimuli), evoked potential audiometry, and auditory morphology. Since no direct measurements of hearing exist for baleen whales, hearing sensitivity was estimated from behavioral responses (or lack thereof) to sounds, commonly used vocalization frequencies, body size, ambient noise levels at common vocalization frequencies, and cochlear measurements. NOAA modified the functional hearing groups of Southall et al. (2007) to extend the upper range of low-frequency cetaceans and to divide the pinniped hearing group into Phocid and Otariid hearing groups (NOAA 2015a). Detailed descriptions of marine mammal auditory weighting functions and functional hearing groups are available in NOAA (2015b). Table 3.2-8 presents the functional hearing groups and representative species or taxonomic groups for each; most species found in the SEFSC project areas are in the first two groups, low frequency cetaceans (baleen whales) and mid frequency cetaceans (odontocetes). The study by Southall et al. (2007) excluded manatees, so data on manatee hearing included in the following table are from Gerstein et al. (1999).

Table 3.2-8 Summary of the Functional Hearing Groups of Marine Mammals

Functional Hearing Group	Estimated Auditory Bandwidth	Species or Taxonomic Groups
Low Frequency Cetaceans (Mysticetes–Baleen whales)	7 Hertz (Hz) to 25 kilohertz (kHz) (best hearing is generally below 1000 Hz, higher frequencies result from humpback whales)	All baleen whales
Mid- Frequency Cetaceans (Odontocetes – Toothed whales)	150 Hz to 160 kHz (best hearing is from approximately 10-120 kHz)	Includes species in the following genera: *Steno, Tursiops, Stenella, Delphinus, Lagenodelphis, Lissodelphis, Grampus, Peponocephala, Feresa, Pseudorca, Orcinus, Globicephala, Physeter, Ziphius, Mesoplodon*
High-frequency Cetaceans (Odontocetes)	200 Hz to 180 kHz (best hearing is from approximately 10-150kHz)	Includes species in genera *Kogia* and *Phocoena*
Phocid pinnipeds (true seals)	75 Hz to 100 kHz (best hearing is from approximately 1-30 kHz)	Includes species in the genera *Phoca* and *Halichoerus*
Sirenians	0.4 to 46 kHz (peak frequency sensitivity at 16-18 kHz)	West Indian Manatee

Source: Based on Southall et al. 2007, DON 2008, and NOAA 2015b; Manatee information from Gerstein et al. 1999.

3.2.2.2 Threatened and Endangered Marine Mammals

This section only discusses species listed as threatened or endangered under the ESA; Table 3.2-7 lists all marine mammal species encountered in the SEFSC Atlantic, Gulf of Mexico, and Caribbean Research Areas.

North Atlantic Right Whale

Status and trends: The North Atlantic right whale is one of the most critically endangered large whales in the world (Clapham et al. 1999, Perry et al. 1999). The western North Atlantic right whale stock was estimated to include at least 476 individuals in 2011 (Waring et al. 2015b). The estimated population growth rate was 2.5 percent for the period 1986-1992 (Knowlton et al. 1994). Subsequent analyses suggested declining survival probability in the 1990s (Best et al. 2001, Caswell et al. 1999, Clapham 2002). Recent review of the minimum number alive population index derived from the individual sightings database indicates a positive population trend, with a geometric mean growth rate of 2.8 percent for the years 1990-2011 (Waring et al. 2015b). A Recovery Plan, originally published in 1991 and most recently revised in 2005, is currently in effect for this species (NMFS 2005a).

Based on the minimum population size of 476, a recovery factor of 0.1 and a maximum productivity rate of 0.04, the PBR for the Western Atlantic stock of North Atlantic right whales is 1.0. The minimum rate of anthropogenic mortality and serious injury to right whales averaged 4.3 per year, 2009-2013. This includes reported incidental fishery entanglements of 3.4 per year (U.S. waters, 0.2; Canadian waters, 0; unassigned location, first sighting in U.S., 2.05; unassigned location, first sighting in Canada, 1.15) and reported ship strikes of 0.9 per year (U.S. waters, 0.7; Canadian waters, 0; unassigned location, first sighted in U.S., 0.2; unassigned location, first sighting in Canada, 0). All but one of the fishery entanglements resulting in serious injury or mortality reported in U. S. waters during this period occurred after the Atlantic Large Whale Take Reduction Plan's sinking-groundline rule went into effect in 2009. All of the five reported ship strike serious injury and mortalities in U.S. waters during this time occurred after the speed limit rule went into effect in December 2008, although none occurred in areas with mandated speed restrictions under the rule (Waring et al. 2015b). Given that the species is critically endangered and that the average annual anthropogenic mortality and serious injury exceeds PBR, no mortality or serious injury is considered insignificant (Waring et al. 2015b).

The right whale is listed as endangered under the ESA, and therefore designated as depleted under the MMPA. In 2008, NMFS relisted northern right whales as two separate endangered species: the North Pacific right whale (*E. japonica*) and the North Atlantic right whale (*E. glacialis*) (73 FR 12024, March 6, 2008).

Distribution and habitat preferences: The range of the western North Atlantic right whale population extends from wintering and calving grounds in the southeastern U.S. to summer feeding grounds in New England waters and the Canadian Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence (CETAP 1982, Kraus and Rolland 2007, Waring et al. 2015b). The six major congregation areas are: coastal waters of the southeastern U.S. (Georgia-North Florida coast); the Great South Channel; Gulf of Maine/Georges Bank; Cape Cod and Massachusetts Bays; the Bay of Fundy; and the Scotian Shelf (Waring et al. 2013). The only known calving and nursery grounds are in the coastal waters off the southeastern U.S., from Savannah, Georgia to St. Augustine, Florida, although calf sightings off North Carolina suggest that calving grounds may extend as far north as Cape Fear (McLellan et al. 2004). Sighting in the Gulf of Mexico are rare and are likely either anomalies or in areas that were historically part of the winter range of right whales (Moore and Clark 1963, Schmidly *et al*. 1972, Ward-Geiger *et al.* 2011, Waring *et al*. 2013).

In 1994, NMFS designated critical habitat for the northern right whale in U.S. waters of the North Atlantic (59 FR 28805, June 3, 1994). The Cape Cod Bay and Great South Channel Critical Habitat Areas are important feeding and nursery areas off the New England coast. The Southeastern U.S. Critical Habitat Area is a primary calving area for this population. On Febrary 20, 2015, NMFS proposed replacing the critical habitat for right whales in the North Atlantic with two new areas (80 FR 9314). On January 27, 2016 (81 FR 4838), NMFS published a final rule redefining critical habitat for North Atlantic right whales, including calving areas along the U.S. coast from Cape Fear, North Carolina to 28° North latitude, just south of Cape Canaveral, Florida (Figure 3.2-1). The newly defined critical habitat contains approximately 29,763 km^2 of marine habitat in the Gulf of Maine and Georges Bank region (Unit 1) and off the Southeast U.S. coast (Unit 2). The latter region overlaps with the SEFSC ARA.

Behavior and life history: Breeding, mating, and calving of right whales occurs during winter, typically in shallow coastal regions or bays; calving may take place at geographically distant sites from mating (Kenney 2009). Calving takes place between December and March in the western North Atlantic after 12-13 months of gestation (Best et al. 2001) The mean calving interval from 1980-1992 was calculated as 3.67 years (Knowlton et al. 1994), increased to 5 years using data from 1998-2003 (Best et al. 2001, Kraus et al. 2001), and, most recently (2004-2005), appears closer to 3 years (Kraus et al. 2007). North Atlantic right whales primarily on copepods of the genera *Calanus* and *Pseudocalanus* in New England and eastern Canadian waters (Kenney 2001).

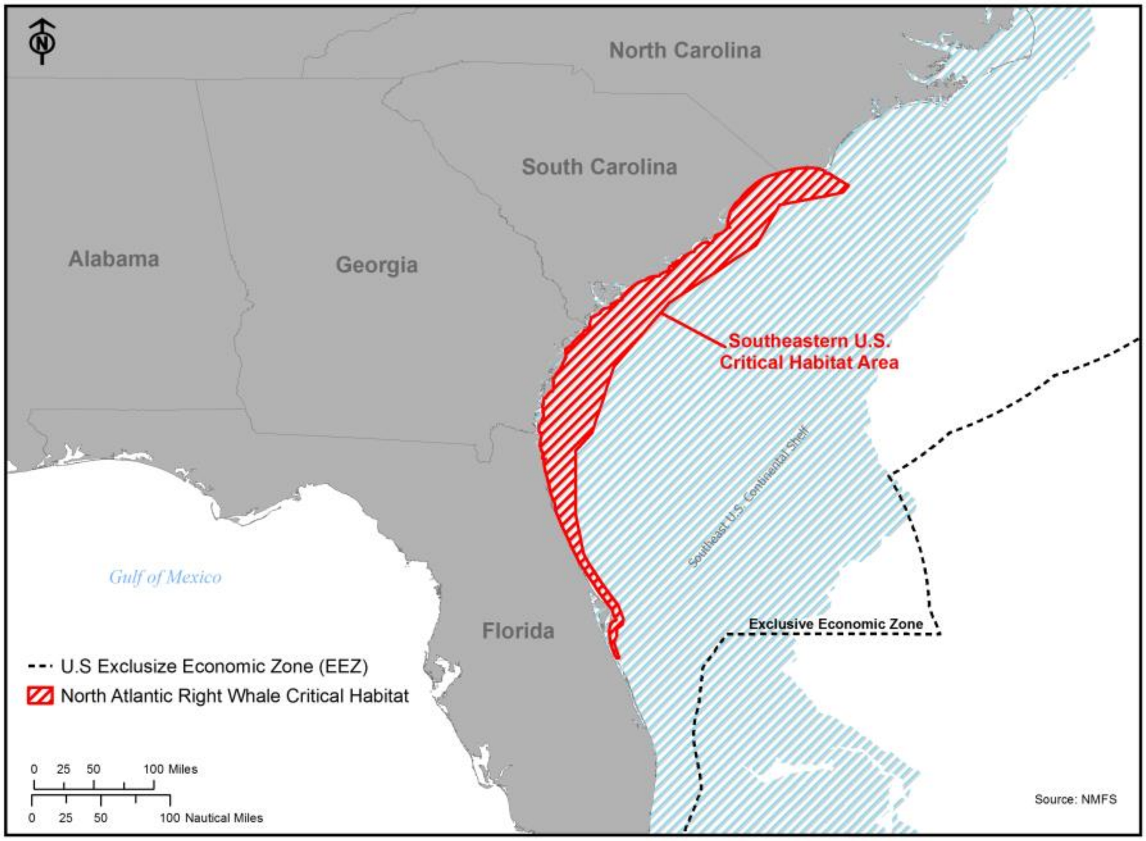

Figure 3.2-1 Currently Designated Critical Habitat for the North Atlantic Right Whale in the Southeast Region

Humpback whale

Status and trends: The western North Atlantic humpback whale population includes six relatively discrete feeding-area subpopulations: the east coast of the U.S. (including the Gulf of Maine), the Gulf of St. Lawrence, Newfoundland/Labrador, western Greenland, Iceland, and northern Norway (Clapham et al. 2003, Katona and Beard 1990, Palsbøll et al. 1997, Waring et al. 2013). Based on genetic analyses, the Gulf of Maine feeding stock is treated as a separate management stock (IWC 2002, Palsbøll et al. 1995). Individuals from all feeding areas have been identified in the West Indies breeding and calving areas, including Puerto Rico (Stevick et al. 2003a).

The best available estimate for the entire North Atlantic humpback whale population is 11,570, based on data collected in 1992 and 1993, and the average annual rate of increase was estimated at 3.1 percent (Stevick et al. 2003b). Although recent abundance estimates indicate continued population growth, the size of the humpback whale stock off the U.S. east coast may still be below its optimum sustainable population (OSP). Based on photographically identified individual humpback whales in the Gulf of Maine, the estimated minimum number alive in 2008 was 823 whales (Waring et al. 2015b). PBR for this stock is 2.7 whales (Waring et al. 2015b). The average annual rate of human-caused mortality and serious injury for 2009 to 2013 was 9 Gulf of Maine humpback whales per year. This includes 7.4 entanglements

(U.S. waters, 1.8; Canadian waters, 0.35; unassigned location, first sighted in U.S., 4.55; unassigned location, first sighting in Canada, 0.7) and 1.6 vessel collisions, all in U.S. waters (Waring et al. 2015b).

Swartz et al. (2001) provided a provisional estimate of 532 humpback whales on the Puerto Rican-Virgin Islands insular shelf during February/March 2001. Although total U.S. fishery-caused mortality and serious injury for 2007 to 2011 is unknown, reported levels exceed 10 percent of PBR, so cannot be considered insignificant or approaching zero mortality and serious injury rate. This is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and because the North Atlantic humpback whale is an endangered species (Waring et al. 2015b). A Recovery Plan was published and is currently in effect (NMFS 1991).

The humpback whale is listed as endangered under the ESA and as depleted under the MMPA. A Recovery Plan was published and is currently in effect (NMFS 1991). In April 2015, NMFS finished a status review of humpback whales and announced a proposal to revise the listing status by splitting the endangered species into 14 DPSs and replacing the current species-level listing with listings by DPS, defined by breeding population (80 FR 22304, April 21, 2015). The result would be two listed as endangered (Cape Verde Islands/Northwest Africa and Arabian Seas DPSs), two as threatened (Western North Pacific and Central America DPSs), and ten not proposed for listing (the West Indies, Hawaii, Mexico, Brazil, Gabon/Southwest Africa, Southeast Africa/Madagascar, West Australia, East Australia, Oceania, and Southeastern Pacific DPSs). Humpback whales in the western North Atlantic, including the Gulf of Maine population, would be included in the West Indies DPS that is not proposed for listing (80 FR 22304, April 21, 2015).

Distribution and habitat preferences: Humpback whales are found in all oceans of the world and migrate from high latitude feeding grounds to low latitude calving areas. They are typically found in coastal or shelf waters in summer and close to islands and reef systems in winter (Clapham 2009).

Important feeding areas off the eastern U.S. include the Gulf of Maine and Georges Bank (Paquet et al. 1997, Stevick, P., pers. comm., unpublished data, Provincetown Center for Coastal Studies and College of the Atlantic, Payne et al. 1986). Most North Atlantic humpback whales migrate to the West Indies during the winter to mate and calve (Katona and Beard 1990, Palsbøll et al. 1995). In the West Indies, the majority occur in the waters of the Dominican Republic, with lower densities throughout the remainder of the Antillean island chain, from Puerto Rico to the coast of Venezuela (Waring et al. 2013 and citations therein). Concentration areas in the latter region include the northwestern coast of Puerto Rico and the northern Virgin Islands (Mignucci-Giannoni 1998). Humpback whales are occasionally seen in the nearshore waters of the Gulf of Mexico, but such sightings are rare (NMFS 2006c).

Not all migrate south, however. Significant numbers occur in mid- and high-latitude regions in winter, including off Chesapeake and Delaware Bays and along the Virginia and North Carolina coasts (Clapham et al. 1993, Swingle et al. 1993, Wiley et al. 1995). Most of the individually identified whales in this region were from the Gulf of Maine, but some were from Newfoundland and the Gulf of St. Lawrence. The Mid-Atlantic region appears to be a supplemental winter feeding area for humpbacks whales (Barco et al. 2002).

Behavior and life history: Humpback whales are known for their spectacular aerial behaviors and complex songs of males, the latter of which is presumably to attract females. They breed and calve in warm tropical waters after an 11 month gestation period; calves feed independently after about 6 months. Humpback whales feed on euphausiids and various schooling fishes, including herring, capelin, sand lance, and mackerel (Clapham 2009).

<u>Fin whale</u>

Status and trends: Fin whales of the western North Atlantic stock commonly occur in U.S. waters from Cape Hatteras northward. The best abundance estimate for this stock is 1,618 whales, derived from 2011

NOAA shipboard surveys. This represents the most current data, despite excluding a large portion of the stock's range. The minimum population estimate is 1,234 whales and the calculated PBR is 2.5 fin whales (Waring et al. 2015b). From 2009 through 2013, the minimum annual rate of human-caused mortality and serious injury for western North Atlantic fin whales averaged 3.55 whales. This includes 1.75 entanglements (U.S. waters, 0.2; Canadian waters, 0.6; unassigned location, first sighted in U.S., 0.65; unassigned location, first sighting in Canada, 0.3) and 1.8 vessel collisions, in U.S. waters only (Waring et al. 2015b). Total U.S. fishery related mortality and serious injury for this stock is likely biased low and is not less than 10 percent of PBR, so cannot be considered insignificant and approaching a zero mortality and serious injury rate (Waring et al. 2015b).

The fin whale is listed as endangered under the ESA, yet the status of the stock off the U.S. Atlantic coast, relative to OSP, is unknown and data are inadequate to determine the population trend for fin whales. A Final Recovery Plan was published in 2010 (NMFS 2010b).

Distribution and habitat preferences: Fin whales are distributed widely in the world's oceans and occur in both the Northern and Southern Hemispheres between 20–75^{o} latitude (DON 2008). Fin whales are common in waters off the U.S. east coast, principally from Cape Hatteras northward. They are not, however, common in the SEFSC survey areas; New England waters represent a major feeding area for fin whales (Hain et al. 1992, Kenney et al. 1997), with key feeding grounds in the western Gulf of Maine from Stellwagen Bank to Jeffreys Ledge. Calving, mating, or wintering areas are unknown for most of the population, although Hain et al. (1992) suggested calving takes place during October to January off the U.S. Mid-Atlantic region. Fin whales off the U.S. Atlantic coast may migrate into Canadian waters, open-ocean areas, or even subtropical or tropical regions. It is, however, unlikely that fin whales undergo distinct annual migrations (Waring et al. 2015b).

Behavior and life history: Calving, mating, or wintering areas are unknown for most of the population, although Hain et al. (1992) suggested calving takes place during October to January off the U.S. Mid-Atlantic region. Fin whales become sexually mature between 6 to 10 years of age, and reproduce primarily in the winter. Gestation lasts about 11 months and nursing occurs for 6 to 11 months (Aguilar 2009). Fin whales feed on planktonic crustaceans, including *Thysanoessa* sp. and *Calanus* sp., as well as schooling fish including sand lance, herring, capelin and mackerel (Aguilar 2009).

<u>Sperm whale</u>

Status and trends: Three stocks of sperm whales occur in the SEFSC research areas: the North Atlantic, northern Gulf of Mexico, and the Puerto Rico and U.S. Virgin Islands stocks. All of these stocks are listed as endangered under the ESA. A Recovery Plan was published and is currently in effect (NMFS 2010c). In March 2013, NMFS announced a 90-day finding on a petition to list sperm whales in the Gulf of Mexico as an endangered or threatened DPS. NMFS initiated a status review to determine if such action is warranted (78 FR 19176, March 29, 2013) and, ultimately, determined that it was not (78 FR 68032, November 13, 2013).

Currently, the best population estimate for western North Atlantic sperm whales (2,288) is the sum of estimates from surveys between central Florida and the lower Bay of Fundy in 2011. This is likely an underestimate, as the estimates were not corrected for dive times, which average 30 to 60 minutes. The minimum population estimate for the western North Atlantic stock was 1,185 and the PBR, 3.6 (Waring et al. 2015a). Between 2008 and 2012, average annual human-caused mortality was 0.8, based on reports of sperm whales mortalities in 2009 and 2010 in the Canadian Labrador halibut longline fishery, one entanglement mortality in Canadian pot/trap gear, and one vessel strike mortality. There have been no reported entanglements of sperm whales in U.S. Atlantic fisheries. Vessel strike was determined as the cause of death in a sperm whale stranded in Florida in 2012 (Waring et al. 2015a).

The best available abundance estimate for northern Gulf of Mexico sperm whales is 763, derived from an oceanic survey of waters from the 200 m isobath to the seaward extent of the U.S. EEZ in 2009 (Waring et al. 2015b). The minimum population estimate is 560, with a PBR of 1.1 sperm whales. There is insufficient information to determine population trends. Sperm whales occur throughout oceanic waters of the Gulf of Mexico, but 65 percent of those waters are south of the U.S. EEZ. Surveys limited to U.S. waters are not able to discern shifts in distribution to other areas in the Gulf of Mexico that could account for changes in abundance (Waring et al. 2015b). Total human-caused mortality and serious injury for this stock during 2009-2013 was zero.Total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate (Waring et al. 2015b).

The Puerto Rico and U.S. Virgin Islands sperm whale population is provisionally considered a separate stock for management purposes. Sperm whales are among the most common species to strand in waters of Puerto Rico and the Virgin Islands, but have not been extensively studied there (Waring et al. 2010). Research conducted in the eastern Caribbean Sea (islands of Dominica, Guadeloupe, Grenada, St. Lucia and Martinique) by Gero et al. (2007) suggests that the population of sperm whales there was small and isolated. An estimated abundance for the Puerto Rico and U.S. Virgin Islands stock of sperm whales is unknown. Present data are insufficient to calculate a minimum population estimate or to determine population trends for this stock of sperm whales. PBR for this stock is also unknown, as is the level of human-caused mortality and serious injury (Waring et al. 2010). The only documented ship-strike mortality of a sperm whale off Puerto Rico was caused by a U.S. Navy vessel in 2001(Jensen and Silber 2003).

Distribution and habitat preferences: Sperm whales occur primarily along continental shelf edges, over the continental slope, and in oceanic waters throughout their range (CETAP 1982, Mignucci-Giannoni 1998, Waring et al. 1993, 2001, 2007). Distribution off the eastern U.S. coast varies seasonally (CETAP 1982, Scott and Sadove 1997). In winter, sperm whales concentrate east and northeast of Cape Hatteras.

Distribution shifts northward in spring to east of Delaware and Virginia, and, in summer, to the area east and north of Georges Bank and the continental shelf south of New England (Scott and Sadove 1997, Waring et al. 2001). Sperm whales are abundant on the continental shelf south of New England and along the continental shelf edge in the Mid-Atlantic Bight in fall (Waring et al. 2007).

Sperm whales occur year round in the northern Gulf of Mexico along the continental slope and in oceanic waters; information is limited for the southern Gulf of Mexico (Waring et al. 2013 and citations therein). Satellite-tagging studies showed no discernible seasonal migrations except for Gulf-wide movements particularly along the northern Gulf slope. Mature males, however, appear to move in and out of the Gulf (Englehaupt et al. 2009, Jochens et al. 2008, Waring et al. 2013). Females more frequently occur on the upper continental slope of the northern Gulf of Mexico, while males tend to use regions of deeper water (Jochens et al. 2008).

Sperm whales also inhabit continental slope and oceanic waters surrounding Puerto Rico and the U.S. Virgin Islands. Sperm whales are found in the northeastern Caribbean from late fall, through winter and early spring. Sightings occur as early as October, increase from November through January, peak in February, and decrease through March. Sperm whales are rarely seen during April through September (Mignucci-Giannoni 1998).

Behavior and life history: Females reach sexual maturity when approximately 9 years old and roughly 9 m long and give birth about every 5 years; gestation is 14-16 months (Whitehead 2009). Sperm whales consume a wide variety of deep water fish and cephalopods. They forage during deep dives that routinely exceed a depth of 400 m and duration of 30 min (Watkins et al. 2002). They are capable of diving to depths of over 2,000 m with durations of over 60 min. Sperm whales spend up to 83 percent of daylight hours underwater. Males do not spend extensive periods of time at the surface, whereas females may spend 1-5 hours daily at the surface without foraging (Whitehead 2009).

West Indian manatee

Status and trends: The West Indian manatee includes two subspecies: the Antillean manatee (*Trichechus manatus manatus*) and the Florida manatee (*Trichechus manatus latirostris*). The Antillean manatee occurs in eastern Mexico, Central America, northern and eastern South America, and in the Greater Antilles; distribution extends eastward only to Puerto Rico, with occasional sightings in the Lesser Antilles. The Puerto Rico population of the Antillean manatee is considered a separate stock (USFWS 2009a and citations therein). Florida manatees occur throughout the southeastern U.S. (USFWS 2009b). The Florida manatee and the Puerto Rico stock are considered here.

The State of Florida, through the Florida FWC, conducts annual winter counts of manatees at warm water sites along the Florida peninsula. Annual total winter counts include a sum of counts of each warm water location and do not provide statistically robust abundance estimates (USFWS 2014a). The best available minimum population estimate of Florida manatees is the FWC's January 2011 count of 4,834 animals (Laist et al. 2013). Using counts from separate east and west coast of Florida surveys in 2011 and 2012, Martin et al. (2015) devised a novel approach that combines multiple sources of information and accounts for sources of error. The result is the first statewide estimate of manatee abundance (6,350), with 2,790 on the west coast (2011) and 3,560 on the east coast (2012). Manatee populations are increasing or stable throughout most of Florida. The calculated PBR for the Florida manatee is 14.98 animals (USFWS 2014a). From 2008-2012, the average annual human-caused mortality was 98.6 manatees, 89 percent of which was due to watercraft, including by vessels of similar size to those used by commercial and recreational fisheries (USFWS 2014a and citations therein). The annual average rate of serious injury from 2008 to 2012 was 17.6 manatees, 2.6 of which were due to entanglements and 15 were watercraft-related (USFWS 2014a). Entanglements in commercial blue crab trap/pot fisheries in the Atlantic and Gulf of Mexico occur, but no lethal takes were reported in those fisheries during 2008-2012. Two seriously injured manatees reported in each area were successfully treated and released. One manatee death occurred incidental to a Georgia in-shore bait shrimp fishery. Total commercial fishery mortality and serious injury is less than the calculated PBR and considered insignificant and approaching a zero mortality and serious injury rate (USFWS 2014a).

The manatee population in Puerto Rico appears to be small, but widely distributed. In 2010, survey methodology and analysis were revised to enable statistically robust population estimates with calculated probability detection and confidence intervals. Aerial surveys now include repetitions in "manatee hot spots" and in certain low density areas (USFWS 2014b). These revised methods are still being verified and tested. The USFWS is, therefore, continuing to use direct counts to assess population size while awaiting further analysis. The most recent count of Antillean manatees in Puerto Rico is 142 animals in January 2013. This currently serves as the minimum population estimate (USFWS 2014b). Although quantitative information on trends in abundance is limited, the Puerto Rico population appears to be relatively stable. The calculated PBR for this stock is 0.284 or, essentially, zero (USFWS 2014b). From 2008 to 2012, there were no records of serious injuries to manatees in Puerto Rico, but 47 manatees were reported dead. Most deaths (79 percent) were either undetermined or natural causes; five (11 percent) of the deaths were watercraft-related (USFWS 2014b). Although USFWS acknowledges that the available data are limited and that some of the deaths for which cause is undetermined may be fisheries-related, incidental mortality and serious injury of manatees due to commercial fisheries in Puerto Rico and the U.S. Virgin Islands is minimal and approaching a zero mortality and serious injury rate. The exception is possible effects of beach seine gear that, beginning in late 2010, is permitted except within Puerto Rico inner water and river mouths (USFWS 2014b).

The West Indian Manatee is listed as endangered under the ESA and falls under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS). The USFWS published the third revision of the Florida manatee recovery plan in 2001 (USFWS 2001). In its five-year review, the USFWS suggested that the West Indian manatee no longer meets the definition of an endangered species and should be reclassified as threatened due to continued threats of potential habitat loss and watercraft collisions and concerns regarding adequate regulation of those threats (USFWS 2007). The USFWS, in a 90-day finding on a petition to reclassify the West Indian manatee, determined that the petitioned action may be warranted, prompting the initiation of a status review of the species and a new five-year review (79 FR 37706, July 2, 2014).

Distribution and habitat preferences: Florida manatees occur throughout the southeastern U.S., which is at the northern limit of their range (Lefebvre et al. 2001). They occur in freshwater, brackish, and marine environments that typically include coastal tidal rivers and streams, mangrove swamps, salt marshes, freshwater springs, and vegetated bottoms (FWC 2005). Manatees use different habitats at different times of the year. During cold winter temperatures, they concentrate along peninsular Florida and many rely on warm water from natural springs, passive thermal basins, and power plant outfalls (Laist et al. 2013, USFWS 2001). During summer, they expand their range; manatees are occasionally seen as far north as Rhode Island on the Atlantic coast and as far west as Texas on the Gulf of Mexico coast (USFWS 2001).

Manatees in Puerto Rico are more common along the eastern and southern coasts than along the northern coast of the main island (USFWS 2014b). They occur in coastal areas from San Juan, eastward to the east coast, (including Vieques Island) and then south and west, past Jobos Bay, to the west coast, and then about as far to the northwest as Rincon. Distribution is mostly related to availability of protected waters in coastal embayments or cays, forage, and the presence of fresh water sources. Sightings are extremely rare in the U.S. Virgin Islands (USFWS 2007). Manatee habitat in Puerto Rico includes seagrass beds, sources of fresh water, quiet backwaters, and open areas used as travel corridors (Magor 1979, Lefebvre et al. 2000).

USFWS designated critical habitat for the Florida manatee in 1976 (41 FR 41914). This was one of the first ESA designations of critical habitat for an endangered species and the first for an endangered marine mammal. The designation delineated specific waterways in Florida that were known to be important concentration areas for manatees at that time, including locations in Citrus, Hillsborough, Manatee, Sarasota, Charlotte, De Soto, Lee, Collier, Monroe, Dade, Palm Beach, Martin, West Palm Beach, Volusia, Brevard, Nassau and Duval Counties. In 2010, the USFWS determined that revisions to critical habitat for the Florida manatee are warranted. Sufficient funding was not available because of higher priority actions; the USFWS plans to initiate rulemaking when those priorities are complete and necessary resources are available (75 FR 1574, January 12, 2010).

Behavior and life history: Manatees are long-lived, with a maximum known age of 60 years. The earliest age of first reproduction is 3-4 years, although 5 years is the average. Gestation is approximately 11-13 months. Most births occur during May to September. Higher numbers of mating herds of Florida manatees occur in February to July (Reynolds et al. 2009). Manatees are herbivores that feed opportunistically a variety of submerged, floating, and shoreline vegetation. The West Indian manatee is known to consume more than 60 different plant species; seagrasses appear to be regularly consumed in coastal areas (Reynolds et al. 2009, USFWS 2001and citations therein).

3.2.2.3 Non-ESA Listed Marine Mammals that could be Taken during the Course of SEFSC Research Activities

Species included in this section are non-ESA listed species that could be taken by mortality/serious injury or ‘Level A’ harassment during the course of SEFSC fisheries research over the next five years. This includes species that have historically (2002-2014) been taken, those with vulnerabilities similar to those previously taken and could, therefore, be taken in the future, and species that have been taken by commercial fisheries using gear analogous to that used during fisheries research. Species historically taken include Atlantic spotted dolphins and multiple stocks of bottlenose dolphins. Detailed species descriptions and take determinations are available in Appendix C (the LOA Application) and, for the latter, in Table 4.2.3-9 of this DPEA.

<u>Melon-headed whale—Northern Gulf of Mexico Stock</u>

The Gulf of Mexico population of melon-headed whales is provisionally considered one stock for management purposes. Information to differentiate this stock from the Atlantic Ocean stock(s) is lacking. The best available population estimate for melon-headed whales in the northern Gulf of Mexico is 2,235, derived from a summer 2009 survey that covered waters from the 200m isobaths to the offshore extent of the U.S. EEZ. The minimum population estimate is 1,274 and the calculated PBR is 13 (Waring et al. 2013). There has been no fishery-related mortality or serious injury reported for this stock from 1998 to 2010. Total human-caused mortality and serious injury is not known, although none has been reported. It is assumed that average annual human-related mortality and serious injury is less than PBR, so this is not considered a strategic stock (Waring et al. 2013).

Melon-headed whales in the northern Gulf of Mexico are generally sighted in water depths >800m and west of Mobile Bay, Alabama (Mullin et al. 1994, Mullin and Fulling 2004, Maze-Foley and Mullin 2006). Sightings occurred during in all seasons in the northern Gulf of Mexico (Hansen et al. 1996, Mullin and Hoggard 2000). Squid appear to be the preferred prey, along with some fish and shrimp (Perryman 2009).

<u>Risso’s dolphin</u>

There is no information on stock structure of Risso's dolphin in the western North Atlantic, and it is not currently possible to determine if separate stocks exist in the Gulf of Mexico and in the Atlantic. The Gulf of Mexico and Atlantic stocks are, therefore, currently being treated as two separate stocks (Waring et al. 2015b).

Total numbers of Risso’s dolphins off the U.S. or Canadian Atlantic coast are unknown, although several abundance estimates exist for select times and places. The best abundance estimate for Risso’s dolphins is 18,250, the sum of the estimates from two 2011 U.S. Atlantic surveys. The estimate for Virginia to the Bay of Fundy is 15,197 and Florida to Virginia is 3,053. The minimum population estimate for the western North Atlantic Risso’s dolphin is 12,619 and PBR is 126 (Waring et al. 2015b). The total annual average estimated fishery mortality and serious injury for this stock for 2009-2013 was 54 dolphins. This is not less than 10 percent of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate (Waring et al. 2015b).

The best available abundance estimate for northern Gulf of Mexico Risso’s dolphins is 2,442, based on a summer 2009 survey of waters from the 200 m isobath to the seaward extent of the U.S. EEZ. The minimum population estimate is 1,563 and the calculated PBR is 16 Risso’s dolphins (Waring et al. 2015b). Estimated annual average fishery-related mortality and serious injury for this stock (7.9 dolphins during 2009 to 2013) is based on observed serious injury and mortality in the Pelagic Longline fishery. Total fishery-related mortality and serious injury is not less than ten percent of PBR for this stock, so cannot be considered insignificant and approaching a zero mortality rate. Average human-caused mortality and serious injury does not, however, exceed PBR, so this is not considered a strategic stock (Waring et al. 2015b).

The Puerto Rico and U.S. Virgin islands stock of short-finned pilot whales are, for management purposes, provisionally considered a separate stock from the North Atlantic stock off the east coast of the U.S. and the Gulf of Mexico stock. They have not been extensively studied in these waters. Abundance is unknown (best and minimum) and data are insufficient to determine trends and to calculate PBR. Total human-caused mortality and serious injury is unknown and there is not systematic monitoring of all fisheries that may take this stock. Due to these factors and because there are documented interactions between short-finned pilot whales and the pelagic longline fishery in waters off Cuba, this is considered a strategic stock (Waring et al. 2012).

Risso's dolphins are distributed world-wide in tropical and warm-temperate waters. They occur along the continental shelf edge from Cape Hatteras to Georges Bank during spring, summer, and fall (CETAP 1982, Payne et al. 1984). In winter, they range from the Mid-Atlantic Bight to offshore oceanic waters (Payne et al. 1984). Risso's dolphins occur throughout the oceanic waters of the northern Gulf of Mexico, but concentrate along the continental slope (Baumgartner 1997, Maze-Foley and Mullin 2006).

Long-finned pilot whale

Long-finned and short-finned pilot whales are difficult to distinguish at sea, so sighting data are reported as *Globicephala* sp. Survey data are, therefore, combined with the analysis of spatial distribution of the two species based on genetic analyses of biopsy samples to generate individual abundance estimates (Waring et al. 2015b). The best estimate of abundance for western North Atlantic long-finned pilot whales is 5,636, derived from summer 2011 surveys from central Virginia to the lower Bay of Fundy. This is considered the best estimate, as it is the most recent, but the 2011 surveys did not include areas of the Scotian Shelf where the highest densities of long-finned pilot whales occurred in 2006. The minimum population estimate is 3,464 whales and the PBR is 35 (Waring et al. 2015b). There are insufficient data to determine population trends. The total annual observed fishery-related mortality or serious injury during 2009 to 2013 averaged 31 long-finned pilot whales. Takes in bottom trawl, mid-water trawl, and gillnet fisheries were examined using model-based predictions and all were assigned as long-finned pilot whales; bycatch of pilot whales in the pelagic longline fishery appears to be restricted to short-finned pilot whales. The total U.S. fishery-related mortality and serious injury for long-finned pilot whales exceeds 10 percent of PBR, so cannot be considered to be insignificant and approaching a zero mortality and serious injury rate (Waring et al. 2015b).

Long-finned pilot whales concentrate along the northeast U.S. shelf edge between the 100 m and 1000 m isobaths during mid-winter and early spring (CETAP 1982, Payne and Heinemann 1993, Abend and Smith 1999). In late spring, they whales move onto Georges Bank, into the Gulf of Maine, and water farther north, where they remain through the fall. Pilot whales tend to occupy areas of high relief or submerged banks and associate with the Gulf Stream wall and thermal fronts along the continental shelf edge (Waring et al. 1992). Long-finned and short-finned pilot whales overlap spatially along the mid-Atlantic shelf break between Cape Hatteras, North Carolina, and New Jersey. Pilot whales south of Cape Hatteras are expected to be short-finned (Waring et al. 2011)

Short-finned pilot whale

The abundance of short-finned pilot whales in the ARA appears to be variable and influenced by prevailing oceanographic conditions. The best available estimate for short-finned pilot whales in the western North Atlantic is 21,515, derived from summer 2011 surveys from central Florida to the lower Bay of Fundy. A regression model developed to predict the probability of a pilot whale being either long-finned or short-finned as a function of sea surface temperature and water depth was used to partition abundance estimates from the 2011 survey (Waring et al. 2015b). The minimum population estimate is 15,913 and the calculated PBR for short-finnned pilot whales is 159. The total annual estimated average fishery-related mortality and serious injury in the pelagic longline fishery was 148 short-finned pilot whales from 2009 through 2013. The total annual fishery-related mortality and serious injury is not known. In addition to the observed takes in the pelagic longline fishery, there was a self-reported take in the hook-and-line fishery in 2013 (Waring et al. 2015b). Total U.S. fishery-related mortality and serious injury for short-finned pilot whales exceeds 10 percent of PBR and cannot be considered insignificant and approaching zero mortality and injury rate (Waring et al. 2015b).

The Gulf of Mexico population of short-finned pilot whales is considered a separate stock for management purposes. Currently, information to differentiate this stock from Atlantic stocks is not available. The best available abundance estimate for northern Gulf of Mexico short-finned pilot whales is 2,415, based on a summer 2009 survey of waters from the 200 m isobath to the seaward extent of the U.S.

EEZ. The minimum population estimate is 1,456 and the calculated PBR is 15 pilot whales (Waring et al. 2015b). The estimated average annual fishery-related mortality and serious injury was 0.5 short-finned pilot whales, 2009 to 2013, in the pelagic longline fishery. Total human-caused mortality and serious injury is less than ten percent of PBR (Waring et al. 2015b).

The Puerto Rico and U.S. Virgin islands stock of short-finned pilot whales are provisionally considered a separate stock from the North Atlantic stock off the east coast of the U.S. and the Gulf of Mexico stock. They have not been extensively studied in these waters. Abundance is unknown and data are insufficient to determine trends and to calculate PBR. Total human-caused mortality and serious injury is unknown and there is not systematic monitoring of all fisheries that may take this stock. Because of this and the fact that there are documented interactions between short-finned pilot whales and the pelagic longline fishery in waters off Cuba, this is considered a strategic stock (Waring et al. 2012).

Short-finned pilot whales occur worldwide in tropical to warm-temperate seas and usually do not range north of 50^o N or south of 40^o S. They may seasonally extend into shelf-edge waters north of Cape Hatteras (Leatherwood and Reeves 1983). The NEFSC and SEFSC are using genetic and photo-identification data to better define the northern range of this species and habitat overlap with the long-finned pilot whale off the eastern U.S. Sightings of short-finned pilot whales in the northern Gulf of Mexico are primarily on the continental slope west of 89˚W (Mullin and Fulling 2004, Maze-Foley and Mullin 2006).

<u>Short-beaked common dolphin</u>

The common dolphin may be one of the most widely distributed cetacean species, yet total numbers off the U.S. Atlantic coast is unknown, as is stock status within these waters. Data are also insufficient to determine population trends.

The best abundance estimate for western North Atlantic short-beaked common dolphins (173,486 animals) is derived from the Canadian Trans-North Atlantic Sighting Survey (TNASS) during summer 2007 (Waring et al. 2015b). The most recent estimates of common dolphins in U.S. waters are 67,191 for central Virginia to the lower Bay of Fundy and 2,993 for central Florida to central Virginia, derived from shipboard and aerial surveys during June-August 2011. The minimum population estimate of common dolphins in the western North Atlantic, based on TNASS, us 112,531 and the PBR is 1,125 (Waring et al. 2015b). Total estimated annual average fishery-related mortality and serious injury, 2009 to 2013, was 363 short-beaked common dolphins, with more than half (210.2) taken in the Mid-Atlantic bottom trawl fishery. Total fishery-related mortality and serious injury is not less than 10 percent of PBR, so cannot be considered insignificant and approaching zero mortality and serious injury rate (Waring et al. 2015b).

Short-beaked common dolphins are the most abundant dolphin in offshore warm-temperate waters in the Atlantic and Pacific (Perrin 2009a). They occur worldwide from about 40-60^o N to about 50^o S (Perrin 2009a). They tend to prefer cooler water farther offshore than the sympatric long-beaked common dolphin; they occupy upwelling-modified habitats with less tropical characteristics than surrounding water masses (Perrin 2009a). During summer and fall, short-beaked common dolphins primarily occur along the outer coast in waters deeper than 200 m, south of 42^o N and to a lesser extent in water depths between 100 m and 200 m south of 42^o N, and seaward of the 100 m water depth north of 42^o N. In winter and spring, animals typically stay south of the 13^o C isotherm.

<u>Atlantic spotted dolphin</u>

The Atlantic spotted dolphin is one of two spotted dolphin species found in the Atlantic Ocean, the other being the pantropical spotted dolphin. The stocks of Atlantic spotted dolphins that occur in the SEFSC research areas are the western North Atlantic stock, the northern Gulf of Mexico stock, and the Puerto Rico and U.S. Virgin Islands stock. The western North Atlantic stock consists of two forms that may be distinct sub-species, but are currently considered as one stock for assessment and management purposes.

A large, heavily spotted form inhabits the continental shelf, usually inside or near the 650-ft (200-m) isobath and a smaller, less spotted island and offshore form occurs in the Atlantic Ocean, but not in the Gulf of Mexico. The offshore form of Atlantic spotted dolphin and the pantropical spotted dolphin can be difficult to differentiate at sea where they co-occur (Waring et al. 2015b and citations therein).

The best currently available abundance estimate for the western North Atlantic stock of Atlantic spotted dolphins is 44,715, based on a 2011 survey from central Florida to the lower Bay of Fundy (Waring et al. 2015b). The minimum population estimate is 31,610 and PBR for the combined offshore and coastal forms is 316. The annual estimated average fishery-related mortality or serious injury for this stock was 42 dolphins in the shrimp trawl fishery during 2007-2011; more recent data are not yet available (Waring et al. 2015b).

The current population size is unknown for Atlantic spotted dolphins in the northern Gulf of Mexico, since the most recent surveys were more than eight years ago in 2000-2001 and 2003-2004. The current and minimum population estimates and PBR are, therefore, also unknown since these data are greater than eight years old. Total human-caused mortality and serious injury for this stock is unknown (Waring et al. 2015b).

The Puerto Rico and U.S. Virgin Islands Atlantic spotted dolphin stock is likely trans-boundary, at least in waters near adjacent Caribbean islands, including those outside of the U.S. EEZ. The abundance of the Puerto Rico and U.S. Virgin Islands stock is unknown and data are insufficient to determine population trends or to calculate PBR. The sizes of this stock or of any Atlantic spotted dolphin populations in the northeast Caribbean have not been assessed. There is no systematic monitoring of fisheries that may cause injury or serious mortality to this stock (Waring et al. 2012).

Atlantic spotted dolphins are endemic to the tropical and warm-temperate Atlantic (Perrin 2009b). The range extends from about 50^{o} N to about 25^{o} S, through the Gulf of Mexico and the Caribbean to Venezuela (Leatherwood et al. 1976, Perrin et al. 1994, Perrin 2009b). They regularly occur in the inshore waters south of Chesapeake Bay and near the continental shelf edge and continental slope waters north of this region (Payne et al. 1984, Mullin and Fulling 2003). Atlantic spotted dolphins north of Cape Hatteras also associate with the north wall of the Gulf Stream and warm-core rings (Waring et al. 1992).

Pantropical spotted dolphin

Pantropical spotted dolphins can be difficult to differentiate from Atlantic spotted dolphins at sea, so abundance estimates prior to 1999 included both species combined. More recent estimates are species-specific, since the species can be confidently identified south of Cape Hatteras. The current best abundance estimate for pantropical spotted dolphins is 3,333, based on 2011 summer surveys from central Florida to the lower Bay of Fundy. All sightings of this species occurred in waters between central Florida and Central Virginia. The minimum estimate is 1,733 and the calculated PBR is 17. There were zero reported fishery-related mortalities or serious injuries to this stock from 2007 to 2011 (Waring et al. 2014). The western North Atlantic pantropical spotted dolphin population is being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock(s).

The best currently available population estimate for pantropical spotted dolphins in the northern Gulf of Mexico is 50,880 from a summer 2009 oceanic survey that extended from the 200 m isobath to the seaward extent of the U.S. EEZ from Texas to Florida. The minimum population estimate is 40,699 and the PBR is 407 (Waring et al. 2015b). The estimated average annual fishery-related mortality and serious injury for this stock during 2009-2013 was 3.8, based on takes of pantropical spotted dolphins in the pelagic longline fishery. Additional mean annual mortality and serious injury due to non-SEFSC associated fishery research was 0.6, for a total mean annual human-caused mortality and serious injury for this stock during 2009-2013 of 4.4. Total fishery-related mortality and serious injury for this stock is less than 10 percent of PBR and can be considered to be insignificant and approaching a zero mortality and serious injury rate (Waring et al. 2015b) This is not considered a strategic stock since the average annual human-related mortality and serious injury does not exceed PBR (Waring et al. 2015b).

The pantropical spotted dolphin is distributed worldwide in tropical and some sub-tropical oceans (Perrin 2009c). Pantropical spotted dolphins are seen year round in the northern Gulf of Mexico, where they occur primarily in oceanic waters (Mullin and Fulling 2004, Maze-Foley and Mullin 2006, Hansen et al. 1996, Mullin and Hoggard 2000).

Striped dolphin

Striped dolphins in the western North Atlantic and in the Gulf of Mexico are not listed as either threatened or endangered under the ESA. The Atlantic and Gulf of Mexico populations are provisionally considered separate stocks stocks for management purposes; adequate information to distinguish them is currently lacking (Waring et al. 2013). The best abundance estimate for striped dolphins in the western North Atlantic is the sum of summer 2011 survey estimates – 54,807 dolphins. The estimate for waters off central Virginia to the lower Bay of Fundy is 46,882 and for central Florida to central Virginia, it is 7,925 (Waring et al. 2014). The minimum population estimate is 42,804 and the calculated PBR is 428 striped dolphins. Total annual average fishery-related mortality of this stock was zero for the period 2007 to 2011 (Waring et al. 2014).

The best currently available population estimate for striped dolphins in the northern Gulf of Mexico is 1,849 from a summer 2009 oceanic survey that included waters from the 200m isobath offshore to the seaward extent of the U.S. EEZ. The minimum population estimate is 1,041 and the PBR is 10 (Waring et al. 2013). There has been no reported fishery-related mortality or serious injury to this stock from 1998 to 2010 and total human-caused mortality and serious injury is unknown (Waring et al. 2013).

Striped dolphins are distributed worldwide in warm-temperate to tropical zones. In the western North Atlantic, they range from Nova Scotia to, at least, Jamaica and into the Gulf of Mexico (Waring et al. 2014 and citations therein). Striped dolphins are usually found beyond the continental shelf, typically over the continental slope out to oceanic waters and are often associated with convergence zones and waters influenced by upwelling. Off the northeastern U.S. striped dolphins distribute along the continental shelf edge from Cape Hatteras to the southern edge of Georges Bank and offshore over the continental slope and rise (CETAP 1982, Mullin and Fulling 2003). Striped dolphins are seen year round in the northern Gulf of Mexico, where they occur primarily in oceanic waters (Mullin and Fulling 2004, Maze-Foley and Mullin 2006, Hansen et al. 1996, Mullin and Hoggard 2000).

Rough-toothed dolphin--Northern Gulf of Mexico Stock

The Gulf of Mexico population of rough-toothed dolphins is provisionally considered a separate stock from Atlantic Ocean stocks for management purposes; adequate information to distinguish this stock from others in the Atlantic or to determine if there are multiple stocks in the Gulf of Mexico is currently lacking (Waring et al. 2013). The best currently available population estimate for rough-toothed dolphins in the northern Gulf of Mexico is 624 from a summer 2009 oceanic survey that included waters from the 200 m isobath offshore to the seaward extent of the U.S. EEZ. The minimum population estimate is 311 and the PBR is 3.1 (Waring et al. 2013). There has been no reported fishery-related mortality or serious injury to this stock from 1992 to 2010 and total human-caused mortality and serious injury is unknown. This species is not listed under the ESA as either threatened or endangered, nor is it considered a strategic stock since it is unlikely that the average human-caused mortality and serious injury exceeds PBR (Waring et al. 2013).

Rough-toothed dolphins have been seen in all seasons in the northern Gulf of Mexico, where they occur primarily in oceanic, but also in continental shelf, waters (Fulling et al. 2003, Mullin and Fulling 2004, Maze-Foley and Mullin 2006, Hansen et al. 1996, Mullin and Hoggard 2000).

Spinner dolphin--Northern Gulf of Mexico stock

The Gulf of Mexico population is provisionally considered a separate stock from Atlantic Ocean stocks for management purposes; adequate information to distinguish this stock from others in the Atlantic is currently lacking (Waring et al. 2013). The best currently available population estimate for spinner dolphins in the northern Gulf of Mexico is 11,441 from a summer 2009 oceanic survey that included waters from the 200m isobath offshore to the seaward extent of the U.S. EEZ. The minimum population estimate is 6,221 and the PBR is 62 (Waring et al. 2013). There has been no reported fishery-related mortality or serious injury to this stock from 1998 to 2010 and total human-caused mortality and serious injury is unknown. This species is not listed under the ESA, nor is it considered a strategic stock since it is unlikely that the average human-caused mortality and serious injury exceeds PBR (Waring et al. 2013).

Spinner dolphins occur in tropical and most sub-tropical waters between 30-40o N and 20-40o S latitude, generally in areas with a shallow mixed layer, shallow and steep thermocline, and little variation in surface temperatures (Perrin 2009a). Spinner dolphins in the northern Gulf of Mexico occur in oceanic waters, typically east of the Mississippi River and have been seen during all seasons (Hansen et al. 1996, Mullin and Hoggard 2000).

Bottlenose dolphin

There are currently 54 stocks of bottlenose dolphins within the SEFSC research areas: 17 in the ARA, 36 in the GOMRA, and one in the CRA (Table 3.2-9, Figures 3.2-2 and 3.2-3). Current research on bottlenose dolphins in the northern Gulf of Mexico and western North Atlantic Ocean indicate that stock structure is uncertain, yet complex and may be subject to further revision (Waring et al. 2013). Abundance estimates and, consequently, PBR are unknown or undetermined for 34 of the 54 stocks. None of the bottlenose stocks are ESA-listed, but five coastal stocks in the ARA are considered depleted under the MMPA and several are strategic (Table 3.2-9). Given the number of stocks in the SEFSC research areas, abundance and PBR levels are shown in Table 3.2-9 rather than described in text.

The estimated average annual fishery-related serious injury and mortality levels during 2009-2013 are known for eleven of the coastal and estuarine stocks in the ARA: northern coastal migratory (1 -7.5), southern coastal migratory (1-12), South Carolina/Georgia coastal stock (1.2-1.6), northern Florida coastal stock (0.4), central Florida coastal stock (0.2), northern North Carolina estuarine system (1-16.7), southern North Carolina estuarine system (0-0.4), northern South Carolina estuarine system (0.2), northernGeorgia/southern South Carolina estuarine system (1.4), Jacksonville estuarine system (1.2), and the Indian River Lagoon estuarine system stock (4.4). The range listed reflects the uncertainty in assigning observed bycatch to specific stocks (Waring et al. 2015b). Total estimated mean annual mortality and serious injury of western North Atlantic offshore bottlenose dolphins from commercial fisheries during 2009-2013 was 43.9, with takes in the Northeast sink gillnet (5.2), Northeast bottom trawl (6.4),Mid-Atlantic bottom trawl (18.2), and pelagic longline (14.1) fisheries (Waring et al. 2015b).

Minimum average annual fishery-related mortality and serious injury information (excluding data from the shrimp trawl fishery) is available for the following northern Gulf of Mexico stocks for 2009-2013: the continental shelf (0.6); eastern coastal (1.6); northern coastal (0.4); western coastal (0.6); Barataria Bay (0.8); Mississippi Sound, Lake Borgne, Bay Boudreau (1.6); and Choctawhatchee Bay (0.4) stocks (Waring et al. 2015b). Total annual human-caused mortality and serious injury levels are unknown for the coastal and BSE stocks for 2009-2013, as these stocks are known to interact with unobserved fisheries and because the most current observer data for the shrimp trawl fishery are for 2007-2011 (Waring et al. 2015b). The northern Gulf of Mexico oceanic stock's known and reported fishery-related mortality and serious injury averaged 6.5 per year for 2008-2012 in the Gulf of Mexico pelagic longline fishery (Waring et al. 2015a). These levels of take are not less than 10 percent of PBR for the oceanic; Mississippi Sound, Lake Borgne, Bay Boudreau; and Choctawhatchee Bay stocks, so cannot be considered insignificant and approaching zero mortality and serious injury rate for those stocks (Waring et al. 2015a, b). The Gulf of Mexico bay, sound, and estuary stocks are listed as strategic due to largely unknown, but likely small, stock sizes and low numbers of mortalities and serious injuries would exceed PBR (Waring et al. 2015b).

Total human-caused mortality and serious injury is unknown for the Puerto Rico and U.S. Virgin Islands stock and systematic monitoring of fisheries with which this stock may interact is lacking. Lacking this information, this stock is being considered strategic (Waring et al. 2012).

The coastal and offshore forms of bottlenose dolphins are morphologically and genetically distinct morphotypes (Duffield et al. 1983, Duffield 1986). Both inhabit waters along the U.S. Atlantic and Gulf of Mexico coasts (Hersh and Duffield 1990, Mead and Potter 1995, Curry and Smith 1997). The coastal morphotype of bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York around the Florida peninsula and into the Gulf of Mexico. The estuarine stocks are believed to stay in nearshore waters within 1.8 miles of shore and may overlap with coastal stocks in these waters (Waring et al. 2014 and citations therein). The offshore form is distributed primarily along the outer continental shelf and continental slope (CETAP 1982, Kenney 1990). Torres et al. (2003) found that the offshore form was found exclusively seaward of 21 miles (34 km) and that all bottlenose dolphins within 4 miles (7.5 km) of shore were of the coastal form. Since the continental shelf if much wider in the Gulf of Mexico than along the U.S. eastern seaboard, this may not apply. In the northern Gulf of Mexico, bottlenose dolphins inhabiting waters less than 65 ft (20 m) deep are considered inshore or coastal stocks and those in waters deeper than 656 ft (200 m) are of the oceanic stock. The continental shelf stock may overlap with the coastal and oceanic stocks (Waring et al. 2013). Bottlenose dolphins are among the most commonly sighted cetaceans in waters near Puerto Rico, the U.S. Virgin Islands, and in the northeastern Caribbean Sea. They occur throughout the area, primarily over the shelf or shelf-edge habitats (Mignucci-Giannoni 1998, Waring et al. 2012 and citations therein).

Table 3.2-9 Stocks of Bottlenose Dolphins *(Tursiops truncatus)* in the SEFSC Research Areas

Stock	MMPA Status	Best Abundance Estimate	Minimum Abundance Estimate	PBR
ATLANTIC RESEARCH AREA				
Western North Atlantic Offshore	Not Strategic	77,532	56,053	561
Northern Migratory Coastal	Depleted	11,548	8,620	86
Southern Migratory Coastal	Depleted	9,173	6,326	63
South Carolina & Georgia Coastal	Depleted	4,377	3,097	31
Northern Florida Coastal	Depleted	1,219	730	7
Central Florida Coastal	Depleted	4,895	2,851	29
Northern North Carolina Estuarine System	Strategic	823	782	7.8
Southern North Carolina Estuarine System	Strategic	unknown	unknown	undetermined
Northern South Carolina Estuarine System	Strategic	unknown	unknown	undetermined
Charleston Estuarine System	Strategic	unknown	unknown	undetermined
Northern Georgia/Southern South Carolina Estuarine System	Strategic	unknown	unknown	undetermined
Central Georgia Estuarine System	Strategic	192	185	1.9
Southern Georgia Estuarine System	Strategic	194	185	1.9
Jacksonville Estuarine System	Strategic	unknown	unknown	undetermined

Stock	MMPA Status	Best Abundance Estimate	Minimum Abundance Estimate	PBR
Indian River Lagoon Estuarine System	Strategic	unknown	unknown	undetermined
Biscayne Bay	Strategic	unknown	unknown	undetermined
Florida Bay	Not Strategic	unknown	unknown	undetermined
GULF OF MEXICO RESEARCH AREA				
Northern Gulf of Mexico Continental shelf [2]	Not Strategic	51,192	46,926	469
Northern Gulf of Mexico, eastern coastal [2]	Not Strategic	12,388	11,110	111
Northern Gulf of Mexico, northern coastal [2]	Not Strategic	7,185	6,004	60
Northern Gulf of Mexico, western coastal [2]	Not Strategic	20,161	17,491	175
Northern Gulf of Mexico Oceanic	Not Strategic	5,806	4,230	42
Northern Gulf of Mexico Bay, Sound, and Estuary (31 stocks listed below) [2, 3]				
Laguna Madre[2]	Strategic	unknown	unknown	undetermined
Nueces Bay, Corpus Christi Bay[2]	Strategic	unknown	unknown	undetermined
Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espirtu Santo Bay[2]	Strategic	unknown	unknown	undetermined
Matagorda Bay, Tres Palacios Bay, Lavaca Bay[2]	Strategic	unknown	unknown	undetermined
West Bay[2]	Strategic	unknown	unknown	undetermined
Galveston Bay, East Bay, Trinity Bay[2]	Strategic	unknown	unknown	undetermined
Sabine Lake[2]	Strategic	unknown	unknown	undetermined
Calcasieu Lake[2]	Strategic	unknown	unknown	undetermined
Vermillion Bay, West Cote Blanche Bay, Atchafalaya Bay[2]	Strategic	unknown	unknown	undetermined
Terrebonne Bay, Timbalier Bay[2]	Strategic	unknown	unknown	undetermined
Barataria Bay[4]	Strategic	unknown	unknown	undetermined
Mississippi River Delta [2]	Strategic	332	170	1.7
Mississippi Sound, Lake Borgne, Bay Boudreau [2]	Strategic	901	551	5.6
Mobile Bay, Bonsecour Bay[2]	Strategic	unknown	unknown	undetermined
Perdido Bay[2]	Strategic	unknown	unknown	undetermined
Pensacola Bay, East Bay[2]	Strategic	unknown	unknown	undetermined
Choctawhatchee Bay [2]	Strategic	179	173	1.7
St. Andrews Bay[2]	Strategic	unknown	unknown	undetermined
St. Joseph Bay [2]	Strategic	152	142	1.4
St. Vincent Sound, Apalachiola Bay, St. George Sound [2]	Strategic	439	390	3.9
Apalachee Bay[2]	Strategic	unknown	unknown	undetermined

Stock	MMPA Status	Best Abundance Estimate	Minimum Abundance Estimate	PBR
Waccasassa Bay, Withlacoochee Bay, Crystal Bay[2]	Strategic	unknown	unknown	undetermined
St. Joseph Sound, Clearwater Harbor[2]	Strategic	unknown	unknown	undetermined
Tampa Bay[2]	Strategic	unknown	unknown	undetermined
Sarasota Bay, Little Sarasota Bay [2]	Strategic	160	160	1.6
Pine Island Sound, Charlotte Harbor, Gasparilla Sound, Lemon Bay[2]	Strategic	unknown	unknown	undetermined
Caloosahatchee River[2]	Strategic	unknown	unknown	undetermined
Estero Bay[2]	Strategic	unknown	unknown	undetermined
Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay[2]	Strategic	unknown	unknown	undetermined
Whitewater Bay[2]	Strategic	unknown	unknown	undetermined
Florida Keys (Bahia Honda to Key West)[2]	Strategic	unknown	unknown	undetermined
CARIBBEAN RESEARCH AREA				
Puerto Rico and U.S. Virgin Islands[4]	Strategic	unknown	unknown	undetermined

1. Source: Waring et al. 2014, Waring et al. 2015b
2. Source: Waring et al. 2013, Waring et al. 2015a, b
3. NMFS is in the process of writing individual stock assessment reports for each of the 31 bay, sound and estuary stocks of bottlenose dolphins included in Waring et al. 2015b. Mississippi River Delta; Mississippi Sound, Lake Borgne, Bay Boudreau; St. Joseph; Choctawhatchee Bay; St. Vincent Sound, Apalachiola Bay, St. George Sound; and Sarasota Bay, Little Sarasota Bay stocks are the only stocks among the 31 stocks for which there are recent estimates.
4. Source: Waring et al. 2012

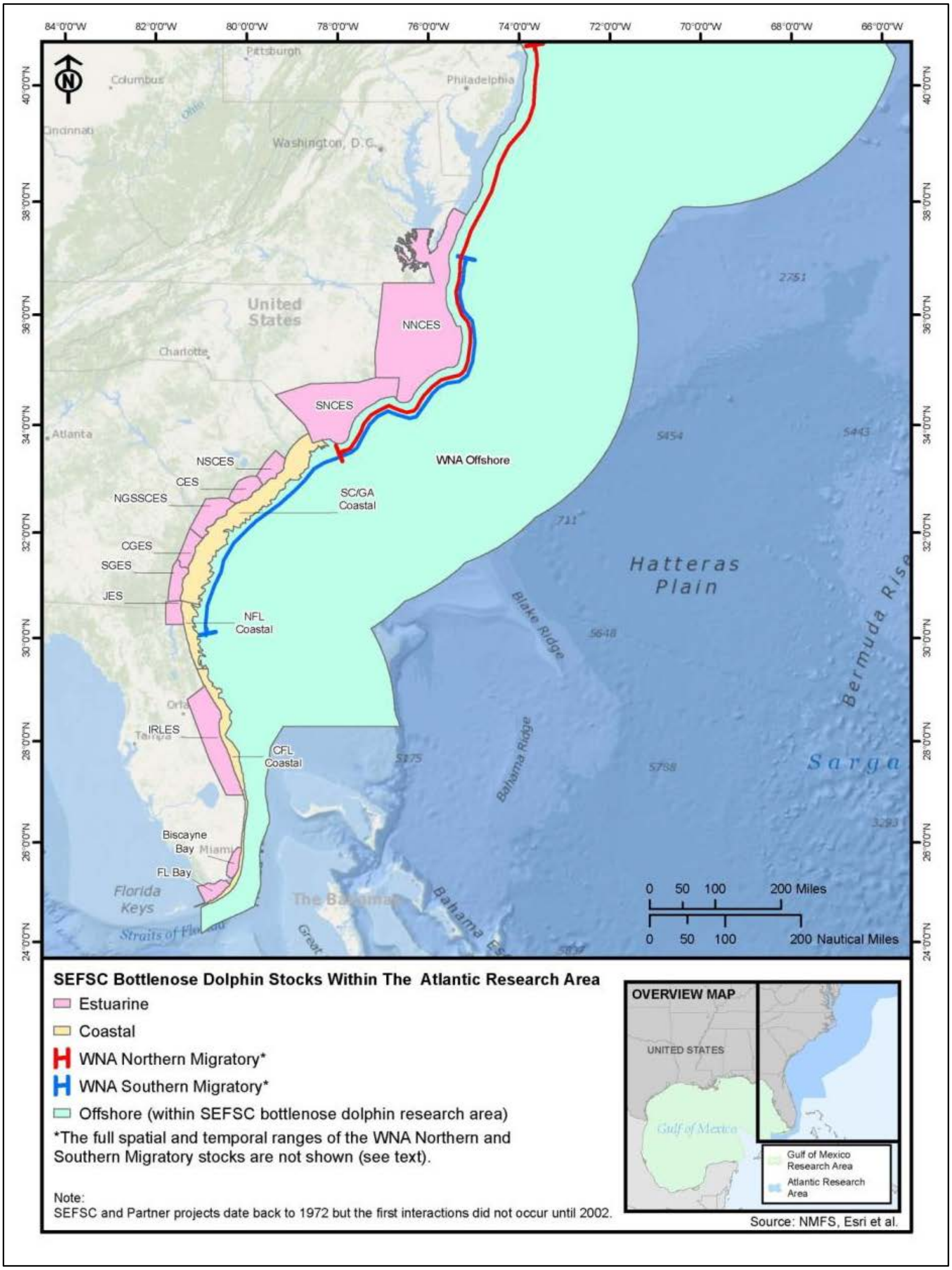

Figure 3.2-2 Bottlenose Dolphin Stocks within the SEFSC Atlantic Research Area

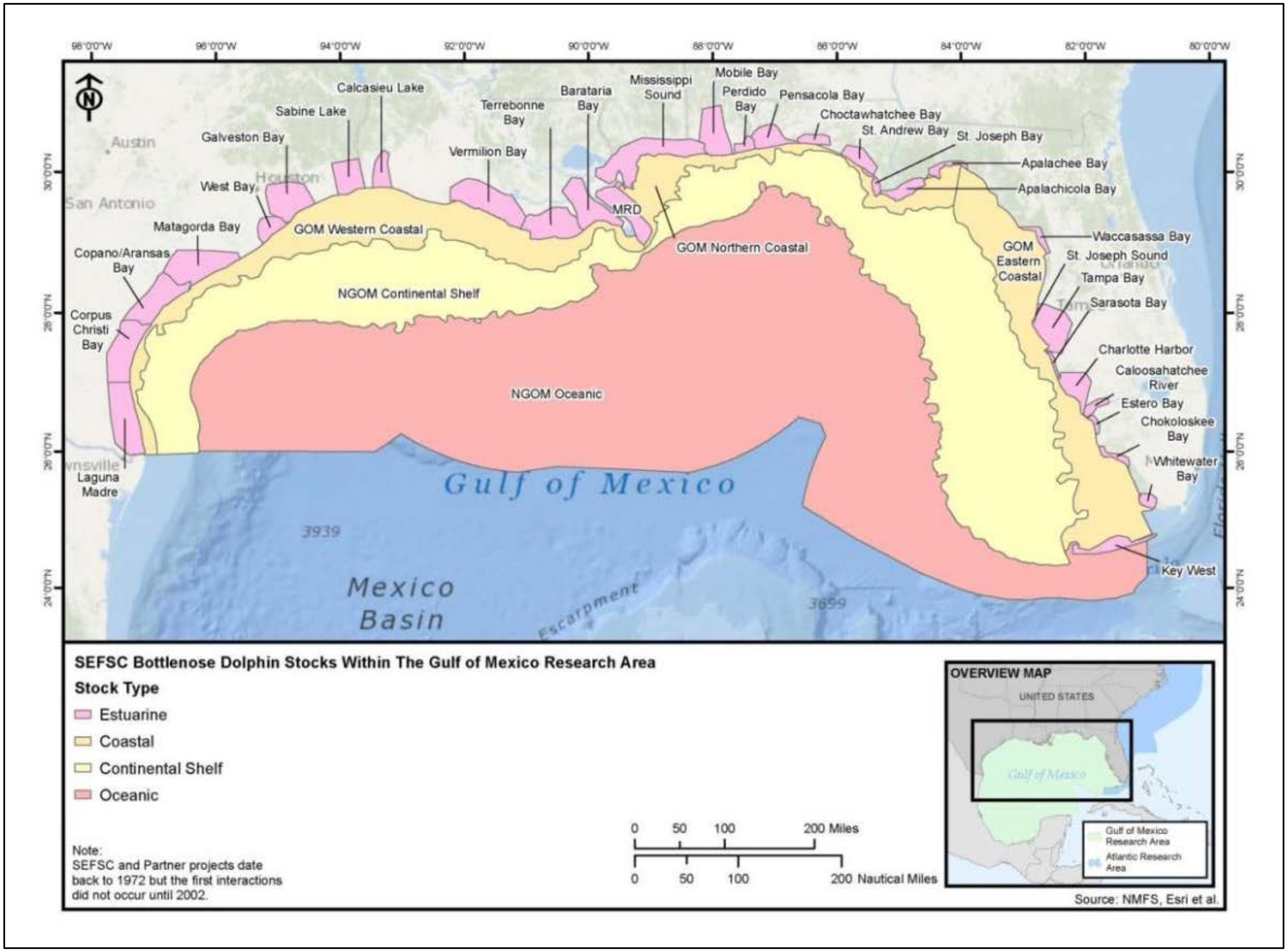

Figure 3.2-3 Bottlenose Dolphin Stocks within the SEFSC Gulf of Mexico Research Area

Harbor porpoise

The stock of harbor porpoise found in U.S. and Canadian Atlantic waters is the Gulf of Maine/Bay of Fundy stock (Waring et al. 2015b). This stock is currently not listed under the ESA. Population trends for this species are unknown. The best, and most recent, population estimate for this stock is 79,833, based on 2011 survey results. The minimum estimated population size is 61,415 and the PBR is 706 (Waring et al. 2015b). The total estimated average annual human-caused mortality and serious injury is 564 porpoises (521 from U.S. fisheries and 43 from Canadian fisheries). Most (385.5) were taken in the Northeast sink gillnet fishery, followed by 133 takes in the mid-Atlantic sink gillnet fishery between 2009 and 2013. Since total U.S. fishery-related mortality and serious injury exceeds ten percent of PBR for this stock, it cannot be considered to be insignificant and approaching a zero mortality and serious injury rate (Waring et al. 2015b). Harbor porpoise are reported stranded along the U.S. coast from Maine to North Carolina, with 515 strandings from 2009to 2013, 69 of which were in North Carolina (Waring et al. 2015b).

Gulf of Maine/Bay of Fundy harbor porpoises typically occupy cooler (< 17° C) and relatively shallow (< 200 m) coastal waters off the Northeast U.S., Bay of Fundy, and southwest Nova Scotia, Canada (Gaskin 1984, Palka et al. 1996, Read 1999). Harbor porpoises exhibit strong seasonal distribution patterns. During summer (July to September), they concentrate in the northern Gulf of Maine and southern Bay of Fundy region. During fall (October-December) and spring (April-June), they widely disperse from New Jersey to Maine, with lower densities farther north and south. During winter (January to March), intermediate densities of harbor porpoises occur from New Jersey to North Carolina, with lower densities off New York to New Brunswick, Canada (Waring et al. 2015b and citations therein). Habitat use is believed to be associated with prey, particularly Atlantic herring (Recchia and Read 1989, Palka 1995, Gannon et al. 1998).

Harbor seal

The stock structure of the western North Atlantic population of harbor seals is unknown, although those found along the eastern U.S. and Canadian coasts are thought to represent one population (Temte et al. 1991). The most recent coast-wide survey of the Maine coast in 2012 resulted in a corrected estimate of 75,834 seals. The minimum population estimate is 66,884 and the calculated PBR is 2,006 seals (Waring et al. 2015b). The estimated annual average human-caused mortality and serious injury to harbor seals was 420 for 2009-2013. Most (408) were from observed fisheries and twelve were non-fishery-related, human-interaction strandings or direct interactions. The Northeast sink gillnet fishery was responsible for 358 of the fishery-related mortalities (Waring et al. 2015b). Harbor seals are not considered threatened or endangered under the ESA.

Harbor seals occupy all nearshore waters of the Atlantic Ocean and adjoining seas above about 30º N (Katona et al. 1993). In the western North Atlantic, they range from the eastern Canadian Arctic and Greenland to southern New England and New York, and occasionally to the Carolinas (Mansfield 1967, Boulva and McLaren 1979, Katona et al. 1993, Gilbert and Guldager 1998, Baird 2001). Breeding and pupping in U.S. waters generally occurs along the coast of Maine from mid-May through June. Harbor seals occur year-round in coastal waters of eastern Canada and Maine (Katona et al. 1993) and along the southern New England and New York coasts from September through late May (Schneider and Payne 1983). In recent years, small numbers (<50) of harbor seals established a winter haul-out site near Oregon Inlet, North Carolina (Waring et al. 2015b). Scattered sightings and strandings have been recorded as far south as Florida. Of the 1,318 harbor seal stranding mortalities reported in 2009-2013, 24 were in North Carolina and one was in South Carolina (NMFS unpublished data cited in Waring et al. 2015b).

<u>Gray Seal</u>

The three major populations of gray seals in the North Atlantic are in eastern Canada, northwestern Europe, and the Baltic Sea (Katona et al. 1993). The western North Atlantic stock is equivalent to the eastern Canada population, and ranges from New England to Labrador (Mansfield 1966, Katona et al. 1993, Davies 1957, Lesage and Hammill 2001). Current estimates of the total western North Atlantic population are not available, although estimates for stock components exist. The combined estimated total abundance for Sable Island, Gulf of St. Lawrence, and Coastal Nova Scotia was 505,000 in 2014 (Waring et al. 2015b). The minimum population size and PBR for western North Atlantic gray seals in U.S. waters are unknown. Total estimated human-caused mortality and serious injury to gray seals from 2009 to 2013 averaged 5,004 per year, with 1,193.4 from U.S. observed fisheries (1,076 in the Northeast sink gillnet fishery), 7.6 from non-fishery human-interaction strandings, 172 from the Canadian hunt, 82 from Canada's Department of Fisheries and Oceans scientific collections, and 3,549 removals of nuisance animals in Canada (Waring et al. 2015b).

The population in U.S. waters is increasing due to a combination of recolonization by Canadian gray seals and increased pupping. Gray seal breeding colonies in New England include Muskget Island and Monomoy Island in Massachusetts and Green and Seal Islands in Maine, where a combined minimum of 2,620 pups were born in 2008 (Wood Lafond 2009). A minimum of 2,750 and 3,037 pups were counted on Muskeget Island in 2013 and 2014, respectively (Waring et al. 2015b). Pups have been seen on Matinicus Rock, Maine (Waring et al. 2013). Gray seals are also observed in New England outside of the pupping season. A maximum count of 15,756 gray seals was made in southeastern Massachusetts coastal waters in March 2011 (Waring et al. 2015b). Gray seals have also recently been recorded in surveys off eastern Long Island (Waring et al. 2015b). . Strandings have been reported as far south as North Carolina, with four stranding mortalities between 2009 and 2013 (Waring et al. 2015b).

3.2.3 Birds

The two major laws protecting birds in the SEFSC research areas are the ESA of 1973, as amended, and the MBTA of 1918, as amended. Currently, there are two species of seabirds listed under the ESA that spend time in SEFSC research areas: the Bermuda petrel (*Pterodrama cahow*) and the roseate tern (*Sterna dougallii*), and two shorebird species, the piping plover (*Charadrius melodus*), and the red knot (*Calidris canutus rufa*). The MBTA protects essentially all seabirds and shorebirds. Under this Act, the taking, killing, possessing, transportation and importation of migratory birds, their eggs or nests are unlawful except as permitted by law. The definition of "take" under the MBTA is "to pursue, hunt, shoot, wound, kill, trap, capture or collect" or attempt to do any of the former. In a fishery context, "take" refers to birds killed or injured during fishing operations whether from gear or striking the vessel (Murphy n.d.). The MBTA is silent as to its geographic scope although the U.S. Department of the Interior has previously claimed that the Act applies to the seaward limit of the U.S. EEZ (NOAA 2013b). Regardless of the geographic jurisdiction of the MBTA, the Act applies to all federal agencies, including NMFS, as stated in EO 13186.

3.2.3.1 Threatened and Endangered Species

The ESA allows the USFWS to list bird species as endangered or threatened regardless of which country the species lives in. Although greater legal protections are given to ESA-listed species within the U.S. EEZ, the law also protects listed species wherever they occur from potentially adverse interactions with people and entities subject to U.S. jurisdiction, such as the SEFSC and its researchers. Table 3.2-10 identifies the four ESA-listed species occurring within the SEFSC's LMEs. The brown pelican (*Pelecanus occidentalis*) was delisted in 2009 due to recovery (74 FR 59444). The least tern (*Sterna antillarum)* is listed as endangered in the interior part of its U.S. range but is not listed on the Atlantic coast (USFWS 2010).

Table 3.2-10 ESA-listed Birds Occurring in the SEFSC Research Areas

Species		ARA	GOMRA	CRA	Federal ESA Status
Common Name	**Scientific Name**				
Roseate tern	*Sterna dougallii*	X	X	X	Threatened[1]
Piping plover	*Charadrius melodus*	X	X	X	Threatened
Bermuda petrel	*Pterodroma cahow*	X			Endangered
Red Knot	*Calidris canutus rufa*	X	X	X	Threatened

1. Roseate terns are endangered on the Atlantic coast from Maine to North Carolina and threatened elsewhere.

Roseate tern

Roseate terns have nesting populations in tropical and subtropical areas of the Indian and North Atlantic Oceans as well as temperate zone breeding populations in North America, Europe, South Africa, and Western Australia (Spendelow 1995). These birds winter in coastal areas of northern South America. The population was subject to extensive mortality from historical feather hunters but has also suffered from nesting habitat loss due to coastal development and heavy predation and competition from large gulls (Spendelow 1995). Roseate terns forage for food offshore and capture fish mainly by plunge-diving, sometimes submerging completely in pursuit of prey. No roseate terns have been taken in any of the SEFSC fisheries research surveys.

Piping plover

The piping plover is a small, stocky shorebird that nests and feeds on sandy beaches. The Atlantic Coast and Northern Great Plains populations were listed as threatened, and the Great Lakes population was listed as endangered in 1986. Piping plovers from all three of these breeding populations winter along South Atlantic, Gulf Coast, and Caribbean beaches and barrier islands, and they are considered threatened throughout their wintering range (USFWS 2014c). Major threats to this species include habitat loss or degradation, nest disturbance, and predation (USFWS 2014c). No piping plovers have been taken in any of the SEFSC fisheries research surveys.

Bermuda petrel

The Bermuda petrel is a pelagic seabird that nests only on the islands of Bermuda. Once thought to have numbered more than half a million birds, Bermuda petrels were catastrophically affected by the arrival of humans and introduced mammal predators on the island in the early 1600s. During the summer, solitary birds are occasionally seen in the warm waters of the Gulf Stream off the coasts of North and South Carolina (Alsop III 2001). This pelagic species ranges widely on the open ocean, however, is considered rare and only occurring in low numbers off the Atlantic coast (SAFMC 2012). Bermuda petrels forage for squid, shrimp and fish from the ocean surface. Predominant threats are habitat loss, predation, and contaminants (SAFMC 2012). Other threats include human encroachment at breeding sites, offshore oil and gas exploration at Gulf Stream foraging sites, lighted ships and platforms that attract birds at night leading to collisions with wires or other structures, and conflicts with offshore fishing gear as they may be attracted to baited hooks (Hunter et al. 2006). No piping plovers have been taken in any of the SEFSC fisheries research surveys.

Red Knot

The *rufa* subspecies of the red knot is a migratory shorebird that breeds in the Canadian Arctic, winters in parts of the U.S., the Caribbean, and South America, and uses well known spring and fall stopover areas on the Atlantic coast of the U.S. (USFWS 2014d). Well-known spring stopover areas along the Atlantic coast include the Southeast U.S. (e.g., Georgia and the Carolinas); the Virginia barrier islands. Wintering areas for the rufa red knot include the Northwest Gulf of Mexico from the Mexican State of Tamaulipas through Texas (particularly at Laguna Madre) to Louisiana, and the Southeast U.S. from Florida (particularly the central Gulf coast) to North Carolina (USFWS 2014e).

In the southeastern U.S., red knots forage along sandy beaches, tidal mudflats, and peat banks during spring and fall migration from Maryland through Florida. Along the Texas coast, red knots forage on beaches, oyster reefs, and exposed bay bottoms, and roost on high sandflats, reefs, and other sites protected from high tides (USFWS 2014e).

Across all subspecies, *Calidris canutus* is a specialized molluscivore, eating hard-shelled mollusks, sometimes supplemented with easily accessed softer invertebrate prey, such as shrimp- and crab-like organisms, marine worms, and horseshoe crab eggs (Harrington 2001).

Surveys of wintering knots along the coasts of southern Chile and Argentina and during spring migration in Delaware Bay on the U.S. coast indicate that a serious population decline occurred in the 2000s. For example, the knot population decline that occurred in the 2000s was caused primarily by reduced food availability from increased harvests of horseshoe crabs, exacerbated by small changes in the timing that knots arrived at the Delaware Bay. Horseshoe crab harvests are now managed with explicit goals to stabilize and recover knot populations. Knot numbers appear to have stabilized since 2011, but they remain at low levels relative to earlier decades (USFWS 2014d). No red knots have been taken in any of the SEFSC fisheries research surveys.

3.2.3.2 Other Bird Species

Other birds likely to occur in the project area are listed in Table 3.2-11. The list only includes coastal and pelagic species with the potential to occur in offshore or nearshore ocean habitats. Most wading and shorebirds are excluded because their habitat preferences significantly lower or eliminate their risk of becoming bycatch. Species are described by their seasonal potential to occur in the three SEFSC research areas. Non-breeding resident species are generally only found outside of the breeding season (fall-spring). Breeding residents generally only occur during the breeding season from late spring to early fall and may have less extensive ranges during this time because they are tied to terrestrial nest sites. Permanent residents breed and winter within the research areas, and passage migrants only occur during migration between breeding and wintering ranges. These seasonal and distributional distinctions all affect each species' risk of becoming bycatch. All species listed in Table 3.2-11 are protected by the Migratory Bird Treaty Act (16 USC 703 et.seq.). Several species are also Birds of Management Concern and Birds of Conservation Concern. Birds of Management Concern are a subset of all species protected by the MBTA, and includes gamebirds below their desired condition and nongame birds which pose special management challenges due to a variety of factors (e.g., too few, too many, conflicts with human interests, or societal demands) (USFWS 2008). Birds of Conservation Concern are largely a subset of BMC and represent species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are considered by the USFWS likely to become candidates for listing under the ESA (USFWS 2008).

These species could interact with research vessels and gear.

Table 3.2-11 Bird Species Commonly Found in SEFSC Research Areas

Abbreviations used: BR = Breeding resident (summer); PR = Permanent resident (year-round); NBR = Non-breeding resident (winter); PM = Passage migrant (spring/fall)

Common Name	Scientific Name	Distribution by SEFSC Research Area			Foraging Habitat
		ARA	GOMRA	CRA	
American white pelican	*Pelecanus erthrorhynchos*	NBR	NBR		Coastal
Audubon's shearwater[1,2]	*Puffinus Iherminieri*	NBR		PR, BR	Pelagic
Band-rumped storm-petrel[1,2]	*Oceanodroma castro*	NBR			Pelagic
Bermuda petrel	*Pterodroma cahow*	NBR			Pelagic
Black noddy	*Anous stolidus*			BR	Pelagic
Black scoter[1]	*Melanitta nigra*	NBR	NBR		Coastal
Black skimmer[1,2]	*Rynchops niger*	PR		PR	Coastal
Black tern[1]	*Chlidonias niger*	PM	PM	PM	Coastal/Pelagic
Black-capped petrel[1,2]	*Pterodroma hasitata*	NBR		NBR	Pelagic
Bonaparte's gull	*Larus philadelphia*	NBR	NBR		Coastal
Bridled tern	*Sterna anaethetus*	BR, NBR		BR, NBR	Pelagic
Brown booby[1,2]	*Sula leucogaster*	PR		BR, PR	Pelagic
Brown noddy	*Anous stolidus*	NBR, PM		BR, NBR	Pelagic
Brown pelican	*Pelecanus occidentalis*	BR, PR	BR, PR	BR, PR	Coastal
Bufflehead	*Bucephala albeola*	NBR	NBR		Coastal
Caspian tern[1]	*Sterna caspia*	NBR	NBR	NBR	Coastal
Common goldeneye	*Bucephala clangula*	NBR	NBR		Coastal
Common loon	*Gavia immer*	NBR	NBR		Coastal
Common tern[1]	*Sterna hirundo*	PM	PM	NBR	Coastal
Cory's shearwater	*Calonectris diomedea*	NBR		NBR	Pelagic
Double-crested cormorant[1]	*Phalacrocorax auritus*	PR, NBR	PR, NBR		Coastal
Dovekie	*Alle alle*	NBR			Pelagic
Forster's tern	*Sterna forsteri*	NBR	NBR		Coastal
Great black-backed gull	*Larus marinus*	NBR			Coastal
Great cormorant[1]	*Phalacrocorax carbo*	NBR			Coastal
Great skua	*Stercorarius skua*	NBR			Pelagic
Greater scaup	*Aythya marila*	NBR	NBR		
Greater shearwater[1]	*Puffinus gravis*	NBR		NBR	Pelagic
Gull-billed tern[1,2]	*Sterna nilotica*	BR	PR	NBR	Coastal
Herring gull	*Larus argentatus*	PR, NBR	NBR		Coastal
Hooded merganser	*Lophodytes cucullatus*	PR, NBR	NBR		Coastal
Horned grebe[1]	*Podiceps auritus*	NBR	NBR		Coastal

Common Name	Scientific Name	Distribution by SEFSC Research Area			Foraging Habitat
		ARA	GOMRA	CRA	
Laughing gull	*Leucophaeus atricilla*	PR	PR	PR	Coastal
Leach's storm-petrel	*Oceanodroma leucorhoa*	NBR		NBR	Pelagic
Least tern[1,2]	*Sterna antillarum*	BR, NBR	BR	BR, NBR	Coastal
Lesser black-backed gull	*Larus fuscus*	NBR	NBR		Coastal
Long-tailed duck[1]	*Clangula hyemalis*	NBR			Coastal
Long-tailed jaeger	*Stercorarius longicaudus*			PM	Pelagic
Magnificent frigatebird[1,2]	*Fregata magnificens*	PR, NBR	PR, NBR	BR, NBR	Coastal
Manx shearwater	*Puffinus puffinus*	NBR			Pelagic
Masked booby[1,2]	*Sula dactylatra*	BR, NBR		BR, NBR	Pelagic
Neotropic cormorant	*Phalacrocorax brasilianus*		PR		Coastal
Northern gannet	*Morus bassanus*	NBR	NBR		Coastal/Pelagic
Osprey	*Pandion haliaetus*	PR	PR, NBR	NBR	Coastal
Parasitic jaeger	*Stercorarius parasiticus*	NBR, PM	NBR, PM		Pelagic
Pomarine jaeger	*Stercorarius pomarinus*	NBR	NBR	NBR	Pelagic
Razorbill	*Alca torda*	NBR			Pelagic
Red phalarope	*Phalaropus fulicaria*	NBR, PM	NBR		Coastal/Pelagic
Red-billed tropicbird	*Phaethon aethereus*			BR, PR	Pelagic
Red-breasted merganser	*Mergus serrator*	NBR	NBR		Coastal
Red-footed booby[1,2]	*Sula sula*			BR, PR	Pelagic
Red-necked phalarope	*Phalaropus lobatus*	PM			Coastal/Pelagic
Red-throated loon[1,2]	*Gavia Stellata*	NBR			Coastal
Roseate tern[1]	*Sterna dougallii*	BR, NBR		BR, NBR	Coastal
Royal tern	*Sterna maxima*	PR, NBR	PR, NBR	PR	Coastal
Sandwich tern[1,2]	*Sterna sanvicensis*	NBR	PR, NBR	NBR	Coastal
Sooty shearwater	*Puffinus griseus*	NBR		NBR	Pelagic
Sooty tern	*Sterna fuscata*	BR, PM	BR, PM	BR, NBR	Pelagic
South polar skua	*Stercorarius maccormicki*	PM			Pelagic
Surf scoter[1]	*Melanitta perspecillata*	NBR	NBR		Coastal
White-tailed tropicbird	*Phaethon lepturus*	NBR		BR, PR	Pelagic
White-winged scoter[1]	*Melanitta fusca*	NBR	NBR		Coastal
Wilson's storm-petrel	*Oceanites oceanicus*	NBR		NBR	Pelagic

1. Birds of Management Concern (USFWS 2011)
2. Birds of Conservation Concern (USFWS 2008) Fishery Management Council:
Sources: Info Natura 2007, Ridgely et al. 2005, Sibley 2000

The following accounts give brief overviews of the marine bird communities in the three SEFSC research areas.

ARA

The most common seabirds in the ARA include a variety of shearwaters, petrels, storm-petrels, terns, plovers, jaegers, loons, and tropicbirds, herons, cormorants, egrets, pelicans, gulls, albatrosses, fulmars, grebes, frigatebirds, gannets, boobies, sea ducks, skuas, skimmers, alcids (Watson and McWilliams 2005, Hunter et al. 2001).

Wintering birds in the ARA include common and red-throated loons, horned grebes, great cormorants, northern gannets, long-tailed ducks, surf scoters, black scoters, white-winged scoters, common goldeneyes, buffleheads, and red-breasted mergansers. Year-round residents include the brown pelican and double-crested cormorant. Magnificent frigatebirds breed in the Dry Tortugas and migrate along the coast. Brown and masked boobies are usually found far offshore and may occur in the waters around southern Florida (Sibley 2000). Black-capped petrels can be found in warm Gulf Stream waters. Shearwaters (Cory's, greater, Manx, Audubon's, and sooty), storm-petrels (Wilson's, band-rumped, and Leach's), and white-tailed tropicbirds migrate along the Atlantic (Sibley 2000).

Birds of Conservation and Management Concern include the Audubon's shearwater, band-rumped storm-petrel, black skimmer, black-capped petrel, brown booby, gull-billed tern, least tern, magnificent frigatebird, masked booby, red-throated loon, and sandwich tern. BMCs include the black scoter, black tern, caspian tern, common tern, double-crested cormorant, great cormorant, greater shearwater, horned grebe, long-tailed duck, roseate tern, surf scoter, white-winged scoter.

Threats to pelagic seabirds in the ARA include the possibility of take from longline fisheries, entanglement in gillnet fisheries, and collisions with lighted ships and platforms (Watson and McWilliams 2005, Hunter et al. 2001).

Birds most commonly observed during fisheries surveys in the ARA included brown pelicans, gulls (laughing, great black-backed, and herring), terns (royal and common), northern gannets, boobies, double-crested cormorants, shearwaters (Cory's, greater, and Audubon's), black-capped petrel, Wilson's storm-petrel and jaegers.

GOMRA

The most common seabirds found in the GOMRA include shearwaters, petrels, tropicbirds, boobies, gannets, pelicans, phalaropes, jaegers, gulls, and terns (Duncan and Havard 1980).

Summer/breeding residents include the gull-billed tern, least tern, and sooty tern. The magnificent frigatebird breeds in the Dry Tortugas and can be found along the rest of the Gulf Coast outside of the breeding season. Year-round residents include the double-crested cormorant, laughing gull, neotropic cormorant, royal tern, and sandwich tern (Sibley 2000). Winter/non-breeding residents include the black scoter, black tern, Bonaparte's gull, bufflehead, caspian tern, common goldeneye, common loon, Forster's tern, herring gull, horned grebe, lesser black-backed gull, northern gannet, parasitic jaeger, pomaraine jaeger, red phalarope, red-breasted merganser, surf scoter, and white-tailed tropicbird (Sibley 2000).

Birds of Conservation and Management Concern include the gull-billed tern, least tern, magnificent frigatebird, and sandwich tern. BMCs include the black scoter, black tern, caspian tern, common tern, double-crested cormorant, and surf scoter.

Seabird distribution is generally patchy over much of the ocean, but higher densities of seabirds are typically found around floating Sargassum (seaweed) reefs, upwellings, convergence zones, thermal fronts, salinity gradients, and areas of high planktonic productivity (Ribic et al. 1997, Davis et al. 2000). Sargassum reefs originate in the Gulf of Mexico each year and follow predictable currents and trade winds into the Atlantic Ocean (Gower and King 2011). These circulating reefs provide extensive habitat, and are important feeding and roosting sites for many seabirds (Haney 1986, Moser and Lee 2012).

Seabird populations in the Gulf of Mexico have been impacted in recent years by oil spills (2010 Deepwater Horizon oil spill), and hurricanes (Katrina and Rita), resulting in the mortality of many birds, reduced prey availability, and habitat loss (Hunter et al. 2006).

Birds most commonly observed during fisheries surveys in the GOMRA included pelicans (brown and white), ospreys, gulls (including laughing and herring), terns (common, least, Forster's, royal, black, sooty, gull-billed, sandwich, and bridled), magnificent frigatebirds, boobies (masked and brown), storm-petrels (Wilson's and band-rumped), shearwater (Audubon's and Cory's), loons, double-crested cormorants, northern gannets, pomarine jaegers, and black skimmers. Bird observation data was not collected for some surveys.

<u>CRA</u>

Year-round residents of the CRA include the Audubon's shearwater, black noddy, brown booby, brown pelican, laughing gull, red-billed tropicbird, red-footed booby, royal tern, sandwich tern, and white-tailed tropicbird (Ridgely et al. 2005). Summer/breeding residents include the bridled tern, brown noddy, least tern, magnificent frigatebird, masked booby, roseate tern, and sooty tern (Ridgely et al. 2005). Winter/non-breeding residents include the black tern, black-capped petrel, bridled tern, brown noddy, caspian tern, common tern, Cory's shearwater, greater shearwater, gull-billed tern, leach's storm-petrel, magnificent frigatebird, masked booby, pomaraine jaeger, roseate tern, sooty shearwater, and sooty tern (Ridgely et al. 2005). Several species occur as both breeding and non-breeding residents. This is often because during the breeding season, some species are more restricted to foraging areas near their breeding sites, while in the non-breeding season, they disperse to different foraging areas. Long-tailed and parasitic jaegers occur in the CRA area as passage migrants (Ridgely et al. 2005).

The Caribbean provides important breeding habitat for many seabird species. There are approximately 53 seabird colonies located in Puerto Rico, and 49 colonies in the U.S. Virgin Islands (Mackin and Lee 2008). The island of La Parguera in Puerto Rico supports a large breeding colony for roseate terns. Threats to seabirds in the Caribbean region include mortality caused by invasive species (goats, pigs, feral cats, and rats), oil spills, hurricanes, pesticide and heavy metal contamination, and human disturbance (National Fish and Wildlife Foundation 2012, Mackin and Lee 2008).

Birds most commonly observed during fisheries surveys in the CRA included gulls, sooty terns, magnificent frigatebirds, boobies (masked, red-footed, Audubon's shearwater, and loons. Bird observation data was not collected for most surveys.

3.2.4 Sea Turtles

Five species of sea turtles can be found within the area of the proposed SEFSC research activities: green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricate*), Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), and loggerhead (*Carretta carretta*). All life history phases and associated size classes for these particular species occur within the SEFSC research area. Additional background information on the range-wide status of these species has been published in a number of documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995, 2007a, 2007b, 2007c, 2007d, 2007e, Hirth 1997, USFWS 1997, Turtle Expert Working Group 1998, 2000, 2007, Conant *et al*. 2009), as well as recovery plans for the leatherback turtle (NMFS and USFWS 1992), Kemp's ridley turtle (USFWS and NMFS 1992, NMFS, USFWS and SEMARNAT 2011), green turtle (NMFS and USFWS 1991a), loggerhead turtle (NMFS and USFWS 1991b, 2008), and hawksbill turtle (NMFS and USFWS 1993).

3.2.4.1 Threatened and Endangered Species

All of the sea turtles found in the area of the SEFSC research activities are listed as threatened or endangered under the federal ESA (Table 3.2-12). The information presented in the following species accounts is primarily from the NOAA Fisheries OPR website (NOAA 2014), available online at: http://www.nmfs.noaa.gov/pr/species/turtles/.

Table 3.2-12 ESA-listed Sea Turtles found within the ARA, GOMRA, and CRA

Common Name	Scientific Name	Status
Green turtle	*Chelonia mydas*	Endangered[1]
Hawksbill turtle	*Eretmochelys imbricata*	Endangered
Kemp's Ridley turtle	*Lepidochelys kempii*	Endangered
Leatherback turtle	*Dermochelys coriacea*	Endangered
Loggerhead turtle (Northwest Atlantic DPS)	*Carretta carretta*	Threatened

Green turtles in U.S. waters are listed as threatened except for the breeding populations in Florida and the Pacific coast of Mexico, which are listed as endangered. Due to the inability to distinguish between these populations away from the nesting beach, green turtles are considered endangered wherever they occur in U.S. waters.

Green turtle

Green turtles are distributed circumglobally and occur throughout the SEFSC research area. In the western Atlantic they range from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean, but are considered rare north of Cape Hatteras (Wynne and Schwartz 1999). Most green turtle nesting in the continental U.S. occurs on the Atlantic Coast of Florida (Ehrhart 1979). Green turtles in the SEFSC research area are part of the Atlantic, Northwest Regional Management Unit which includes Central America and the Gulf of Mexico, the Caribbean (excluding the Antilles), out to Bermuda and back into the U.S. at the mid-Atlantic coast. Regional Management Units are geographically explicit population segments based on geographic boundaries to distributions derived from studies on genetics, tag returns, satellite telemetry, and other data (Kot et al. 2013).

Green turtles use mid-Atlantic and northern areas of the western Atlantic coast as important summer developmental habitat. Green turtles are found in estuarine and coastal waters as far north as Long Island Sound, Chesapeake Bay, and North Carolina sounds (Musick and Limpus 1997). Green turtles that use northern waters during the summer must return to warmer waters when water temperatures drop or face the risk of cold stunning. Cold stunning of green turtles may occur in southern areas as well (e.g., Indian River, Florida [Witherington and Ehrhart 1989]), as these natural mortality events are dependent on water temperatures and not solely geographical location. In January 2010, an unusually long spell of cold weather in Florida led to a statewide sea turtle cold-stunning event where over 4,500 sea turtles cold-stunned over several weeks resulting in the worst cold-stun event to date (http://archive.onearth.org/blog/a-record-5000-sea-turtles-cold-stunned-in-florida). Several species were involved but over 90% were green sea turtles (http://www.heraldtribune.com/article/20100122/ARTICLE/1221064).

The breeding populations in Florida and the Pacific coast of Mexico are currently listed as endangered under the ESA. All remaining populations of green turtles are listed as threatened. NMFS and the USFWS recently proposed to recognize 11 DPS of green turtles worldwide, with eight DPS proposed for threatened status and three DPS proposed for endangered status (80 FR 15272, 23 March 2015). Due to the inability to distinguish between different populations away from the nesting beach, green turtles are considered endangered wherever they occur in U.S. waters. Critical habitat for green turtles was designated in 1998 for coastal waters around Culebra Island, Puerto Rico.

Fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like dredging, pollution, and habitat destruction account for an unknown level of other mortality. Mortalities and bycatch of green turtles have been recorded by observers in the pelagic driftnet, pelagic longline, sea scallop dredge, southeast shrimp trawl, and summer flounder bottom trawl fisheries.

<u>Hawksbill turtle</u>

Hawksbill turtles are circumtropical, usually occurring from 30° N to 30° S latitude in the Atlantic, Pacific, and Indian Oceans and associated bodies of water. Hawksbills are widely distributed throughout the Caribbean Sea and western Atlantic Ocean, regularly occurring in southern Florida and the Gulf of Mexico (especially Texas). This species has been observed during SEFSC surveys in the GOMRA and CRA, but not in the ARA. Hawksbills prefer coral reefs, such as those found in the Caribbean and Central America (NMFS and USFWS 1993). Hawksbills feed primarily on a wide variety of sponges but also consume bryozoans, coelenterates, and mollusks. The Culebra Archipelago of Puerto Rico contains especially important foraging habitat for hawksbills. Nesting areas in the western north Atlantic include Puerto Rico and the Virgin Islands. There are accounts of hawksbills in south Florida and a number are encountered in Texas. In the north Atlantic, small hawksbills have stranded as far north as Cape Cod (Sea Turtle Stranding and Salvage Network [STSSN] database). However, many of these strandings were observed after hurricanes or offshore storms. Hawksbill turtles use different habitats at different stages of their life cycle, but are most commonly associated with healthy coral reefs. Oceanic stage juveniles are believed to occupy the pelagic environment.

Hawksbill turtles in the SEFSC research area are part of the Atlantic, West Regional Management Unit which includes the mid-Atlantic U.S., south through the Caribbean, and midway down the coast of Guyana. Regional Management Units are geographically explicit population segments based on geographic boundaries to distributions derived from studies on genetics, tag returns, satellite telemetry, and other data (Kot et al. 2013).

Hawksbills face threats on both nesting beaches and in the marine environment with the primary global threat to hawksbills being the loss of coral reef communities. Increased recreational and commercial use of nesting beaches, beach camping and fires, litter and other refuse, general harassment of turtles, and loss of nesting habitat from human activities negatively impact hawksbills. Incidental capture in fishing gear (primarily in gillnets) and vessel strikes also adversely affect the species' recovery. Critical habitat for hawksbill turtles was designated in 1998 for coastal waters around Mona and Monito Islands, Puerto Rico. (NMFS and USFWS 2013)

<u>Kemp’s Ridley turtle</u>

The Kemp’s ridley turtle is the smallest and most endangered of the world’s sea turtle species. This species has been observed during SEFSC surveys in all three research areas. Of the seven extant species of sea turtles, the Kemp’s ridley has declined to the lowest population level. This species typically occurs only in the Gulf of Mexico and the northwestern Atlantic Ocean but is not expected to commonly occur in the CRA (USFWS and NMFS 1992). Nesting typically occurs in Mexico, and occasionally in Texas, North Carolina, South Carolina, and the Gulf and Atlantic coasts of Florida. Juvenile Kemp’s ridleys use northeastern and Mid-Atlantic coastal waters of the U.S. Atlantic coastline as primary developmental habitat during summer months, with shallow coastal embayments serving as important foraging grounds. Next to loggerheads, they are the second most abundant sea turtle in Virginia and Maryland waters, arriving in these areas during May and June (Keinath et al. 1987, Musick and Limpus 1997). With the onset of winter and the decline of water temperatures, these turtles migrate to more southerly waters from September to November (Keinath et al. 1987, Musick and Limpus 1997). Turtles that do not head south soon enough face the risks of cold stunning in northern waters. Cold stunning can be a significant natural cause of mortality for sea turtles, especially Kemp’s ridleys, in Cape Cod Bay and Long Island Sound (http://www.greateratlantic.fisheries.noaa.gov/protected/stranding/overview/cold.html). In 2014, an unprecedented 1,200 Kemp's ridley sea turtles cold-stunned in Cape Cod Bay (http://www.businessinsider.com/sea-turtles-washing-up-in-cape-cod-bay-2014-12).

Like other turtle species, the severe decline in the Kemp's ridley population seems to have been heavily influenced by a combination of exploitation of eggs and impacts from fishery interactions. Currently, impacts to the Kemp's ridley population are similar to those discussed above for other sea turtle species. Takes of Kemp's ridley turtles have been recorded in the northeast otter trawl fisheries, pelagic longline fisheries, and southeast shrimp and summer flounder bottom trawl fisheries. Kemp's ridleys may also be affected by large-mesh gillnet fisheries.

In February, 2010, NMFS and USFWS were petitioned to designate critical habitat for Kemp's ridley nesting habitat along the Texas coast and marine habitats in the Gulf of Mexico and Atlantic Ocean. Based on the five-year status review of the Kemp's ridley turtle, NMFS and USFWS (2007b) determined that this species should remain classified as endangered under the ESA.

<u>Leatherback turtles</u>

Leatherback turtles occur throughout the SEFSC research area and are widely distributed throughout the oceans of the world (Ernst and Barbour 1972). This species has been observed during SEFSC surveys in all three research areas. The leatherback turtle is the largest living turtle and ranges farther than any other sea turtle species, exhibiting broad thermal tolerances that allow it to forage into the colder waters (NMFS and USFWS 1995). They can consume twice their own body weight in prey per day, feeding exclusively on soft-bodied invertebrates like jellyfish and tunicates. Sea nettle jellyfish and other species of the genus *Chrysaora* are preferred prey for leatherback turtles.

The U.S. Caribbean, primarily Puerto Rico and the U.S. Virgin Islands, and southeast Florida support the most significant nesting colonies within the U.S., and nesting trends in these areas have been increasing in recent years. Tagging and satellite telemetry data indicate that leatherbacks from the nesting beaches of the western North Atlantic use the entire North Atlantic Ocean (TEWG 2007). Leatherback turtles in the SEFSC research area are part of the Atlantic, Northwest Regional Management Unit which includes areas around Canada, under Greenland and Iceland around to the beginning of Northern Europe, the Mediterranean, the Atlantic south to the bulge of Brazil and Nigeria. Regional Management Units are geographically explicit population segments based on geographic boundaries to distributions derived from studies on genetics, tag returns, satellite telemetry, and other data (Kot et al. 2013).

Critical habitat for the leatherback turtle was designated in areas adjacent to St. Croix, U.S. Virgin Islands in 1979 (44 FR 17710, 23 March 1979). The boundaries of the critical habitat areas were designed to protect courting and breeding areas and provide access to nesting beaches.

Declines in the leatherback population have resulted from fishery interactions as well as exploitation of the eggs (Ross 1996). Eckert and Lien (1999) and Spotila et al. (1996) reported that adult mortality has also increased significantly, particularly as a result of driftnet and longline fisheries. Zug and Parham (1996) attributed the sharp decline in leatherback populations to the combination of the loss of long-lived adults in fishery related mortality, and the lack of recruitment, stemming from elimination of annual influxes of hatchlings because of egg harvesting. The five-year status review (NMFS and USFWS 2007a) and the Turtle Expert Working Group (TEWG) report (TEWG 2007) indicate that leatherbacks seem to be the most vulnerable to entanglement in fishing gear, particularly in trap and pot gear. In the Atlantic and Gulf of Mexico, federal and state agencies have established regulations (gear modifications, changes to fishing practices, and time/area closures) to reduce turtle bycatch in longline, gillnet, and trawl fisheries. An increasing or stable trend of leatherback nests for five of seven populations or groups of populations (Florida, North Caribbean, Southern Caribbean, South Africa, and Brazil) has been reported from the Turtle Expert Working Group (TEWG 2007), with the exception of the Western Caribbean and West Africa groups.

Based on its five-year status review of the leatherback species, NMFS and USFWS (2007a) determined that endangered leatherback turtles should not be delisted or reclassified. An analysis and review of the species was recommended to be conducted in the future to determine whether Distinct Population Segments should be identified for this species.

<u>Loggerhead turtle</u>

Loggerhead turtles occur throughout the entire SEFSC research area and are part of the Northwest Atlantic DPS (Kot et al. 2013). Their global distribution includes the temperate and tropical regions of the Pacific, Atlantic, and Indian Oceans in a wide range of habitats. These include the open ocean, continental shelves, bays, lagoons, and estuaries (NMFS and USFWS 1991b and 1995, Witherington et al. 2006). Loggerhead turtles are primarily benthic feeders, opportunistically foraging on crustaceans and mollusks (Wynne and Schwartz 1999, Witherington et al. 2006). Under certain conditions, they may also scavenge fish or forage on jellyfish in the water column (NMFS and USFWS 1991b). Shallow water habitats with large expanses of open ocean access provide year-round foraging areas for adult male and female loggerheads (Conant et al. 2009).

The threatened loggerhead turtle is the most abundant of the sea turtles listed as threatened or endangered in the U.S. waters. In the western North Atlantic, most loggerhead turtles nest from North Carolina to Florida and along the gulf coast of Florida. The activity of the loggerhead is limited by temperature. Loggerheads commonly occur throughout the inner continental shelf from Florida through Cape Cod, Massachusetts. Surveys conducted offshore, as well as sea turtle stranding data collected during November and December off North Carolina, suggest that sea turtles emigrating from northern waters in fall and winter months may concentrate in nearshore and southerly areas influenced by warmer Gulf Stream waters (Epperly et al. 1995). This is supported by the collected work of Morreale and Standora (1998), who satellite-tracked 12 loggerheads and three Kemp’s ridleys. All of the turtles followed similar spatial and temporal corridors, migrating south from Long Island Sound, New York, during October through December. The turtles traveled within a narrow band along the continental shelf and became sedentary for one or two months south of Cape Hatteras.

Loggerheads face threats on both nesting beaches and in the marine environment. The greatest cause of decline and the continuing primary threat to loggerhead turtle populations worldwide is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and dredges. The main anthropogenic threats impacting loggerhead nesting habitat include the destruction and modification of coastal habitats worldwide. Directed harvest for loggerheads still occurs in many places (e.g., Cuba and Mexico) and is a serious and continuing threat to loggerhead recovery. (NMFS and USFWS 1991b and 1995)

In September of 2011, NMFS and the USFWS determined that the loggerhead turtle is composed of nine DPS around the world. NMFS and USFWS designated critical habitat for Northwest Atlantic Ocean DPS loggerheads on nesting beaches along the U.S. coast from North Carolina to southeastern Florida, in the Dry Tortugas, southwestern Florida, and selected areas along the Florida panhandle, Alabama, and Mississippi as well as marine waters from offshore Virginia south and west to Texas (79 FR 39756 and 79 FR 39856, 10 July 2014). Figure 3.2-4 provides a large-scale view of loggerhead turtle critical habitat, although readers should look to the *Federal Register* notices for details about particular beaches and estuaries that are included.

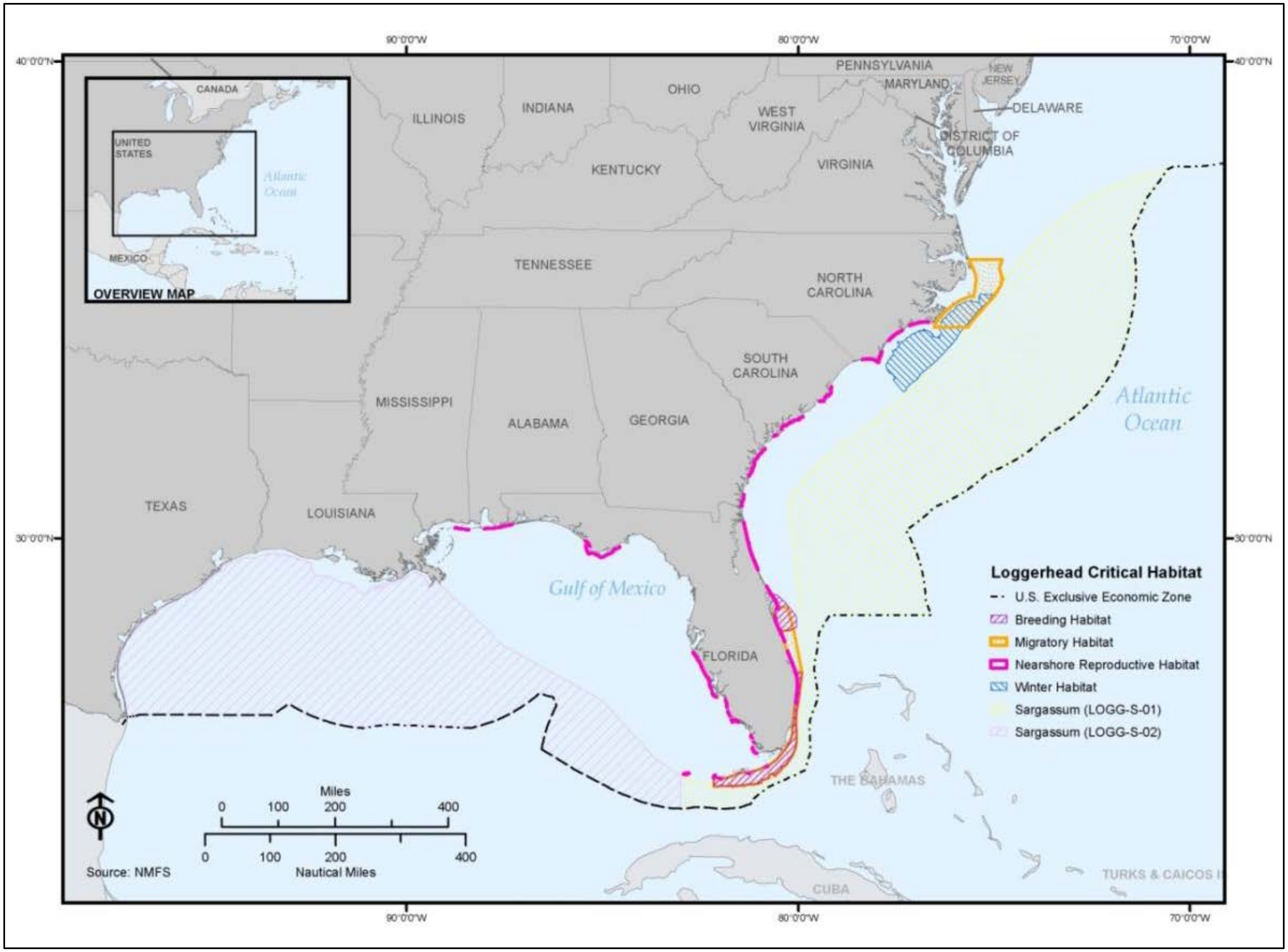

Figure 3.2-4 Loggerhead Turtle Critical Habitat in the SEFSC Research Areas

3.2.5 Invertebrates and Plants

3.2.5.1 Threatened and Endangered Species

Seven invertebrates and one plant species found within the SEFSC region are listed as threatened under the ESA (Table 3.2-13): elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicornis*), pillar coral (*Dendrogyra cylindrus*), rough cactus coral (*Mycetophyllia ferox*), lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), boulder star coral (*Orbicella franksi*), and Johnson's seagrass *(Halophila johnsonii*). Brief descriptions are given for each of these species including habitat, distribution, and threats. The information presented in the following species accounts are primarily from the NOAA Fisheries Office of Protected Resources website (http://www.nmfs.noaa.gov/pr/species/invertebrates/) and the Status Review Report of Candidate Coral Species (Brainard et al. 2011).

Table 3.2-13 Threatened and Endangered Plant and Invertebrate Species Occurring in the SEFSC Research Areas

Common Name	Scientific Name	ARA	GOMRA	CRA	ESA Status
Elkhorn coral	*Acropora palmata*	X	X*	X	Threatened
Johnson's seagrass	*Halophila johnsonii*	X			Threatened
Staghorn coral	*Acropora cervicornis*	X		X	Threatened
Pillar coral	*Dendrogyra cylindrus*	X		X	Threatened
Rough cactus coral	*Mycetophyllia ferox*	X		X	Threatened
Lobed star coral	*Orbicella annularis*	X	X	X	Threatened
Mountainous star coral	*Orbicella faveolata*	X	X	X	Threatened
Boulder star coral	*Orbicella franksi*	X	X	X	Threatened

* In the GOMRA, elkhorn coral is only found in two colonies in the Flower Garden Banks National Marine Sanctuary.

Source: Brainard et al. 2011, NMFS 2014, NMFS 2005b, NOAA 2014a

Elkhorn coral

Elkhorn coral (*Acropora palmata*) is a large branching coral with thick and sturdy antler-like branches found on coral reefs in southern Florida, the Bahamas, and throughout the Caribbean. Its northern limit is Broward County, Florida, and it extends south to Venezuela, though it is not found in Bermuda. NMFS designated critical habitat for elkhorn and staghorn corals in November 2008 in four areas: Florida, Puerto Rico, St. John/St. Thomas, and St. Croix (Figure 3.2-2). Elkhorn coral colonies prefer exposed reef crest and fore reef environments in depths of less than 20 ft (6 m), although isolated corals may occur to depths of 65 ft (20 m).

The dominant mode of reproduction for elkhorn coral is asexual, with new colonies forming when branches break off of a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. The coral larvae (planula) live in the water column as plankton for several days until finding a suitable area to settle, but very few larvae survive to settle and metamorphose into new colonies. The preponderance of asexual reproduction in this species raises the possibility that genetic diversity may be very low in the remnant populations. Colonies are fast growing: branches increase in length by 2-4 inches (5-10 centimeter [cm]) per year, with colonies reaching their maximum size in approximately 10-12 years.

Over the last 10,000 years, elkhorn coral has been one of the three most important Caribbean corals contributing to reef growth and development and providing essential fish habitat. Elkhorn coral was formerly the dominant species in shallow water (3 ft-16 ft [1-5 m]) deep throughout the Caribbean and on the Florida Reef Tract, forming extensive, densely aggregated thickets (stands) in areas of heavy surf. Once found in continuous stands that extended along the front side of most coral reefs, the characteristic "Acropora palmata zone" supported a diverse assemblage of other invertebrates and fish. These zones have been largely transformed into rubble fields with few, isolated living colonies. In areas where loss has been quantified, estimates are in the range of 90-95 percent reduction in abundance since 1980. Additional drastic reductions (around 75-90 percent) were recently observed in some areas such as the Florida Keys in 1998 due to bleaching and hurricane damage.

Staghorn coral

Staghorn coral (*Acropora cervicornis*) is a branching coral with cylindrical branches and is found throughout the Florida Keys, the Bahamas, the Caribbean islands, and Venezuela. The northern limit of staghorn coral is around West Palm Beach, Florida. Staghorn coral occur in back reef and fore reef environments from 0-100 ft (0 to 30 m) deep. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Fore reef zones at intermediate depths of 15-80 ft (5-25 m) were formerly dominated by extensive single species stands of staghorn coral until the mid-1980s. Staghorn coral has been one of the three most important Caribbean corals in terms of its contribution to reef growth and fish habitat. NMFS designated critical habitat for elkhorn and staghorn corals in November 2008 in four areas: Florida, Puerto Rico, St. John/ St. Thomas, and St. Croix (Figure 3.2-2).

The dominant mode of reproduction for staghorn coral is asexual fragmentation, with new colonies forming when branches break off a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once per year in August or September. The preponderance of asexual reproduction in this species raises the possibility that genetic diversity is very low in the remnant populations.

Pillar coral

Pillar coral *(Dendrogyra cylindrus)* has an encrusting base on which cylindrical columns develop and can reach up to 2 m in height. This species is found in waters of south Florida and the U.S. Caribbean in most reef environments from 2 to 25 m. It has been recorded in the Florida Keys National Marine Sanctuary, Navassa National Wildlife Refuge, Dry Tortugas National Park, Virgin Islands National Park, Biscayne National Park, and Buck Island National Monument. Critical habitat was undeterminable at the time of listing for pillar coral (79 FR 53852). Designation of critical habitat will occur in a separate rule-making process in the near future.

The dominant mode of reproduction for pillar coral is broadcast spawning, although it has a relatively low annual egg production for its size. Pillar coral can also propagate by fragmentation following storms or other physical disturbances. Average growth rates of 1.8 to 2.0 cm per year in linear extension have been reported in the Florida Keys.

Rough cactus coral

Rough cactus coral (*Mycetophyllia ferox*) is an encrusting coral with thin weakly attached plates with interconnecting and slightly sinuous narrow valleys, and a maximum colony size of 50 cm. This species is found throughout most of the Caribbean, including the Bahamas, in water depths from 5 to 30 m. Within federally protected U.S. waters, it has been recorded in Dry Tortugas National Park, Virgin Island National Park/Monument, Florida Keys National Marine Sanctuary, Navassa Island National Wildlife Refuge, Biscayne National Park, and Buck Island Reef National Monument. Critical habitat was undeterminable at the time of listing for rough cactus coral (79 FR 53852). Designation of critical habitat will occur in a separate rule-making process in the near future.

The dominant mode of reproduction for rough cactus coral is hermaphroditic brooding. Gametes are released into the water column and transported by waves and current before sinking to the ocean floor and taken in by coral polyps of the same species, where fertilization occurs internally. Coral colony size at first reproduction is over 100 square centimeters (cm^2).

Lobed star coral

Lobed star coral (*Orbicella annularis*) forms columns that exhibit rapid and regular upward growth. This species is found throughout the Caribbean, Bahamas, and Flower Garden Banks, but may be absent from Bermuda. It is reported in most reef environments at water depths of 0.5 to 20 m. Within federally protected U.S. water, it has been recorded in Flower Garden Bank Sanctuary, Dry Tortugas National Park, Virgin Island National Park/Monument, Biscayne National Park, Florida Keys National Marine Sanctuary, Navassa National Wildlife Refuge, and Buck Island Reef National Monument. Critical habitat was undeterminable at the time of listing for lobed star coral (79 FR 53852). Designation of critical habitat will occur in a separate rule-making process in the near future.

The dominant mode of reproduction for lobed star coral is hermaphroditic broadcast spawning, with spawning concentrated on six to eight nights following the full moon in late August, September, or early October. The reported growth rate of lobed star coral is 0.4 to 1.2 cm per year.

Mountainous star coral

Mountainous star coral (*Orbicella faveolata*) grows in heads or sheets with a surface that may be smooth or have keels or bumps. The colony diameter can reach up to 10 m with a height of 4 to 5 m. This species is found throughout the Caribbean, including the Bahamas, Flower Garden Banks, and the entire Caribbean coastline, in water depths from 0.5 to 40 m. Within federally protected U.S. waters, it has been recorded in Flower Garden Banks National Marine Sanctuary, Florida Keys National Marine Sanctuary, Dry Tortugas National Park, Virgin Island National Park/Monument, Biscayne National Park, Navassa Island National Wildlife Refuge, and Buck Island Reef National Monument. Critical habitat was undeterminable at the time of listing for mountainous star coral (79 FR 53852). Designation of critical habitat will occur in a separate rule-making process in the near future.

The dominant mode of reproduction for mountainous star coral is hermaphroditic broadcast spawning, with spawning concentrated on six to eight nights following the full moon in late August, September, or early October. The reported growth rate of mountainous star coral is 0.3 to 1.6 cm per year.

Boulder star coral

Boulder star coral (*Orbicella franksi*) is distinguished by large, unevenly-arrayed polyps that give the colony a characteristic irregular surface. Colony diameter can reach up to 5 m with a height up to 2 m. This species is found throughout the Caribbean, including the Bahamas, Flower Garden Banks, Bermuda, and the entire Caribbean coastline, in water depths from 5 to 50 m. Within federally protected U.S. waters, it has been recorded in Flower Garden Banks National Marine Sanctuary, Florida Keys National Marine Sanctuary, Dry Tortugas National Park, Virgin Island National Park/Monument, Biscayne National Park, Navassa Island National Wildlife Refuge, and Buck Island Reef National Monument. Critical habitat was undeterminable at the time of listing for boulder star coral (79 FR 53852). Designation of critical habitat will occur in a separate rule-making process in the near future.

The dominant mode of reproduction for lobed star coral is hermaphroditic broadcast spawning, with spawning concentrated on six to eight nights following the full moon in late August, September, or early

October. The reported growth rate for boulder star coral is slower, and spawning is reported to be about 1 hour earlier than for mountainous star coral and lobed star coral.

Threats to ESA-listed corals

NMFS identified nine threats to be the most significant to the current or expected future extinction risk of reef-building corals: ocean warming (bleaching), disease, ocean acidification, trophic effects of fishing, sedimentation, nutrients, sea-level rise, predation, and collection and trade (79 FR 53852). Susceptibility of a coral species can vary greatly between and within taxa, depending on the biological processes and characteristics of each coral species. Details on the species-specific or genera-specific threat susceptibilities of the above ESA-listed corals include:

- *Acropora* spp. (elkhorn and staghorn coral) are highly susceptible to ocean warming, disease, ocean acidification, sedimentation, nutrients, and predation and are susceptible to trophic effects of fishing, depensatory population effects from rapid, drastic declines and low sexual recruitment, and anthropogenic and natural abrasion and breakage.
- *Dendrogyra cylindrus* is susceptible to ocean warming, disease, acidification, nutrient enrichment, sedimentation, and trophic effects of fishing.
- *Mycetophyllia ferox* is highly susceptible to disease and is susceptible to ocean warming, acidification, trophic effects of fishing, nutrients, and sedimentation.
- *Orbicella* spp. are highly susceptible to ocean warming, disease, ocean acidification, sedimentation, and nutrients and are susceptible to trophic effects of fishing.

Johnson’s seagrass

Johnson's seagrass (*Halophila johnsonii*) has a very limited distribution and is the least abundant seagrass within its range. It has a disjunct and patchy distribution along the east coast of Florida from central Biscayne Bay to Sebastian Inlet. The largest patches have been documented inside Lake Worth Inlet. The southernmost distribution is reported to be in the vicinity of Virginia Key in Biscayne Bay, near Miami. Johnson's seagrass prefers to grow in coastal lagoons in the intertidal zone. This species has been found in coarse sand and muddy substrates and in areas of turbid waters and high tidal currents. NMFS designated critical habitat on April 5, 2000, in areas of Florida (Figure 3.2-3).

Johnson’s seagrass has a limited ability to disperse and colonize habitats because of its asexual reproduction and dependence on substrate stability. Threats for this species include boating impacts such as propeller scarring of the substrate, anchoring, and mooring; dredging; storm action and sedimentation; and degraded water quality.

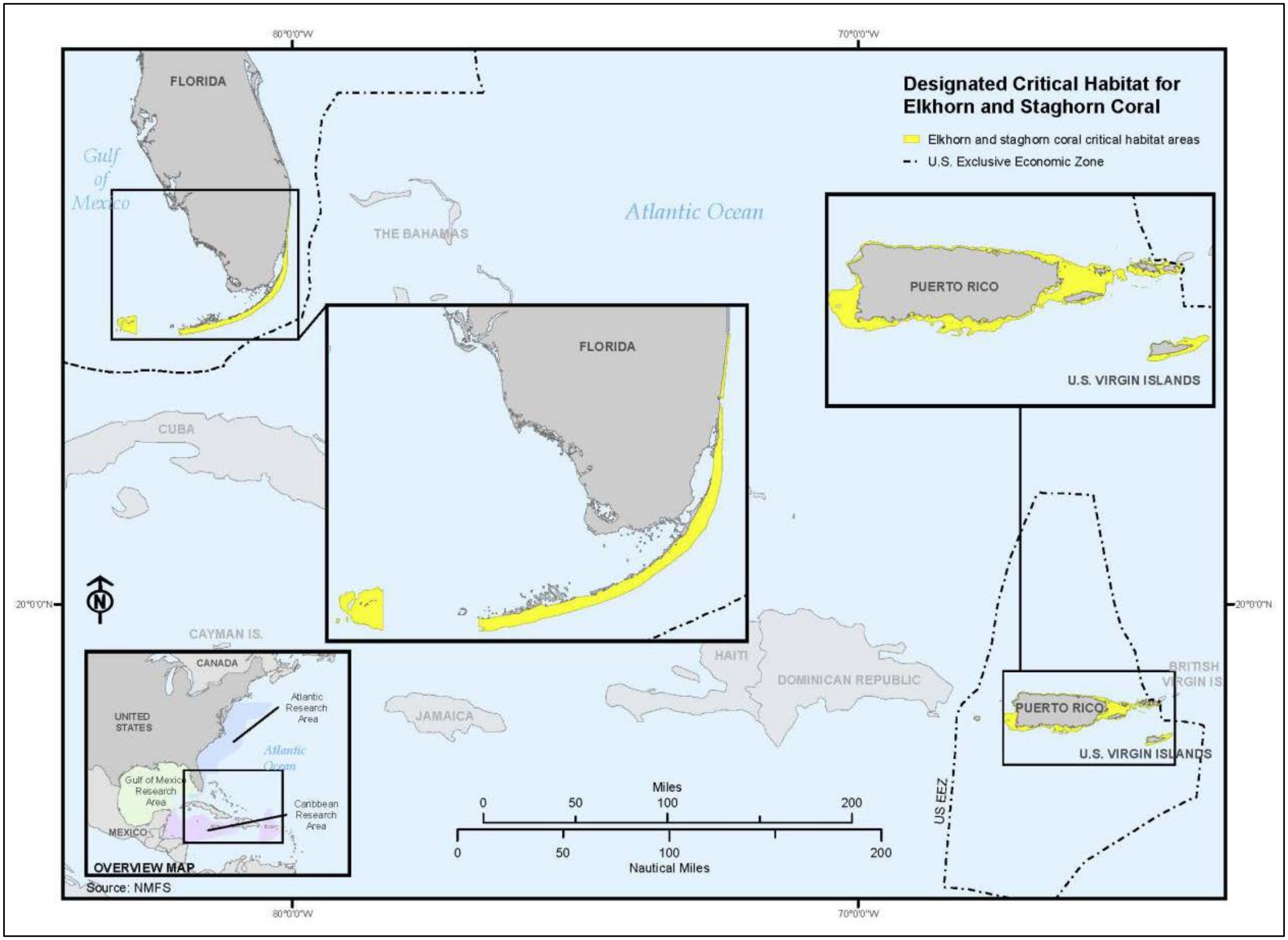

Figure 3.2-5 Designated Critical Habitat for Elkhorn and Staghorn Cora

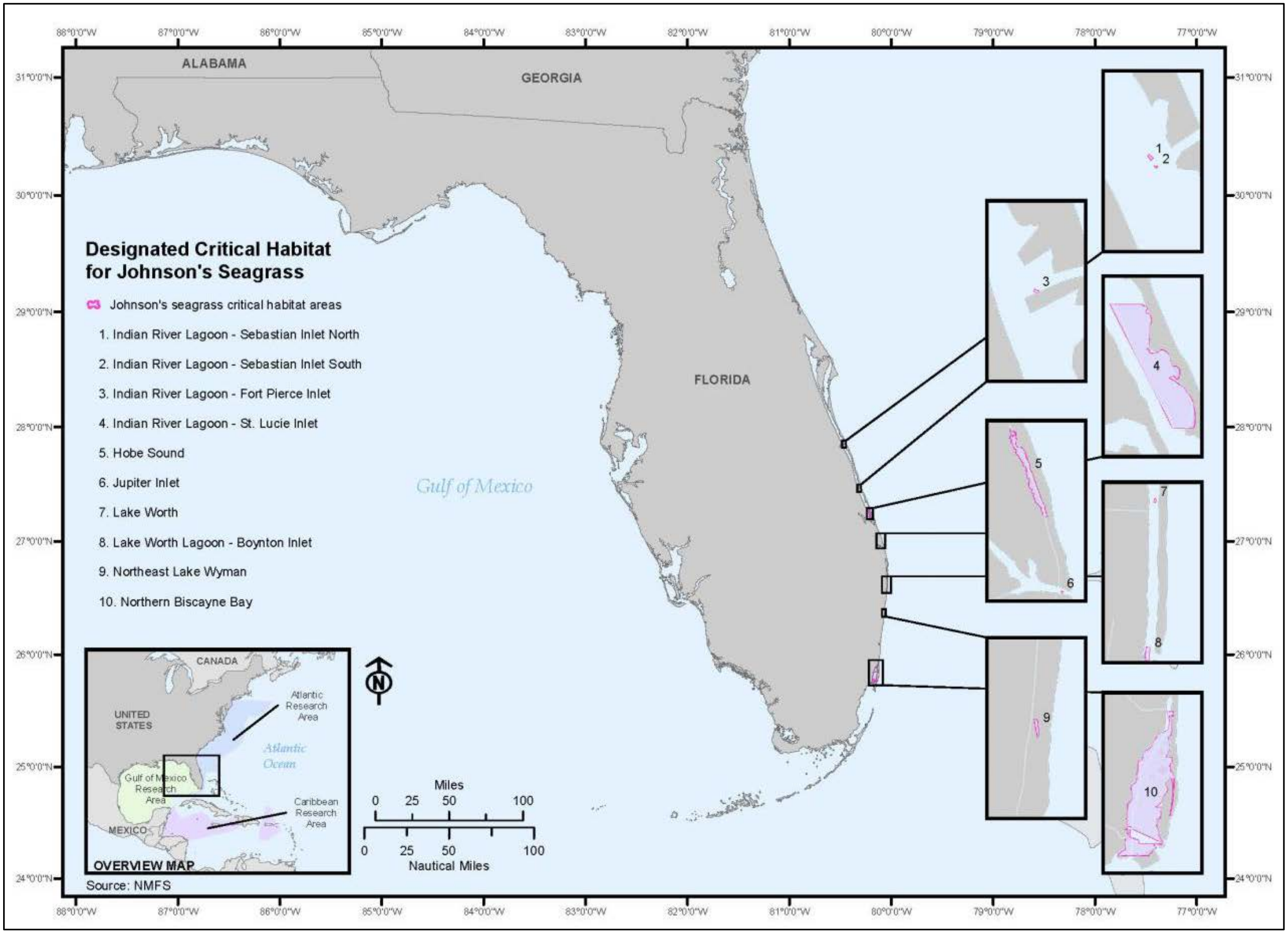

Figure 3.2-6 Designated Critical Habitat for Johnson's Seagrass

3.2.5.2 Target Species

For the purposes of this DPEA, target species are those invertebrates which are managed under an FMP for commercial and recreational fisheries and are the subject of SEFSC research surveys for stock assessment purposes. Only species with a 2008-2012 average annual research catch of at least 1000 kg in SEFSC and research partner surveys are shown in Table 3.2-14. No invertebrate catches were reported for the Caribbean Research Area. The only two target invertebrate species (based on average annual research catch) are white shrimp and brown shrimp. No invertebrates with a stock status of “overfishing” or “overfished” were caught.

Table 3.2-14 Target Invertebrate Species Caught in the SEFSC Research Areas

Only species with an annual average catch of > 1000 kg in SEFSC and research partner surveys are shown.

Common Name	Scientific Name	Research Area		Status of the Stock	Fishery Management Plans	Fishery Management Councils
		ARA	GOMRA			
Brown Shrimp	*Penaeus aztecus*		x	no overfishing not overfished	Shrimp Fishery of the South Atlantic/Gulf of Mexico	SAFMC/GMFMC
White Shrimp	*Litopenaeus setiferus*	x		no overfishing not overfished	Shrimp Fishery of the South Atlantic/Gulf of Mexico	SAFMC/GMFMC

Source: NOAA 2014b

3.2.5.3 Other Species

Other species include non-managed invertebrates with a 2008-2012 average annual research catch of at least 1000 kg and special status species not listed as threatened or endangered under the ESA that were caught in any amount during research activities. Other invertebrates are listed in Table 3.2-15 and include cannonball jellyfish, sponges (of unidentified species), horseshoe crabs, and moon jellies based on average annual catch weights of at least one metric ton.

Table 3.2-15 Other Invertebrates Caught in the SEFSC Research Areas

Only species with an annual average catch of > 1000 kg in SEFSC and research partner surveys are shown.

Common Name	Scientific Name	Research Area Catch Location		Special Status
		ARA	GOMRA	
Cannonball Jellyfish	*Stomolophus meleagris*	x		
Sponges	*Porifera sp.*		x	
Horseshoe Crab	*Limulus polyphemus*	x		
Moon Jelly	*Aerelia aurita*		x	

3.3 SOCIAL AND ECONOMIC ENVIRONMENT

Activities associated with the intent and implementation of SEFSC fisheries research have several implications for the social and economic environment affected by SEFSC fisheries research. These include providing guidance for federally managed commercial and recreational fisheries, providing information associated with international treaty obligations, and direct and indirect expenditures on goods and services associated with fisheries research.

The SEFSC conducts field and laboratory research to help conserve and manage the region's living marine resources in compliance with the MSA, the MMPA of 1972, and the Endangered Species Act of 1973. The 1996 amendments to the MSA require assessment, specification, and description of the effects of conservation and management measures on participants in fisheries, and on fishing communities (NMFS 2007b). The MSA states:

> *Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.*

The NMFS Economics Program monitors status and trends in performance of the commercial and recreational fishing sectors, including assessing regional economic impacts (sales, value-added, and jobs impacts). NMFS' Human Dimensions Program conducts community studies and develops statistical methodologies and economic models to identify and describe communities substantially engaged in fishing. This information is ultimately used by fishery managers, whose decisions balance the needs of a variety of fishing communities and users.

NMFS provides an annual report, *Fisheries Economics of the United States* (NMFS 2014a), which provides an annual analysis of states' economic participation in fisheries. NMFS also provides *Fishing Communities of the United States* (NMFS 2009b) which estimates community engagement and dependence on managed fisheries. Factors included in the estimations are commercial market conditions, recreational fishing expenditures and levels of participation, key species, and community profiles. The profiles are developed with data about the home ports of vessels participating in a particular fishery, the residence of commercial or recreational fishing participants, port landings, and the location of processing and service facilities.

3.3.1 Commercial Fisheries

Key commercial species and species groups, accounting for 91 percent of landings revenue for the Gulf of Mexico Region between 2003 and 2012, include blue crab, crawfish, groupers, menhaden, mullets, oysters, red snapper, shrimp, stone crab, and tunas. Key species and species groups for the South Atlantic Region include blue crab, clams, flounders, groupers, king mackerels, oysters, shrimp, snappers, swordfish, and tunas. Menhaden contributed the most to landings in the Gulf of Mexico Region, averaging 1.1 billion pounds from 2003 to 2012. In the South Atlantic Region, blue crab contributed the most to landings, averaging 41 million pounds from 2003 to 2012 (NMFS 2014a). Table 3.3-1 shows landings and revenue data for 2008 to 2012 for Virginia, the South Atlantic states, and the Gulf of Mexico states.

Table 3.3-1 Commercial Landings, Revenue, and Top Species (by Weight) for Virginia and the South Atlantic and Gulf of Mexico States 2008-2012

	All Species		Top Species, by Weight				Top Species Percent of All Species (Pounds)	Top Species Percent of All Species (Revenue)
	Pounds	Revenue	Pounds	Revenue	Price per Pound	Top Species		
VIRGINIA								
2008	422,594,753	$146,611,091	353,895,252	$21,270,652	$0.06	Menhaden	83.74%	14.51%
2009	426,282,450	$152,021,704	351,387,718	$23,577,557	$0.07	Menhaden	82.43%	15.51%
2010	509,841,262	$183,893,909	433,240,773	$34,476,161	$0.08	Menhaden	84.98%	18.75%
2011	494,028,366	$191,664,734	413,835,360	$32,977,529	$0.08	Menhaden	83.77%	17.21%
2012	461,943,838	$175,640,081	390,283,964	$31,104,139	$0.08	Menhaden	84.49%	17.71%
NORTH CAROLINA								
2008	71,209,454	$86,821,982	32,338,899	$25,429,241	$0.79	Blue Crab	45.41%	29.29%
2009	68,962,222	$77,248,224	29,140,483	$25,039,362	$0.86	Blue Crab	42.26%	32.41%
2010	71,993,699	$79,865,134	29,794,332	$23,801,608	$0.80	Blue Crab	41.38%	29.80%
2011	67,483,195	$71,177,197	28,964,480	$18,016,541	$0.62	Blue Crab	42.92%	25.31%
2012	56,670,559	$72,905,625	25,991,391	$20,198,895	$0.78	Blue Crab	45.86%	27.71%
SOUTH CAROLINA								
2008	10,080,363	$17,871,497	4,434,619	$3,897,559	$0.88	Blue Crab	43.99%	21.81%
2009	9,599,134	$17,255,591	3,968,657	$3,816,196	$0.96	Blue Crab	41.34%	22.12%
2010	10,566,854	$21,204,622	3,203,527	$3,194,953	$1.00	Blue Crab	30.32%	15.07%
2011	12,130,917	$23,300,372	5,415,179	$4,945,231	$0.91	Blue Crab	44.64%	21.22%
2012	12,259,570	$23,977,631	5,864,785	$5,591,989	$0.95	Blue Crab	47.84%	23.32%

	All Species		Top Species, by Weight				Top Species Percent of All Species (Pounds)	Top Species Percent of All Species (Revenue)
	Pounds	Revenue	Pounds	Revenue	Price per Pound	Top Species		
GEORGIA								
2008	8,929,669	$13,079,557	4,165,955	$3,579,353	$0.86	Blue Crab	46.65%	27.37%
2009	7,421,484	$11,754,835	3,498,917	$3,380,311	$0.97	Blue Crab	47.15%	28.76%
2010	7,214,866	$13,719,303	3,868,956	$8,534,531	$2.21	White Shrimp	53.62%	62.21%
2011	12,794,875	$16,179,339	4,745,040	$301,876	$0.06	Jellyfish	37.09%	1.87%
2012	10,304,490	$16,315,409	4,057,561	$3,780,459	$0.93	Blue Crab	39.38%	23.17%
FLORIDA								
2008	86,873,602	$171,946,988	8,389,725	$4,826,441	$0.58	Striped Mullet	9.66%	2.81%
2009	93,972,300	$158,449,932	10,353,632	$5,600,550	$0.54	Striped Mullet	11.02%	3.53%
2010	93,572,751	$190,435,605	10,589,460	$18,433,197	$1.74	Pink Shrimp	11.32%	9.68%
2011	109,702,981	$226,658,087	12,695,526	$9,500,710	$0.75	Striped Mullet	11.57%	4.19%
2012	91,303,052	$198,940,843	8,444,878	$5,869,096	$0.69	Striped Mullet	9.25%	2.95%
ALABAMA								
2008	24,612,323	$44,502,943	10,092,234	$21,269,454	$2.11	Brown Shrimp	41.00%	47.79%
2009	29,198,849	$39,623,888	14,702,489	$19,070,204	$1.30	Brown Shrimp	50.35%	48.13%
2010	14,062,723	$26,334,796	4,580,164	$10,110,499	$2.21	Brown Shrimp	32.57%	38.39%
2011	26,119,043	$50,909,988	10,603,515	$19,995,925	$1.89	Brown Shrimp	40.60%	39.28%
2012	26,336,576	$46,534,329	13,353,854	$26,721,196	$2.00	Brown Shrimp	50.70%	57.42%
MISSISSIPPI								
2008	201,822,002	$43,696,487	189,117,937	$18,533,559	$0.10	Menhaden	93.71%	42.41%
2009	230,254,818	$37,956,005	216,709,145	$17,986,861	$0.08	Menhaden	94.12%	47.39%

	All Species		Top Species, by Weight				Top Species Percent of All Species (Pounds)	Top Species Percent of All Species (Revenue)
	Pounds	Revenue	Pounds	Revenue	Price per Pound	Top Species		
2010	111,228,700	$21,894,945	104,729,230	$8,378,337	$0.08	Menhaden	94.16%	38.27%
2011	278,075,226	$30,290,993	266,774,325	$9,870,790	$0.04	Menhaden	95.94%	32.59%
2012	263,615,415	$49,281,843	248,823,731	$22,394,134	$0.09	Menhaden	94.39%	45.44%
LOUISIANA								
2008	919,016,927	$275,700,601	738,092,100	$45,768,240	$0.05	Menhaden	80.31%	16.60%
2009	1,007,474,064	$286,992,924	785,574,598	$42,554,990	$0.05	Menhaden	77.97%	14.83%
2010	793,377,682	$233,561,463	648,561,005	$43,330,511	$0.07	Menhaden	81.75%	18.55%
2011	1,311,040,048	$324,122,880	1,131,286,558	$82,880,855	$0.07	Menhaden	86.29%	25.57%
2012	856,665,125	$309,956,208	666,054,968	$44,875,101	$0.07	Menhaden	77.75%	14.48%
TEXAS								
2008	73,048,128	$176,097,836	37,520,760	$85,761,894	$2.29	Brown Shrimp	51.36%	48.70%
2009	102,350,743	$154,530,282	66,747,474	$88,585,538	$1.33	Brown Shrimp	65.21%	57.33%
2010	89,721,415	$203,794,798	48,220,832	$98,649,202	$2.05	Brown Shrimp	53.75%	48.41%
2011	98,857,046	$240,566,040	59,823,158	$133,565,137	$2.23	Brown Shrimp	60.51%	55.52%
2012	90,557,774	$213,313,076	51,390,094	$109,319,835	$2.13	Brown Shrimp	56.75%	51.25%

Source: NMFS 2014b

Fisheries Economics of the United States 2012 analyzed commercial fisheries data for 2012 (NMFS 2014a). In that year, commercial fishers in the Gulf of Mexico and South Atlantic regions landed 1.7 billion pounds and 108 million pounds, respectively, of fish and shellfish. Landings revenue in the South Atlantic Region totaled $171 million in 2012. This was a 9.1 percent increase (a 22 percent decrease in real terms) from 2003 levels ($157 million) and a 0.7 percent increase (a 1.1 percent increase in real terms) relative to 2011 ($170 million). In the Gulf of Mexico Region, landings revenue totaled $763 million in 2012. This was a 15 percent increase (a 18 percent decrease in real terms) from 2003 levels ($663 million) and a 6.8 percent decrease (a 6.4 percent decrease in real terms) relative to 2011 ($819 million) (NMFS 2014a).

In 2012, Florida had the third largest number of jobs supported by the seafood industry (82,141) and the second highest sales impacts generated by the seafood industry ($17 billion) in the U.S.. Nationwide, Louisiana had the eighth largest number of jobs (33,391) and Texas had the tenth largest number of jobs (25,911) supported by the seafood industry. Texas had the nation's eighth highest sales impacts generated by the seafood industry ($2.5 billion), followed by Georgia ($2.0 billion). In 2012, Louisiana had the second largest landings in the nation at 1.2 billion pounds, followed by Virginia at 461 million pounds. Louisiana and Texas had the highest landings revenue of the states in the SEFSC research area ($331 million and $194 million, respectively) (NMFS 2014a).

The most active west coast commercial fishing ports, in landings of finfish and shellfish, from 2003 to 2012 were: Hampton Roads Area, Virginia; Key West, Florida; Empire-Venice and Dulac-Chauvin, Louisiana; and Brownsville-Port Isabel and Galveston, Texas (NMFS 2014c). Table 3.3-2 shows commercial landings data by port.

Table 3.3-2 Top Commercial Landings (by Revenue) Locations in Virginia and the South Atlantic and Gulf of Mexico States

Year	U.S. Rank (by Dollar Value)	Port	Millions of Pounds	Millions of Dollars
2003	4	Hampton Roads Area, VA	30.1	$78.0
	5	Empire-Venice, LA	400.0	$50.8
2004	3	Hampton Roads Area, VA	34.7	$100.8
	6	Empire-Venice, LA	379.0	$60.2
2005	4	Hampton Roads Area, VA	23.5	$85.1
	7	Dulac-Chauvin, LA	42.6	$54.6
2006	5	Key West, FL	13.2	$54.4
	7	Brownsville-Port Isabel, TX	30.5	$52.0
2007	4	Empire-Venice, LA	323.1	$73.5
	5	Hampton Roads Area, VA	21.1	$71.2
2008	6	Hampton Roads Area, VA	19.3	$72.3
	8	Empire-Venice, LA	353.2	$62.9
2009	6	Hampton Roads Area, VA	18.0	$68.1
	7	Empire-Venice, LA	411.8	$67.1
2010	8	Hampton Roads Area, VA	16.1	$75.4
	12	Empire-Venice, LA	353.5	$59.4
2011	8	Empire-Venice, LA	531.5	$99.2
	9	Hampton Roads Area, VA	18.3	$88.3
2012	7	Empire-Venice, LA	500.4	$79.7
	10	Galveston, TX	26.6	$74.3

Source: NMFS 2014c

3.3.2 Recreational Fisheries

NMFS estimates recreational fishing data, based on a variety of sources. Data are partially derived from intercept surveys and mail and phone surveys, with contacts sampled from applicable fishing licenses. NMFS uses a regional input-output economic model to generate different metrics for assessing the contributions to a region's economy from expenditures on marine recreational fishing. For data collection and analysis, the state of Florida was divided into East Florida, which is considered part of the NMFS' South Atlantic Region, and West Florida, which is considered part of the NMFS' Gulf of Mexico Region (Lovell et al. 2013). Economic impacts of marine recreational fishing are shown in Table 3.3-3.

In 2012, over 2.6 million recreational anglers took 18 million fishing trips in the South Atlantic Region, which includes North Carolina, South Carolina, Georgia, and East Florida. In the Gulf of Mexico Region, which includes West Florida, Alabama, Mississippi, Louisiana, and Texas, over 3.1 million recreational anglers took 23 million fishing trips in 2012. Over 81 percent of South Atlantic anglers and over 91 percent of Gulf of Mexico anglers were residents of a regional coastal county. Employment impacts in 2012 were calculated from expenditures on recreational fishing trips taken by anglers (private or rental boat, for-hire boat, or shore-based trips) and expenditures on durable equipment. Throughout the South Atlantic and Gulf of Mexico regions, most of the employment impacts in 2012 were generated by expenditures on durable equipment (NMFS 2014a).

Table 3.3-3 Total Economic Impacts Generated from Marine Recreational Fishing in 2011

	Expense ($1,000)	Economic Contribution				Taxes ($1,000)
		Employment (Jobs)	Income ($1,000)	Value Added ($1,000)	Output ($1,000)	
Virginia	$923,405	9,454	$386,143	$626,991	$969,571	$180,687
North Carolina	$1,606,436	15,831	$604,275	$970,422	$1,622,060	$264,010
South Carolina	$287,152	3,303	$114,530	$185,318	$306,678	$25,731
Georgia	$327,152	2,753	$135,146	$216,863	$344,794	$52,460
East Florida	$3,843,439	32,118	$1,399,563	$2,223,161	$3,771,614	$595,009
West Florida	$5,494,695	66,237	$2,954,453	$4,629,218	$8,054,526	$1,194,809
Alabama	$856,334	8,867	$318,759	$504,980	$819,340	$132,379
Mississippi	$149,129	1,383	$45,502	$71,868	$120,644	$19,348
Louisiana	$1,879,471	17,808	$758,673	$1,152,657	$2,062,048	$290,282
Texas	$1,402,517	13,332	$585,857	$958,064	$1,644,672	$244,003
Puerto Rico	$72,410	—	—	—	—	—

Source: Lovell et al. 2013

Note: For data collection and analysis, the state of Florida was divided into East Florida, which is considered part of the NMFS' South Atlantic Region, and West Florida, which is considered part of the NMFS' Gulf of Mexico Region.

Economic impacts for marine recreational expenditures in Puerto Rico were not able to be estimated due to no currently available input-output model for Puerto Rico.

Key South Atlantic Region recreational species and specie groups include black sea bass, bluefish, dolphin fish, Atlantic croaker and spot, spotted seatrout, king mackerel, sheepshead porgy, red drum, sharks, and Spanish mackerel. Key species and species groups for the Gulf of Mexico Region include Atlantic croaker, gulf and southern kingfish, sand and silver seatrout, spotted seatrout, sheepshead porgy, red drum, red snapper, southern flounder, Spanish mackerel, and striped mullet. Spotted seatrout was the most commonly caught species in the Gulf of Mexico Region from 2003-2012, averaging 31 million fish annually, with an average of 61 percent released rather than harvested. In the South Atlantic Region, Atlantic croaker and spot was the most commonly caught species group from 2003-2012, averaging 8.4 million fish annually, with an average of 51 percent released rather than harvested (NMFS 2014a).

3.3.3 Fishing Communities

Over 400 fishing communities in the SEFSC research areas have been identified by NMFS social scientists because of the nature of their links with commercial and/or recreational fishing. The South Atlantic Region's top commercial fishing communities range in size from sub-areas of large cities like Jacksonville (population 735,617) and Miami (population 362,470), Florida, and Savannah, Georgia (population 131,510), to small villages like McClellanville, South Carolina (population 459) and Bath, North Carolina (population 275). East Florida's top commercial fishing communities tend to be the largest in the region – all have populations of more than 10,000. At the other extreme, North Carolina's top commercial fishing communities all have populations of less than 6,000, and several of these communities are smaller than 2,000. The Gulf of Mexico's top fishing communities were typically smaller towns and villages with populations below 20,000 people. However, one major metropolitan center approaching two million (Houston, Texas), and a few larger coastal cities also have significant fisheries involvement (Tampa and St. Petersburg, Florida; Mobile, Alabama; and Brownsville, Texas) (NMFS 2009b).

According to the 2000 U.S. Census, 9.2 percent of families lived below the poverty line in the U.S., the median income level was $42,000, and 18 percent of residents over five years of age spoke a language other than English at home. The South Atlantic Region and its fishing communities are fairly comparable to the national picture with state-level poverty rates ranging from 9 percent to 10.7 percent; median income levels ranging from $37,000 to $42,000; and the percentage of individuals over five years of age who speak a language other than English at home ranging from 5.2 percent to 23.1 percent. Compared to the nation, the Gulf of Mexico Region has a higher percentage of families living in poverty, a lower median income level, and a higher percentage of residents older than five who spoke a language other than English at home. The differences between the demographics of most, though not all, of the Gulf region's fishing communities and the rest of the U.S. is quite striking (NMFS 2009b).

The following sections list the fishing communities in the SEFSC Research Area:

3.3.3.1 Virginia

- Carrolton, Cheriton, Chincoteague, Hampton, Newport News, Norfolk, Poquoson, Seaford, Virginia Beach, Wachapreague

3.3.3.2 North Carolina

- Atlantic, Atlantic Beach, Aurora, Avon, Ayden, Bath, Bayboro, Beaufort, Belhaven, Carolina Beach, Columbia, Elizabeth City, Engelhard, Harker's Island, Hatteras, Kill Devil Hills, Lowland, Manteo, Morehead City, Nags Head, New Bern, Ocracoke, Oriental, Shiloh, Sneads Ferry, Southport/Bald Head Island, Surf City/Topsail Beach, Swan Quarter, Swansboro, Vandemere/Mesic, Varnamtown, Wanchese, Wilmington, Wrightsville Beach.

3.3.3.3 South Carolina

- Beaufort/Port Royal, Bluffton, Burton, Charleston, Edisto Beach, Georgetown, Green Pond, Hilton Head Island, Isle of Palms, Little River, McClellanville, Mt. Pleasant, Murrells Inlet, North Charleston, Port Royal, Seabrook Island, Saint Helena Island, Wadmalaw Island, Walterboro

3.3.3.4 Georgia

- Brunswick, Crescent, Darien, Midway, Richmond Hill, Savannah, Saint Mary's, Saint Simon's Island, Thunderbolt, Townsend, Tybee Island, Waynesville, Valona

3.3.3.5 Florida – East Coast

- Atlantic Beach, Big Pine Key, Boca Raton, Cape Canaveral, Cocoa Beach, Fernandina Beach, Key West, Fort Lauderdale, Fort Pierce, Islamorada, Jacksonville, Jupiter, Key Largo, Marathon, Margate, Mayport, Merritt Island, Miami, Palm Beach, Ponce Inlet, Port Orange, Saint Augustine, Sebastian, Titusville

3.3.3.6 Florida – West Coast

- Alva, Anclote, Anna Maria, Apollo Beach. Apalachicola, Archer, Aripeka, Bagdad, Bell, Belleair, Boca Grande, Bradenton, Bradenton Beach, Brandon, Brooksville, Cantonment, Cape Coral, Captiva Island, Carrabelle, Cedar Key, Chiefland, Chokoloskee, Clearwater, Copeland, Cortez, Crawfordville, Crystal River, DeFuniak Springs, Destin, Dover, Dunedin, East Point, El Jobean, Englewood, Estero, Everglades City, Fort Meyers, Fort Meyers Beach, Fort Walton Beach, Freeport, Gibsonton, Goodland, Gulf Breeze, Gulf Hammock, Gulfport, Hernando, Holiday, Holmes Beach, Homosassa, Homosassa Springs, Hudson, Indian Rocks Beach, Inglis, Inverness, Jena, Keaton Beach, Lakeland, Lamont, Lanark Village, Largo, Lecanto, Longboat Key, Lutz, Lynn Haven, Madeira Beach, Marco Island, Mary Esther, Mexico Beach, Milton, Navarre, New Port Richey, Nokomis/Odessa, North Fort Myers, Old Town, Oldsmar, Osprey, Ozona, Pace, Palm Harbor, Palmetto, Panacea, Panama City, Panama City Beach, Pensacola, Pine Island Communities (includes Pineland, Matlacha, Bokeelia, St. James City), Placida, Port Charlotte, Port Richey, Port St. Joe, Punta Gorda, Redington Beach, Riverview, Royal Palm Hammock, Ruskin, Sanibel Island, Santa Rosa Beach, Sarasota, Seminole, Shalimar, Sopchoppy, Southport, Spring Hill, St. George, St. Marks, St. Petersburg, Steinhatchee, Suwannee, Tampa, Tarpon Springs, Terra Ceia, Tierra Verde, Treasure Island, Trenton, Valparaiso, Venice, White City, Yankeetown, Youngstown

3.3.3.7 Alabama

- Atmore, Axis, Bay Minette, Bayou La Batre, Bon Secour, Coden, Daphne, Dauphin Island, Eight Mile, Elberta, Fairhope, Foley, Grand Bay, Gulf Shores, Irvington, Lillian, Loxley, Magnolia Springs, Mobile, Orange Beach, Perdido Beach, Robertsdale, Saraland, Semmes, Silverhill, Spanish Fort, St. Elmo, Stapleton, Summerdale, Theodore

3.3.3.8 Mississippi

- Bay St. Louis, Biloxi, D'Iberville, Gautier, Gulfport, Kiln, Lakeshore, Long Beach, Moss Point, Ocean Springs, Pascagoula, Pass Christian, Pearlington, Waveland

3.3.3.9 Louisiana

- Abbeville, Akers/Port Manchac, Amelia, Arabi, Arnaudville, Avondale, Baldwin, Barataria, Belle Chasse, Belle Rose, Berwick, Boothville, Bourg, Braithwaite, Breaux Bridge, Bridge City, Buras, Cameron, Chalmette, Charenton, Chauvin, Cocodrie, Creole, Cut Off, Cypremort Point, Delacroix, Delcambre, Denham Springs, Des Allemands, Destrehan, Deville, Donaldsonville, Dulac, Empire, Erath, Franklin, Galliano, Gheens, Gibson, Golden Meadow, Gonzales, Grand Isle, Grand Chenier, Gray, Gretna, Grosse Tete, Gueydan, Harvey, Houma, Intracoastal City, Jeanerette, Jonesville, Kaplan, Krotz Springs, Lacombe, Lafitte, Lake Arthur, Lake Charles, La

Place, Larose, Leeville, Lockport, Luling, Lydia, Madisonville, Mandeville, Marerro, Maringouin, Meraux, Metairie, Montegut, New Orleans, Paradis, Patterson, Pearl River, Pecan Island, Pierre Part, Plaquemine, Pointe a la Hache, Ponchatoula, Port Fourchon, Raceland, Reserve, St. Bernard, St. Martinville, Simmesport, Slidell, Terrytown, Theriot, Thibodaux, Vacherie, Venice, Vinton, Violet, Westlake, Westwego, Youngsville, Yscloskey

3.3.3.10 Texas

- Alvin, Anahuac, Aransas Pass, Bacliff, Baycity, Bayside, Baytown, Beaumont, Brazoria, Bridge City, Brownsville, Carrollton, Channelview, Clute, Corpus Christi, Crystal Beach, Dickinson, Freeport, Friendswood, Fulton, Galveston, Groves, Highlands, Houston, Indianola, Ingleside, Kemah, Kingsville, Laguna Vista, Lake Jackson, La Marque, League City, Liberty, Los Fresnos, Matagorda, Nederland, Oak Island, Orange, Palacios, Pasadena, Pearland, Port Acres, Port Aransas, Port Arthur, Port Bolivar, Port Isabel, Port Lavaca, Port Mansfield, Port Neches, Port O'Connor, Portland, Robstown, Rockport, Riviera/Riviera Beach, Sabine Pass, San Benito, San Leon, Sargent, Seabrook, Seadrift, Sinton, South Padre Island, Sweeny, Taft, Texas City, Tivoli, Victoria, Vidor

3.3.4 SEFSC Operations

Research-related spending directly generates jobs and income, and benefits businesses in the private economy by expenditures on research-related equipment. The SEFSC carries out research in facilities located in Miami, Florida; Beaufort, North Carolina; Panama City, Florida; Pascagoula, Mississippi; Stennis, Mississippi; Lafayette, Louisiana; and Galveston, Texas (Figure 1.1-3).

The SEFSC and its cooperating research partners routinely use NOAA vessels, state research vessels, and charter University-National Oceanographic Laboratory System (UNOLS) research vessels and commercial fishing vessels to conduct various types of fisheries research and cooperative research. In addition to leasing vessels, fisheries research contributes to local economies through operational support of NOAA vessels and chartered vessels (fuel, supplies, crew wages, shoreside services), operational costs of research support facilities (utilities, supplies, services), and employment of researchers who live in nearby communities. The SEFSC spends approximately $60-66 million annually in support of the fisheries research activities covered in this DPEA, including charter fees and operating costs for all vessels, salaries for federal and contractual staff participating in fisheries research, travel, and other incidental expenses, but not including capital costs of vessels and facilities (SEFSC Operations Management and Information Staff pers. comm. 2015).

4.1 INTRODUCTION AND ANALYSIS METHODOLOGY

This chapter presents an analysis of the potential direct and indirect effects of the alternatives on the physical, biological, and social environments consistent with Section 1502.16 of the CEQ NEPA regulations (40 CFR Part 1500) and NAO 216-6 (Environmental Review Procedures for Implementing the National Environmental Policy Act). Four alternatives have been brought forward for detailed analysis (see Chapter 2):

- The No Action/Status Quo Alternative, where fisheries and ecosystem research programs conducted and funded by the SEFSC would be performed as they were at the end of 2015. This is considered the No Action Alternative for ongoing programs under NEPA.
- The Preferred Alternative, where the SEFSC would conduct some new research activities and implement new protocols intended to mitigate impacts to protected species in addition to those described under the Status Quo Alternative.
- The Modified Research Alternative, where the SEFSC would conduct fisheries and ecosystem research with scope and protocols modified to minimize risks to protected species.
- The No Research Alternative, where the SEFSC would no longer conduct or fund fieldwork in marine waters for the fisheries and ecosystem research considered in the scope of this DPEA.

In addition to a suite of fisheries and ecological research conducted or funded by the SEFSC as the primary federal action, the second and third alternatives would also include promulgation of regulations and subsequent issuance of LOAs under Section 101(a)(5)(A) of the MMPA for the incidental, but not intentional, taking of marine mammals as the secondary federal action.

As was discussed in Chapter 1 of this DPEA, the NMFS is fundamentally a science-based agency, its primary mission being the stewardship of living marine resources through science-based management. The first three alternatives evaluated in this DPEA would enable the SEFSC to collect additional scientific information that otherwise would not be fully replaced by other sources, while the fourth alternative (The No Research Alternative) would not enable the collection of such information. In NMFS view, the inability to acquire scientific information essential to managing fisheries on a sustainable basis and rebuilding overfished stocks would ultimately imperil the agency's ability to meet its mandate to promote healthy fish stocks and restore the nation's fishery resources. Similar concerns apply to the conservation and management of protected species, their habitats, and other marine ecosystem components. However, there are several plausible scenarios (such as federal budget cuts, legal actions against NMFS, or natural disasters affecting SEFSC facilities) where the research activities of the SEFSC could be severely curtailed or eliminated for a period of time. The No Research Alternative therefore allows NMFS to examine the effects on the human environment of discontinuing federally funded fisheries research in the SEFSC research areas.

4.1.1 Impact Assessment Methodology

The authors of the sections in this chapter are subject matter experts. They developed a discussion of the effects on each resource component based on their best professional judgment; relying on the collective knowledge of other specialists in their respective fields and the body of accepted literature.

The impact assessment methodology consists of the following steps:

1. Review and understand the proposed action and alternatives (Chapter 2).
2. Identify and describe:

a. Direct effects that would be "caused by the action and occur at the same time and place" (40 CFR § 1508.8(a)), and

b. Indirect effects that would be "caused by the action and (would occur) later in time or farther removed in distance, but are still reasonably foreseeable" (40 CFR § 1508.8(b)).

3. Compare the impacts to the baseline conditions described in Chapter 3 and rate them as major, moderate, or minor. In order to help consistently assess impacts and support the conclusions reached, the authors developed a criteria table that defines impact ratings for the resource components (Table 4.1-1). The criteria provide guidance for the authors to place the impacts of the alternatives in an appropriate context, determine their level of intensity, and assess the likelihood that they would occur. Although some evaluation criteria have been designated based on legal or regulatory limits or requirements (see description of criteria for marine mammals below), others are based on best professional judgment and best management practices. The evaluation criteria include both quantitative and qualitative analyses, as appropriate to each resource. The authors then determine an overall rating of impacts to a given resource by combining the assessment of the impact components.

As described in Section 1.4, the reason an EA is developed is to determine whether significant environmental impacts could result from a proposed action and to inform the decision about whether an Environmental Impact Statement needs to be developed. If no significant impacts are discovered, NMFS can document its decision on the proposed action with a Finding of No Significant Impact. The assessment methodology described in this section is consistent with NAO 216-6, which provides guidance on how the agency should make determinations of significance in NEPA documents.

Table 4.1-1 Criteria for Determining Effect Levels

Resource Components	Assessment Factor	Effect Level		
		Major	**Moderate**	**Minor**
Physical Environment	**Magnitude or intensity**	Large, acute, or obvious changes that are easily quantified	Small but measurable changes	No measurable changes
	Geographic extent	> 10% of project area (widespread)	5-10% of project area (limited)	0-5% of project area (localized)
	Frequency and duration	Chronic or constant and lasting up to several months or years (long-term)	Periodic or intermittent and lasting from several weeks to months (intermediate)	Occasional or rare and lasting less than a few weeks (short-term)
	Likelihood	Certain	Probable	Possible
Biological Environment	**Magnitude or intensity**	Measurably affects population trend For marine mammals, mortality and serious injury greater than or equal to 50% of PBR[1]	Population level effects may be measurable For marine mammals, mortality and serious injury between 10% and 50% of PBR	No measurable population change For marine mammals, mortality and serious injury less than or equal to 10% of PBR
	Geographic extent	Distributed across range of a population	Distributed across several areas identified to support vital life phase(s) of a population	Localized to one area identified to support vital life phase(s) of a population or non-vital areas

Resource Components	Assessment Factor	Effect Level		
		Major	**Moderate**	**Minor**
	Frequency and duration	Chronic or constant and lasting up to several months or years (long-term)	Periodic or intermittent and lasting from several weeks to months (intermediate)	Occasional or rare and lasting less than a few weeks (short-term)
	Likelihood	Certain	Probable	Possible
Social and Economic Environment	**Magnitude or intensity**	Substantial contribution to changes in economic status of region or fishing communities	Small but measurable contribution to changes in economic status of region or fishing communities	No measurable contribution to changes in economic status of region or fishing communities
	Geographic extent	Affects region (multiple states)	Affects state	Affects local area
	Frequency and duration	Chronic or constant and lasting up to several months or years (long-term)	Periodic or intermittent and lasting from several weeks to months (intermediate)	Occasional or rare and lasting less than a few weeks (short-term)
	Likelihood	Certain	Probable	Possible

1. Potential Biological Removal (PBR).

4.1.2 Impact Criteria for Marine Mammals

The impact criteria for the magnitude of effects on marine mammals have been developed in the context of two important factors derived from the MMPA. The first factor is the calculation of PBR for each marine mammal stock. The MMPA defined PBR at 16 U.S.C. § 1362(20) as, "the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its OSP." PBR was intended to serve as an upper limit guideline for anthropogenic mortality for each species. Calculations of PBR are stock-specific and include estimates of the minimum population size, reproductive potential of the species, and a recovery factor related to the conservation status of the stock (e.g., whether the stock is listed under the ESA or depleted under the MMPA). NMFS and USFWS are required to calculate PBR (if possible) for each stock of marine mammals they have jurisdiction over and to report PBR in the annual marine mammal stock assessment reports (SARs) mandated by the MMPA. The PBR metric has been used extensively to assess human impacts on marine mammals in many commercial fisheries involving mortality and serious injury (M&SI) and is a recognized and acceptable metric used by NMFS Office of Protected Resources in the evaluation of commercial fisheries incidental takes of marine mammals in U.S. waters as well as for other sources of mortality such as ship strikes.

The second factor is the categorization of commercial fisheries with respect to their adverse interactions with marine mammals. Under Section 118 of the MMPA, NMFS must classify all U.S. commercial fisheries into one of three categories based on the level of marine mammal M&SI that occurs incidental to each fishery, which it does in the List of Fisheries (LOF) published annually. Category III fisheries are considered to have a remote likelihood of or no known incidental M&SI of marine mammals. Category II fisheries are those that have occasional incidental M&SI of marine mammals. Category I fisheries are those that have frequent incidental M&SI of marine mammals. A two-tiered classification system is used to develop the LOF, with different thresholds of incidental M&SI compared to the PBR of a given marine mammal stock.

However, the LOF criteria is primarily used for managing commercial fisheries based on their actual levels of marine mammal M&SI and is not necessarily designed to assess impacts of projected takes on a given marine mammal stock. Because the analysis of direct impacts of SEFSC fisheries research on marine mammals in this DPEA is based on projected takes rather than actual takes, we use a similar but not identical model to the LOF criteria.

In spite of some fundamental differences between most SEFSC fisheries research activities and commercial fishing practices, it is appropriate under NEPA to assess the impacts of incidental takes due to research in a manner similar to what is done for commercial fisheries for two reasons:

- SEFSC fisheries research activities are similar to many commercial fisheries in the fishing gear and types of vessels used, and
- SEFSC fisheries research plays a key role in supporting commercial fisheries.

As part of the NEPA impact assessment criteria (Table 4.1-1), if the estimated annual average M&SI of a marine mammal stock from all SEFSC fisheries research activities is less than or equal to 10 percent of PBR for that stock, the effect would be considered minor in magnitude for the marine mammal stock, similar to the LOF's Category III fisheries that have a remote likelihood of M&SI with marine mammals with no measurable population change. Projected annual M&SI from SEFSC fisheries research activities between 10 and 50 percent of PBR for that stock would be moderate in magnitude for the marine mammal stock, similar to the LOF's Category II fisheries that have occasional M&SI with marine mammals where population effects may be measurable. Projected annual M&SI from SEFSC fisheries research activities greater than or equal to 50 percent of PBR would be major in magnitude for the marine mammal stock, similar to the LOF's Category I fisheries that have frequent M&SI with marine mammals which measurably affect a marine mammal stock's population trend. Note that NEPA requires several other components to be considered for impact assessments (see Table 4.1-1); the magnitude of impact is not necessarily the same as the overall impact assessment in a NEPA context.

In the MMPA LOA application, SEFSC estimated takes for each marine mammal stock are grouped by gear type (i.e., trawl gear and longline gear) with the resulting take request not apportioned by individual research activities (e.g., by survey). This precludes impact analysis at the individual activity or project level within the DPEA.

NMFS recognizes that more than one of its regional Fisheries Science Centers may interact with the same stock of marine mammals in the Atlantic, namely the SEFSC and the Northeast Fisheries Science Center (NEFSC), and that the collective impact from both of these FSCs on marine mammal stocks should be considered. The NEFSC is currently working on their own NEPA and MMPA compliance processes. Historical data on incidental takes from the NEFSC and their estimated takes from their LOA application will be considered along with the contribution of the SEFSC in the Cumulative Effects section of this DPEA (Chapter 5). NMFS does not anticipate incidental takes from NEFSC research activities to substantially increase the aggregate impacts on marine mammal stocks shared with the SEFSC.

The contribution of SEFSC fisheries research activities to overall impacts on marine mammals will be aggregated with past, present, and reasonably foreseeable future impacts on marine mammals from commercial fisheries and other factors external to SEFSC fisheries research activities in the Cumulative Effects analysis in Chapter 5. NMFS will report all sources of M&SI in the annual marine mammal stock assessment reports (SARs), including any incidental M&SI takes that may occur from any of the FSCs. The cumulative effects analysis will use the same impact assessment criteria and thresholds as described in Table 4.1-1, only they will be applied to collective sources of M&SI and other types of impacts on marine mammals.

4.2 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1 – NO ACTION/STATUS QUO ALTERNATIVE

This section presents an analysis of the potential direct and indirect effects of Alternative 1 – the No Action/Status Quo Alternative on the physical, biological, and social environment. Under this Alternative, fisheries research programs conducted and funded by the SEFSC would be performed as they have been over the previous five years. Potential direct and indirect effects were evaluated according to the criteria described in Table 4.1-1. A summary of the impact rating determinations for all topics evaluated under Alternative 1 is presented below in Table 4.2-1.

Table 4.2-1 Alternative 1 Summary of Effects

Resource	Physical Environment	Special Resource Areas	Fish	Marine Mammals	Birds	Sea Turtles	Invertebrates	Social and Economic
SECTION #	**4.2.1**	**4.2.2**	**4.2.3**	**4.2.4**	**4.2.5**	**4.2.6**	**4.2.7**	**4.2.8**
Effects Conclusion	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor to Moderate *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor to Moderate *beneficial*

4.2.1 Effects on the Physical Environment

Section 3.1.1 describes the physical environment within the SEFSC research area. This section describes the effects that SEFSC fisheries and ecosystem research activities may have on the physical environment. The potential effects of fisheries research activities on the physical environment would vary depending on the types of survey gear and other equipment used, but could generally include:

- Physical damage to benthic (seafloor) habitat
- Changes in water quality
- Removal of organisms that create structure

4.2.1.1 Physical Damage to Benthic (Seafloor) Habitat

Fishing gear that contacts the seafloor can alter and/or physically damage seafloor habitat. Physical damage includes furrowing and smoothing of the seafloor as well as the displacement of rocks and boulders as fishing gear is towed across the bottom. In addition, gear that contacts the seafloor can destroy sea-grass beds, corals, submerged aquatic vegetation, and hard-bottom habitat (Morgan and Chuenpagdee 2003). Physical damage to the seafloor can increase with multiple tows in the same area (NRC 2002).

These types of effects on the physical environment are caused primarily by bottom trawl equipment as it comes into contact with the seafloor (NRC 2002, Morgan and Chuenpagdee 2003) although stationary gear such as fish and crab traps can also have impacts (Barnette 2001). Historically, the SEFSC has used benthic trawls, otter trawls, modified beam trawls, skimmer trawls, shrimp trawls, high opening bottom trawls, falcon bottom trawls, and roller frame trawls. SEFSC has also used stationary gear (bottom gillnets, bottom longlines, fyke nets) and pot gear (e.g., chevron fish traps, oyster dredges, shrimp cages, and throw traps) that temporarily contacts the seafloor and can impact benthic habitat (Table 2.2-1, Appendix A).

Historically, bottom trawls have been deployed in the GOMRA and ARA during each survey season; however, efforts are generally lower in the winter. Bottom trawling surveys are not conducted in the CRA. Oyster dredges have been used annually in the GOMRA.

The seafloor habitats in the three SEFSC research areas include mangroves, seagrass beds, coral reefs, and hardbottom habitats (Sherman and Hempel 2008). SEFSC bottom trawl and dredge operations are unlikely to result in any direct impacts to mangroves or seagrass beds due to the operational difficulties associated with deployment of trawls or dredges in mangrove or seagrass bed communities. Weights and anchors associated with fishing pots may physically damage fragile species such as corals, which are more common in rocky substrates (Macdonald et al. 1996, Eno et al. 2001). However, physical impacts to coral reef habitats would be unlikely to result from SEFSC trawl or dredge operations because SEFSC trawl and dredge operations would not occur in known coral reef areas.

The majority of hardbottom in the GOMRA and ARA consists of exposed limestone on which algae, coral, and sponges establish and accumulate. Hardbottom areas may be found throughout the Gulf of Mexico, especially along the west coast of Florida, as well as along the entire eastern seaboard to North Carolina. Furthermore, many areas along the west coast of Florida are characterized by a thin sand veneer covering solid limestone (Barnette 2001). Soft bottom habitats are typically less affected by pot gear than vegetated or hard bottom habitats (Barnette 2001). Although pot gear may be deployed in some hard bottom habitats that are not suitable for trawling or dredging, its use is not limited to rocky substrates and data on the substrate for each pot used in past research is not available for quantitative estimates by habitat type. Overall, the magnitude of benthic habitats affected by pot gear used for fisheries research is expected to be very small.

The geographic area directly affected by SEFSC bottom trawl surveys from 2009 through 2013 is estimated to be 139.32 mi^2. During this time period, the areas of seafloor affected by SEFSC research each year were a very small fraction of the total area of the three research areas, and the geographic extent of impacts would remain similar under the Status Quo Alternative (Table 4.2-2). The GOMRA covers an area of approximately 800,000 mi^2, the ARA covers more than 530,000 mi^2, and the CRA covers approximately 400,000 mi^2. Under the Status Quo Alternative, bottom disturbance resulting from annual SEFSC fisheries research activity would affect less than 0.02 percent of each SEFSC research area (Table 4.2-2). Bottom trawl surveys account for most of the physical impacts to bottom habitat. The total area affected by SEFSC dredging activity between 2009 and 2013 was 19,289 ft^2 (approximately 0.0007 mi^2), which is negligible compared to the area impacted by bottom trawl activities over the same period of time (139.32 mi^2). Under the Status Quo Alternative, physical impacts to bottom habitat would affect less than 0.002 percent of the overall SEFSC research area. Impacts would occur primarily in the Gulf of Mexico Research Area, and to a lesser extent in the Atlantic Research Area. The Carribean Research Area would not be affected by SEFSC bottom trawl or dredge research activities, because such activities do not occur in the Carribean Research Area.

Table 4.2-2 Area of Seafloor Affected by SEFSC and Cooperative Research Bottom-Tending Gear by Research Area and Season

Season	Number Bottom Trawls	Area Affected by Trawls (mi^2)	Number Dredges	Area Affected by Dredges (ft^2)	Total Area Affected (mi^2)	Percent Affected
GULF OF MEXICO RESEARCH AREA (798,416 MI^2)						
Spring	727	7.63	10	5076	7.63	0.00096%
Summer	1941	97.95	12	6091	97.95	0.012%
Fall	931	12.00	6	3046	12.00	0.0015%

Season	Number Bottom Trawls	Area Affected by Trawls (mi^2)	Number Dredges	Area Affected by Dredges (ft^2)	Total Area Affected (mi^2)	Percent Affected
Winter	579	4.32	10	5076	4.32	0.00054%
Totals	**4178**	**121.9**	**38**	**19289**	**121.9**	**0.015%**
ATLANTIC RESEARCH AREA (532,928 MI^2)						
Spring	392	1.14	0	NA	1.14	0.00021%
Summer	716	1.99	0	NA	1.99	0.00037%
Fall	430	4.50	0	NA	4.50	0.00084%
Winter	580	9.89	0	NA	9.89	0.0019%
Totals	**2118**	**17.52**	0	-	**17.52**	**0.0033%**
CARIBBEAN RESEARCH AREA (396,333 MI^2)						
Spring	0	NA	0	NA	NA	0
Summer	0	NA	0	NA	NA	0
Fall	0	NA	0	NA	NA	0
Winter	0	NA	0	NA	NA	0
Totals	**0**	-	**0**	-	-	**0**

4.2.1.2 Changes in Water Quality

Fishing gear that contacts the seafloor could increase the turbidity of the water by resuspending fine sediments and benthic algae from the seafloor. Bottom-contact trawl gear can also increase turbidity and alter the chemical composition of water near the seafloor. However, these effects would be short-term, minor in magnitude, and limited in geographic extent. Consolidated and unconsolidated sediments within the Southeast Region include a wide variety of coarse sands, shell hash, and fine silts and muds, the disturbance of which could result in temporary, low intensity impacts to water quality in the immediate vicinity of research activities that involve bottom contact gear (Barnette 2001). While such impacts are certain to occur under the status quo alternative, the intensity of the impacts would be minor. The three research areas all include areas with very high baseline concentrations of suspended solids and associated high levels of turbidity in the water due to sediment-laden river runoff. Under Alternative 1, any impacts to water quality resulting from SEFSC research activities would be minor; concentrations of suspended sediments in the water and associated levels of turbidity would likely remain within naturally occuring ranges, and any measureable changes resulting from the suite of SEFSC research proposed under Alternative 1 would be small.

Likewise, potentially adverse effects to benthic habitats resulting from discharge of contaminants from vessels used during research surveys are possible, but unlikely. If such effects were to occur, they would be infrequent, temporary, and localized. All NOAA and ocean going vessels are subject to the regulations of MARPOL 73/78, the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (NOAA 2010a). MARPOL includes six Annexes that cover discharge of oil, noxious liquid substances, harmful packaged substances, sewage, garbage, and air pollution (IMO 2010). Adherence to these regulations minimizes or negates the likelihood of discharges of potentially harmful substances into the marine environment. Annex V specifically prohibits plastic disposal anywhere at sea and severely restricts discharge of other garbage (IMO 2010). NOAA vessels are fully equipped to respond to emergencies, including fuel spills, and crew receive extensive safety and emergency response training. These precautionary measures help reduce the likelihood of fuel spills occurring and increase the chance that they will be responded to and contained quickly. Oil spill prevention training and equipment may be more variable on commercial fishing vessels used in cooperative research although all vessels are required to comply with U.S. Coast Guard regulations on spills. Potential effects on the physical environment resulting from discharged or spilled materials are not gear type dependent and would be minor to negligible throughout the SEFSC research areas.

4.2.1.3 Damage to Organisms that Produce Structure

Dredges and other bottom-contact gear can cause damage to organisms that produce structure, for example, oysters and corals. In addition, bottom-contact research activities can suspend large quantities of sediment that could smother structure building organisms. Oysters and corals create reef structures which provide interstitial spaces for small invertebrates and fish to live. They also create habitat for transient and resident fish. Bottom longlines could impact benthic communities in the same manner as lines between fish and lobster traps; during recovery the line may sweep the sea floor before rising off the bottom, dislodging objects and impacting hard corals (NMFS 1998a). Under the Status Quo Alternative, effects on seafloor organisms that produce structure would be considered minor adverse due in part to the small areal extent of surveys using bottom trawl (Table 4.2-2). Such impacts would be limited to the GOMRA and ARA because the SEFSC does not use bottom trawl gear in the CRA. Direct and indirect effects resulting from the removal of organisms that produce structure would be localized, short-term in duration, and would result in small but measurable changes. Overall, impacts to seafloor structural organisms in the SEFSC research areas would be considered minor adverse under the Status Quo Alternative according to the criteria in Table 4.1-1.

4.2.1.4 Conclusion

The effects of the Status Quo Alternative on the physical environment would include potential changes to the benthic environment, changes in water quality, and damage to structure producing organisms. These effects would almost certainly occur under the Status Quo Alternative, and the duration of such effects would be on the order of weeks to months. The intensity of impacts to the benthic habitat would be small but measurable, and the geographic extent of any physical contact with benthic habitats would be much less than 0.02 percent of the overall SEFSC research area and therefore considered minor.

Adverse effects on water quality from research activities are caused by the resuspension of sediments and are considered minor in magnitude. These effects are certain, but of short duration and therefore have minor impacts.

Overall, effects on the physical environment are almost certain to occur under the status quo alternative, changes to the resource would be small but measureable, would cover a small geographic area, and would be temporary in duration. Therefore overall it is considered a minor adverse effect according to the impact criteria in Table 4.1-1.

4.2.2 Effects on Special Resource Areas and Essential Fish Habitat

Section 3.1.2 describes the special fisheries related areas that are likely to occur in the same geographic areas and seasons as the SEFSC fishery research activities. This section describes the effects that SEFSC fisheries and ecosystem research activities would have on the following special resource areas:

- EFH and HAPC
- Closed Areas
- MPAs and National Marine Sanctuaries

4.2.2.1 EFH and HAPC

Essential Fish Habitat (EFH) occurs throughout the SEFSC areas, as noted in Section 3.1.2. Stevenson et al. (2004) acknowledges that the information base required to quantify the physical effect of fishing on each life stage of EFH for different species is insufficient. Barnette (2001) surveyed available research and concluded that trawling in the Gulf of Mexico and south Atlantic potentially have minor impacts to EFH due to the rapid recovery potential of the muddy and sandy substrates that underlie many areas where fishing is focused. Impacts of bottom trawling to EFH involving coral and oyster reef habitats would be more significant due to the longer recovery times of these habitat types (Barnette 2001).

The tow locations of SEFSC trawl and dredge surveys vary from year to year and it is therefore unknown which species' EFH may be affected in any one survey season until the gear is deployed. However, it is possible to determine an area-wide average of the amount of bottom habitat that may be affected during each survey year. The geographical areas directly affected by the Status Quo Alternative bottom trawl and dredge surveys every year are estimated to be about 122 mi^2 in the GOMRA and 18 mi^2 in the ARA (Table 4.2-2). There are no trawl or dredge surveys in the Caribbean Research Area under the Status Quo Alternative. Together, these affected areas represent a very small fraction (much less than 0.1 percent) of the total area for each research area affected (Table 4.2-2).

While the proportion of bottom habitat affected is small in comparison to the overall size of each research area (Table 4.2-2), the effect on a given species' EFH may be relatively greater if survey deployments were focused on an area in which a large proportion of a species' EFH occurred. The likelihood of this is reduced due to the stratified random sampling design used in most surveys. Additionally, as outlined in Section 3.1.2, EFH for most species generally consist of expansive areas of habitat, reducing the likelihood of concentrated effects on a single species or lifestage. As shown in Appendix B, survey stations tend to be spread out among large areas and concentrated sampling effort in particular locations is not part of Status Quo survey methodologies. Bottom trawl and dredge surveys attempt to avoid setting on hard substrates that may damage the research gear, typically conducting sonar scans to look for untrawlable habitats prior to deploying gear, and therefore tend to avoid areas with hard corals and other sensitive EFH, so the potential for adverse effects to the concentrated EFH and HAPC in these habitats is reduced.

Adverse effects on EFH and HAPC are certain to occur due to from bottom-contact research gear under the Status Quo Alternative. Changes to the resource would be small but measureable, would cover a small geographic area, and would mostly be temporary or short-term in duration, although impacts on sensitive benthic substrates, should they occur, may last several years. The overall effects of the Status Quo Alternative on EFH and HAPC would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.2.2.2 Closed Areas

There are a number of SEFSC fisheries research surveys and cooperative research partner surveys that occur in permanent or temporarily closed fishing areas, such as area closures in the Tortugas Marine Reserves HAPC, West and East Flower Garden Banks HAPC, Stetson Bank HAPC, Madison and Swanson Sites and Steamboat Lumps and the Edges, North Florida MPA, Georgia MPA, Edisto MPA, Northern South Caroline MPA, and Snowy Wreck MPA (Figures 3.1-9 to 3.1-11). However, there have been no SEFSC survey stations using trawl or dredge bottom-contact gear within closed areas in the past five years. Surveys in these areas have been limited to deployment of SCUBA divers, camera arrays, and similar gear, where the impact is minimal. It is assumed that a similar amount of survey effort would continue in the future under the Status Quo Alternative.

Deployment of SCUBA divers and camera arrays can increase turbidity and alter the physical environment of the ocean floor. However, these effects are temporary, localized, and small in extent.

Given the limited gear use and absence of trawls or dredges within closed areas, the overall effect of the Status Quo Alternative on closed areas is considered minor according to the impact criteria in Table 4.1-1.

4.2.2.3 Marine Protected Areas

Resources within MPAs potentially affected by SEFSC research activities include cultural or heritage landmarks, commercial or recreational fisheries, and other natural resources. MPAs that are designated for cultural and natural heritage values tend to be nearshore sites that are not subject to survey efforts. In the case of known ship wrecks, which are sometimes protected by MPAs, bottom contact survey gear would not be used because it may be damaged or hung up on the wreckage. Pelagic trawls and oceanographic measurements may be taken in such areas, but they would have no effect on the values of the MPA. MPAs that are managed for sustainable production and/or have restrictions for commercial or recreational fishing encompass almost the entire area where research surveys are conducted (Figure 3.1-15, National MPAs Center 2012). MPAs vary widely in the level and type of legal protection afforded to the sites' natural resources and ecological processes. As such, SEFSC will comply with any specific conditions or restrictions as stipulated by collection or research permits within MPAs.

Considering the wide range of conservation goals and varying degrees of legal protection associated with individual MPAs in the SEFSC research areas, it is impractical to assess the impacts of SEFSC research activities to those areas on a case-by-case basis. Locations of randomized sampling sites vary from year to year, and impacts of research surveys within particular MPAs would vary substantially over space and time. The amount of research conducted in each MPA is not readily available but based on the general effects of research on the environment as discussed in Section 4.2.1, the effects on MPAs is likely to be minor in geographic extent, and minor in duration or frequency. The effect of the Status Quo Alternative on marine protected areas is therefore considered minor according to the impact criteria in Table 4.1-1.

4.2.2.4 National Marine Sanctuaries

National Marine Sanctuaries (NMS) are MPAs with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or aesthetic qualities. There are three National Marine Sanctuaries in the SEFSC research areas; Flower Garden Banks, Florida Keys, and Gray's Reef (Figure 3.1-16).

Section 304(d) of the National Marine Sanctuaries Act (NMSA) requires interagency consultation between the NOAA Office of NMS and federal agencies taking actions that are "likely to destroy, cause the loss of, or injure a sanctuary resource." Sanctuary consultation requires the federal action agency to submit a "sanctuary resource statement," which describes the agency action and its potential effects on sanctuary resources. Sanctuary resource statements are not necessarily separate documents prepared by the federal agency, and may consist of documents prepared in compliance with other statutes such as the NEPA. The following analysis describes the potential effects of SEFSC research activities on each of the three NMS, and provides the requisite information for a sanctuary resource statement pursuant to section 304(d) of the NMSA.

Table 4.2-3 Number and Percentage of SEFSC Survey Stations Conducted within National Marine Sanctuaries

Table indicates the number and percentage of survey stations that occur within each of the Sanctuaries. See Table 2.2-1 for information on the gear types and seasonality of each survey. Only surveys with stations located within an NMS are shown. Surveys use stratified random designs so the number of stations in a given area fluctuates annually. Data are an average of the number of stations conducted within NMS boundaries from in the past five years.

Survey Name	Total # Stations in survey	Flower Garden Banks		Florida Keys		Gray's Reef		Combined percentage of survey effort occurring
		# within NMS	% of total	# within NMS	% of total	# within NMS	% of total	
Florida/Dry Tortugas Coral Reef Benthic Survey	**300**	0	**0**	150	**50**	0	**0**	**50**
SEAMAP-GOM Reef Fish Survey	**458**	32	**7.0**	0	**0**	0	**0**	**7.0**
Southeast Fishery-Independent Survey	**998**	0	**0**	0	**0**	15	**1.5**	**1.5**

Only three SEFSC survey programs (Florida/Dry Tortugas Coral Reef Benthic Survey, SEAMAP-GOM Reef Fish Survey, and the Southeast Fishery-Independent Survey) are conducted partially within the Flower Garden Banks, Florida Keys, and Gray's Reef NMS (Table 4.2-3). Potential impacts resulting from SEFSC fisheries research activities conducted within these NMS are discussed below.

The types of effects on NMS resulting from SEFSC research are substantially the same as those discussed for physical and biological resources elsewhere in this DPEA. These potential effects are discuss below and primarily involve disturbance of benthic habitat and historic artifacts with bottom-contact gear, displacement of pelagic species, removal of fish and invertebrates through sampling with research gear, interactions with protected species, and the risk of accidental spills or contamination from vessel operation.

The Florida/Dry Tortugas Coral Reef Benthic Surveys only deploy SCUBA divers, with bottom-contact gear limited to stakes and coral tags that consist of numerous individual 4 cm^2 pieces of rebar or galvanized nails. On average, the number of stakes and coral tags from this survey conducted within the Florida Keys NMS would have a total footprint of less than 2.5 m^2 per year. Other survey equipment that contacts the sea floor from SEAMAP-GOM Reef Fish and Southeast Fishery-Independent Surveys include chevron fish traps, acoustic devices, and water samplers (e.g. CTD profiler). Although this gear could cause localized physical damage to benthic habitats, the effects of such equipment on benthic habitat would be limited to very small areas because the equipment is not dragged on the seafloor (e.g. trawls or dredges). Furthermore, these deployments would be dispersed throughout the Sanctuaries and the effects on bottom habitat would be temporary or short-term. Overall gear effects on benthic habitat within Sanctuaries would therefore be considered minor according to the impact criteria in Table 4.1-1.

Bottom-contact gear also has the potential to have unintentional interactions with shipwrecks that may be considered historic properties or archaeological resources within Flower Garden Banks, Florida Keys, and Gray's Reef NMS. The precise position of known historical properties and archeological resources are not made public in order to minimize the risk of unauthorized salvage efforts. However, prior to SEFSC cruises using bottom contact gear, the SEFSC sends coordinates for proposed sampling sites to the Office of National Marine Sanctuaries to compare with their list of historical sites. If there is a potential conflict the SEFSC is notified and chooses a new sampling site for that cruise. Stations located within NMS are identified prior to the cruise and reported to the chief scientist. In addition, current SEFSC cruise protocols for bottom trawl surveys include checking for hazards along a station transect before the trawl gear is deployed, typically by using sonar gear to look for unsuitable bottom topography, but also by checking maritime charts for known shipwreck sites. Any known shipwreck sites would be avoided as they could snag and ruin the research gear so new survey stations are selected if hazards are identified. These protocols apply to all bottom trawl survey stations regardless of whether or not they occur in an NMS. If these precautions do not identify potential shipwrecks and the research gear incidentally interacts with a wreck, current SEFSC policy stipulates that any artifacts brought aboard the vessel due to fishing in NMS must be photographed and Sanctuary staff immediately contacted for directions on the disposition of the artifact. This may include returning the artifact, as near as possible, to the location of interception. An artifact is defined as anything of manmade origin with the exception of modern fishing gear. Due to these established protocols, the SEFSC finds that the proposed activity would have "No Adverse Effect" on submerged historic or archaeological properties.

The use of chevron traps, acoustic devices, and water samplers would also result in temporary changes to pelagic habitat within Flower Garden Banks and Gray's Reef NMS. The presence of sampling equipment may result in temporary disturbance or displacement of pelagic species that happen to be close to the gear during or after deployment. SCUBA divers may also displace pelagic species during research dives within Florida Keys NMS. However, these potential effects would be low in magnitude, temporary, and dispersed across large areas and would be considered minor for all species.

The amount of fish caught from Sanctuaries is small, and the effects of biomass removal on biological populations and habitats would be minor. Furthermore, all fish caught in Gray's Reef were vented and released alive during Southeast Fishery-Independent Surveys, as per agreement with Gray's Reef NMS staff and Gray's Reef sampling permit held by SEFSC. Fish were held in large water-filled holding tanks as they waited venting and release. As a result, no permanent biomass removal has occurred within Gray's Reef NMS by SEFSC research activities. Table 4.2-4 shows average annual catch from Flower Garden Banks and Gray's Reef NMS in the past five years. Under the Status Quo Alternative, the SEFSC would conduct a relatively small amount of research within NMS and that research effort would result in the removal of very small amounts of biomass.

Table 4.2-4 Average Annual Catch within Flower Garden Banks and Gray's Reef National Marine Sanctuary from SEFSC Fisheries Research Activities

Average annual catch from Flower Garden Bank and Gray's Reef NMS were calculated for the ten most abundant species by weight caught in the past five years. Catch data was calculated by multiplying the total catch of each species during SEFSC surveys by the fraction of survey effort occurring within each NMS.

Species		Average catch/year (kg)	Species		Average catch/year (kg)
Common Name	**Scientific Name**		**Common Name**	**Scientific Name**	
FLOWER GARDEN BANKS NMS			**GRAYS REEF NMS**		
Red Snapper	*Lutjanus campechanus*	41.52	**Black Sea Bass**	*Centropristis*	389.77
Marbled Grouper	*Dermatolepis inermis*	1.58	**Stmenotomus Porgy**	*Genus stenotomus*	12.38
Red Porgy	*Pagrus pagrus*	1.39	**Tomtate**	*Haemulon*	10.61
Gray Triggerfish	*Balistes capriscus*	1.34	**Gray Triggerfish**	*Balistes capriscus*	6.90
Yellowedge Grouper	*Hyporthodus*	1.18	**Red Snapper**	*Lutjanus*	5.37
Scamp	*Mycteroperca phenax*	1.01	**Pinfish**	*Lagodon*	3.46
Greater Amberjack	*Seriola dumerili*	0.74	**Cubbyu**	*Pareques*	1.12
Warsaw Grouper	*Hyporthodus nigritus*	0.63	**Spottail Pinfish**	*Diplodus*	0.40
Yellowmouth	*Mycteroperca*	0.39	**Toadfish**	*Genus opsanus*	0.36
Vermilion Snapper	*Rhomboplites aurorubens*	0.31	**Gag Grouper**	*Mycteroperca*	0.27
Whitebone Porgy	*Calamus leucosteus*	0.08	**Pigfish**	*Orthopristis*	0.11
Squirrelfish	*Holocentrus adscensionis*	0.04	**Bank Sea Bass**	*Centropristis*	0.08
Longspine Porgy	*Stenotomus caprinus*	0.02	**Sand Perch**	*Diplectrum*	0.06
Tattler	*Serranus phoebe*	0.01	**Whitespotted**	*Rypticus*	0.03
Tomtate	*Haemulon aurolineatum*	0.01	**TOTAL**		**430.91**
TOTAL		**50.25**			

SEFSC survey activities within National Marine Sanctuaries may result in interactions with protected species, including marine mammals, sea turtles, and ESA-listed birds and fish species. Interactions with marine mammals may include disturbance from vessels, active acoustic equipment, and incidental take. However, SEFSC fisheries research survey activities have not resulted in any capture, serious injury, or mortality takes of protected species within NMS boundaries in the past five years. A similar level of interaction with protected species would be expected to result from the SEFSC research activities included under the Status Quo Alternative. Mitigation measures intended to mitigate the effects of interactions with protected species are described in Section 2.2 of this document.

MPAs, including National Marine Sanctuaries, which are managed for sustainable production and/or have restrictions for commercial or recreational fishing encompass a large fraction of the area where SEFSC research surveys are conducted (National MPA Center 2012). SEFSC survey activities provide essential information related to the science-based management, conservation, and protection of living marine resources and ecosystem services within these areas. The information developed from SEFSC research activities is essential to the development of a broad array of fisheries, habitat, and ecosystem management actions taken not only by NMFS, but also by other federal, state, and international authorities. Science-based management of marine resources supported by SEFSC research activities included under the Status Quo Alternative would therefore result in beneficial effects to MPAs, including National Marine Sanctuaries, in addition to the minor adverse effects to sanctuary resources that may result from SEFSC research activities.

4.2.2.5 Conclusion

Special resource areas within the SEFSC research areas include EFH and HAPC areas, closed areas, and MPAs, including National Marine Sanctuaries. Impacts from SEFSC-affiliated fisheries research under the Status Quo Alternative include effects on the physical environment as well as biological components. The analysis of effects on these general components (Section 4.2.1 for the physical environment and Sections 4.2.3-4.2.7 for the biological components) are reflected in the analysis for the special resource areas. The magnitude of effects on benthic habitats is relatively small (much less than 0.1 percent of the research areas are affected by bottom-contact research gear per year) and such effects would mostly be temporary or short-term in duration, although impacts on benthic habitats may last several years in certain substrates. The removal of fish and invertebrates during research is also relatively small in magnitude and dispersed over time and space and unlikely to affect the populations of any species. The analysis of research impacts within Flower Garden Banks, Florida Keys, and Gray's Reef NMS is consistent with the relatively small and temporary or short-term effects described in general. The overall effects on special resource areas under the Status Quo Alternative would be certain to occur but minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration, and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1. In contrast to these adverse effects, the scientific data generated from SEFSC research activities would contribute to beneficial effects on special resource areas, including National Marine Sanctuaries, through their contribution to science-based conservation management practices.

4.2.3 Effects on Fish

This section describes the types of effects of the Status Quo Alternative on fish species in the SEFSC research areas (Section 3.2.1). While there are three main sections to the SEFSC research areas – the Gulf of Mexico, the Atlantic, and the Caribbean - the potential effects of research vessels, survey gear, and other associated equipment on fish are generally similar and include:

- Mortality from fisheries research activities
- Contamination from discharges
- Disturbance and changes in behavior due to sound sources

<u>Mortality from fisheries research activities</u>

Direct mortality of fish occurs as a result of various fisheries research activities. Fish are caught in a variety of gear types, some of which involve experimental tests of gears designed to reduce incidental catch of non-target species or protected species. These surveys provide important data to determine biomass estimates, reproductive potential, and distribution of fish stocks, which are necessary for fisheries managers to maintain healthy populations and rebuild overfished/depressed stocks. The SEFSC also conducts surveys to provide indices of juvenile abundance that are used to identify and characterize the strength of year classes before fish are large enough to be harvested by commercial or recreational fisheries. Stock assessments based on accurate abundance and distribution data are essential to developing effective management strategies.

The majority of fish affected by SEFSC-affiliated research projects are caught and killed during these six annual surveys:

- SEAMAP-SA Coastal Trawl Survey (South Carolina Department of Natural Resources [SCDNR])
- SEAMAP-GOM Shrimp/Groundfish (Summer/Fall) Trawl (Florida Fish & Wildlife Conservation Commission [FFWCC])

- Small Pelagics Trawl Survey (SEFSC)
- Shark and Red Snapper Bottom Longline Survey (SEFSC)
- SEAMAP-GOM Shrimp/Groundfish (Summer/Fall) Trawl Survey (SEFSC)
- MARMAP Reef Fish Long Bottom Longline Survey (SCDNR)

Most of the longline and other hook-and-line projects (i.e., those using bandit gear/vertical line gear and rod and reel deployments) conducted by the SEFSC and its cooperating partners are intended to catch fish for morphological measurements and tagging. Since most of these fish are released alive, mortality rates are low. The capture rate of fish species in research surveys varies substantially within each subarea, with higher numbers in samples from some areas and very low or no individuals collected in other samples. This variability in catch is used to determine species abundance and distribution. Concentrations of biomass and species richness depend on topographic features, water temperature and salinity, prey availability, and other habitat characteristics. Other projects funded by or otherwise affiliated with the SEFSC (Table 2.2-2) have a wide variety of research objectives. Some, such as video camera projects and SCUBA surveys, have no catch of fish. For these surveys, mortality and effects on fish species is non-existent.

The impact of mortality from fisheries research depends on the magnitude of the research catch relative to the overall biomass or population level of the species. Measuring these relative effects is difficult because there are many species for which total biomass estimates have fairly large confidence intervals so comparisons would also have a large range of relative magnitude. For the purpose of assessing the magnitude of mortality effects in this DPEA, the amount of fish caught in SEFSC research is compared to two different metrics, depending on the species being reviewed. One is the comparison of research catch to commercial and recreational Annual Catch Limit (ACL). ACL requirements were implemented in the 2006 reauthorization of the Magnuson-Stevens Act as a standardized method to track and prevent overfishing. ACLs represent the maximum amount recreational or commercial fishers are allowed to catch of a managed species or species group during a predetermined time period (usually a calendar year). ACLs are generally calculated to be less than what the biomass of a population can absorb prior to being declared overfished, which makes them a good tool for comparing research catch to overall population strength. However, ACLs are not required for all species; for many species not required to have an ACL, estimates of the amount caught in commercial and recreational fisheries are available. Non-ACL commercial and recreational harvest limits are also generally set at a fraction of theoretical stock biomass so the magnitude of research catches relative to overall population levels would be much less than what is indicated in the comparisons with landings. Additionally, this DPEA does not attempt to analyze the effects of research mortality on each of the hundreds of species caught in the various surveys. Rather, to demonstrate the effects of research mortality on fish stocks, it analyzes only the effects on species that are caught most frequently in the surveys (annual catch over one ton in the Atlantic and GOM Research Areas; over 100 kg in the Caribbean Research Area), and species that are overfished or where overfishing is occurring.

Most research surveys (Appendix B) are conducted during the spring, summer, and fall when target fish species are more likely to be encountered in higher numbers. Spatially, trawl and longline surveys that target fish are disbursed fairly evenly along the South Atlantic to the Gulf of Mexico, although some research may be conducted in specific locations important to commercial fisheries or habitat conservation. In comparison to commercial fisheries-related mortality, mortality due to research activities occurs in small areas, research tow times are much shorter than commercial tows, and sampling is usually not repeated in the same area, in contrast to commercial fisheries that focus primarily on areas of fish concentrations.

Disturbance and changes in behavior due to sound sources

There are several mechanisms by which noise sources from research activities could potentially disturb fish and alter behavior, including the physical movement of marine vessels and fishing gear through the water, gear contact with the substrate, and operational sounds from engines, hydraulic gear, and acoustical devices used for navigation and research.

Noise from active acoustic devices used on vessels conducting fisheries research could potentially affect fish. The LOA application (Appendix C, Section 6.2) describes the types of acoustic devices used on SEFSC research vessels. Fish with a swim bladder (or other air bubble) that is near, or connected to, the auditory structures likely have the best hearing sensitivity among fish, with a presumed functional hearing range of approximately 200 hertz (Hz) to 10 kilohertz (kHz) (Mann et al 2001). Gulf menhaden are in this category of fish, which are specialized to hear high frequency sounds that are within the range of acoustic devices used in research. These types of fish are likely to detect acoustic devices, but only if they are relatively near the source. Because vessels are usually moving while using acoustic gear, the source of potentially disturbing sounds would be localized and the behavioral response of fish would likely be limited to temporary avoidance behavior.

Globally, approximately 25,000 fish species have a swim bladder (or other air cavity) that is not near the ear (for example, salmonids). These species probably detect some pressure from large physical disturbances of the water or vessel traffic, but functional hearing is most likely in the 30 Hz to 500 Hz range (Popper and Fay 2011) and higher frequency acoustic devices used in research are unlikely to be audible. Any acoustic effect that is audible and that would cause avoidance disturbance, would be minor in intensity, occur over a local geographic extent, and the duration would be temporary.

Commercial vessel and fishing gear noise, and recreational vessel noise are common components of background (ambient) noise in the marine environment. At present, there are thousands of commercial fishing, transport vessels, and recreational vessels in the project area that contribute to background vessel noise.

Potential disturbance and acoustic masking effects from research vessel noise under the Status Quo Alternative would likely be geographically localized, minimal in magnitude, and temporary in duration; this type of effect would be considered minor adverse for all fish species according to the impact criteria in Table 4.1-1.

Contamination from discharges

Discharge from vessels, whether accidental or intentional, include sewage, ballast water, fuel, oil, miscellaneous chemicals, garbage, and plastics. Impacts to fish exposed to the discharge range from superficial exposure to ingestion and related effects. Even at low concentrations that are not directly lethal, some contaminants can cause sub-lethal effects on sensory systems, growth, and behavior of animals, or may be bioaccumulated (DOE 2008, NOAA 2010b).

All NOAA vessels and SEFSC chartered vessels are subject to the regulations of MARPOL 73/78, the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (NOAA 2010a). MARPOL includes six annexes that cover discharge of oil, noxious liquid substances, harmful packaged substances, sewage, garbage, and air pollution (IMO 2010). Adherence to these regulations minimizes or negates the likelihood of discharges of potentially harmful substances into the marine environment. Annex V specifically prohibits plastic disposal anywhere at sea and severely restricts discharge of other garbage (IMO 2010). In addition, all NOAA vessels are fully equipped to respond to emergencies, including fuel spills, and crew receive extensive safety and emergency response training. These precautionary measures help reduce the likelihood of fuel spills occurring and increase the chance that they will be responded to and contained quickly.

Discharge of contaminants from SEFSC vessels and SEFSC chartered vessels is possible, but unlikely to occur in the near future. If an accidental discharge does occur, it is likely to be a rare event and the potential volume of material is likely to be small and localized. The potential impacts to fish would be similarly short-term, localized, and likely affect a small number of animals. The overall impact of accidental contamination of fish would therefore be considered minor adverse.

As the potential effects of discharges, regulations governing discharges, and the likelihood of discharges are universal throughout the SEFSC research areas, this type of potential effect on fish will not be discussed further in this analysis.

4.2.3.1 ESA-listed Species

There are five marine fish species in the project areas currently listed as threatened or endangered under the ESA - the smalltooth sawfish, largetooth sawfish, scalloped hammerhead shark, and three species of sturgeon – the Atlantic, gulf and shortnose. The Nassau grouper has been proposed to be listed but a final determination has yet to be made and there has been no recent historic survey catch so this species is not discussed here. The NEPA context for impacts to threatened and endangered species is considered important due to their status as ESA species. However, directed research on ESA-listed species requires permitting under section 10 of the ESA, which is subject to its own NEPA analysis, and is not covered under this DPEA. The following discussion involves effects on ESA-listed species incidental to the purpose of SEFSC-affiliated fisheries research.

The smalltooth sawfish consists of two DPSs, U.S. and non-US, and both are listed as endangered. Scalloped hammerhead shark has multiple DPSs worldwide, but only the Central and Southwest Atlantic (CSA) DPS occurs in the project area and is listed as threatened. The Atlantic sturgeon has multiple DPSs that overlap SEFSC research areas. The Gulf of Maine DPS is listed as threatened while the remaining four DPSs (New York Bight DPS, Chesapeake DPS, South Atlantic DPS, and Carolina DPS) are listed as endangered. The shortnose sturgeon is considered endangered throughout its range and the Gulf sturgeon, a subspecies of the Atlantic sturgeon that is limited to the Gulf of Mexico, is considered threatened throughout its range.

<u>Mortality from fisheries research activities</u>

Smalltooth sawfish have been taken as part of SEFSC directed research as well as bycatch during other SEFSC surveys. As mentioned above, directed research on ESA-listed species (such as the Smalltooth Sawfish Abundance Survey) requires permitting under section 10 of the ESA (with its own NEPA environmental review process) and the effects of that permitted research on the listed species are not covered under this DPEA. As part of non-directed research, one smalltooth sawfish was incidentally taken in 2011 during the Summer SEAMAP-GOM Shrimp/Groundfish Trawl Survey, in an area where the population has historically been strongest (NMFS 2010d). The animal was spotted during the hauling of the net and the haul was aborted. After extraction from the net, the fish was released alive and was observed swimming away from the vessel. Due to the low catch rate (one fish from all surveys prosecuted over a five-year period) and the large number of surveys that take place in areas where smalltooth sawfish have been historically found, future catch of this species in SEFSC research is possible but would likely be a rare event and the effect of fishery research activities on this species through direct mortality is therefore considered minor adverse.

Scalloped hammerhead sharks have been caught in all SEFSC research areas. However, they are only considered threatened in the CSA DPS and there is evidence that scalloped hammerhead sharks do not range significantly or genetically mix between DPSs (78 FR 20718). The only SEFSC research that potentially overlaps with the CSA DPS is in the CRA and that is limited. Only seven scalloped hammerhead sharks have been caught in SEFSC surveys in the area and all of those were released alive (three were tagged and released).

Population size estimates for the CSA DPS are not available, although it is presumed to be similar to that of the Northwest Atlantic/Gulf of Mexico DPS (78 FR 20718). The population for the entire Western North Atlantic and Gulf of Mexico region in 2005 was estimated to be approximately 25,000 individuals, depending on estimation methodology (Hayes et al 2009). Given the few scalloped hammerhead sharks caught in the CRA and the lack of mortality in these SEFSC surveys, there is likely a minor impact on the CSA DPS.

There are several sturgeon species that have historically existed in Gulf of Mexico and Atlantic SEFSC research areas. Gulf sturgeon is listed as threatened under the ESA and its population traditionally has included just the waters of the Gulf of Mexico research area. However, they have never been caught during SEFSC fishery surveys in any research area under the Status Quo and indeed no sturgeon of any species have been taken from surveys prosecuted in the Gulf of Mexico. Future SEFSC research activities on NOAA vessels and cooperative research surveys could encounter this species but it would likely be a rare occurrence with minimal magnitude of effect and, therefore, would be considered a minor adverse effect according to the criteria in Table 4.1-1.

Shortnose sturgeon have historically been found between Maine and Eastern Florida. Five of them have been taken in Atlantic SEFSC surveys since 2004 - one in the 2004 Ecological Monitoring Trawl Survey, and four in the American Shad Drift Gillnet Survey (ASDGS) in 2011-2012. The purpose of the ASDGS is to collect data on abundance and evaluate catch rates during commercial fishery openers by capturing shad, tagging them, and releasing them alive. As a result, soak times are kept short and the nets are tended constantly. When a sturgeon is encountered, the fish is immediately removed from the net, measured, and in some cases the fish is PIT-tagged and DNA samples are collected. The ASDGS deployed approximately 600 sets between 2008 and 2012. Due to the 20 minute soak time, and the nature of the vessel (which allows observed catches to be extracted from the net quickly and easily), the likelihood of mortality is low. As a benefit, a platform such as this allows scientists the ability to opportunistically tag and collect DNA samples from sturgeon. No other SEFSC research programs in the Atlantic area (Table 2.2-1) use gillnet gear.

Forty-three Atlantic sturgeon have been taken incidentally in SEFSC surveys in the ARA since they were listed in 2012: thirty in the 2012 ASDGS, four in the Atlantic Striped Bass Tagging Bottom Trawl Survey (ASBTBTS), four in the Ecological Monitoring Trawl Survey (EMTS), three in the SEAMAP Coastal Trawl Survey (CTS), and two in the Juvenile Stage Trawl Survey (JSTS). In all of these surveys, fishing is nearshore or in rivers, soak times are 30 minutes or less and when sturgeons are encountered, they receive high priority for handling as soon as possible after the gear is brought aboard, and all were released alive and in good condition. Sturgeon are weighed and measured, and may be scanned for PIT tags and sampled for genetics unless there is concern that survivability may be affected.

Table 4.2-5 provides a summary of Atlantic sturgeon caught in various SEFSC surveys before and after they were listed under the ESA in February 2012. This table includes an analysis of capture rates per set that will be used to estimate future takes of this species. Figure 4.2-1 shows the locations of ESA-listed fish caught in SEFSC surveys, including Atlantic sturgeon.

Table 4.2-5 Summary of Atlantic Sturgeon Catch and Capture Rates during SEFSC-affiliated Research

All Atlantic sturgeon caught were released alive and in good condition.

Survey name	Field seasons	Total caught and released	Total sets[1]	Capture rate (sturgeon/trawl)
American Shad Drift Gillnet Survey	2008-2011	9	480	0.01875
	2012-2014	30	360	0.08333
	Total (2008-2014)	39	840	0.04643
Atlantic Striped Bass Tagging Bottom Trawl Survey[3]	1988-2006[2]	146	2819	0.05179
	2008-2010	103	739	0.13938
	2013-2014	4	700	0.00571
	Total (1988-2014)	253	4258	0.05942
Ecological Monitoring Trawl Survey	2012-2014	4	1512	0.00264
	Total (2012-2014)	4	1512	0.00264
Juvenile Stage Trawl Survey	2012-2014	2	648	0.00309
	Total (2012-2014)	2	648	0.00309
SEAMAP-SA Coastal Trawl Survey -All Seasons	2004-2013	13	3169	0.00410
	2012-2014	3	937	0.00320
	Total (1990-2014)	25	6967	0.00359

1. Set estimates derived from Table 2.2-1, using lowest end values when a range is provided, except ASBTBTS 1988-2006 where data was derived from Laney et al 2007.
2. Data from Laney et al 2007.
3. Trawl survey not prosecuted in 2011-2012; all tagging done during these years used longline gear to catch fish. No sturgeon encountered during these surveys.

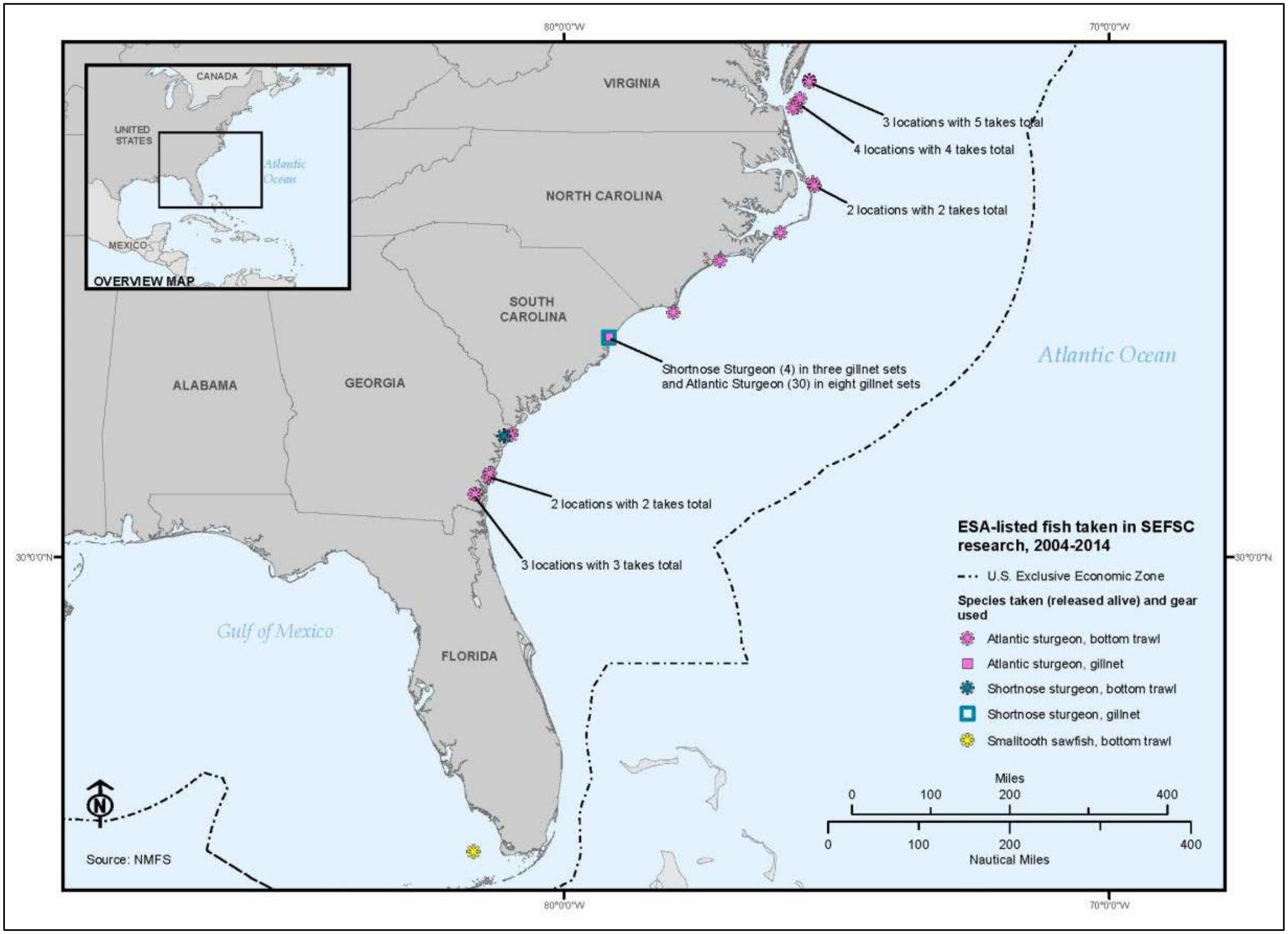

Figure 4.2-1 Location of ESA-listed Atlantic Sturgeon, Shortnose Sturgeon, and Smalltooth Sawfish Caught during SEFSC-affiliated Research from 2004 through 2014

There are many factors which influence the risk of capturing Atlantic sturgeon in research gear, including location, time of year, depth of water, water temperature, size of fishing gear, duration of the tow, etc. For the purposes of this DPEA analysis, estimates of future Atlantic sturgeon takes under the Status Quo Alternative will be made in several parts. The long-term surveys with a history of sturgeon catch will be assessed separately based on their respective capture rates, as described above and summarized in Table 4.2-5. All of these surveys had inconsistent capture rates when compared to before and after Atlantic sturgeon were listed under the ESA so utilizing the highest periodic capture rate for these surveys (in all cases, from the post-listing period) will give the most conservative estimate possible. For the purpose of estimating the future impacts of other long-term, bottom trawl-based research conducted in SEFSC research areas, this DPEA will assume that the surveys would collectively have the same potential to capture Atlantic sturgeon as the ASBTBTS, which has the highest sturgeon catch rate of all ARA bottom trawl surveys.

Other than the ASDGS, no other SEFSC-affiliated research projects in the ARA have reported any sturgeon interactions using gillnets. Gillnets are used in the Gulf of Mexico for several other long-term research projects, including the HMS GULFSPAN Survey and the IJA Coastal Finfish Gillnet Survey. Both surveys use short set times (<1 hour), fish in daylight only, and continuously monitor the net for marine mammal and turtle interactions. The IJA Coastal Finfish Gillnet Survey also sets in less than 2 m of water which allows improved monitoring during soaking. Based on past experience, the potential for capturing sturgeon in the GULFSPAN or IJA Coastal Finfish Gillnet survey is low and the potential for mortality is negligible.

Table 4.2-6 provides estimates of Atlantic sturgeon take for each set of research activities and the overall total for SEFSC-affiliated fisheries research. Based on this analysis, up to 228 Atlantic sturgeon per year could be captured in SEFSC-affiliated research under the Status Quo Alternative. This estimate is considered conservative in that it exceeds past recorded takes and actual take levels are likely to be less than the estimate. Most Atlantic sturgeon caught would be expected to be released alive and in good condition based on past experience. Given that no current surveys are designed to mimic commercial fishing gear and operations which have reported mortality of sturgeon (Stein et al. 2004), it is unlikely for any SEFSC-affiliated fisheries research to cause mortality of sturgeon in the future.

Table 4.2-6 Estimated Future Takes of Atlantic Sturgeon Under the Status Quo Alternative

All Atlantic sturgeon caught were released alive and in good condition.

Research Activity	Trawls per year[1]	Capture rate (sturgeon per trawl)	Estimated annual captures	Estimated Atlantic sturgeon takes per year (rounded up)
Atlantic Striped Bass Tagging Bottom Trawl Survey	350	0.13938	47.78	48
Ecological Monitoring Trawl Survey	502	0.00264	1.33	2
Juvenile Stage Trawl Survey	216	0.00309	0.67	1
SEAMAP-SA Coastal Trawl Survey	350	0.00320	1.12	2
Other long-term Atlantic area research using bottom trawl gear	1037	0.13938	144.53	145
American Shad Drift Gillnet Survey	360	0.08333	30	30
Total estimated Atlantic sturgeon takes per year in SEFSC-affiliated bottom trawl gear				**228**

1. Set estimates derived from Table 2.2-1 using highest end values when a range is provided.

Overall, the potential effects of bycatch of Atlantic sturgeon during SEFSC-affiliated fisheries research conducted under the Status Quo Alternative would be low in magnitude, distributed over a wide geographic area, and temporary or short-term (for fish captured and released); the effects are considered minor adverse according to the criteria in Table 4.1-1.

4.2.3.2 Target and Other Fish Species

<u>Mortality from fisheries research activities in the Gulf of Mexico Research Area</u>

Table 4.2-7 and Table 4.2-8 both show the average annual catch (by weight) of the most frequently caught fish species in a recent five-year period (2008-2012) from SEFSC-affiliated research surveys in the Gulf of Mexico. SEFSC-affiliated research includes surveys and other research activities either conducted by the SEFSC or funded, at least in part, by the SEFSC but conducted by cooperative research partners (Table 2.2-1). Some surveys only record number of each species of fish and not weight. For a rough estimate of caught weight from these surveys, average weights were derived from published SEFSC survey data (GSMFC 2014), applied to average number reported, and added to weights from surveys where weights were recorded. Table 4.2-7 compares these average annual research catches to the average annual combined commercial and recreational ACL for those species for the 2012-2014 period. Table 4.2-8 compares the research catches of species without a currently established ACL to the average annual commercial landings of target species to give an indication of their relative size and, for species that are frequently caught by recreational anglers, estimates of average annual recreational catches are also provided for comparison. These data indicate that for most target species the average amount of fish killed in Gulf of Mexico SEFSC-affiliated research is much less than one percent of commercial and recreational quotas or landings. For these species, the magnitude of research mortality is very small relative to the fisheries and even smaller relative to the estimated populations of these fish.

The most frequently caught species in SEFSC Gulf of Mexico-area research, Atlantic croaker, is very abundant and a substantial number are landed commercially and recreationally, as shown in Table 4.2-7. The fish's life history in the Gulf of Mexico indicates a short time to maturity (1 to 2 years) and a wide overall population distribution and high reproductive potential.

For the Atlantic bumper, research catch approaches 85 percent of the reported combined commercial and recreational catch. There are many potential reasons for this, one of them being that specific commercial catch information is not available for this species. Atlantic bumpers are in the Jack family and some reporting may be occurring at this level even though they are not part of the defined "Jacks Complex" management group (which includes almaco jack, banded rudderfish, and lesser amberjack). The "Jacks Complex" management group is not currently considered overfished. Comparing Atlantic bumper research catch (1.4 mt per year) to the commercial catch of the Jacks Complex, over 40 mt per year, indicates a potentially low species impact overall.

For spot and longspine porgy, the proportion of research catch to commercial and recreational catch greatly exceeds one percent. Spot, longspine porgy and Atlantic croaker are often caught as bycatch in commercial shrimp fisheries where they may be discarded rather than brought to market (UNFAO 1997). In some areas of the Atlantic, Atlantic croakers are a component of "scrap" fisheries where species are not always completely sorted and often not included in state or federal landing estimates (ASMFC 2010). Rough scad research catch is also larger than one percent of the combined commercial and research catch. This information may be deceptive, however, because the available recreational data indicates the number of fish landed, not the weight of those fish. Depending on the source, the average weight for this species can range from 0.03 kg (as outlined from Gulf of Mexico trawl surveys listed in Grace et al. 2010, or in GSMFC 2014) to 0.5 kg (as noted in UNFAO 1993). As the former document consists of data collected in the Gulf of Mexico, the smaller of the average weight estimates was used for this analysis. These items outline multiple sources of potential unreported catch, which contributes to an unknown impact of research catch. Given the unknown information about them, scientific data provided by SEFSC surveys are important to monitor the status of these species, which are unknown but currently not considered overfished.

SEFSC surveys and cooperative research projects catch stocks of species that are considered overfished or in regions where overfishing is occurring, including stocks of red snapper, greater amberjack, hogfish, and gray triggerfish (Table 4.2-7). In general, the type of programmatic analysis presented in this section indicates that research activities have minimal impact on these populations and therefore pose little conservation concern. However, this programmatic analysis is based on average catch levels over a five-year period, with all fishery management regions combined, and comparisons with an area-wide harvest metric from a particular year. This approach precludes the assessment of potential effects of research on overfished stocks or where overfishing is occurring in one or more fishery management regions. The status and trends of such stocks can change rapidly, either increasing or decreasing, and average catch per unit effort can vary dramatically from year to year with change in abundance. In addition, research catch in one fishery management region where a species is not overfished (e.g., greater amberjack in the South Atlantic), could be problematic if it was conducted in a region where the stock is overfished (e.g., greater amberjack in the GOM) and the commercial fisheries have been curtailed to help the overfished stock rebuild.

Most research activities conducted in the Gulf of Mexico are multi-species surveys that cover large areas, involve minimal sampling, and do not target overfished species. Research catches in these surveys are generally very small for uncommon species. However, many of the short-term research projects are focused on a particular fishery and could catch substantial amounts of bycatch in a relatively small area, e.g, studies comparing different configurations of shrimp bycatch reduction devices. If such research captured a large incidence of an overfished stock, this could theoretically account for a substantial portion of the ACL for that stock or other fishery management metric (e.g., overfishing level) and could interfere with the rebuilding plan for that stock.

Research data is necessary for monitoring the status of overfished stocks and other stocks of conservation concern and to determine if management objectives for rebuilding those stocks are being met. Under the Status Quo Alternative, scientific research proposals for both long-term and short-term projects require scientific research permits or experimental fishing permits. The potential impacts of those proposed projects are assessed for each stock, including overfished stocks, before those permits are issued. Fisheries managers typically consider the estimated amount of research catch from all projects along with other sources of mortality (e.g., bycatch in other fisheries and predation) before setting commercial fishing limits to prevent overfishing of stocks or to help overfished stocks rebuild. This type of annual review of research proposals would continue to occur in the future under the Status Quo Alternative. Any future proposed projects targeting overfished stocks, or projects likely to have substantial bycatch of an overfished stock, would receive additional scrutiny on a stock by stock basis to ensure minimal impact on the stock before a research permit is issued. These permitting reviews would also determine whether the proposed projects were consistent with the NEPA analysis presented in the DPEA or whether additional NEPA analysis was required (see Section 2.3.5).

Table 4.2-7 and Table 4.2-8 indicate that, while mortality to fish species is a direct effect of the SEFSC Gulf of Mexico surveys, there are likely no measurable population changes occurring as a result of these research activities because they represent such a small percentage of allowable quota in commercial and recreational fisheries, which are just fractions of the total populations for these species. For all target species in the Southeast region, mortality from SEFSC research activities would be low in magnitude, dispersed over a wide geographic area, and therefore considered minor adverse for all target species under the Status Quo Alternative.

Table 4.2-7 Comparison of Estimated Fish Caught under the Status Quo Alternative Compared to Commercial ACL and Recreational ACL for ACL species in the Gulf of Mexico Research Area

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than one metric ton (1 mt = 1000 kilograms) and those that are overfished where overfishing is occurring, or where overfishing is unknown are listed

Species	Stock Status[1]	Average SEFSC research catch per year (mt) (2008-2012)[2]	Average commercial ACL per year (mt)[3] (2012-2014)	Average recreational ACL estimate per year[3] (mt) (2012-2014)	Total average annual commercial and recreational ACL (mt)	Average SEFSC research catch compared to commercial and recreational ACL (percentage)
Red snapper	Overfished	3.59	2.32	2.23	4548	0.08%
Greater amberjack	Overfished	0.1	170.6	564.0	734.6	0.01%
Hogfish[4]	Unknown	0.04	NA	NA	94.3	0.04%
Gray triggerfish	Overfished	0.11	27.7	122.8	150.5	0.08%
Warsaw grouper[5]	Unknown	0.06	NA	NA	647.6	<0.01%
Speckled hind[5]	Unknown	0.01	NA	NA	647.6	<0.01%
Snowy grouper[5]	Unknown	0.007	NA	NA	647.6	<0.01%

1. Source: Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Third Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html
2. Most survey data includes information from 2008-2012 but several surveys include data from 2004-2006 (Pacific Longline Survey) or from 2013.
3. Source: ACL Monitoring information for most species from http://sero.nmfs.noaa.gov/sustainable_fisheries/acl_monitoring/index.html, collected online February 4, 2015. Red snapper ACL information from GMFMC 2015.
4. Hogfish is a "Stock ACL" species, meaning only one ACL is set for the total commercial+recreational quota. Hogfish has recently been split into multiple stocks with varying overfishing statuses. Differential quotas for each stock have not yet been determined so for the purposes of this DPEA, they are considered as one stock with a single GOM quota and unknown stock status.
5. This fish is part of the "Deep water grouper" species complex. Species include snowy, Warsaw, and yellowedge grouper, and speckled hind. "Deep water grouper" is a "Stock ACL" species group, meaning only one ACL is set for the total commercial + recreational quota.

Table 4.2-8 Comparison of Estimated Fish Caught under the Status Quo Alternative Compared to Commercial Catch (Landings) and Recreational Catch for the Gulf of Mexico Research Area

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than one metric ton (1 mt = 1000 kilograms) and those that are overfished where overfishing is occurring, or where overfishing is unknown are listed

Species	Stock Status[1]	Average SEFSC research catch per year (mt) (2008-2012)[2]	Average commercial catch per year (mt)[3] (2008-2012)	Average recreational catch estimate per year (mt) (2008-2012)[4]	Total average annual commercial and recreational catch (mt)	Average SEFSC research catch compared to commercial and recreational catch (percentage)
Atlantic croaker	Unknown	16.5	52.2	281.5	333.7	4.94%
Longspine porgy	Unknown	3.9	.04	40.3[5]	40.34	9.67%
Rough scad	Unknown	2.8	252.9[6]	1.2[7]	254.1	1.10%
Gulf butterfish	Unknown	2.7	422.0[8]	NA	422.0	0.65%
Spot	Unknown	3.4	6.7	2.7	9.4	36.18%
Pinfish	Unknown	2.6	36.7	723.4	760.1	0.34%
Atlantic cutlassfish	Unknown	1.4	8.7	1.7[9]	10.4	13.54%
Atlantic bumper	Unknown	1.4	NA	1.7	1.7	83.17%
Sand seatrout	Unknown	1.2	36.5	1145.4	1181.9	0.10%
Red drum	Unknown	0.7	14.5	6089.2	6103.7	0.01%
Goliath grouper[10]	Unknown[11]	0.05	1.5[12]	484.0[13]	485.5	0.01%

1. Source: Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Third Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html
2. Most survey data includes information from 2008-2012 but several surveys include data from 2004-2006 (Pacific Longline Survey) or from 2013.
3. Source: Commercial catch data from NMFS Office of Sustainable Fisheries website: http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings/index
4. Source: Recreational catch data from NOAA Fisheries Marine Recreational Information Program website: http://www.st.nmfs.noaa.gov/recreational-fisheries/index
5. Data only available for "Other Porgies"; used average catch of all.
6. Data available for Bigeye scad and "Scads". Used average catch of non-specific group.
7. Weight data not available, only number. Used average weight derived from Gulf of Mexico surveys (from GSMFC-Seamap, September 2014.)
8. Data only available for "butterfish"; used average catch of all.
9. Atlantic Cutlassfish reported by number for 2011 & 2012. Average catch represents only data from 2008 (the one year where weight was reported).
10. This species is jointly managed by SAFMC and GMFMC. Since there has been no recent catch in the Atlantic research area, it has been included in the Gulf of Mexico Research Area tables and not the Atlantic Research Area tables.
11. According to the current stock assessment, the status is unknown because the "Fishery in the EEZ and state waters is closed; therefore, fishing mortality is approaching zero."
12. Data only available for several individual grouper species and "Groupers". Used average catch of non-specific group.
13. Data only available for "*Epinephelus* groupers"; used average catch of non-specific group.

Mortality from fisheries research activities in the Atlantic Research Area

Table 4.2-9 and Table 4.2-10 both show the average annual catch (by weight) of the most frequently caught fish species in the past five years (2008-2012) from SEFSC-affiliated research surveys in the Atlantic. SEFSC-affiliated research includes surveys and other research activities either conducted by the SEFSC or funded, at least in part, by the SEFSC but conducted by cooperative research partners (Table 2.2-1). Some surveys only record number of each species of fish and not weight. For a rough estimate of caught weight from these surveys, average weights were derived from published SEFSC survey data (GSMFC 2014), applied to average number reported, and added to weights from surveys where weights were recorded. Table 4.2-9 compares these average annual research catches to the average annual combined commercial and recreational ACL for those species for the 2012-2014 period. Table 4.2-10 compares the research catches of species without a currently established ACL to the average annual commercial landings of target species to give an indication of their relative size and, for species that are frequently caught by recreational anglers, estimates of average annual recreational catches are also provided for comparison. These data indicate that for most target species the average amount of fish killed in Atlantic SEFSC-affiliated research is much less than one percent of commercial and recreational quotas or landings. For these species, the magnitude of research mortality is very small relative to the fisheries and even smaller relative to the estimated populations of these fish.

The most frequently caught species in the SEFSC ARA is the great northern tilefish. It has a large annual ACL, and despite the fact that recreational ACLs are not included in this analysis (due to ACL being set to a specific number of fish and not a weight), research catch is less than 4 percent of the commercial quota. Reasons for the large incidence of survey catch of this species are not clear but may be due to the coastwide distribution of this species (SEDAR 2011) and overlap with survey locations the multiple locations where research takes place. This species is not currently considered overfished however, there is some uncertainty regarding the ability of this species to respond to temperature fluctuations and information on the species' reproductive potential is limited (SEDAR 2011) so scientific data provided by SEFSC surveys are important to monitor the status of the species.

For the Atlantic bumper and banded drum and star drum, the research catch appears to be significantly higher than the reported combined commercial and recreational catch. There are many potential reasons for this, one of them being that specific commercial catch information is not available for these species. Atlantic bumpers are in the Jack family and some reporting may be occurring at this level even though they are not part of the defined "Jacks Complex" management group (which includes almaco jack, banded rudderfish, and lesser amberjack). Comparing Atlantic bumper research catch (1.4 mt per year) to the commercial catch of the Jacks Complex, over 40 mt per year, indicates a potentially low species impact overall. Star drum have historically been caught in large numbers as bycatch in commercial shrimp fisheries where they may be discarded rather than brought to market (Anderson and Gehringer 1965). Information on bycatch of banded drum is limited but bycatch rates in some fisheries do not appear to be significant (Passerotti et al. 2010). These items outline multiple sources of potential unreported catch, which contributes to an unknown impact of research catch. Given the unknown information about them, scientific data provided by SEFSC surveys are important to monitor the status of these species, which are unknown but currently not considered overfished.

SEFSC surveys and cooperative research projects in the Atlantic also catch stocks of species that are considered overfished or in regions where overfishing is occurring, including stocks of snowy grouper, red snapper, blueline tilefish, red porgy, speckled hind and Warsaw grouper (Table 4.2-9). In general, the type of programmatic analysis presented in section 4.2 indicates that research activities have minimal impact on these populations and therefore pose little conservation concern. These ideas were presented earlier in this document during the discussion of mortality from fisheries research activities in the Gulf of Mexico Research Area; refer to that section for further information.

Table 4.2-9 and Table 4.2-10 indicate that, while mortality to fish species is a direct effect of the SEFSC Atlantic Research Area surveys, there are likely no measurable population changes occurring as a result of these research activities because they represent such a small percentage of allowable quota in commercial and recreational fisheries, which are just fractions of the total populations for these species. For all target species in the Southeast region, mortality from SEFSC research activities would be low in magnitude, dispersed over a wide geographic area, and therefore considered minor adverse for all target species under the Status Quo Alternative.

Table 4.2-9 Comparison of Estimated Fish Caught under the Status Quo Alternative Compared to Commercial ACL and Recreational ACL for ACL species in the Atlantic Research Area

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than one metric ton (1 mt = 1000 kilograms) and those that are overfished, where overfishing is occurring, or where overfishing is unknown are listed

Species	Stock Status[A]	Average SEFSC research catch per year (mt) (2008-2012)	Average commercial ACL per year (mt)[B] (2012-2014)	Average recreational ACL per year (mt)[B] (2012-2014)	Total average annual commercial and recreational ACL (mt)	Average SEFSC research catch compared to commercial and recreational ACL (percentage)
Great northern tilefish	Not overfished	10.0	275.0	9.59[C]	284.59	3.51%
Snowy grouper	Overfished	4	40.7	0.6[D]	41.3	9.7%
Greater amberjack	Not overfished	1.6	793.9[E]	529.7	1323.6	0.12%
Almaco jack	Unknown	1.2	86.6[F]	120.5[F]	207.1	0.58%
Scamp	Unknown	0.5	152.4	76.3	228.7	0.22%
Blueline tilefish	Overfished	0.2	163.4[G]	151.2[G]	314.6	0.06%
Red snapper	Overfished	0.1	16.7	43.01[H]	59.71	0.03
Gray triggerfish	Unknown	0.01	128.7	162.5	291.2	0.0%
Red porgy	Overfished	0.04	77.3	76.4	153.7	0.03%
White grunt	Unknown	.005	98.5[H]	262.8[H]	361.3	0.0%
Speckled hind	Overfished	0.08	0[I]	0[I]	0[I]	NA
Warsaw grouper	Overfished	0.1	0[I]	0[I]	0[I]	NA

A. Source: Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Third Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

B. Source: ACL Monitoring information from http://sero.nmfs.noaa.gov/sustainable_fisheries/acl_monitoring/index.html, collected online January 30, 2015

C. Great northern tilefish recreational ACL is based on number of fish. Used average weight derived from MAFMC white paper on tilefish (http://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/547cc256e4b094d782be030f/1417462358526/Tab+08_Tilefish+White+Paper.pdf) to calculate weight of ACL. Used lowest average weight listed in the paper, 7 lb per fish, to calculate maximize potential impact of research catch.

D. Snowy grouper recreational ACL is based on number of fish. Used average weight derived from SEDAR 36 stock assessment report (SEDAR 2013.)

E. Open season for this species is May 1-April 31. The data in this table represents the average of the three fishing periods of 2011-2012, 2012-2013, and 2013-2014.

F. This species is included in the "Jacks Complex". Other species include: banded rudderfish, and lesser amberjack. The value stated includes all species in this group.

G. During 2012 and 2013, this species was included in the "Deepwater Complex". Other species included: yellowedge grouper, silk snapper, misty grouper, queen snapper, sand tilefish, black snapper and blackfin snapper. The value stated includes all species in this group. For 2014, blueline tilefish was removed from this group so the data above represents only the years 2012-2013.

H. Red snapper recreational ACL not open until 2014 and is based on number of fish. Used average weight derived from SEDAR-25 (http://sedarweb.org/docs/sar/SEDAR%2024_SARRedSnap_Final.pdf) to calculate weight of ACL. Used lowest average listed in the paper, 4.2lb per fish, to calculate maximize potential impact of research catch.

I. This species is included in the "Grunts Complex". Other species include: margate, sailor's choice, and tomtate. The values stated includes all species in this group.

J.ACL for this species not set due to prohibited catch in federal waters https://www.federalregister.gov/articles/2011/12/29/2011-33185/fisheries-of-the-caribbean-gulf-of-mexico-and-south-atlantic-generic-annual-catch .

Table 4.2-10 Comparison of Estimated Fish Caught under the Status Quo Alternative Compared to Commercial Catch (Landings) and Recreational Catch for Non-ACL Species in the Atlantic Research Area

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than one metric ton (1 mt = 1000 kilograms) and those that are overfished, where overfishing is occurring, or where overfishing is unknown are listed

Species	Stock Status[A]	Average SEFSC research catch per year (mt) (2008-2012)	Average commercial catch per year (mt)[B] (2008-2012)	Average recreational catch estimate per year[C] (mt) (2008-2012)	Total average annual commercial and recreational catch (mt)	Average SEFSC research catch compared to commercial and recreational catch (percentage)
Atlantic croaker	Overfishing not occurring, likely not overfished	9.5	2505.7	207.1	2712.8	0.35%
Spot	Unknown	7.4	353.7	333.6	687.3	1.08%
Red drum	Overfishing not occurring, likely not overfished	6.3	74.5	668.4	742.9	0.84%
Atlantic bumper	Unknown	4.1	NA	1.2	NA	NA
Bullnose ray	Unknown	3.7[D]	NA	NA	NA	NA
Cownose ray	Unknown	3.1[D]	25	91.42	116.7	2.66%
Southern kingfish	Unknown	2	NA	599.6	599.6	0.34%
Banded drum	Unknown	1.8	NA	<0.1	NA	NA
Bluntnose stingray	Unknown	1.7[D]	NA	NA	NA	NA
Spiny butterfly ray	Unknown	1.7[D]	NA	NA	NA	NA
Pinfish	Unknown	1.5	17.1	161.4	178.5	0.84%
Star drum	Unknown	1.3	NA	<0.1	<0.1	NA
Weakfish	Depleated, with overfishing not occurring	1.2	60	47.1	107.1	1.12%
***Stenotomus* porgy genus**	Not overfished[E]	1	80[F]	0.4	80.4	1.24%

A. Source: Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Third Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html. Stock status information for Atlantic croaker, red drum, spot, and weakfish from ASMFC website http://www.asmfc.org/fisheries-science/stock-assessments.

B. Source: Commercial catch data from NMFS Office of Sustainable Fisheries website: http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings/index

C. Source: Recreational catch data from NOAA Fisheries Marine Recreational Information Program website http://www.st.nmfs.noaa.gov/recreational-fisheries/index

D. These species are also caught during red drum surveys; most individuals of all species released alive and weight data was not available for these species from these surveys. However, count data suggests minimal impact compared to weight data from other surveys.5. The only stock status reference to fishes within this genus is for "Longspine porgy", but there is no specific information regarding overfishing according to the most recent quarterly status of stocks. However, according to http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2013/2013_rtc_methodology.pdf , since this species is an "Ecosystem Component (EC) species", it is "…not subject to overfishing or overfished (or likely to become so)…". As a result, the species has been categorized as "Not overfished".

E. Catch reported as "Scup" and "Scups or Porgies" have potential to be *Stenotomus sp.* so both were used to determine average catch.

F. Data available for both *Stenotomus caprinus* and *Stenotomus chrysops.* Value represents combined average for both species.

Mortality from fisheries research activities in the Caribbean Research Area

Table 4.2-11 and Table 4.2-12 both show the average annual catch (by weight) of the most frequently caught fish species in a recent five-year period (2008-2012) from SEFSC-affiliated research surveys in the Caribbean Research Area. SEFSC-affiliated research includes surveys and other research activities either conducted by the SEFSC or funded, at least in part, by the SEFSC but conducted by cooperative research partners (Table 2.2-1). Table 4.2-11 compares these average annual research catches to the combined commercial and recreational ACL for those species or groups to which those species belong. Table 4.2-12 compares the research catches of species without a currently established ACL to the average annual commercial landings of target species to give an indication of their relative size and, for species that are frequently caught by recreational anglers, estimates of average annual recreational catches are also provided for comparison. These data indicate that for most species the average amount of fish killed in SEFSC-affiliated research is much less than one percent of commercial and recreational quotas or landings. For these species, the magnitude of research mortality is very small relative to the fisheries and even smaller relative to the estimated populations of these fish.

There are several factors unique to the Caribbean that make assessment of survey catch impact difficult. First, for most species in the Caribbean there is not a specific ACL, instead there is a single ACL for the group a species belongs to. Additionally, there are also management differences within the Caribbean research area. For example in Puerto Rico, "snappers" are split into four different snapper Fishery Management Units (FMUs). However, for both the St. Croix and the St. Thomas/St. John areas, all snapper species are combined into one FMU. Due to this complexity and to low overall survey catch rates (less than 1500 kg per year), FMUs for Puerto Rico, for St. Croix, and for St. Thomas/St. John were combined to derive a single ACL for each species group in the Caribbean region in order to facilitate comparison. Stock status for caught species represents status of the FMU for that species.

The most frequently caught species in SEFSC Caribbean research are horse-eye jack and yellowtail snapper. Horse-eye jacks are part of the managed "Jacks" FMU. While there is limited population information available for horse-eye jacks, the "Jacks" FMU is not considered overfished. Also frequently caught is yellowtail snapper, part of the "snapper" FMU, a group that is also not considered overfished. As reported in SEDAR Procedures Workshop 3, yellowtail snapper has historically been caught in significant numbers (SEDAR 2009). And, According to one data collection study, both species occur as bycatch in several U.S. Virgin Islands commercial fisheries (SEDAR 2006) Considering significant historical catch, as well as the small relative survey catch rate compared to ACL for the group (less than 0.04 percent for Jacks and 0.03 percent for Snappers), the amount of research catch is minimal.

There are several other species of groupers and snappers that are caught during SEFSC research in the Caribbean. Many of these, such as yellowtail, lane and mutton snapper, red hind, coney, and white grunt are also managed as part of FMUs that are not generally considered overfished and again, research catch is less than 0.1 percent of FMUs for these species.

Regarding species that are not managed through ACLs, the southern stingray and barracuda have both been caught as part of surveys. Data regarding southern stingray catch is limited but research catch rates are low and while the status of the stock is unknown, the species is not considered overfished, indicating that the impact is likely negligible. For the barracuda, recreational catch data exists and survey catch is less than 0.1 percent of it, also indicating minimal impact.

SEFSC surveys and cooperative research projects also catch stocks of species that are considered overfished or in regions where overfishing is occurring, including stocks of blackfin, silk and vermillion snapper, and puddingwife (Table 4.2-12). In general, the type of programmatic analysis presented in this section indicates that research activities have minimal impact on these populations and therefore pose little conservation concern. These ideas were presented earlier in this document during the discussion of mortality from fisheries research activities in the Gulf of Mexico Research Area; refer to that section for further information.

Table 4.2-11 and Table 4.2-12 indicate that, while mortality to fish species is a direct effect of the SEFSC Caribbean Research Area surveys, there are likely no measurable population changes occurring as a result of these research activities because they represent such a small percentage of allowable quota in commercial and recreational fisheries, which are just fractions of the total populations for these species. For all target species in the Southeast region, mortality from SEFSC research activities would be low in magnitude, dispersed over a wide geographic area, and therefore considered minor adverse for all target species under the Status Quo Alternative.

Table 4.2-11 Comparison of Estimated Fish Caught under the Status Quo Alternative Compared to Commercial ACL and Recreational ACL for ACL species in the Caribbean Research Area

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than 10 kilograms and those that are overfished, where overfishing is occurring, or where overfishing is unknown are listed

Species Group	Stock Status[1]	Species	Average SEFSC research catch per year (kg) (2008-2012)	Average SEFSC research catch per year (kg) for group (2008-2012)	Commercial ACL For Group (kg)[2] (2012)	Recreational ACL per year (kg)[2] (2012)	Total average annual commercial and recreational ACL (kg)	Average SEFSC research catch compared to commercial and recreational ACL (percentage)
Jacks	Unknown	Horse-eye jack	261	288	70060	2134	72194	0.4%
	Unknown	Blue runner	27					
Snappers[3]	Unknown	Yellowtail snapper	82	242.3	628857	109771	738628	0.03%
	Unknown	Lane snapper	54					
	Unknown	Mutton snapper	31					
	Approaching Overfished Condition	Blackfin snapper	25					
	Unknown	Dog snapper	19					
	Unknown	Schoolmaster	16					
	Approaching Overfished Condition	Silk snapper	10					
	Approaching Overfished Condition	Vermilion snapper	4					
	Approaching Overfished Condition	Wenchman	0.3					

Species Group	Stock Status[1]	Species	Average SEFSC research catch per year (kg) (2008-2012)	Average SEFSC research catch per year (kg) for group (2008-2012)	Commercial ACL For Group (kg)[2] (2012)	Recreational ACL per year (kg)[2] (2012)	Total average annual commercial and recreational ACL (kg)	Average SEFSC research catch compared to commercial and recreational ACL (percentage)
Groupers	Unknown	Red hind	31	64	117842	35023	152865	0.04%
	Unknown	Coney	29					
	Overfished[4]	Red grouper	4					
Grunts	Unknown	White grunt	19	19	116525	2281	118806	0.02%
Porgies	Overfishing occurring	Pluma	6	6.1	23221	1169	24390	0.02%
Wrasses	Overfishing occurring	Puddingwife	0.1	0.1	24829	2291	27120	<0.01%

1. Source: Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Third Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

2. Source: ACL Monitoring information available online: http://sero.nmfs.noaa.gov/sustainable_fisheries/acl_monitoring/index.html . ACLs for this area were implemented in 2012 and although Accountability Measures have been implemented due to overages of the ACL, none have resulted in a change in the ACL for that species or species group. As a result, the ACLs listed are not an average of multiple years of implementation but rather the actual ACL in effect for each year.

3. Puerto Rico snappers are divided into 4 management units. For St. Croix and St. Thomas/St. John, snappers are considered a single unit. For simplicity's sake, all snapper ACLs were combined in this single snapper group.

4. Caribbean grouper Unit 4 is considered overfished. It is composed of black, red, tiger, and yellowfin grouper

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Table 4.2-12 Comparison of Estimated Fish Caught under the Status Quo Alternative Compared to Commercial Catch (Landings) and Recreational Catch for the Caribbean Research Area

Species are listed in descending order of total research catch by weight. Only survey species with total catch greater than 10 kilograms) and those that are overfished, where overfishing is occurring, or where overfishing is unknown are listed

Species	Stock Status[1]	Average SEFSC research catch per year (kg) (2008-2012)	Average commercial catch per year (kg)[2] (2008-2012)	Average recreational catch estimate per year[3] (kg) (2008-2012)	Total average annual commercial and recreational catch (kg)	Average SEFSC research catch compared to commercial and recreational catch (percentage)
Southern stingray	Unknown	74	NA	0	0	NA
Great barracuda	Unknown	12	NA	13051	13051	0.092%

1. Source: Status of stocks information from NOAA Fisheries Office of Sustainable Fisheries, Third Quarter 2014 Status of U.S. Fisheries. Available online: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

2. Source: Recreational catch data from NOAA Fisheries Marine Recreational Information Program website: http://www.st.nmfs.noaa.gov/recreational-fisheries/index .

3. Recreational harvest data is not collected in the U.S. Virgin Islands so all information is from Puerto Rico.

4.2.3.3 Highly Migratory Species

Mortality from fisheries research activities

Multiple SEFSC-affiliated research surveys occur for HMS. They are primarily focused on sharks but some surveys target and catch tuna and billfish as well. These surveys provide scientific advice, data, and analyses directly to NMFS HMS Management Division and to the SEDAR process run by the South Atlantic Fishery Management Council. Information from the SEDAR process is used to develop and amend the Consolidated Atlantic Highly Migratory Species Fisheries Management Plan.

The HMS–GULFSPAN Survey and the HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Surveys primarily monitor shark populations. The Pelagic Longline Survey, the Shark and Red Snapper Bottom Longline survey, and the SEAMAP-GOM bottom longline survey target both sharks and finfish in their research. In all cases, the surveys are designed to release captured sharks alive in good condition after measurements have been taken and, for certain surveys, tags affixed. Data on the tagging and recapture locations for some tagged sharks later caught in recreational and commercial fisheries, by other federal and state agencies, and by academic institutions are used to determine abundance, distribution, and migratory patterns.

Shark, tuna and billfish catch information from 2008-2012 is presented in Table 4.2-13. Data are presented as numbers of fish rather than weight - mortality observed during these tagging surveys is relatively low and is caused by a combination of depredation by sharks as hooked fish are being hauled in, fish sacrificed for scientific sampling, and fish that are dead upon retrieval. Dead fish are often retained for bioprofiles, research samples, and stock assessment purposes.

Table 4.2-13 Summary of the Number of Sharks Caught and Tagged during SEFSC Shark Surveys from 2008 to 2012[1]

Fish that are not tagged or mortalities are released

Species	Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) Survey FSU Total caught (tagged) [mortality]	Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) Survey SEFSC Total caught (tagged)[2]	Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) Survey USM/GRCL Total caught (tagged) [mortality]	HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Survey Total caught (tagged) [mortality]	Pelagic Longline Survey Total caught (tagged) [mortality]	SEAMAP-GOM bottom longline survey Total caught (tagged) [mortality]	Shark and Red Snapper Bottom Longline survey Total caught (tagged) [mortality]	Totals
Atlantic blue marlin	0	0	0	0	1 (1) [0]	0	0	1 (1) [0]
Atlantic sharpnose shark	5138 (1652) [2100]	3672 (794)	255 (122)[14]	521 (232) [212]	0	6364 (2774) [669]	5936 (142) [1180]	21886 (5716) [4175]
Bigeye thresher	0	0	0	0	2 (1) [0]	0	0	2 (1) [0]
Bigeye tuna	0	0	0	0	1 (0) [1]	0	0	1 (0) [1]
Bignose shark	0	0	0	5 (2) [2]	0	0	2 (0)[0]	7 (2) [2]
Blacknose shark	154 (68) [48]	81 (8)	1 (0) [1]	2 (0) [1]	0	289 (75) [92]	741 (355) [57]	1268 (506) [199]
Blacktip shark	1162 (538) [366]	678 (179)	52 (25) [12]	87 (39) [34]	6 (6) [0]	1397 (751) [142]	339 (157) [32]	3721 (1695) [586]
Blue shark	0	0	0	0	1 (1) [0]	0	0	1 (1) [0]
Bluntnose sixgill shark	0	0	0	2 (2) [0]	0	0	0	2 (2) [0]
Bonnethead shark	1518 (420) [650]	680 (107)	7 (2) [3]	1 (1) [0]	0	19 (10) [2]	5 (3) [0]	2230 (543) [655]

Species	Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) Survey FSU Total caught (tagged) [mortality]	Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) Survey SEFSC Total caught (tagged)[2]	Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) Survey USM/GRCL Total caught (tagged) [mortality]	HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Survey Total caught (tagged) [mortality]	Pelagic Longline Survey Total caught (tagged) [mortality]	SEAMAP-GOM bottom longline survey Total caught (tagged) [mortality]	Shark and Red Snapper Bottom Longline survey Total caught (tagged) [mortality]	Totals
Bull shark	58 (46) [0]	4 (2)	6 (5) [0]	2 (2) [0]	1 (0) [0]	325 (181) [4]	68 (38) [0]	464 (274) [4]
Caribbean sharpnose shark	0	0	0	0	0	8 (4) [0]	0	8 (4) [0]
Common thresher	0	0	0	1 (1) [0]	0	0	0	1 (1) [0]
Dusky shark	0	0	0	127 (96) [21]	9 (7) [0]	0	6 (5) [0]	142 (108) [21]
Dusky smooth-hound	0	0	0	16 (15) [0]	0	1031 (509) [13]	0	1047 (524) [13]
Finetooth shark	20 (10) [8]	231 (26)	19 (7) [4]	0	0	170 (83) [37]	3 (0) [2]	443 (126) [51]
Great hammerhead shark	14 (8) [2]	5 (2)	0	0	1 (1) [0]	21 (7) [5]	22 (18) [0]	63 (36) [7]
Indo-Pacific sailfish	0	0	0	0	2 (1) [0]	0	0	2 (1) [0]
Lemon shark	44 (40) [0]	0	0	0	0	0	5 (2) [0]	49 (42) [0]
Narrowfin smooth-hound	14 (0) [2]	29 (21)	0	0	0	0	0	43 (21) [2]
Night shark	0	0	0	0	44 (28) [8]	0	8 (5) [0]	52 (33) [8]
Nurse shark	22 (4) [0]	1 (1)	0	0	0	8 (1) [0]	89 (60) [0]	120 (66) [0]

Species	Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) Survey FSU Total caught (tagged) [mortality]	Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) Survey SEFSC Total caught (tagged)[2]	Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) Survey USM/GRCL Total caught (tagged) [mortality]	HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Survey Total caught (tagged) [mortality]	Pelagic Longline Survey Total caught (tagged) [mortality]	SEAMAP-GOM bottom longline survey Total caught (tagged) [mortality]	Shark and Red Snapper Bottom Longline survey Total caught (tagged) [mortality]	Totals
Requiem shark family	0	0	0	0	0	7 (0) [0]	0	7 (0) [0]
Requiem shark spp	0	0	1 (0) [0]	0	0	0	0	1 (0) [0]
Sand tiger shark	0	0	0	18 (15) [0]	0	0	0	18 (15) [0]
Sandbar shark	0	27 (11)	0	858 (720) [46]	16 (13) [0]	93 (33) [0]	435 (331) [0]	1429 (1108) [46]
Scalloped hammerhead shark	2 (2) [0]	422 (32)	1 (0) [1]	19 (10) [8]	74 (23) [34]	78 (33) [4]	94 (59) [14]	690 (159) [61]
Sharpnose sevengill shark	0	0	0	0	2 (2) [0]	0	2 (0) [0]	4 (2) [0]
Shortfin mako shark	0	0	0	0	1 (0) [1]	0	0	1 (0) [1]
Shortspine dogfish	0	0	0	1 (1) [0]	0	0	0	1 (1) [0]
Silky shark	0	0	0	0	180 (119) [18]	38 (19) [0]	73 (38) [14]	291 (176) [32]
Smooth hammerhead shark	0	0	0	7 (4) [3]	0	0	0	7 (4) [3]
Spinner shark	102 (28) [50]	273 (73)	1 (1) [0]	100 (29) [49]	7 (3) [3]	382 (192) [45]	183 (56) [65]	1048 (382) [212]

Species	Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) Survey FSU Total caught (tagged) [mortality]	Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) Survey SEFSC Total caught (tagged)[2]	Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) Survey USM/GRCL Total caught (tagged) [mortality]	HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Survey Total caught (tagged) [mortality]	Pelagic Longline Survey Total caught (tagged) [mortality]	SEAMAP-GOM bottom longline survey Total caught (tagged) [mortality]	Shark and Red Snapper Bottom Longline survey Total caught (tagged) [mortality]	Totals
Swordfish	0	0	0	0	51 (12) [29]	0	1 (0) [0]	52 (12) [29]
Taiwan gulper shark	0	0	0	20 (0) [20]	0	0	0	20 (0) [20]
Tiger shark	44 (28) [0]	0	0	76 (64) [1]	8 (4) [0]	82 (50) [4]	279 (191) [4]	489 (337) [9]
White shark	0	0	0	1 (0) [0]	0	0	0	1 (0) [0]
Yellowfin tuna	0	0	0	0	3 (1) [0]	0	0	3 (1) [0]

Source: SEFSC unpublished data, 2014

1. Most recent Pelagic Longline urvey was only years 2004, 2005, 2006. Data is from these years.

2. For Highly Migratory Species (HMS) – Gulf of Mexico Shark Pupping & Nursery (GULFSPAN) FSU Survey, mortality of untagged fish is not tracked.

Sharks, tunas and billfish are also periodically caught as incidentals in SEFSC surveys. Data from these surveys are tabulated and presented in Table 4.2-14. Many of the sharks caught during SEFSC research surveys were captured alive, measured, tagged, and released alive.

Several shark species are prohibited from commercial or recreational retention due to management options outlined in the HMS regulations at 50 CFR 653.34(c). Those that have been recently caught in SEFSC surveys include Atlantic angel, bluntnose sixgill, bigeyed sixgill, bignose, Caribbean reef, Caribbean sharpnose, dusky, night, sand tiger, sharpnose sevengill, silky, and white. Since it is therefore not possible to collect accurate population data based on commercial or recreational landings of these species, information garnered from fishery-independent research is valuable for population estimation and research.

Table 4.2-14 Summary of the Number of Sharks Caught in Non-shark-targeted Surveys from 2008 to 2012

Fish that are not tagged or mortalities are released.

Species	Total Number Caught	Total Number Tagged	Total Number Killed
Arrowhead dogfish	4	0	4
Atlantic angel shark	535	0	413
Atlantic sharpnose shark	16,683	2	534
Bigeyed sixgill shark	2	1	0
Bignose shark	13	4	1
Blacknose shark	1,321	801	122
Blacktip shark	747	425	28
Bonnethead shark	5,271	410	71
Bull shark	119	64	2
Caribbean lanternshark	18	0	18
Caribbean reef shark	10	0	9
Caribbean sharpnose Shark	33	5	22
Chain catshark	7	0	5
Cuban dogfish	359	0	351
Dusky shark	7	0	3
Dusky smooth-hound	1,427	41	75
Finetooth shark	470	276	9
Genus smooth hound sharks	168	42	59
Great hammerhead shark	5	2	1
Green lanternshark	61	0	61
Gulf smooth-hound	148	0	130
Gulper shark	12	0	12
Gulper shark sp	18	9	0
Kitefin shark	6	1	2
Lanternshark genus	6	0	6

Species	Total Number Caught	Total Number Tagged	Total Number Killed
Lemon shark	56	14	0
Narrowfin smooth-hound	15	0	7
Night shark	19	0	0
Nurse shark	68	29	1
Requiem shark sp	5	1	0
Roughskin dogfish	1	0	1
Roughskin spurdog	35	0	0
Roughtail catshark	4	0	4
Sand tiger shark	24	1	
Sandbar shark	803	677	17
Scalloped hammerhead shark	190	28	11
Squaliform shark genus	10	0	10
Sharpnose sevengill shark	2	0	2
Shortspine dogfish	14	0	0
Silky shark	53	1	3
Smalltooth sawfish	170	170	0
Spined pygmy shark	1	0	1
Spinner shark	100	65	1
Spiny dogfish	23,149	52	138
Spurdog family	13	0	0
Spurdog genus	5	0	5
Thresher shark genus	11	1	0
Tiger shark	49	38	0
Unknown shark	1	0	0
White shark	1	0	0

Source: SEFSC unpublished data, 2014.

SEFSC and cooperative research surveys will continue to catch HMS sharks, tunas and billfish intentionally and incidental to surveys targeting other species, but mortality will likely be low in magnitude, infrequent, and distributed over a wide geographic area; the effects of mortality on HMS species from SEFSC fisheries research under the Status Quo Alternative would be considered minor adverse according to the criteria in Table 4.1-1.

4.2.3.4 Conclusion

SEFSC fisheries research conducted under the Status Quo Alternative could have effects on ESA-listed species, commercially and recreationally targeted species, non-managed fish species, and highly migratory species through mortality, disturbance, and changes in habitat.

For ESA-listed species, incidental capture of Atlantic sturgeon has occurred on a regular basis in bottom-trawl surveys, especially in nearshore surveys in shallower water, but all of these fish have been released alive and in apparently good condition. Such incidental captures would likely continue to occur on a regular basis under the Status Quo Alternative but the risk of mortality would be low due to short tow times in research protocols. Incidental capture of smalltooth sawfish has occurred and would likely continue to occur only rarely and would have minimal effects on the population. Impacts on Atlantic sturgeon benthic habitat would be limited to temporary and localized increases in turbidity from research bottom-contact gear and accidental contamination, if it occurred, from fuel spills and other compounds from research vessels. Given the spill response equipment and emergency training required of all research vessels by Coast Guard regulations regarding safety and pollution prevention, and the experience of OMAO and charter captains and crew, the potential for accidental fuel spills or other contamination from research vessels is considered small and any incidents would likely be rare, small in magnitude, and quickly contained (Section 4.2.1). The overall effects of the Status Quo Alternative on ESA-listed fish would be minor in magnitude, distributed over a wide geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the criteria in Table 4.1-1.

For most species targeted by commercial fisheries and managed under Fishery Management Plans, mortality due to research surveys and projects is much less than one percent of ACLs or commercial and recreational harvest and is considered to be minor in magnitude for all species. For a few species which do not have a large commercial market due to various market conditions or past overfishing, the research catch exceeds one percent of commercial catch but is still small relative to the population of each species and is considered minor in magnitude. Proposed research projects that target stocks that are overfished or where overfishing is occurring are reviewed annually before research permits are issued to determine if they would conflict with rebuilding plans or present other conservation concerns. For highly migratory species (almost exclusively sharks) and species that are not managed under FMPs, research catch is also relatively small and considered to be minor in magnitude for all species. Mortality for all species would be distributed across a wide geographic area rather than concentrated in particular localities. Disturbance of fish and benthic habitats from research activities would be temporary and minor in magnitude for all species. As described above, the potential for accidental contamination of fish habitat is considered minor in magnitude and temporary or short-term in duration. The overall effects of the Status Quo Alternative on non-ESA-listed fish would be minor in magnitude, distributed over a wide geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the criteria in Table 4.1-1.

In contrast to these adverse effects, SEFSC research also provides long-term beneficial effects on managed fish species throughout the Southeast region through its contribution to sustainable fisheries management. Data from SEFSC-affiliated research provides the scientific basis to reduce bycatch, establish optimal fishing levels, prevent overfishing, and recover overfished stocks. The beneficial effects of the time-series data provided by SEFSC research programs effects are especially valuable for long-term trend analysis for commercially harvested fish and, combined with other oceanographic data collected during fisheries research, provide the basis for monitoring changes to the marine environment important to fish populations.

4.2.4 Effects on Marine Mammals

Section 3.2.2 describes the marine mammals that are likely to overlap with fishery research activities in the three SEFSC research areas. This section describes the potential effects of the SEFSC research activities on marine mammals under the Status Quo Alternative, including measures that have been implemented in the past to mitigate those effects. Because the secondary federal action considered in this DPEA is the promulgation of regulations and subsequent issuance of LOAs under Section 101(a)(5)(A) of the MMPA, this section provides more information and analysis for effects on marine mammals than is presented for the analysis of effects on other resources.

Potential effects of fishery research vessels, survey gear, sonar and other active acoustic devices, and other associated equipment on marine mammals include:

- Disturbance and behavioral changes due to acoustic equipment
- Injury or mortality due to ship strikes
- Injury or mortality due to entanglement/hooking in gear
- Changes in food availability due to research removal of prey and discards
- Contamination from discharges

The first part of this section provides information on the mechanisms for these different types of effects. For effects for which the mechanisms and levels of impact are similar for all species of marine mammals, the analysis is not repeated in the following research area and species subsections.

The second part of the analysis provides information on the effects of the SEFSC research activities on marine mammals and their habitat in each research area. An application for Incidental Take Authorization under the MMPA (referred to in this document as the LOA application) must include estimates of the numbers of animals that may be taken by serious injury or mortality, harassment that has the potential to injure (Level A harassment takes), and harassment that has the potential to disturb (Level B harassment takes). The SEFSC LOA application (Appendix C) only concerns the Preferred Alternative because that is the SEFSC's proposed action. However, the analysis of takes in the LOA application is based on a similar scope of research activities as the Status Quo Alternative (a few projects would not be continued and a few new projects would be added under the Preferred Alternative) and is therefore helpful in describing the potential effects of the Status Quo Alternative. For those research areas and marine mammal species where the effects of the Status Quo are considered the same or very similar to the Preferred Alternative, analysis provided in the LOA application is summarized and referenced in this section. Where the scope of activities differs between the Status Quo and Preferred Alternatives, the analysis of effects from the LOA application are summarized and referenced in the Preferred Alternative (Section 4.3.5). The following analysis focuses on the types of research gear most likely to have adverse interactions with marine mammals.

<u>Disturbance and behavioral responses due to acoustic equipment</u>

Several mechanisms exist by which research activities could potentially disturb marine mammals and alter behavior, including the physical presence of marine vessels and fishing gear combined with operational sounds from engines, hydraulic gear, and acoustical devices used for navigation and research. The impacts of anthropogenic noise on marine mammals have been summarized in numerous articles and reports including Richardson et al. (1995), NRC (2005), and Southall et al. (2007). Marine mammals use hearing and sound transmission to perform vital life functions. Sound (hearing and vocalization/ echolocation) serves four primary functions for marine mammals, including: 1) providing information about their environment, 2) communication, 3) prey detection, and 4) predator detection. Introducing sound into their environment could disrupt those behaviors. The distances to which anthropogenic sounds are audible depend upon source levels, frequency, ambient noise levels, the propagation characteristics of the environment, and sensitivity of the marine mammal (Richardson et al. 1995).

In assessing potential effects of noise, Richardson et al. (1995) suggested four criteria for defining zones of influence:

- Zone of audibility – the area within which the marine mammal might hear the sound. Marine mammals as a group have functional hearing ranges of 10 Hz to 180 kHz, with highest sensitivities to sounds near 40 kHz (Ketten 1998, Kastak et al. 2005, Southall et al. 2007). These data show reasonably consistent patterns of hearing sensitivity within each of four groups: baleen whales, small odontocetes (such as the harbor porpoise), other odontocetes (such as beluga, sperm, and killer whales), and pinnipeds.

- Zone of responsiveness – the area within which the animal reacts behaviorally or physiologically. The behavioral responses of marine mammals to sound depend on: 1) acoustic characteristics of the noise source; 2) physical and behavioral state of animals at time of exposure; 3) ambient acoustic and ecological characteristics of the environment; and 4) context of the sound (e.g., whether it sounds similar to a predator) (Richardson et al. 1995, Southall et al. 2007). Temporary behavioral effects, however, often merely show that an animal heard a sound and may not indicate lasting consequences for exposed individuals (Southall et al. 2007). Recent analysis of potential causes of a mass stranding of 100 typically oceanic melon-headed whales (Peponocephala electra) in Madagascar in 2008 implicate a mapping survey using a high-power 12 kHz multi-beam echosounder (MBES) as a likely trigger for this event. Although the cause is equivocal and other environmental, social, or anthropogenic factors may have facilitated the strandings, the authors determined the MBES the most plausible factor initiating the stranding response, suggesting that avoidance behavior may have driven the pelagic whales into shallow, unfamiliar waters (Southall et al. 2013).

  All of these factors that may affect the response of a marine mammal to a given noise generally cannot be determined ahead of time. In lieu of having this information, NMFS uses a standardized noise level to help determine how many animals may be disturbed (harassed) by a given activity during the MMPA authorization process. NMFS currently uses a sound threshold of 160 decibels (dB) referenced to 1 micro Pascal (μPa) for impulse noises to determine the onset of behavioral harassment for marine mammals (Level B harassment takes) (NMFS 2005c). Any animal exposed to impulse noises above this level is assumed to respond in a way consistent with the definition of a behavioral “take” under the MMPA, although NMFS acknowledges that some marine mammals may react to sounds below this threshold and that some animals exposed to sounds at or above this threshold may not react in ways consistent with behavioral harassment.

- Zone of masking – the area within which the noise may interfere with detection of other sounds, including communication calls, prey sounds, or other environmental sounds.
- Zone of hearing loss, discomfort, or injury – the area within which the received sound level is potentially high enough to cause discomfort or tissue damage to auditory or other systems. Underwater sounds produced by the active acoustic equipment used during SEFSC research have several characteristics (e.g., frequency, pulse duration, directionality, and power level) that make them highly unlikely to produce hearing loss or injury (Level A harassment) in marine mammals, which is an issue of concern for industrial and military actions.

The SEFSC has been using a variety of sonar systems during its research cruises to characterize marine habitats and fish aggregations. The sounds produced by equipment used by the SEFSC range from 18-333 kHz and from <200 dB to 224 dB referenced to 1 μPa at 1 m (Appendix C, Section 6.2). This acoustic equipment sends pulses of sound into the marine environment which provide information as they reflect back to the ship and are recorded (see Appendix A for a more detailed description of active acoustic instruments used in SEFSC research, including frequency ranges, beam width, source power levels, and other sound characteristics). The LOA application (Appendix C, Section 6.2) categorized active acoustic sources used by the SEFSC during research based on operating frequency and output characteristics. Category 1 active acoustic sources include short range echosounders and acoustic Doppler current profilers (ADCPs). These have output frequencies >300 kHz, are generally of short duration, and have high signal directivity. Category 2 active acoustic sources include various single, dual, and multi-beam echosounders, devices used to determine trawl net orientation, and current profilers of lower output frequencies than category 1 sources. Output frequencies of category 2 sources range from 12 to 200 kHz, have short ping durations, and are usually highly directional for mapping purposes.

Although these acoustic systems have been used for years and may have been a source of disturbance for nearby marine mammals, no direct observations of disturbance have been documented, primarily because any such disturbance, if it occurred, would have taken place under water. For animals at the surface, it is very difficult to determine whether a given sound source has caused any observed changes in behavior or whether the physical presence of the vessel has caused the disturbance. In many cases it is likely to be a combination of visual and audio components that causes a disturbance. It may also be difficult to determine if an animal has actually changed its behavior to avoid a disturbance or if it is moving for other reasons (e.g., to pursue nearby prey). For these reasons there have been no records or documentation of how many animals may have been disturbed (Level B harassment) by sounds generated from acoustic equipment during research cruises in the past. However, the MMPA requires applicants who are requesting authorization for incidental take of marine mammals to estimate how many animals may be affected by their actions.

NMFS regulations for implementing the MMPA distinguish between Level B harassment that causes behavioral changes in the affected marine mammals and Level A harassment that has the potential to cause injury. Animals exposed to intense sounds may experience reduced hearing sensitivity for some period of time following exposure. This change in hearing threshold is known as noise induced threshold shift (TS). The amount of TS incurred is influenced by amplitude, duration, frequency content, temporal pattern, and energy distribution of the noise (Richardson et al. 1995, Southall et al. 2007). It is also influenced by characteristics of the animal, such as hearing range of the species, behavior, age, history of noise exposure, and health. The magnitude of TS generally decreases over time after noise exposure and if it eventually returns to zero, it is known as ‘temporary threshold shift’ (TTS). If TS does not return to zero after some time (generally on the order of weeks), it is known as ‘permanent threshold shift’ (PTS). Sound levels associated with TTS onset are generally considered to be below the levels that will cause PTS, which is considered to be auditory injury.

The current NMFS policy regarding Level A harassment is that cetaceans should not be exposed to impulsive sounds greater than 180 dB re 1 μPa (root mean square) and that pinnipeds should not be exposed to impulsive sounds greater than 190 dB re 1μPa (root mean square) (65 FR 39874, June 28, 2000). However, these criteria were established before information was available about minimum received levels of sound that would cause auditory injury in marine mammals. They are likely lower than necessary and are intended to be precautionary estimates above which physical injury may occur (Southall et al. 2007).

In an extensive review of the effects of noise on marine mammal hearing and behavior, Southall et al. (2007) suggest that relatively high levels of sound are likely required to cause TTS in most pinnipeds and odontocete cetaceans (e.g., Schlundt et al. 2000, Finneran et al. 2002, 2005, 2007, Kastak et al. 1999, 2005, 2007). Based on the results of these studies, peak sound pressure levels in the range of approximately 180-220 dB re: 1µPa are required to induce onset of TTS for most species; the TTS onset values for harbor seals in air ranged from 135 to 149 dB re: 20µPa (Southall et al. 2007). PTS onset criteria, based on sound pressure level, for individual marine mammals exposed to discrete single pulse, multiple pulse, or nonpulse noise events were derived by adding 6 dB to peak pressure levels known or assumed to elicit TTS-onset. Resulting values are 230 dB re: 1µPa for cetaceans, 281 dB re: 1µPa for pinnipeds in water, and 149 db re: 20 µPa for pinnipeds in air (Southall et al. 2007). Southall et al. (2007) also provided some frequency weighting functions for different marine mammal groups to account for the fact that impacts of noise on hearing depend in large part on the overlap between the range of frequencies in the sound source and the hearing range of the species. Based on the Southall et al. (2007) results, Lurton and DeRuiter (2011) modeled the potential impacts (PTS and behavioral reaction) of conventional echosounders on marine mammals. They estimated PTS onset at typical distances of 32 to 328 ft (10 to 100 m) for the kinds of acoustic sources used in fisheries surveys considered here. They also emphasized that these effects would very likely only occur in the cone insonified below the ship and that behavioral responses to the vessel at these extremely close ranges would very likely influence the probability of animals being exposed to these levels.

Animals are likely to avoid a moving vessel, either because of its physical presence or because of behavioral harassment resulting from exposure to sound from active acoustic sources. It is unlikely that animals would remain in the presence of a harassing stimulus absent some overriding contextual factor. Because of this likely avoidance behavior, as well as the source characteristics (i.e., intermittent pulsing and narrow cones of ensonification), the SEFSC has determined that the risk of animals experiencing repetitive exposures at the close range or of the duration necessary to cause PTS is negligible. The SEFSC therefore does not anticipate causing any Level A harassment by acoustic sources of marine mammals and the LOA application includes no such take estimates. The potential for this type of impact on marine mammals will not be discussed further in this DPEA.

However, the SEFSC recognizes that the use of active acoustic equipment in its research activities has the potential to cause Level B harassment of marine mammals. In its LOA application for the Preferred Alternative, the SEFSC estimated the numbers of marine mammals that may be exposed to sound levels of 160 dB or above due to the use of acoustic sonars during research cruises (Level B harassment takes). The LOA application used the operational conditions and scope of work conducted in the past five years to estimate what may occur in the future under the Preferred Alternative. The Preferred Alternative would include a few changes in the SEFSC surveys and research projects relative to the Status Quo Alternative (Tables 2.2-1 and 2.3-1) , but none of them would deploy new types of acoustic devices or use protocols that would otherwise change the potential for acoustic disturbance of marine mammals. The acoustic take estimates presented in the LOA application therefore also represent potential numbers of animals affected under the status quo conditions.

As explained in the LOA application, these estimates attempt to quantify a dynamic situation with substantial unavoidable uncertainty regarding the propagation of sound in the water and distribution of marine mammals over very large areas. The scientific description of sound generated by sonar gear and its propagation through water is complicated, especially considering a sound source that is moving (on a vessel) through waters of different depths and properties (e.g. salinity and temperature) that affect sound transmission. The LOA application provides details on the assumptions that were made about the source levels and acoustic properties of sonar pulses, the directionality of the sound, and propagation/attenuation properties that were used to calculate an “insonified area” considered loud enough to harass marine mammals. One part of the SEFSC acoustic take calculation used a model of sound propagation from typical sonar equipment used during research to estimate the shape and dimensions of a typical insonified zone $\geq$ 160 dB re 1 μPa, which was multiplied by the distance research ships travel with active sonar gear to derive an estimated total area insonified to the Level B harassment take guidelines.

Another aspect of this Level B harassment take estimation process subject to large uncertainty concerns the distribution and abundance of marine mammals in the area. No species is distributed evenly throughout its range; they are typically patchy in distribution with strong seasonal variations and preferences for certain zones within the water column. Although some preferred habitats and general distributions are known, it is not possible to know precisely how many animals will be in a given area at any point in the future. The estimation process therefore uses average density of each species within the different research areas to estimate how many may be affected within the insonified area. One refinement that has been built into the Level B harassment take model is to categorize each marine mammal species according to its typical dive depth range, which affects the size of the insonified zone to which they may be exposed (Appendix C). The estimation process is admittedly subject to great uncertainty and there is no way to assess how realistic these estimates are in terms of the number of animals that would be disturbed by the activity. However, development of the Level B harassment take model was precautionaryin that assumptions made would tend to overestimate the size of the insonified area and the number of animals affected.

This DPEA (and the LOA application) must also assess what the likely biological effects may be for the estimated Level B harassment takes by acoustic sources. The LOA application (Appendix C, Section 6.2) provides an analysis of the potential effects of acoustic equipment used in SEFSC research on marine mammals. The analysis in this DPEA is a summary of the LOA application analysis and will be provided in the species subsections since different hearing ranges and frequencies used for communication determine what the effects of different acoustic equipment might be. This effort to examine the biological importance of acoustic disturbance requires knowledge about whether animals can perceive the sonar signals, their potential reactions to various types of sounds, and the conditions under which particular sound sources may lead to biologically meaningful effects (i.e. interference with feeding opportunities or critical social communication). Many key aspects of marine mammal behavior relevant to this discussion are, however, poorly understood. Most of the data on marine mammal hearing and behavioral reactions to sound come from relatively few captive, trained animals and likely does not reflect the diversity of behaviors in wild animals. Some behavioral reactions, if they occur in one or more species, could substantially reduce the numbers of animals exposed to high sound levels (e.g. swimming away from an approaching ship before sound levels reach the 160 dB level). Industrial projects such as seismic exploration for oil and gas and pile driving in relation to coastal developments are typically required to monitor marine mammal behavioral responses in relation to percussive industrial sounds but there have been few efforts to document behavioral changes in response to acoustic equipment commonly used in fisheries research.

Injury or mortality due to ship strikes

The southeastern coast of the U.S., the Gulf of Mexico, and Puerto Rico and the USVI areas encompass numerous shipping lanes, active ports, military bases, and vessel traffic. Vessel collisions with marine mammals, or ship strikes, can lead to death by massive trauma, hemorrhaging, broken bones, or propeller wounds (Knowlton and Kraus 2001). Large whales, such as fin whales, are occasionally found draped across the bulbous bow of large ships upon arriving in port. Massive propeller wounds can be immediately fatal. If more superficial, the whales may survive the collisions (Silber et al. 2009). Jensen and Silber (2003) summarized large whale ship strikes world-wide and found that most collisions occurred in the open ocean involving large vessels. Commercial fishing vessels were responsible for four of 134 records (three percent), and one collision (0.75 percent) was reported for a research boat, pilot boat, whale catcher boat, and dredge boat. Between 2009 and 2013, there were 29 confirmed ship strike mortalities involving baleen whales along the U.S. east coast and Gulf of Mexico. Species and stocks (and number) include: western North Atlantic right whale (2), Gulf of Maine humpback whale (8), western North Atlantic fin whale (9), Nova Scotian sei whale (2), Canadian east coast minke whale (6), and Northern Gulf of Mexico Bryde’s whales (1) (Henry et al. 2015). Ship strikes are a major cause of mortality and serious injury in right whales, accounting for 35 percent of deaths from 1970-1999 (Knowlton and Kraus 2001). Average annual reported mortality and serious injury of right whales from ship strikes, 2009-2013, was 0.9 (Waring et al. 2015b).

Vessel speed appears to be key in determining the frequency and severity of ship strikes, with the potential for collision increasing at ship speeds of 15 knots and greater (Laist et al. 2001, Vanderlaan and Taggart 2007). In the relatively few recorded cases of ship strikes at speeds below 15 knots, the chance of mortality declines from approximately 80 percent at 15 knots to approximately 20 percent at 8.6 knots (Vanderlaan and Taggart 2007). Reducing the co-occurrence of whales and vessels may be the only sure way to reduce ship strikes, but this is not always feasible (Silber et al. 2009).

Vessel speed restrictions or advisories are widely used to reduce the likelihood and severity of ship strikes, particularly for endangered large whales. Vessels 65 ft (19.8 m) in length or greater are currently subject to ship strike management measures in defined areas during certain times of the year (78 FR 73726, December 9, 2013). This includes NOAA ships, commercial vessels (fishing vessels, tugs and tows, passenger vessels, passenger vessels for hire, large commercial vessels) and recreational vessels

(NERO 2004). NMFS based the 65 ft threshold on analysis of ship strike mortalities and serious injuries. Most vessels involved were greater than 262 ft long. However, one right whale calf was struck and killed by an 82 ft vessel. Vessels smaller than 65 ft may also pose a threat, but the 65 ft threshold was deemed appropriate since it included most vessels involved in collisions and corresponded with established size criteria used in several other existing regulatory requirements (NERO 2004, NMFS 2008a). These measures are aimed specifically at reducing collisions with endangered North Atlantic right whales. Refer to Section 2.2.2.1, Ship Strikes, for further information on ship strike mitigation measures.

Collisions with watercraft are a leading source of injury and mortality for manatees in Florida. From 2008 to 2012, watercraft accounted for an average of 19 percent of total annual manatee deaths. Total annual mortality includes human caused, perinatal, cold stress, natural causes, and undetermined causes. Eighty-nine percent of all human-caused deaths during this period were by watercraft (USFWS 2014a). Vessel speed reduction zones, with voluntary compliance, were instituted to mitigate the problem (USFWS 2001). However, over half of observed recreational watercraft studied was noncompliant with posted speed restrictions (Jett et al. 2012). Further details on manatee protection zones and regulations are in Section 2.2.2.1, Ship Strikes.

No collisions with large whales or manatees have been reported from any fisheries research activities conducted or funded by the SEFSC, although the death of an Atlantic spotted dolphin calf during a marine mammal survey in 2011 was apparently caused by the ship's propeller, following bow-riding by a group of dolphins. Transit speeds generally range from 6-14 knots, but average 10 knots. The vessel's speed during active sampling is typically 2-4 knots due to sampling design and these much slower speeds essentially eliminate the risk of ship strikes.

Given the relatively slow speeds of research vessels, the presence of bridge crew watching for marine mammals during many survey activities, and the small number of research cruises, ship strikes with marine mammals during the research activities described in this DPEA would be considered rare in frequency, localized in geographic scope, and unlikely to occur in the near future. The potential for fisheries research vessels to cause serious injury or mortality to any marine mammals due to ship strikes is considered minor adverse throughout the SEFSC research areas using vessel types and protocols currently in use. This potential effect of research will not be discussed further in the following analysis.

<u>Injury or mortality due to entanglement/hooking in fishing gear</u>

Entanglement in fishing gear is a significant source of human-caused injury or mortality for some marine mammals. Although they may be immediately fatal, entanglements can also lead to prolonged weakening or deterioration of an animal (Knowlton and Kraus 2001). This is particularly true for large whales; small whales, dolphins, porpoises, are more likely to die when entangled.

Commercial fisheries along the southeastern U.S. coast, in the Gulf of Mexico, and Caribbean with known bycatch of marine mammals include those using pelagic longlines, gillnets, trawls, haul/beach seines, purse seines, pound nets, hook-and-line gear, and trap/pot gear (79 FR 77919, December 29, 2014; Waring et al. 2015b). Further details regarding specific fisheries and marine mammal bycatch are noted in species descriptions in Section 3.2.2 and will be discussed further when considering cumulative effects (Section 5.3.2). Several of these gear types are employed during SEFSC fisheries research surveys, including bottom and mid-water trawls, surface trawls, longlines, gillnets, beach and purse seines, hook-and-line, and traps/pots (Appendix A and B).

The 1994 amendments to the MMPA tasked NMFS with establishing monitoring programs to estimate mortality and serious injury of marine mammals incidental to commercial fishing operations and to develop Take Reduction Plans (TRPs) in order to reduce commercial fishing takes of strategic stocks of marine mammals below PBR. The ALWTRP was developed to reduce mortality and serious injury of North Atlantic right, humpback, and fin whales in gillnets and pot/trap gear but also benefits minke whales (NMFS 2010a). The Bottlenose Dolphin Take Reduction Plan was created to reduce mortality and serious injury of bottlenose dolphins within the Western North Atlantic coastal morphotype in specific Category I and II commercial fisheries that are identified and updated in the annual LOF (50 CFR 229.35). The Atlantic Pelagic Longline Take Reduction Plan was developed to reduce serious injury and morality of pilot whales and Risso's dolphins in the Mid-Atlantic portion of the pelagic longline fishery (50 CFR 229.36). The Atlantic Trawl Gear Take Reduction Strategy (ATGTRS) addresses protected species interactions (primarily pilot whales, short-beaked common dolphins, and Atlantic white-sided dolphins) in bottom and mid-water trawl fisheries through research, education, and outreach (ATGTRT 2008). Additional information on Take Reduction Teams and TRPs relevant to the SEFSC research areas is in Section 2.2.2.2, Take Reduction Plans.

Incidental takes of marine mammals during SEFSC fisheries research involved bottom and skimmer trawls, trammel nets, gillnets, and longline gear. Eleven marine mammals—all bottlenose dolphins--were incidentally taken in research fishing gear during SEFSC research activities from 2002 to 2015 (Table 4.2-15 and Figure 4.2-2). Takes involved six different coastal, bay, sound, or estuarine stocks in the ARA and GOMRA. Five of the seven takes in the ARA occurred in bottom trawls and two in a single trammel net. Six out of seven dolphins taken were killed; one was released alive from a bottom trawl. Gear involved in takes in the GOMRA was more varied and included skimmer trawls, bottom longline gear, and a gillnet. Two takes resulted in death and two were released alive (Table 4.2-15). There have been no takes of marine mammals incidental to SEFSC fisheries research in the CRA. The SEFSC has made a concerted effort to develop and implement mitigation measures to reduce the risk of such takes. These mitigation measures are part of the Status Quo Alternative and are described in Section 2.2.1.

Most of the mitigation measures rely on visual monitoring and detection of marine mammals near the vessel or fishing gear. There are many variables that influence the effectiveness of visual monitoring at any one time, including the lighting and sea state and the capabilities of the person(s) assigned to watch, so it is impossible to determine an overall measure of effectiveness, such as how many animals may have been avoided with visual monitoring compared to having no monitors. The value of implementing some mitigation measures is therefore based on general principles and best available information even if their effectiveness at reducing takes has not been scientifically demonstrated.

Figure 4.2-2 shows the spatial distribution of marine mammals that have been taken in SEFSC surveys from 2002 through 2015, and Table 4.2-15 indicates the date and time of interaction. These historical takes are dispersed fairly widely and there does not appear to be any spatial pattern of high risk areas (i.e., "hot spots" for marine mammal takes) or any temporal pattern with regard to seasons or times of day. All of the takes were, however, in coastal or estuarine waters.

The MMPA authorization process requires the applicant (SEFSC) to estimate how many marine mammals may be captured or entangled in the future under the proposed set of conditions. As is the case for Level B harassment takes by acoustic sources, the LOA application (Appendix C) describes the methodology used to estimate the species and numbers of animals that may be taken by Level A harassment and serious injury or mortality during future research conducted under the Preferred Alternative. The LOA application combines estimated Level A harassment takes with serious injury or mortality takes because the severity of injury resulting from gear interaction cannot be predicted. The gear take estimates are based on the past history of takes (both lethal takes and animals captured and released alive) by the SEFSC under the status quo conditions. For species that have been taken historically (i.e., bottlenose dolphins), the LOA application uses the calculated average annual numbers of takes that occurred in the past fourteen years (2002-2015) and "rounds up" this annual average to the next highest whole number of animals. For example, an average of 0.5 animals per year was rounded up to one animal. Since the LOA application requests takes for a five-year period, this intentionally inflated annual average is multiplied by five to produce an estimate higher than the historic average take for this species that has been taken incidentally during SEFSC research.

The bottlenose dolphin is the only marine mammal species historically taken during SEFSC fisheries research, and all takes were from coastal or bay, sound, and estuarine (BSE) stocks. Bottlenose dolphin stock structure in the SEFSC research areas is complex, with more than 50 stocks combined; ARA (11 BSE, 5 coastal, 1 offshore), GOMRA (31 BSE, 3 coastal, 1 continental shelf, 1 oceanic), and CRA (1 shelf/offshore) (Table 3.2-9). Stock structure is uncertain in portions of the northern Gulf of Mexico and abundance estimates and, hence PBR, are unknown or undetermined for 34 stocks, many of which are purportedly small. Consequently, estimated takes of BSE and coastal bottlenose dolphins during SEFSC fisheries research in the ARA and GOMRA were calculated using a method specific to these stocks and the challenges they present.

The SEFSC calculated the average number of historical bottlenose dolphin takes in all gear types for each research area from 2002 through 2015. However, using historical takes to determine take requests by gear type for each coastal and BSE stock would result in an overestimate of the number of potential takes. The overall SEFSC take request for coastal and BSE bottlenose dolphins is, therefore, for all gear types combined. This was determined for historically captured bottlenose dolphins by rounding the annual average take for all gear interactions and stocks combined (Atlantic = 0.5; Gulf of Mexico = 0.3) up to the nearest whole number and multiplying by five to account for the five-year LOA authorization period. Although unlikely, based on historical takes, a small take level, such as five dolphins, could be exceeded in one or two trawl tows, trammel net sets, or gillnet sets if multiple animals were taken. To be precautionary, the estimate based on historical takes was, therefore, doubled for both the ARA and GOMRA. Specifically, 10 takes are requested for each of these two areas for all coastal/BSE stocks, but potential takes requested for each stock would be restricted on a stock-by-stock basis. Further details on take determinations by stock follow below in Sections 4.2.4.1 and 4.2.4.2 and in Section 6.1.3 of the LOA application (Appendix C).

The LOA application also includes estimates for future incidental takes of species that have not been taken historically but exist in the same areas and show similar vulnerabilities as species that have been taken in other analogous contexts (e.g., commercial fishing gear and non-SEFSC research). Factors considered when determining if a species may have similar vulnerabilities to certain types of gear as analogous contexts include density, abundance, behavior, feeding ecology, group size and composition, and association with species historically taken. For these analogous species, the SEFSC estimates the annual take to be equal to the maximum take per any given set of a similar species that was historically taken during 2002 through 2015. This method is based on the assumption that such takes would likely occur rarely, if at all, but may involve more than one animal in a given trawl or set given the social nature of many marine mammals.

The only SEFSC marine mammal take in longline gear was one bottlenose dolphin in the GOMRA in 2013 that was released alive. Requested longline takes are, therefore, largely based on takes in analogous commercial fishing operations. For analogous commercial fisheries, the SEFSC referenced the 2015 List of Fisheries. There are several species, such as large whales, that are known to interact with commercial longline fisheries but for which SEFSC is not requesting take. The likelihood of interacting with SEFSC longline gear is extremely low considering the low level of survey effort relative to that of commercial fisheries.

Table 4.2-15 Historical Takes of Marine Mammals during SEFSC Surveys, 2002-2015

Survey Name	Protected Species Taken	Gear Type	Date (Time) Taken	# Killed	# Released Alive[1]	Total Taken
ATLANTIC RESEARCH AREA						
2014						
SEAMAP-SA Coastal Trawl Survey_Spring (SCDNR)	Bottlenose dolphin (Northern Florida Coastal)	Bottom trawl	11 April (4:07 pm)	1	0	1
2012						
SEAMAP-SA Coastal Trawl Survey_Summer (SCDNR)	Bottlenose dolphin (SC/GA Coastal)	Bottom trawl	2 August (11:54 am)	1	0	1
SEAMAP-SA Coastal Trawl Survey_Summer (SCDNR)	Bottlenose dolphin (SC/GA Coastal)	Bottom trawl	11 July (2:30 pm)	0	1	1
2006						
SEAMAP-SA Coastal Trawl Survey_Fall (SCDNR)	Bottlenose dolphin (Southern Migratory)	Bottom trawl	5 October (1:29 pm)	1	0	1
SEAMAP-SA Coastal Trawl Survey_Summer(SCDNR)	Bottlenose dolphin (SC/GA Coastal)	Bottom trawl	28 July (9:18 am)	1	0	1
2002						
RecFIN Red Drum Trammel Net Survey (SCDNR)	Bottlenose dolphin (Charleston Estuarine System)	Trammel net	22 August (10:00 am)	2		2
ARA TOTAL				**6**	**1**	**7**
GULF OF MEXICO RESEARCH AREA						
2014						
SEFSC Skimmer Trawl TED Testing	Bottlenose dolphin (MS Sound, Lake Borgne, Bay Boudreau)	Skimmer trawl	1 October (5:53 am)	1	0	1
2013						
SEFSC Skimmer Trawl TED Testing	Bottlenose dolphin (MS Sound, Lake Borgne, Bay Boudreau)	Skimmer trawl	13 October (6:50 pm)	0	1	1
SEAMAP-GOM Bottom Longline Survey (ADCNR)	Bottlenose dolphin (Mobile Bay, Bonsecour Bay)	Bottom Longline	6 August (4:10:00 pm)	0	1	1
2011						
Gulf of Mexico Shark Pupping and Nursery GULFSPAN (USA/DISL)	Bottlenose dolphin (MS Sound, Lake Borgne, Bay Boudreau)	Gillnet	18 April (2:20 am)	1	0	1
GOMRA TOTAL				2	2	4
TOTAL ALL AREAS[2]						
				8	**3**	**11**

1. Serious injury determinations were not previously made for animals released alive, but are now part of standard protocols for released animals and will be reported in Stock Assessment Reports.
2. There have been no historical takes in the Caribbean Research Area.

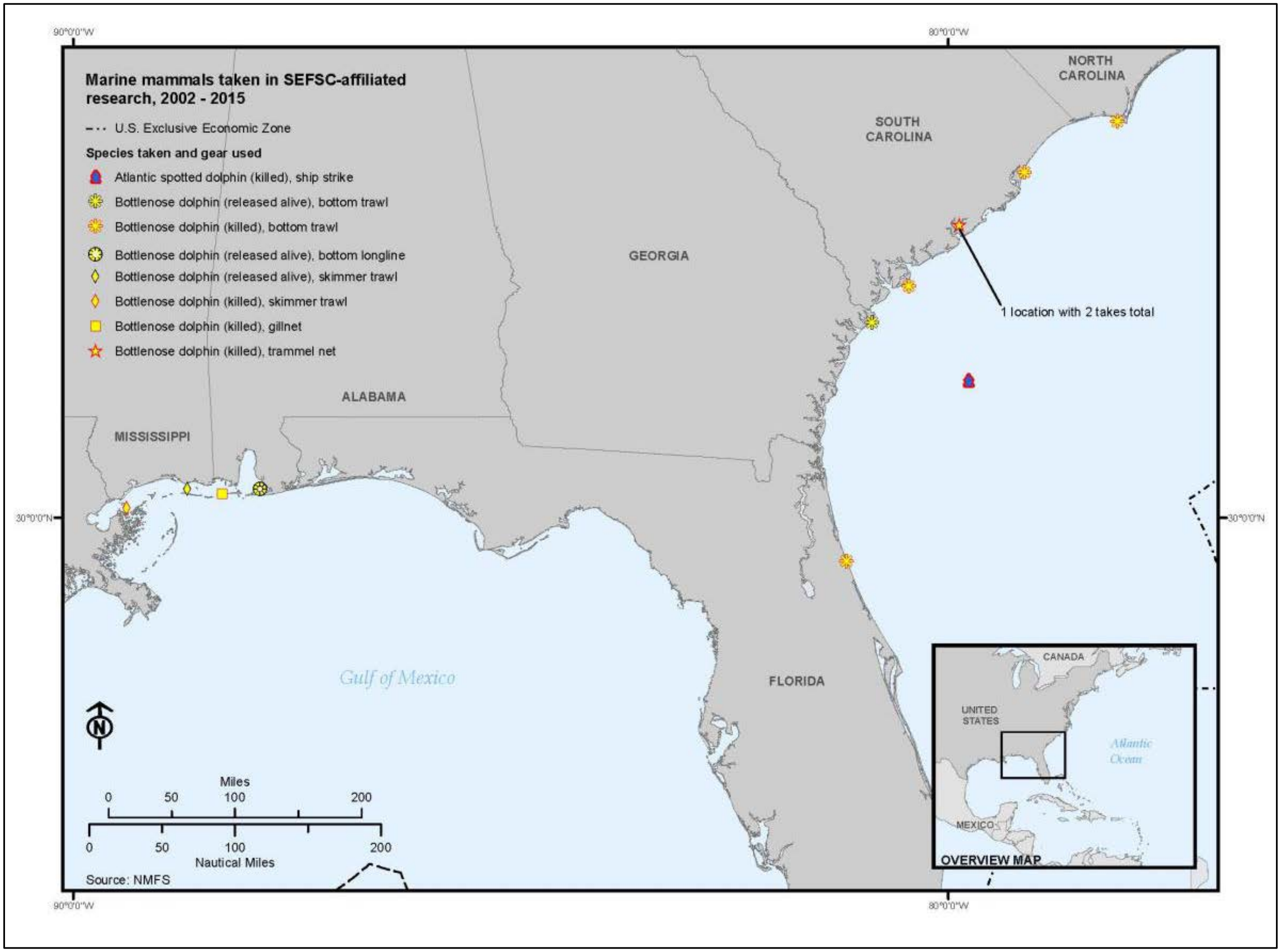

Figure 4.2-2 Location of Marine Mammal Takes during SEFSC Research from 2002 through 2015

Changes in food availability due to research survey removal of prey and discards

Prey of marine mammals varies by species, season, and location and, for some, is not well documented. For marine mammals occurring in the SEFSC research areas, prey types range widely from squid and other cephalopods to fish, zooplankton, and, for manatees, vegetation. There is some overlap in prey of marine mammals in the SEFSC research areas and the species sampled and removed during fisheries research surveys. However, the total amount of these species taken in research surveys is very small relative to their overall commercial and recreational catches and biomass, when known (See Section 4.2.3 for more information on fish caught during research surveys). In addition, research catches are generally widely distributed because of the random sampling design covering large sample areas. Fish, invertebrates, and zooplankton removals by research, therefore, tend to be highly localized and unlikely to affect the spatial concentrations and availability of prey for marine mammal species.

SEFSC fisheries research catch levels are also very small relative to the estimated consumption of prey by marine mammals, dispersed over large areas and time periods, and are unlikely to affect changes in prey type or quantity available to any marine mammals._The potential for SEFSC research to affect the availability of prey to marine mammals is considered to be minor adverse for all species and all three research areas and it will not be discussed further.

Contamination from discharges

Discharge from vessels, whether accidental or intentional, include sewage, ballast water, fuel, oil, miscellaneous chemicals, garbage, and plastics. Impacts to marine mammals in the vicinity of the discharge range from superficial exposure to ingestion and related effects. Even at low concentrations that are not directly lethal, some contaminants can cause sub-lethal effects on sensory systems, growth, and behavior of animals, or may be bioaccumulated (DOE 2008).

All NOAA vessels and SEFSC chartered vessels are subject to the regulations of MARPOL 73/78, the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (NOAA 2010a). MARPOL includes six annexes that cover discharge of oil, noxious liquid substances, harmful packaged substances, sewage, garbage, and air pollution (IMO 2010). Adherence to these regulations minimizes or negates the likelihood of discharges of potentially harmful substances into the marine environment. Annex V specifically prohibits plastic disposal anywhere at sea and severely restricts discharge of other garbage (IMO 2010).

Discharge of contaminants from SEFSC vessels and SEFSC chartered vessels is possible, but unlikely to occur in the next five years. If an accidental discharge does occur, it is likely to be a rare event and the potential volume of material is likely to be small and localized. The potential impacts to marine mammals would be similarly short-term, localized, and likely affect a small number of animals. The overall impact of accidental contamination of marine mammals would therefore be considered minor adverse. As the potential effects of discharges, regulations governing discharges, and the likelihood of discharges is universal throughout the SEFSC research areas, this will not be discussed further in this analysis.

4.2.4.1 Atlantic Research Area

ESA-listed species

The endangered marine mammals that occur in the ARA include North Atlantic right, humpback, fin, sei, blue, and sperm whales, and the Florida manatee. Manatees are under the jurisdiction of the USFWS, while the remainder is under the jurisdiction of NMFS in regards to compliance with the MMPA and ESA. Human-caused mortality and serious injury may have more profound effects on right whales than on any other species due to their small population size and low reproductive rate. Ship strikes and entanglement in fishing gear are considered major factors limiting population growth and recovery of right whales (Waring et al. 2014).

Disturbance and behavioral responses due to acoustic equipment

The LOA application (Appendix C) includes calculations of the number of marine mammals that may be exposed to sound levels above 160 dB from all acoustic devices used during SEFSC research activities in the ARA. Those calculations include a number of assumptions and elements with large variables over time and space (e.g., the volumetric densities of marine mammals and the propagation of sound under different conditions). The SEFSC believes this quantitative approach benefits from its simplicity and consistency with current NMFS guidelines on estimating Level B harassment by acoustic sources, but cautions that the resulting take estimates should be considered as overestimates of behavioral harassment from acoustic devices. The DPEA summarizes the results of those estimates in Table 4.2-16 below, but see Appendix C for a detailed discussion about the derivation of and concerns about the accuracy of these estimates. The likely impact on ESA-listed species from the different types of acoustic devices is discussed below.

Table 4.2-16 Estimated Level B Harassment Takes of Marine Mammals by Acoustic Sources during SEFSC Research in the ARA

Take estimates summarized in this table are for all relevant active acoustic sources combined. Takes are for all stocks combined for species with multiple stocks in the ARA.

Species (Common Name)	Total Estimated Level B Take (numbers of animals)	Species (Common Name)	Total Estimated Level B Take (numbers of animals)
Fin whale [1]	1	**Short-beaked common dolphin**	3
Sperm whale [1]	2	**Atlantic spotted dolphin**	163
Pygmy/dwarf sperm whale	6	**Pantropical spotted dolphin**	3
False killer whale	1	**Striped dolphin**	6
Mesoplodont beaked whales	9	**Rough-toothed dolphin**	1
Risso's dolphin	3	**Bottlenose dolphin (numerous stocks)[2]**	134
Short-finned pilot whale	48		

1. ESA-listed species

2. Estimated take is for all stocks combined. Refer to Table 3.2-9 for stock delineations.

The output frequencies of Category 1 active acoustic sources (short range echosounders, Acoustic Doppler Current Profilers) are >300 kHz and are generally short duration signals with high signal directivity (Appendix C, Section 6.2). The functional hearing range of baleen whales is 7 Hz-22 kHz, with highest sensitivity generally below 1 kHz, and that of sperm whales is 150 Hz-160 kHz, with highest sensitivity from 10-120 kHz. These functional hearing ranges fall below the output frequency of Category 1 sources, which are unlikely to be detected by right, humpback, fin, or sperm whales (Figure 4.2-3).

Category 2 active acoustic sources (various single, dual, and multi-beam echosounders, devices used to determine trawl net orientation and several current profilers) have frequencies of 12-200 kHz, short ping durations, and are usually highly directional. These are unlikely to be heard by most baleen whales, but are within the hearing range of sperm whales. If detected, short term avoidance is the most likely response, which would tend to reduce the exposure of animals to high sound levels, so that the potential for direct physical injury is virtually zero (Appendix C, Section 6.2).

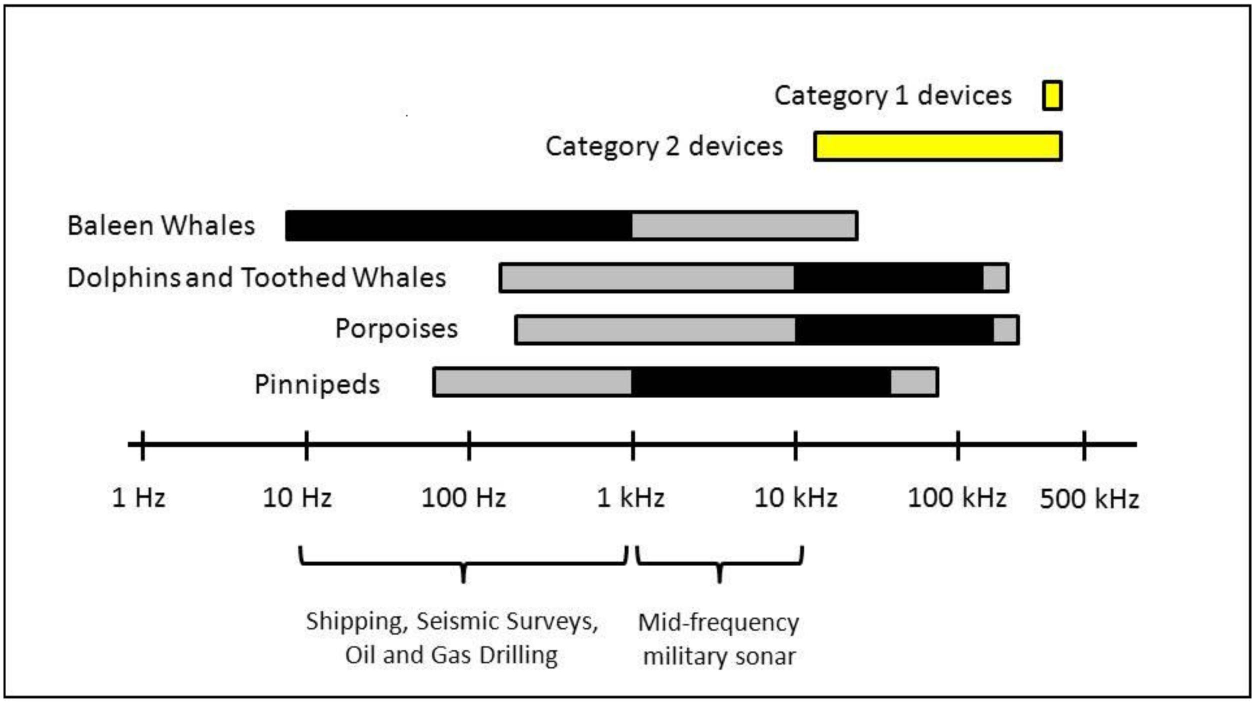

Figure 4.2-3 Typical Frequency Ranges of Hearing in Marine Mammals
Figure 4.2-3 shows hearing ranges for different marine mammal groups (gray and black bars) relative to the frequency outputs of the two categories of acoustic devices used in SEFSC research (yellow bars), as identified in Appendix C, Section 6.2. Black bars indicate the most sensitive hearing ranges of different marine mammals. Brackets indicate frequency ranges of several industrial sound sources as well as U.S. Navy mid-frequency active sonar for comparison. Data on hearing ranges is from Southall et al. (2007) and modified from DON (2008).

The anticipated effects of active acoustic sources used during SEFSC fisheries research on threatened and endangered marine mammals is likely to occur infrequently, although they may occur over a large geographic area. Most of the frequencies are well above detection ranges for ESA-listed baleen whales, while Category 2 output overlaps with the hearing range of sperm whales. To date, there have been no reports or observations of sounds from SEFSC research activities disturbing or affecting behavioral changes in ESA-listed species.

Vessel noise may affect large whales through masking of biologically important sounds, particularly for low frequency baleen whales (Clark et al. 2009). The biological significance of masking from vessel noise is not known for any species but presumably the effects could include a decreased ability to detect sounds used in communication, predator avoidance, and orientation. However, the relatively small number of SEFSC research vessels is likely to only result in temporary and minimal effects from acoustic masking as vessels pass through an area (Appendix C, Section 6.2).

The potential effects from the use of active acoustic devices during research activities would be small in magnitude and short-term in duration, although they would be dispersed over a wide geographic area and be likely to occur under the Status Quo Alternative. The overall impacts of acoustic disturbance to ESA-listed marine mammals throughout the ARA are therefore considered to be minor adverse.

Injury and mortality due to entanglement /hooking in gear

Table 4.2-15 indicates marine mammal takes by all SEFSC research activities from 2002 through 2015. None of the historical entanglements or takes of marine mammals in SEFSC fisheries research from NOAA vessels or NOAA chartered vessels are ESA-listed species. The SEFSC is not requesting the take of any ESA-listed cetaceans due to lack of historical interactions and the low probability of take due to several factors, including density, abundance, and behavior. The SEFSC also does not anticipate any future takes of manatees, which are under the jurisdiction of the USFWS and are not covered in the LOA application to NMFS.

The SEFSC has no historical takes of marine mammals in its longline gear in the ARA; the one interaction with a bottom longline in the GOMRA involved a bottlenose dolphin that was released alive. However, there are some records of marine mammals being caught in commercial longline fisheries. The 2015 List of Fisheries classifies commercial fisheries based on prior interactions with marine mammals. The SEFSC used this information to make informed decisions on the probability of specific cetacean and large whale interactions with longline gear in the ARA, as well as accounting for several other factors (e.g., relative survey effort, survey location, similarity in gear type, animal behavior, prior history of SEFSC interactions with longline gear etc.). As a result, there are several species that have been shown to interact with commercial longline fisheries but for which SEFSC is not requesting take. For example, the SEFSC is not requesting takes of large whales in longline gear. Although large whale species could become entangled in longline gear, the probability of interaction with SEFSC longline gear is extremely low considering a lower level of survey effort relative to that of commercial fisheries. Although data on commercial fishing effort similar to what is described for SEFSC fisheries research are not publically available, based on the amount of fish caught by commercial fisheries versus SEFSC fisheries research, the “footprint” of research effort compared to commercial fisheries is very small.

Measures to mitigate the risk of entanglements are described in Section 2.2.1. Vessel captains, bridge officers, and crew watch for marine mammals while underway and while setting fishing gear and take action to avoid them. The lack of recent entanglements of threatened and endangered marine mammals, thus far, indicates that the frequency of these types of interactions in fisheries research gear is low. The potential effects from entanglement in research gear is, therefore, considered minor adverse for threatened and endangered species throughout the SEFSC research area during all seasons using gear types similar to those currently in use.

<u>Other cetaceans</u>

This section describes impacts to cetaceans that are not ESA-listed. Minke whales are the only baleen whale species included in this section. The remaining cetaceans are toothed whale species (i.e., odontocetes), including whales, dolphins, and porpoises.

Disturbance and behavioral responses due to acoustic equipment

The analysis of acoustic effects on these species is similar to that discussed for ESA-listed species above. Table 4.2-16 provides summaries of the numbers of each species that could be taken by Level B acoustic harassment during SEFSC research activities. The likely impact on cetaceans from the different types of acoustic devices is discussed below.

The mid-frequency odontocetes (e.g., pilot whales, killer whales, beaked whales, and dolphins) have a functional hearing range of 150 Hz to 160 kHz, with highest sensitivity from 10-120 kHz. The high-frequency odontocetes (e.g., dwarf and pygmy sperm whales and harbor porpoises) have a functional hearing range of 200 Hz to 180 kHz, with highest sensitivity from 10-150 kHz. The output frequencies of Category 1 active acoustic sources (>300 kHz) are above the functional hearing range of baleen whales and cetaceans in the mid- and high-frequency hearing groups (Figure 4.2-3). Because they would not be able to hear them, cetaceans are not expected to be affected by Category 1 sound sources (Appendix C, Section 6.2).

Most Category 2 active acoustic sources are operated at frequencies unlikely to be heard by most baleen whales but are within the range of hearing for various odontocetes, especially high frequency hearing *Kogia* species and harbor porpoise. One acoustic device used by the SEFSC is infrequently used at 18 kHz so there is a potential for nearby baleen whales to hear these devices when they are used. Some Category 2 devices are used on trawl nets during fishing so their use is intermittent, localized and directional, and they are deployed on moving sources. Other Category 2 devices, such as echosounders and current profilers, may be deployed continuously or over long periods during a research cruise. These sound sources are highly directional. The sounds could be loud to cetaceans in close proximity to the sound source but physical damage is unlikely, although TTS could occur if animals remained close to the source (tens to a few hundred meters) for prolonged periods (Appendix C, Section 6.2). Deployment of such devices on moving vessels/gear, their narrow beam widths, and the short duration of most research tows (< 30 minutes) should minimize that likelihood. If detected, short term avoidance is the most likely response (Appendix C, Section 6.2).

There have been no documented cases of marine mammals being disturbed or changing their behavior in response to SEFSC research vessels other than bow-riding by dolphins, which is common with marine vessels and generally not considered a detrimental effect on the animals. The active sound sources used during fisheries research would not likely be detected by minke whales, although they may be detected by odontocetes, particularly higher frequency hearing *Kogia* species and harbor porpoise. Sound emission from these active sources is short-term in any localized area. The most likely effect on cetaceans would be localized and temporary avoidance (Appendix C, Section 6.2). Potential disturbance from active acoustic equipment used during research would, therefore, not have any measurable effect on the population of any cetacean and would be considered minor in magnitude. Such disturbance is likely to occur wherever survey vessels use the equipment, but cetaceans would only be close enough to a vessel to be affected on a rare or intermittent basis and any behavioral changes would be temporary. The overall impact of active acoustic sound sources on non ESA-listed cetaceans throughout the SEFSC research area is considered to be minor adverse according to the criteria in Table 4.1-1.

Injury, serious injury, or mortality due to entanglement/hooking in gear

Table 4.2-15 shows the recent history of marine mammal takes by all SEFSC research activities, which includes seven bottlenose dolphins from four different stocks in the ARA. All but one died and five of the seven takes involved bottom trawl gear. Measures to mitigate the risk of entanglements are described in Section 2.2.1.

The bottlenose dolphin is the only species historically taken during SEFSC fisheries research, and all takes were from coastal or BSE stocks. Due to the number, complexity, and uncertainties regarding bottlenose dolphin stocks, all stocks were considered in the take request in addition to those historically taken (Table 4.2-17). However, some stocks occur in limited geographic areas where the SEFSC and research partners do not conduct fisheries research and were therefore considered unlikely to interact with SEFSC research; no incidental takes were expected from these stocks. Only those stocks whose ranges overlap with SEFSC and research partner fisheries research activity have been requested for potential take by the SEFSC. Figure 4.2-4 illustrates stock boundaries within which SEFSC fisheries research occurs within the ARA.

Bottlenose dolphins have been taken in the course of SEFSC fisheries research in bottom trawls, trammel nets, skimmer trawls, longline gear, and gillnets. Take requests specified by each gear-type for each coastal and BSE stock would lead to an overestimate of the number of takes anticipated based on historical takes. Therefore, the overall SEFSC take request for coastal and BSE bottlenose dolphins is for all gear-types combined. Rounding the annual average historical take of bottlenose dolphins in the ARA

(0.5 animals per year) to the nearest whole number, then multiplying by five to account for the five-year LOA authorization period, resulted in a calculated five-year take of five bottlenose dolphins (all stocks combined) in the ARA. To account for the unlikely scenario of exceeding this number in one or two interactions if multiple animals were taken, this estimated average-based value was increased to ten requested takes in the ARA for all coastal and BSE bottlenose dolphin stocks combined. Potential takes requested for each stock would, however, be restricted on a stock-by-stock basis.

Table 4.2-17 indicates the maximum number of potential takes requested for each coastal and BSE bottlenose dolphin stock (not to exceed 10 total takes for all stocks combined in the ARA). Potential takes are based on: 1) Stock size – larger stocks (>1000 dolphins) were assumed to have a higher probability of a take and stocks with no current (i.e., older than 8 years) stock size information were assumed to have a very small stock size (<1000 dolphins) and, hence, a lower take probability; 2) Proximity of SEFSC-funded research; and 3) History of takes documented in the PSIT database. Based on the location of stock ranges and SEFSC research efforts in the last five years, the stocks with overlaps of SEFSC research within their ranges (Figure 4.2-4) are assumed to have a higher probability of takes.

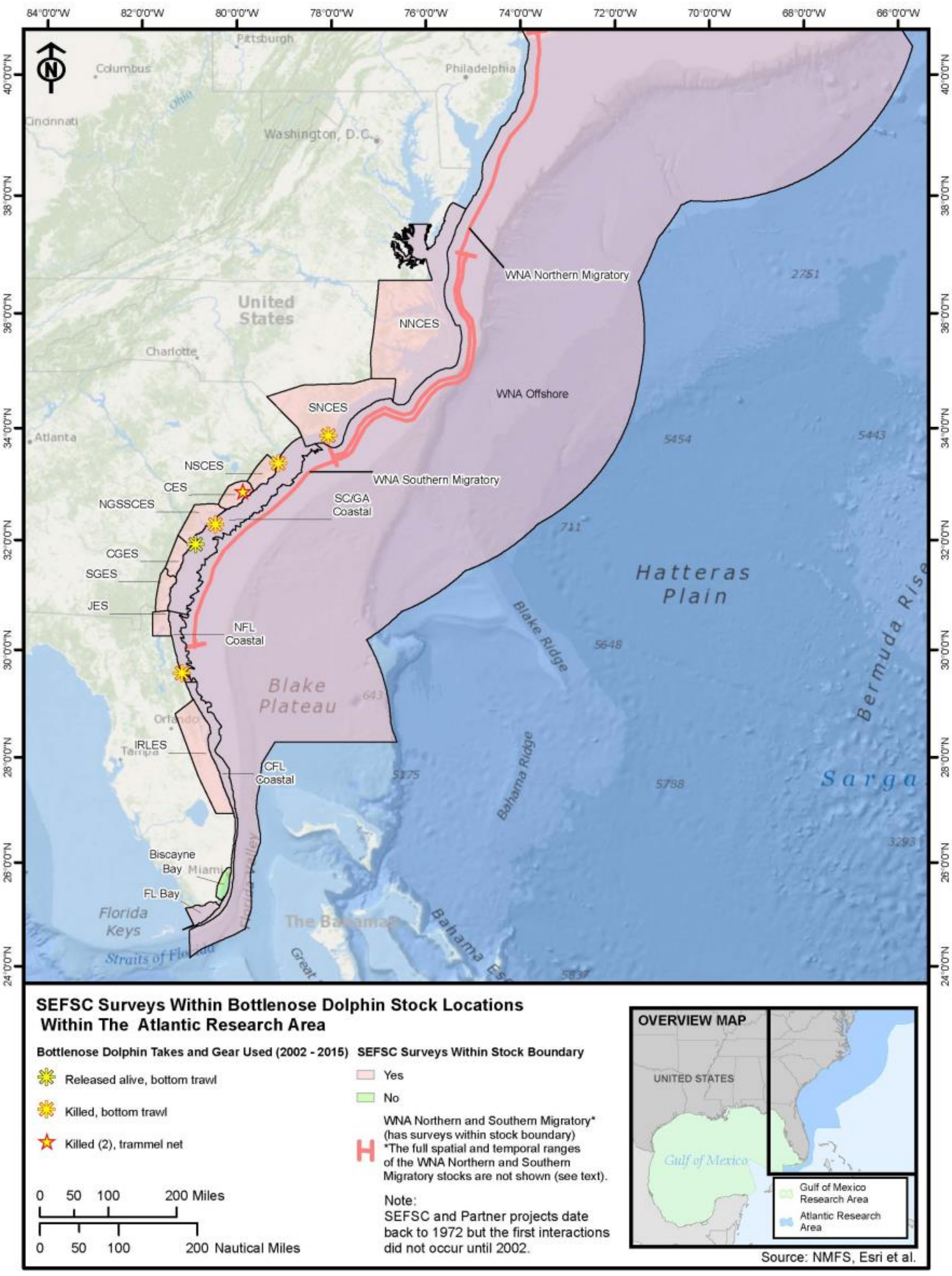

Figure 4.2-4 SEFSC Surveys within Bottlenose Dolphin Stock Boundaries within the Atlantic Research Area

Based on these criteria, the maximum number of takes requested to be authorized for each stock is either one or three dolphins over the five-year authorization period. Stocks with one potential take are for stock areas with small stock size or unknown stock size, or stocks with a low level of SEFSC research activities within the BSE boundary or in adjacent coastal waters. Those with three potential takes requested are stocks with a large stock size, a high concentration of SEFSC research and/or a history of research takes.

Seven of the bay and estuarine stocks in the ARA for which takes are requested have an undetermined PBR due to limitations in population assessment research (Table 4.2-17). For most of the bottlenose dolphin stocks in the ARA for which take is requested and PBR is known, the average annual take represents less than 10 percent of PBR and, if it occurred, would be considered minor in magnitude. For two stocks of bottlenose dolphins in the ARA for which PBR is known (Central Georgia Estuarine stock and Southern Georgia Estuarine stock), the requested take of one animal over the five-year authorization period, if it actually occurred, would be between 10 percent and 20 percent of that stock's PBR and would be considered moderate in magnitude. The seven bay and estuarine stocks with undetermined PBR are also probably small and, if their populations were determined, would also likely have small PBRs and the take request could be a similar percentage of their respective PBRs as the stocks with a calculated PBR. Given the relative infrequency with which take historically occurred (seven bottlenose dolphins from four stocks over 14 years in the ARA), the limited scope of SEFSC research efforts within the ranges of these coastal and estuarine stocks, and the mitigation measures that are implemented during research (see Section 2.2.2), the SEFSC does not expect this level of take to actually occur. The likelihood of taking the maximum number for any one stock is low, as is reaching the upper limit of 10 takes for all stocks combined over five years.

As described above, the population size and status of many bottlenose dolphins stocks in the SEFSC research areas are poorly known, resulting in undetermined PBR values for these stocks. The lack of any recent population information for these stocks prevents this DPEA from providing a quantitative assessment with up-to-date information on the potential impacts of the requested takes of animals from these stocks in SEFSC fisheries and ecosystem research gear. The resulting uncertainty regarding the potential effects on these populations could only be addressed with new field and laboratory research on these stocks. Given the large number of stocks that overlap with SEFSC research activities and the huge geographic area in which they occur, such a research program to better define the populations of this species would be a very large and expensive operation. It is not clear what the prospect is that such a comprehensive research program would be funded in the future but it would likely take years to conduct the research, analyze the data, and incorporate the information into the SARs. This NEPA document is based on the best, currently available information but if new population estimates for one or more stocks of bottlenose dolphins are developed in the future, NMFS will consider the potential impacts of its ongoing fisheries research program and requested take authorizations on an adaptive management basis, including the potential for additional mitigation measures as necessary.

At the requested level of takes for stocks of unknown size, one animal over the five- year authorization period, or 0.2 animals/year, the impact of a take on survival or reproductive success of the stock is unknown. However, the potential impacts can be placed in perspective. From a population dynamics perspective, the sex and age of the animal taken is important where the removal of a reproductive female would have the largest impact on the reproductive success of the stock. If takes were purely random from a sex/age perspective, the probability of a reproductive female being taken is less than 50 percent. The impact of the removal of a reproductive female depends on the size of the population which is taken into account with the PBR perspective. From a PBR perspective, the stock size would have to be 30 individuals or fewer for the requested take to exceed PBR over five years. While again unknown, the likelihood that many stocks, if any, are comprised of 30 individuals or fewer is very remote. Also, the level of taking would have to exceed PBR over an extended period of time to impact the survival of the stock. That is, one instance of one take over five years that exceeds PBR would not in isolation impact the survival of the stock.

The SEFSC LOA application (Appendix C) also includes estimates of the potential number of other cetaceans that may interact with research gear based on their similarity to historically taken species and historical takes in commercial fisheries operating in similar areas and using similar gear types (Table 4. 2-17). The LOA application combines estimated Level A harassment takes with serious injury or mortality takes because the degree of injury resulting from gear interaction cannot be predicted. Note that the LOA application does not request authorization to take all species of marine mammals that occur in the SEFSC research area, only those species considered to have a reasonable risk of adverse interactions with gear used for SEFSC research. The LOA application used precautionary procedures to estimate potential future takes of marine mammals, so these estimates are greater than what is likely to occur in the future, especially for species that have never been taken in the past and that are infrequently encountered during research surveys.

Based on species previously caught in analogous commercial trawl gear, the SEFSC determined that low levels of take of the nine cetacean species shown in Table 4.2-18 over the five-year authorization period in the ARA is an appropriate precautionary estimate. The SEFSC is not requesting takes of large whales and several other cetaceans by trawl gear due to lack of historical interactions and the low probability of take due to species' distribution, density, abundance, and behavior.

The SEFSC has no history of marine mammal takes in longline or other hook-and-line gear (bandit gear and rod and reel deployments) in the ARA (one bottlenose dolphin was taken in a bottom longline in the GOMRA in 2013 and was released alive), so any requested takes are based on takes in analogous research or commercial fishing operations. There are several species, such as large whales, that are known to interact with commercial longline fisheries but for which SEFSC is not requesting take. Other species known to interact with longline gear, such as Risso's dolphins and pilot whales, are included among those for which minimal levels of take (one over the five-year authorization period) are requested in hook-and-line gear (Table 4.2-18).

The LOA application also includes requests for takes of one "undetermined delphinid" in any hook-and-line gear type over the five-year LOA period, for an average annual take of 0.2. This request is made to account for similar looking species that may be caught or entangled in gear, but free themselves or are released before they can be identified or photographed by research personnel. The top priority for live animals is to release them as quickly and safely as possible. The SEFSC ship's crew and research personnel make concerted efforts to identify animals incidentally caught in research gear whenever crew and vessel safety are not jeopardized. This type of situation would be more likely to occur during the night or other periods of poor visibility or weather conditions.

The estimated average annual take for each cetacean species listed in Table 4.2-18 in all gears is well below 10 percent of PBR for all species, and less than one percent for all but one species for which takes are requested. This level of serious injury or mortality, were it to occur, would be considered minor in magnitude for the species. For impact analysis purposes, the undetermined delphinid take is assigned to each delphind stock considered susceptible to hook-and-line gear, i.e., those species for which specific takes were requested in hook-and-line gear. This consideration results in the addition of 0.2 average annual takes to each of those delphind stocks (Table 4.2-18). Even with the addition of these "undetermined" takes, the combined take request would still be well below 10 percent of PBR for all of these stocks and would be considered minor in magnitude.

Entanglements or hookings of cetaceans in SEFSC and research partner fisheries research gear are expected to be rare or infrequent events. The overall impact of the potential takes of these species, if they occurred, would be considered minor or moderate adverse according to the criteria described in Table 4.1-1.

Table 4.2-17 Evaluation of Impact Relative to PBR for all ARA Coastal and Estuarine Stocks of Bottlenose Dolphins Based on the Average Annual Requested Take for all Gears

This table summarizes information presented in the LOA application (Appendix C) on the combined potential takes of bottlenose dolphin stocks by Mortality and Serious Injury (M&SI) and Level A harassment over a five-year period. The gear types for which bottlenose dolphin stocks are requested include trawls, gillnets, trammel nets, longlines, bandit gear, and rod and reel. The table shows all stocks in the ARA but the SEFSC did not request takes from the Biscayne Bay stock due to the lack of fisheries research in that area. Although potential take for each requested stock is either one or three over the five-year period and, if simply added, would equal 25 takes over that period, the maximum requested take, for all gear types combined, is 10 bottlenose dolphins in the ARA over the five-year LOA period. All population estimates, Potential Biological Removal (PBR) values, and total annual mortality and serious injury data are from the most recent stock assessment reports (Waring et al. 2015a, b). Note that PBR is an annual measure of mortality, while the LOA application estimates potential takes for the five-year period. The requested take is presented as an average annual take estimate that can be compared with PBR. Abbreviation: Not Available = NA

Stock	Average Annual Take Request for All Gear Types	PBR	% of PBR Requested
Northern North Carolina Estuarine System	0.2	7.8	2.6%
Southern North Carolina Estuarine System	0.2	undetermined	NA
Northern South Carolina Estuarine System	0.2	undetermined	NA
Charleston Estuarine System	0.2	undetermined	NA
Northern Georgia/Southern South Carolina Estuarine System	0.2	undetermined	NA
Central Georgia Estuarine System	0.2	1.9	10.5%
Southern Georgia Estuarine System	0.2	1.9	10.5%
Jacksonville Estuarine System	0.2	undetermined	NA
Indian River Lagoon Estuarine System	0.2	undetermined	NA
Biscayne Bay	0	undetermined	0%
Florida Bay	0.2	undetermined	NA
Western North Atlantic South Carolina & Georgia Coastal	0.6	31	1.9%
Western North Atlantic Northern Florida Coastal	0.6	7	8.6%
Western North Atlantic Central Florida Coastal	0.6	29	2.1%
Western North Atlantic Northern Migratory Coastal	0.6	86	0.7%
Western North Atlantic Southern Migratory Coastal	0.6	63	0.9%

Table 4.2-18 Other Stocks for which SEFSC is Requesting Incidental Take from the ARA and Evaluation of Impact Relative to PBR

This table summarizes information presented in the LOA application (Appendix C) on the combined potential takes by M&SI and Level A harassment over a five-year period using trawl, longlines, bandit gear, and rod and reel gear. Species included in this table have known takes in analogous gear used in commercial fisheries; none have been taken previously in SEFSC fisheries research. All population estimates, PBR values, and total annual mortality and serious injury data are from the most recent stock assessment reports (Waring et al. 2015a, b). Note that PBR is an annual measure of mortality. The LOA application estimates potential takes for the five-year period and these have been averaged for an annual take estimate that can be compared with PBR.

Species (Stock)	Average Annual Take Request for In Trawls and Hook-and-line Gears	PBR	% of PBR requested	Total Annual Take Request with Undetermined Delphinids	Total Annual Take Request with Undetermined Delphinids as % of PBR
Risso's dolphin (Western North Atlantic)	0.2	126	0.2%	0.4	0.3%
Short-finned pilot whale (Western North Atlantic)	0.2	159	0.1%	0.4	0.3%
Long-finned pilot whale (Western North Atlantic)	0.2	199	0.1%	0.4	0.2%
Short-beaked common dolphin	0.8	1,125	<0.1%	1.0	0.1%
Atlantic spotted dolphin (Western North Atlantic)	0.8	316	0.1%	1.0	0.3%
Pantropical spotted dolphin (Western North Atlantic)	0.2	17	1.2%	0.4	2.4%
Striped dolphin (Western North Atlantic)	0.6	428	0.1%	0.6	0.1%
Bottlenose dolphin (Western North Atlantic Offshore)	0.8	561	0.1%	1.0	0.2%
Harbor porpoise (Gulf of Maine/Bay of Fundy)	0.2	706	<0.1%	0.2	<0.1%
Undetermined delphinid	0.2		NA		
Harbor seal (Western North Atlantic)	0.2	2,006	<0.1%	0.2	<0.1%
Gray seal (Western North Atlantic)	0.2	undetermined	NA	0.2	NA

Pinnipeds

This section describes potential impacts to harbor seals and gray seals. The former hauls out in small numbers in North Carolina during winter, while the latter is known from periodic strandings in the northern part of the SEFSC ARA. The Atlantic Striped Bass Tagging Bottom Trawl Survey is conducted during January and February north of Cape Hatteras, NC and could potentially interact with these species.

Disturbance and behavioral responses due to acoustic equipment

The potential exposure of these two pinniped species to active acoustic sources used in SEFSC research during winter months is very small and the LOA does not include any take requests for these species.

Injury, serious injury, or mortality due to entanglement in gear

Table 4.2-15 shows the recent history of marine mammal takes by all SEFSC research activities. The SEFSC has had no historical interactions with pinnipeds. Measures to mitigate potential risk of entanglements are described in Section 2.2.1.

The SEFSC LOA application (Appendix C) includes estimates of the potential number of marine mammals that may interact with research gear based on historical takes in commercial fisheries operating in similar areas and using similar gear types. Based on seals previously caught in analogous commercial fishing gear (Northeast and Mid-Atlantic bottom trawl fisheries), the SEFSC determined that takes of one harbor seal and one gray seal in trawl gear over the five-year authorization period in the ARA is an appropriate precautionary estimate (Table 4.2-18). The estimated average annual take for harbor seals is less than one percent of PBR and, although PBR is undetermined for gray seals, such a low level of take would likely be equally inconsequential on a population level for that species. This level of mortality, were it to occur, would be considered minor in magnitude for each species.

4.2.4.2 Gulf of Mexico Research Area

<u>ESA-listed species</u>

The endangered marine mammals that regularly occur in the GOMRA include sperm whales and manatees. Manatees are under the jurisdiction of the USFWS, while sperm whales are under the jurisdiction of NMFS in regards to compliance with the MMPA and ESA.

Disturbance and behavioral responses due to acoustic equipment

The LOA application (Appendix C) includes calculations of the number of marine mammals that may be exposed to sound levels above 160 dB from all acoustic devices used during SEFSC research activities in the GOMRA. Those calculations include a number of assumptions and elements with large variables over time and space (e.g., the volumetric densities of marine mammals and the propagation of sound under different conditions). The SEFSC believes this quantitative approach benefits from its simplicity and consistency with current NMFS guidelines on estimating Level B harassment by acoustic sources, but cautions that the resulting take estimates should be considered as overestimates of behavioral harassment from acoustic devices. The DPEA summarizes the results of those estimates in Table 4.2-19 below, but see Appendix C for a detailed discussion about the derivation of and concerns about the accuracy of these estimates. The likely impact on ESA-listed species (primarily sperm whales) in the GOMRA from the different types of acoustic devices is as discussed above for the ARA in Section 4.2.4.1.

Table 4.2-19 Estimated Level B Harassment Takes of Marine Mammals by Acoustic Sources during SEFSC Research in the GOMRA

Take estimates summarized in this table are for all relevant active acoustic sources combined. Takes are for all stocks combined for species with multiple stocks in the Gulf of Mexico Research Area.

Species (Common name)	Total Estimated Level B Take (numbers of animals)	Species (Common name)	Total Estimated Level B Take (numbers of animals)
Bryde's whale	1	**Short-finned pilot whale**	4
Sperm whale [1]	36	**Atlantic spotted dolphin**	198
Pygmy or dwarf sperm whale	152	**Pantropical spotted dolphin**	203
Pygmy killer whale	2	**Striped dolphin**	16

Species (Common name)	Total Estimated Level B Take (numbers of animals)	Species (Common name)	Total Estimated Level B Take (numbers of animals)
False killer whale	2	**Rough-toothed dolphin**	23
Mesoplodont beaked whales	76	**Clymene dolphin**	20
Melon-headed whale	11	**Spinner dolphin**	41
Risso's dolphin	12	**Bottlenose dolphin (numerous stocks)[2]**	635

1. ESA-listed species

2. Estimated take is for all stocks combined. Refer to Table 3.2-9 for stock delineations.

Injury, serious injury, or mortality due to entanglement in gear

Table 4.2-15 and Figure 4.2-2 indicate marine mammal takes by all SEFSC research activities from 2002 through 2015. There have been no takes of threatened or endangered marine mammals in the GOMRA by any SEFSC fisheries research activities. The SEFSC is not requesting the take of large whales or other ESA-listed marine mammals due to lack of historical interactions and the low probability of take due to several factors, including density, abundance, distribution, and behavior of these species.

Measures to mitigate the risk of entanglements are described in Section 2.2.1. Vessel captains, bridge officers, and crew watch for marine mammals while underway and while setting fishing gear and take action to avoid them. The lack of entanglements of ESA-listed marine mammals indicates that the risk of these types of interactions in SEFSC fisheries research gear is low. The potential effects from entanglement in research gear is, therefore, considered minor adverse for ESA-listed species throughout the GOMRA during all seasons using gear types similar to those currently in use.

<u>Other cetaceans</u>

This section describes impacts to cetaceans that are not ESA-listed. Bryde's whale is the only baleen whale species included in this section. All other species considered here are toothed whales (odontocetes), including small whales, dolphins, and porpoises.

Disturbance and behavioral responses due to acoustic equipment

The analysis and likely impact of acoustic effects on these species is similar to that discussed for ESA-listed species above and for the ARA in Section 4.2.4.1. Table 4.2-19 provides summaries of the numbers of each species that could be taken by Level B acoustic harassment during SEFSC research activities in the GOMRA.

The mid-frequency odontocetes (e.g., pilot whales, killer whales, beaked whales, and dolphins) have a functional hearing range of 150 Hz to 160 kHz, with highest sensitivity from 10-120 kHz. The high-frequency odontocetes (e.g., dwarf and pygmy sperm whales) have a functional hearing range of 200 Hz to 180 kHz, with highest sensitivity from 10-150 kHz. The output frequencies of Category 1 active acoustic sources (>300 kHz) are above the functional hearing range of baleen whales and cetaceans in the mid- and high-frequency hearing groups (Figure 4.2-3). Because they would not be able to hear them, cetaceans are not expected to be affected by Category 1 sound sources (Appendix C, Section 6.2).

Most Category 2 active acoustic sources are operated at frequencies unlikely to be heard by most baleen whales but are within the range of hearing for various odontocetes, especially high frequency hearing *Kogia* species. One acoustic device used by the SEFSC is infrequently used at 18 kHz so there is a potential for nearby baleen whales to hear these devices when they are used. Some of these devices are used on trawl nets during fishing so their use is intermittent, localized and directional, and they are deployed on moving sources. Other Category 2 devices, such as echosounders and current profilers, may be deployed continuously or over long periods during a research cruise. These sound sources are highly directional. The sounds could be loud to cetaceans in close proximity to the sound source but physical damage is unlikely, although TTS could occur if animals remained close to the source (tens to a few hundred meters) for prolonged periods (Appendix C, Section 6.2). Deployment of such devices on moving vessels/gear, their narrow beam widths, and the short duration of most research tows (< 30 minutes) should minimize that likelihood. If detected, short term avoidance is the most likely response (Appendix C, Section 6.2).

There have been no documented cases of marine mammals being disturbed or changing their behavior in response to SEFSC research vessels other than bow-riding by dolphins, which is common with marine vessels and generally not considered a detrimental effect on the animals. The active sound sources used during fisheries research may be detected by odontocetes, particularly higher frequency hearing *Kogia* species. Sound emission from these active sources is short-term in any localized area. The most likely effect on cetaceans would be localized and temporary avoidance (Appendix C, Section 6.2). Potential disturbance from active acoustic equipment used during research would, therefore, not have any measurable effect on the population of any cetacean and would be considered minor in magnitude. Such disturbance is likely to occur wherever survey vessels use the equipment, but cetaceans would only be close enough to a vessel to be affected on a rare or intermittent basis and any behavioral changes would be temporary. The overall impact of active acoustic sound sources on non ESA-listed cetaceans throughout the GOMRA is considered to be minor adverse according to the criteria in Table 4.1-1.

Injury, serious injury, or mortality due to entanglement/hooking in gear

Table 4.2-15 shows the recent history of marine mammal takes by all SEFSC research activities, which includes four bottlenose dolphins from two different stocks in the GOMRA. Two died and two were released alive. Takes occurred in skimmer trawls, a bottom longline, and a gillnet. Measures to mitigate the risks of entanglements are described in Section 2.2.1.

The bottlenose dolphin is the only species historically taken during SEFSC fisheries research, and all takes were from coastal or bay, sound, and estuarine (BSE) stocks. Due to the number, complexity, and uncertainties regarding bottlenose dolphin stocks, all stocks were considered in the take request in addition to those historically taken (Table 4.2-20). Methodology used to calculate potential requested takes of bottlenose dolphin stocks in the GOMRA are as described above for the ARA in Section 4.2.4.1. Generally only those stocks whose ranges overlap with SEFSC and research partner fisheries research activity have been requested for potential take by the SEFSC. Figure 4.2-5 illustrates stock boundaries within which SEFSC fisheries research occurs within the GOMRA. Additionally, in some cases BSE stocks include a strip of coastal waters up to 3 km wide. When BSE stocks are studied, the BSE dolphins are usually found to use a narrow strip of coastal waters; therefore, research that occurs in coastal waters very close to the boundary of a BSE stock area has the potential to impact that stock. For this reason, the SEFSC has included potential takes of bottlenose dolphins from three stocks (Sabine Lake, Terrebone Bay, and Barataria Bay) where SEFSC fisheries research does not directly overlap but occurs in nearby coastal waters.

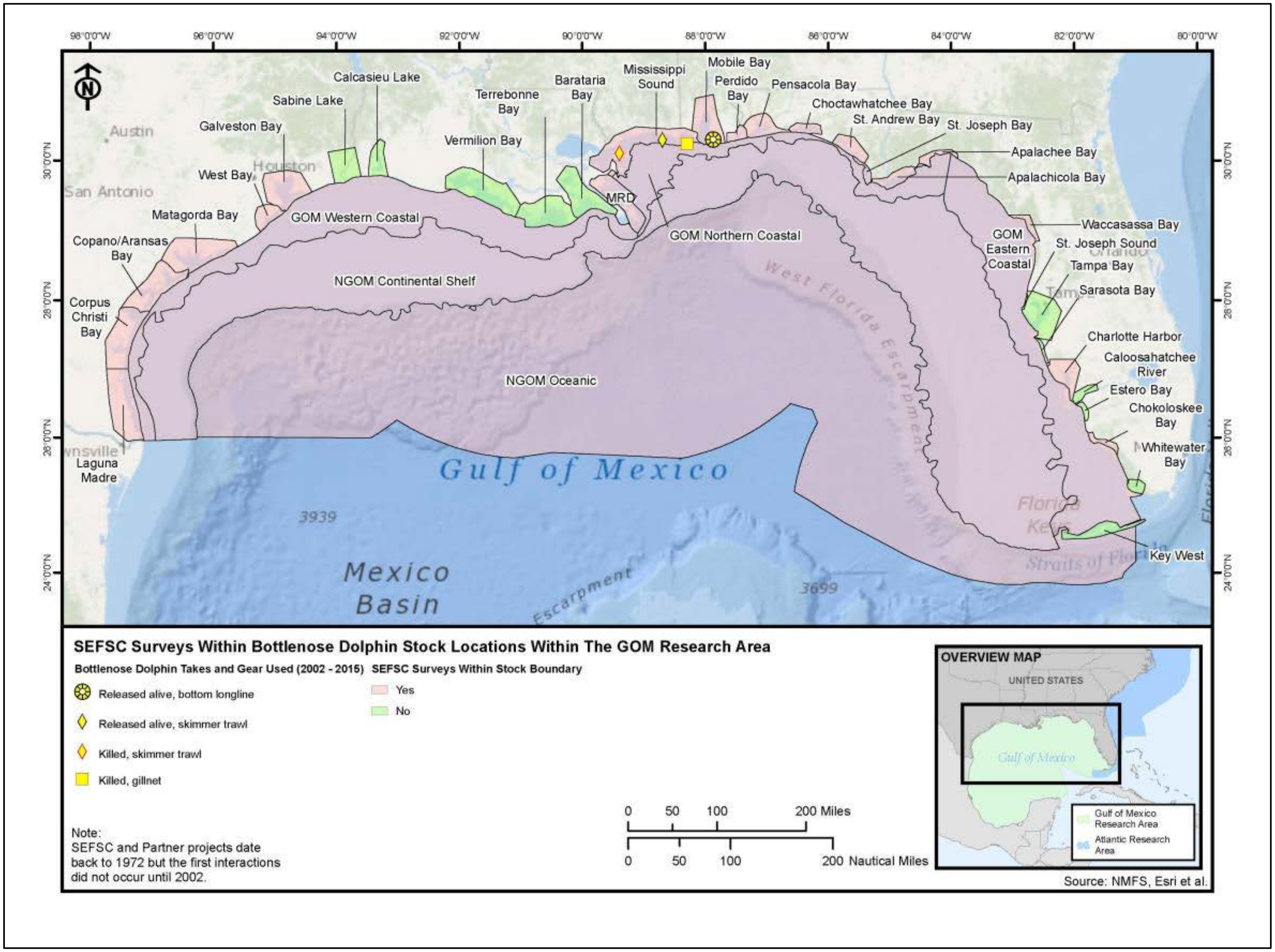

Figure 4.2-5 SEFSC Surveys within Bottlenose Dolphin Stock Boundaries within the Gulf of Mexico Research Area

Table 4.2-20 shows the maximum number of potential takes requested for each stock (not to exceed 10 total takes for all stocks combined in the GOMRA). The LOA application includes take requests for 22 stocks from the Northern Gulf of Mexico Bay, Sound, and Estuarine Stock complex, 17 of which have an undetermined PBR due to limitations in population assessment research. For all but one of these stocks the SEFSC is requesting one take over the five-year authorization period. The exception is the Mississippi Sound/Lake Bornge/Bay Boudreau stock, which has been taken historically in SEFSC fisheries research and for which the SEFSC has requested three potential takes over the five-year authorization period. Four of the five requested BSE stocks where PBR has been determined (Mississippi River Delta, Mississippi Sound/Lake Bornge/Bay Boudreau, Choctwhatchee Bay, and St. Joseph Bay) have small PBRs and the average annual take request would be between 10 percent and 15 percent of PBR. This level of take, if it occurred, would be considered to be a moderate magnitude of impact on these stocks. For the other requested stock with a determined PBR (St. Vincent Sound/Apalachiola Bay/St. George Sound), the requested take would be less than 10 percent of PBR and would be considered minor in magnitude. Many of the stocks with undetermined PBR are also small and, if their populations were determined, would also likely have small PBRs and the take request could be a similar percentage of their respective PBRs as the five stocks with a calculated PBR.

As described for bottlenose stocks in the ARA, there are a large number of stocks in the GOMRA with unknown population estimates and undetermined PBR values. The lack of any recent population information for these stocks prevents this DPEA from providing a quantitative assessment with up-to-date information on the potential impacts of the requested takes of animals from these stocks in SEFSC fisheries and ecosystem research gear. The resulting uncertainty regarding the potential effects on these populations could only be addressed with new field and laboratory research on these stocks, which is limited due to funding. This NEPA document is based on the best, currently available information but if new population estimates for one or more stocks of bottlenose dolphins are developed in the future, NMFS will consider the potential impacts of its ongoing fisheries research program and requested take authorizations on an adaptive management basis, including the potential for additional mitigation measures as necessary.

The SEFSC LOA application (Appendix C) also includes estimates of the potential number of other cetaceans that may interact with research gear based on their similarity to historically taken species and historical takes in commercial fisheries operating in similar areas and using similar gear types (Table 4.2-21). The LOA application combines estimated Level A harassment takes with serious injury or mortality takes because the degree of injury resulting from gear interaction cannot be predicted. Note that the LOA application does not request authorization to take all species of marine mammals that occur in the SEFSC research area, only those species considered to have a reasonable risk of adverse interactions with gear used for SEFSC research. The LOA application used precautionary procedures to estimate potential future takes of marine mammals, so these estimates are greater than what is likely to occur in the future, especially for species that have never been taken in the past and that are infrequently encountered during research surveys.

Based on species previously caught in analogous commercial fishing gear, the SEFSC determined that low levels of takes of the ten cetacean species shown in Table 4.2-21 over the five-year authorization period in the GOMRA is an appropriate precautionary estimate. The SEFSC is not requesting takes of large whales and several other cetaceans by trawl gear due to lack of historical interactions and the low probability of take due to species' distribution, density, abundance, and behavior.

The only SEFSC take of a marine mammal in longline gear occurred in 2013 and involved a single bottlenose dolphin in a bottom longline survey in the GOMRA. The animal was released alive. Therefore, requested takes are largely based on takes in analogous non-SEFSC research or commercial fishing operations. There are several species, such as large whales, that are known to interact with commercial longline fisheries but for which SEFSC is not requesting take. Other species known to interact with hook-and-line gear, such as Risso's dolphins and pilot whales, are included among those for which low levels of take are requested (Table 4.2-21). The likelihood of interacting with SEFSC hook-and-line gear is small considering the low level of survey effort (small numbers of short sets of limited length gear) and the mitigation measures employed so the SEFSC is requesting a minimal number of potential takes in hook-and-line research gear, one take of each species over the five-year authorization period (Table 4.2-21).

The LOA application also includes requests for takes of one "undetermined delphinid" in any hook-and-line gear type over the five-year LOA period, for an average annual take of 0.2. This request is made to account for similar looking species that may be caught or entangled in gear, but free themselves or are released before they can be identified or photographed by research personnel. The top priority for live animals is to release them as quickly and safely as possible. The SEFSC ship's crew and research personnel make concerted efforts to identify animals incidentally caught in research gear whenever crew and vessel safety are not jeopardized. This type of situation would be more likely to occur during the night or other periods of poor visibility or weather conditions.

The estimated average annual take for each specified cetacean species--other than the coastal and BSE bottlenose dolphin stocks--is below 10 percent of PBR for all species (Table 4.2-21**).** This level of mortality, were it to occur, would be considered minor in magnitude.

For impact analysis purposes, the undetermined delphinid take is assigned to each delphind stock considered susceptible to hook-and-line gear, i.e., those species for which specific takes were requested in hook-and-line gear. This consideration results in the addition of 0.2 average annual takes to each of those delphind stocks (Table 4.2-21). Even with the addition of these "undetermined" takes, the combined take request would still be below 10 percent of PBR for almost all of these stocks (except rough-toothed dolphin) and would be considered minor on the population level. For rough-toothed dolphin, the combined take request, if it occurred, would be between 10 percent and 20 percent of that stock's PBR and would be considered moderate on the population level. Given the fact that this species has never been taken historically by the SEFSC and the mitigation measures that are implemented during research, the SEFSC does not expect this level of take to actually occur.

These potential mortalities would likely be rare or infrequent events. The overall impact of the potential takes of these species, if they occurred, would be considered minor to moderate adverse according to the criteria described in Table 4.1-1.

Table 4.2-20 Evaluation of Impact Relative to PBR for all GOMRA Coastal and BSE Stocks of Bottlenose Dolphins Based on the Average Annual Requested Take for all Gears

This table summarizes information presented in the LOA application (Appendix C) on the combined potential takes of bottlenose dolphin stocks by M&SI and Level A harassment over a five-year period. The gear types for which these bottlenose dolphin stocks are requested include trawls, gillnets, trammel nets, longlines, bandit gear, and rod and reel gear. The table shows all stocks in the GOMRA but the SEFSC did not request takes from all stocks due to the lack of fisheries research in those areas. Although potential take for each requested stock is either one or three over the five-year period and, if simply added, would equal 33 takes over that period, the maximum requested take, for all gear types combined, is 10 bottlenose dolphins from the coastal and BSE stocks in the GOMRA over the five-year LOA application period. All population estimates and PBR values are from the most recent stock assessment reports (Waring et al. 2015a,b). Note that PBR is an annual measure of mortality, while the LOA application estimates potential takes for the five-year period. The requested take is presented as an average annual take estimate that can be compared with PBR.

Stock	Average Annual Take Request for all Gear	PBR	% of PBR Requested
Northern Gulf of Mexico Western Coastal Stock	0.6	175	0.3%
Northern Gulf of Mexico Northern Coastal Stock	0.6	60	1.0%

Stock	Average Annual Take Request for all Gear	PBR	% of PBR Requested
Northern Gulf of Mexico Eastern Coastal Stock	0.6	111	0.5%
Northern Gulf of Mexico Bay, Sound, and Estuarine Stocks (31 stocks below)			
Laguna Madre	0.2	undetermined	NA
Nueces Bay, Corpus Christi Bay	0.2	undetermined	NA
Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espirtu Santo Bay	0.2	undetermined	NA
Matagorda Bay, Tres Palacios Bay, Lavaca Bay	0.2	undetermined	NA
West Bay	0.2	undetermined	NA
Galveston Bay, East Bay, Trinity Bay	0.2	undetermined	NA
Sabine Lake	0.2	undetermined	NA
Calcasieu Lake	0	undetermined	0%
Atchalfalaya Bay, Vermilion Bay, West Cote Blanche Bay	0	undetermined	0%
Terrabonne Bay, Timbalier Bay	0.2	undetermined	NA
Barataria Bay Estuarine System	0.2	undetermined	NA
Mississippi River Delta	0.2	1.7	11.8%
Mississippi Sound, Lake Bornge, Bay Boudreau	0.6	5.6	10.7%
Mobile Bay, Bonsecour Bay	0.2	undetermined	NA
Perdido Bay	0.2	undetermined	NA
Pensacola Bay, East Bay	0.2	undetermined	NA
Choctwhatchee Bay	0.2	1.7	11.8%
St. Andrew Bay	0.2	undetermined	NA
St. Joseph Bay	0.2	1.4	14.3%
St. Vincent Sound, Apalachiola Bay, St. George Sound	0.2	3.9	5.1%
Apalachee Bay	0.2	undetermined	NA
Waccasassa Bay, Withlacoochee Bay, Crystal Bay	0.2	undetermined	NA
St. Joseph Sound, Clearwater Harbor	0	undetermined	0%
Tampa Bay	0	undetermined	0%
Sarasota Bay, Little Sarasota Bay	0	1.6	0%
Pine Island Sound, Charlotte Harbor, Gasparilla Sound, Lemon Bay	0.2	undetermined	NA
Caloosahatchee River	0	undetermined	0%
Estero Bay	0	undetermined	0%
Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay	0.2	undetermined	NA
Whitewater Bay	0	undetermined	0%
Florida Keys-Bahia Honda to Key West	0	undetermined	0%

Table 4.2-21 Other Stocks for which SEFSC is Requesting Incidental Take from the GOMRA and Evaluation of Impact Relative to PBR

This table summarizes information presented in the LOA application (Appendix C) on the combined potential takes by M&SI and Level A harassment over a five-year period using trawl, longlines, bandit gear, and rod and reel gear. Species included in this table have known takes in analogous gear used in commercial fisheries; none have been taken previously in SEFSC fisheries research. All population estimates and PBR values are from the most recent stock assessment reports (Waring et al. 2015a,b). Note that PBR is an annual measure of mortality. The LOA application estimates potential takes for the five-year period and these have been averaged for an annual take estimate that can be compared with PBR.

Species (Stock)	Average Annual Take Request In Trawls and Hook-and-line Gears	PBR	% of PBR Requested	Total Annual Take Request with Undetermined Delphinids	Total Annual Take Request with Undetermined Delphinids as % of PBR
Melon-headed whale	0.6	13	4.6%	0.6	4.6%
Risso's dolphin	0.2	16	1.3%	0.4	2.5%
Short-finned pilot whale	0.2	15	1.3%	0.4	2.7%
Atlantic spotted dolphin	0.8	undetermined	NA	1.0	NA
Pantropical spotted dolphin	0.8	407	0.2%	1.0	0.2%
Striped dolphin	0.6	10	6.0%	0.6	6.0%
Rough-toothed dolphin	0.2	3	6.7%	0.4	13.3%
Spinner dolphin	0.6	62	1.0%	0.6	1.0%
Bottlenose dolphin (Northern Gulf of Mexico Continental Shelf)	0.8	469	0.2%	1.0	0.2%
Bottlenose dolphin (Northern Gulf of Mexico Oceanic)	0.8	42	1.9%	1.0	2.4%
Undetermined delphinid	0.2		NA		

4.2.4.3 Caribbean Research Area

ESA-listed species

The endangered marine mammals that occur in the CRA include humpback whales, sperm whales, and West Indian manatees. Manatees are under the jurisdiction of the USFWS, while humpback and sperm whales are under the jurisdiction of NMFS in regards to compliance with the MMPA and ESA.

Disturbance and behavioral responses due to acoustic equipment

The LOA application (Appendix C) includes calculations of the number of marine mammals that may be exposed to sound levels above 160 dB from all acoustic devices used during SEFSC research activities in the GOMRA. Those calculations include a number of assumptions and elements with large variables over time and space (e.g., the volumetric densities of marine mammals and the propagation of sound under different conditions). The SEFSC believes this quantitative approach benefits from its simplicity and consistency with current NMFS guidelines on estimating Level B harassment by acoustic sources, but cautions that the resulting take estimates should be considered as overestimates of behavioral harassment from acoustic devices. The DPEA summarizes the results of those estimates in Table 4.2-22 below, but see Appendix C for a detailed discussion about the derivation of and concerns about the accuracy of these estimates. The likely impact on ESA-listed species (sperm whales) in the CRA from the different types of acoustic devices is as discussed above for the ARA in Section 4.2.4.1.

Table 4.2-22 Estimated Level B Harassment Takes of Marine Mammals by Acoustic Sources during SEFSC Research in the CRA

Take estimates summarized in this table are for all relevant active acoustic sources combined. Takes are for all stocks combined for species with multiple stocks in the Caribbean Research Area.

Species	Total Estimated Level B Take (numbers of animals)	Species	Total Estimated Level B Take (numbers of animals)
Sperm whale [1]	4	**Short-finned pilot whale**	1
Pygmy/dwarf sperm whale	17	**Pantropical spotted dolphin**	22
Pygmy killer whale	1	**Striped dolphin**	2
False killer whale	1	**Rough-toothed dolphin**	2
Mesoplodont beaked whales	9	**Clymene dolphin**	3
Melon-headed whale	2	**Spinner dolphin**	5
Risso's dolphin	2	**Bottlenose dolphin**	6

1. ESA-listed species

Injury, serious injury, or mortality due to entanglement/hooking in gear

There have been no historical takes of ESA-listed species of marine mammals in the CRA and the SEFSC is not anticipating any future takes of ESA-listed species in the CRA because the risk of interactions with fisheries research gear used in the CRA is very low. The potential effects from entanglement in research gear is, therefore, considered minor adverse for ESA-listed species throughout the CRA during all seasons using gear types similar to those currently in use.

Other cetaceans

This section describes impacts to cetaceans that are not ESA-listed. All species considered here are toothed whales (odontocetes), including small whales, dolphins, and porpoises.

Disturbance and behavioral responses due to acoustic equipment

The analysis and likely impact of acoustic effects on these species is similar to that discussed for ESA-listed species above and for the ARA and GOMRA in Sections 4.2.4.1 and 4.2.4.2. Table 4.2-22 provides summaries of the numbers of each species that could be taken by Level B acoustic harassment during SEFSC research activities in the CRA.

Injury, serious injury, or mortality due to entanglement/hooking in gear

There have been no historical takes of marine mammals by SEFSC in the CRA. In addition, there are no documented takes in Caribbean fisheries, including gillnet or beach seine fisheries, over the last five years. Potential takes are, therefore, estimated based on takes in analogous commercial fisheries using hook-and-line gear in the Gulf of Mexico. Potential numbers of non-ESA-listed marine mammals that may be taken during the course of SEFSC fisheries research in the CRA are shown in Table 4.2-23. Included on this table and in the LOA application, is a requested take of one "undetermined delphinid" in hook-and-line gear over the five-year LOA period, for an average annual take of 0.2. This request is made to account for similar looking species that may be hooked or entangled in gear, but free themselves or are released before they can be identified or photographed by research personnel. This type of situation would be more likely to occur during the night or other periods of poor visibility.

Since population estimates are unknown and PBR cannot be determined for any of the species included here, quantitative impact analysis and determinations are not possible. As is the case for many bottlenose dolphin stocks in the ARA and GOMRA, additional field research on the status of these stocks would be required to provide the basis for a quantitative assessment. However, the potential take levels are sufficiently small that impacts are likely to be minor for most species. If new population estimates for one or more cetacean stocks in the CRA are developed in the future, NMFS will consider the potential impacts of its ongoing fisheries research program and requested take authorizations on an adaptive management basis, including the potential for additional mitigation measures as necessary.

Table 4.2-23 Stocks for which SEFSC is Requesting Incidental Take from the CRA and Evaluation of Impact Relative to PBR

This table summarizes information presented in the LOA application (Appendix C) on the combined potential takes by M&SI and Level A harassment over a five-year period in longlines, bandit gear, and rod and reel gear. All species included in this table are requested based on analogous gear used in commercial fisheries in other research areas; none have been taken previously in SEFSC fisheries research. There are no population estimates for these species in this area and PBR values are undetermined (Waring et al. 2015a).

Species	Average Annual M&SI and Level A Take Request (animals per year)	PBR	% of PBR requested
Risso's dolphin	0.2	undetermined	NA
Short-finned pilot whale	0.2	undetermined	NA
Atlantic spotted dolphin	0.2	undetermined	NA
Pantropical spotted dolphin	0.2	undetermined	NA
Bottlenose dolphin (Puerto Rico & U.S.V.I stock)	0.2	undetermined	NA
Undetermined delphinid	0.2		

4.2.4.4 Conclusion

Potential direct and indirect effects of SEFSC research activities on marine mammals have been considered for all gear used in research under the Status Quo Alternative. Given the very small amounts of fish and invertebrates removed from the ecosystem during scientific sampling, the dispersal of those sampling efforts over large geographic areas, and the short duration of sampling efforts, the overall risk of causing changes in food availability for marine mammals is considered minor adverse. Also, given the crew training, required emergency equipment, and adherence to environmental safety protocols on NOAA research vessels and NOAA chartered vessels, the risk of altering marine mammal habitat through contamination from accidental discharges into the marine environment is considered minor adverse.

All species may be exposed to sounds from active acoustic equipment used in SEFSC research, although several acoustic sources are not likely audible to many species. Those that are audible would likely cause temporary and minor changes in behavior for nearby animals as the ships pass through a given area. The potential for temporary threshold shifts in hearing is low for high frequency cetaceans (pygmy and dwarf sperm whales and harbor porpoise) and very low to zero for other species, particularly low frequency cetaceans. The potential for hearing loss or injury to any marine mammal is essentially zero. Because of the minor magnitude of effects and temporary duration of acoustic disturbance, the overall effects of acoustic disturbance are considered minor adverse for all species throughout the SEFSC research areas.

Bottlenose dolphins are the only marine mammal species historically caught in SEFSC research gear. In addition, the complex stock structure, delineation, and minimal abundance information for the 54 bottlenose dolphin stocks in the SEFSC research areas necessitated analysis of potential takes and impacts separately for this species. The estimated annual average potential takes for most stocks for which PBR is known and takes are requested would be at or below 10 percent of PBR and would be considered to have minor magnitudes of effect at the population level; the remainder could have average annual takes between 10 percent and 20 percent of PBR and, if such takes occurred, would be considered of moderate magnitude. The lack of recent population information for many stocks prevents a quantitative assessment of the potential impact of requested takes for stocks with undetermined PBR. If new population estimates for one or more stocks of bottlenose dolphins are developed in the future, NMFS will consider the potential impacts of its ongoing fisheries research program and requested take authorizations on an adaptive management basis, including the potential for additional mitigation measures as necessary.

Historic take data and other data on mortalities in commercial fisheries using similar gear were used to estimate potential takes (combined Level A harassment and serious injury and mortality) in the next five years, which include a suite of mitigation measures implemented for SEFSC surveys. Future takes, if they occur, would likely be fewer than that estimated since estimates are based on a precautionary approach to ensure accounting for a maximum amount of potential take. The annual average number of requested takes for most non-bottlenose dolphin species in the ARA and GOMRA are less than 10 percent of PBR and would be considered to have minor magnitudes of effect at the population level. The exception is for rough-toothed dolphins, where the requested take, including an assigned take for "undetermined delphinids" would be moderate in magnitude. PBR is undetermined for CRA species so no quantitative assessment of potential impacts is possible. Adverse interactions with research gear would likely continue to occur rarely but could occur anywhere the SEFSC conducts fisheries research; impacts would likely be dispersed over time and space.

The overall effects of the Status Quo Alternative on marine mammals would be minor to moderate in magnitude, dispersed over a large geographic area, and non-mortality impacts would be temporary or short-term in duration, and would therefore be considered minor to moderate adverse according to the impact criteria in Table 4.1-1.

4.2.5 Effects on Birds

This section describes the general types of effects of the Status Quo Alternative on seabirds. Seabirds occur throughout the year in all research areas concurrent with SEFSC research activities. The potential effects of research vessels, survey gear, and other associated equipment on seabirds include:

- Injury or mortality due to ship strikes and entanglement in gear
- Changes in food availability due to survey removal of prey and discards
- Contamination or degradation of habitat

4.2.5.1 Injury or Mortality from Surveys

There are several potential mechanisms for SEFSC research activities to cause injury or mortality to seabirds. Many birds are attracted to fishing vessels in order to forage on bait, offal, discards, and natural prey disturbed by the fishing operation. This attraction to fishing vessels creates the opportunity for birds to inadvertently collide with cables or lines and other structures on the vessel as well as being caught in the fishing gear. Bird strikes are probably most numerous during the night and during storms or foggy conditions when bright deck lights are on, which can cause the birds to become disoriented (NMFS

2004). However, such collisions with gear or vessels are hard to detect, especially without a dedicated research effort to monitor bird interactions.

Commercial fisheries using gillnets, longlines, trawls, and dredges have all been documented to take various species of seabirds and a number of species are considered to have potential population-level effects as a result (Zollett 2009).

The Southeast U.S. Waterbird Conservation Plan (Hunter et al. 2006) identified populations of red-throated loon, common loon, northern gannet, horned grebe, black-capped petrel, Bermuda petrel, and Audubon's shearwater as negatively impacted by interactions with fisheries.

Keene (et al. 2006) reports that the Observer Program recorded 128 birds caught in commercial longline fisheries in the Northwest Atlantic between 1992 and 2004. Almost half (58) were recorded as unidentified seabirds. Of the species identified, shearwaters (greater and unidentified) and gulls (laughing, herring, black-backed, and unidentified) were the most numerous, followed by northern gannett and one Wilson's storm petrel. Seventy percent were killed.

Fisheries research surveys use several gear types that have been demonstrated to result in seabird mortality including bottom trawls, longlines, and gillnets. No ESA-listed species are expected to be affected by the SEFSC research activities because the habitats used by the two shorebird species (piping plover and red knot) would generally not overlap with the deeper-water habitats where project activities would occur, and neither of the two listed seabird species (roseate tern and Bermuda petrel), has ever been documented as bycatch. Interactions with fisheries have not been identified as a conservation threat for any of these species (Zollett 2009).

The only records of bird interactions with fishing gear during the SEFSC conducted or funded research activities are listed in Table 4.2-24.

Table 4.2-24 Historical Takes of Birds in Research Gear during SEFSC Surveys from 2007 to 2014

All takes occurred in the Atlantic Research Area. Data are from NMFS Protected Species Incidental Take database.

Survey Name	Species Taken	Gear	Date (Time) Taken	# Killed	# Released Alive Injured	# Released Alive Uninjured	Total Taken	Notes
SEAMAP-SA Coastal Trawl Survey Spring (SCDNR)	Brown pelican	Bottom Trawl	4/11/2014	1	0	0	1	Pelican dove and got hung on sugar line. Release was unsuccessful.
SEAMAP-SA Coastal Trawl Survey Spring (SCDNR)	Brown pelican	Bottom Trawl	4/22/2014	1	0	0	1	Pelican dove and got hung on sugar line. Release was unsuccessful. Diving in front of sugar line is very rare outside of FL. Did not catch event fast enough for successful release.
SEAMAP-SA Red Drum Bottom Longline Survey (NCDENR)	Brown pelican	Bottom Longline	6/19/2007	0	0	2	2	Pelicans were observed on line and immediately released - flew away in good condition.

Brown pelicans were listed as threatened in 1970 but have since recovered and were delisted in 2009. While the interactions had an adverse effect, the loss of two birds and disturbance of two more is not expected to affect population levels. On NOAA vessels or chartered vessels, any seabirds caught during survey efforts would be recorded. It is usually very difficult to detect seabird collisions with gear or vessels but there are no records of any bird mortalities due to ship strikes during SEFSC conducted fisheries research activities. There is a potential for this to occur, but is likely to be a relatively rare event. Although it is less likely that commercial fishing vessels participating in cooperative or independent research surveys would record or report any incidental catches of seabirds if they occurred, given the low number of seabird interactions on NOAA ships over time and the similar types of sampling efforts in cooperative research, it is likely that any incidental catches of seabird would be rare events and affect small numbers of birds.

4.2.5.2 Changes in Food Availability

Fishing activities can adversely affect seabirds through changing the abundance or distribution of their prey species. A recent study (Cury et al. 2011) examined data from the past 45 years and all of the world's oceans and found that when prey abundance (small fish and invertebrates) dropped below one third of maximum documented biomass, seabird reproductive success declined significantly. This held true for species all over the world. Many factors influence the abundance and distribution of seabird prey, including strong roles for oceanographic and weather fluctuations, but commercial fisheries are also a factor. Although it is very difficult to demonstrate the indirect effects of fishing for other species and size classes on the availability of prey for seabirds, directed fishing on small schooling fish (e.g., sardines and anchovies) and invertebrates (e.g., krill) have played major roles in driving seabird prey populations below the "one third" limit in many areas (Cury et al. 2011).

Fishing activities may also have beneficial effects on seabirds by providing offal and discards that would otherwise be unavailable to birds. In some areas with intensive fishing efforts, offal may provide a substantial portion of the total food consumed by scavenging species such as gulls (Tasker and Furness 1996). However, while scavenging may benefit individual birds, it also places them in danger from entanglement and incidental mortalities in fishing gear.

The short duration of fisheries research tows, the dispersal of research effort over wide areas of sea, and the relatively small number of research surveys over time makes it very unlikely that the abundance or distribution of seabird prey would be affected by research activities. This is especially true for the small size classes of fish and pelagic invertebrates favored by most seabirds because of their large biomasses and the minimal amounts taken in research samples (Sections 4.2.3 and 4.2.7). For the same reasons, the amount of food made available through research activities is unlikely to have more than temporary and highly localized beneficial effects on seabirds.

4.2.5.3 Contamination or Degradation of Habitat

For the same reasons described for fish (Section 4.2.3) and marine mammals (Section 4.2.4), potential effects on seabirds from accidental discharges of fuel or other contaminants from SEFSC research vessels are possible but unlikely to occur in the near future. If an accidental discharge does occur, it is likely to be a rare event and the potential volume of material is likely to be small and localized. The potential impacts to seabirds would be similarly short-term, localized, and likely affect a small number of animals. The overall impact of accidental contamination of seabirds would therefore be considered minor adverse. This type of potential effect on seabirds will not be discussed further in this analysis.

4.2.5.4 Conclusion

SEFSC-affiliated fisheries research conducted under the Status Quo Alternative could have direct and indirect effects on seabirds through injury or mortality from ship strikes or entanglement in gear, changes in food availability due to survey removal of prey and discards, or contamination or degradation of habitat. There have been very few reported captures of seabirds in SEFSC research gear and no reported incidents of ship strikes in the past. Given the occurrence of seabird bycatch in commercial fisheries in the Southeast region, such effects could occur in the future under the Status Quo Alternative but would likely be rare and minor in magnitude. For reasons similar to those described for marine mammals above, the overall risk of SEFSC fisheries research causing changes in food availability for seabirds or contamination in the marine environment is considered minor adverse.

The overall effects on seabirds from SEFSC research activities under the Status Quo Alternative would likely be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the criteria in Table 4.1-1.

4.2.6 Effects on Sea Turtles

This section describes the types of effects of the Status Quo Alternative on five different species of ESA-listed sea turtles: leatherback, Kemp's ridley, green, loggerhead, and hawksbill sea turtles. Direct and indirect effects of research vessels, survey gear, active acoustic gears, and other associated equipment on sea turtles include:

- Disturbance/change in behavior due to physical presence and sounds
- Injury or mortality due to ship strikes
- Injury or mortality due to interactions with fishing gear
- Contamination or degradation of habitat

The overlap of research activities with the presence of sea turtles can result in incidental takes of these ESA-listed species. The Southeast Regional Office Protected Resource Division will conduct a section 7 consultation on the majority of SEFSC fisheries research covered under this DPEA. The resulting BiOp may contain mandatory reasonable and prudent measures that the SEFSC must follow to minimize effects of incidental take on sea turtles. However, the SEFSC research surveys already include protocols to avoid interactions with turtles if possible but also to collect a variety of data on incidentally caught sea turtles and to report this information to Protected Resources. This information has been used to document the characteristics of sea turtles encountered and provide data that may help develop more effective measures to avoid future interactions. These mitigation, monitoring, and reporting protocols are therefore included as part of the proposed research activities under the Status Quo Alternative as described in Section 2.2.1, and the analysis of effects on sea turtles takes them into account.

4.2.6.1 Disturbance and Changes in Behavior Due to Physical Presence and Sound Sources

There is a potential for research activities to negatively affect or disturb sea turtles and cause changes in behavior, primarily through the physical presence of marine vessels and fishing gear combined with operational sounds from engines, hydraulic gear, and acoustical devices used for navigation and research.

Little is known about hearing in sea turtles, but the available information suggests that their underwater hearing capabilities are quite limited both in functional hearing bandwidth and in absolute hearing sensitivity. The limited data suggest that sea turtles probably have functional hearing sensitivity between about 100 Hz and 1.2 kHz (Ketten and Bartol 2005, Dow Piniak et al. 2012), which is well below the frequencies of acoustic instruments used in fisheries research. The higher frequency sounds are unlikely to be audible to sea turtles and therefore unlikely to have adverse effects on sea turtles.

Sea turtles may be disturbed or displaced from their normal behavior or movements by passing vessels or fishing gear in the water. Given the small number of SEFSC research vessels and their dispersal over a wide area, these types of disturbances would be temporary in nature, lasting only a few minutes as the research vessel passes, and are therefore likely to have no more than negligible effects on turtle foraging success or survival.

4.2.6.2 Injury or Mortality Due to Ship Strikes

The two main mechanisms for research activities to cause injury or mortality to sea turtles are through ship strikes and interactions with fishing gear. Sea turtles come to the surface to breathe, and also to rest, making them susceptible to ship strikes. Because it is often difficult for vessels underway to see turtles, there is little data available on the frequency of ship strikes on sea turtles. Bridge crew on SEFSC research cruises routinely watch for floating obstacles while underway and take measures to avoid collisions with sea turtles if possible. There have been no reported incidents of ship strikes by NMFS research vessels or by cooperative research partner vessels, although there is the possibility that such strikes have occurred without notice by the crew.

4.2.6.3 Injury or Mortality Due to Interactions with Fishing Gear

There are many factors that may contribute to the likelihood of sea turtles interacting with fishing gear, including capture or entanglement in various nets, collisions with dredges or other mobile gear, and getting hooked by fishing gear. Some of the variables involve details of the fishing gear; the type and size of hooks and the bait used and the use of TEDs on nets. Other variables involve the distribution and abundance of sea turtles in the area which may be related to the presence of prey sources, seasonal migration patterns, and oceanographic features.

The gear types with documented bycatch of sea turtles include gillnets, longlines, trawls, traps/pots, dredges, and seines (Zollett 2009). Loggerhead sea turtles are often hooked by longline gear as a result of depredation (i.e. when they attempt to eat bait), while leatherback sea turtles are more likely to become entangled in the gear (NMFS 2008b). A turtle that was hit by bottom trawl gear or a scallop dredge could suffer fractures to the carapace as a result of being struck (NMFS 2007a). Turtles may also be captured in trawl nets or dredge bags where they may drown or be further injured or killed when the catch and heavy gear are dumped on the vessel deck (NMFS 2008b).

One of the most important factors determining the likelihood of mortality for turtles caught in fishing gear is the length of time they are held underwater (Henwood and Stuntz 1987, Epperly et al. 2002, and Sasso and Epperly 2006). According to a study conducted by the National Research Council, “death rates [of sea turtles incidentally captured in trawls] are near zero until tow times exceed 60 minutes, then they rise rapidly with increasing tow times to around 50 percent for tow times in excess of 200 minutes” (NRC 1990). While long tow times are common in commercial fisheries, most of the SEFSC-affiliated research surveys using trawl gear (Table 2.2-1) have protocols with tow times less than 30 minutes long, much less than the 60 minute threshold described above, and thus all turtles caught in these SEFSC-affiliated research tows have been released alive. Some SEFSC-affiliated research projects use longer tow times but these projects use TEDs as required for commercial trawl fisheries. Much of that research is designed to help test more effective TEDs and reduce incidental catch of turtles in fisheries.

Over the past 25 years (1990-2014), SEFSC-affiliated research activities have caught 1,107 sea turtles in the GOMRA and ARA, primarily in bottom trawl gear but also trammel nets and longline gear and a few other net gears. All but two of these turtles have been released alive and 50 turtles had injuries when released. The majority of injuries from trawl gear involved spines from rays caught in the net but also included abrasions and cuts on the flippers. Longline injuries involved hooking of the flippers and mouth, with a few animals being released with hooks still in place. No sea turtles have been caught in the CRA in SEFSC or cooperating research partner research gear.

Sea turtle populations have been changing in abundance in the past 25 years in both the GOMRA and ARA, which has likely affected the frequency of gear interactions. Research protocols have also changed over that time, with potential gear interaction effects. For these reasons, the following analysis uses data on SEFSC gear interactions from the last five years, 2010 through 2014, rather than the entire history of SEFSC takes in order to better represent the current situation and provide better estimates of future takes in SEFSC research gear. Table 4.2-25 provides a summary of species caught in each area with different gear types in the particular research surveys that have caught sea turtles from 2010 through 2014. Table 4.2-25 also shows the rate of incidental catch per unit of effort for each of those research efforts during that time period. These incidental catch rates are used to estimate numbers of each species that may be caught in the future. Figures 4.2-4 through 4.2-9 show the locations of sea turtles caught in various research gears in the GOMRA and ARA from 2010 through 2014.

Table 4.2-25 Historical Takes of Sea Turtles and Incidental Capture Rates during SEFSC-Affiliated Research from 2010 through 2014

Most sea turtles were released in good to excellent condition and without any gear attached except for one mortality (a Kemp's ridley). Hawksbill sea turtles are more tropical species and are rarely encountered during SEFSC research surveys; there has been only one take in the past 25 years and none in the last five years.

Survey	Loggerhead		Kemp's Ridley		Green		Leatherback		Unidentified		Total Takes
	Takes	Rate	Takes	Rate	Takes	Rate	Takes	Rate	Takes	Rate	
GULF OF MEXICO RESEARCH AREA											
Surveys Using Bottom Trawl Gear											
SEAMAP-GOM Shrimp/ Groundfish Trawl Survey, (SEFSC) – Fall 325 tows/yr @ 30 min/tow x 5 yr = 813 tow	6	0.0074 turtles per tow-hr (t/t-h)	4	0.0049 t/t-h							**10**
SEAMAP-GOM Shrimp/ Groundfish Trawl Survey, (SEFSC) – Summer 345 tows/yr @30 min/tow x 5 yr = 862.5 tow-hr	2	0.0023 t/t-h	3	0.0035 t/t-h							**5**
SEAMAP-GOM Shrimp/ Groundfish Trawl Survey, (FFWCC) – Fall 160 tows/yr @ 30 min/tow x 5 yr = 400 tows –hr	4	0.01 t/t-h	1	0.0025 t/t-h							**5**
SEAMAP-GOM Shrimp/ Groundfish Trawl Survey, (FFWCC) – Summer 160 tows/yr @ 30 min/tow x 5 yr = 400 tow-hr	15	0.038 t/t-h	1	0.0025 t/t-h	1	0.0025 t/t-h					**17**
SEAMAP-GOM Shrimp/ Groundfish Trawl Survey, (USM/GCRL) – Fall & Summer 60 tows/yr @ 30 min/tow x 5 yr = 150 tow-hr	3	0.02 t/t-h	1	0.007 t/t-h							**4**
Small Pelagics Trawl Survey, (SEFSC) 150-200 tows/yr @ 30 min/tow x 5 yr = 375 - 500 tow-hr	2	0.0053 – 0.004 t/t-h									**2**

Survey	Loggerhead		Kemp's Ridley		Green		Leatherback		Unidentified		Total Takes
	Takes	Rate	Takes	Rate	Takes	Rate	Takes	Rate	Takes	Rate	
Surveys Using Longline Gear											
SEAMAP – GOM Bottom Longline Survey, (LDWF) 96 sets/yr x 100 hooks/set @1 hr/set x 5 yr = 48,000 hook-hr			1	0.000021 turtles per hook-hr (t/h-h)							**1**
SEAMAP – GOM Bottom Longline Survey, (TPWD) 20 sets/yr x 100 hooks/set @ 1hr/set x 5 yr= 10,000 hook-hr	1	0.0001 t/h-h									**1**
SEAMAP – GOM Bottom Longline Survey, (USM/GCRL) 48 sets/yr x 100 hook/set @ 1 hr/set x 5 yr = 24,000 hook-hr	4	0.00016 t/h-h	1	0.000042 t/h-h							**5**
Shark and Red Snapper Bottom Longline Survey, (SEFSC) 240–280 sets/yr x 100 hooks/set @ 1 hr/set x 5 yr = 120,000–140,000 hook- hr	1	0.000007-0.000008 t/h-h									**1**
Surveys Using Gillnet Gear											
HMS–GOM Shark Pupping & Nursery Survey, (SEFSC) 150 sets/yr @ 1 hr/set x 5 yr = 750 set-hr			2	0.0026 turtles per set-hr (t/s-h)							**2**
HMS–GOM Shark Pupping & Nursery Survey, (USM/GCRL) 21sets/yr @ 1 hr/set x 5 yr = 105 set-hr			1	0.0095 t/s-h							**1**
HMS–GOM Shark Pupping & Nursery Survey, (USA/DISL) 90 sets/yr @ 1 hr/set x 5 yr = 450 set-hr									1	0.0022 t/s-h	**1**

Survey	Loggerhead		Kemp's Ridley		Green		Leatherback		Unidentified		Total Takes
	Takes	Rate	Takes	Rate	Takes	Rate	Takes	Rate	Takes	Rate	
Surveys Using Neuston Nets											
SEAMAP-GOM Shrimp/Groundfish Trawl Survey – Fall 75 tows/yr @ 10 min/tow x 5 yr = 62.5 tow-hrs	1	0.016 t/t-h									1
Total Takes for All Gears in the Gulf of Mexico Research Area, 2010-2014	**39 Loggerheads**		**15 Kemp's ridleys**		**1 Green**		**0 Leatherback**		**1 Unidentified**		**56 Sea Turtles**
ATLANTIC RESEARCH AREA											
Surveys Using Bottom Trawl Gear											
ACFCMA Ecological Monitoring Trawl Survey, (GDNR) 504 tows/yr @ 15 min/tow x 5 yr = 630 tow-hr	1	0.0016 t/t-h	13	0.021 t/t-h	5	0.0079 t/t-h					**19**
ACFCMA Juvenile Stage Trawl Survey, (GDNR) 216 tows/yr @ 5 min/tow x 5 yr = 90 tow-hr	1	0.011 t/t-h									**1**
SEAMAP-SA NC Pamlico Sound Trawl Survey, (NCDNR) 108 tow/yr @ 20 min/tow x 5 yr = 180 tow-hr			1	0.0055 t/t-h							**1**
SEAMAP-SA Coastal Trawl Survey, (SCDNR) – Fall, Spring, Summer 300-350 tow/yr @ 20 min/tow x 5 yr = 500 – 583 tow- hr	157	0.31-00.27 t/t-h	83	0.16-0.14 t/t-h	4	0.008-0.0069 t/t-h	2	0.004-0.0034 t/t-h			**246**
Surveys Using Longline Gear											
SEAMAP-SA Red Drum Bottom Longline Survey, (GDNR) 200-275sets/yr x 60 hooks/set @ 30 min/set x 5 yr = 30,000- 41,250 hook-hr	6	0.0002 - 0.00014 t/h-h	18	0.0006 - 0.00044 t/h-h							**24**

Survey	Loggerhead		Kemp's Ridley		Green		Leatherback		Unidentified		Total Takes
	Takes	Rate	Takes	Rate	Takes	Rate	Takes	Rate	Takes	Rate	
SEAMAP-SA Red Drum Bottom Longline Survey, (NCDNR) 75-100 sets/yr x 100 hooks/set @ 30 min/set x 5 yr = 18,750 – 25,000 hook-hr	1	0.00005 - 0.00004 t/h-h									**1**
HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Survey, (VIMS) 50 sets/yr x 100-120 hooks/set @ 4 hr soak x 5 yr = 100,000-120,000 hook-hr							1	0.00001-0.000008 t/h-h			**1**
Surveys Using Trammel Nets											
RecFIN Red Drum Trammel Net Survey, (SCDNR) 1000 sets/yr @ 10 min/set x 5 yr =833 set-hr	2	0.0024 t/s-h	3	0.0036 t/s-h	84	0.10 t/s-h					**89**
Total Takes for All Gears in the Atlantic Research Area, 2010-2014	**168 Loggerheads**		**118 Kemp's ridleys**		**93 Greens**		**3 Leatherbacks**		**0 Unidentified**		**382 Sea Turtles**
Total Takes for All Gears and Both Research Areas, 2010-2014	**207 Loggerheads**		**133 Kemp's ridleys**		**94 Greens**		**3 Leatherbacks**		**1 Unidentified**		**438 Sea Turtles**

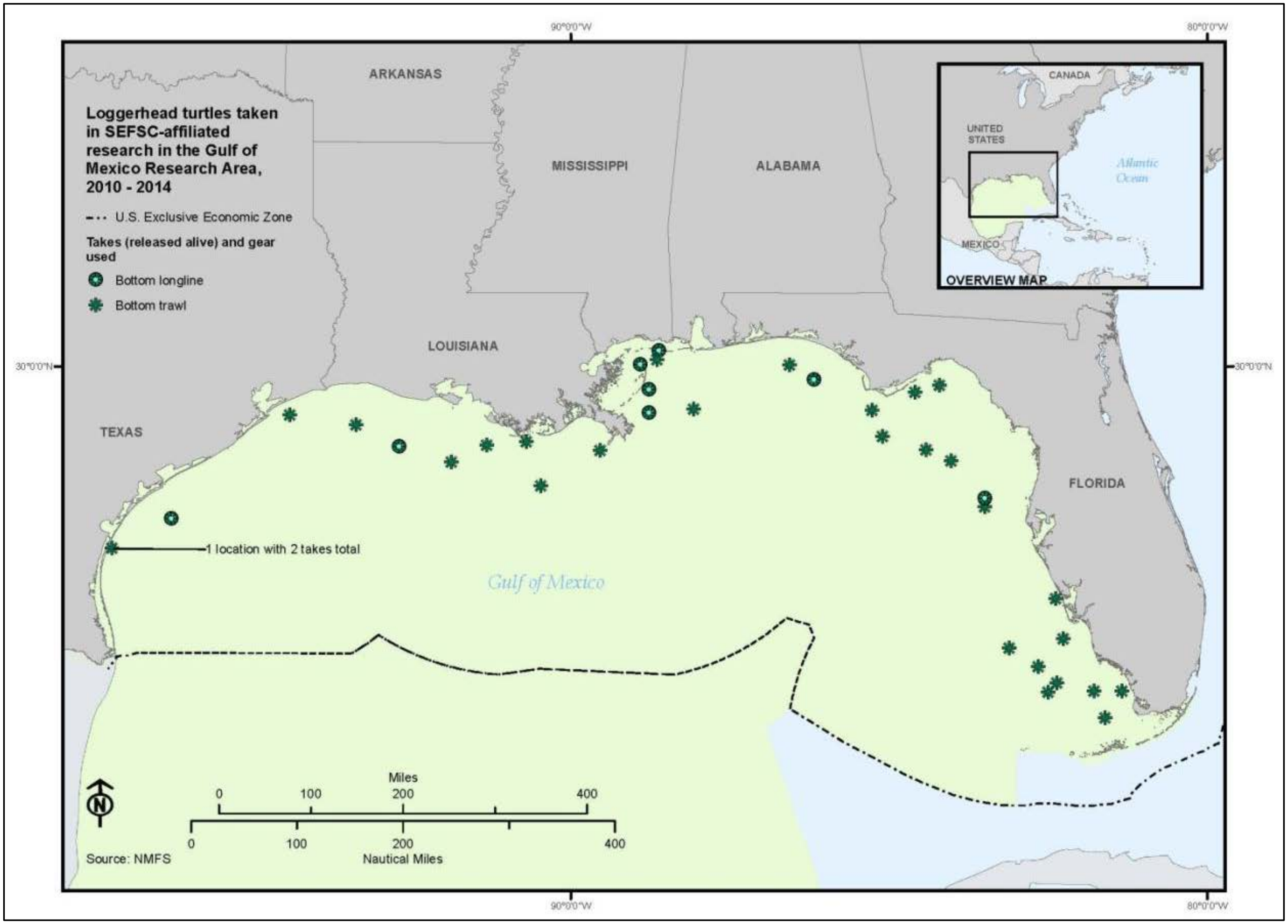

Figure 4.2-6 Location of Loggerhead Sea Turtle Takes in the Gulf of Mexico Research Area during SEFSC-affiliated Research from 2010 through 2014

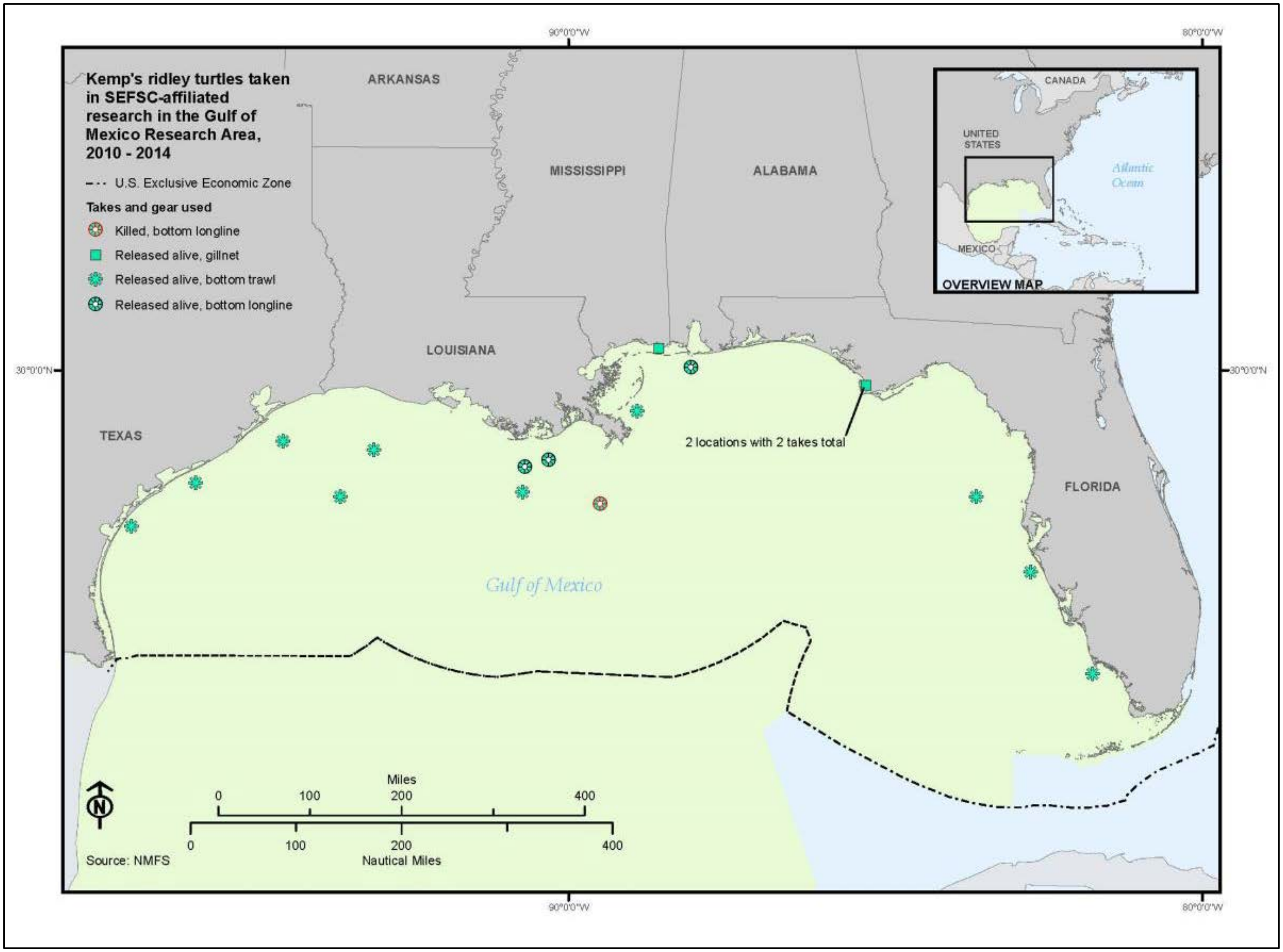

Figure 4.2-7 Location of Kemp's Ridley Sea Turtle Takes in the Gulf of Mexico Research Area during SEFSC-affiliated Research from 2010 through 2014

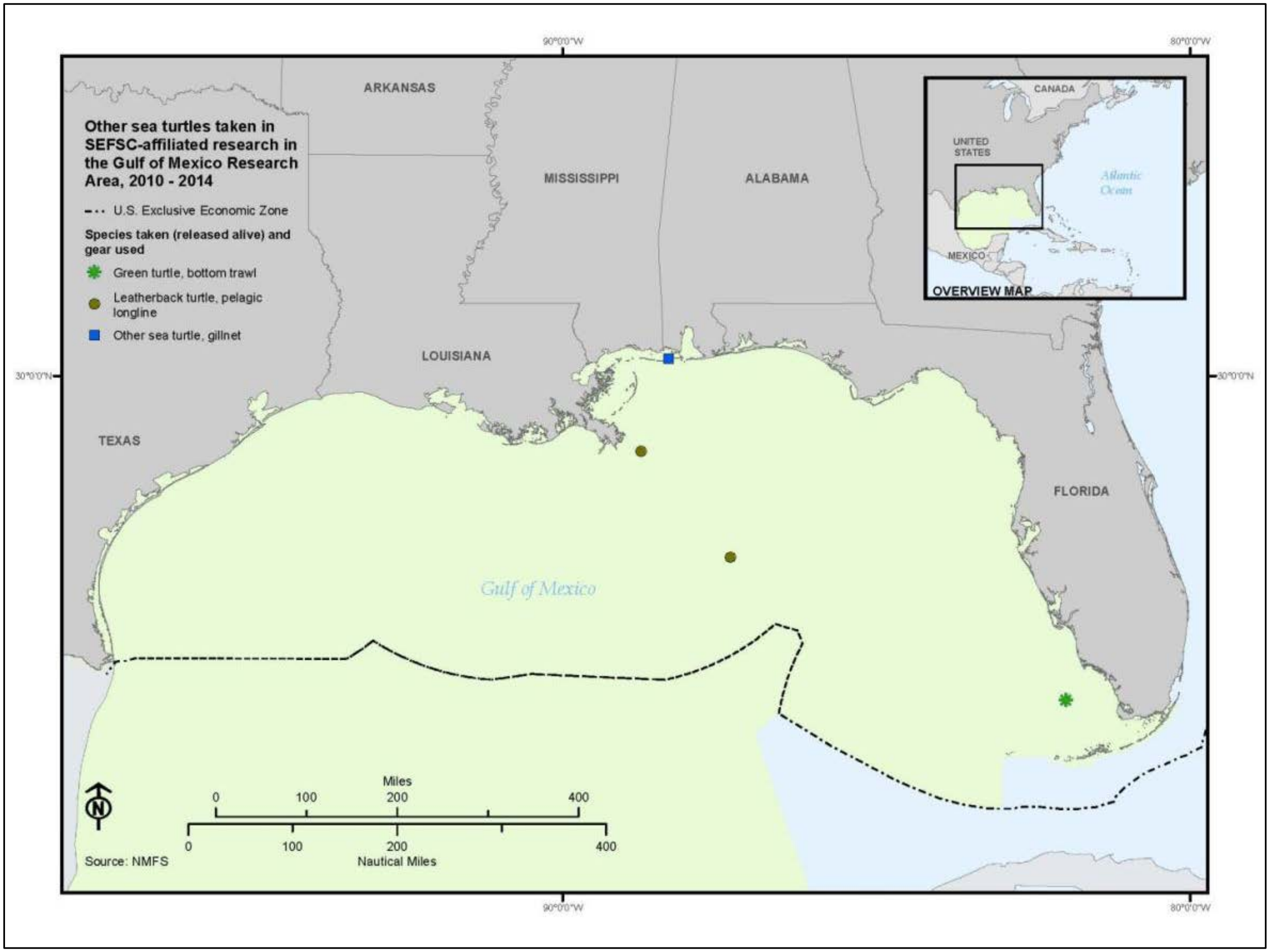

Figure 4.2-8 Location of Other Sea Turtle Takes in the Gulf of Mexico Research Area during SEFSC-affiliated Research from 2010 through 2014

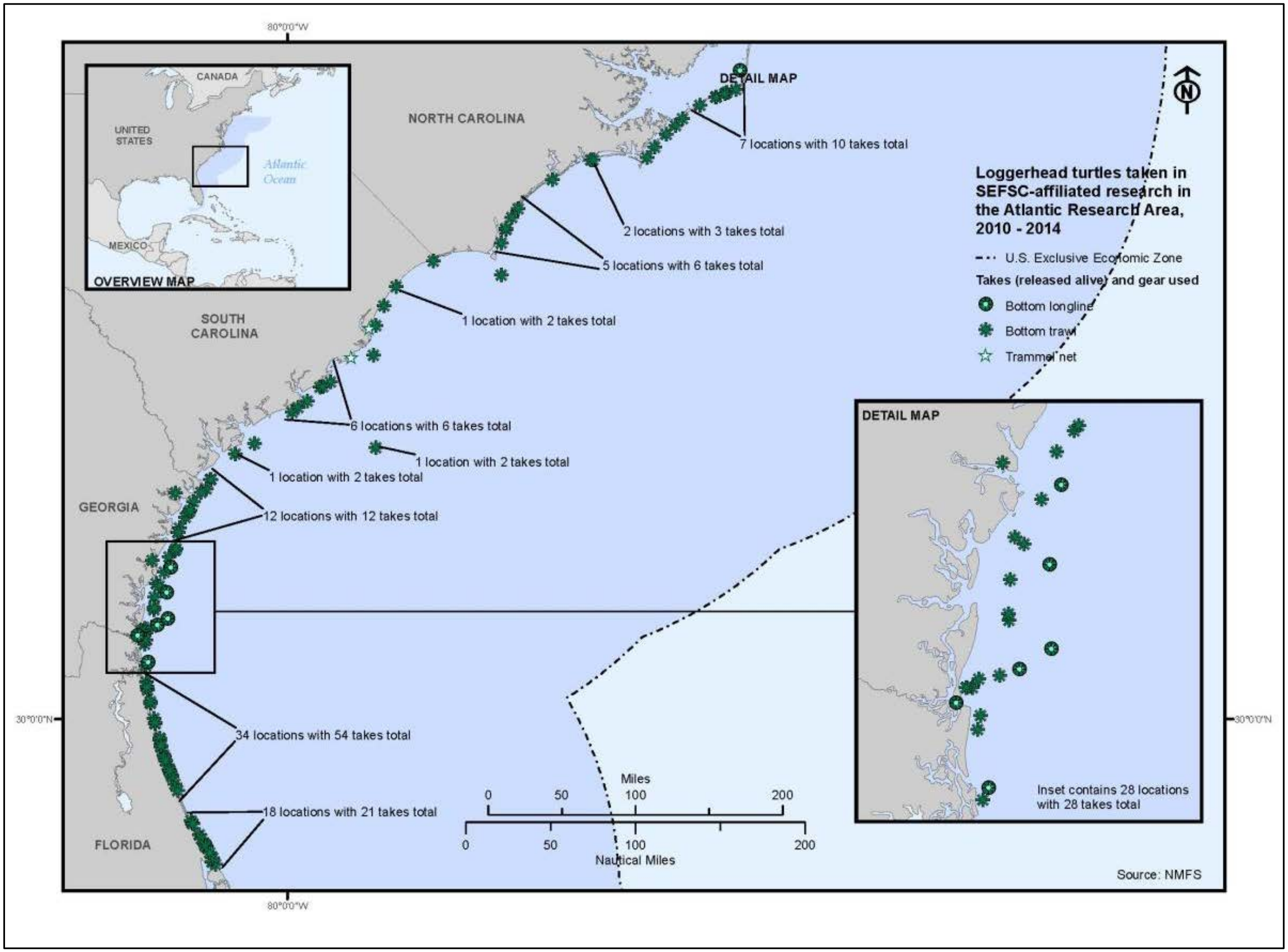

Figure 4.2-9 Location of Loggerhead Sea Turtle Takes in the Atlantic Research Area during SEFSC-affiliated Research from 2010 through 2014

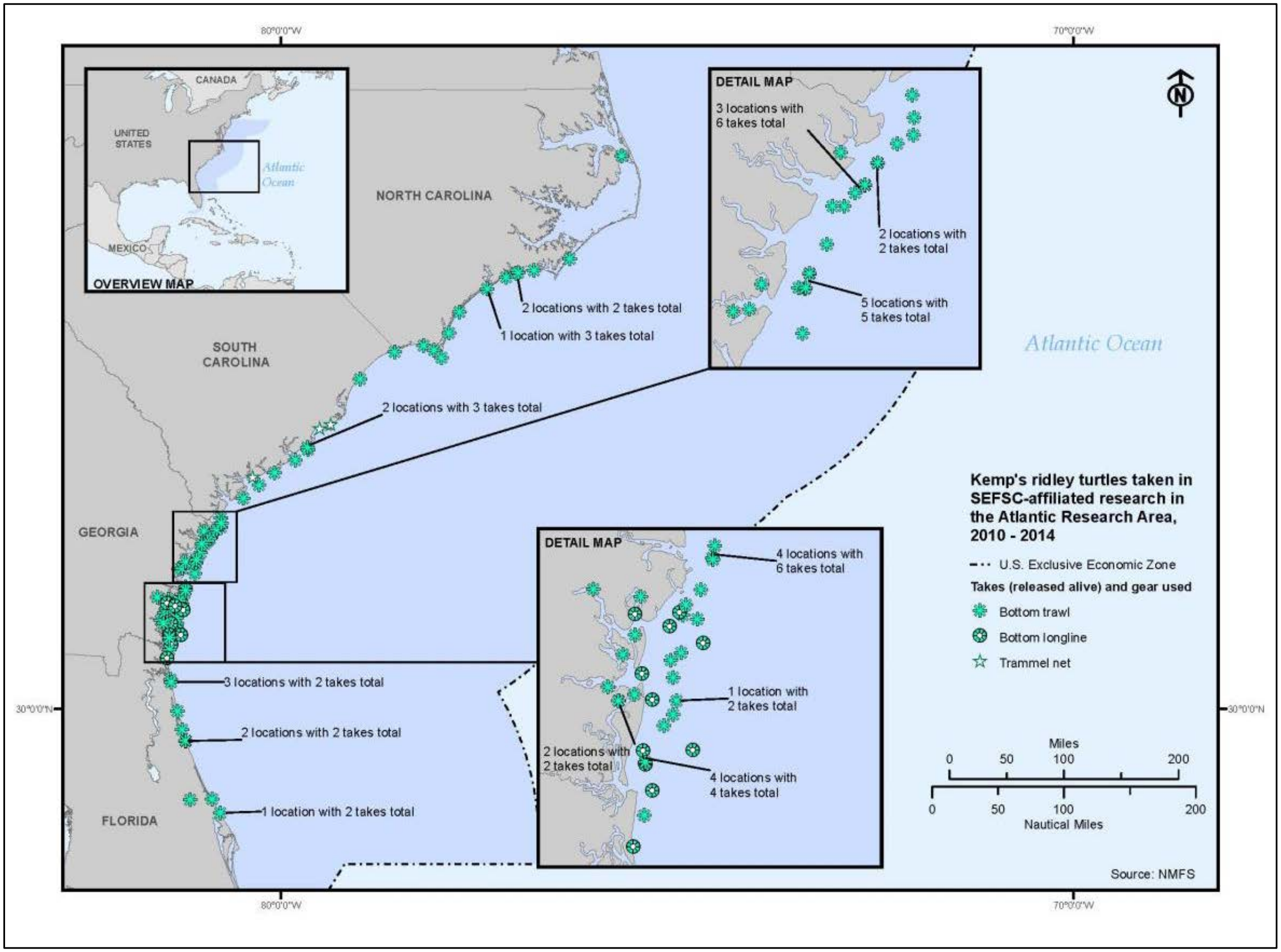

Figure 4.2-10 Location of Kemp's Ridley Sea Turtle Takes in the Atlantic Research Area during SEFSC-affiliated Research from 2010 through 2014

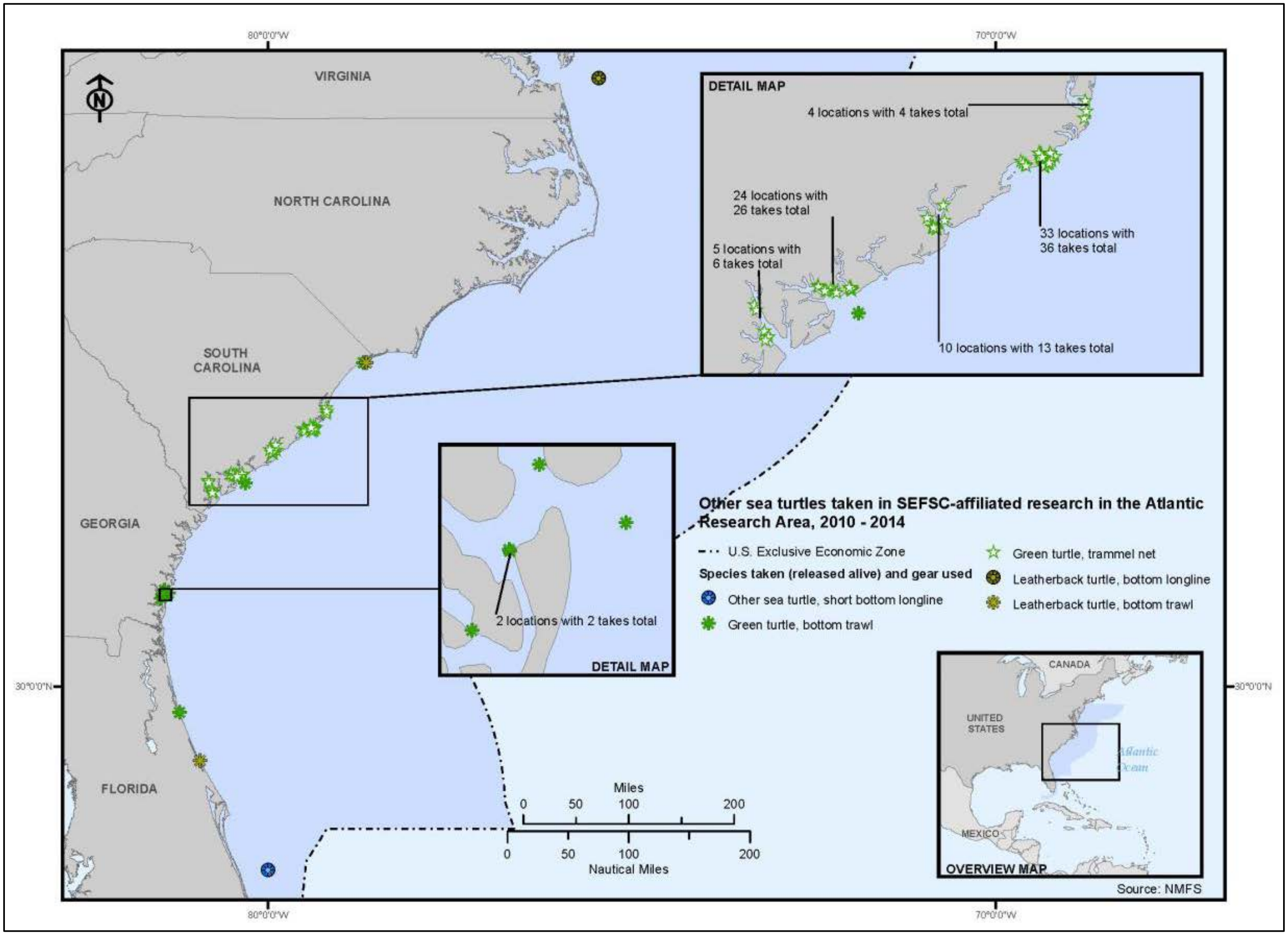

Figure 4.2-11 Location of Other Sea Turtle Takes in the Atlantic Research Area during SEFSC-affiliated Research from 2010 through 2014

Table 4.2-26 Estimated Annual Future Takes of Sea Turtles under the Status Quo Alternative

For surveys that have caught sea turtles in the recent past (2010-2014), estimates of annual future captures in research gear are based on annual research effort and incidental capture rates from those surveys (Table 4.2-25). For surveys that have not caught sea turtles in the recent past, the lowest incidental capture rates from other SEFSC research surveys are used to estimate future takes for each species. For surveys with variable levels of effort and for a range of capture rates, the highest value of each variable is used to provide a precautionary estimate of future takes.

Survey	Annual Effort	Loggerhead		Kemp's Ridley		Green		Leatherback		Total Takes Per Year
		Rate	# takes	Rate	# takes	Rate	# takes	Rate	# takes	
GULF OF MEXICO RESEARCH AREA										
Surveys Using Trawl Gear										
SEAMAP-GOM Shrimp/Groundfish Trawl Survey, (SEFSC) - Fall 325 tows/yr @ 30 min/tow	162.5 tow-hours (t-h)	0.0074 turtles per tow-hr (t/t-h)	1.2	0.0049 t/t-h	0.8					**2.0**
SEAMAP-GOM Shrimp/Groundfish Trawl Survey, (SEFSC) – Summer 345 tows/yr @30 min/tow	172.5 t-h	0.0023 t/t-h	0.4	0.0035 t/t-h	0.6					**1.0**
SEAMAP-GOM Shrimp/Groundfish Trawl Survey, (FFWCC) – Fall 160 tows/yr @ 30 min/tow	80 t-h	0.01 t/t-h	0.8	0.0025 t/t-h	0.2					**1.0**
SEAMAP-GOM Shrimp/Groundfish Trawl Survey, (FFWCC)-Summer 160 tows/yr @ 30 min/tow	80 t-h	0.038 t/t-h	3.0	0.0025 t/t-h	0.2	0.0025 t/t-h	0.2			**3.4**
SEAMAP-GOM Shrimp/Groundfish Trawl Survey, (USM/GCRL)-Fall &Summer 60 tows/yr @ 30 min/tow	30 t-h	0.02 t/t-h	0.6	0.007 t/t-h	0.2					**0.8**
Small Pelagics Trawl Survey, (SEFSC) 150-200 tows/yr @ 30 min/tow	75-100 t-h	0.0053 – 0.004 t/t-h	0.4							**0.4**

Survey	Annual Effort	Loggerhead		Kemp's Ridley		Green		Leatherback		Total Takes Per Year
		Rate	# takes	Rate	# takes	Rate	# takes	Rate	# takes	
All other research with trawl gear (see Table 4.2-27)	885 t-h	0.0023 t/t-h	2.0	0.0025 t/t-h	2.2	0.0025 t/t-h	2.2			**6.4**
Total estimated takes in trawl gear in the GOMRA		**(8.4) 9 Loggerheads**		**(4.2) 5 Kemp's ridleys**		**(2.4) 3 Greens**		**0 Leatherbacks**		**17 Turtles**
Surveys Using Longline Gear										
SEAMAP-GOM Bottom Longline Survey, (LDWF) 96 sets/yr x 100 hooks/set @1 hr/set	9,600 hook-hours (h-h)			0.000021 turtles per hook-hour (t/h-h)	0.2[1]					**0.2**
SEAMAP-GOM Bottom Longline Survey, (TPWD) 20 sets/yr x 100 hooks/set @ 1hr/set	2,000 h-h	0.0001 t/h-h	0.2							**0.2**
SEAMAP-GOM Bottom Longline Survey, (USM/GCRL) 48 sets/yr x 100 hook/set @ 1 hr/set	4,800 h-h	0.00016 t/h-h	0.8	0.000046 t/h-h	0.2					**1.0**
Shark and Red Snapper Bottom Longline Survey, (SEFSC) 240–280 sets/yr x 100 hooks/set @ 1 hr/set	24,000-28,000 h-h	0.000008-0.000007 t/h-h	0.2[1]							**0.2**
Pelagic Longline Survey, (SEFSC) 100-125 sets/yr x 100 hooks/set @ 3 hr/set	30,000 – 37,500 h-h	0.000033-0.000026 t/h-h	1.0							**1.0**
All other research with longline gear (see Table 4.2-27)	3,200 h-h	0.000026 t/h-h	0.1	0.000021 t/h-h	0.1					**0.2**
Total estimated takes in longline gear in the GOMRA		**(2.3) 3 Loggerheads**		**(0.5) 1 Kemp's ridley**		**0 Greens**		**0 Leatherbacks**		**4 Turtles**

Survey	Annual Effort	Loggerhead		Kemp's Ridley		Green		Leatherback		Total Takes Per Year
		Rate	# takes	Rate	# takes	Rate	# takes	Rate	# takes	
Surveys Using Gillnet Gear										
HMS–GOM Shark Pupping & Nursery Survey, (SEFSC) 150 sets/yr @ 1 hr/set	150 set-hours (s-h)			0.0026 turtles per set-hr (t/s-h)	0.4					**0.4**
HMS–GOM Shark Pupping & Nursery Survey, (USM/GCRL) 21sets/yr @ 1 hr/set	21 s-h			0.0095 t/s-h	0.2					**0.2**
HMS–GOM Shark Pupping & Nursery Survey, (USA/DISL) 90 sets/yr @ 1 hr/set	90 s-h			0.0022 t/s-h	0.2					**0.2**
All other research with gillnet gear (see Table 4.2-27)	1,010 s-h			0.0022 t/s-h	2.2					**2.2**
Total estimated takes in gillnet gear in the GOMRA		**0 Loggerheads**		**(3.0) 3 Kemp's ridleys**		**0 Greens**		**0 Leatherbacks**		**3 Turtles**
Total Estimated Takes Per Year in the GOMRA in All Gears		**(10.7) 11 Loggerheads**		**(7.7) 8 Kemp's ridleys**		**(2.4) 3 Greens**		**0 Leatherbacks**		**22 Turtles**
ATLANTIC RESEARCH AREA										
Surveys Using Bottom Trawl Gear										
ACFCMA Ecological Monitoring Trawl Survey, (GDNR) 504 tows/yr @ 15 min/tow	126 t-h	0.0016 t/t-h	0.2	0.021 t/t-h	2.6	0.0079 t/t-h	1.0			**3.8**
ACFCMA Juvenile Stage Trawl Survey, (GDNR) 216 tows/yr @ 5 min/tow	18 t-h	0.011 t/t-h	0.2							**0.2**
SEAMAP-SA NC Pamlico Sound Trawl Survey, (NCDENR) 108 tow/yr @ 20 min/tow	36 t-h			0.0055 t/t-h	0.2					**0.2**

Survey	Annual Effort	Loggerhead		Kemp's Ridley		Green		Leatherback		Total Takes Per Year
		Rate	# takes	Rate	# takes	Rate	# takes	Rate	# takes	
SEAMAP-SA Coastal Trawl Survey, (SCDNR) - Fall, Spring, Summer 300-350 tow/yr @ 20 min/tow	100-117 t-h	0.31-0.27 t/t-h	31.4	0.16-0.14 t/t-h	16.6	0.008-0.0069 t/t-h	0.8	0.004-0.0034 t/t-h	0.4	**49.2**
All other research with trawl gear (see Table 4.2-27)	189 t-h	0.011 t/t-h	2.1	0.0055 t/t-h	1.0	0.0069 t/t-h	1.3	0.0034 t/t-h	0.6	**10.8**
Total estimated takes in trawl gear in the ARA		**(33.9) 34 Loggerheads**		**(20.4) 21 Kemp's ridleys**		**(3.1) 4 Greens**		**(1.0) 1 Leatherback**		**60 Turtles**
Surveys Using Longline Gear										
SEAMAP-SA Red Drum Bottom Longline Survey, (GDNR) 200-275sets/yr x 60 hooks/set @ 30 min/set	6,000-8,250 h-h	0.0002 - 0.00014 t/h-h	1.2	0.0006 - 0.00044 t/h-h	3.6					**4.8**
SEAMAP-SA Red Drum Bottom Longline Survey (NCDNR) 75-100 sets/yr x 100 hooks/set @ 30 min/set	3,750-5,000 h-h	0.00005 - 0.00004 t/h-h	0.2							**0.2**
HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Survey, (VIMS) 50 sets/yr x 100-120 hooks/set @ 4 hr/ soak	20,000-24,000 h-h							0.00001-0.000008 t/h-h	0.2	**0.2**
All other research with longline gear (see Table 4.2-27)	22,000 h-h	0.00004 t/h-h	0.9	0.00044 t/h-h	9.7			0.000008 t/h-h	0.2	**10.8**
Total estimated takes in longline gear in the ARA		**(2.3) 3 Loggerheads**		**(13.3) 14 Kemp's ridleys**		**0 Greens**		**(0.4) 1 Leatherback**		**18 Turtles**

Survey	Annual Effort	Loggerhead		Kemp's Ridley		Green		Leatherback		Total Takes Per Year
		Rate	# takes	Rate	# takes	Rate	# takes	Rate	# takes	
Surveys Using Trammel Net Gear										
RecFIN Red Drum Trammel Net Survey, (SCDNR) **1000 sets/yr @ 10 min/set**	167 s-h	0.0024 t/s-h	0.4	0.0036 t/s-h	0.6	0.10 t/s-h	16.7			**17.7**
Total estimated takes in trammel net gear in the ARA		**(0.4)** **1 Loggerhead**		**(0.6)** **1 Kemp's ridley**		**(16.7)** **17 Greens**		**0 Leatherbacks**		**19 Turtles**
Total Estimated Takes Per Year in the ARA in All Gears		**(36.6)** **37 Loggerheads**		**(34.1)** **35 Kemp's ridleys**		**(19.8)** **20 Greens**		**(1.4)** **2 Leatherbacks**		**94 Turtles**
Total Estimated Takes Per Year in All Areas and Gears		**48 Loggerheads**		**43 Kemp's ridleys**		**23 Greens**		**2 Leatherbacks**		**116 Turtles**

1 Only two SWFSC-affiliated surveys have had sea turtle mortalities since 1990; the SEAMAP-GOM Bottom Longline Survey (LDWF) had a Kemp's ridley mortality in 2011 and the Shark and Red Snapper Bottom Longline Survey (SEFSC) had a loggerhead mortality in 2009.

Table 4.2-27 SEFSC-affiliated Research without Recent Sea Turtle Takes (2010-2014)

Survey	Sampling Effort	Annual Fishing Effort
GULF OF MEXICO RESEARCH AREA		
Surveys Using Trawl Gear		
IJA Biloxi Bay Beam Trawl Survey, (MDMR)	132 trawls/yr @ 20 min/tow	44 trawl-hours (t-h)
IJA Inshore Finfish Trawl Survey, (MDMR)	72 trawls/yr @ 10 min/tow	12 t-h
IJA Open Bay Shellfish Trawl Survey, (TPWD)	1080 trawls/yr @ 10 min/tow	180 t-h
Oceanic Deep-water Trawl – GOM, (SEFSC)	60 trawls/yr @ 1-3 hr/tow	180 t-h
St. Andrew Bay Juvenile Reef Fish Trawl Survey, (SEFSC)	364 trawls/yr @ 30 min/tow	182 t-h
SEFSC BRD Evaluations, (SEFSC)	40 paired trawls/year @ 2 hr/tow max	80 t-h
SEAMAP-GOM Shrimp/Groundfish Trawl Survey, (LDWF)-Summer	50 trawls /yr @ 30 min/tow	25 t-h
SEAMAP-GOM Shrimp/Groundfish Trawl Survey, (TPWD)- Fall	80 trawls /yr @ 30 min/tow	40 t-h
SEAMAP-GOM Shrimp/Groundfish Trawl Survey, (TPWD)- Summer	120 trawls /yr @ 30 min/tow	60 t-h
SEFSC-GOM Ted Evaluations, (SEFSC)	90 paired trawls/yr @ 55 min/tow	82 t-h
Total Trawl Effort		**885 t-h**
Surveys Using Longline Gear		
SEAMAP-GOM Bottom Longline Survey, (ADCNR)	32 sets/yr x 100 hooks/set @ 1 hr/set	**3,200 hook-hours (h-h)**
Surveys Using Gillnet Gear		
HMS–GOM Shark Pupping & Nursery Survey, (FSU/CML)	74 sets/yr @ 1 hr/set	74 set-hours (s-h)
HMS–GOM Shark Pupping & Nursery Survey, (UWF)	40 sets/yr @ 1 hr/set	40 s-h
IJA Coastal Finfish Gillnet Survey, (MDMR)	96 sets/yr @ 1 hr/set	96 s-h
Smalltooth Sawfish Abundance Survey, (SEFSC)	200 sets/yr @ 1-4 hr/set	800 s-h
Total Gillnet Effort		**1,010 s-h**
ATLANTIC RESEARCH AREA		
Surveys Using Bottom Trawl Gear		
Atlantic Striped Bass Tagging Bottom Trawl Survey, (USFWS)	350 trawls/yr @ 30 min/tow	175 t-h
Juvenile Sport Fish Trawl Monitoring in Florida Bay, (SEFSC)	429 trawls/yr @ 2 min/tow	14 t-h
Total Trawl Effort		**189 t-h**

Survey	Sampling Effort	Annual Fishing Effort
Surveys Using Longline Gear		
MARMAP Reef Fish Bottom Longline Survey, (SCDNR)	60 sets/yr x 100 hooks/set @ 90 min/set	9,000 h-h
SEAMAP-SA Red Drum Bottom Longline Survey, (SCNDR)	360 sets/yr x 40 hooks/set @ 30 min/set	7,200 h-h
MARMAP/SEAMAP-SA Reef Fish Survey, (SCDNR)	200 sets/yr x 20 hooks/set @ 90 min/set	6,000 h-h
Total Longline Effort		**22,200 h-h**

Captures and mortality in trawl gear

Table 4.2-26 provides an estimate of the annual number of sea turtles that may be caught in various SEFSC research gears in the future under the Status Quo Alternative. For those projects that have caught sea turtles in the past five years (2010-2014), these estimates are based on the incidental catch rate of different species in those particular surveys on a per unit effort (trawl-hours for various types of trawls, set-hours for gillnets and trammel nets, and hook-hours for longline gear). The annual fishing effort with different gears is derived from Table 2.2-1 for each survey. Fishing effort is multiplied by the incidental catch rate to yield the estimated numbers of turtles of each species expected to be caught in the future. In addition, Table 4.2-26 includes an estimate of potential takes for surveys using those four gear types that have not caught sea turtles in the past five years (Table 4.2-27). These surveys may have avoided takes because of their particular location and season relative to sea turtle distribution or perhaps other factors but they are using gears that have a demonstrated risk of incidental take. For these surveys, the total fishing effort with different gear types is totaled for each research area (GOMRA and ARA) and multiplied by the lowest incidental catch rate for different species with each gear type and region (Table 4.2-26). The lowest incidental catch rate is used to account for the fact that these surveys have had no takes or at least no recent takes in the past and to provide a precautionary accounting of the risk presented by the collective level of SEFSC-affiliated research with these gears.

Based on the long record of SEFSC-affiliated research with trawl gear, all incidentally caught sea turtles in the future are expected to be alive when captured. Although a small percentage of turtles suffer abrasions or cuts from the net and others get injured by spines from rays caught in the net, all turtles with injuries would be treated as possible and would likely be released alive and in good condition.

For all SEFSC-affiliated research surveys using trawl gear in the GOMRA:

- Up to nine loggerhead turtles may be incidentally captured per year.
- Up to five Kemp’s ridley turtles may be incidentally captured per year.
- Up to three green turtles may be incidentally captured per year.
- No leatherback or hawksbill turtles are expected to be incidentally captured.

For all SEFSC-affiliated research surveys using trawl gear in the ARA:

- Up to 34 loggerhead turtles may be incidentally captured per year.
- Up to 21 Kemp’s ridley turtles may be incidentally captured per year.
- Up to four green turtles may be incidentally captured per year.
- Up to one leatherback turtle may be incidentally captured per year.
- No hawksbill turtles are expected to be incidentally captured.

Captures and mortality in longline gear

Table 4.2-26 shows the estimated number of sea turtles that could be expected to be taken annually in SEFSC-affiliated research longline gear. Turtles are most frequently hooked on the flippers and less often in the mouth. All SEFSC-affiliated researchers working with longline gear have been trained in the proper procedures to handle, unhook or otherwise release the turtle, and treatment of wounds. All research vessels carry the necessary gear to unhook sea turtles under different conditions. In most cases turtles have the hooks removed and are released with minor injuries. In some infrequent cases, large turtles are too big to be brought on board or otherwise manipulated to remove the hook, in which case the line is cut as close to the turtle as possible. On rare occasions turtles have swallowed the hook and have died as a result (two instances since records began in 1990) or were released with the hook still in it, which is considered a serious injury. Given this history, serious injuries or mortalities are expected to occur rarely in the future, certainly less than once every year, but this risk remains for all sea turtles caught on longline gear.

For all SEFSC-affiliated research surveys using longline gear in the GOMRA:

- Up to three loggerhead turtles may be incidentally hooked per year.
- Up to one Kemp’s ridley turtles may be incidentally hooked per year.
- No green, leatherback, or hawksbill turtles are expected to be incidentally hooked.

For all SEFSC-affiliated research surveys using longline gear in the ARA:

- Up to three loggerhead turtles may be incidentally hooked per year.
- Up to 14 Kemp’s ridley turtles may be incidentally hooked per year.
- Up to one leatherback turtles may be incidentally hooked per year.
- No green or hawksbill turtles are expected to be incidentally hooked.

Captures and mortality in gillnet gear

Table 4.2-26 shows the estimated number of sea turtles that could be expected to be taken annually in SEFSC-affiliated research using gillnet gear. Almost all of this work occurs in the GOMRA and the one project in the ARA occurs in a river estuary where sea turtles would not be expected; all estimated takes in this gear type would occur in the GOMRA. There is a high risk of injury for sea turtles captured in commercial gillnet gear because of long soak times and prolonged forced submersion. Murray (2009) examined sea turtle mortality in commercial gillnet gear in the mid-Atlantic as a function of several variables, including soak duration. Gillnet sets that were less than 20 hours in duration resulted in captures but no serious injuries or mortalities. Mortality rates increased to 27 percent with soak times up to 40 hours and 70 percent with soak times up to 100 hours (Murray 2009). The SEFSC-affiliated gillnet efforts involve much smaller nets than commercial sets and most research protocols use soak times of one hour but no more than four hours. There have been no past mortalities or serious injuries of turtles in this gear type and all sea turtles captured by SEFSC-affiliated surveys in the future are therefore expected to be released alive and in good condition.

For all SEFSC-affiliated research surveys using gillnet gear in the GOMRA:

- Up to three Kemp’s ridley turtles may be incidentally caught per year.
- No loggerhead, green, leatherback, or hawksbill turtles are expected to be incidentally caught.

Captures and mortality in trammel net gear

There is only one SEFSC-affiliated research survey using trammel nets and that occurs along the coast of South Carolina. The survey protocol allows for soaks of only 10 minutes and nets are tended constantly so, although there have been regular captures of turtles in the past, all turtles have been released alive and in good condition. For this one survey in the ARA:

- Up to one loggerhead turtle may be incidentally captured per year.
- Up to one Kemp's ridley turtle may be incidentally captured per year.
- Up to 17 green turtles may be incidentally captured per year.
- No leatherback or hawksbill turtles are expected to be incidentally caught.

4.2.6.4 Contamination or Degradation of Habitat

Bottom trawl and dredging gear contact the bottom and can disrupt the ocean floor and benthic sediment. This can disturb or damage important foraging habitats for sea turtles, and cause turbidity in the water that would make it difficult for turtles to locate prey. However, surveys conducted by SEFSC research programs impact very small areas of the ocean floor relative to the entire area and relative to the footprint of commercial fisheries (see Section 4.2.2), and, due to the stratified random design of many surveys, typically do not occur in the same geographic location from year to year. The proposed critical habitat for the Northwest Atlantic Ocean DPS of loggerhead sea turtle (78 FR 43006, 18 July 2013) includes marine waters around Cape Hatteras that may be affected by SEFSC-affiliated research activities, including bottom trawls. The number of research trawls in the proposed area would vary from year to year, but would likely be limited to a small number of tows (tens, not hundreds), each of which would last about 20 minutes and impact about 0.0135 mi^2. The impacts of research gear on benthic habitat, including critical habitat for loggerheads, are therefore small in magnitude and temporary in duration.

For the same reasons described for fish (Section 4.2.3) and marine mammals (Section 4.2.4), potential effects on sea turtles from accidental discharges of fuel or other contaminants from SEFSC research vessels are possible but unlikely to occur in the near future. If an accidental discharge does occur, it is likely to be a rare event and the potential volume of material is likely to be small and localized. The potential impacts to sea turtles would be similarly short-term, localized, and likely affect a small number of animals. The overall impact of accidental contamination of sea turtles would therefore be considered minor adverse. This type of potential effect on sea turtles will not be discussed further in this analysis.

4.2.6.5 Conclusion

SEFSC fisheries research activities conducted under the Status Quo Alternative involve a relatively small number of research vessels, short deployments of fishing gear, and sample sites dispersed over a wide area. Behavioral disturbances of sea turtles from research vessels or fishing gear would be temporary in nature, lasting only a few minutes as the research vessel passes and are therefore likely to have negligible effects on turtle foraging success or survival. The potential for research vessels to degrade turtle habitat through benthic disturbance or contamination from accidental spills and discharges would likely be minor in magnitude, infrequent or rare, and localized.

Four species of ESA-listed sea turtles have been incidentally captured or hooked in SEFSC-affiliated research gear in the past, including trawls, longline gear, gillnets, and trammel nets, and all of these have occurred in the GOMRA or ARA. These incidental takes have occurred on a regular basis but almost all of these turtles have been released alive in good to excellent condition. Only two sea turtles have been recorded to be mortalities since 1990, although there have been infrequent cases of serious injury. Future incidental captures of sea turtles in these research gear types are certain, but it is likely that most of these turtles will be released in good condition because of the short tow and set durations of most SEFSC research activities and the presence of trained turtle-handling personnel on research crews. There is a potential for serious injury and mortality of sea turtles in research gear, primarily in longline gear. The DPEA uses a number of assumptions to provide a precautionary estimate of future captures/hookings of sea turtles in SEFSC-affiliated research gear but future serious injuries and mortalities are expected to be rare (less than one per year). This level of mortality for these species, if it occurred, would be minor in magnitude relative to the overall size of these populations.

The overall effects of the Status Quo Alternative on ESA-listed sea turtles would likely be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and would therefore be considered minor adverse on all species of sea turtles according to the criteria in Table 4.1-1.

4.2.7 Effects on Invertebrates and Plants

This section describes the general types of effects of the Status Quo Alternative on invertebrate and plant species. The potential effects of research vessels, survey gear, and other associated equipment on invertebrates and plants include:

- Mortality from surveys
- Physical damage to infauna, epifauna, and seagrasses
- Changes in species composition
- Contamination or degradation of habitat

Seven invertebrate species found within SEFSC research areas are listed as threatened under the ESA (Table 3.2-13): elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicornis*), pillar coral (*Dendrogyra cylindrus*), rough cactus coral (*Mycetophyllia ferox*), lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), and boulder star coral (*Orbicella franksi*). Designated critical habitat for elkhorn and staghorn coral overlaps SEFSC research areas, but not in areas where bottom trawl or dredge surveys occur. ESA-listed coral species have not been caught by SEFSC-affiliated research surveys in the past five years (2008-2012) and are unlikely to be caught in the future. Johnson's seagrass (*Halophila johnsonii*) also occurs within SEFSC research areas and is listed as threatened under the ESA. Designated critical habitat only exists in portions of the Indian River Lagoon and Biscayne Bay, FL. SEFSC surveys in these areas are limited to SCUBA divers and trap gear, where impact to substrate is minor and short in duration. Seagrass shoot density of other species (*Thalassia testudinum* and *Syringodium filiforme* in the Florida Keys) has been shown to only begin to decline after being covered by traps for 6 weeks or longer (Uhrin et al. 2005). The potential effects of the Status Quo Alternative on the above ESA-listed species are therefore negligible and will not be discussed in further detail.

4.2.7.1 Mortality from Surveys

Shrimp are the only invertebrates typically targeted for research in the SEFSC research areas because they are commercially important. Most research mortality of invertebrates occurs during targeted surveys, but also results from bycatch during other research surveys, such as bottom trawl surveys. In addition, benthic invertebrates can be crushed by fishing gear that contacts the sea floor, such as bottom trawls and dredges. There is decreased crush injury to invertebrates in locations where the substrate consists of sand, silt and/or mud (Hiddink et al. 2006).

The impact of mortality from fisheries research depends on the magnitude of the research catch relative to the overall biomass or population level of the species. Measuring these relative effects is difficult because there are very few species for which total populations have been estimated with any degree of certainty. To assess the magnitude of mortality effects in this DPEA, the amount of invertebrates caught in SEFSC-conducted research is combined with catch data from cooperative research partner surveys and compared to the amount caught in commercial fisheries in the SEFSC research areas, which is well known. Because commercial harvest limits are set at a fraction of estimated population, the magnitude of research catches relative to overall population levels would be much less than what is indicated in the comparisons with commercial landings.

The DPEA does not attempt to analyze the effects of research mortality on each of the hundreds of species caught in the various surveys; only species that are caught most frequently (total catch over one mt), and those species that are overfished or where overfishing is occurring (no applicable invertebrates for the SEFSC area) are analyzed.

Table 4.2-28 shows the average annual weight of the most frequently caught invertebrate species in the status quo period (2008-2012) from SEFSC-affiliated research surveys. These average annual research catches are compared to the average annual commercial landings of target species in the SEFSC area (2008-2012), to give an indication of the relative size of research catches. Research landings were well below 0.01 percent of commercial landings for the shrimp and jellyfish species caught in research surveys. For these species, the magnitude of research mortality is very small relative to the fisheries and even smaller relative to the estimated populations of these invertebrates.

Research landings of horseshoe crab and sponges were higher, but below 10 percent of commercial landings. All commercial catch data available for horseshoe crab for the SEFSC area are from North Carolina. No catch data was available for other states in the SEFSC area. Stock statuses are not available for these invertebrates. However, a study on sponges in the Florida Keys indicated that populations of certain sponge species are on the rise (Mcmurray et al. 2010).

The majority of horseshoe crab catches occurred in the South ARA during ACFCMA Ecological Monitoring Trawl Surveys (GDNR) and SEAMAP-SA Coastal Trawl Surveys (SCDNR). The most recent horseshoe crab stock assessment was conducted in 2009 and concluded that abundance trends varied regionally but were stable or increasing in the Southeast region (ASMFC 2009). Additional research indicates that horshoe crab abundance in the Southeast region has remained stable or continued to increase since 2009 (ASMFC 2013).

Table 4.2-28 Relative Size of SEFSC-Affiliated Research Catch of Invertebrates Compared to Commercial Catch (Landings) in Metric Tons (mt)[1]

Common Name	Status of the Stock	Catch for SAFMC (mt)	Catch for GOMFMC (mt)	Total average SEFSC affiliated research catch per year (mt) (2008-2012)	Average commercial landings per year (mt)[2] SEFSC (2008-2012)	Average research catch compared to commercial landings (%)
Brown Shrimp	no overfishing not overfished	0.2	1.4	1.6	98,818.4	<0.1
Cannonball Jellyfish	NA	14.9	<0.1	14.9	1293.95[3]	<0.1
Horseshoe crab	NA	<0.1	3.0	3.0	36.6	8.2
Moon Jellyfish	NA	0	1.7	1.7	1293.95[3]	<0.1
Sponges	NA	0	5.0	5.0	100	5.0
White Shrimp	no overfishing not overfished	1.9	<0.1	1.9	50,885.7	<0.1

1 Only species/groups with total catch greater than one mt (1,000 kg) are listed.

2 Sources: NOAA 2014b, NOAA 2014c

3 Commercial catch data is for all jellyfish species combined

4.2.7.2 Physical Damage to Infauna, Epifauna, and Seagrasses

Many gear types used by SEFSC, including hook-and-line gear, plankton trawls, dip nets, seines and gillnets, visual surveys, ROVs, and acoustic equipment are not likely to physically damage infauna, epifauna, or seagrasses. These gears generally do not interact with the benthos and their likelihood for physical disturbance can be considered negligible. Corals with branching morphology do have the potential to become fouled by hook-and-line gear, but fishing effort by SEFSC is relatively low, especially compared to recreational and commercial fisheries. For example, hook-and-line sampling by SEFSC in the CRA deploys approximately 900 lines among three surveys, compared to 363,237 angler trips in the Caribbean in 2014 (Fisheries Statistics Division, NMFS, pers. comm. to A. Herndon, NMFS, December 19, 2014).

SCUBA surveys have the potential to physically damage infauna, epifauna, and seagrasses through incidental contact. However, the use of highly qualified divers, extensive dive training, and adherence to best practices designed to minimize unnecessary contact with benthos diminish the likelihood of any potential incidental effects to infauna, epifauna, and seagrasses.

SEFSC surveys using bottom trawls, dredges, fish traps, and underwater camera arrays can impact infaunal and epifaunal invertebrates in sand, silt, gravel, and coral habitats. Seagrasses may also be impacted by these gear types during deployment. Infauna live in the seafloor or within structures that are on the seafloor and include clams, tubeworms, and burrowing crabs that usually construct tubes or burrows and commonly occur in deeper and subtidal waters. Epifauna, including coral, crabs, and sponges, live on the surface of the seafloor or on structures on the seafloor such as rocks, pilings, or vegetation. They either attach to these surfaces or range freely over them by crawling or swimming. Fishing gear that contacts the seafloor can disturb infauna and epifauna by crushing them, burying them, removing them, or exposing them to predators, and thus can reduce complexity and species diversity (Collie et al. 2000, Morgan and Chuenpagdee 2003). Trawling can also bury shoots, leaves, and flowering structures of seagrasses. Once buried, the leaves of seagrasses can no longer function, which diminishes their ability to grow and reproduce (ASMFC 2000). The level of biological damage to infauna, epifauna, and seagrasses can vary from very minimal with infrequent disturbance to severe with repeated disturbance in the same areas (ASMFC 2000, Stevenson et al. 2004). Since many research surveys are not conducted in fixed locations locations every year, the potential for repeated disturbance to any specific area is very low. Fish traps and underwater camera arrays may cause abrasion or fragmentation if they contact coral colonies or other benthos, but they are lowered to the bottom (not dropped) and are not intentionally deployed directly atop of known reef habitats. Furthermore, bottom trawl surveys are only conducted on suitable benthic substrates, e.g. sand, silt or gravel bottoms with few large rocks or sharp surfaces that may damage the gear. Rocky areas that are more likely to support corals and other epifauna are generally avoided by using sonar to examine the bottom contours before surveys are conducted. Given this practice, catch of corals from bottom trawling has been infrequent (total catch less averaging less than 50 kg per year, with no ESA-listed corals caught) and limited in geographic scope. Therefore, the magnitude and geographic extent of potential physical damage to infauna, epifauna, and seagrasses due to SEFSC research activities would be considered minor.

4.2.7.3 Changes in Species Composition

Massive removals of marine invertebrate species from an ecosystem could potentially alter community structure and predator-prey relationships (Donaldson et al. 2010). Commercially important invertebrate species are managed under FMPs with the management intent to harvest at rates that promote optimal yield, with an increasing emphasis on taking ecosystem considerations into account when setting harvest levels. In commercial fisheries, bycatch is either returned to the sea or landed if it has adequate commercial value and is allowed by the appropriate FMP. Bycatch can be minimized through gear and operational modifications, including localized fishing closures.

Studies conducted in the North Sea found that chronic commercial trawling reduced benthic biomass by approximately 50 percent (Hiddink et al. 2006). Species richness and the functional composition of benthic communities were also impacted. Species most affected by the trawling were permanently attached species, larger bodied and longer-lived species, and filter-feeders, while scavengers, burrowers, and short-lived and small species were not significantly affected (Hiddink et al. 2006, Tillin et al. 2006). Despite large reductions in infauna and epifauna biomass in intensively trawled areas, the mean trophic level of the benthic communities and trophic relationships within the communities were relatively unchanged (Jennings et al. 2001). The study concluded that trophic structure of intensively trawled benthic invertebrate communities may be a robust feature of the North Sea ecosystem. Within SEFSC research areas, a study in South Carolina estuarine sounds noted no obvious differences in species composition between trawled and non-trawled sites before and after commercial shrimp trawling with respect to indices of species diversity (Van Dolah et al. 1991). Contrary to the intensive and chronic bottom trawling conducted by commercial fisheries in localized regions of high catch probability, SEFSC research bottom trawl and dredge surveys are of short duration, generally of randomized design, are rarely repeated in the same location over time, and are collectively much smaller in scale. They are, therefore, likely to have only minor and short-term effects on benthic communities.

4.2.7.4 Contamination or Degradation of Habitat

Fishing activities involving gear that contacts the sea floor (e.g. bottom trawls and dredges) can physically disturb benthic habitat (including seagrass beds) used by invertebrate species. Such effects can include furrowing and smoothing of the sea floor (Morgan and Chuenpagdee 2003). Physical effects to the sea floor from fishing gear increase with increasing frequency and duration. In addition, bottom trawl activities can locally increase turbidity which may interfere with feeding activities of filter-feeding organisms. However, many research surveys conducted by the SEFSC and cooperative research programs are stratified random designs, meaning the exact location of a survey trawl or dredge is randomly determined each year within an area of interest. Repeated trawls in the same location are rare or infrequent. Research tows are also generally limited to 15-30 minutes so the footprint of each tow is very small. Longer duration tows are limited to the SEFSC BRD Evaluations Survey, SEFSC-GOM TED Evaluations Survey, and SEFSC Small Turtle TED Testing and Gear Evaluations Survey, where tows are conducted for up to 2 hours. However, each of these surveys is short in duration and requires no more than 21 DAS. An analysis of the area involved in bottom trawl and dredge surveys in Section 4.2.1 indicates that research surveys in the Status Quo Alternative would cover much less than 0.1 percent of the Gulf of Mexico and Atlantic Research Areas, even in the most heavily sampled seasons. There are no trawl or dredge surveys in the Caribbean Research Area under the Status Quo Alternative. Recovery time from trawl surveys in the soft-bottom environments they target is estimated to be less than two years (Jennings et al. 2001). Therefore, effects to invertebrate habitat from research surveys are expected to be minor in magnitude and short-term in duration, especially compared to the magnitude of habitat disturbance caused by commercial fishing operations.

The potential for research vessels to cause degradation of benthic and pelagic habitat through contamination would only be through accidental spills and discharges, which would likely be limited in magnitude, rare, and localized (see Section 4.2.3).

4.2.7.5 Conclusion

SEFSC-affiliated fisheries research conducted under the Status Quo Alternative could have direct and indirect effects on many invertebrate species through mortality, physical damage to infauna and epifauna, changes in species composition, and contamination or degradation of habitat.

Mortality due to research surveys are well below 0.01 percent of commercial landings for shrimp and jellyfish species and below 10 percent for horseshoe crabs and sponges and is considered to be minor in magnitude for all species. Mortality for all species would be distributed across a wide geographic area rather than concentrated in particular localities and the risk of altering benthic community structure would be minimal. Disturbance of animals and benthic habitats from research activities would be temporary and minor in magnitude for all species. As described in Section 4.2.1, the potential for accidental contamination of marine habitats from accidental spills from research vessels is considered unlikely and would be minor in magnitude and temporary or short-term in duration. The overall direct and indirect effects of the Status Quo Alternative on invertebrates would be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.2.8 Effects on the Social and Economic Environment

Section 3.3 describes the interaction of the SEFSC with the social and economic environment of the Southeast coastal U.S. This section describes the effects of SEFSC-affiliated fisheries and ecosystem research conducted under the Status Quo Alternative on socioeconomic resources of the Southeast region. Major factors that could be influenced by the SEFSC research program include:

- Collection of scientific data used in sustainable fisheries management
- Economic support for fishing communities
- Collaborations between the fishing industry and fisheries research
- Fulfillment of legal obligations specified by laws and treaties

4.2.8.1 Collection of Scientific Data used in Sustainable Fisheries Management

The SEFSC fisheries research program has the most potential to affect the social and economic environment through its contribution to the fisheries management process. The MSA, as amended by the Sustainable Fisheries Act, establishes a collaborative fisheries management process with key roles for NOAA Fisheries, the regional Fishery Management Councils, and the Interstate Marine Fisheries Commissions. Under the MSA, FMPs must contain conservation and management measures which prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery. The MSA defines optimum yield as:

(A) the amount of fish which will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems;

(B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and

(C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Among other considerations, FMPs must also contain provisions to conserve essential fish habitat, minimize bycatch and the mortality of bycatch, and provide for the sustained participation of fishing communities while minimizing adverse economic impacts on them, to the extent practicable and consistent with conservation aims and requirements. In carrying out Congress's mandate under the MSA, NOAA Fisheries is responsible for ensuring that management decisions involving fishery resources are based on the highest quality, best available scientific information on the biological, social, and economic status of the fisheries.

Under the Status Quo Alternative, the long-term, standardized resource surveys conducted by the SEFSC and its cooperative research partners, as summarized in Table 2.2-1, provide a rigorous scientific basis for the development of fisheries stock assessments and federal fishery management actions in the Southeast region. The extended time-series of data helps identify trends that inform fisheries management planning.

This information is essential to establishing annual species-specific sustainable harvest limits on an optimal yield basis.

Many of the Status Quo research surveys also provide important comparative information on open, managed, and closed fishing areas, such as the differences between recovery rates, biodiversity, and species density that is vital to assessing the success of fisheries management measures. SEFSC fisheries research also provides information on ecosystem characteristics that is essential to management of commercial fisheries. Climate change and increase in ocean acidification have the potential to impact the population and distribution of marine species. Long-term, predictable marine research provides information on changes to and trends regarding the marine ecosystem that must be considered by fisheries managers. In addition to the long-term SEFSC research surveys, short-term research projects conducted by cooperative research partners, as described in Table 2.2-2, address strategic issues important to the commercial fishing industry, such as the development and monitoring of current and emerging fisheries, habitat characterization and conservation, development of ecosystem management methods, and ways to reduce bycatch of non-target species. The scientific information provided by the SEFSC is therefore used not just for current management decisions, but also to conserve resources and anticipate future trends, ensure future fishing utilization opportunities, and assess the effectiveness of the agency’s management efforts.

The fisheries management process can be contentious when fisheries stocks are relatively scarce and resources must be rationed and allocated among competing commercial, recreational, and environmental interests. Past overfishing practices have led to depleted stocks and, under mandates from the MSA to establish harvest limits to halt overfishing and rebuild depleted stocks, the fishery management process has imposed significant reductions in harvest limits for some fisheries in order to rebuild stocks of overfished species. These reductions in harvest limits have resulted in adverse economic impacts on certain sectors of the fishing industry with associated adverse social impacts on fishing communities. However, after decades of overfishing and diminishing yields, fish stocks in the Southeast region are generally in recovery, due in part to management decisions made with the input from SEFSC fisheries research activities. Rebuilding stocks of important commercial and recreational species would result in long-term beneficial effects on the economies and social relations and cultural institutions of many fishing communities along the Atlantic coast and Gulf Coast. Scientific data provided through the long-term and short-term fisheries research conducted and associated with the SEFSC has played an important role in the development of fisheries and conservation policies through informing the fisheries management process.

4.2.8.2 Economic Support for Fishing Communities

One of the ways the SEFSC research activities support the social and economic environments is through its role in supporting commercial and recreational fisheries management in the Southeast. In 2012, commercial fishermen in the Southeast landed 1.7 billion and 108 million pounds of fish and shellfish respectively, earning $171 million in landings revenue. Overall, commercial fishing (exclusive of imports) along the Atlantic coast and Gulf Coast contributed to approximately 204,000 thousand jobs, about $1.4 million in sales, and $9.7 million in value added (NMFS 2014a). In that same period, 5.7 million recreational anglers (over 81 percent of South Atlantic anglers and over 91 percent of Gulf of Mexico anglers were residents of a regional coastal county) took 41 million trips. Overall, recreational fishing generated 171 thousand jobs, $16.7 billion in expense, $7.3 billion in income, and $11.5 billion in value added (Table 3.3-3).

In addition, the majority of commercial and recreational fishermen value fishing as much for the activity itself and the part it plays in their way of life and cultural traditions as they do for the money they earn (Holland and Ditton 1992, Pollnac and Poggie 2008, Smith and Clay 2010). In some cases, fishermen will even subsidize fishing with income from another job in order to stay on the water (Veltre and Veltre

1983, Doeringer et al. 1986). Further, recreational fishing can also include some subsistence fishing, potentially based on ethnicity, gender or location (Toth and Brown 1997, Steinback et al. 2009).

Within this context, social and economic data collection and analysis in the Southeast allows for determination of the relative social and economic impacts of a set of proposed management alternatives. This type of information is also important for compliance with EO 12898 on environmental justice, which directs agencies to assess actions that may disproportionately affect low income and minority populations. Where conservation outcomes are similar, NMFS attempts to choose alternatives with the most positive or, at a minimum, least negative social and economic impact on fishermen, the fishing industry, related shoreside industries, and fishing communities.

SEFSC contributes to the social and economic environments through direct expenditures on fisheries research. The SEFSC's annual spending fluctuates, but has averaged about $60 -63 million in recent years (SEFSC Operations Management and Information Staff pers. comm. 2015). This spending has direct and indirect beneficial economic effects on the communities and ports in the Southeast Region through expenditures in support of NOAA vessels, chartered vessels, and research facilities as well as providing employment and contracted services that contribute to local economies. Some commercial fishing operations are compensated for participation in cooperative research projects through grants or shares in fishing quotas that they sell on the market. Other cooperative research partners, including state agencies, universities, and commercial fishing associations, receive funding through the SEFSC which supports their employees, research vessels, and facilities and therefore supports a large number of local economies. Altogether, the SEFSC currently spends approximately $29.3 million annually in support of the fisheries research activities covered in the Status Quo Alternative, not including capital costs of vessels and facilities (SEFSC Operations Management and Information Staff pers. comm. 2015). This includes ship time, staff time, equipment, materials, logistics costs, and contracts. Funding for cooperative research programs has fluctuated widely in the past and was strongly influenced by congressional earmarking during budget appropriations. The average amount of money distributed through the various cooperative research efforts administered through the SEFSC has averaged about $2.3 million in recent years. Similarly, in addition to benefits of social and economic research to the fisheries management enterprise, SEFSC supplies contracts and grants to individual social science researchers and to academic and other institutions throughout the Southeast that conduct social science research on how humans impact and are impacted by ecosystems, climate change, interactions with protected species, wind energy development, and other issues.

The magnitude of the economic impacts of SEFSC fisheries research activities must be placed in the context of regional and local economies according to the impact criteria in Table 4.1-1. While the contribution of research-related employment and purchased services is undoubtedly important and beneficial for many individuals and families, the total sums spent for research are very small compared to the value of commercial and recreational fisheries in the area as well as the overall economy of those communities. The contribution of SEFSC research is relatively larger for some communities where the research is centered (i.e., Hampton Roads Area, Virginia) and may be considerate moderate in magnitude for those communities but the overall direct impact would be minor in magnitude for most communities. These direct impacts would be certain to occur under the Status Quo Alternative, would affect numerous communities throughout the region, and would be long-term and beneficial. Overall, the beneficial economic impacts of SEFSC fisheries research activities would be considered minor to moderate according to the impact criteria in Table 4.1-1.

There are certainly indirect impacts of fisheries research to the economic status of fishing communities but these impacts are filtered through a long and complicated fisheries management environment. It is not possible to assign a monetary value to these indirect impacts although, as stated before, these impacts are generally considered beneficial to fishing communities through their contribution to sustainable fisheries management. In any case, fisheries management decisions by the Fishery Management Councils and

NMFS are subject to their own NEPA compliance processes where these types of economic impacts are analyzed in depth so they will not be assessed in this DPEA.

4.2.8.3 Collaborations between the Fishing Industry and Fisheries Research

Cooperative research is an important element in establishing communication, trust, and information exchanges between scientists, fisheries managers, and the fishing industry. Cooperative research is used to: a) increase the precision and expand the scope of resource surveys; b) provide supplemental information about fishing operations; c) incorporate fishing expertise into the design and implementation of research; and d) build mutual understanding and respect among scientists and people in the fishing industry. Collaboration in the development of new gear and techniques encourages participation in developing sustainable fishing practices and contributes to a broader understanding of management for marine resources.

Under the Status Quo Alternative, the relationships that are being built between scientists and the fishing industry through the cooperative research programs would continue to serve as a vehicle for sharing knowledge and building mutual understanding and respect. Several SEFSC-affiliated fisheries research programs, such as the highly migratory species surveys, provide opportunities for undergraduate and graduate students to participate in and gain valuable practical experience in marine research. As more members of the fishing industry become engaged in the research programs that ultimately feed into the development of fisheries management measures, there will be an increased level of public education and awareness about the basis for fishery regulatory changes. The participation of highly experienced and resourceful members of the fishing industry also leads to valuable advances in conservation engineering, which in turn results in more efficient fishing and fewer adverse effects on the marine environment.

4.2.8.4 Fulfillment of Legal Obligations Specified by Laws and Treaties

Chapter 6 provides a list of laws and treaties applicable to the SEFSC fisheries research program. These obligations include the 1996 amendment to the MSA, which requires assessment, specification, and description of the effects of conservation and management measures on participants in fisheries, and on fishing communities (NMFS 2007b). The SEFSC fisheries research programs help fulfill these obligations under the MSA for the Southeast Region. In addition, research conducted by the SEFSC and cooperating partners on highly migratory species helps fulfill U.S. treaty obligations for conservation and management of these species under the International Convention for the Conservation of Atlantic Tunas.

4.2.8.5 Conclusion

SEFSC-affiliated fisheries and ecosystem research conducted under the Status Quo Alternative would provide a rigorous scientific basis for fisheries managers to set optimum yield fishery harvests while protecting the recovery of overfished resources and ultimately rebuilding these stocks to appropriate levels. It also contributes directly and indirectly to local economies, promotes collaboration and positive relationships between NMFS and other researchers as well as with commercial and recreational fishing interests, and helps fulfill NMFS obligations to communities under U.S. laws and international treaties.

The direct and indirect effects of the Status Quo Alternative on the social and economic environment would be certain to occur, minor to moderate in magnitude depending on the community, long-term, and would be felt throughout the Southeast region. According to the impact criteria established in Table 4.1-1, the direct and indirect effects of the Status Quo Alternative on the social and economic environment would be minor to moderate and beneficial.

4.3 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2 - PREFERRED ALTERNATIVE

This section presents an analysis of the potential direct and indirect effects of Alternative 2 – Preferred Alternative on the physical, biological, and social environment. Under this Alternative, the SEFSC would conduct a new suite of research activities and implement new mitigation measures in addition to the Status Quo program to comply with the MMPA and ESA compliance process. The new suite of research activities is a combination of past research and additional, new research. Potential direct and indirect effects were evaluated according to the criteria described in Table 4.1-1. A summary of the impact rating determinations for all topics evaluated under Alternative 2 is presented below in Table 4.3-1.

Table 4.3-1 Alternative 2 Summary of Effects

Resource	Physical Environment	Special Resource Areas	Fish	Marine Mammals	Birds	Sea Turtles	Invertebrates	Social and Economic
Section #	**4.3.1**	**4.3.2**	**4.3.3**	**4.3.4**	**4.3.5**	**4.3.6**	**4.3.7**	**4.3.8**
Effects Conclusion	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor to Moderate *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor to Moderate *beneficial*

4.3.1 Effects on the Physical Environment

The effects of the Preferred Alternative on the physical environment would be similar to those of the Status Quo Alternative (Section 4.2.1). The additional mitigation measures for protected species proposed under the Preferred Alternative would not change the effects of the research activities on physical properties of the environment. The changes to the suite of research activities conducted under the Preferred Alternative would result in minimal changes to the physical effects to the benthic environment relative to the Status Quo Alternative. Therefore, the overall effects of The Preferred Alternative on the physical environment are certain to occur and the duration of such effects would be on the order of weeks to months. The intensity of impacts to the benthic habitat would be small but measurable, and the geographic extent of any physical contact with benthic habitats would be much less than 0.02 percent of the overall SEFSC research area and therefore considered minor.

Adverse effects on water quality from research activities are caused by the resuspension of sediments and are considered minor in magnitude. These effects are certain, but of short duration and therefore have minor impacts.

Overall, effects on the physical environment are almost certain to occur under the preferred alternative, changes to the resource would be small but measureable, would cover a small geographic area, and would be temporary in duration. Therefore overall it is considered a minor adverse effect according to the impact criteria in Table 4.1-1.

4.3.2 Effects on Special Resource Areas and Essential Fish Habitat

The effects of the Preferred Alternative on special resource areas and EFH would be similar to those of the Status Quo Alternative (Section 4.2.2). The additional mitigation measures for protected species proposed under the Preferred Alternative would not change the effects of the research activities on the physical components of the environment or most biological components; they would only tend to decrease effects on protected species. The changes to the suite of research activities conducted under the Preferred Alternative (Table 2.3-1) would result in minimal changes to the physical and biological effects to special resource areas relative to the Status Quo Alternative. None of the new research activities proposed under the preferred alternative would occur within any NMS. Effects of the new research activities to other special resource areas including EFH, HAPC, and closed areas would be similar to those of the Status Quo Alternative.

Therefore, the overall effects of The Preferred Alternative on special resource areas and EFH would be minor in magnitude, dispersed over a large geographic area, and would mostly be temporary or short-term in duration, although impacts on sensitive benthic substrates, should they occur, may last several years. The overall impacts of SEFSC fisheries research on special resource areas and EFH would therefore be considered minor adverse according to the impact criteria in Table 4.1-1. As was the case for the Status Quo Alternative, the scientific data generated from SEFSC research activities under the Preferred Alternative would also have beneficial effects on special resource areas, including National Marine Sanctuaries, through their contribution to science-based conservation management practices.

4.3.3 Effects on Fish

SEFSC-affiliated fisheries research conducted under the Preferred Alternative would have the same types of effects on fish species as described for the Status Quo Alternative (Section 4.2.3) through mortality, disturbance, and changes in habitat. There are small changes in the research projects conducted under the Preferred Alternative (Table 2.3-1) that could affect the catch rate or species of fish caught relative to the Status Quo, including:

- Elimination of one component of the HMS–GOM Shark Pupping & Nursery Survey, that conducted by the USA/DISL, will not be continued under the Preferred Alternative.
- Addition of one component of the HMS–GOM Shark Pupping & Nursery Survey conducted by the Mote Marine Laboratory.
- Elimination of one component of the SEAMAP-GOM Shrimp/Groundfish Trawl Survey, that conducted by the Texas Parks & Wildlife Department (TPWD).
- Addition of SEAMAP-GOM Finfish Vertical Line Survey (University of Southern Mississippi Gulf Coast Research Lab [USM/GCRL] and Mississippi Department of Marine Resources [MDMR]).
- Elimination of Panama City Laboratory ROV Reef Fish Survey (SEFSC).
- Elimination of ACFCMA American Eel Fyke Net Survey (GDNR).
- Elimination of Environmental Influences on Pink Shrimp research (SEFSC).
- Addition of Oceanic Deep-water Trawl Survey (SEFSC). (This survey has been planned but not yet funded).
- Addition of SEAMAP-C Lane Snapper Bottom Longline Survey, (Puerto Rico Department of Natural and Environmental Resources [PR-DNER]).

None of the differences between the Preferred Alternative and the Status Quo Alternative would substantially change the potential impacts of research on benthic habitat or the risk of accidental contamination. These potential effects were considered minor adverse under the Status Quo Alternative because of their relatively low magnitude, dispersal over time and space, and, in the case of contamination, the small risk of occurrence (Section 4.2.3). These types of effects would also be considered minor adverse under the Preferred Alternative for the same reasons. The following discussion will therefore focus on potential effects through mortality of fish.

4.3.3.1 ESA-listed Species

Mortality from fisheries research activities

There are five marine fish species in the project areas currently listed as threatened or endangered under the ESA - the smalltooth sawfish, the scalloped hammerhead shark, and three species of sturgeon – the Atlantic, gulf and shortnose. None of the new surveys target any of these species. However, the additional sampling component of the HMS–GULFSPAN Survey conducted by the Mote Marine Laboratory (MML) targets juvenile sharks in the Charlotte Harbor estuary in state waters of Southwestern Florida and has the potential to catch smalltooth sawfish or scalloped hammerhead sharks. The area from Charlotte Harbor estuary south to Everglades National Park has historically contained the largest populations of small tooth sawfish (NMFS 2010d), with Charlotte Harbor estuary designated as a potential nursery area for the species (NMFS 2010d). Scalloped hammerhead sharks and sturgeon species also could be caught with this survey (although no sturgeon species have been taken in any of the various GULFSPAN surveys). Survey protocols indicate the potential for interaction and mortality is minimized: the net will be set for short soak times (less than 1 hour) and only during daytime hours in the spring and summer, facilitating the ability of scientists to better attend to the net if interactions are observed. The Alabama portion of the GULFSPAN survey has had no historical catch of ESA-Listed species and its removal is expected to be negligible.

The SEAMAP-GOM Shrimp/Groundfish Trawl Survey has the only historical take of ESA-listed smalltooth sawfish in SEFSC research. That fish was taken and released alive during the FFWCC portion of the survey, in coastal waters of Southwest Florida. This survey has also taken scalloped hammerhead sharks from sets in Louisiana and Mississippi but these fish were not from the ESA-listed CSA DPS. No sturgeon species have been taken in any of the various Shrimp/Groundfish Trawl surveys. Elimination of the TPWD component, which took place in coastal waters of Texas, therefore likely has little to no effect on the overall ability of this survey to capture ESA-listed species. The other eliminated surveys likewise have had zero take of ESA-listed species and no effect from their exclusion is expected.

The new SEAMAP-GOM Finfish Vertical Line Survey and the Oceanic Deep-water Trawl Survey have the potential to catch ESA-listed species, including sturgeon. The SEAMAP-C Lane Snapper Bottom Longline Survey would be prosecuted in Puerto Rico, where ESA-listed sturgeon do not occur. Overall, it is assumed that potential impacts on ESA-listed species would be similar under the Preferred Alternative to what they were in the Status Quo Alternative (Section 4.2.3.1). Under the Preferred Alternative, the anticipated impacts of SEFSC research on ESA-listed species would be low in magnitude, would occur rarely or infrequently, would be dispersed over time and space, and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.3.3.2 Target and Other Species

Mortality from fisheries research activities

The USM/GCRL & MDMR SEAMAP-GOM Finfish Vertical Line Survey is designed similarly to existing surveys prosecuted by Alabama Department of Conservation & Natural Resources (ADCNR) and LDWF. These surveys both use the same type of gear and target reef fish in the Gulf of Mexico Research Area. The existing surveys only have minimal historical catch of species other than red snapper. Combined red snapper catch between the two surveys amount to approximately 1326 kg per year, about 37.7 percent of the total red snapper research catch. This amounts to about 0.03 percent of the ACL for this species (Table 4.2-8). Conservatively assuming a doubling of total red snapper research catch by all three vertical line surveys, the total percent of ACL remains below 0.2 percent. This amount is considered low in magnitude but the research also has beneficial effects through the valuable data collected for this important fishery.

GULFSPAN surveys are fairly consistent in regards to gear and sampling methodologies (Table 2.2-1) so comparisons of the loss of one eliminated survey (that prosecuted by USA/DISL) to the addition of another (that prosecuted by MML) are necessarily focused on the area where the surveys are fished. However, the specific locations where this new survey would be conducted and the protocols have not been determined yet; these details would greatly influence the types and amount of species caught. Similarly, the Oceanic Deep-water Trawl Survey (SEFSC) would also be prosecuted in areas where surveys have not historically been completed. The impact of these surveys is therefore unknown but, considering comparisons of catch rates to similar GULFSPAN or trawl surveys, is considered small in magnitude, dispersed in time and geographic area, and likely to have minimal impact.

The issues concerning overfished species or other species with conservation concerns would be the same under the Preferred Alternative as described for the Status Quo Alternative (Section 4.2.3.2). Most research activities conducted by the SEFSC are multi-species surveys that cover large areas, involve minimal sampling, and do not target overfished species. Research catches in these surveys are generally very small for uncommon species. None of the new projects are focused on a particular species or group of fish so the impact of research on overfished stocks is not expected to interfere with rebuilding plans for those stocks. Overall, the impact of NWFSC research on target and bycatch fishes under the Preferred Alternative is considered minor adverse according to the impact criteria described in Table 4.1-1.

Research data is necessary for monitoring the status of overfished stocks and other stocks of conservation concern and to determine if management objectives for rebuilding those stocks are being met. Under the Preferred Alternative, proposals for scientific research projects must go through a rigorous process to get scientific research permits or experimental fishing permits. The potential impacts of those proposed projects are assessed for each stock, including overfished stocks, before those permits are issued. Fisheries managers typically consider the estimated amount of research catch from all projects along with other sources of mortality (e.g., bycatch in other fisheries and predation) before setting commercial fishing limits to prevent overfishing of stocks or to help overfished stocks rebuild. This type of annual review of research proposals would continue to occur in the future under the Preferred Alternative. Any future proposed projects targeting overfished stocks, or projects likely to have substantial bycatch of an overfished stock, would receive additional scrutiny on a stock by stock basis to ensure minimal impact on the stock before a research permit is issued. These permitting reviews would also determine whether the proposed projects were consistent with the NEPA analysis presented in this DPEA or whether additional NEPA analysis was required (see Section 2.3.5).

4.3.3.3 Highly Migratory Species

GULFSPAN surveys target highly migratory shark species. As mentioned above, the new GULFSPAN survey prosecuted by MML is fairly consistent in regards to gear and sampling methodologies with existing GULFSPAN surveys (Table 2.2-1) so comparisons of the loss of one eliminated survey (that prosecuted by USA/DISL) to the addition of another are necessarily focused on the area where the surveys are fished. However, the specific locations where this new survey would be conducted and the protocols have not been determined yet; these details would greatly influence the types and amount of species caught. Therefore, presumptions require that the removed GULFSPAN be considered to have the same impact as the eliminated survey. As existing surveys are considered to be small in magnitude, dispersed in time and geographic area, and likely to have minimal impact on HMS populations, new surveys can be considered to have similar impacts in absence of new survey data. Overall, the impact of NWFSC research on HMS fishes under the Preferred Alternative is considered minor adverse according to the impact criteria described in Table 4.1-1.

4.3.4 Effects on Marine Mammals

The direct and indirect effects of the Preferred Alternative on marine mammals are very similar to those described for the Status Quo Alternative (Section 4.2.4). Differences between the alternatives that may affect the impacts of SEFSC fisheries research on marine mammals include:

- Improved and formalized protected species training, awareness, and reporting procedures to facilitate and improve implementing mitigation measures (see below).
- Discontinuation of part or all of five projects and the addition or modification of several other projects (Section 2.3, Table 2.3-1).

The following analysis draws heavily on the analysis provided under the Status Quo Alternative (Section 4.2.4), but focuses on differences that may result from the new research elements and mitigation measures added under the Preferred Alternative.

The Preferred Alternative is the SEFSC research program and suite of mitigation measures that are being proposed in the MMPA LOA application (Appendix C). The analysis of effects in the LOA application was based primarily on the history of past effects under status quo conditions, including mitigation measures as they were implemented at the end of 2015. However, the nature of the status quo conditions has changed in the last ten years in terms of the specific research being conducted and the implementation of mitigation measures for protected species interactions. The SEFSC regularly assesses their effects on the marine environment and explores ways to effectively reduce adverse interactions while fulfilling their mission to collect scientific information for fisheries and natural resource management. The Status Quo Alternative, therefore, reflects the mitigation equipment and procedures as they were implemented through the end of 2015, while the Preferred Alternative includes ongoing efforts to develop new mitigation measures.

The Preferred Alternative includes the same suite of mitigation measures described under the Status Quo Alternative with the following modifications to reduce the risk of adverse interactions with protected species (Section 2.3.2). The SEFSC proposes improvements to its protected species training, awareness, and reporting procedures under the Preferred Alternative in order to facilitate and improve the implementation of mitigation measures described under the Status Quo Alternative. Enhancements include:

- The SEFSC will initiate a process for its FPCs, SWLs, scientists, and vessel captains and crew to communicate with each other about protected species interactions during research surveys in order to improve decision-making regarding avoidance of adverse interactions. The intent of this mitigation measure would be to draw on the collective experience of people who have been making those decisions, provide a forum for the exchange of information about what went right and what went wrong, and try to determine if there are any rules-of-thumb or key factors to consider that would help in future decisions regarding avoidance practices. The SEFSC would coordinate not only among its staff and vessel captains and crew but also with those from other fisheries science centers, research partners, the NMFS Southeast Regional Office, and other institutions with similar experience.
- Formalized training has not been required under the status quo conditions for all SEFSC researchers and partners. All OMAO officers and SEFSC scientists are knowledgeable about the mitigation requirements of all take reduction and ship strike avoidance plans, and general mitigation measures to avoid protected species incidental take, and these protocols are described in written cruise instructions and safety placards posted on research vessels. Many scientists have also received varying levels of training through formal workshops and in-house presentations. In an effort to help standardize and further emphasize the importance of protected species information, the SEFSC will require that at a minimum, two members of the scientific party or

crew participating on each field survey, including SEFSC research crews and research partner crews, will receive formal training through NMFS Highly Migratory Species/Protected Species Safe Handling, Release, and Identification Workshops (http://www.nmfs.noaa.gov/sfa/hms/compliance/workshops/protected_species_workshop/index.html) or other similar workshops. This workshop is designed to teach protected species identification as well as proper techniques for safe handling and release of entangled or hooked protected species, such as sea turtles, marine mammals, and smalltooth sawfish.

- The SEFSC will implement the use of a Protected Species Safe Handling and Release Manual (Appendix D). The manual includes topics such as current mitigation measures, decision-making factors for avoiding take, procedures for handling and releasing protected species caught in research gear, and reporting requirements. Review and discussion of the manual would be conducted by the SEFSC on a regular basis and updates would be distributed to SEFSC and partner scientists.
- For all SEFSC and partner research projects, mitigation measures are included in the written cruise instructions. In addition, informational placards and reporting procedures will be reviewed and updated as necessary for consistency and accuracy. Many research cruises already include pre-sail review of protected species protocols for participating scientists and crew but the SEFSC will require pre-sail briefings to be conducted before all research cruises, including those conducted by research partners.
- The SEFSC will incorporate specific language into its contracts that specifies training requirements, operating procedures, and reporting requirements for protected species that will be required for all surveys conducted by research partners, including those conducted on chartered vessels.
- The SEFSC has developed Protected Species Incidental Take reporting form and instructions (Appenix D) and will require all SEFSC and research partners to use this form for reporting incidental takes of all protected species. The form includes information about the interaction, biological information, gear and any mitigation measures in place. The information collected can then be reviewed and used to determine whether additional mitigation measures are necessary for that survey or gear type.

The potential effects of the Preferred Alternative on marine mammals involve adverse interactions with research vessels, survey gear, sonar and other active acoustic devices, and other associated equipment, including:

- Disturbance and behavioral responses due to acoustic equipment
- Injury or mortality due to ship strikes and entanglement in gear
- Changes in food availability due to research survey removal of prey and discards
- Contamination from discharges

These mechanisms of potential effects are discussed under the Status Quo Alternative (Section 4.2.4), most of which will not be repeated here. The mechanism in the first bullet, acoustic disturbance, would be similar under the Preferred Alternative as it is for the Status Quo Alternative since no new acoustic sound sources would be introduced and no new mitigation measures are being proposed that would address potential effects due to acoustic disturbance. Although every species of marine mammal in the research area may be exposed to sounds from active acoustic equipment used in SEFSC research, many of the acoustic sources are likely not audible to most species and the others would likely cause temporary and minor changes in behavior for nearby animals as the ships pass through a given area. The overall effects from acoustic disturbance are considered minor adverse for all species in the SEFSC research areas. The potential effects from changes in food availability and contamination were also considered to be minor adverse for all species of marine mammals and will not be discussed further. The following discussion will therefore focus on the potential effects from entanglement or incidental capture in fishing gear used in SEFSC research, especially with regard to any differences between the Status Quo Alternative and the Preferred Alternative.

4.3.4.1 Atlantic Research Area

<u>ESA-listed species</u>

The endangered marine mammals that occur in the ARA include North Atlantic right, humpback, fin, and sperm whales, and the Florida manatee. Manatees are under the jurisdiction of the USFWS, while the remainder is under the jurisdiction of NMFS in regards to compliance with the MMPA and ESA.

Injury, serious injury, or mortality due to entanglement/hooking in gear

There have been no entanglements or takes of current ESA-listed marine mammals in SEFSC ARA fisheries research and the LOA application does not include any estimated Level A harassment or serious injury and mortality takes of threatened or endangered marine mammals during the five-year authorization period. The SEFSC also does not anticipate any future takes of manatees due to their nearshore habitat and lack of overlap with SEFSC research activities. Manatees are under the jurisdiction of the USFWS and are not covered in the LOA application to NMFS.

In addition to the mitigation measures that have been implemented in recent years under the Status Quo Alternative, the Preferred Alternative includes several new measures that may further reduce the risk of future marine mammal takes. Measures to mitigate the risk of entanglements are described in Section 2.3.1 and summarized above. Given these measures and the lack of prior entanglements of ESA-listed marine mammals, the likelihood of these types of interactions in fisheries research gear under the Preferred Alternative would be low. The potential effects from entanglement in research gear in the ARA under the Preferred Alternative are, therefore, considered minor adverse for ESA-listed marine mammal species.

<u>Other cetaceans</u>

This section describes impacts to cetaceans that are not ESA-listed. Minke whales are the only baleen whale species included in this section. The remaining cetaceans are toothed whale species (i.e., odontocetes), including whales, dolphins, and porpoises.

Injury, serious injury, or mortality due to entanglement/hooking in gear

The analysis of historical takes and estimated takes for cetaceans in the LOA application are the same as presented under the Status Quo Alternative (Section 4.2.4). Potential takes are determined by historical takes in fisheries research, species with similar vulnerabilities to historically taken species, and historical takes in analogous commercial fisheries. Bottlenose dolphins are the only species with historical takes in SEFSC fisheries research. Take requests for other species are based on species analogous to bottlenose dolphins or known takes in commercial fisheries using analogous fishing gear. Potential effects under the Preferred Alternative would be similar to those expected under Status Quo conditions, although the SEFSC anticipates that new training programs included in the Preferred Alternative could further reduce risks of adverse interactions with marine mammals. However, any attempt to quantitatively estimate how much these enhancements would reduce potential interactions would be speculative so the effects analysis for the Preferred Alternative is based on the estimated marine mammal takes in the LOA application (Appendix C and Tables 4.2-17 and 4.2-18).

Seven of the estuarine and bay stocks in the ARA for which takes are requested have an undetermined PBR due to limitations in population assessment research (Table 4.2-17). For most of the bottlenose dolphin stocks in the ARA for which take is requested and PBR is known, the average annual take represents less than 10 percent of PBR and, if it occurred, would be considered minor in magnitude. For two stocks of bottlenose dolphins in the ARA for which PBR is known (Central Georgia Estuarine stock and Southern Georgia Estuarine stock), the requested take of one animal over the five-year authorization period, if it actually occurred, would be between 10 percent and 20 percent of that stock's PBR and would be considered moderate in magnitude. The seven estuarine and bay stocks with undetermined PBR are also probably small and, if their populations were determined, would also likely have small PBRs and the take request could be a similar percentage of their respective PBRs as the stocks with a calculated PBR.

The lack of recent population information for many bottlenose dolphin stocks prevents a quantitative assessment of the potential impact of requested takes for stocks with undetermined PBR. If new population estimates for one or more stocks of bottlenose dolphins are developed in the future, NMFS will consider the potential impacts of its ongoing fisheries research program and requested take authorizations on an adaptive management basis, including the potential for additional mitigation measures as necessary.

Given the relative infrequency with which take historically occurred (seven bottlenose dolphins from four stocks over 14 years in the ARA), the limited scope of SEFSC research efforts within the ranges of these coastal and estuarine stocks, and the mitigation measures that are implemented during research (see Section 2.2.2), the SEFSC does not expect this level of take to actually occur. The likelihood of taking the maximum number for any one stock is low, as is reaching the upper limit of 10 takes for all stocks combined over five years.

For species for which takes are requested other than coastal and BSE stocks of bottlenose dolphins, the estimated average annual take in trawl and hook-and-line gears is well below 10 percent of PBR for all species (Table 4.2-18**).** This level of mortality, were it to occur, would be considered minor in magnitude.

The LOA application also includes requests for takes of one "undetermined delphinid" in hook-and-line gear over the five-year LOA period, for an average annual take of 0.2. This request is made to account for similar looking species that may be caught or entangled in gear, but free themselves or are released before they can be identified or photographed by research personnel. The top priority for live animals is to release them as quickly and safely as possible. The SEFSC ship's crew and research personnel make concerted efforts to identify animals incidentally caught in research gear whenever crew and vessel safety are not jeopardized. This type of situation would be more likely to occur during the night or other periods of poor visibility or weather conditions.

For impact analysis purposes, the undetermined delphinid take is assigned to each delphind stock (other than coastal and BSE stocks of bottlenose dolphins) considered susceptible to hook-and-line gear, i.e., those species for which specific takes were requested in hook-and-line gear. This consideration results in the addition of 0.2 average annual takes to each of those delphind stocks (Table 4.2-18). Even with the addition of these "undetermined" takes, the combined take request would still be well below 10 percent of PBR for all of these stocks and would be considered minor in magnitude.These potential mortalities would be rare or infrequent events. The overall impact of the potential takes of these species, if they occurred under the Preferred Alternative, would be considered minor adverse according to the criteria described in Table 4.1-1.

<u>Pinnipeds</u>

This section describes potential impacts to harbor seals and gray seals. The former hauls out in small numbers in North Carolina during winter, while the latter is known from periodic strandings in the northern part of the SEFSC ARA. The Atlantic Striped Bass Tagging Bottom Trawl Survey during January and February north of Cape Hatteras, NC could potentially interact with these species.

Disturbance and behavioral responses due to acoustic equipment

The potential exposure of these two pinniped species to active acoustic sources used in SEFSC research during winter months is very small and the LOA does not include any take request for these species with acoustic sources.

Injury, serious injury, or mortality due to entanglement/hooking in gear

The analysis of estimated takes for pinnipeds in the LOA application are the same as presented under the Status Quo Alternative (Section 4.2.4). Potential takes are determined by historical takes in analogous commercial fisheries. Potential effects under the Preferred Alternative would be similar to those expected under Status Quo conditions, although the SEFSC anticipates that new training programs included in the Preferred Alternative could further reduce risks of adverse interactions with marine mammals. However, any attempt to quantitatively estimate how much these enhancements would reduce potential interactions would be speculative so the effects analysis for the Preferred Alternative is based on the estimated marine mammal takes in the LOA application (Appendix C and Table 4.2-18).

Based on seals previously caught in analogous commercial fishing gear (Northeast and Mid-Atlantic bottom trawl fisheries), the SEFSC determined that takes of one harbor seal and one gray seal in trawl gear over the five-year authorization period in the ARA is an appropriate precautionary estimate (Table 4.2-18). The estimated average annual take for harbor seals is less than one percent of PBR and, although PBR is undetermined for gray seals, such a low level of would likely be equally inconsequential on a population level for that species. This level of mortality, were it to occur, would be considered minor in magnitude.

4.3.4.2 Gulf of Mexico Research Area

ESA-listed species

The endangered marine mammals that regularly occur in the GOMRA include sperm whales and manatees. Manatees are under the jurisdiction of the USFWS, while sperm whales are under the jurisdiction of NMFS in regards to compliance with the MMPA and ESA.

Injury, serious injury, or mortality due to entanglement/hooking in gear

The analysis of historical takes and estimated takes for cetaceans in the LOA application are the same as presented under the Status Quo Alternative (Section 4.2.4). Bottlenose dolphins are the only species with historical takes in SEFSC fisheries research. Take requests for other species are based on species analogous to bottlenose dolphins or on takes in commercial fisheries using analogous fishing gear. Potential effects under the Preferred Alternative would be similar to those expected under Status Quo conditions, although the SEFSC anticipates that additional training programs and improved education and communication included in the Preferred Alternative would further reduce risks of adverse interactions with marine mammals. In addition to the mitigation measures that have been implemented in recent years under the Status Quo Alternative, the Preferred Alternative includes new measures that may further reduce the risk of future marine mammal takes primarily through additional communication and training procedures.

There have been no historical takes of ESA-listed marine mammals in the GOMRA by any SEFSC fisheries research activities. The LOA application does not include any estimated Level A harassment or serious injury and mortality takes of threatened or endangered marine mammals during the five-year authorization period. The SEFSC also does not anticipate any future takes of manatees due to their nearshore habitat and lack of overlap with SEFSC research activities. Measures to mitigate the risk of entanglements are described in Section 2.3.1 and summarized above. Given these measures and the lack of prior entanglements of ESA-listed marine mammals, the likelihood of these types of interactions in fisheries research gear under the Preferred Alternative would be low. The potential effects from entanglement in research gear in the GOMRA under the Preferred Alternative are, therefore, considered minor adverse for ESA-listed marine mammal species according to the criteria described in Table 4.1-1.

Other cetaceans

This section describes impacts to cetaceans that are not ESA-listed. Bryde's whale is the only baleen whale species included in this section. All other species considered here are toothed whales (odontocetes), including small whales, dolphins, and porpoises.

Injury, Serious Injury, or Mortality due to Entanglement/Hooking in Gear

The analysis of historical takes and estimated takes for non-ESA listed cetaceans in the LOA application (and under the Preferred Alternative) are the same as presented under the Status Quo Alternative (Section 4.2.4). Estimated effects are, therefore, the same for both alternatives, with take requests as shown in Tables 4.2-20 and 4.2-21). The SEFSC anticipates that new research and training programs included in the Preferred Alternative could further reduce risks of adverse interactions with marine mammals.

Bottlenose dolphins are the only species with historical takes in SEFSC fisheries research. Take requests for other species are based on species analogous to bottlenose dolphins or known takes in commercial fisheries using analogous fishing gear. Only those coastal or BSE stocks of bottlenose dolphins whose ranges overlap with SEFSC and cooperating research partner fisheries research activity have been requested for potential take by the SEFSC. Figure 4.2-5 illustrates stock boundaries within which SEFSC fisheries research occurs within the GOMRA.

Table 4.2-20 shows the maximum number of potential takes requested for each stock (not to exceed 10 total takes for all stocks combined in the GOMRA). The SEFSC and its research partners conduct research within the ranges or directly adjacent to the ranges of 22 stocks from the Northern Gulf of Mexico Bay, Sound, and Estuarine Stock complex, 17 of which have an undetermined PBR due to limitations in population assessment research. For all but one of these stocks the SEFSC is requesting one take over the five-year period. The exception is the Mississippi Sound/Lake Bornge/Bay Boudreau stock, for which three takes are requested over the five-year authorization period. For four of the stocks where PBR has been determined (Mississippi River Delta, Mississippi Sound/Lake Bornge/Bay Boudreau, Choctwhatchee Bay, and St. Joseph Bay), PBR is small and the average annual take request would be between 10 percent and 20 percent of PBR. This level of take, if it occurred, would be considered to be a moderate magnitude of impact on these stocks. For one stock for which PBR has been determined (St. Vincent Sound/Apalachiola Bay/St. George Sound), the average annual take request would be less than 10 percent of PBR and, if it occurred, would be considered to be minor in magnitude for the stock. Many of the stocks with undetermined PBR are also small and, if their populations were determined, would also likely have small PBRs and the take request could be a similar percentage of their respective PBRs as the five stocks with a calculated PBR.

Of the Northern Gulf of Mexico Bay, Sound, and Estuarine Stocks, SEFSC research has historically taken bottlenose dolphins only from the Mobile Bay/Bonsecour Bay and the Mississippi Sound/Lake Bornge/Bay Boudreau stocks: two takes occurred in the SEFSC TED testing research in skimmer trawls (one released alive), one was caught and released from a bottom longline in the SEAMAP-GOM survey, and one died after being caught in a gillnet used in the Gulf of Mexico Shark Pupping and Nursery project. Given the historically low levels of take from these stocks (four takes over 14 years of research), the lack of historical takes of other stocks, the relatively small amount of research within their ranges, and the implementation of mitigation measures as described sections 2.2.2 and 2.3.2, the SEFSC believes it is unlikely to exceed the one take per five-year authorization period for any of the requested BSE stocks.

The lack of recent population information for many bottlenose dolphin stocks prevents a quantitative assessment of the potential impact of requested takes for stocks with undetermined PBR. If new population estimates for one or more stocks of bottlenose dolphins are developed in the future, NMFS will consider the potential impacts of its ongoing fisheries research program and requested take authorizations on an adaptive management basis, including the potential for additional mitigation measures as necessary.

Based on species previously caught in analogous commercial fishing gear, the SEFSC determined that low levels of takes of the ten cetacean species shown in Table 4.2-21 over the five-year authorization period in the GOMRA is an appropriate precautionary estimate. The SEFSC is not requesting takes of large whales and several other cetaceans by trawl gear due to lack of historical interactions and the low probability of take due to species' distribution, density, abundance, and behavior.

The only SEFSC take of a marine mammal in longline gear occurred in 2013 and involved a single bottlenose dolphin in a bottom longline in the GOMRA. The animal was released alive. Therefore, requested takes are largely based on takes in analogous research or commercial fishing operations. There are several species, such as large whales, that are known to interact with commercial longline fisheries but for which SEFSC is not requesting take. Other species known to interact with hook-and-line gear, such as Risso's dolphins and pilot whales, are included among those for which low levels of take are requested (Table 4.2-21). The likelihood of interacting with SEFSC hook-and-line gear is small considering the low level of survey effort (small numbers of short sets of limited length gear) and the mitigation measures employed so the SEFSC is requesting a minimal number of potential takes in hook-and-line research gear, one take of each species over the five-year authorization period (Table 4.2-21).

The LOA application also includes requests for takes of one "undetermined delphinid" in any hook-and-line gear type over the five-year LOA period, for an average annual take of 0.2. This request is made to account for similar looking species that may be caught or entangled in gear, but free themselves or are released before they can be identified or photographed by research personnel. The top priority for live animals is to release them as quickly and safely as possible. Ship's crew and research personnel make concerted efforts to identify animals incidentally caught in research gear whenever crew and vessel safety are not jeopardized. This type of situation would be more likely to occur during the night or other periods of poor visibility or weather conditions.

The estimated average annual take for each specified cetacean species other than the coastal and BSE bottlenose dolphin stocks is below 10 percent of PBR for all species (Table 4.2-21). This level of mortality, were it to occur, would be considered minor in magnitude. For impact analysis purposes, the undetermined delphinid take is assigned to each delphind stock considered susceptible to hook-and-line gear, i.e., those species for which specific takes were requested in hook-and-line gear. This consideration results in the addition of 0.2 average annual takes to each of those delphind stocks (Table 4.2-21). Even with the addition of these "undetermined" takes, the combined take request would still be less than 10 percent of PBR for almost all of these stocks (except rough-toothed dolphin) and would be considered minor on the population level. For rough-toothed dolphin, the combined take request, if it occurred, would be between 10 percent and 20 percent of that stock's PBR and would be considered moderate in magnitude on the population level. Given the fact that this species has never been taken historically by the SEFSC and the mitigation measures that are implemented during research, the SEFSC does not expect this level of take to actually occur.

These potential mortalities would be rare or infrequent events. The overall impact of the potential takes of cetacean species, if they occurred under the Preferred Alternative, would be considered minor to moderate adverse according to the criteria described in Table 4.1-1.

4.3.4.3 Caribbean Research Area

ESA-listed species

The endangered marine mammals that occur in the CRA include humpback whales, sperm whales, and West Indian manatees. Manatees are under the jurisdiction of the USFWS, while the whales are under the jurisdiction of NMFS in regards to compliance with the MMPA and ESA.

Injury, serious injury, or mortality due to entanglement in gear

Potential effects under the Preferred Alternative are anticipated to be the same as under Status Quo conditions. There have been no historical takes of ESA-listed species of marine mammals in the CRA and the SEFSC is not anticipating any future takes of ESA-listed species in the CRA because the risk of interactions with fisheries research gear used in the CRA is very low. The potential effects from entanglement in research gear is, therefore, considered minor adverse for ESA-listed species throughout the CRA during all seasons using gear types similar to those currently in use.

Other cetaceans

This section describes impacts to cetaceans that are not ESA-listed, all of which are toothed whales (odontocetes), including small whales, dolphins, and porpoises

Injury, serious injury, or mortality due to entanglement in gear

The analysis of historical takes and estimated takes for non-ESA listed cetaceans in the LOA application (and under the Preferred Alternative) are the same as presented under the Status Quo Alternative (Section 4.2.4). Estimated effects are, therefore, the same for both alternatives, with take requests as shown in Table 4.2-23).

There have been no historical takes of marine mammals by SEFSC in the CRA and there are no documented takes in Caribbean fisheries, including gillnet or beach seine fisheries, over the last five years. Potential takes are, therefore, estimated based on takes in analogous commercial fisheries in the Gulf of Mexico. Five species ofcetaceans are considered to have a reasonable risk of being taken in hook-and-line gear during the course of SEFSC fisheries research in the CRA, as shown in Table 4.2-23. Included on this table and in the LOA application, is a requested take of one “undetermined delphinid” in hook-and-line gear over the five-year LOA period, for an average annual take of 0.2. Since population estimates are unknown and PBR cannot be determined for any of the species included here, impact analysis and determinations are not possible. However, the potential take levels are sufficiently small that impacts are likely to be minor for most species.

4.3.4.4 Conclusion

Under the Preferred Alternative, potential direct and indirect effects on marine mammals through acoustic disturbance, potential changes in prey availability, and contamination or degradation of habitat would be similar to those described for the Status Quo Alternative (Section 4.2.4) and would be considered minor adverse for all species. Effects due to entanglement in fisheries research gear would also be similar to those anticipated under the Status Quo alternative and would be considered minor adverse for most species. Impact levels for species or stocks with small populations and low PBR levels could be minor to moderate adverse.

The numbers of marine mammals estimated to be taken in future SEFSC-affiliated research under the Preferred Alternative are based on the historical takes of eleven bottlenose dolphins during SEFSC research surveys in the ARA and GOMRA from 2002 through 2015. Takes involved bottom trawl, trammel nets, skimmer trawls, and bottom longline gear. Available historic data and other data on mortalities in commercial fisheries using similar gear were used to estimate the potential for combined level A harassment takes and serious injuries and mortalities under the Preferred Alternative. The Preferred Alternative also includes a suite of mitigation measures currently implemented for SEFSC surveys under the Status Quo Alternative and several new training and communication programs intended to improve the effectiveness of the existing mitigation measures used to protect marine mammals and other protected species. New measures proposed under the Preferred Alternative should help reduce impacts relative to the Status Quo Alternative. Future takes, if they occur, would likely be fewer than the estimated numbers since estimates are based on a precautionary approach to ensure accounting for a maximum level of potential take. The estimated potential takes in all research gears and in all research areas would be less than 10 percent of PBR for most species/stocks for which PBR is known and would be considered to have minor magnitudes of effect on the population level for each of impacted species. For a few stocks, estimated potential takes would be between 10 and 20 perent of PBR and, if they occurred, would be considered moderate in magnitude.

The overall effects of the Preferred Alternative on marine mammals would be minor to moderate in magnitude, dispersed over a large geographic area, and non-mortality impacts would be temporary or short-term in duration, and would therefore be considered minor to moderate adverse according to the impact criteria in Table 4.1-1.

4.3.5 Effects on Birds

The effects of the Preferred Alternative on birds would be very similar to those described for the Status Quo Alternative (Section 4.2.5). The additional mitigation measures for protected species proposed under the Preferred Alternative may raise awareness about potential interactions with seabirds and strengthen reporting practices in general but they are unlikely to change the actual effects of SEFSC research activities on seabirds, which are minor. The changes to the suite of research activities conducted under the Preferred Alternative would also result in minimal changes to the effects on seabirds relative to the Status Quo Alternative. The overall effects of the Preferred Alternative on seabirds would likely be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration, and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.3.6 Effects on Sea Turtles

The Preferred Alternative would have the same types of effects on sea turtles as those described for the Status Quo Alternative (Section 4.2.7). Direct and indirect effects of SEFSC research activities on sea turtles may include: disturbances or changes in sea turtle behavior due to physical movements and sounds, injury or mortality due to ship strikes, entanglement in gear, and contamination or degradation of sea turtle habitat.

The primary difference between these alternatives in their effects on sea turtles is the risk of adverse gear interactions (capture and entanglement). Unless otherwise noted below, all other effects on sea turtles are the same as described in Section 4.2.6.

The scope of SEFSC fisheries research activities under the Preferred Alternative is similar to that described for the Status Quo Alternative except for the following elements that could affect the overall risk of incidental gear interactions with sea turtles:

- The addition of one survey component adding about 80 gillnet sets per year in the GOMRA (HMS–GOM Shark Pupping & Nursery Survey conducted by the Mote Marine Laboratory)
- The addition of one longline survey in the CRA (SEAMAP-C Lane Snapper Bottom Longline Survey conducted by PR-DNER), adding 180 longline sets per year in this region that has had no historical takes of sea turtles.

4.3.6.1 Captures and Mortality in Gillnet Gear

The addition of 80 gillnet sets per year in the GOMRA, of less than one hour duration each, would incrementally raise the risk of gear interactions above the level of the Status Quo Alternative. Assuming the highest capture rate among all the other components of this survey (the HMS–GOM Shark Pupping & Nursery Survey conducted by USM/GCRL, Table 4.2-25), this component would have an annual risk of 80 set-hours x 0.0095 Kemp's ridley turtles per set-hour = 0.76. This additional component would therefore raise the expected number of sea turtles to be caught in the GOMRA in gillnet gear from three Kemp's ridleys to four per year. Given the short set duration and continual presence of researchers monitoring the gear, all of these turtles are expected to be released alive and in good condition.

4.3.6.2 Captures and Mortality in Longline Gear

There have been no takes of sea turtles in any SEFSC-affiliated research gear in the CRA in the past and none were expected to occur in the future under the Status Quo Alternative. The addition of one longline survey in the CRA, 180 sets of 100 hooks each, would add a minimal amount of risk that sea turtles may be caught in research gear. However, there are no past takes in this area on which to base a take estimate and basing estimates on capture rates from other areas would be inappropriate. There would be some risk of future captures but future takes of sea turtles in the CRA would likely be rare events, if they occured.

4.3.6.3 Conclusion

The effects of the Preferred Alternative on sea turtles through disturbance, changes in prey availability, and contamination or degradation of habitat would be similar to those described for the Status Quo Alternative (Section 4.2.6) and would be considered minor adverse. The Preferred Alternative includes several new training and communication programs intended to improve the effectiveness of the existing mitigation measures used to protect sea turtles and other protected species. It is not possible to quantify how much these new measures would reduce impacts to sea turtles but they would help reduce such impacts relative to the Status Quo Alternative.

The increase risk of capture of sea turtles in these areas under the Preferred Alternative would be very small relative to the overall numbers of sea turtles expected to be captured or hooked in SEFSC-affiliated research (about 133 turtles per year under the Status Quo, Table 4.2-26). Although this may introduce risk of captures and injuries or mortality in an area where no captures have occurred in the past, the overall impact on sea turtles due to gear interactions would still be considered minor in magnitude under the Preferred Alternative.

The overall effects of the Preferred Alternative on ESA-listed sea turtles would likely be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.3.7 Effects on Invertebrates and Plants

SEFSC-affiliated fisheries research conducted under the Preferred Alternative would have the same negligible effects on ESA-listed invertebrates and plants as discussed under the Status Quo Alternative. The Preferred Alternative would also have the same types of effects on other invertebrates and seagrasses as described for the Status Quo Alternative (Section 4.2.7) and include mortality, physical damage, and changes in species composition. The main difference between the Status Quo and the Preferred Alternative in regard to these effects is the discontinuation and addition of various research surveys (Table 2.3-1).

No new surveys in the Preferred Alternative use bottom trawl or dredge gear that may significantly impact invertebrates. The only new survey with potential to increase invertebrate mortality, physical damage, or change species composition is the Oceanic Deep-water Trawl Survey, which would deploy approximately 60 high speed mid-water trawls per year. However, the discontinuation of the Environmental Influences on Pink Shrimp Survey (20 trawls per year) and TPWD cooperation of the SEAMAP-GOM Shrimp/Groundfish Trawl Survey (200 trawls per year) would negate the adverse effects of the new trawl survey.

The overall effects of the Preferred Alternative on invertebrates would likely be low in magnitude, distributed over a wide geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the criteria in Table 4.1-1. In addition to these adverse effects, the Preferred Alternative would contribute to long-term beneficial effects on managed invertebrate and plant species through the contribution of SEFSC-affiliated fisheries research to sustainable fisheries management. Data from SEFSC-affiliated research provides the scientific basis to reduce bycatch, establish optimal fishing levels, prevent overfishing, and recover overfished stocks. The beneficial effects of the time-series data provided by SEFSC research programs are especially valuable for long-term trend analysis for commercially harvested invertebrates and, combined with other oceanographic data collected during fisheries research, provide the basis for monitoring changes to the marine environment important to invertebrate populations.

4.3.8 Effects on the Social and Economic Environment

The SEFSC-affiliated research program under the Preferred Alternative includes the addition or expansion of several long-term surveys noted in Table 2.3-1 and the discontinuation of several long-term surveys conducted under the Status Quo Alternative noted in Table 2.2-1. In addition, short-term cooperative research projects would use the same types of fishing gears but have greater levels of effort than the Status Quo Alternative and the particular goals and objectives of those projects could be different under the Preferred Alternative (see Section 2.3.4). These differences in the SEFSC fisheries research program under the Preferred Alternative are not expected to measurably increase or decrease socioeconomic effects compared to the Status Quo Alternative (see Section 4.2.8).

SEFSC-affiliated fisheries and ecosystem research conducted under the Preferred Alternative would provide a rigorous scientific basis for fisheries managers to set optimum yield fishery harvests while protecting the recovery of overfished resources and ultimately rebuilding these stocks to appropriate levels. It would also contribute directly and indirectly to local economies, promotes collaboration and positive relationships between NMFS and other researchers as well as with commercial and recreational fishing interests, and help fulfill NMFS obligations to communities under U.S. laws and international treaties.

The direct and indirect effects of the Preferred Alternative on the social and economic environment would be certain to occur, minor to moderate in magnitude depending on the community, long-term, and would be felt throughout the Southeast region. According to the impact criteria established in Table 4.1-1, the direct and indirect effects of the Preferred Alternative on the social and economic environment would be minor to moderate and beneficial.

4.4 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 3 – MODIFIED RESEARCH ALTERNATIVE

This section presents an analysis of the potential direct and indirect effects of Alternative 3 – Additional Mitigation Alternative on the physical, biological, and social environment. Under this Alternative, the SEFSC would conduct a new suite of research activities and implement new mitigation measures in addition to the Status Quo program. The new suite of research activities is a combination of past research and additional, new research, as described for the Preferred Alternative. Potential direct and indirect effects were evaluated according to the criteria described in Table 4.1-1. A summary of the impact rating determinations for all topics evaluated under Alternative 3 is presented below in Table 4.4-1.

Table 4.4-1 Alternative 3 Summary of Effects

Resource	Physical Environment	Special Resource Areas	Fish	Marine Mammals	Birds	Sea Turtles	Invertebrates	Social and Economic
Section #	**4.4.1**	**4.4.2**	**4.4.3**	**4.4.4**	**4.4.5**	**4.4.6**	**4.4.7**	**4.4.8**
Effects Conclusion	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor to Moderate *adverse*	Minor *adverse*	Minor *adverse*	Minor *adverse*	Minor to Moderate *beneficial*

4.4.1 Effects on the Physical Environment

The effects of the Modified Research Alternative on the physical environment would be similar to those of the Status Quo Alternative (see Section 4.2.1). Additional mitigation measures for protected species required under the Modified Research Alternative would not change the effects of the research activities on physical properties of the environment. Therefore, the overall effects of The Modified Research Alternative on the physical environment are certain to occur and the duration of such effects would be on the order of weeks to months. The intensity of impacts to the benthic habitat would be small but measurable, and the geographic extent of any physical contact with benthic habitats would be much less than 0.02 percent of the overall SEFSC research area and therefore considered minor.

Adverse effects on water quality from research activities are caused by the resuspension of sediments and are considered minor in magnitude. These effects are certain, but of short duration and therefore have minor impacts.

Overall, effects on the physical environment are almost certain to occur under the Modified Research alternative, changes to the resource would be small but measureable, would cover a small geographic area, and would be temporary in duration. Therefore overall it is considered a minor adverse effect according to the impact criteria in Table 4.1-1.

4.4.2 Effects on Special Resource Areas and Essential Fish Habitat

The effects of the Modified Research Alternative on special resource areas and EFH would be similar to those of the Status Quo Alternative (see Section 4.2.2). Most of the additional mitigation measures for protected species proposed under the Modified Research Alternative would not change the effects of the research activities on the physical components of the environment or most biological components; they would only tend to decrease effects on protected species. The exception is the potential for spatial/temporal restrictions on SEFSC research activities intended to reduce adverse impacts on protected species. These restrictions could be placed on particular gear types of concern or in particular areas of concern such as federal and state MPAs. An MPA is defined by EO 13158 as "any area of the marine environment that has been reserved by federal, state, tribal, territorial, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." They include: state MPAs, National Wildlife Refuges, National Park Service MPAs, and National Marine Sanctuaries (see Section 3.1.2.4). EO 13158 also includes the following directive: "To the extent permitted by law and to the maximum extent practicable, each federal agency, in taking such actions, shall avoid harm to the natural and cultural resources that are protected by an MPA."

MPAs within the SEFSC fisheries research areas include Florida Keys, Flower Garden Banks, and Gray's Reef NMS, EFH, and HAPC, areas closed to fishing or certain fishing gears, and numerous smaller protected areas (NMPAC 2012).

Some MPAs have permit systems for activities that would otherwise be prohibited, such as scientific research with bottom trawl gear, and the SEFSC routinely applies for such permits if a particular research activity may adversely affect the MPA. These permits may restrict the level of effort, gear types used, locations, and other conditions of the activity as well as having monitoring and reporting requirements. The Status Quo therefore already includes the potential prohibition or restriction of SEFSC research activities in MPAs. Any spatial/temporal restrictions on SEFSC fisheries research in MPAs (or other designated areas) under the Modified Research Alternative would further decrease or minimize the potential for direct adverse impacts to special resource areas relative to The Status Quo Alternative, which were considered minor.

MPAs are, by definition, managed more carefully than other special resource areas and depend more heavily on scientific data about their status to sustain the habitats and resources they are designed to protect. As was the case for the Status Quo Alternative, the scientific data generated from SEFSC research activities under the Modified Research Alternative could have beneficial effects on special resource areas, including National Marine Sanctuaries, through their contribution to science-based conservation management practices. This is why many MPAs include exemptions or permit processes for scientific research. Indirect effects resulting from spatial/temporal restrictions on research in MPAs could include adverse impacts resulting from a lack of the data needed to support science-based management of MPAs. The magnitude and duration of the indirect adverse effects would depend on how extensive the restrictions on research became and how long such restrictions lasted.

Specific spatial/temporal restrictions on SEFSC research have not been proposed under the Modified Research Alternative; the overall level of research effort and therefore effects on the marine environment are assumed to be essentially the same as those described under the Status Quo Alternative. Therefore, the overall effects of the Modified Research Alternative on special resource areas would be minor in magnitude, dispersed over a large geographic area, and would mostly be temporary or short-term in duration, although impacts on sensitive benthic substrates, should they occur, may last several years. The overall impacts of SEFSC fisheries research on special resource areas and EFH would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.4.3 Effects on Fish

Under the Modified Research Alternative, the SEFSC would implement additional mitigation measures for protected species while conducting the same scope of research as described under the Preferred Alternative. Most of the additional mitigation measures would be unlikely to affect the amount of fish caught for research purposes. The exceptions are the potential for spatial/temporal restrictions on SEFSC-affiliated research in areas considered important to protected species and the potential for incorporation of marine mammal or sea turtle excluder devices in research trawls.

Spatial/temporal restrictions could reduce research fishing and hence impacts on fish in some locations. However, researchers may respond to spatial/temporal restrictions by redirecting research efforts to other locations if such movements are consistent with research goals and do not compromise time-series data sets. If so, overall research efforts could remain the same. The Modified Research Alternative does not specify particular spatial/temporal restrictions but it is assumed for the DPEA analysis that overall research effort and therefore impacts to fish would be very similar under the Modified Research Alternative as they are for the Preferred Alternative, although they may occur in somewhat different locations and times.

The SEFSC currently uses a turtle excluder device in the BRD Evaluation, GOM TED Evaluation, SA TED Evaluation, Skimmer Trawl TED Testing, and Small Turtle TED Testing and Gear Evaluations surveys (Table 2.2-1). The incorporation of marine mammal or sea turtle excluder devices in other research trawls could affect the numbers, species, and size/age classes of fish caught in the trawls. These potential changes in the catchability of research trawls would have critical implications for the scientific validity of the research and could compromise the integrity of time-series data used to inform fisheries stock assessments. Other gear modifications proposed include hook size increases and bait alterations to reduce incidental takes of sea turtles. Any such gear changes would require extensive and expensive testing and calibration studies across the range of habitats, depths, spatial areas, and seasons of the survey to test potential impacts under all survey conditions before they could be implemented. For surveys such as the HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Survey, continued time-series data would be severely affected by such adjustments. For this reason, the SEFSC is not proposing to add additional excluder devices or other gear modifications to its research protocols under the Preferred Alternative. It is not possible to estimate what the effects may be for any species of fish if such changes were mandated under the Modified Research Alternative.

It is assumed for this DPEA analysis that overall impacts to fish under the Modified Research Alternative would be substantially the same as those described under the Preferred Alternative. These effects would be low in magnitude, distributed over a wide geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the criteria in Table 4.1-1. As was the case with the Status Quo and Preferred Alternatives, the Modified Research Alternative would also contribute to long-term beneficial effects on managed fish species throughout the South Atlantic, Gulf of Mexico and Caribbean Region through the contribution of SEFSC-affiliated fisheries research to sustainable fisheries management.

4.4.4 Effects on Marine Mammals

The Modified Research Alternative includes the same scope of research in all three SEFSC research areas as the Preferred Alternative, including the same mitigation measures currently implemented or to be implemented, and intended to reduce potentially adverse interactions with marine mammals and other protected species. The Modified Research Alternative differs from the Preferred Alternative in that it also includes a suite of mitigation measures that the SEFSC is not proposing to implement as part of the proposed action in the SEFSC LOA application (Appendix C). The SEFSC considers the suite of mitigation measures to be implemented under the Preferred Alternative to represent the most effective and practicable means to reduce the risk of adverse interactions with protected species without adversely affecting the scientific integrity of its research programs. However, NMFSs Office of Protected Resources (OPR) must consider a broad range of mitigation measures under the MMPA authorization and ESA consultation processes, and these additional measures will be considered in this alternative. These additional mitigation measures focus on reducing the likelihood of mortality or injury from interaction with fisheries research gear (Level A harassment and serious injury and mortality take), particularly trawl and longline gear, and are described in Section 2.4 of this DPEA. They involve:

- The use of additional personnel and equipment/technologies to improve detection of marine mammals, especially at night or other low-visibility conditions.
- Operational restrictions on survey activities at night or other low-visibility conditions.

- The use of additional acoustic or visual deterrents to keep marine mammals away from research gear.
- Gear modifications, including marine mammal excluder devices on trawl nets and video sampling. Temporal or geographic restrictions to avoid known concentrations of marine mammals or federal and state MPAs.
- Use of decoy vessels to distract marine mammals away from research sets.

None of the additional mitigation measures directly concern the reduction of noise from vessels or acoustic devices (Level B harassment take), reducing the numbers of fish and invertebrates caught in research samples, or reducing the risk of accidental contamination from spills. The analyses of effects through these mechanisms (disturbance or changes in habitat quality) are the same as described for the Status Quo and Preferred Alternatives and will not be discussed further. The following analysis will therefore focus on the potential for the additional mitigation measures to reduce the risk of Level A harassment, injury, and mortality through entanglement in fishing gear or ship strikes.

Scientists at the SEFSC continually review their procedures to see if they can do their work more efficiently and with fewer incidental effects on the marine environment, including effects on marine mammals. Many of the additional mitigation measures included in this alternative have been discussed and considered in the past by SEFSC scientists; however, any changes to operational procedures or the equipment used during surveys must also be considered from the standpoint of how they affect the integrity of the scientific data collected, the cost of implementing equipment or operational changes, and the safety of the vessel and crew. It is not possible at this time to quantify how much any one of these measures (or some combination of them) may reduce the risk of future takes relative to the Status Quo or Preferred Alternatives. Any revisions to the estimated takes of each species to directly compare with the Status Quo or Preferred Alternatives would be based on speculation. This analysis will therefore provide a qualitative discussion of the potential for each additional mitigation measure to reduce takes and other effects on marine mammals as well as how each measure may affect practicability, data integrity, and other aspects of the survey work.

Trawl surveys

Several SEFSC surveys use bottom, mid-water, and surface trawl gear (see Tables 4.2-1 and 4.3-1). The following mitigation measures would apply to all trawl gear, even though marine mammal takes between 1999 and 2014 occurred only in bottom and skimmer trawls.

4.4.4.1 Monitoring Methods

Visual observations (using bridge binoculars as needed) by the officer on watch, Chief Scientist (CS) or other designated scientist, and crew standing watch are currently the primary means of detecting protected species in order to avoid potentially adverse interactions. However, there are other detection methods that have been tested or used in commercial fisheries, naval exercises, and geotechnical exploration that could be considered. These additional types of detection methods would be intended to be used in specific circumstances, such as operating at night or in low visibility conditions.

<u>Visual surveillance by dedicated Protected Species Observers (PSO)</u>

This measure would require the SEFSC to use trained protected species observers whose dedicated job is to detect the presence of marine mammals and other protected species within the survey area and communicate their presence to ship operations personnel. Considerations include the use of dedicated observers for all surveys or during trawl surveys of particular concern.

Under the Status Quo Alternative, the officer on watch (or other designated member of the scientific party), and crew standing watch on the bridge visually scan for marine mammals (and other protected species) during all daytime operations. Bridge binoculars are used as necessary to survey the area upon arrival at the station, during reconnaissance of the trawl line to look for potential hazards (e.g., presence of commercial fishing gear, sonar sweeps to check if bottom topography is suitable for trawling, etc.), and while the gear is deployed. If any marine mammals are sighted by the bridge or deck crew prior to or after setting the gear, the bridge crew and/or Chief Scientist are alerted as soon as possible. Currently, not all crew members have received formal training in marine mammal identification or marine mammal mitigation procedures, although they are briefed on what they are looking for and may have considerable experience with the task. However, the Preferred Alternative does include a new program to refine and formalize the training and decision-making process for all Chief Scientists, bridge crew, and deck crew that may be assigned to the observer post in the future. This new program would provide the same types of training for all appropriate crew members as PSOs trained for that specific task. This training would be provided by the commercial fisheries Observer Program staff at NMFS using the same course materials and reporting forms as used to train PSOs for applicable commercial fisheries. The difficulty in having crew members assigned only to PSO duties is that most vessels have limited carrying capacity for personnel and any berths given to PSOs would mean a reduction in personnel available to help with other research or vessel duties. This could compromise crew safety or the amount of research that could be conducted. For research projects using contracted commercial fishing vessels, there is often no additional space on the vessels for personnel other than essential crew. By providing formal PSO training for crew already trained in other skills, the SEFSC believes it can provide the same quality of visual monitoring for marine mammals and other protected species as would occur with dedicated PSOs while maintaining the flexibility to fulfill all other crew duties.

<u>Use of underwater video systems to monitor trawl gear</u>

Underwater video technology may allow the SEFSC to determine the frequency of marine mammal interactions with the trawl gear and evaluate the effectiveness of MMEDs or other efforts to mitigate entanglement interactions. Underwater video systems have been used for these purposes in several fisheries, both in the U.S. and abroad (Northridge 2003, Lyle and Willcox 2008, Dotson et al. 2010). Northridge (2003) describes a twin camera system used to monitor the grid and escape hole of an MMED and quantify the frequency and outcome of marine mammal interactions with trawl gear. Video images were carried by cable from the cameras to the wheelhouse for continuous display and recording (Northridge 2003). Similarly, Lyle and Willcox (2008) used a low-light black and white digital camera with a 90 degree wide-angle lens coupled to a commercially available hard drive unit to monitor interactions involving marine mammals and other megafauna.

Underwater video equipment may provide useful information about the efficacy of additional mitigation measures but the video equipment itself is unlikely to influence bycatch rates of marine mammals. In order to directly reduce takes of marine mammals, a video system to detect marine mammals underwater would have to be linked to a means of avoiding entanglement in gear. However, ships with deployed trawl nets cannot "swerve" to avoid a marine mammal for two reasons: 1) all marine mammals can swim faster than the tow speed so trying to move gear away from an animal that is likely attracted to fish in the net will be ineffective, and 2) changing the vessel direction suddenly risks tangling the gear, making it difficult and dangerous to retrieve, delaying retrieval and making the risk of marine mammal entanglement worse. In addition, many parts of the GOMRA and ARA have high-turbidity waters that would limit the range at which marine mammals could potentially be detected by underwater video gear and essentially eliminating any "advanced warning" that marine mammals were about to interact with the research gear.

<u>Use of passive acoustic monitoring</u>

Passive acoustic monitoring involves the detection of animals by listening for the sounds that they produce (Barlow and Gisiner 2006). Use of passive acoustic monitoring may aid in the detection of marine mammals present in survey areas, and could potentially be used to inform decisions about when to implement appropriate modifications of fishing operations to prevent interactions with marine mammals. Marine mammal calls can be reliably detected using hydrophones mounted on ships, autonomous underwater gliders, buoys, moorings, or bottom-founded installations. However, not all marine mammals vocalize and the vocalization rates of marine mammals may vary in a complex fashion depending upon environmental factors, including long periods of silence (Barlow and Gisiner 2006). While detection of a marine mammal call indicates the presence of a marine mammal, the absence of marine mammal calls does not necessarily indicate the absence of marine mammals. In addition, if the intent is to locate marine mammals so that they can be avoided, hydrophones in multiple locations combined with real-time processing are required to allow triangulation of the acoustic signal. This may be more practicable for planning large-scale activities at a set time and place rather than directing specific locations for research sampling, which involves continuous movement of a vessel from widely spaced sampling stations. Taking the time to set up a triangulated hydrophone system in an area prior to each 20 minute trawl would greatly lengthen the time and cost of collecting a certain amount of sample data. In summary, passive acoustic monitoring may be useful for detecting underwater marine mammals that could potentially interact with research activities but it would have substantial costs in terms of the research data collected and it would not guarantee the avoidance of all adverse interactions; passive acoustic monitoring inevitably overlooks those marine mammals that are not vocalizing and marine mammals may move into an area after trawl gear is deployed and still be at risk.

<u>Use of aircraft or unmanned aerial or underwater gliders to expand detection of marine mammals</u>

Currently, surveys using manned aircraft are routinely conducted to obtain unbiased estimates of marine mammal populations and their distributions. Aerial surveys provide reliable information about marine mammal populations because they are able to cover large areas over relatively short periods of time. In addition, airborne survey platforms generally do not influence the distribution or behavior of the marine mammals being counted, whereas many species of marine mammals are either attracted to or avoid seagoing vessels (Barlow and Gisiner 2006). The usefulness of manned aerial surveys for detection of marine mammals that could interact with fisheries research activities is limited by the range that the aircraft may travel from shore, flight time constraints, weather conditions, poor visibility in rough seas, logistical difficulties in matching a fast-moving airplane with a slow-moving research vessel, and considerable expense that would likely decrease the amount of ship-based research that could be conducted. Aerial surveys may be more practicable for planning large-scale activities at a set time and place rather than directing specific locations for research sampling, which involves continuous movement of a vessel from widely spaced sampling stations. Even with this capacity, the risk of marine mammal interactions would remain because any marine mammals that are not near the surface would not be detectable by airborne observers and, as with other extended detection methods, marine mammals may move into an area after trawl gear is deployed but before it is retrieved.

Unmanned aerial vehicles have the potential to overcome many of the limitations associated with manned aerial surveys for detection of marine mammals. Unmanned aerial systems range from inexpensive lightweight radio-controlled aircraft to complex autonomous aircraft developed for military applications. Unmanned aerial systems could be launched and retrieved from the research vessel, stream video data to observers onboard or at a shore station, and provide near-real-time data of marine mammals in proximity to fisheries research activities. Several systems are commercially available that have the ability to remain airborne for up to 24 hours and can be operated up to 93 miles from the control station. Several tests have successfully used unmanned aerial vehicles for marine mammal detection (NOAA 2006). However, these systems can only be operated in mild to moderate wind conditions, with increasing wind speeds strongly reducing their range and making recovery difficult.

Advantages associated with the use of unmanned aerial systems include the ability to operate in areas far from shore, long flight times, increased safety of observers who can monitor the data from the ship or a shore based location, and decreased expense relative to surveillance conducted from manned aircraft. Unmanned aerial technologies are rapidly evolving; over the next five to 10 years, increased video resolution and advanced sensors are likely to increase the utility of these systems for monitoring marine mammals. However, approval from additional regulatory agencies, including the Federal Aviation Administration, would be required for operation of unmanned aerial vehicles for marine mammal monitoring or research purposes. Federal Aviation Administration approval has been very difficult to obtain, even in areas with very little air traffic, which currently limits the potential for using these systems over large areas.

Autonomous underwater gliders are highly successful platforms for the collection of oceanographic data and environmental characterization. Gliders offer an attractive platform for marine mammal detection due to their relatively low cost, low power consumption, and the ability to cover large areas of ocean during long-term deployments (Olmstead et al. 2010). Gliders have been used to locate and identify marine mammals using passive acoustic technology, and the U.S. Navy is conducting additional research and development using autonomous underwater gliders to support efforts to mitigate impacts from marine mammal interactions (Hildebrand et al. 2009). The use of underwater gliders to provide mitigation options for research activities is limited by the same issues as described above for other passive acoustic detection systems.

<u>Use of infrared technologies</u>

IR sensors may be useful for detection of marine mammals under certain circumstances. IR sensors used for marine mammal detection generally measure the spatial distribution of mid-wavelength IR radiation (three to five micrometers). IR emissivity of an object in this waveband is closely correlated to the object's surface temperature, such that IR sensor arrays can detect slight variations in temperature across relatively large areas. This technology, also known as 'thermal imaging', could be useful to augment visual detection of marine mammals, particularly in conditions with low ambient light when visual detection of marine mammals would be difficult. IR image data also lends itself to automated image processing. With additional research and development, it is possible that an automated marine mammal detector could be designed to recognize the IR 'signatures' of certain marine mammals. However, several major drawbacks currently preclude such use of IR detection for automated marine mammal detection.

First, because emitted IR radiation is absorbed in the first few millimeters of water surrounding an object, IR technology is only able to detect animals at the surface, and only those parts that are above the surface of the water. Since water is virtually opaque to IR radiation, IR detection of marine mammals is also complicated by the thin film of water that covers the dorsal surfaces of marine mammals at the sea surface. The temperature measured by an IR sensor is the temperature of the water on the surface of the animal, which may only be a couple degrees above the surface water temperature (Cuyler et al. 1992, Kasting et al. 1989). Under ideal conditions (flat calm seas and close proximity to the IR detector), this slight temperature difference can be detected. However, waves cause the measured temperature of the sea surface to be much more variable and the thermal signature of the animal can easily be masked (Graber et al. 2011).

Second, the likelihood of detecting a temperature signature from a marine mammal falls off quickly with distance from the detector. In tests under ideal conditions, the ability of an IR system to detect killer whales, which present a large portion of their body and a tall dorsal fin above the surface of the water, was very poor beyond 330 ft (Graber et al. 2011). The ability of an IR system to detect much smaller targets like dolphins and porpoises would presumably be much less than it is for killer whales. Finally, considerable effort and time is required to process the video data so that the thermal signatures of animals can be distinguished from the surrounding water. This greatly reduces the effectiveness of the technique for real-time monitoring tied to potential mitigation. In summary, the logistical difficulties of using IR detectors in a real-life context on a research vessel would be overwhelming and currently preclude this potential tool as a practical element of mitigation.

Use of night vision devices

Like IR imaging devices, night vision devices may be used for detecting marine mammals at or above the water surface in low-light conditions. Unlike IR sensors, night vision devices operate by amplifying the signal produced when visible light interacts with a detector. Although night vision devices could potentially improve an observer's ability to detect a marine mammal under low light conditions, previous studies have shown that the effective range of detection for marine mammals using night vision devices is only about 330 ft (Calambokidis and Chandler 2000, Barlow and Gisner 2006). These devices work best when there is a little light on the water (from the moon or nearby land sources) but they must be directed away from deck lights because they are too bright. This means they could not be used to monitor trawl gear as it is being deployed or retrieved because of the deck lights used for crew safety. They also have a very narrow field of view, making broad area searches inefficient and unreliable, and if sea conditions are rough the many reflections off waves make it very difficult to distinguish objects in the water. Some observers found the devices disorienting and uncomfortable and all observers said it was very difficult to estimate distances while using the night vision devices (Calambokidis and Chandler 2000). Failure to detect marine mammals using such devices would not decrease the uncertainty about whether marine mammals are actually in the immediate area or not and would thus offer no help in deciding whether to deploy trawl gear or not.

4.4.4.2 Operational Restrictions

One potential mitigation measure would require the SEFSC to suspend trawl operations at night or during periods of low visibility (including fog and high sea state) to minimize interactions with marine mammals that would be difficult to detect by visual monitoring. Although only a small portion of the marine mammal takes in SEFSC research gear (three out of eleven) occurred during dusk, hours of darkness, or in early morning conditions, this measure has the potential to reduce the risk of interactions with marine mammals. However, many takes occurred during daylight hours (Table 4.2-15), so restricting operations to only daylight hours would not eliminate the majority of risk. In addition, restrictions on trawling at night could seriously hinder the ability of the SEFSC to complete their sampling protocol. If survey vessels had to stand down when they encountered fog or rough seas, survey periods would have to be extended or fewer stations would have to be sampled to accommodate such delays. This would mean substantially higher costs and/or decreased quality of data. Although visual monitoring is a reasonable and practicable precaution to undertake for trawl surveys, it does not ensure that marine mammals will be detected or that entanglement can be prevented even if they are detected.

An operational procedure for mitigating takes in longlines would require use of a decoy research vessel playing pre-recorded longline fishing sounds to distract marine mammals away from research longline sets. There have been no attempts to test the effectiveness of this method but it is likely that cetaceans would quickly learn to tell the difference between decoys and actual fishing operations (Gillman et al. 2006). Although the potential effectiveness is not clear, the additional cost of chartering another vessel to serve as a decoy would certainly compromise the research budget and restrict the amount of data that could be collected. In addition, a second vessel and broadcast fishing sounds would add to the amount of noise introduced to the marine environment, potentially increasing the number of animals taken by disturbance (Level B takes) everywhere the survey was conducted.

4.4.4.3 Acoustic and Visual Deterrents

This measure would require the SEFSC to use acoustic deterrents on all trawl gear, including pingers and recordings of predator (e.g., killer whale) vocalizations to deter interactions with trawl gear. This measure would also require the SEFSC to use visual deterrence techniques (e.g., lights, light sticks, reflective twine/rope) to reduce marine mammal interactions with the gear.

Acoustic pingers have been shown to be effective in deterring some marine mammals, particularly harbor porpoises, from interacting with gillnet gear (Nowacek et al. 2007, Carretta and Barlow 2011). There are, however, few studies testing their efficacy when used with trawl gear. Studies of acoustic deterrents in a trawl fishery in Australia concluded that pingers are not likely to be effective in deterring bottlenose dolphins, as they are already aware of the gear due to the noisy nature of the fishery (Stephenson and Wells 2008, Allen et al. 2014). Acoustic deterrents were also ineffective in reducing bycatch of common dolphins in the U.K. bass pair trawl fishery (Mackay and Northridge 2006). Although acoustic deterrents may be effective in preventing bycatch in gillnets, their efficacy in preventing bycatch in trawl nets is currently uncertain. A primary reason for this is that the noise associated with trawl gear (chains, ropes, trawl doors) is sufficiently loud that any acoustic device used would have to be louder than that generated by the ship and fishing gear which could, in turn, cause auditory damage or exclusion of cetaceans from important habitat (Zollett 2005). Underwater broadcasting of pre-recorded predator sounds (e.g. killer whale calls) to scare animals away from the fishing operation has been suggested as a potential mitigation measure but Jefferson and Curry (1996) concluded that this technique was largely ineffective for reducing marine mammal interactions with commercial fisheries based on their review of multiple studies.

Several methods have been suggested to help protected species visually detect fishing gear and avoid entanglement. Increasing acoustic reflectivity of nets through the addition of materials such as barium sulphate or acoustic reflectors has been tested, with varying degrees of success, in several set-net fisheries (Mooney et al. 2004, Rowe 2007). The applicability and efficacy in trawl fisheries is currently unknown. Similarly, nets could be illuminated with phosphorescent or luminescent materials and, ultimately, reduce the potential for entanglement. Wang et al. (2013) tested the efficacy of illuminating nets used in a Mexican bottom set-net fishery with ultraviolet (UV) light-emitting diodes to reduce sea turtle bycatch. UV net illumination significantly reduced green sea turtle bycatch without impacting target fish catch rates. Applicability in trawl fisheries and efficacy in deterring marine mammals with similar technology are, however, currently unknown.

4.4.4.4 Gear Modifications

Under the Modified Research Alternative, SEFSC would require a marine mammal excluder device on all trawl nets that do not already use excluder devices or on a subset of those gears considered to have a high risk of protected species interactions. Marine mammal excluder devices have been developed for several types of trawl nets and at least one device is being used by the Southwest Fisheries Science Center (SWFSC) during fisheries research with the Nordic 264 mid-water trawl. In addition, the SWFSC is developing a marine mammal excluder device for the modified Cobb mid-water trawl (SWFSC 2013). These devices are similar to turtle excluder devices and are designed to allow fish to pass through the bars of the excluder while marine mammals are guided to an escape hatch built into the net. The challenge with developing an excluder device is to minimize the impact on the fishing performance of the net while effectively reducing captures of marine mammals in the net. The shape, size, design, and positioning of an excluder device in the net can substantially impact the fishing performance of the net (Dotson et al. 2010).

An important factor to consider when developing excluder devices or any other gear modifications is to determine how the device or gear modification impacts the scientific objectives of the research. In the case of the SWFSC survey that now uses a marine mammal excluder device on the Nordic 264 trawl, the relevant objective of the survey is to collect a sample of individual fish for a variety of measurements and to examine their reproductive status. The reduced efficiency of the modified net in catching fish therefore does not substantially interfere with the scientific objective of the research. However, if the scientific objective of the surveys using trawl gear is to estimate overall population abundance and distribution of numerous species across large geographic areas, reductions in catchability of one or more fish species or size classes of fish, or increasing the variability of catch rates under different ocean conditions, could compromise the validity of the research survey and disrupt time-series data sets used to inform stock assessments. Given the value of these long time-series data sets for tracking ecosystem changes and the potentially huge economic implications for fisheries management of highly valuable commercial fisheries, any potential changes to research gear or protocols that may introduce uncertainty and bias into survey results must be thoroughly examined and planned years in advance of their implementation.

The SEFSC has not attempted to develop marine mammal excluder devices for any of the bottom or mid-water trawls it uses for research. Such an effort would require a substantial effort to design and test potential excluder devices for specific nets and survey objectives. Given the minimal number of takes of marine mammals with these trawl types during fisheries research, the scientific uncertainties it could introduce into the time-series data, and the economic cost of conducting calibration experiments to validate such gear modifications, the SEFSC is not proposing to conduct such gear modification research in the near future.

4.4.4.5 Temporal or Geographic Restrictions

Spatial/temporal restrictions can be a direct way of reducing adverse impacts to protected species if there are known overlaps in time and space of the survey's footprint with concentrations of protected species. This measure would require the SEFSC to identify areas and times that are most likely to result in adverse interactions with marine mammals (e.g., areas of peak abundance) and to avoid, postpone, or limit their research activity to minimize the risk of such interactions with marine mammals. This may include limits on specific locations, physical or oceanographic features, biologically important times, and/or gear types.

While the rationale for such restrictions is clear, careful and persistent research must be conducted to identify appropriate places and times for effective restrictions given the dynamic patterns of marine mammal abundance and distribution. These patterns of abundance are often correlated to particular oceanographic conditions, which vary among seasons and years, so marine mammal survey information from the previous year or even the previous month may not reflect actual conditions when it is time to deploy trawl gear. It might be possible to conduct aerial surveys or passive acoustic surveys in an area prior to conducting trawls, but such surveys require time to process data before actual density information is available.

Assuming recent marine mammal survey data are available for delimiting time or area restrictions, questions remain about what standards of density should be used for limiting research. This is important to the potential effectiveness of such restrictions because it is not clear if marine mammal density is a key factor in the risk of catching animals in a research trawl. Marine mammals can all swim much faster than an active trawl tow (two to four knots) so they can easily avoid such gear if they perceive it and choose to move. This is true no matter how many animals are in a given area. The risk of entanglement is likely influenced much more by the attraction of marine mammals to fish caught in the trawl or disturbed by it as the trawl passes by, which in turn may be influenced by the overall availability of prey and the nutritional status of the marine mammals. Even if there are only a few marine mammals in an area, the risk of entanglement could be high if they are strongly food-motivated and attracted to fish in a trawl. Conversely, the risk of entanglement could be quite small even if there are many marine mammals in an area if they have been foraging successfully and are inclined to avoid the disturbance of a trawl operation.

In any case, under the Status Quo and Preferred Alternatives, the "move-on" rule would be applied if any marine mammals are sighted from the vessel before deploying trawl gear and appear to be at risk of interactions with the gear. If an area has a high density of marine mammals, they would likely be sighted during this pre-trawl monitoring period prior to setting the gear and the station would be moved away or abandoned to avoid the marine mammals.

A special case of spatial/temporal restrictions would be for the SEFSC to avoid trawl survey work within federal and state MPAs (see Section 3.1.2). While the SEFSC has conducted survey work within some MPAs under the authority of special use permits, these permits primarily provide authority to scientifically sample fish in areas that are otherwise closed to fishing and do not specify particular protocols concerning the avoidance of incidental take of marine mammals. The SEFSC will continue to apply for special use permits to sample in MPAs as necessary to meet the scientific needs of their surveys and, if the managing agencies of any MPAs prohibit such sampling, the SEFSC will avoid those areas. However, as described above, the same concerns about the effectiveness of spatial/temporal restrictions as a mitigation measure would apply to MPAs. They may or may not have high concentrations of marine mammals relative to the surrounding areas but, given some uncertainty about all of the factors that contribute to high risk of entanglement in trawl gear and the imposition of the "move-on" rule, the potential for actually reducing incidental take by avoiding certain areas is not clear. Such avoidance also comes at the cost of not sampling in areas that are important to different fish species or that were established to promote recovery of depleted stocks. Scientific sampling is often the only reliable way to track the status of these stocks and the effectiveness of the MPA in fulfilling its established goals.

4.4.4.6 Conclusion

Under the Modified Research Alternative, the SEFSC would implement additional mitigation measures for protected species while conducting the same scope of research as described under the Preferred Alternative. Of the potential techniques and procedures considered under this alternative to improve monitoring of trawl gear, three techniques appear to offer some promise in helping to detect marine mammals in conjunction with the current visual monitoring protocol. These include the use of underwater video technology, passive acoustic monitoring, and unmanned aerial or underwater surveillance vehicles. However, all three techniques have substantial limitations in terms of conditions under which they may be useful (e.g. weather and sea state), the logistics of incorporating them into sampling procedures (e.g. timing of deployment, crew responsibilities, and data processing), and how they might be incorporated into actual marine mammal take-avoidance decisions like the "move-on" rule. These three techniques may warrant further examination to explore these limitations and to see how they may be applied under actual survey conditions if the technology advances and is improved. The other technological approaches considered, infra-red imaging and use of night vision devices, have severe limitations to their usefulness in a real-world situation and therefore offer no advantages for actual mitigation.

The use of trained personnel to monitor for protected species would occur under the Preferred Alternative once the crew and scientists of research surveys complete the new protected species training program. Currently, at least one member of the trawl survey crew or scientific party is dedicated to monitoring for protected species before research gear is deployed. Given the new protected species training program for scientists under the Preferred Alternative, the use of dedicated PSOs for monitoring during trawl operations would offer no advantage to what will occur under the Preferred Alternative.

Operational restrictions such as not allowing trawls to be set at night or in poor visibility conditions would certainly reduce the risk of taking marine mammals. However, part of their effectiveness may be due to reduced overall sampling effort rather than because marine mammals are more likely to be caught under those conditions Such restrictions could have a serious impact on the ability of the SEFSC to collect certain kinds of research data and would have impacts to the cost and scope of research that could be conducted. The spatial/temporal restrictions that were considered to avoid high densities of marine mammals are similar in that they would reduce risk of take by reducing overall sampling effort but also strongly impact the ability of the SEFSC to pursue certain scientific goals.

The use of additional acoustic and visual deterrents may warrant further investigation if new devices enter the market and are demonstrated to be effective. However, the effectiveness of the devices considered in this alternative appears to be species specific; mitigation advantages for some species may lead to higher risk for other species. The effectiveness of these techniques may also decrease with time as animals habituate to various devices and techniques.

The analysis of additional measures considered to decrease the risk of marine mammal takes in longline gear is similar to trawl gear. Longline surveys are conducted on much smaller vessels with limited crew. Dedicated PSOs could offer an advantage for monitoring, but the lack of crew space is limiting; all crew members have multiple tasks that are necessary for safe navigation and to conduct the survey. Decoy vessels, acoustic deterrents, and visual deterrents are all unlikely to provide consistent mitigation value and may increase the risk for certain species. New variations on these techniques may be developed in the future that address some of these concerns.

In conclusion, some elements of the Modified Research Alternative (e.g., dedicated PSOs) could offer mitigation advantages compared to the Status Quo Alternative. The Modified Research Alternative does not, however, appear to offer a substantial reduction in the risk of adverse interactions with marine mammals compared to the Preferred Alternative other than through reducing overall fishing effort. The impacts of the Modified Research Alternative on marine mammals would therefore be similar to the impacts of the Preferred Alternative, which were considered minor to moderate adverse under the criteria described in Table 4.1-1. Some concepts and technologies considered in the Modified Research Alternative are promising and NMFS will evaluate the potential for implementation if they become more practicable.

4.4.5 Effects on Birds

The effects of the Modified Research Alternative on birds would be very similar to those described for the Status Quo Alternative (Section 4.2.5) and the Preferred Alternative (Section 4.3.5). The exceptions involve a potential additional mitigation measure intended to reduce impacts on protected species. The Modified Research Alternative includes potential spatial/temporal restrictions on where and when SEFSC-affiliated research could occur. Such restrictions may reduce impacts on sea birds in certain areas such as marine protected areas if such closures were determined to be effective mitigation measures. However, specific determinations about potential research restrictions have not been made and it is assumed that the overall research effort would be very similar under the Modified Research Alternative as it would be under the Status Quo Alternative. Overall effects on seabirds would therefore be similar even if research was conducted in somewhat different places and times.

The overall effects of SEFSC research activities on birds under the Modified Research Alternative would likely be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration, and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.4.6 Effects on Sea Turtles

The Modified Research Alternative would include the same scope of research activities as the Preferred Alternative but those activities would be conducted under different operating procedures and gears in order to mitigate, to the greatest possible extent, any potentially adverse impacts on protected species, including sea turtles. Most of these additional mitigation measures are being considered in this DPEA in order to address marine mammal protection issues under the MMPA (see Section 4.4.4) but many of them may have implications for avoiding potentially adverse interactions with sea turtles, including:

- The use of dedicated protected species observers and additional equipment/technologies to improve monitoring.
- Operational restrictions on research activities in low visibility conditions.
- The use of acoustic and visual deterrents on selected gear types.
- Gear modifications, including turtle excluder devices on trawl nets.
- The incorporation of high-resolution, high-speed video cameras into trawl nets with open cod ends.
- Temporal or geographic restrictions to avoid known concentrations of marine mammals or federal and state MPAs.

None of the additional mitigation measures involve reducing the number of research vessels or samples taken during research, how much fish and invertebrates are caught in research samples, or reducing the risk of accidental contamination from spills. The analyses of effects through these mechanisms (disturbance or changes in habitat quality) are the same as described for the Status Quo and Preferred Alternatives and will not be discussed further. The following analysis will therefore focus on the potential for the additional mitigation measures to reduce the risk of injury, serious injury, and mortality of sea turtles through entanglement or hooking in fishing gear.

Scientists at the SEFSC regularly review their procedures to see if they can do their work more efficiently and with fewer incidental effects on the marine environment, including effects on sea turtles. In fact, some of the research projects considered in this DPEA are designed to test ways to reduce bycatch of sea turtles in commercial fisheries. Although some of the additional mitigation measures included in this alternative may have been discussed and considered in the past by SEFSC scientists, any changes to operational procedures or the equipment used during surveys must also be considered from the standpoint of how they affect the integrity of the scientific data collected, the cost of implementing equipment or operational changes, and the safety of the vessel and crew. It is not possible to quantify how much any one of these measures (or some combination of them) may reduce the risk of future takes relative to the Status Quo or Preferred Alternatives. Any revisions to the estimated takes of each species to directly compare with the Status Quo or Preferred Alternatives would be based on speculation. This analysis will therefore provide a qualitative discussion of the potential for each additional mitigation measure to reduce takes and other effects on sea turtles.

4.4.6.1 Monitoring Methods

Visual observations (using bridge binoculars as needed) by the officer on watch, FPC, or other designated scientist, and crew standing watch are currently the primary means of detecting protected species in order to avoid potentially adverse interactions. However, there are other detection methods that have been tested or used in commercial fisheries, naval exercises, and geotechnical exploration that could be considered.

Visual surveillance by dedicated Protected Species Observers (PSO)

This measure would require the SEFSC to use trained PSOs whose dedicated job is to detect the presence of protected species within the survey area and communicate their presence to ship operations personnel. Considerations include the use of dedicated observers for all surveys or during surveys with gear types and protocols of particular concern.

For trawl, longline, and gillnet surveys under the Status Quo Alternative, at least one member of the crew is dedicated to observe for protected species prior to deploying research gear and operational procedures to avoid interactions if protected species are seen and appear to be in danger of interaction. During surveys on small vessels with only a few crew members, all personnel have multiple duties in addition to looking for protected species (e.g., finding an appropriate set location, driving the boat, and preparing the gear for deployment). Currently, at least some crew members on each survey have received formal training in sea turtle handling and mitigation procedures. Other crew assigned to watch may not have formal training in species identification and other topics typically associated with PSOs, but they are briefed on what they are looking for and may have considerable experience with the task. However, the Preferred Alternative does include a new program to refine and formalize the training and decision-making process for all FPCs, bridge crew, and deck crew that may be assigned to the observer post in the future. This new program would provide the same types of training for all appropriate crew members as PSOs trained for that specific task. This training would be developed in coordination with the commercial fisheries Observer Program staff and customized for SEFSC-affiliated staff using similar course materials and reporting forms as are used to train PSOs for applicable commercial fisheries.

The difficulty in having crew members assigned only to PSO duties is that most vessels have limited carrying capacity for personnel, and any space or berths given to PSOs would mean a reduction in personnel available to help with other research or vessel duties. This could compromise crew safety or the amount of research that could be conducted. By providing formal PSO-type of training for crew already trained in other skills, the SEFSC believes it can provide a similar quality of visual monitoring for sea turtles and other protected species as would occur with dedicated PSOs while maintaining the flexibility to fulfill all other crew duties.

Use of underwater video systems to monitor fishing gear

The SEFSC (and other Fisheries Science Centers) have used underwater video systems extensively to help study the benthic environment (Tables 2.2-1) and to monitor the performance of different types of fishing gear, including the efficacy of turtle excluder devices on trawl gear. They have also been used to study depredation of longline gear by sea turtles and marine mammals. Live feed video monitoring systems can provide real-time information about the species and size classes of fish and other organisms (i.e., sea turtles and marine mammals) that are captured or avoid the fishing net, although cloudy water often limits the usable range of camera systems such that only portions of the fishing gear may be monitored at a time or visibility in front of towed gear is limited. Video camera systems are a powerful tool for studying the marine environment and fishing technologies but their use for direct mitigation of adverse interactions with sea turtles and other protected species is problematic.

In order to directly reduce takes of sea turtles, a live feed video system to detect sea turtles underwater would have to be linked to a means of avoiding entanglement in gear. However, ships with deployed trawl nets or dredge gear cannot stop suddenly or “swerve” to avoid a sea turtle because quickly changing the vessel speed or direction risks tangling the gear, making it difficult and dangerous to retrieve, delaying retrieval and potentially making the risk of sea turtle entanglement worse. In addition, sampling protocols would be needlessly compromised if tows were interrupted every time a sea turtle or marine mammal was seen in the vicinity of the fishing gear. Sea turtles are probably able to detect approaching fishing gear at a distance and swim away, but they may also be attracted to fish and other species disturbed by the passing gear. It would therefore be difficult to determine in real time whether a given turtle was actually in danger of being captured or was just using the gear as a foraging opportunity. Given this uncertainty about appropriate and safe responses to video camera information and the infrequency of sea turtle captures in SEFSC research fishing, with only rare cases of serious injury or mortality, the SEFSC does not consider the use of video systems to monitor and avoid potentially adverse sea turtle interactions to be effective, safe, or to outweigh the loss of scientific data due to the disruption of research protocols. However, the SEFSC will continue to use video technologies to study the effectiveness of fishing gear modifications and fishing methods to reduce adverse interactions with sea turtles.

An alternative strategy would be to incorporate high-resolution, high-speed video cameras into trawl nets with open cod ends for the purpose of sampling fish without capturing them. The idea is that fish entering the trawl could be identified and counted through review of the video images but they would pass through the open cod end. This technique could potentially allow any incidentally captured sea turtles to pass through the open cod end as well. Such an approach might be appropriate for swept area surveys designed to determine the density of fish or shrimp if the relevant species could be distinguished in video images, but it would not be appropriate for surveys designed to determine the reproductive condition of adult fish or the growth rates of fish as these measurements require the dissection of specimens. It would also be inappropriate for surveys targeting very small fish or shrimp because species identification often requires high resolution analysis. Although this technique holds promise for reducing the risk of sea turtle interactions, the SEFSC is not proposing to conduct any surveys with trawl gear under the Modified Research Alternative that would be appropriate for an open cod end.

Use of other monitoring technologies

Passive acoustic monitoring involves the detection of animals by listening for the sounds that they produce. This technology is not expected to be effective for detection or avoidance of sea turtles because sea turtles vocalize only during copulation and nesting, and are the least vocal of living reptiles (Cook and Forrest 2005). Autonomous underwater gliders are highly successful platforms for the collection of oceanographic data and they have been used to detect the presence of marine mammals (Hildebrand et al. 2009) but their success in monitoring for these species is tied to the use of passive acoustics, which is ineffective for sea turtles. IR detection is unlikely to improve the ability to detect and avoid sea turtles in the water because water is effectively opaque to IR radiation. Although turtles come to the surface to breathe, only a very small area of a turtle is exposed above the sea surface. In addition, because turtles are ectothermic (cold-blooded) reptiles, temperature differences between the turtle and the surrounding water would be minimal and difficult to detect using IR-sensing devices. Similarly, sea turtles in the water would be extremely difficult to detect using night-vision technology.

4.4.6.2 Operational Restrictions

Operational restrictions proposed under the Modified Research Alternative would require the SEFSC to suspend trawl operations at night or during periods of low visibility (including fog and high sea state) to minimize adverse interactions with protected species, including sea turtles, which would be impossible to detect by visual monitoring under low-visibility conditions. However, many of the sea turtles that have been caught in SEFSC surveys have been taken in surveys that only occur during daylight hours. The elimination of night trawls would therefore do little to reduce the risk of catching sea turtles and would compromise the ability of the SEFSC and its research partners to effectively conduct its research program.

4.4.6.3 Acoustic and Visual Deterrents

Several methods have been suggested to help protected species detect the presence of fishing gear with the expectation that these methods will help animals avoid entanglement. The effectiveness of visual deterrents for mitigation of sea turtle interactions with fishing gear is uncertain. Some data suggest that the use of luminescent lightsticks and LEDs may decrease rates of green sea turtle bycatch in gillnet gear (Wang et al. 2009). In contrast, results from other studies demonstrate that sea turtles are attracted to underwater illumination (Wang et al. 2007, Southwood et al. 2008). Thus, the efficacy of such mitigation measures could be different under different conditions and for different species, and should be examined on a case-by-case basis.

Southwood et al. (2008) examined the potential for using acoustic deterrents for sea turtles on longline gear, but concluded that any such devices would likely also deter the target fish species, have the potential for sea turtles to habituate to or be attracted to the sound, and add to the level of anthropogenic sounds in the ocean without a reasonable chance of success in reducing incidental take of turtles.

4.4.6.4 Gear Modifications

The SEFSC has long supported research on the development of TEDs and other gear modifications to reduce the impacts of commercial fisheries on sea turtles. SEFSC-affiliated research projects that are conducted by fishing industry-related research partners currently employ all such devices on their research projects in situations where fisheries regulations require them for specific gears and areas. Some projects have received scientific research permits to test variations in excluder devices that are not covered in fishing regulations.

However, many SEFSC trawl surveys do not use turtle excluder devices on their trawl nets because their tow times are 10-30 minutes and these short tow durations minimize the risk of mortality by drowning. A TED is installed in nets that are towed in excess of 55 minutes as required by 50 CFR 223.206. TEDs are not installed in short-duration tows because they would introduce extensive scientific uncertainties into the time-series data and there would be a great economic cost of conducting calibration experiments to validate such gear modifications. Given the already minimal risk to sea turtles in these types of trawls, the SEFSC is not proposing to use TEDs on short-duration trawls.

All of the turtles caught in research trawl gear to date have been released alive and in apparently good condition. Captured turtles are measured, sampled for genetic material, scanned for PIT tags, and tagged with a PIT tag by a qualified biologist if they do not already have one. All tagging and sampling of live turtles is done in compliance with 50 CFR 222.310 and 223.206. The tagging and sampling activities contribute to the scientific understanding of sea turtle biology at sea.

4.4.6.5 Temporal or Geographic Restrictions

Time-area restrictions are one of the most direct means of reducing adverse impacts to protected species if there are known overlaps in time and space of the fisheries research footprint with concentrations of those species. The implementation of spatial/temporal closures to restrict fishing activities at times and places turtles are most likely to be present in the highest numbers has been shown to be effective in reducing impacts to sea turtles in the Pacific Islands region (Kobayashi and Polovina 2005). Spatial/temporal restrictions proposed as mitigation measures under the Modified Research Alternative could potentially alter the distribution and overall level of impacts to sea turtles resulting from SEFSC research activities. The identification of specific sea turtle migratory pathways or high-residence areas and times is essential for the establishment of effective spatial/temporal restrictions to reduce adverse interactions with sea turtles. NMFS has recently proposed to designate critical habitat for the Northwest Atlantic Ocean DPS of loggerhead sea turtle (78 FR 43006, 18 July 2013), which includes migration corridors and wintering areas in marine waters around Cape Hatteras, North Carolina as well as many coastal areas south of Cape Hatteras. These areas would be good candidates for consideration of fishing closures. Other areas for consideration under the Modified Research Alternative include MPA and National Marine Sanctuaries.

The SEFSC recognizes the potential for this type of mitigation but is not proposing to implement such spatial/temporal restrictions on its research program for several reasons:

- Many of these areas may be important to commercial fish stocks as well as sea turtles and avoidance of scientific sampling in times and places important to different fish species would limit the SEFSC’s effectiveness in fulfilling its stock assessment mission under the MSA.
- Some MPAs have been established to help promote recovery of depleted fish stocks and provide refugia for other species. Scientific sampling is often the only reliable way to track the status of these stocks and the effectiveness of the MPA in fulfilling its established goals.
- Sea turtle interactions with SEFSC research gear occur on a regular basis but the risk of serious injury or mortality is very small given current research protocols (short tow and set durations) and mitigation measures. The additional crew training for all SEFSC and cooperative research partners under the Preferred Alternative, including safe handling procedures for captured sea turtles, would likely reduce this risk even further.

4.4.6.6 Conclusion

Under the Modified Research Alternative, the SEFSC would implement additional mitigation measures for protected species while conducting the same scope of research as described under the Preferred Alternative. Several methods are considered under the Modified Research Alternative that would attempt to improve monitoring for sea turtles with the expectation that this would help researchers avoid potentially adverse interactions with fishing gear. The technology-based methods all have substantial limitations on their potential to detect sea turtles and, there are serious concerns about the logistics of how to incorporate them into effective mitigation procedures. However, the SEFSC will continue to explore the potential application of these and emerging technologies for sea turtle monitoring as they are developed. Given the new protected species training and mitigation workshops and updated written materials for each vessel proposed under the Preferred Alternative, the use of PSOs under the Modified Research Alternative appears to offer limited advantages relative to Preferred Alternative.

The use of visual deterrents for different types of fishing gear holds promise in theory but needs to be tested in specific situations as its effectiveness for deterring turtles without reducing catch rates for targeted fish species appears to be inconsistent. Turtle excluder devices and other gear modifications present similar opportunities for reducing impacts on turtles but also have substantial implications for scientific objectives and compatibility with previous time-series data sets (see discussion in Section 4.4.4). Any such gear modifications would need to be thoroughly tested through calibration experiments before they could be implemented.

Operational restrictions such as not allowing trawls to be set in poor visibility conditions could reduce the risk of taking sea turtles. However, part of their effectiveness may be due to reduced overall sampling effort rather than because sea turtles are more likely to be caught under those conditions. Such restrictions would have a serious impact on the ability of the SEFSC to collect certain kinds of research data and would have impacts to the cost and scope of research that could be conducted. Spatial/temporal restrictions to avoid high densities of sea turtles could also reduce the risk of incidentally capturing sea turtles but it would also likely increase the cost of research, thereby reducing overall sampling effort and strongly impacting the ability of the SEFSC to pursue certain scientific goals. Given the relatively small impacts on sea turtles under the Status Quo or Preferred Alternatives, the SEFSC does not consider such operational restrictions to be practicable.

The overall effects of the Modified Research Alternative on ESA-listed sea turtles would likely be less than the Preferred Alternative, which were considered minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and therefore minor adverse according to the impact criteria in Table 4.1-1.

4.4.7 Effects on Invertebrates and Plants

The effects of the Modified Research Alternative on invertebrates and plants, including ESA-listed species, would be very similar to those described for the Preferred Alternative (Section 4.3.7). The exception involves one potential additional mitigation measure intended to reduce impacts on protected species, none of which are invertebrates or plants. The Modified Research Alternative includes potential spatial/temporal restrictions on where and when SEFSC-affiliated research could occur. Spatial/temporal restrictions may reduce impacts on invertebrates in certain areas such as marine protected areas if such closures were determined to be effective mitigation measures. Such restrictions could also reduce overall research fishing effort in important habitats and limit the ability of the SEFSC to sample commercial invertebrate stocks as prescribed in their research plans. However, specific determinations about potential research restrictions have not been made and it is assumed that the overall research effort would be very similar under the Modified Research Alternative as it would be under the Preferred Alternative. Overall effects on invertebrates would therefore be similar even if research was conducted in somewhat different places and times.

Overall impacts to invertebrates under the Modified Research Alternative would likely be minor in magnitude, dispersed over a large geographic area, and temporary or short-term in duration and would therefore be considered minor adverse according to the impact criteria in Table 4.1-1.

4.4.8 Effects on the Social and Economic Environment

The effects of the Modified Research Alternative on the social and economic environment depend on the extent that additional mitigation measures would be implemented. Some of the mitigation measures require additional equipment than is currently used and the addition of trained protected species observers to the crew, which could increase spending on wages, rentals, and equipment (see Section 2.4.1).

However, on surveys conducted on relatively small vessels with limited crew space, the inclusion of crew dedicated to protected species monitoring would decrease the number of crew available to conduct research, thereby decreasing the amount of research that could be conducted in a given time period and potentially creating safety concerns. Other measures such as 30 minute marine mammal monitoring periods and spatial/temporal restrictions could curtail research operations in areas important for stock assessment and fishery management purposes. Spatial/temporal restrictions may reduce some operational costs if surveys are reduced in scope, with a resulting loss of scientific information, but may also increase survey expenses if surveys need to be extended in time to compensate for restricted data collection opportunities.

The scientific value of data collected with changes in research protocols due to additional mitigation measures has not been evaluated because the number of unresolved variables would make any such analysis speculative. It is therefore uncertain if an altered SEFSC fisheries research program under the Modified Research Alternative would contribute a similar value to fisheries management as the Status Quo Alternative. However, it is probable that some of the additional mitigation measures included in the Modified Research Alternative, if implemented, would decrease the ability of the SEFSC to provide comparable levels or quality of scientific information to the fisheries management process. While these conditions may reduce the scientific value of SEFSC research relative to the Status Quo Alternative, the overall contribution of SEFSC research to the socioeconomic environment would likely be similar to those described for the Status Quo Alternative (Section 4.2.8).

The direct and indirect effects of the Modified Research Alternative on the social and economic environment would be certain to occur, minor to moderate in magnitude depending on the community, long-term, and would be felt throughout the Southeast Region. According to the impact criteria established in Table 4.1-1, the direct and indirect effects of the Modified Research Alternative on the social and economic environment would be minor to moderate and beneficial.

4.5 DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 4 – NO RESEARCH ALTERNATIVE

This section presents an analysis of the potential direct and indirect effects of Alternative 4 – the No Research Alternative – on the physical, biological, and social environment. Under the No Research Alternative, SEFSC would no longer conduct or fund fieldwork for the fisheries and ecosystem research considered in the scope of this DPEA. This moratorium on fieldwork would not extend to research that is not in scope of this DPEA, such as directed research on marine mammals and ESA-listed species covered under separate research permits and NEPA documents. NMFS would need to rely on other data sources, such as fishery-dependent data (i.e., harvest data), and state or privately supported data collection programs to fulfill its responsibility to manage, conserve, and protect living marine resources in the U.S.

The potential direct and indirect effects of implementing Alternative 4 were evaluated according to the criteria described in Table 4.1-1. A summary of the impact rating determinations for all topics evaluated under this Alternative are presented below in Table 4.5-1.

Table 4.5-1 Alternative 4 Summary of Effects

Resource	Physical Environment	Special Resource Areas	Fish	Marine Mammals	Birds	Sea Turtles	Invertebrates	Social and Economic
Section #	**4.5.1**	**4.5.2**	**4.5.3**	**4.5.4**	**4.5.5**	**4.5.6**	**4.5.7**	**4.5.8**
Effects Conclusion	Minor *adverse*	Minor *adverse*	Moderate *adverse*	Minor *adverse*	Minor *adverse*	Moderate *adverse*	Moderate *adverse*	Moderate *adverse*

4.5.1 Effects on the Physical Environment

Under the No Research Alternative, the SEFSC would no longer conduct or fund fisheries and ecosystem research involving fieldwork in marine waters of the Atlantic. This would eliminate the potential for direct adverse impacts to the physical environment from SEFSC-affiliated fisheries research.

The research conducted by the SEFSC includes assessments of fisheries and marine habitat that are used to inform a wide range of plans, policies, and resource management decisions. Many of the plans, polices, and decisions that are partially based upon SEFSC data are concerned with conservation of ecological properties of the environment and maintenance of the habitat that sustains living resources in the Atlantic. FMPs developed for the region are partially based on scientific advice derived from SEFSC data. These FMPs strategically limit impacts to physical habitat such as disturbance of benthic habitat and removal of organisms that produce seafloor structure. Without a relatively continuous input of SEFSC data, especially time-series data extending over 50 years, management authorities would lose some of the information necessary to establish management measures in a meaningful fashion. It would also substantially reduce the capacity of SEFSC to monitor and investigate changes to the seafloor and water quality due to coastal developments, marine industrial activities, and climate change among other factors.

The loss of information on physical resources under the No Research Alternative would affect a number of different federal and state resource management agencies to various degrees. The SEFSC research program is not the only source of information available to these resource managers but the No Research Alternative could lead to changes in some management scenarios based on greater uncertainty. Given the potential for resource management agencies to compensate for this loss of information to some extent, and the preference to avoid rapid, major changes in management strategies, the potential magnitude of effects on the physical environment would likely vary from minor to moderate and be limited in geographic extent in the near future. Under the No Research Alternative, the overall impact of these indirect effects on physical resources would be considered adverse and minor according to the criteria in Table 4.1-1.

4.5.2 Effects on Special Resource Areas and Essential Fish Habitat

The No Research Alternative would result in the elimination of the minor adverse direct impacts to special resource areas described in Section 4.2.2 for the Status Quo Alternative. However, the beneficial effects of SEFSC research on the conservation management of special resource areas would also be lost under the No Research Alternative.

The loss of scientific information about these areas would make it difficult for fisheries managers to assess the habitats, resources, and ecosystem functions that closed areas, MPAs, and National Marine Sanctuaries are designed to protect through the implementation of sound science-based management practices. Furthermore, a loss of input from SEFSC research would handicap the maintenance and effective management of existing EFH, HAPC, and closed areas, and would encumber the designation of additional special resource areas in the future. The loss of information about special resource areas under the No Research Alternative would have various implications for different federal and state resource management agencies. The SEFSC research program is not the only source of information available to these resource managers but it could lead to changes in some management scenarios based on greater uncertainty (e.g., greater restrictions on commercial fisheries in MPAs). If the SEFSC discontinued collecting information on special resource areas, management authorities would lose important information needed to establish management measures in a meaningful fashion, and current conservation measures in place to protect ecological properties of the environment could become less effective. The indirect effects of these potential management implications would likely vary among the many special resource areas considered. Given the potential for resource management agencies to compensate for this loss of information to some extent and the tendency to avoid rapid, major changes in management strategies, the potential magnitude of effects on special resource areas would likely vary from minor to moderate and be limited to a few local areas within the Atlantic in the near future. Under the No Research Alternative, the overall impact of these indirect effects on special resource areas would be considered adverse and minor according to the impact criteria described in Table 4.1-1.

4.5.3 Effects on Fish

Under the No Research Alternative, there would be no direct effects of SEFSC-affiliated research on fish because the SEFSC would no longer conduct or fund fieldwork for fisheries and ecosystem research. The lack of at-sea research activities would eliminate the risk of mortality from fisheries research activities, disturbance and changes in behavior due to the presence of vessels and research gear, and potential contamination from vessel discharges. However, the loss of scientific information about fish populations and their habitats, especially commercially valuable species, would make it increasingly difficult for fisheries managers to effectively monitor stock status, set commercial harvest limits, or develop fishery regulations to recover depleted stocks or protect vulnerable stocks, especially as information used in stock assessments gets older and less reliable. For non-commercial species, the absence of new fieldwork conducted and funded by the SEFSC would interrupt time-series data sets important for tracking ecosystem-level changes due to fishing impacts, climate change, ocean acidification, and other factors. The loss of this information would increase uncertainty about future trends which may be important to natural resource managers, although the impact of this uncertainty on particular fish species is unknown.

The conservation and management of fishery resources is a core mission for NMFS and is listed among the ten National Standards set forth in the MSA. In carrying out Congress's mandate under the MSA, NMFS is responsible for ensuring that management decisions involving fishery resources are based on the highest quality, best available scientific information on the biological, social, and economic status of the fisheries. In the South Atlantic, Gulf of Mexico and U.S. waters of the Caribbean, this is achieved through the work of the SEFSC and Southeast Fisheries Science Center, which provide supporting scientific information that NMFS uses as the basis for their fisheries management actions. In addition to assessing the status of stocks and examining potential effects of commercial fishing activities, NMFS uses SEFSC research data in the development and implementation of FMPs. The ability to acquire scientific information is essential to the agency's responsibility to manage our nation's fishery resources.

Without SEFSC fisheries research, NMFS would need to rely on other data sources, such as fishery-dependent harvest data and state or privately supported fishery-independent data collection surveys or programs. It is unlikely that any of the state or other institutional research programs would be able to undergo the fundamental realignment of budgets and scientific programs necessary to maintain the level and continuity of information currently provided by the SEFSC.

Although other data sources are available to support resource management decisions, the No Research Alternative would be expected to result in increased uncertainty and changes in some management scenarios. If the SEFSC discontinued collecting information on fish stocks, management authorities would lose important information needed to establish sustainable harvest limits and other management measures in a meaningful fashion, and current conservation measures in place to rebuild overfished stocks and protect ecological properties of the environment would become less effective. The indirect effects of these potential management implications would likely vary among fisheries management areas and the different fish stocks assessed by the SEFSC. There are too many unknown variables to estimate what the indirect effects of this loss of information would mean to any particular fish stock. Given the potential for resource management agencies to compensate for this loss of scientific information to some extent and the tendency to avoid major changes in management strategies, the potential magnitude of effects on fish stocks would likely vary from minor to moderate but the effects could be regional in geographic scope and have long-term effects. Through these indirect effects on future management decisions, the overall impact on commercially important fish stocks would be considered moderate adverse for the areas surveyed by the SEFSC according to the criteria in Table 4.1-1.

4.5.4 Effects on Marine Mammals

Under the No Research Alternative, the SEFSC would no longer conduct or fund fisheries and ecosystem research associated with directed marine mammal research fieldwork in marine waters off the southeastern U.S, the Gulf of Mexico, and off Puerto Rico and the U.S. Virgin Islands. Directed research on marine mammals may continue under MMPA section 10 directed research permits (e.g., the Marine Mammal and Ecosystem Assessment Survey) but the associated use of acoustic equipment and fishing gear (various nets and hook-and-line gear) to sample prey fields and other oceanographic conditions would not be conducted under the No Research Alternative. This would eliminate the potential for direct effects of SEFSC fisheries research on marine mammals through capture and entanglement in research gear, potential Level B harassment due to acoustic disturbance, and impacts to prey fields due to fisheries and ecosystem research in all three research areas and for all species of marine mammals. This moratorium on fieldwork would not include research outside the scope of this DPEA, such as research conducted or funded by entities other than the SEFSC.

In addition to conducting fisheries research, SEFSC surveys are sometimes used as "ships of opportunity" for at-sea observational surveys of seabirds and marine mammals. Given the difficulty in getting long-term funding for dedicated surveys, these fairly consistent data collection opportunities on long-term SEFSC fisheries research cruises are valuable contributions to multidisciplinary ecosystem research efforts. Under the No Research Alternative, the use of SEFSC research cruises as ships of opportunity would be eliminated. While these opportunistic transects are not the primary source of information about the status of marine mammals, they do contribute to NMFS annual marine mammal stock assessments. Oceanographic and fisheries data collected by the SEFSC is also important for monitoring the ecological status of the environment important to marine mammals. While there would be no direct effects on marine mammals due to adverse interactions with ships and scientific gear, the loss of observational and ecological information important to marine mammals could indirectly and adversely affect resource management decisions concerning the conservation of marine mammals, especially as time went on and uncertainty about the status of the marine environment increased.

There are too many unknown variables to estimate the magnitude of effects this lack of information would mean to any particular stock of marine mammal but they would likely vary from minor to moderate in magnitude over the next five years. These indirect effects could have short-term to long-term effects on management of marine mammal species that interact with fisheries and have impacts over a large geographic area. However, given the fact that SEFSC fisheries and ecosystem research is not the only source of information available to federal and state resource managers and that there is potential for resource managers to compensate for this loss of information, the No Research Alternative is expected to have an adverse and minor indirect effect on marine mammals through these indirect effects on future management decisions according to the criteria in Table 4.1-1.

4.5.5 Effects on Birds

The No Research Alternative would result in the elimination of the minor adverse direct impacts to seabirds through disturbance, entanglement in gear, changes to prey fields, and contamination of the marine environment for all species of birds (Section 4.2.5). However, as discussed in the marine mammal section above, some of the SEFSC projects that would be eliminated under this alternative include seabird observations made from SEFSC research vessels which provide scientific data on the abundance and distribution of seabirds in the Atlantic. This information contributes to ecosystem modeling and resource management issues important to seabirds. Oceanographic and fisheries data collected by the SEFSC is also important for monitoring the ecological status of the environment important to seabirds. While there would be no direct effects on seabirds, the loss of observational and ecological information important to seabirds would adversely affect resource management decisions concerning the conservation of seabirds. Although NMFS does not have regulatory jurisdiction over birds, the scientific contribution from the SEFSC observational research on seabirds is used, at least partially, to support fishery management decisions, USFWS conservation efforts, energy development siting considerations, and international treaties. If the SEFSC discontinued collecting ecological and observational information on seabirds, long-term data sets contributing to the quality of information about seabird trends would be disrupted and adversely affect the ability of state and federal agencies to make informed decisions about seabirds and the marine environment, especially as time went on and uncertainty about the status of various populations of birds increased. Given the fact that the seabird-related data from SEFSC fisheries research cruises is not the only source of information available to federal and state resource managers, and the potential for resource managers to compensate for this loss of information to some extent on other vessels of opportunity, the No Research Alternative is expected to have an adverse and minor indirect effect on seabirds in the SEFSC research area.

4.5.6 Effects on Sea Turtles

The No Research Alternative would result in the elimination of the potential minor adverse direct impacts to sea turtles from SEFSC research activities through disturbance, injury and mortality in research gear, changes to prey fields, and contamination of the marine environment (Section 4.2.6). This moratorium on fieldwork would not include research outside the scope of this DPEA, such as directed research on sea turtles covered under separate research permits and NEPA documents.

As discussed in the marine mammal and bird sections above, some of the SEFSC projects that would be eliminated under this alternative include sea turtle observations made from SEFSC research vessels which provide scientific data on the abundance and distribution of sea turtles in the GOMRA, ARA, and CRA. This information contributes to ecosystem modeling and resource management issues important to sea turtles. The elimination of SEFSC research activities would also substantially reduce the collection of oceanographic and fisheries data important for monitoring the ecological status of the environment important to sea turtles. SEFSC-affiliated fisheries research, including conservation engineering projects in partnership with the fishing industry, supports the management and conservation of sea turtle populations and the habitats and ecosystems that sustain them. An important example is the role SEFSC-affiliated research has played in the establishment of regulations mandating the use of TEDs in commercial trawl fisheries and circle hooks in longline fisheries. Another example is the contribution of SEFSC research to decisions regarding designated critical habitat for loggerhead sea turtles and other species. These management measures strategically reduce impacts to sea turtles and protect habitats important to their recovery and are partially dependent on periodic input of SEFSC data. The loss of scientific information important to understanding sea turtle ecology and fisheries mitigation measures under The No Research Alternative would affect federal and state resource management agencies to various degrees. Without the input of SEFSC data relevant to sea turtle ecology, management authorities would lose important information needed to establish new management measures in a meaningful fashion, current conservation measures could become less effective, and the ability of managers to track long-term ecological trends important to ESA-listed sea turtles, such as climate change and ocean acidification, would be greatly diminished.

There are too many unknown variables to estimate what the indirect effects of this loss of information and associated management implications would mean to any particular sea turtle species but all of them are considered important resources because of ESA-listing. Under the No Research Alternative, the loss of information currently provided by SEFSC research activities is likely to have adverse and moderate indirect effects on ESA-listed sea turtles in the Gulf of Mexico, Atlantic, and Caribbean.

4.5.7 Effects on Invertebrates and Plants

Under the No Research Alternative, there would be no direct effects of SEFSC-affiliated research on invertebrates or plants (including ESA-listed species) through mortality, physical damage to infauna or epifauna, change in species composition, or contamination or degradation of habitat. However, the loss of scientific information about invertebrates, particularly commercially valuable species, would impede the ability of fisheries managers to effectively assess and monitor stocks, set harvest limits, or develop necessary regulations to protect vulnerable stocks. For non-commercial species, the absence of new fieldwork conducted and funded by the SEFSC would interrupt time-series data sets important for tracking ecosystem-level changes due to fishing impacts, climate change, ocean acidification, and other factors. The loss of this information would increase uncertainty about future trends which may be important to natural resource managers, although the impact of this uncertainty on particular invertebrate and plant species is unknown.

As described in Section 4.5.3 for fish, the conservation and management of marine invertebrate resources is a core mission for NMFS under the MSA and needs to be based on the best available scientific information. In addition to assessing the status of invertebrate stocks and examining potential effects of commercial fishing activities, NMFS uses SEFSC research data to develop and implement FMPs. The ability to acquire scientific information is essential to the agency's responsibility to manage our nation's fishery resources.

Without SEFSC-affiliated fisheries research, NMFS would need to rely on other data sources such as fishery-dependent harvest data and state or privately supported fishery-independent data collection surveys or programs. It is unlikely that any of the state or other institutional research programs would be able to undergo the fundamental realignment of budgets and scientific programs necessary to maintain the level and continuity of information currently provided by the SEFSC.

Although other data are available to support resource management decisions, the interruption or cessation of long-term data series on commercially valuable invertebrate stocks could lead to increased uncertainty and changes in some management scenarios. Management authorities would lose important information needed to establish sustainable harvest limits and help conserve and restore benthic habitats. Given the potential for resource management agencies to compensate for this loss of scientific information to some extent and the tendency to avoid major changes in management strategies, the potential magnitude of effects on invertebrate stocks would likely vary from minor to moderate but the effects could be regional in geographic scope and have long-term effects. Through these indirect effects on future management decisions, the overall impact on commercially important invertebrate stocks would be considered moderate adverse according to the impact criteria in Table 4.1-1.

4.5.8 Effects on the Social and Economic Environment

Section 3.3 describes the interaction of the SEFSC with the social and economic environment of the Southeast coastal U.S. This section describes the effects of the No Research Alternative on socioeconomic resources of the Southeast Region. Major factors that would be affected by the cessation of fieldwork associated with the SEFSC fisheries research program include:

- Collection of scientific data used in sustainable fisheries management
- Economic support for fishing communities
- Collaborations between the fishing industry and fisheries research
- Fulfillment of legal obligations specified by laws and treaties

4.5.8.1 Collection of Scientific Data Used in Sustainable Fisheries Management

Under the No Action Alternative, the SEFSC would not conduct or fund fisheries research involving the deployment of vessels or fishing gear in marine waters of the U.S. Southern Atlantic Ocean, Gulf of Mexico, or Caribbean Sea. Without the scientific data for updated stock and habitat assessments provided by SEFSC-affiliated research, scientists and fisheries managers would have to rely on other data sources, such as commercial and recreational fisheries harvest data and fisheries-independent research conducted and funded by state agencies, academic institutions, or other independent research organizations. Organizations that have participated in cooperative research programs may or may not continue their research efforts depending on whether they are able to secure alternative sources of funding (see Section 2.5). This would have a direct adverse effect on the statistical confidence of stock assessments and other scientific information important to fisheries management. Without federal fisheries-independent research, areas closed to fishing for various conservation reasons, such as stock or habitat recovery, would be without the primary scientific data used to monitor the effectiveness of those conservation measures and the recovery of depleted species.

The use of fishery-dependent data alone may severely limit the ability of managers to evaluate and make predictions about the status of some stocks because harvest data do not sample early age classes and therefore provide little data on potential recruitment to harvestable stocks. Uncertainty about stock assessments would increase over time as knowledge of population structures diminish. This, in turn, could require use of ever more precautionary approaches, which could reduce commercial and recreational fishing opportunities, and therefore associated income, through such means as reduced fishing quotas or target catch levels and/or extended closures of fishing areas. The redistribution of research effort to non-NMFS entities would also require new lines of communication with the Fishery Management Councils, new data review processes, and new procedures for integrating separate research results into the regional perspective. Cessation of fisheries research conducted and funded by the SEFSC would gradually undermine the statistical basis for use of more sophisticated management models, leading to reliance on less sophisticated and more conservative fishery management.

Another potential result of greater uncertainty in the scientific basis for fisheries management is that fisheries managers may overestimate overfishing levels and set harvest limits too high for some species, resulting in overfishing and depletion of fish stocks. The initial effect of this would be to increase the revenues from commercial fishing and its related industries. However, over time, the depletion of fish stocks would result in lower catches and therefore reduced incomes. Further, quotas that are lower than objectively necessary mean not only losses to the fishing industry, fisheries dependent shoreside industries and fishing families and communities, but also losses to the Nation through foregone revenue from missed harvesting opportunities. And even with a precautionary approach, in the absence of objective data, quotas may still be set too high, meaning the long-term yield from the fishery will be driven down due to unsustainable harvest levels. This would result in both a conservation loss and a long-term economic loss to the Southeast Region and the Nation.

The absence of federal fishery-independent research surveys and the long-term data sets they provide would eliminate the primary set of trend information used to monitor broad changes in the marine ecosystem. Climate change and ocean acidification have the potential to impact the population and distribution of many marine species. Long-term, scientifically robust research that provide**s** information on changes to and trends in the marine ecosystem, and on human impacts from and adaptations to those changes and trends, would be greatly diminished if the SEFSC ceased conducting and funding fisheries and ecosystem fieldwork.

The end result could be an undermining of confidence in the fisheries management program. This could lead to less cooperation and exchange of important information and data. Without this cooperation the interstate commissions and Fishery Management Councils would find it more difficult to sustain the support of the individual states, potentially undermining the fisheries management process. The No Research Alternative clearly does not enable collection and development of adequate, timely, high quality scientific information comparable to that provided by the SEFSC under any of the three research alternatives. In NMFS view, the inability to acquire scientific information essential to developing fisheries management actions that must prevent overfishing and rebuild overfished stocks would ultimately imperil the agency's ability to meet its mandate to promote healthy fish stocks and fully restore the nation's fishery resources.

4.5.8.2 Economic Support of Fishing Communities

As stated previously, the SEFSC currently spends approximately $29.3 million annually in support of fisheries research that support local economies in the form of employment, services, chartered vessels, fees, taxes, equipment, and fuel. Cooperative research grants and research set-aside programs account for substantial additional charter services. Under the No Research Alternative, this financial contribution to local economies and the resulting support of the social environment would cease. A number of people currently employed to conduct fisheries research either as federal employees or contractors would likely lose their jobs and the number of support services required for the SEFSC would decrease substantially. It is unlikely that state agencies or other funding sources would be able to completely compensate for this loss of federal funding to support fisheries research by state agencies, academic institutions, and industry groups.

While the loss of research-related employment and purchased services would be important and adverse for many individuals and families, the total sums spent for research are very small compared to the value of commercial and recreational fisheries in the area as well as the overall economy of those communities. The lost economic contribution of SEFSC research would be relatively larger for some communities where the research is centered (i.e., Hampton Roads Area, Virginia) and may be considerate moderate in magnitude for those communities but the overall direct impact of that loss would be minor in magnitude for most communities. These direct adverse economic impacts would be certain to occur under the No Research Alternative, would affect numerous communities throughout the region, and could be felt for several years. Overall, the direct economic impacts of the No Research Alternative would be considered minor to moderate and adverse according to the impact criteria in Table 4.1-1.

4.5.8.3 Collaborations between the Fishing Industry and Fisheries Management

Over time, the No Research Alternative would cause an adverse indirect effect on the social and economic environment by degrading the relationships that has been established between scientists and fishing groups through working together on cooperative research programs. This deterioration in trust and cooperation would likely get worse if commercial fisheries were managed more conservatively because of higher uncertainty resulting from less reliable information to feed into fisheries management. It is not clear what impacts this would have on particular economic or regulatory issues but an atmosphere of distrust often complicates and slows down public decision-making processes such as those used to develop fisheries regulations and harvest allocations. This type of effect could last for many years and would therefore be considered a long-term, adverse effect.

4.5.8.4 Fulfillment of Legal Obligations Specified by Laws and Treaties

The cessation of field work associated with the SEFSC research programs considered in this DPEA would compromise the ability of NMFS to fulfill its obligations under various U.S. laws and international treaties (Chapter 6). NMFS manages finfish and shellfish harvest under the provisions of several major statutes, including the MSA, MMPA, ESA, and the Atlantic Tuna Conventions Act. Fulfilling the obligations of these statutes requires NMFS to provide specific research data and scientific expertise to support legal reviews and management decision-making processes. The cessation of field research would substantially erode the value of scientific advice provided to these various processes and increase uncertainty about the effects of conservation and management measures on fishing communities as well as NMFS ability to provide socioeconomic analyses required for fisheries regulatory actions. It would also compromise the U.S. partnership and collaboration with other agencies, entities, and countries that collect, analyze, and share complementary data for management of highly migratory species and other international resources.

4.5.8.5 Conclusion

The direct and indirect effects of The No Research Alternative on the social and economic environment would be subject to a great deal of uncertainty depending on the response of many entities to the cessation of SEFSC fisheries research and the ensuing uncertainty in the fisheries management process. The impacts on the economies of local communities would be adverse, minor to moderate in magnitude depending on the community, long-term in duration, and would be felt throughout the Southeast region. The loss of research related to highly migratory species would compromise the ability of the U.S. to comply with its international treaty obligations. The loss of cooperative research programs would also cause deterioration in the relationships between NMFS scientists and fisheries managers with the fishing industry and public, with decreasing public trust in fisheries management regulations. The overall direct and indirect effects of the No Research Alternative on the social and economic environment would be minor to moderate in magnitude, felt across a broad geographic area, and long-term and would therefore be considered moderate adverse according to the impact criteria established in Table 4.1-1.

4.6 COMPARISON OF THE ALTERNATIVES

4.6.1 Summary of Effects on the Physical Environment

Under the three research alternatives, direct impacts to benthic habitats would occur through the use of several bottom-contact fishing gears (primarily trawl gears). The DPEA includes an analysis of the total footprint of SEFSC-affiliated research on benthic habitat. Under Alternative 1, SEFSC-affiliated research directly impacts a small percentage of the sea floor in the GOMRA and ARA each year with bottom trawls. No SEFSC surveys or research projects using bottom-contact gear are conducted in the CRA. Most of the bottom trawls occur in mud/silt or sand/gravel benthic habitats, and any disturbances to such substrates would be expected to recover with 18 months due to the action of ocean currents and natural depositions. Water quality could be affected through disturbance of bottom sediments, causing temporary and localized increases in turbidity. Given the spill response equipment and emergency training required of all research vessels by Coast Guard regulations regarding safety and pollution prevention, and the experience of OMAO and charter captains and crew, the potential for accidental fuel spills or other contamination from research vessels is considered small and any incidents would be rare. The overall effects on benthic habitat and water quality are considered small in magnitude, short-term in duration, and localized in geographic scope and are therefore considered minor adverse under all three of the research alternatives, as they would all have similar impacts on the physical environment. Under the No Research Alternative, there would be no direct impacts on the physical environment from SEFSC-affiliated fisheries and ecological research. However, the loss of scientific information generated by SEFSC research would contribute to greater uncertainty about the effects of climate change, ocean acidification, commercial fisheries impacts, and other external factors on benthic ecosystems. Indirect effects could occur through less scientifically informed decisions by resource management agencies. The loss of information from the SEFSC would likely affect a large geographic area but would be minor in magnitude given other potential sources of scientific research data. Impacts to the physical environment would therefore be considered minor adverse under the No Research Alternative.

4.6.2 Summary of Effects on Special Resource Areas and Essential Fish Habitat

Under the three research alternative, direct impacts may occur to EFH, HAPC, closed areas, and MPAs, including NMS within the SEFSC research areas. Direct impacts to EFH and HAPC would occur through the use of several bottom-contact fishing gears and mortality of fish and invertebrates. As described for the physical environment, the effects of SEFSC-affiliated research on benthic habitat are considered small in magnitude, localized in geographic scope, and mostly temporary or short-term in duration, although impacts on sensitive benthic substrates, should they occur, may last several years. Direct impacts to Closed Areas would likely be limited to deployment of SCUBA divers, camera arrays, and similar gear, where the impact is small. SEFSC survey locations of randomized sampling sites vary from year to year, and impacts of research surveys within particular MPAs would vary substantially over space and time. Based on the general effects of research on the environment as discussed in Section 4.2.1, the effects on MPAs is likely to be minor in geographic extent, and minor in duration or frequency. An analysis is presented on the amount of research sampling and catch made within these NMS. The annual number of research surveys conducted within NMS and the removals of fish and invertebrates for scientific purposes are relatively small, therefore any adverse effects on NMS would be temporary and minor.

Impacts to special resource areas under Alternative 2 would be very similar to the impacts under Alternative 1. Alternative 3 includes the potential for spatial/temporal restrictions on SEFSC-affiliated research as a means to reduce impacts on protected species. This provision may reduce impacts on certain areas if such closures were determined to be effective mitigation measures. However, specific determinations about potential research restrictions have not been made and it is assumed that impacts to special resource areas under Alternative 3 would be very similar to those under Alternatives 1 and 2.

Under the No Research Alternative, there would be no direct impacts on special resource areas from SEFSC-affiliated fisheries and ecological research. However, the indirect effects on resource management agencies and conservation plans for protected areas due to the loss of scientific information would be similar to that described for the physical environment and would be considered minor adverse.

4.6.3 Summary of Effects on Fish

The SEFSC conducts and funds stock assessment and habitat research for many commercially valuable and recreationally important fish species, providing the scientific basis for sustainable fisheries management. SEFSC fisheries and ecosystem research also provides critical information on oceanographic conditions and the status of other fish species that are not harvested but which play key roles in the marine food web, providing the scientific basis for NMFS goal of ecosystem-based management, as outlined in NOAA Fisheries Strategic Plan (NOAA 1997). Under the three research alternatives, relatively small impacts to fish populations are expected as a result of on-going research activities.

There are five marine fish species in the project areas currently listed as threatened or endangered under the ESA - the smalltooth sawfish, largetooth sawfish, scalloped hammerhead shark, and three species of sturgeon – the Atlantic, gulf and shortnose. Directed research on ESA-listed species (such as the Smalltooth Sawfish Abundance Survey) requires permitting under section 10 of the ESA and the effects of that research on the listed species are subject to their own NEPA analysis in the permitting process, and is not covered under this DPEA. However, effects on ESA-listed species incidental to other SEFSC fisheries research is covered in this DPEA. Mortality from captures in SEFSC and research partner surveys is a potential impact for ESA-listed species but historical levels of catch of all listed species are small and all such fish have been tended and released alive, often after valuable scientific data was collected.

For most species targeted by commercial fisheries and recreational anglers, mortality due to research surveys and projects is much less than one percent of commercial and recreational Annual Catch Limits (ACL) (Tables 4.2.3-6 through 4.2.3-11) and is considered to have minor adverse effects for all species. For a few species which do not have a large commercial market due to various market conditions or past overfishing, the research catch exceeds one percent of commercial catch but is still small relative to the population of each species and is considered minor. For highly migratory species (tunas, sharks, swordfish, and billfish) and species that are not managed under Fishery Management Plans (FMPs), research catch is also relatively small and considered to be minor for all species. Mortality for all species would be distributed across a wide geographic area rather than concentrated in particular localities.

The DPEA uses an average level of catch and bycatch over the status quo period to determine the impacts of research on fish species based on their current or recent stock status and conservation concerns. However, the status of fish stocks varies over time and by fishery management region. Proposed research projects that target stocks that are overfished or where overfishing is occurring are reviewed annually before research permits are issued to determine if they would conflict with rebuilding plans or present other conservation concerns. If a future project proposes to conduct research on a fish stock that is overfished or depleted at the time, or if it would occur in areas and with gear that would likely result in substantial bycatch of overfished stocks, the potential effects of the proposed research project could be much greater than estimated in this DPEA and could conflict with rebuilding plans or present other conservation concerns. These future research projects may require additional NEPA analyses before they are issued research permits.

In contrast to these adverse effects on fish, SEFSC research also provides long-term beneficial effects on target species populations through its contribution to sustainable fisheries management. Data from SEFSC-affiliated research provides the scientific basis to reduce bycatch, establish optimal fishing levels, prevent overfishing, and recover overfished stocks.

The suite of research programs conducted under Alternatives 2 and 3 are similar but not the same as Alternative 1; several past surveys/projects have been discontinued or modified and several new research programs and additional gears are anticipated to begin in the near future. None of the new or modified research activities under Alternative 2 are likely to affect ESA-listed species. The amount of fish caught in Alternative 1 research activities that are discontinued under Alternative 2 is likely to be roughly the same as the amount of fish caught in new or modified research activities under Alternative 2, although the species, proportions of catch, and areas where research is conducted would vary to some degree. Overall the impacts to all fish species in terms of abundance and distribution would be minor under all three research alternatives.

Another potential difference with regard to research catch of fish is the potential for spatial/temporal restrictions on SEFSC fisheries research under Alternative 3. If particular areas and times were determined to be important to avoid as a means to reduce impacts on protected species, research fishing and hence impacts on fish could be reduced in some locations. However, researchers may respond to spatial/temporal restrictions by redirecting research efforts to other locations such that overall research effort remains the same. Alternative 3 does not specify particular spatial/temporal restrictions but it is assumed for the DPEA analysis that overall research effort and therefore impacts to fish under Alternative 3 would be very similar to those under Alternative 2, although they may occur in somewhat different locations.

Under the No Research Alternative, there would be no direct adverse impacts on fish from SEFSC fisheries research. However, the loss of scientific information for fisheries management could have long-term moderate adverse impacts on fish stocks through increasing uncertainty in fisheries management decisions, which could lead to potential overfishing on some stocks, underutilization of some stocks, uncertainty about the recovery of overfished stocks, and increasing uncertainty about the efficacy of fishing regulations designed to protect fish stocks and habitat from overfishing. Inappropriate management decisions could have minor to moderate magnitudes of effects on given stocks, depending on how fisheries managers responded to the loss of scientific information from the SEFSC. These indirect effects would likely be long-term and occur over a large geographic area. The overall impacts to fish stocks under Alternative 4 are therefore considered minor to moderate adverse.

4.6.4 Summary of Effects on Marine Mammals

The DPEA analyzes several types of potential effects of SEFSC fisheries research on marine mammals, including ship strikes, contamination of the marine environment, removal of marine mammal prey, and incidental take through use of active acoustic instruments and interactions with research gear. Given the same basic scope of research effort in all three research alternatives (although some details would be different), and the use of the same vessels and research gear, the potential effects from all of these factors except incidental take by entanglement or capture in research gear are considered the same for the three research alternatives.

No collisions with large whales have been reported from any fisheries research activities conducted or funded by the SEFSC. Given the relatively slow speeds of research vessels, the presence of bridge crew watching for marine mammals during many survey activities, and the small number of research cruises, ship strikes with marine mammals during the research activities described in this DPEA would be unlikely to occur in the near future.

SEFSC-affiliated fisheries research removes very small amounts of fish, invertebrates, and plankton relative to the amount estimated to be consumed by marine mammals every year. These research removals are distributed broadly throughout the research area in numerous brief, small sampling efforts. These small removals are unlikely to affect the prey availability or foraging success of any marine mammals.

All NOAA vessels, SEFSC chartered vessels, and vessels used by SEFSC-funded research partners are subject to the regulations of MARPOL 73/78, the International Convention for the Prevention of Pollution from Ships, which prohibits discharges of potentially harmful substances into the marine environment. In addition, all NOAA vessels are fully equipped to respond to emergencies, including fuel spills, and crew receive extensive safety and emergency response training. These precautionary measures help reduce the likelihood of fuel spills occurring and increase the chance that they would be responded to and contained quickly. Accidental spills of noxious compounds from research vessels could occur but would likely be rare, temporary, and localized and would be unlikely to have any adverse effects on marine mammals.

All three research alternatives would use the same type of acoustic instruments for reconnaissance and scientific mapping/survey purposes. These devices produce sounds that may be detected by marine mammals and cause changes in their behavior which would constitute Level B harassment under the MMPA. None of the acoustic equipment used by the SEFSC and its research partners is likely to present risks of hearing loss or injury to any marine mammal. The SEFSC LOA application (attached to this DPEA as Appendix C) includes estimates of Level B harassment takes through the use of acoustic instruments in the three SEFSC research areas using the scope of research and mitigation measures described in Alternative 2, which is assumed to be the same amount of Level B harassment that would take place under Alternatives 1 and 3 (see Tables 4.2-19, 4.2-22, and 4.2-24). The analysis is based on sound characteristics of the instruments, the distance research vessels travel with these instruments engaged, calculations of volumes of water insonified to 160 decibels (root mean square) or more (NMFS current recommended threshold for Level B harassment from the active acoustic equipment considered in this DPEA), and density estimates for each marine mammal species in the research area. The numbers of Level B takes for each species are small and the potential effects are likely to be temporary. The overall impact of acoustic disturbance to marine mammals under any of the three research alternatives is therefore considered to be minor adverse. As described earlier, Alternative 3 includes potential spatial/temporal restrictions that may lead to differences in where and when effects on marine mammals occur relative to Alternatives 1 and 2.

The primary difference between the alternatives regarding marine mammals involves incidental take through entanglement, hooking, or capture in fisheries research gear, and the mitigation measures used to reduce the risk of those interactions. Incidental take of marine mammals in research gear includes animals captured, hooked, or entangled in fishing gear but released without serious injury (Level A harassment under the MMPA), and incidental capture, hooking, or entanglement resulting in serious injury or mortality. The MMPA requires applicants for regulations and subsequent LOAs to estimate the number of each species of marine mammal that may be incidentally taken by harassment or serious injury and mortality during the proposed action. Because it is impossible to predict whether a future interaction will lead to serious injury or mortality or whether the animal may be released with only non-serious injury, the SEFSC has combined its estimates for Level A harassment and serious injury and mortality in its LOA application.

The estimated take numbers are based on the historical capture of 11 bottlenose dolphins from six stocks in the ARA (seven animals) and GOMRA (four animals) from 2002-2015 (Table 4.2-15). Past marine mammal takes during SEFSC and research partner surveys have occurred using surface (skimmer) trawls (two animals), bottom trawls (five animals), bottom longline (one animal), gillnets (one animal), and trammel nets (two animals). Of the 11 animals captured, three were released alive.

For the six stocks of bottlenose dolphins that have been taken in research gear in the past, the LOA application uses a precautionary approach for estimating future takes, using the average annual number of animals caught in all gear types in the past 14 years (2002-2015), rounding up to the nearest whole number of animals, and multiplying by five to account for the five-year authorization period (MMPA regulations concerning incidental take of marine mammals, if promulgated, would likely be issued for a five-year period). While it is not expected based on historical takes, bottlenose dolphins occur in groups and it is possible that a take request for only a small number of takes (e.g., five) could be exceeded in one or two trawl tows, trammel net sets, or gillnet sets if multiple animals were taken in a single set. Therefore, because of bottlenose dolphin propensity to travel in groups, the SEFSC increased the estimate to 10 for both the ARA and GOMRA in the event of multiple takes during one event. That is, 10 takes are requested for the ARA and 10 takes requested for the GOMRA over the five-year authorization period for all coastal and bay, sound, and estuary stocks of bottlenose dolphins; however, the potential takes requested for each stock will be restricted on a stock-by-stock basis. There are 17 stocks of bottlenose dolphins in the ARA, 36 stocks in the GOMRA, and one stock in the CRA. The SEFSC is only requesting takes from those stocks that overlap spatially with SEFSC and SEFSC-affiliated fisheries research activities. For each of these stocks, the requested number of takes is either one or three animals over the five-year authorization period based on the size of the stock and the amount of research conducted within its range. Given the fact that bottlenose dolphins have been taken in five different research gear types in the past, the requests are made for takes in any of these gears.

Other species and stocks that have not been captured in the past have been included in the LOA application request for take authorization based on incidental take in analogous commercial fisheries. The requests are for either one or three animals per stock in trawl and hook-and-line gears over the five-year authorization period. The SEFSC also includes a request for one “undetermined delphinid” in hook-and-line gear in each research area to account for the potential for an animal to be hooked but either free itself or be released before it could be identified.

The SEFSC considers its estimation method to be precautionary in that it likely overestimates the number of animals that could be caught in the future in order to ensure accounting for a maximum amount of potential take. The DPEA uses the estimated takes in the LOA application to assess the impacts on marine mammals for all three research alternatives in the ARA (Tables 4.2-17 and 4.2-18), GOMRA (Tables 4.2-20 and 4.2-21), and CRA (Table 4.2-23).

For almost all stocks of marine mammals for which PBR has been determined and that are considered to have potential interactions with SEFSC fisheries research, the requested number of Level A harassment/serious injury and mortality takes would be less than 10 percent of their respective PBRs, even if the requested “undetermined delphinid” take were assigned to each appropriate stock. These takes, if they occurred, would likely be rare or infrequent events and would be considered to have overall minor adverse effects on the population of each species. The exceptions are for stocks with very small or unknown PBR values, i.e. several estuarine stocks of bottlenose dolphin and rough-toothed dolpin in the GOMRA, where the requested level of take could be moderate in magnitude relative to PBR. Given the limited research effort in nearshore and estuarine areas, the small size of many stocks, and the mitigation measures in place for the research, the SEFSC considers the overall level of impact on these small stocks of bottlenose dolphin to be minor to moderate adverse. Given the likelihood that these are overestimates, the actual effects from injury, serious injury or mortality could be substantially less than described.

The lack of recent population information for many bottlenose dolphin stocks and for all stocks in the CRA prevents a quantitative assessment of the potential impact of requested takes for stocks with undetermined PBR. If new population estimates for one or more stocks of bottlenose dolphins are developed in the future, NMFS will consider the potential impacts of its ongoing fisheries research program and requested take authorizations on an adaptive management basis, including the potential for additional mitigation measures as necessary.

The main difference between the alternatives in regard to marine mammals is the mitigation measures that would be implemented to reduce the risk of marine mammal interactions with research gear. The DPEA does not attempt to quantify the effectiveness of the different mitigation measures considered in the different alternatives; the analysis provides a qualitative description of how such measures could reduce the risk of interactions with marine mammals and how their incorporation into scientific protocols may impact the fisheries research programs.

Alternative 1 represents the Status Quo conditions as they existed at the end of 2015, although the implementation of mitigation measures has not been static over the past ten years. Alternative 1 mitigation measures for marine mammals include at least one member of the ships' crew or scientific party designated to monitor for marine mammals before any research fishing gear (trawls, gillnets, longlines, etc.) are deployed. If any marine mammals are sighted around the vessel before setting the gear, the vessel may be moved away from the animals to a different section of the sampling area if the animals appear to be at risk of interaction with the gear. This protocol has not had a specific name under Alternative 1 but will be referred to as the "move-on rule" under Alternative 2. The crew standing watch continue to monitor the waters around the vessel while the gear is in the water and, if any marine mammals are sighted that appear to be in danger of interacting with the gear, the gear may be removed from the water immediately or other appropriate actions taken to reduce the risk. Standard tow and set durations have also been reduced to minimize the risk of serious injuries and drowning.

Alternative 2 includes these same mitigation measures plus some additional measures intended to improve the implementation of existing protocols. The SEFSC proposes a series of improvements to its protected species training, awareness, and reporting procedures under Alternative 2 that would apply equally to SEFSC research crews and research partner crews. These include a new program for its Field Party Chiefs, Scientific Watch leaders, scientists, and vessel captains to communicate with each other about their experiences with protected species interactions during research work with the goal of improving decision-making regarding avoidance of adverse interactions. Alternative 2 also includes new training requirements on protected species protocols for all research scientists and crew members that may be assigned to monitor for the presence of marine mammals during future surveys, including scientists and crew from SEFSC research partners. This training would formalize and standardize the information provided to all crew that might experience protected species interactions during research activities. A new Protected Species Safe Handling and Release Manual will be developed and will include topics such as current mitigation measures, decision-making factors for avoiding take, procedures for handling and releasing protected species caught in research gear, and reporting requirements. This manual and other appropriate material will be used in required training workshops and discussions about mitigation issues on a regular basis. Written cruise instructions, protocols, and information signage on research vessels regarding avoidance of adverse interactions with protected species will be reviewed and, if found insufficient, made fully consistent with the protected species training materials and any guidance on decision-making that arises out of the new training programs described above. The SEFSC will also develop a Protected Species Incidental Take (PSIT) reporting form and instructions for use during all of its fisheries and ecosystem research activities and require all SEFSC and research partners to use this form for reporting incidental takes of all protected species. The SEFSC will incorporate specific language into its contracts that specifies all training requirements, operating procedures, and reporting requirements for protected species that will be required for all charter vessels and research partners. The SEFSC expects these new procedures to facilitate and improve the implementation of the mitigation measures described under Alternative 1. However, the DPEA does not provide quantitative estimates of how these changes would decrease adverse interactions with marine mammals, which would be speculative, only that actual impacts to marine mammals will likely be less than described under Alternatives 1 and 2.

Alternative 3 includes the same mitigation measures as Alternative 2 but also includes a number of other potential mitigation measures that the SEFSC is not proposing to implement in its LOA application. These include a number of alternative methods for monitoring for protected species (e.g., use of dedicated Protected Species Observers, night-vision goggles, and passive acoustic devices for periods of low visibility), gear modifications such as a camera or underwater video system to monitor any interactions of protected species with all trawl gear, and aircraft, unmanned aerial vehicles, or autonomous underwater gliders to provide additional detection capabilities. The analysis describes how these potential mitigation measures could reduce adverse impacts to marine mammals. However, some of these additional mitigation measures would have limited or no utility for mitigation, would have a serious adverse impact on the ability of the SEFSC to collect certain kinds of research data, would compromise the scientific value of time-series data, and would have prohibitive impacts on the cost of research and therefore greatly reduce the scope of research that could be conducted. Some concepts and technologies considered in Alternative 3 are promising as a means to reduce risks to marine mammals and NMFS will evaluate the potential for implementation if they become more practicable.

Under the No Research Alternative, no direct adverse impacts to marine mammals from SEFSC fisheries research (i.e., takes by gear interaction and acoustic disturbance) would occur. However, many of the SEFSC research projects that would be eliminated under this alternative contribute valuable ecological information important for tracking long-term trends affecting the marine ecosystem and, indirectly, marine mammal management, especially for ESA-listed species and stocks considered depleted under the MMPA. The loss of information on marine mammal habitats would indirectly affect resource management decisions concerning the conservation of marine mammals, especially as time went on and uncertainty about the status of the marine environment increased. There are too many unknown variables to estimate the specific effects this lack of information could have on any particular stock of marine mammals but the No Research Alternative would likely have minor adverse effects for the foreseeable future.

4.6.5 Summary of Effects on Birds

There have been very few adverse interactions with seabirds during SEFSC research activities. All three of the research alternatives include the use of fishing gear (i.e., trawls, gillnets, and longlines) that have had substantial incidental catch of seabirds in Southeast commercial fisheries. However, research gear is generally smaller than commercial gear and research protocols are quite different than commercial fishing practices. In particular, fisheries research uses much shorter duration trawls/sets than commercial fisheries and no bait/offal is thrown overboard while research gear is in the water, thereby greatly reducing the attraction of seabirds to research vessels. Based on the scarcity of historical interactions with seabirds and the research protocols used by the SEFSC, incidental take of seabirds in research gear is unlikely. The DPEA also considers the potential for fisheries research to affect the habitat quality of seabirds through removal of prey and water contamination and, as described above for marine mammals, concludes that these effects would be minor adverse for all species. The overall effects on seabirds are therefore considered minor adverse under all three research alternatives. One potential mitigation measure under Alternative 3 would be for the SEFSC to deploy streamer lines on longline gear to reduce the risk of catching seabirds. If seabird interactions with longline gear are documented in the future, the SEFSC will evaluate whether use of streamer lines is warranted given the tradeoffs between the potential conservation benefit and changes to research protocols that might affect time-series data.

Some SEFSC surveys take bird biologists on board when there is bunk space available to conduct transect surveys for bird distribution and abundance in the SEFSC research area. This information is used by NMFS, the U.S. Fish and Wildlife Service, and other international resource management agencies to help with bird conservation issues and is considered to have indirect beneficial effects on birds.

Under the No Research Alternative, the risk of direct adverse effects on seabirds from SEFSC research would be eliminated, but there could be potential long-term minor adverse indirect impacts to seabirds because resource management authorities would lose ecological information about the marine environment important to seabird conservation.

4.6.6 Summary of Effects on Sea Turtles

The DPEA analyzes the same direct and indirect effects of SEFSC fisheries research on sea turtles as described for marine mammals. The potential for ship strikes, removal of prey, and contamination of marine habitat would be similar to the risks described for marine mammals; these effects are considered minor adverse for all species under all three research alternatives. Sea turtles hearing range is apparently well below the frequencies of acoustic instruments used in fisheries research so turtles are unlikely to detect these sounds or be affected by them.

There have been 455 sea turtles incidentally captured during SEFSC-affiliated research from 2010 through 2014, all but one of which have been released alive. The DPEA uses capture rate data from these historical takes, which occurred with different types of fishing gear (bottom trawls, longline gear, trammel nets, and gillnets), to estimate how many sea turtles may be captured given the estimated fishing effort under the three research alternatives (Table 4.2-26) . Future incidental captures of sea turtles in these gear types are certain but it is likely that most of these turtles will be released in good condition because of the short tow and set durations of most SEFSC research activities and the presence of trained turtle-handling personnel on research crews. There is a potential for serious injury and mortality of sea turtles in research gear, especially with longline gears, but the estimated level of mortality, if it occurred, would be rare and small relative to overall population size for each species. The overall effects of the research alternatives on ESA-listed sea turtles would likely be small in magnitude, temporary or short-term in duration, limited to small geographic areas, and considered to have minor adverse effects on all species of sea turtles. However, the incidental capture of sea turtles by researchers also provides an opportunity to collect information on the physiological health of sea turtle populations and to tag individual turtles fitted with PIT and flipper tags. The collection of this scientific information on sea turtles has a beneficial effect on turtle management and potentially indirect benefits to sea turtle species.

As with other resources, the No Research Alternative would eliminate the risk of direct adverse effects on sea turtles from SEFSC research. However, the data collected on sea turtles from SEFSC and research partner activities provide scientific data on the abundance and distribution of sea turtles in the ARA, GOMRA, and CRA. This information contributes to ecosystem modeling and resource management issues important to sea turtles. The elimination of SEFSC research activities would also substantially reduce the collection of oceanographic and fisheries data important for monitoring the ecological status of the environment important to sea turtles. SEFSC-affiliated fisheries research includes conservation engineering projects that have played an important role in the establishment of regulations mandating the use of TEDs in commercial trawl fisheries and circle hooks in longline fisheries. SEFSC research has also contributed to decisions regarding designated critical habitat for loggerhead sea turtles and other species. These management measures strategically reduce impacts to sea turtles and protect habitats important to their recovery and are partially dependent on periodic input of SEFSC data. The loss of scientific information important to understanding sea turtle ecology and fisheries mitigation measures under the No Research Alternative could have adverse and moderate indirect effects on ESA-listed sea turtles.

4.6.7 Summary of Effects on Invertebrates and Plants

The SEFSC conducts stock assessment and habitat research for several important invertebrate species (e.g. white and brown shrimp) that are important for commercial and recreational fisheries. The scope and methodologies used to assess these stocks would be similar for all three research alternatives and, similar to the situation described for valuable fish species, the magnitude of mortality due to research sampling would be small relative to commercial harvests (Table 4.2-28). The footprint of bottom-contact gear used in research is also relatively small in magnitude and impacts to benthic infauna and epifauna would be short-term. Under the three research alternatives, minor adverse impacts to invertebrates are expected from SEFSC research activities. SEFSC research is also important for the scientific and sustainable management of these valuable fisheries, helping to prevent overfishing on the stocks, and therefore has beneficial indirect effects on the species.

As described for effects on fish, another difference between the research alternatives concerning invertebrates is the potential for spatial/temporal restrictions under Alternative 3, which could reduce overall research effort or cause changes in specific locations where that research occurs or when it occurs. Without further details on such restrictions, it is assumed that overall effects on invertebrates would be very similar to Alternatives 1 and 2.

Under the No Research Alternative, direct adverse impacts to invertebrates would be eliminated. As was the case with commercially important fish species, the loss of stock assessment and marine environment information could indirectly result in moderate adverse effects on commercially targeted invertebrate species through increasing uncertainty in the fishery management process.

4.6.8 Summary of Effects on the Social and Economic Environment

The effects of SEFSC fisheries and ecosystem research on the social and economic environment are expected to be very similar under all three research alternatives. Each of these alternatives would include important scientific contributions to sustainable fisheries management for some of the most valuable commercial and recreational fisheries along the U.S. Atlantic and Gulf Coast, which benefits commercial and recreational fisheries and the communities that support them. These industries have large economic footprints, generate billions of dollars' worth of sales and thousands of commercial fishing-related jobs, and provide millions of people across the country with highly valued seafood. Millions of recreational fishers also participate and support fishing service industries. SEFSC fisheries research activities would also have minor to moderate beneficial impacts to the economies of fishing communities through direct employment, purchase of fuel, vessel charters, and supplies. Continued SEFSC fisheries research is important to build trust and cooperation between the fishing industry and NMFS scientists and fisheries managers. The overall effects of SEFSC-affiliated research would be long-term, distributed widely across the Southeast region, and would be considered minor to moderately beneficial to the social and economic environment for all three research alternatives.

The impacts of the No Research Alternative would be the inverse of the three research alternatives. It would likely have minor to moderate adverse impacts on the social and economic environment through greater uncertainty in fisheries management, which could lead to more conservative fishing quotas (i.e., underutilized stocks and lost opportunity) or an increased risk of overfishing, followed by reductions in commercial and recreational fisheries harvests. The lack of scientific information would also compromise efforts to rebuild overfished stocks and monitor the effectiveness of no-fishing conservation areas. These impacts would adversely affect the ability of NMFS to comply with its obligations under the MSA. It would also eliminate research-associated federal spending on charter vessels, fuel, supplies, and support services in various communities. The No Research Alternative would also have long-term adverse impacts on the scientific information the SEFSC contributes to meet U.S. obligations for living marine resource management under international treaties.

5.1 INTRODUCTION AND ANALYSIS METHODOLOGY

The CEQ defines cumulative impact as:

> *"The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 Code of Federal Regulations [CFR] 1508.7).*

Cumulative effects are assessed by aggregating the potential direct and indirect effects of the proposed action with the impacts of past, present, and reasonably foreseeable future actions in the vicinity of the project. The ultimate goal of identifying potential cumulative effects is to provide for informed decisions that consider the total effects (direct, indirect, and cumulative) of the project alternatives. As suggested by the CEQ handbook, *Considering Cumulative Effects under the National Environmental Policy Act* (1997), the following basic types of cumulative effects are considered:

- Additive – the sum total impact resulting from more than one action;
- Countervailing – adverse impacts that are offset by beneficial impacts; and
- Synergistic – when the total impact is greater than the sum of the effects taken independently.

Cumulative effects may result from the incremental accumulation of similar effects or the synergistic interaction of different effects. Repeated actions may cause effects to build up over time, or different actions may produce effects that interact to produce cumulative impacts greater than (or less than) the sum of the effects of the individual actions.

As directed by CEQ's NEPA regulations (40 CFR 1502.16), this chapter discusses direct and indirect impacts on specific physical, biological, and social resources in combination with varying levels of effects, ranging from minor to major. While the effects of individual actions may be only minor, substantial cumulative effects may result from multiple actions occurring in the same geographic area. The implementing regulations of NEPA require analysis of cumulative effects in order to alert decision makers of the full consequences of all actions affecting a resource component and assess the relative contribution of the proposed action and alternatives.

Chapter 3 of this DPEA provides baseline information on the physical, biological, and social components of the environment that may be affected by SEFSC research activities. Chapter 4 provides an analysis of the direct and indirect effects on these resources of the four alternatives considered in this DPEA. Because the first three alternatives involve the continuation of SEFSC research activities (referred to collectively as the research alternatives) and contribute similar effects to the cumulative effects on most resources, they are generally considered together in the following Chapter 5 analysis. The contribution of the No Research Alternative to cumulative effects is quite different and is considered separately for each resource.

5.1.1 Analysis Methodology

The cumulative effects analysis methodology is similar to the effect assessment methodology for direct and indirect effects in Section 4.1. It consists of the following steps:

1. Define the geographic area and timeframe. These may vary between resource components.
2. Identify external actions, including:
    a. Past actions that have already occurred and resulted in lasting effects (see Chapter 3),

   b. Present actions occurring within the same timeframe as the proposed action and alternatives (see Chapter 3), and
   c. Reasonably foreseeable future actions (RFFAs), which are planned and likely to occur (see Table 5.1-1).
3. Evaluate the direct and indirect effects of the proposed action and alternatives along with the adverse and beneficial effects of external actions and rate the cumulative effect using the effects criteria table (Table 4.1-1).
4. Assess the relative contributions of the alternatives to the cumulative effects.

5.1.2 Geographic Area and Timeframe

This cumulative effects analysis considers external actions that influence the geographic areas where SEFSC-affiliated research activities occur; these areas include the Southeast U.S. Continental Shelf LME, the Gulf of Mexico LME, and the Caribbean Sea LME (Figures 3.1-1 and 3.1-2) as described in Section 3.1.1. Some actions that originate outside of the SEFSC research areas, such as discharge of pollutants, or actions that influence populations of highly migratory species, could potentially contribute to cumulative effects within the geographic areas of interest; such actions are considered in the analysis of cumulative effects. Other actions considered in the analysis of cumulative effects may be geographically widespread, such as those that could potentially result in climate change or ocean acidification. Although discussions of past actions primarily focus on the last five years, the availability of existing information and the period of time that must be considered to understand the baseline conditions vary between resource components. All analyses project five years into the future from the date this DPEA is finalized.

5.1.3 Reasonably Foreseeable Future Actions

Table 5.1-1 summarizes the RFFAs external to SEFSC fisheries research that are likely to occur in the next five years and the resources they are likely to affect. This information has been collected from a wide variety of sources, including recent NEPA documents covering the Northeast marine environment, federal and state fishery agency websites and documents, U.S. Navy websites and documents, and a variety of documents concerning industrial developments such as Liquefied Natural Gas import terminals, offshore wind farms, ocean current energy projects, dredging, and ocean disposal. Wildlife management documents such as endangered species recovery plans and take reduction plans for sea turtles and marine mammals were also consulted to identify conservation concerns for different species and habitats.

Deciding whether to include actions that have already occurred, are ongoing, or are reasonably foreseeable in the cumulative impacts analysis depends on the resource being analyzed. Past, ongoing, and future actions must have some known or expected influence on the same resources that would be affected by the alternatives to be included in the cumulative impacts analysis. CEQ refers to this as the cause-and-effect method of connecting human activities and resources or ecosystems. The magnitude and extent of the effect of an action on a resource or ecosystem depends on whether the cumulative impacts exceed the capacity of the resource/ecosystem to sustain itself and remain productive over the long-term.

CEQ guidelines state that “it is not practical to analyze cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful.” In general, actions can be excluded from the analysis of cumulative impacts if:

- The action is outside the geographic boundaries or timeframe established for the cumulative impacts analysis.
- The action will not affect resources that are the subject of the cumulative impacts analysis.
- The action is not planned or is not reasonably foreseeable (e.g., formally proposed, planned, permitted, authorized, or funded).

Table 5.1-1 Reasonably Foreseeable Future Actions (RFFAs) and Potential Effects on Different Resources in the SEFSC Research Areas

Blank cells indicate no effects on that resource.

Action	SEFSC Research Area			Effect on Physical Environment	Effect on Special Resource Areas	Effect on Fish	Effect on Marine Mammals	Effect on Seabirds	Effect on Sea Turtles	Effect on Invertebrates	Effect on Social and Economic Environment
	Atlantic	Gulf of Mexico	Caribbean								
Other (non-SEFSC) Scientific Research	X	X	X	Presence of additional vessel traffic Seafloor disturbance Generation of Marine debris Contamination (Spills, Discharges)	Habitat disturbance Contamination (Spills, Discharges)	Habitat disturbance Removal of individuals and biomass Behavioral Disruptions	Behavioral disturbance or displacement Loss/injury from ship strikes Noise responses Altered or reduced prey resources Behavioral disturbance or displacement	Loss from avian bycatchbycatch Potential for ship collisions (lighting attraction)	Loss/injury from ship strikes Loss/injury from turtle bycatch Loss/injury from entanglement/hooking in fishing gear	Loss or displacement due to habitat disturbance Removal of individuals and biomass	Increased understanding of environment leading to better resource management
Federal and State Managed Fisheries	X	X	X	Presence of additional vessel traffic Sea floor disturbance Generation of Marine debris Contamination (Spills, Discharges)	Habitat disturbance Contamination (Spills, Discharges) Generation of Marine debris	Removal of managed targeted fisheries species BycatchBycatch removal of non-target managed species Behavioral Disruption Loss from capture by derelict gear Habitat disturbance	Loss/injury from ship strikes Loss/injury from entanglement/hooking Noise responses Altered or reduced prey resources Behavioral disturbance or displacement	Loss from avian bycatchbycatch Potential for ship collisions (lighting attraction) Alteration or reduction of prey resources	Loss/injury from ship strikes Loss/injury from turtle bycatchbycatch Loss/injury from entanglement/hooking in fishing gear	Direct loss or displacement due to bottom trawling Indirect loss or displacement due to habitat disturbance	Provision of jobs and economic opportunity Provision of food and industrial raw materials Cost of operations and gear requirements Need for catch limits for resource management Need for time/area closures for resource management
Other Fishing Operations (Charter, Private, or managed by treaty)	X	X	X	Presence of additional vessel traffic Sea floor disturbance Generation of Marine debris Contamination (Spills, Discharges)	Contamination (Spills, Discharges) Habitat Disturbance Generation of Marine debris	Removal of managed targeted fisheries species BycatchBycatch removal of non-target managed species Behavioral Disruption Loss from capture by derelict gear Habitat disturbance	Loss/injury from ship strikes Loss/injury from entanglement/hooking Noise responses Altered or reduced of prey resources Behavioral disturbance or displacement	Loss from avian bycatch Potential for ship collisions (lighting attraction) Alteration or reduction of prey resources	Loss/injury from ship strikes Loss/injury from turtle bycatch Loss/injury from entanglement in fishing gear	Direct loss or displacement due to bottom trawling Indirect loss or displacement due to habitat disturbance	Provision of jobs and economic opportunity Indirect support of tourist/resort economy Provision of recreational opportunities Provision of food
Recreation and Tourism	X	X	X	Presence of additional vessel traffic Generation of Marine debris	Habitat disturbance Generation of Marine debris	Behavioral Disruption Habitat disturbance	Noise responses Behavioral disturbance or displacement Loss/injury from ship strikes Loss/injury due to ingestion or entanglement in marine debris and fishing gear	Noise responses Potential for ship collisions (lighting attraction) Loss/injury due to ingestion/entanglement in marine debris	Loss/injury from ship strikes Noise responses Displacement Loss/injury due to ingestion/entanglement in marine debris	Loss or displacement due to habitat disturbance Collection and disturbance of corals by divers /swimmers Loss/injury due to contamination Invasive species (Cruise ship ballast water)	Provision of jobs and economic opportunity Provision of recreational opportunities

Action	SEFSC Research Area			Effect on Physical Environment	Effect on Special Resource Areas	Effect on Fish	Effect on Marine Mammals	Effect on Seabirds	Effect on Sea Turtles	Effect on Invertebrates	Effect on Social and Economic Environment
	Atlantic	Gulf of Mexico	Caribbean								
Military Operations (GOMEX Range Complex, other bases)	X	X	X	Contamination of water and sediment Generation of marine debris, including munitions	Contamination Generation of marine debris, including munitions	Noise effects (stress, altered behavior, auditory damage) Mortality near detonation Loss/injury from contamination Contamination of fish for human consumption	Loss/injury from ship strikes Loss/injury from noise effects (stress, altered behavior, auditory damage) Behavioral disturbance Displacement Injury or loss due to ingestion or entanglement in marine debris Mortality near detonation Habitat disturbance	Loss/injury due to ingestion or entanglement in marine debris Potential for ship collisions (lighting attraction) Behavioral disturbance Displacement Mortality near detonation Habitat disturbance	Loss/injury from ship strikes Noise effects (stress, altered behavior, auditory damage) Mortality near detonation Injury or loss due to ingestion or entanglement in marine debris	Injury or loss due to contamination Mortality near detonation	Temporary and localized disruption of fishing Maintaining National defense
Liquid Natural Gas (LNG) Terminals	X	X	X	Increased turbidity (construction phase) Sea floor disturbance Presence of additional vessel traffic Localized changes in water temperature Provision of new underwater structures	Contamination Increased turbidity Sea floor disturbance	Loss/injury from contamination Construction related habitat disturbance Provision of new structured habitat Contamination of fish for human consumption	Loss/injury from ship strikes Noise effects (construction, vessel) Behavioral disturbance/displacement Loss/injury from contamination Loss/injury due to ingestion/entanglement in marine debris Loss/injury due to entanglement in buoy chains Alteration or reduction of prey resources Habitat disturbance	Loss/injury from contamination Loss/injury due to ingestion/entanglement in marine debris Loss/injury from structure or ship collision (lighting attraction) Alteration or reduction of prey resources	Loss/injury from ship strikes Noise effects (construction, vessel) Behavioral disturbance Loss/injury from contamination Loss/injury due to ingestion/entanglement in marine debris Alteration or reduction of prey resources	Habitat disturbance Increased risk of invasive species due to long-distance shipping activity Loss/injury from contamination Creation of new hard substrate habitats on structures	Fishing exclusion zones may displace fisheries Provision of new jobs Increased capacity for inexpensive fuel transport and handling
Oil and Gas Extraction		X		Increased turbidity (construction phase) Sea floor disturbance Contamination (discharges, spills, blowouts) Generation of marine debris	Contamination (discharges, spills, blowouts) Increased turbidity Sea floor disturbance Generation of marine debris	Loss/injury from contamination (spills, discharges, blow-outs) Increased turbidity Habitat disturbance Noise effects	Loss/injury due to ship strikes Noise effects (construction, drilling, vessels) Behavioral disturbance Displacement Loss/injury from contamination (spills, discharges, blowouts) Alteration or reduction of prey resources Loss/injury due to ingestion/entanglement in marine debris Habitat loss/disturbance Compromised health	Loss/injury from contamination (spills, discharges, blowouts) Alteration or reduction of prey resources Noise effects Loss/injury due to structure or ship collision (lighting attraction)	Loss/injury due to ship strikes Noise effects (construction, drilling, vessels) Disturbance Displacement Loss/injury from contamination (spills, discharges, blowouts) Alteration or reduction of prey resources Loss/injury due to ingestion/entanglement in marine debris	Habitat loss/disturbance Loss/injury from contamination (spills, discharges, blowouts) Increased risk from invasive species Creation of new hard substrate habitats on structures Compromised health	Fishing exclusion zones may displace fisheries Increased revenue through new jobs and services Loss of fisheries and tourism revenue in the event of a spill
Vessel Traffic (Shipping)	X	X	X	Contamination of water and sediment (Spills, Discharges)	Increased risk from invasive species due to long-distance shipping activity Contamination	Loss due to competition or predation from invasive species Loss/injury from contamination Noise effects (stress, altered behavior)	Loss/injury from ship strikes Displacement Noise effects (stress, altered behavior) Behavioral disturbance Loss/injury due to ingestion/entanglement in marine debris	Loss/injury from contamination Noise effects (stress, altered behavior) Loss/injury due to ingestion/entanglement in marine debris Ship collision (lighting attraction)	Loss/injury from contamination Noise effects (stress, altered behavior) Loss/injury due to ingestion/entanglement in marine debris	Loss due to competition or predation from invasive species Loss/injury from contamination Loss/injury from vessel grounding	Provision of Jobs and economic opportunity

Action	SEFSC Research Area			Effect on Physical Environment	Effect on Special Resource Areas	Effect on Fish	Effect on Marine Mammals	Effect on Seabirds	Effect on Sea Turtles	Effect on Invertebrates	Effect on Social and Economic Environment
	Atlantic	Gulf of Mexico	Caribbean								
Vessel Traffic (Other)	X	X	X	Contamination of water and sediment (Spills, Discharges)	Increased risk from invasive species due to long-distance vessel transport Contamination	Loss due to competition or predation from invasive species Loss/injury from contamination Noise effects (stress, altered behavior)	Loss/injury from ship strikes Displacement Noise effects (stress, altered behavior) Behavioral disturbance Loss/injury due to ingestion/entanglement in marine debris	Loss/injury from contamination Noise effects (stress, altered behavior) Loss/injury due to ingestion/entanglement in marine debris Ship collision (lighting attraction)	Loss/injury from contamination Noise effects (stress, altered behavior) Loss/injury due to ingestion/entanglement in marine debris	Loss due to competition or predation from invasive species Loss/injury from contamination Loss/injury from vessel grounding	Provision of Jobs and economic opportunity
Ocean Disposal and Discharges	X	X	X	Sea floor disturbance Sedimentation Toxic contamination Eutrophication	Contamination Disturbance of benthic habitats Sea floor disturbance Sedimentation	Bioaccumulation of contaminants Loss/injury from contamination Habitat disturbance	Bioaccumulation of contaminants Loss/injury from contamination Loss/injury from ship strikes Alteration or reduction of prey resources Habitat disturbance Compromised health Eutrophication leading into harmful algal blooms	Bioaccumulation of contaminants Loss/injury from contamination Alteration or reduction of prey resources Habitat disturbance	Bioaccumulation of contaminants Loss/injury from contamination Alteration or reduction of prey resources Habitat disturbance	Bioaccumulation of contaminants Loss/injury from contamination Habitat disturbance Loss/injury from smothering/turbidity Loss/injury via competition from algae blooms caused by eutrophication	Potential indirect impact on subsistence resources
Run-off from Terrestrial Sources	X	X	X	Sedimentation Toxic contamination Eutrophication	Contamination Sedimentation	Bioaccumulation of contaminants Loss/injury from contamination	Bioaccumulation of contaminants Loss/injury from contamination Compromised health Eutrophication leading into harmful algal blooms	Bioaccumulation of contaminants Loss/injury from contamination	Bioaccumulation of contaminants Loss/injury from contamination	Bioaccumulation of contaminants Loss/injury from contamination Loss/injury via competition from algae blooms caused by eutrophication	Potential indirect impact on subsistence resources
Dredging	X	X	X	Sea floor disturbance Increased turbidity Contamination (Discharges)	Sea floor disturbance Increased turbidity	Loss of habitat due to sea floor disturbance Displacement due to increased turbidity	Noise effects (stress, altered behavior) Loss/injury from ship strikes Alteration or reduction of prey resources Habitat disturbance/alteration	Noise effects (stress, altered behavior) Alteration or reduction of prey resources Habitat disturbance/alteration	Mortality by entrainment in dredge Habitat disturbance/alteration	Direct loss or displacement due to sea floor disturbance Indirect loss or displacement due to habitat disturbance Loss/injury displacement due to turbidity	Creation of jobs and purchase of services
Sand and Gravel Mining	X	X		Sea floor disturbance Increased turbidity Contamination (discharges)	Sea floor disturbance Increased turbidity	Loss of habitat due to sea floor disturbance Habitat alteration and/or displacement due to increased turbidity	Noise effects Loss/injury from ship strikes Alteration or reduction of prey resources Habitat disturbance	Noise effects Alteration or reduction of prey resources Habitat disturbance	Mortality by entrainment in dredge Habitat disturbance	Immediate loss or displacement due to sea floor disturbance Long-term loss or displacement due to habitat disturbance Loss or displacement due to increased turbidity	Creation of jobs and purchase of services
Geophysical/ Geotechnical Activities	X	X		Sea floor disturbance	Sea floor disturbance	Habitat disturbance Noise effects from acoustic surveys	Noise effects from acoustic surveys Loss/injury from ship strikes Behavioral disturbance/displacement Habitat disturbance	Loss/injury from ship collisions (lighting attraction) Behavioral disturbance/displacement	Loss/injury from ship strikes Behavioral disturbance/displacement	Habitat disturbance Localized benthos disturbance or mortality	Creation of jobs and purchase of services Temporary disruption of fishing operations

Action	SEFSC Research Area			Effect on Physical Environment	Effect on Special Resource Areas	Effect on Fish	Effect on Marine Mammals	Effect on Seabirds	Effect on Sea Turtles	Effect on Invertebrates	Effect on Social and Economic Environment
	Atlantic	Gulf of Mexico	Caribbean								
Offshore Wind Energy Projects	X			Localized sea floor disturbance during construction Increased turbidity during construction	Localized sea floor disturbance during construction Localized disruption of benthos during construction	Localized disruption of benthos during construction	Localized noise (acoustic harassment) during construction Possible displacement Habitat disturbance	Localized collision with turbine blades	Behavioral disturbance	Localized sea floor disruption	Noise during construction Jobs and purchase of services Renewable energy Visual effects
Sea Turtle Conservation Measures	X	X	X				Potential decreased injury and mortality		Decreased serious injury and mortality		Cost to fisheries Need for gear modifications
Marine Mammal Conservation Measures	X	X	X				Decreased injury and mortality		Potential decreased injury and mortality		Cost to fisheries Displacement of fishers and fisheries Need for time/area closures Gear modifications
Climate Change	X	X	X	Sea level rise, saltwater infusion in estuaries and coastal habitats Increased erosion and siltation Increased water temperatures More extreme storm events Water chemistry changes	Sea level rise, saltwater infusion in estuaries and coastal habitats Increased erosion and siltation Increased water temperatures More extreme storm events	Unknown ecosystem level changes, variable effects on different species	Unknown ecosystem level changes, variable effects on different species	Unknown ecosystem level changes, variable effects on different species	Unknown ecosystem level changes, variable effects on different species	Unknown ecosystem level changes, variable effects on different species Loss/injury/stress to coral caused by increased sea surface temperatures, increased incidence of disease, and increased incidence/severity of storm events	Rising water levels in coastal areas Potential changes in fisheries due to ecosystem changes New regulations on greenhouse gas emissions Incentives for higher vessel fuel efficiency
Ocean Acidification	X	X	X	Water chemistry changes, including increased pCO_2 and decreased pH	Decreased calcification among calcifying and food web organisms Change in primary production	Potential adverse effects on prey and availability of nutritional minerals	Potential adverse effects on prey and availability of nutritional minerals	Potential adverse effects on prey and, availability of nutritional minerals	Potential adverse effects on prey and, availability of nutritional minerals	Decreased calcification and shell hardening impaired Potential adverse effects on prey and availability of nutritional minerals	Potential effects on fisheries, especially for invertebrate shellfish species

Sources: This RFFA table was constructed using a number of sources, including the following NEPA documents and government agency websites:

BOEM. 2012. Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland, and Virginia, Final Environmental Assessment. OCS EIS/EA/BOEM 2012-003. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. Available at: http://www.boem.gov/uploadedFiles/BOEM/Renewable_Energy_Program/Smart_from_the_Start/Mid-Atlantic_Final_EA_012012.pdf

BOEM. 2012. Outer Continental Shelf Oil and Gas Leasing Program: 2012-2017, Final Programmatic Environmental Impact Statement. OCS EIS/EA BOEM2012-030. U.S. Dept. of the Interior, Bureau of Ocean Energy Management. Available at: http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Leasing/Five_Year_Program/2012-2017_Five_Year_Program/2012-2017_Final_PEIS.pdf

BOEM. 2014. Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas, Final Programmatic Environmental Impact Statement. OCS EIS/EA BOEM 2014-001. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. Available at: http://www.boem.gov/BOEM-2014-001-v2/

NMFS. 2012. Draft Environmental Impact Statement to reduce incidental bycatch and mortality if sea turtles in the Southeastern U.S. shrimp fisheries. NOAA, NMFS, Southeast Regional Office, Protected Resources Division, St. Petersburg, FL.

DON. 2010. Gulf of Mexico Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (Final EIS/OEIS). Volume 1. NAVFAC Atlantic, Norfolk, VA. Available at: http://www.navfac.navy.mil/content/dam/navfac/Environmental/PDFs/NEPA/Gomex%20range%20complex%20final%20eis_oeis%20vol%201%20rev%202.pdf

Federal Energy Regulatory Commission website with existing and planned LNG facilities: http://ferc.gov/industries/gas/indus-act/lng.asp

Environmental Protection Agency website with information on ocean dumping in Regions 2 and 4: http://www2.epa.gov/ocean-dumping/managing-ocean-dumping-epa-region-2 and http://www2.epa.gov/ocean-dumping/managing-ocean-dumping-epa-region-4

Bureau of Energy Management website with information on marine minerals leases: http://www.boem.gov/Non-Energy-Minerals/Marine-Mineral-Projects.aspx

5.2 CUMULATIVE EFFECTS ON THE PHYSICAL ENVIRONMENT

Activities external to SEFSC fisheries research that could potentially affect the physical environment within the SEFSC research areas are summarized in Table 5.1-1 and include:

- Sea floor disturbance
- Increased turbidity and re-suspension of sediments
- Presence of new underwater structures
- Effects of climate change such as increased water temperatures and sea level rise

5.2.1 External Factors in the SEFSC Research Areas

The physical environment of the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea along the U.S. coast has been affected by human activity for hundreds of years. Until recent times, however, the magnitude of the effects was limited. With the advent of substantial offshore development and exploitation of resources from the ocean environment, cumulative impacts on the physical environment have increased. Within the SEFSC research areas, the physical environment continues to experience impacts resulting from both natural and anthropogenic factors, including climate change, ocean acidification, seafloor disturbance from commercial fisheries, substrate disturbance from geophysical/ geotechnical activities, contamination from spills and discharges, presence of vessel traffic, and marine debris. Sources of effects to the physical environment from RFFAs are identified in Table 5.1-1.

Past activities that disturbed the seafloor were generally limited to fishing activities and the laying of underwater cables for communications systems. While the effects of fishing activities could be major, they were generally limited to a few heavily fished areas. Current activities that disturb the seafloor include not only more modernized commercial fishing (mainly trawling and dredging), but other heavy industrial activities such as channel dredging, and construction of various nearshore and offshore developments. These activities cause re-suspension of sediments into the water column, changes in bathymetric contours, and permanent loss of benthic habitat. Large areas of the seafloor in the GOMRA and ARA are subject to repeated physical disruption from commercial fishing. However, much of this fishing takes place on sedimentary substrates which recover in relatively short time periods due to natural water currents and sedimentation (Stevenson et al. 2004). Other types of disturbance such as offshore developments tend to have longer-term effects but affect smaller areas. Proposed development of large, offshore energy projects have the potential for long-term effects, but impacts would likely be limited to the areas immediately adjacent to the projects. Such projects would be evaluated for environmental effects, including cumulative effects, before they would be permitted by the appropriate federal agency.

The ocean has been used as a disposal area for shore generated waste for decades. There are numerous offshore marine disposal areas mapped off the Northeast and Mid-Atlantic coasts. These sites contain everything from contaminated dredge spoils, household and industrial waste, to nuclear waste. For any activity that disturbs the sediments in offshore areas, such as trawling or dredging, resuspension of these contaminants in the water column is a potential resultant effect. However, the areas occupied by the dump sites are identified and clearly marked on navigational maps as areas to be avoided.

Contamination from spills and discharges can accumulate in the seafloor and marine life and have a toxic effect on the plants, animals and humans through the food chain (NOAA 2010b). There are huge numbers of potential sources of both direct and indirect marine contamination, including tankers and other marine vessels, military operations, ocean dumping, airborne deposition, and runoff from industrial and agricultural sources on land. Some chemical compounds, such as polychlorinated biphenyl (PCB) and pesticides, can persist for many years while others, such as petroleum products, breakdown relatively quickly. In a similar situation, marine debris can affect the physical environment (NOAA 2010c) but most of these effects are manifested through biological systems, which are discussed in other sections of this document. Pollution is a long-term and widespread issue in the marine environment, although it varies substantially in intensity on a local basis. In recent years there has been a concerted national and international effort to reduce pollution of ocean environments through restrictions on discharges and design features of ocean-going vessels that reduce the probability and severity of spills. As a result, although the historic problems remain, recent issues have either been localized and limited or, if large and widespread, like the 2010 Deepwater Horizon oil release in the Gulf of Mexico, have generated significant cleanup and mitigation responses. Broadly speaking therefore, the cumulative effects of pollution and contamination on water quality of the SEFSC research area is expected to be minor to moderate and adverse from sources external to fisheries research.

Climate change may affect the marine environment in a variety of ways, including changes in sea level, changes in water temperatures, extreme weather events, and alteration of ocean currents (Osgood 2008, Melillo et al. 2014). These changes and others are expected to continue over the reasonably foreseeable future and could aggregate with the effects of industrial activity to impact the physical environment. These changes may contribute in turn to changes in the population and distribution of marine fish, mammals, seabirds, and turtles; changes in the population and distribution of fishery resources harvested in commercial fisheries, with related socioeconomic effects; and changes in FMPs to address potential climate change effects.

In addition to changes in air and water temperatures, a related effect of climate change is increased acidification in the ocean caused by dissolved carbon dioxide (CO_2). Changes in the acidity of the world's oceans are expected to continue and accelerate over the reasonably foreseeable future (United States Geological Survey [USGS] 2011). Ocean acidification can harm organisms that build shells of calcium carbonate, including calcareous phytoplankton and zooplankton, corals, bryozoans, mollusks, and crustaceans. These organisms provide shellfish resources for humans, play vital roles in marine food webs, and add to the physical structure of the ocean floor (NEA 2010). Although the dynamics of climate change and the potential magnitude and timing of its effects are poorly understood, there is general acknowledgement that the potential impacts resulting from climate change could be substantial.

5.2.2 Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on the physical environment in the GOMRA, ARA, and CRA are discussed in sections 4.2.1, 4.3.1, and 4.4.1. Direct and indirect effects to benthic habitat (seafloor disturbance) and removal of organisms that produce structure would be minor and adverse. Since no dumping of waste material would be authorized for SEFSC research activities under the research alternatives, there would be no contribution to cumulative effects from intentional waste disposal at sea. There is the potential for accidental spills to occur. However, given the high degree of emphasis placed on safety and emergency preparedness on OMAO vessels and Coast Guard requirements for training and safety equipment on commercial vessels, the magnitude of these potential spills is likely to be very small and the contribution of fisheries research to the cumulative effects of contamination is considered minor.

Although CO_2 emissions from SEFSC research vessels would contribute to atmospheric CO_2 levels, the contribution would be minor compared to other natural and anthropogenic CO_2 sources. When aggregated with the impacts of past, present, and reasonably foreseeable future actions in the vicinity of the SEFSC research area, SEFSC research activities would make a minor additive contribution to cumulative adverse effects on the physical environment under each of the research alternatives.

Fisheries research programs contribute to the understanding of changes in the physical environment, including those associated with climate change and ocean acidification. Continued fisheries research programs with long-term data sets are essential to understanding changes in the physical and biological environment, and allowing NMFS to take appropriate management actions. SEFSC fisheries research therefore makes a beneficial contribution to cumulative effects on the physical environment.

5.2.3 Contribution of the No Research Alternative

The No Research Alternative would eliminate the risk of direct adverse impacts to physical resources within the SEFSC research area resulting from SEFSC research activities. However, many of the SEFSC projects that would be eliminated under this alternative generate a great deal of information that, when combined with research conducted by other branches of NOAA and other agencies and institutions not included in this DPEA, is used to monitor the effects of climate change, ocean acidification, and other changes in the physical environment. It may also be used by resource managers to limit fishing-related impacts to physical habitat such as disturbance of benthic habitat from dredging and other bottom-contact gear. Without the input of SEFSC data, management authorities would lose important information needed to establish management measures in a meaningful fashion, and current conservation measures in place to protect physical properties of the environment would become less effective. Although resource management agencies have other available data sources to support resource management decisions, the No Research Alternative is expected to result in increased uncertainty and changes in some management scenarios. Through these indirect effects on future management decisions, the contribution of this alternative to adverse cumulative impacts on physical resources would be minor to moderate depending on how well other agencies would be able to compensate for the loss of SEFSC research.

5.3 CUMULATIVE EFFECTS ON SPECIAL RESOURCE AREAS AND EFH

Activities external to SEFSC fisheries research that could potentially affect special resource areas and EFH in the Atlantic, Gulf of Mexico, and Caribbean are summarized in Table 5.1-1 and may include:

- Contamination resulting from spills, discharges, and marine debris
- Seafloor and habitat disturbances
- Increased turbidity and sedimentation
- Increased risk of invasive species introductions resulting from long-distance shipping activity
- Effects of climate change such as increased water temperatures and sea level rise
- Effects of ocean acidification such as decreased calcification among food web organisms and
- Changes in primary production

5.3.1 External Factors in the SEFSC Research Areas

As described in Section 3.2, Special Resource Areas include EFH, HAPC, closed areas, and MPAs, including NMS. The cumulative effects of activities that disturb the seafloor in special resource areas are similar to those discussed for the physical environment in Section 5.2.1. Cumulative impacts to biological resources within special resource areas are discussed in Sections 5.4 through 5.8. Cumulative effects from oil and gas development, offshore wind power developments, dredging, military operations, and geophysical exploration, would be considered as part of the federal permitting process. Contributions to cumulative effects from such activities would be limited by permit conditions and mitigation measures required by permitting agencies. Adverse impacts from commercial fishing operations, especially with bottom contact fishing gears, would be substantial in heavily fished areas and would affect EFH and HAPC areas to various degrees, but would not be as great in permanent closed areas or some marine reserves that are closed to commercial fishing (e.g. The Tortugas Marine Reserves HAPC). In some cases, temporary closed areas have been designated to allow the recovery of areas that were heavily affected by commercial fisheries in the past. In addition to the SEFSC, the NEFSC also conducts fisheries research in portions of the ARA. In instances where the research activities of multiple science centers overlap in space and time, impacts resulting from those activities would accumulate in an additive or synergistic fashion. The cumulative effect from all external sources of disturbance to special resource areas is expected to be minor adverse.

The contribution of SEFSC research to the cumulative effects of marine contaminants in special resource areas are the same as those discussed for the physical environment in Section 5.2.3 and are considered minor adverse.

5.3.2 Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on special resource areas and EFH in the Atlantic are discussed in sections 4.2.2, 4.3.2, and 4.4.2. A relatively small amount of fisheries research using bottom contact gear would occur in most special resource areas under the research alternatives, resulting in a minor adverse contribution to the cumulative effects on these areas. While there are no intentional discharges of pollutants from fisheries research vessels there is potential for accidental spills to occur. However, the magnitude of these potential spills is likely to be very small and the contribution of fisheries research to the cumulative effects of contamination is considered minor.

SEFSC fisheries research programs contribute to understanding the status of special resource areas, including changes to EFH associated with climate change and ocean acidification as well as the recovery of closed area habitats from fishing. Continued fisheries research programs with long-term data sets are essential to understanding changes in the physical and biological environment within special resource areas, which by definition have special management needs. SEFSC fisheries research therefore has a beneficial contribution to cumulative effects on special resource areas in addition to the minor adverse effects.

5.3.3 Contribution of the No Research Alternative

The No Research Alternative would result in elimination of any direct impacts from SEFSC fisheries research to special resource areas and EFH that could potentially occur under each of the research alternatives. However, the SEFSC research activities proposed under the research alternatives would generate information important to resource managers to monitor species and habitat recovery, environmental changes, and the effectiveness of conservation measures for special resource areas and EFH. This type of information is especially important for management of these special resource areas because most of them have been designated to protect and conserve natural resources that are susceptible to natural fluctuations and anthropogenic impacts. Although resource management agencies have other available data sources to support resource management decisions, the No Research Alternative is expected to result in increased uncertainty and changes in some management scenarios that may affect a few local areas. Through these indirect effects on future management decisions, the contribution of this alternative to cumulative impacts on special resource areas, including EFH and NMS, would be minor adverse.

5.4 CUMULATIVE EFFECTS ON FISH

Activities external to SEFSC fisheries research that could potentially affect fish species are summarized in Table 5.1-1 and include:

- Injury or mortality due to directed catch or bycatch in commercial and recreational fisheries
- Habitat disturbances
- Changes in distribution and food availability due to climate change or habitat degradation

5.4.1 ESA-listed Species

5.4.1.1 External Factors in the SEFSC Research Areas

ESA-listed fish species in the research areas include the shortnose sturgeon, Atlantic sturgeon, Gulf sturgeon, smalltooth sawfish, and scalloped hammerhead shark. The past, present, and reasonably foreseeable future activities, external to SEFSC fisheries research, that have or are likely to have the greatest effect on endangered fish in the region are intentional and incidental mortalities in commercial and recreational fisheries, habitat alterations, especially for anadromous species, and periodic short-term and longer term climate changes.

Over a century of fishing for sturgeon contributed to the decline of Atlantic, gulf, and shortnose sturgeon populations along the U.S. East Coast. Overharvesting in commercial fisheries and pollution were primary reasons for listing shortnose sturgeon as endangered under the Endangered Species Conservation Act of 1969. Directed harvest has been prohibited since listing (NMFS 1998b). Habitat degradation or loss from dams, construction, dredging, and pollutant discharges, and mortality from impingement on cooling water intake screens, dredging, and bycatch in other fisheries are considered primary threats to shortnose sturgeon survival (NMFS 1998b).

Historically, Atlantic sturgeon populations declined due to overexploitation through commercial harvests. Currently, incidental catches in fisheries, vessel strikes (in the Delaware and James Rivers), decreased water quality, water availability, dams, lack of protective regulatory mechanisms, and dredging are the most significant threats to Atlantic sturgeon (77 FR 5880 and 77 FR 5914; February 6, 2012). The Atlantic Sturgeon FMP was implemented in 1990. Amendment 1 to the FMP closed remaining Atlantic sturgeon fisheries in U.S. state waters in 1998. In 1999, NMFS passed complementary prohibitions for Atlantic sturgeon in or from the U.S. EEZ. Commercial fisheries for Atlantic sturgeon, however, still exist in Canadian waters (NMFS 2012). Fisheries bycatch in U.S. waters is the primary threat currently affecting all 5 DPSs of Atlantic sturgeon. The NEFSC estimated an average of 3,118 Atlantic sturgeon encounters per year in commercial gillnet and trawl fisheries from 2006 to 2010 based on observed fisheries. Mortality rates in gillnets are approximately 20 percent, except for monkfish gear which is approximately 27 percent, and mortality rates in otter trawl gear are approximately 5 percent (NEFSC 2011, cited in NMFS 2012). Similar estimates are not available for Southeast fisheries or for state fisheries (NMFS 2012). Several conservation measures aimed at decreasing threats to Atlantic sturgeon are ongoing, including convening a recovery team and drafting a recovery plan, research on fishing gear modifications to reduce bycatch, and preparation of ESA Section 10 Habitat Conservation Plans to decrease effects of several state fisheries on Atlantic sturgeon (NMFS 2013a).

Smalltooth sawfish have been adversely affected by the cumulative effects of bycatch in various fisheries, especially in gillnets, and loss of habitat (NMFS 2013a). Juvenile sawfish use shallow habitats with a lot of vegetation, such as mangrove forests, as important nursery areas. Many such habitats have been modified or lost due to development of the waterfront in Florida and other southeastern states (NMFS 2013a). In the Northwest Atlantic, a number of states, including Georgia, South Carolina, and Florida, have prohibited most gillnets and entangling nets in state waters (NMFS 2002, 2009e). The gillnet ban in

Florida has had a beneficial impact on the recovery of smalltooth sawfish which are extremely vulnerable to capture in gillnets. As the recovery of the smalltooth sawfish extends beyond Florida's waters, gillnets will become a serious threat to the success of recovery efforts (NMFS 2013).

Scalloped hammerhead sharks have multiple DPSs worldwide and are likely the most abundant of hammerhead species (Miller et al 2014). Only the Central and Southwest Atlantic DPS is currently ESA-listed as threatened. Fisheries targeting fish from this listed DPS continue in the Caribbean and Brazil. Commercial and recreational fisheries continue to exist in other areas that target other DPSs, such as the Gulf of Mexico and the Southeast coastal U.S. In 2013, the commercial fishery brought in 16.6 mt to Florida, and another 2.3 mt were landed in North Carolina (NMFS 2015a). In the same year, the recreational fishery brought 32 mt into Florida, and another 5 mt into North Carolina (NMFS 2015b).

The environmental effects of climate change could be extensive in geographic area and long-term in duration and could therefore have major cumulative effects on fish species. Some fish species are likely to benefit from changes in the marine environment while others will experience adverse effects. Smalltooth sawfish have historically been captured as far north as New York but the current population appears to be confined to Florida (NMFS 2010d). It is possible that, as the species expands with improved strength and as coastal water temperatures increase, smalltooth sawfish may begin to re-inhabit former areas more easily. Tolerance to climate change may also depend, in part, on impacts from other threats (NMFS 2010d). Anadromous fish species (e.g., sturgeon) may also be affected by changes in river ecology due to altered precipitation, sea-level rise, and water temperature (NMFS 2012, NMFS 2013a). The nature and magnitude of potential climate change effects are, however, very difficult to predict with certainty.

The activities external to SEFSC fisheries research affecting ESA-listed fish will likely continue into the foreseeable future (Table 5.1-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures. The potential effects of climate change are unpredictable, but are also likely to continue into and beyond the foreseeable future.

5.4.1.2 Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on ESA-listed fish are discussed in sections 4.2.3, 4.3.3, and 4.4.3. The three research alternatives considered in this DPEA include similar scopes of research. The primary differences lie in the number and types of associated mitigation measures for protected species. The take level of smalltooth sawfish is exceedingly small (one) and there have been no documented takes of Gulf sturgeon in SEFSC-affiliated fisheries research activities. Atlantic sturgeon have been caught infrequently during bottom trawl surveys (ASBTBTS, SEAMAP, EMTS, JSTS) and more regularly during gillnet surveys (ASDGS). Four shortnose sturgeon have also been taken, in the ASDGS and EMTS. Due to short tow and soak times, and careful handling procedures, all of these sturgeon have been and will likely continue to be released alive with minimal chance of mortality. Similarly, numerous scalloped hammerhead sharks have been taken in SEFSC research but overall mortality has been slight. The Pelagic Longline Survey, last deployed from 2004 to 2006, had a high rate of mortality but survey protocols required that some of it was intentional. Most other surveys resulted in fish released alive, with a combined mortality rate of about 4.6 percent; this rate is expected to continue in absence of significant survey changes.

When considered in conjunction with commercial and recreational fisheries, and aggregated with other past, present, and reasonably foreseeable future activities affecting ESA-listed fish in the SEFSC research areas, the contribution of SEFSC fisheries research activities to cumulative effects would be minor and adverse.

5.4.1.3 Contribution of the No Research Alternative

Under the No Research Alternative, the SEFSC would no longer conduct or fund fieldwork for fisheries and ecosystem research in marine waters of the U.S. Atlantic, Gulf of Mexico and Caribbean coasts considered in the scope of this DPEA, so would not directly contribute to cumulative effects on ESA-listed species in these regions. Although directed research on ESA-listed species is not considered in the scope of this DPEA, the absence of SEFSC research surveys on other fish stocks and environmental conditions important to ESA-listed species would have an adverse impact on the ability of resource managers to monitor the recovery of these species, track the health of their habitats, and implement effective fishery regulations and other conservation strategies for these species. Ceasing or interrupting long-term data series on oceanography, abundance and distribution of various species, and diet studies (e.g., 42 years of HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Survey) would have long-term adverse effects on the ability of scientists to monitor and model effects of ecosystem changes important to ESA-listed species. The indirect effects of the No Research Alternative could, therefore, impact ESA-listed species through a lack of information essential for informed decision making and conservation of the species, their prey, and their habitats. The indirect contribution of the No Research Alternative to cumulative effects on ESA-listed species is difficult to ascertain, but will likely have moderate adverse impacts on conservation management of these species.

5.4.2 Target and Other Species

5.4.2.1 External Factors in the SEFSC Research Areas

By definition, target species are those managed for recreational and commercial fisheries. The other species considered here are generally not targeted by commercial or recreational fishers but may be caught in substantial numbers as bycatch. These recreational and commercial fisheries are the primary past, present, and reasonably foreseeable future activities that have or are likely to have the greatest effect on these species external to SEFSC fisheries research. The numerous target species in the SEFSC research areas are managed by NMFS with directives from the CFMC, GMFMC, Mid-Atlantic Fishery Management Council (MAFMC), SAFMC, ASMFC, and GSMFC in compliance with their respective FMPs (Tables 3.2-2, 3.2-3, and 3.2-4). Other species that may be caught during research surveys are often monitored as part of ecosystem-based management efforts even if they are not subject to stock assessments. The analysis of effects in Chapter 4 focused on those species most frequently caught in SEFSC research activities and species that are considered overfished or where overfishing is occurring (Tables 4.2-7 through 4.2-12). The cumulative effects analysis will take a similar approach.

Multiple target species encountered during SEFSC surveys are considered overfished or approaching an overfished status (Tables 3.2-2, 3.2-3, and 3.2-4, NMFS 2015c). In the ARA, this includes red snapper, blueline tilefish, speckled hind, warsaw grouper, red porgy and snowy grouper. In the GOMRA, this includes greater amberjack, gray triggerfish, hogfish and red snapper. In the CRA, overfished species comprise of the Puerto Rico Scups and Porgies Complex, Puerto Rico Wrasses Complex, goliath grouper, and Nassau grouper. A stock that is subject to overfishing is one with a harvest (mortality) rate that is too high to produce the stock’s maximum sustainable yield (MSY). A stock that is overfished is one whose biomass level is sufficiently depleted to jeopardize the stock’s ability to produce MSY (NMFS 2012). Three stocks (GOM Gag Grouper, mid-Atlantic golden tilefish and butterfish) are considered rebuilt as of 2014 (NMFS 2015c). The remaining species and stocks are either of unknown status or not overfished.

Red snapper has been an important component of Southeastern fisheries for over 150 years. Both the Atlantic and GOM stocks are currently considered overfished while in the Atlantic, overfishing is still occurring. In the GOM, commercial and recreational red snapper fisheries are managed under the reef fish FMP and in the Atlantic, they are managed under the Snapper Grouper FMP. Management measures in both regions include spatial/temporal closures, gear restrictions, size limits, permit moratoria, days-at-sea restrictions, trip limits, and target fishing mortality rates. Total catches (commercial, recreational, and discards) of GOM red snapper ranged from 2,300 to 6,500 mt from 2008-2013, with varying proportions allocated to the commercial and recreational fisheries. Similarly, in the ARA, red snapper catches ranged from 1.2 to 450 mt (NMFS 2015a & NMFS 2015b). In 2010, NMFS implemented a temporary rule to reduce overfishing of South Atlantic red snapper through closure of the commercial and recreational fishery for the first half of 2010, later extended to the second half. (74 FR 63673, December 4, 2009).

Other commercially important species include the baitfish species menhaden and gulf menhaden. Menhaden are managed by the ASMFC and gulf menhaden are managed by the GSMFC. Both species have been heavily exploited consistently over time. The gulf menhaden fishery has gone through significant changes due to weather events (hurricane damage) and vessel and corporate consolidation since record sized catches in the mid 1980's (SEDAR 2013). Commercial gulf menhaden landings exceeded an average of 462,700 tons in 2013 and the stock is not considered overfished. Atlantic menhaden landings decreased from a high in the late 1950's of nearly 700,000 tons (SEDAR 2015) to a current harvest limit of less than 170,000 tons (implemented in 2013 as a way to prevent overfishing).

The activities external to SEFSC fisheries research affecting target species will likely continue into the foreseeable future (Table 5.1-1). The level of impact will depend on the application and efficacy of fishery management plans and habitat protection measures. Natural population fluctuations and periodic short-term and longer term climate changes also affect population viability and stock sizes. The potential effects of climate change are unpredictable, but are also likely to continue into and beyond the foreseeable future.

5.4.2.2 Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on target and other fish are discussed in sections 4.2.3, 4.3.3, and 4.4.3. Mortality of target and other species due to SEFSC fisheries research represents a small fraction of that taken by or allocated to commercial and recreational fisheries. The average annual catch of target species during SEFSC research surveys (Tables 4.2-7 through 4.2-12) is generally much less than 1 percent of the annual average commercial landings of these species, except for a few species that have very small commercial markets. Of those species that are listed as overfished or where overfishing is occurring, SEFSC-affiliated research catch is also comparatively small, with the exception of snowy grouper. SEFSC-affiliated research in the ARA has caught an average of 4 mt of snowy grouper per year, which is about 9.7 percent of annual average combined commercial and recreational ACL. Overfishing of snowy groupers was noted in data analyzed through 2002 and a rebuilding plan was begun shortly thereafter (SEDAR 2013). While the stock is not set to be rebuilt until 2039 (SEDAR 2013), snowy grouper were removed from overfishing status in 2014 (NMFS 2015c), despite this relatively high historical survey catch. Research surveys provide a reliable way to monitor the recovery of the population and can inform decisions about abundance and rebuilding status.

The comparisons made in Tables 4.2-7 through 4.2-12 indicate that, while mortality to fish species is a direct effect of the SEFSC surveys and cooperative research projects, the magnitude of this mortality is very small relative to other sources of mortality and the overall populations of these species.

When considered in conjunction with commercial and recreational fisheries and aggregated with other past, present, and reasonably foreseeable future activities affecting target and other fish species in the Atlantic, Gulf of Mexico and Caribbean Region, the contribution of SEFSC fisheries research activities to the adverse cumulative effects on these species would be minor under all three research alternatives. The SEFSC-affiliated fisheries research program also makes a beneficial contribution to cumulative effects on fish through their role in providing scientific information to the commercial fisheries management process which strives to maintain sustainable populations. The beneficial value of fisheries research to a range of future management challenges from fishing to climate change is quite substantial and helps to address a range of adverse cumulative effects.

5.4.2.3 Contribution of the No Research Alternative

Under the No Research Alternative, the SEFSC would no longer conduct or fund fieldwork for fisheries and ecosystem research in marine waters of the U.S. Atlantic, Gulf of Mexico and Caribbean coasts so would not directly contribute to cumulative effects on fish species in this region. In the absence of research surveys, important scientific information would not be collected about the status of fish stocks used for fisheries and conservation management, including trends in abundance, recruitment rates, and the amount of fish being harvested relative to overfishing metrics. This lack of data would make it much more difficult for fisheries managers to effectively monitor the status of stocks, develop fishery regulations, and rebuild depleted stocks. Ceasing or interrupting long-term data series on oceanography, abundance and distribution of various species, and diet studies (e.g., 42 years of HMS Chesapeake Bay and Coastal Virginia Bottom Longline Shark Survey) would have long-term adverse effects on the ability of scientists to monitor and model effects of ecosystem changes. The lack of information and increasing uncertainty about the status of fish stocks and their habitats would have serious implications for fisheries management. The indirect effects of the No Research Alternative could, therefore, impact fish stocks through a lack of information essential for prudent decision making and conservation of fish, their prey, and their habitats. The indirect contribution of the No Research Alternative to cumulative effects on target and other species is difficult to ascertain, but will likely have moderate adverse impacts on the long-term monitoring ability of NMFS or other agencies and the management capabilities for numerous economically and ecologically important species.

5.4.3 Highly Migratory Species

5.4.3.1 External Factors in the SEFSC Research Areas

SEFSC-affiliated research surveys on HMS focus on sharks. In the Atlantic, NMFS manages seventy-two species of sharks (excluding spiny dogfish) under the Consolidated HMS FMP (NMFS 2006b). Although the Consolidated HMS FMP also includes swordfish, billfish, and tuna, sharks are emphasized here.

Commercial and recreational harvests of HMS along the U.S. Atlantic and Gulf of Mexico coasts are the primary external factors affecting HMS in the SEFSC research areas. Harvests are by gillnet, longline, and hand gear (rod and reel, handline, bandit gear). Total 2013 commercial landings in the ARA and GOMRA included 403 MT of large coastal sharks, 251 tons of small coastal sharks, and 128 MT of pelagic sharks (NMFS 2015a). Catch reported in the U.S. Atlantic Pelagic Longline fishery in 2013 includes 3,384 pelagic sharks kept, 28,151 pelagic sharks discarded, 49 large coastal sharks kept, and 7,997 large coastal sharks discarded (NMFS 2015c). In 2013, the number of large coastal sharks harvested in the Atlantic region was 2,528, with an additional 134,352 coming from the GOMRA. Of these, 105,315 were blacktip sharks, 6,022 were spinner sharks, 2,786 were bull sharks, 1,404 were sandbar sharks, 517 were scalloped hammerhead sharks and the remainder was of various species. The number of pelagic sharks recreationally harvested in 2013 was far fewer, including 6,855 shortfin mako and 2,582 blue sharks. An additional 110,000 small coastal sharks were taken by recreational users in the Atlantic and Gulf of Mexico, including 90,448 Atlantic Sharpnose sharks and 22,132 bonnethead sharks.

The activities external to SEFSC fisheries research affecting HMS fish will likely continue into the foreseeable future (Table 5.1-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures and management schemes. The potential effects of climate variability are unpredictable but are also likely to impact these species and to continue into the foreseeable future.

5.4.3.2 Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on HMS sharks are discussed in sections 4.2.3, 4.3.3, and 4.4.3. Most of the sharks caught in SEFSC research activities are tagged and released alive. A small number of sharks are killed each year for scientific sampling purposes and incidental to other research activities (Tables 4.2-6 and 4.2-7). The magnitude of these shark mortalities is very small relative to commercial catches. Future mortality will likely continue to be low and infrequent and a small fraction of that taken through commercial and recreational fisheries. When considered in conjunction with commercial and recreational fisheries and aggregated with other past, present, and reasonably foreseeable future activities affecting HMS sharks in the Southeast Region, the contribution of SEFSC fisheries research activities to cumulative effects on HMS sharks would be minor adverse under all three research alternatives.

5.4.3.3 Contribution of the No Research Alternative

Under the No Research Alternative, the SEFSC would no longer conduct or fund fieldwork for fisheries and ecosystem research in the Atlantic, Gulf of Mexico or Caribbean, so would not directly contribute to cumulative effects on HMS in this region. In the absence of these research surveys, including coastal shark surveys conducted by state agencies using funding from NMFS, important scientific information would not be collected about the status of stocks used for fisheries and conservation management, including trends in abundance, recruitment rates, and the amount of fish being harvested relative to overfishing metrics. These surveys provide scientific advice, data, and analyses directly to NMFS HMS Management Division and to the SEDAR process run by the South Atlantic Fishery Management Council. Information from the SEDAR process is used to develop and amend the Consolidated Atlantic Highly Migratory Species FMP. The lack of information and increasing uncertainty about the status of shark stocks, habitats, ecology, and life history would have serious implications for shark fishery management. The indirect effects of the No Research Alternative could, therefore, impact shark stocks through a lack of information essential for informed decision making and conservation of species, their prey, and their habitats. The indirect contribution of the No Research Alternative to cumulative effects on HMS is difficult to ascertain, but impacts to long-term monitoring and management capabilities for HMS would likely be moderate adverse.

5.5 CUMULATIVE EFFECTS ON MARINE MAMMALS

Activities external to SEFSC fisheries research that may potentially affect marine mammals in the ARA, GOMRA, and CRA are summarized in Table 5.1.1 and include:

- Disturbance/behavioral changes or physical effects from anthropogenic noise (e.g., marine vessels of all types, military readiness operations, navigational equipment, construction, seismic operations)
- Injury or mortality due to vessel collisions and entanglement/hooking in fishing gear
- Contamination of the marine environment
- Compromised health
- Changes in food availability due to prey removal, ecosystem change, or habitat degradation

5.5.1 Atlantic Research Area

5.5.1.1 ESA-listed Species

External factors in the ARA

The endangered marine mammal species in the ARA include North Atlantic right, humpback, fin, sei, blue, and sperm whales, and West Indian (Florida) manatees. Commercial whaling was the single greatest historical source of mortality for the endangered whale species (Perry et al. 1999). Despite gaining international protection from whaling in 1935, the North Atlantic right whale population remains critically endangered today (NMFS 2005a). Commercial harvests of sperm whales ended worldwide in 1986 (NMFS 2010c). Humpback whales and blue whales were protected in 1966 (Reeves et al. 1998, Perry et al. 1999). Fin whales and sei whales were hunted off eastern Canada until the 1970s (Perry et al. 1999), with commercial takes in the North Atlantic ending in 1987 (NMFS 2010b, 2011). Northwest Atlantic humpback whales appear to be increasing and showing signs of recovery from whaling, while information is insufficient to determine population status and trends of fin, blue, sei, or sperm whales. Manatee populations declined substantially during the 1800s due to commercial and subsistence hunting. The State of Florida passed legislation banning the killing of manatees in 1893 (USWFS 2001).

Conservation concerns and threats to recovery are outlined in the respective recovery plans for each of these species. Noted conservation concerns and threats include vessel/watercraft collisions, entanglement in fishing gear, anthropogenic noise, vessel/human disturbance, pollutants and pathogens, disease, habitat degradation, competition with fisheries for prey, climate change, and, additionally for manatees, being crushed in water control structures and navigational locks.

Vessel collisions are considered threats for several endangered large whales, particularly right, humpback, and fin whales, and for Florida manatees. The contribution of ship strikes to the annual average anthropogenic sources of mortality is noted in Section 3.2.2 under the respective species' descriptions. Between 2009 and 2013, there were 29 confirmed ship strike mortalities involving baleen whales along the U.S. east coast and Gulf of Mexico. Species and stocks (and number) include: western North Atlantic right whale (2), Gulf of Maine humpback whale (8), western North Atlantic fin whale (9), Nova Scotian sei whale (2), Canadian east coast minke whale (6), and Northern Gulf of Mexico Bryde's whales (1) (Henry et al. 2015).One of the right whale mortalities occurred off the coast of North Carolina, five of the humpback whale vessel collisions were between Maryland and Florida, one of the sei whale and one of the fin whale collisions were off Virginia. For the same time period, there were 21 non-serious and three serious vessel strike injuries to right whales and 12 confirmed non-serious vessel strike injuries to humpback whales (Henry et al. 2015). Ship strikes were the cause of 35 percent of right whale deaths between 1970 and 1999 (Knowlton and Kraus 2001). Concern over right whale vulnerability to vessel collisions led to several mitigation measures, including SMAs and DMAs that are triggered by right whale sightings. The SMAs in the Southest U.S. extend from mid-coastal Georgia to northern Florida from 15 November to 15 April and from Wilmington, NC to south of Savannah, Georgia 1 November to 30 April (Silber and Bettridge 2010). A study of vessel usage of SMAs in 2009 recorded over 28,000 transits, with 6,502 of those in the North Carolina-Georgia complex. Over 50 percent of all transits were cargo ships, followed by tankers and tugs. Most transit speeds were between 11 and 16 knots (Silber and Bettridge 2010). In December 2008, previously voluntary vessel speed reductions became mandatory in SMAs, with all vessels ≥65 ft (≥19.8 m) in length required to slow to ≤10 knots. NOAA also added recommended route revisions to Southest U.S. nautical charts in 2006 to minimize transit time within critical habitat. The combined mandated speed reductions and route recommendations decreased the probability of right whale ship strike mortality by 72 percent (Lagueux et al. 2011).

Collisions with watercraft are a leading source of injury and mortality for manatees in Florida. From 2007 to 2012, watercraft accounted for an average of 19 percent of annual manatee deaths. Total annual mortality includes human caused, perinatal, cold stress, natural causes, and undetermined causes. Eighty-nine percent of all human-caused deaths during this period were by watercraft (USFWS 2014a). Vessel speed reduction zones, with voluntary compliance, were instituted to mitigate the problem (USFWS 2001). Jett et al. (2012) found, however, that over half of observed recreational watercraft in their study was noncompliant with posted speed restrictions.

Military operations along the eastern seaboard and offshore waters are also potential sources of behavioral and habitat disturbance, injury, and mortality. Operations occur throughout several range complexes and testing ranges from Maine to Florida within the Atlantic Fleet Training and Testing Area (DON 2013). Sonar, active acoustic sources, airguns, weapons firing, explosives, and vessel and aircraft noise could result in Level A or Level B harassment of some marine mammals, and vessel collisions and explosives could result in injury or mortality. The Navy coordinated with NMFS and USFWS, through consultation and permitting processes, on mitigation measures (DON 2013, 78 FR 73010, December 4, 2013).

Recreational and commercial vessels also contribute to noise in the marine environment through engines, propellers, and sonar equipment which may cause changes in marine mammal behavior or interfere with communication through masking. In addition, there is evidence that exposure to low-frequency ship noise induces chronic stress in North Atlantic right whales (Rolland et al. 2012).

Entanglement in fishing gear is another conservation concern, particularly for right and humpback whales and, to a lesser degree, fin and blue whales whose large size leaves them more likely to break through gear rather than become entangled (Reeves et al 1998, NMFS 2010b). From 1990 to 2010, there were 74 confirmed right whale entanglements in weirs, gillnets, lines and buoys (Waring et al. 2013). Between 2008 2009 and 2013, right whales experienced 28 non-serious injuries, 12 serious injuries, and six mortlalities due to entanglements. Humpbacks were the most commonly observed entangled whale, with 58 non-serious and 33 serious injury entanglements and eight entanglement mortalities and fin whales experienced one non-serious and seven serious injuries and three mortalities from entanglements from 2009 through 2013 (Henry et al. 2015). Most reported entanglements occur off the northeastern U.S. coast and eastern Canada. Seven right whale and nine humpback whale entanglements that resulted in mortality or serious injury from 2009 to 2013 were reported off the southeastern U.S. (Henry et al. 2015). An estimated 89 percent of entanglements of right whales and humpback whales are with pot or gillnet gear (Johnson et al. 2005). Manatees are occasionally entangled in lost or discarded crab pots and monofilament fishing line (USWFS 2007).

The ALWTRP (NMFS 2010a) was developed to help mitigate incidental serious injury and mortality of North Atlantic right, humpback, fin, and minke whales in lobster trap/pot fisheries and several gillnet fisheries. Despite numerous amendments and revisions since going into effect, risk of serious injury and mortality of large whales continues. Sufficient data are not currently available to quantify the relative impact of the ALWTRP on annual entanglement rates, while data do indicate that entanglements continue to pose a threat to large whales, suggesting the need for further modifications (NMFS 2013b).

Direct competition with commercial fisheries in the ARA is unlikely. Blue whales and sei whales are uncommon and planktivorous (feed on krill and copepods), right whales feed primarily on copepods and are not known to feed in the ARA, known feeding areas for fin and humpback whales are generally from the Mid-Atlantic states north where they prey on small schooling fish and zooplankton, and manatees are herbivores.

Climate change impacts on ESA-listed marine mammal species are possible through changes in habitat and food availability. Migration, feeding, and breeding locations influenced by ocean currents and water temperature could be impacted, which could, ultimately, affect productivity of ESA-listed species (NMFS 2010b, NMFS 2011). In addition, some research conducted by the NEFSC occurs in some of the same areas affected by SEFSC research, and is therefore considered in the set of external factors that contribute to cumulative effects in the ARA.

With the exception of the historical sources of population decline, all of the aforementioned effects are likely to continue into the foreseeable future (see Table 5.1-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures. The potential effects of climate change are unpredictable, but are also likely to continue into and beyond the foreseeable future.

Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on ESA-listed marine mammal are discussed in sections 4.2.4, 4.3.4, and 4.4.4. The three research alternatives considered in this DPEA include similar scopes of research. The primary differences lie in the number and types of associated mitigation measures for protected species. The contribution of SEFSC fisheries research activities to cumulative effects on ESA-listed species is likely to be small.

The potential effects from use of active acoustic devices for research activities would have rare or infrequent and temporary behavioral avoidance effects on ESA-listed marine mammals. Relative to the volume of other ship traffic and other anthropogenic sources of acoustic disturbance in the ARA, the contribution of noise from SEFSC research would be minor.

There have been no historical takes of ESA-listed marine mammals during SEFSC fisheries research, and none are anticipated or requested. Incidental take in external commercial fisheries and the volume of ship strikes from external sources exceeds any known or potential takes by SEFSC fisheries research, none of which are ESA-listed species. Prey removal during fisheries research is very small and likely inconsequential to prey availability for any marine mammal species, particularly the planktivorous, or largely planktivorous, species. When considered in conjunction with commercial and recreational fisheries and aggregated with other past, present, and reasonably foreseeable future activities affecting ESA-listed marine mammals in the ARA, the contribution of SEFSC fisheries research activities to cumulative effects on ESA-listed marine mammals would be minor adverse under all three research alternatives.

Contribution of the No Research Alternative

Under the No Research Alternative, NMFS would not promulgate rulemaking or issue LOAs for SEFSC fisheries research. SEFSC would no longer conduct or fund the fisheries and ecosystem research considered in the scope of this DPEA, so would not directly contribute to cumulative effects on ESA-listed marine mammals in the ARA. Indirectly, however, the loss of information obtained from SEFSC ecosystem research on the abundance and distribution of marine mammals, their feeding ecology, oceanographic components of their habitat, status of prey stocks, and fisheries interactions could adversely impact management decisions regarding the recovery of these ESA-listed species and analysis of long-term trends affecting the marine ecosystem. The indirect contribution of the No Research Alternative to cumulative effects is difficult to ascertain for individual species, but will likely impact long-term monitoring of ecosystem changes important to marine mammals and increase uncertainty for management decisions for ESA-listed marine mammals in the ARA. However, given the fact that the SEFSC is not the only source of this type of ecological and oceanographic data, the potential impact of this information loss for management purposes could be compensated by other research programs, at least in part. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting ESA-listed marine mammals in the ARA, the contribution of the No Research Alternative to cumulative effects on ESA-listed marine mammals would be minor adverse.

5.5.1.2 Other Cetaceans

External factors in the ARA

The cetacean species included in this section are not listed as threatened or endangered. These species are all subject to similar types of effects from external activities as described above for ESA-listed species. With the exception of minke whales, the non-ESA listed cetaceans in the ARA are odontocetes. Habitats are wide ranging, as are preferred prey items. Changes in the marine environment related to terrestrial run-off and climate change can have wide-ranging effects on these diverse species through changes in prey fields, eutrophication of estuarine waters, and toxic algal blooms that can cause injury and mortality. Periodic viral or disease outbreaks may also have population impacts. Interactions with commercial fisheries, however, are likely to have the greatest effect on most of these species.

There are several commercial fisheries within the ARA with reported takes of non-ESA listed cetaceans. Entanglement in the pelagic driftnet fishery in the early 1990s contributed to mortality of several species, including Risso's dolphin, pilot whale, short-beaked common dolphin, spotted dolphin, and bottlenose dolphin. The pelagic driftnet fisheries for swordfish and tuna were prohibited in 1999 (64 FR 4055, 64 FR 29089). Category I and II fisheries in the ARA in which incidental takes of non-ESA-listed cetaceans currently occur include the Mid-Atlantic gillnet, Atlantic Ocean large pelagics longline, NC inshore gillnet fishery, Southeast Atlantic gillnet, Southeastern U.S. Atlantic shark gillnet fishery, Mid-Atlantic mid-water trawl, Mid-Atlantic bottom trawl, Southeastern U.S. Atlantic shrimp trawl, various trap/pot fisheries, Mid-Atlantic menhaden purse seine, Mid-Atlantic haul/beach seine, NC long haul seine, Virginia pound net fishery, and NC roe mullet stop net (79 FR 77919, December 29, 2014). Among the affected species taken in these commercial fisheries are a number also listed as potential takes by the SEFSC in Tables 4.2-17 and 4.2-18, including several stocks of bottlenose dolphins, short-beaked common dolphins, Risso's dolphins, and long and short-finned pilot whales (79 FR 77919, December 29, 2014). Average annual mortality and serious injury levels from all known sources, as reported in the most recent SARs, and PBR for these species are shown in Tables 5.5-1 and 5.5-2. These numbers are minimum numbers and are likely underestimates of actual serious injuries and mortalities due to a number of unobserved commercial fisheries, poor monitoring and reporting systems for recreational fisheries, the likelihood that all injured or killed marine mammals are not found or reported, and the difficulty in assigning stranded animals with evidence of fishery related injuries to specific fisheries.

In addition, research conducted by the Northeast Fisheries Science Center (NEFSC) occurs in some of the same areas of the Atlantic affected by SEFSC research, and is therefore considered in the set of external factors that contribute to cumulative effects in the ARA. The NEFSC has conducted its own NEPA and MMPA compliance process and requested authorization for incidental take of some of the same marine mammal stocks as the SEFSC (see Proposed Rule for the NEFSC, 80 FR 39542, 9 July 2015, and addendums to the proposed rule published on 6 August, 2015 [80 FR 46939] and 17 August, 2015 [80 FR 49196]). Table 5.5-1 indicates the requested takes by both the SEFSC and NEFSC in the Atlantic for all shared species. Note that these are precautionary estimates of takes and the actual level of taking by both centers is likely to be much less than these requested takes. Table 5.5-2 shows the contribution of SEFSC requested takes of coastal and estuarine stocks of bottlenose dolphins, none of which were specifically requested by the NEFSC.

Several take reduction plans were developed to mitigate bycatch relevant to species in the ARA. The ALWTRP was developed to reduce mortality and serious injury of North Atlantic right, humpback, and fin whales in gillnets and pot/trap gear but also benefits minke whales (NMFS 2010a). The intent of the BDTRP is to reduce serious injuries and mortalities of coastal bottlenose dolphins incidental to 13 Category I and II commercial fisheries, including gillnets, crab trap/pots, haul/beach seines, pound nets, stop net, and purse seine gear (50 CFR 229.35). The Atlantic Pelagic Longline Take Reduction Plan was developed to reduce serious injury and morality of pilot whales and Risso’s dolphins in the Mid-Atlantic portion of the pelagic longline fishery (50 CFR 229.36). The Atlantic Trawl Gear Take Reduction Strategy addresses protected species interactions (primarily pilot whales, short-beaked common dolphins, and Atlantic white-sided dolphins) in bottom and mid-water trawl fisheries through research, education, and outreach (ATGTRT 2008). Additional information on Take Reduction Teams and TRPs relevant to the SEFSC research areas is in Section 2.2.2.2, Take Reduction Plans.

Military operations along the eastern seaboard and offshore waters are also potential sources of behavioral and habitat disturbance, injury, and mortality. Operations occur throughout several range complexes and testing ranges from Maine to Florida within the Atlantic Fleet Training and Testing Area (DON 2013). Sonar, active acoustic sources, airguns, weapons firing, explosives, and vessel and aircraft noise could result in Level A or Level B harassment of some marine mammals, and vessel collisions and explosives could result in injury or mortality. The Navy coordinated with NMFS and USFWS, through ESA and MMPA consultation and permitting processes, on mitigation, monitoring, and reporting measures (DON 2013).

NOAA Fisheries declared an Unusual Mortality Event (UME) for bottlenose dolphins along the Atlantic coast from New York to Florida. The event began in July 2013 and continued at least through mid-July 2015, during which time 1,827 dolphins stranded. Preliminary diagnostic tests indicate cetacean morbillivirus caused the event. The specific stocks affected are not known, but the Southern Migratory, Northern Migratory, Northern North Carolina Estuarine System, and Offshore stocks are the four potential stocks in the vicinity of where UME-related strandings occurred (NOAA 2015b).

The primary actions that could affect prey availability are climate change and fisheries removals. Among the managed species targeted as prey are Atlantic menhaden, and short-finned squid and long-finned squid. Insufficient information on abundance and prey preferences for most of the cetaceans discussed here preclude adequately assessing the effects that these removals would have on these cetacean populations. Climate change impacts are difficult to predict, but will likely affect non ESA-listed cetaceans through changes in habitat and food availability.

Most of the activities external to SEFSC fisheries research affecting cetaceans are likely to continue into the foreseeable future (see Table 5.1-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures. The potential effects of climate change are unpredictable, but are also likely to continue into and beyond the foreseeable future.

<u>Contribution of the Research Alternatives</u>

Direct and indirect effects of the research alternatives on non-ESA-listed cetaceans are discussed in sections 4.2.4, 4.3.4, and 4.4.4. The three research alternatives considered in this DPEA include similar scopes of research. The primary differences lie in the number and types of associated mitigation measures for protected species. The contribution of SEFSC fisheries research activities to cumulative effects on non-ESA-listed species is likely to be small.

No collisions with large whales have been reported from any fisheries research activities conducted or funded by the SEFSC. The death of an Atlantic spotted dolphin calf during a marine mammal survey in

2011, however, was apparently caused by the ship's propeller, following bow-riding by a group of dolphins. This incident was highly unusual and the likelihood of repeated occurrence is quite small. Overall, the volume of ship traffic generated by SEFSC fisheries research is miniscule compared to the number of other vessels transiting the ARA. Given the relatively slow speeds of research vessels, mitigation measures, and the small number of research cruises, the likelihood of fisheries research vessels causing serious injury or mortality to non ESA-listed species due to ship strikes is considered possible, but the potential risk is minor.

Bottlenose dolphins are the only species for which there are historical takes by SEFSC in the ARA. The average annual take request of bottlenose dolphins is less than 10 percent of PBR for all stocks for which take is requested and PBR is known, except for the Central Georgia and Southern Georgia Estuarine System stocks, for which the requested take is 10.5% of PBR. Takes requested for all other cetaceans are well below 10 percent of PBR (Tables 4.2-17 and 4.2-18). The SEFSC does not think that number of requested takes will actually be taken in the next five years, but used a precautionary estimation procedure to ensure accounting for maximum level of potential take. According to the impact criteria described in Table 4.1-1, the level of mortality of the species considered here, if they occurred, would be considered minor to moderate in magnitude.

The lack of recent population information for many bottlenose dolphin stocks prevents a quantitative assessment of the potential impact of requested takes for stocks with undetermined PBR. If new population estimates for one or more stocks of bottlenose dolphins are developed in the future, NMFS will consider the potential impacts of its ongoing fisheries research program and requested take authorizations on an adaptive management basis, including the potential for additional mitigation measures as necessary.

The potential effects from use of active acoustic devices for research activities would likely involve infrequent and temporary behavioral disturbance and avoidance effects, particularly for the mid- and high-frequency hearing odontocetes. Relative to the volume of other ship traffic and anthropogenic sources of acoustic disturbance, the contribution of noise from SEFSC research would be minor.

Although there is some overlap in prey of non-ESA-listed cetaceans and the species collected during SEFSC research surveys, the total amount sampled is minimal compared to overall biomass and commercial fisheries removals. The contribution of research catches to the effects on cetaceans through competition for prey is therefore considered minor adverse.

When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting non-ESA-listed cetaceans in the ARA, the contribution of the three research alternatives to cumulative effects on cetaceans would be primarily through periodic gear interactions and would be minor and adverse. However, research conducted by the SEFSC (e.g., the Marine Mammal and Ecosystem Assessment Survey) provides valuable information for the conservation and management of these species and this contribution to cumulative effects would be beneficial for cetaceans in the ARA.

Contribution of the No Research Alternative

Under the No Research Alternative, NMFS would not promulgate rulemaking or issue LOAs for SEFSC fisheries research. SEFSC would not directly contribute to cumulative effects on non-ESA-listed cetaceans in the ARA. Indirectly, however, the loss of information obtained from SEFSC ecosystem research on the feeding ecology of marine mammals, oceanographic components of their habitat, and status of prey stocks could adversely affect management decisions and analysis of long-term trends affecting the marine ecosystem. The indirect contribution of the No Research Alternative to cumulative effects is difficult to ascertain for individual species, but would likely impact long-term monitoring of ecosystem changes important to marine mammals and increase uncertainty for management decisions for all cetaceans in the ARA. However, given the fact that the SEFSC is not the only source of this type of ecological and oceanographic data, the potential impact of this information loss for management purposes could be compensated by other research programs, at least in part. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting non-ESA-listed cetaceans in the ARA, the contribution of the No Research Alternative to cumulative effects on non-ESA-listed cetaceans would be minor adverse.

Table 5.5-1 Cumulative M&SI Compared to PBR with Requested Takes from SEFSC and NEFSC for All Stocks of Marine Mammals Shared with SEFSC Requests in the ARA

This table summarizes the known Mortality and Serious Injury (M&SI) from all sources (primarily commercial fishing) compared to PBR for each stock of marine mammals requested for incidental take by the SEFSC during fisheries and ecosystem research in the Atlantic Research Area (ARA). The requested takes from the Northeast Fisheries Science Center (NEFSC) for stocks shared with the SEFSC requests are also shown. The ARA is the only SEFSC research area with potential overlap and shared stocks with the NEFSC. All population estimates, Potential Biological Removal (PBR) values, and total annual M&SI data are from the most recent stock assessment reports (Waring et al. 2014, 2015a, 2015b). Abbreviations: Unknown = Unk., Undetermined = Und., Not Available = NA

Common Name (Stock)	Minimum Population Estimate	PBR	Average Annual M&SI from All Sources [A]	Average Annual M&SI as % of PBR	SEFSC Average Annual Take Request	NEFSC Average Annual Take Request	Total FSC Average Annual Take Request	Total FSC Average Annual Take Request as % of PBR
Risso's dolphin (Western North Atlantic)	12,619	126	54	**42.9%**	0.2	0.6	0.8	**0.6%**
Short-finned pilot whale (Western North Atlantic)	15,913	159	148	**93.1%**	0.2	0.6	0.8	**0.5%**
Long-finned pilot whale (Western North Atlantic)	19,930	199	31	**88.6%**	0.2	0.6	0.8	**0.4%**
Short-beaked common dolphin	112,531	1,125	363	**32.3%**	0.8	1.4	2.2	**0.2%**
Atlantic spotted dolphin (Western North Atlantic)	31,610	316	0	**0.0%**	0.8	0.4	1.2	**0.4%**
Pantropical spotted dolphin (Western North Atlantic)	1,733	17	0	**0.0%**	0.2	0	0.2	**1.2%**
Striped dolphin (Western North Atlantic)	42,804	428	0	**0.0%**	0.6	0	0.6	**0.1%**
Bottlenose dolphin (Western North Atlantic Offshore)	56,053	561	43.9	**7.8%**	0.8	1.6 (all stocks) [B]	0.8-2.4	**0.1-0.4%**
Harbor porpoise (Gulf of Maine/Bay of Fundy)	61,415	706	564	**79.9%**	0.2	1.4	1.6	**0.2%**
Harbor seal (Western North Atlantic)	66,884	2,006	420	**20.9%**	0.2	2.2	2.4	**0.1%**
Gray seal (Western North Atlantic)	Unk.	Und.	3,810	**NA**	0.2	1.4	1.6	**NA**

A – Total M&SI includes combined estimates of observed and reported commercial and non-commercial fisheries interactions, ship strikes, and entanglements in unidentified gear. All estimates are considered smaller than actual M&SI due to unobserved fisheries and other uncertainties in detecting injured or killed animals.

B – The NEFSC take request is for all stocks of bottlenose dolphins in the region, which includes the offshore stock as well as the northern and southern migratory coastal stocks.

Table 5.5-2 Cumulative M&SI Compared to PBR with Requested Number of Bottlenose Dolphin Takes from Coastal and Estuarine Stocks in the ARA

This table summarizes the contribution of requested SEFSC takes of bottlenose dolphin stocks in the ARA with other known sources of M&SI for each coastal and estuarine stock, if known. All population estimates, PBR values, and total annual M&SI data are from the most recent stock assessment reports (Waring et al. 2014, 2015a, 2015b). Abbreviations: Unknown = Unk., Undetermined = Und., Not Available = NA

Stock	Minimum Population Estimate	PBR	Average Annual M&SI from All Sources[A]	Average Annual M&SI as % of PBR	SEFSC Average Annual Requested Take	SEFSC Average Annual Take Request as % of PBR
Northern North Carolina Estuarine System Stock	782	7.8	1.0-16.7	12.8-214.1%	0.4	5.1%
Southern North Carolina Estuarine System Stock	Unk.	Und.	0-0.4	NA	0.2	NA
Northern South Carolina Estuarine System Stock	Unk.	Und.	0.2	NA	0.2	NA
Charleston Estuarine System Stock	Unk.	Und.	unknown	NA	0.2	NA
Northern Georgia/Southern South Carolina Estuarine System Stock	Unk.	Und.	1.4	NA	0.2	NA
Central Georgia Estuarine System Stock	185	1.9	unknown	NA	0.2	10.5%
Southern Georgia Estuarine System Stock	185	1.9	unknown	NA	0.2	10.5%
Jacksonville Estuarine System Stock	Unk.	Und.	1.2	NA	0.2	NA
Western North Atlantic South Carolina & Georgia Coastal Stock	3,097	31	1.2-1.6	3.9-5.2%	0.6	1.9%
Western North Atlantic Northern Florida Coastal Stock	730	7	0.4	5.7%	0.6	8.6%
Western North Atlantic Central Florida Coastal Stock	2,851	29	0.2	0.7%	0.6	2.1%
Western North Atlantic Northern Migratory Coastal Stock	8,620	86	1-7.5	1.2-8.7%	0.6	0.7%
Western North Atlantic	6,326	63	0-12	0-19%	0.6	0.9%

Stock	Minimum Population Estimate	PBR	Average Annual M&SI from All Sources [A]	Average Annual M&SI as % of PBR	SEFSC Average Annual Requested Take	SEFSC Average Annual Take Request as % of PBR
Southern Migratory Coastal Stock						

A – Total M&SI includes combined estimates of observed and reported commercial and non-commercial fisheries interactions, ship strikes, and entanglements in unidentified gear. All estimates are considered smaller than actual M&SI due to unobserved fisheries and other uncertainties in detecting injured or killed animals.

5.5.1.3 Pinnipeds

External factors in the ARA

The pinniped species included in this section, harbor seals and harp seals, are not listed as threatened or endangered. These species are subject to similar types of effects from external activities as described above for ESA-listed species and non-ESA-listed cetaceans. Their occurrence in the northern part of the ARA is, however, at the southern edge of their ranges and most known external factors impacting harbor seal and gray seal populations in U.S. Atlantic waters occur in the Northeast and Mid-Atlantic areas.

The coastal distribution of pinnipeds may leave them vulnerable to effects of near shore activities (coastal development, vessel traffic, fishing, dredging), but unlikely to be affected by more oceanic or offshore activities, such as pelagic fishing, shipping and offshore military exercises. There are no reports of vessel collisions resulting in injury or mortality in the Northeast region where harbor seals and gray seals pup, breed, and haulout in large numbers or in the southern end of their range in the ARA.

Entanglement in fishing gear and bycatch in commercial fisheries occur with regularity in the Northeast and Mid-Atlantic regions and are the primary known causes of mortality and serious injury for pinnipeds in this area. Gillnets are responsible for most observed and reported bycatch, but bottom trawl, mid-water trawl, herring weir, and seine fisheries also contribute (Waring et al. 2015b, Zollett 2009). Table 5.5-1 summarizes the known M&SI from all sources for harbor seals and gray seals along with the contribution from requested takes by the SEFSC and NEFSC.

Perturbations to coastal habitats through dredging, construction, commercial fishing, and climate change could alter the prey upon which pinnipeds in the region depend. However, prey availability does not currently appear to be a limiting factor for pinniped populations that are continuing to increase in abundance in the northeast region (Baraff and Loughlin 2000).

The activities external to SEFSC fisheries research affecting pinnipeds are likely to continue into the foreseeable future (see Table 5.1-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures. The potential effects of climate change are unpredictable, but are also likely to continue into and beyond the foreseeable future.

Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on non-ESA-listed pinnipeds are discussed in sections 4.2.4, 4.3.4, and 4.4.4. The three research alternatives considered in this DPEA include similar scopes of research. The primary differences lie in the number and types of associated mitigation measures for protected species. The contribution of SEFSC fisheries research activities to cumulative effects on non-ESA-listed pinniped species is likely to be small.

No interactions with pinnipeds have been reported from any fisheries research activities conducted or funded by the SEFSC. The average annual requested take of habor seals and gray seals by SEFSC is less than one percent of PBR for harbor seals. PBR is undetermined for gray seals but, given the low level of occurrence in the ARA and presumed large population size, the annual estimated take of 0.2 seals per year is likely inconsequential (Table 5.5-1). The SEFSC does not think that number will actually be taken in the next five years, but used a precautionary estimation procedure to ensure accounting for a maximum level of potential take. According to the impact criteria described in Table 4.1-1, the level of mortality of the species considered here, if they occurred, would be considered minor in magnitude.

Although there is some overlap in prey of non-ESA-listed cetaceans and the species collected during SEFSC research surveys, the total amount sampled is minimal compared to overall biomass and commercial fisheries removals. The contribution of research catches to the effects on cetaceans through competition for prey is therefore considered minor adverse.

When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting non-ESA-listed cetaceans in the ARA, the contribution of the three research alternatives to cumulative effects on pinnipeds would be primarily through periodic gear interactions and would be minor and adverse.

Contribution of the No Research Alternative

Under the No Research Alternative, NMFS would not promulgate rulemaking or issue LOAs for SEFSC fisheries research. SEFSC would not directly contribute to cumulative effects on pinnipeds in the ARA. Indirectly, however, the loss of information obtained from SEFSC ecosystem research on their feeding ecology, oceanographic components of their habitat, and status of prey stocks could adversely affect management decisions and analysis of long-term trends affecting the marine ecosystem. The indirect contribution of the No Research Alternative to cumulative effects is difficult to ascertain for individual species, but would likely impact long-term monitoring of ecosystem changes important to marine mammals and increase uncertainty for management decisions for pinnipeds in the ARA. However, given the fact that the SEFSC is not the only source of this type of ecological and oceanographic data, the potential impact of this information loss for management purposes could be compensated by other research programs, at least in part. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting non-ESA-listed pinnipeds in the ARA, the contribution of the No Research Alternative to cumulative effects on non-ESA-listed pinnipeds would be minor adverse.

5.5.2 Gulf of Mexico Research Area

5.5.2.1 ESA-listed Species

External factors in the GOMRA

The endangered marine mammals that occur in the GOMRA include sperm whales and West Indian (Florida) manatees (Table 3.2-7). Commercial whaling was the single greatest historical source of mortality for sperm whales. Commercial harvests of sperm whales ended worldwide in 1986 (NMFS 2010c). Commercial and subsistence harvests in the 1800s substantially reduced manatee population levels. The State of Florida passed legislation banning the killing of manatees in 1893 (USWFS 2001).

Conservation concerns and threats to recovery are outlined in the respective recovery plans for each of these species. Noted conservation concerns and threats include vessel/watercraft collisions, entanglement in fishing gear, anthropogenic noise, vessel/human disturbance, pollutants and pathogens, disease, habitat degradation, competition with fisheries for prey, climate change, and, additionally for manatees, being crushed in water control structures and navigational locks.

The high level of vessel traffic in the northern GOM could impact marine mammals via collisions, acoustic disturbance, and impacts to water quality (Table 5.1.1). Twelve of the U.S.'s 20 largest ports are located in the GOM. Vessel traffic includes crude oil and liquified natural gas (LNG) tankers, commercial container vessels, military, USCG vessels, cruise ships, commercial fishing vessels, and small watercraft. Vessel calls in GOM ports totaled 18,956 in 2009, which is approximately one third of all U.S. vessel calls. Of these, 3,800 were tankers (BOEM 2012). An estimated 60 percent of all crude oil imports into the U.S. are delivered by tanker ships entering through the GOM (VesselTrax 2007).

Vessel collisions are considered threats for several marine mammal species. Data, however, are insufficient to determine total human caused mortality and serious injury for sperm whales in the northern GOM. One possible vessel strike mortality of a sperm whale was documented off Louisiana in 1990 and one mortality due to entanglement in a sea anchor of a longline vessel was reported in 2008. There were no reported fisheries interactions or vessel collisions with sperm whales during 2009-2013 (Waring et al. 2015b). Collisions with watercraft are a leading source of injury and mortality for manatees in Florida. From 2007 to 2012, watercraft accounted for an average of 19 percent of annual manatee deaths. Total annual mortality includes human caused, perinatal, cold stress, natural causes, and undetermined causes. Eighty-nine percent of all human-caused deaths during this period were by watercraft (USFWS 2014a). These data include manatees from both the Atlantic and Gulf coasts of Florida. Vessel speed reduction zones, with voluntary compliance, were instituted to mitigate the problem (USFWS 2001). Jett et al. (2012) found, however, that over half of observed recreational watercraft in their study was noncompliant with posted speed restrictions.

Recreational and commercial vessels also contribute to noise in the marine environment through engines, propellers, and sonar and seismic equipment which may cause changes in marine mammal behavior or interfere with communication through masking. A controlled sound exposure experiment to assess sperm whale behavioral changes due to airgun sounds in the GOM showed no horizontal avoidance at received sound levels, although habituation to airgun sounds is possible in the GOM. There were, however, indications that full-array airgun firing could lead to decreased foraging effort (Jochens et al. 2008).

Oil and gas development presents potential threats to ESA-listed marine mammals in the GOM (Table 5.1.1). The oil and gas industry is the primary industry in the GOM and one of the most developed in the world. There are 7800 active lease blocks in the GOM planning areas, with more than 3,200 active platforms operating in water depths <61 m (200 ft) and 63 active platforms in depths >61 m (200 ft). Nearly 42,000 km (26,000 mi) of oil and gas pipeline traverses the seafloor. The number of approved drill applications in the GOM exceeded 38,000 as of October 2011 (BOEM 2012). There are several mechanisms by which oil and gas exploration, development, and production can impact marine mammals, including acoustic disturbance, contamination, habitat degradation, and collision.

Large-scale oil spills are rare, but potentially catastrophic, events as evidenced by the *Deepwater Horizon*/BP incident in April 2010. This was the largest spill in U.S. history and the first to use widespread chemical dispersants below the surface. More than 4 million barrels (210 million gallons) of oil were directly released into the GOM over a 3-month period (NOAA 2012). A single dead sperm whale was found floating 77 miles due south of the spill site in June 2010. The whale did not appear oiled and was not in oiled water when found, but location and cause of death are unknown. A currently ongoing UME was declared in 2010 for cetaceans in the northern GOM and includes animals stranded prior to (Feb. 2010), during, and after the spill. Two GOM sperm whales are considered part of the UME; most of the involved cetaceans are dolphins (Waring et al. 2013). Accurately calculating marine mammal deaths is complicated and usually reliant on recovered carcasses, which may grossly underestimate actual deaths (Williams et al. 2011).

Military operations in the GOM are also potential sources of disturbance, collisions, and contamination. Numerous U.S. military bases are located along the GOM coast, out of which various air and ship operations are based. The U.S. Air Force conducts training activities over deep areas of the GOM, while more than 40 military warning areas in the northern GOM region are mostly designated for testing and training operations in waters <800 m (2,600 ft) deep. There are also several military disposal areas for spoil, ordnance, chemical waste, and vessel waste in the GOM (BOEM 2012).

Climate change impacts on ESA-listed species are possible. Climate and oceanographic change could potentially affect habitat and food availability. Migration, feeding, and breeding locations influenced by ocean currents and water temperature could be impacted. Such changes could, ultimately, affect productivity of ESA-listed species (NMFS 2010b, NMFS 2011). The GOM region saw increasing air temperatures since the 1960s, and sea surface temperatures increased in coastal areas and decreased offshore from 1900 to 1991 (BOEM 2012). Most impacts from climate change are currently too uncertain to predict.

The activities external to SEFSC fisheries research affecting ESA-listed marine mammals in the GOMRA are likely to continue into the foreseeable future (see Table 5.1-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures. The potential effects of climate change are unpredictable, but are also likely to continue into and beyond the foreseeable future.

<u>Contribution of the Research Alternatives</u>

Direct and indirect effects of the research alternatives on ESA-listed marine mammal are discussed in sections 4.2.4, 4.3.4, and 4.4.4. The three research alternatives considered in this DPEA include similar scopes of research. The primary differences lie in the number and types of associated mitigation measures for protected species. The contribution of SEFSC fisheries research activities to cumulative effects on ESA-listed species is likely to be small.

There have been no historical takes of ESA-listed marine mammals during SEFSC fisheries research in the GOMRA and none are anticipated or requested. Incidental take in external commercial fisheries and the volume of ship strikes from external sources likely exceeds any known or potential takes by SEFSC fisheries research, none of which are ESA-listed species. Prey removal during fisheries research is very small and likely inconsequential to prey availability for any marine mammal species. When considered in conjunction with commercial and recreational fisheries and aggregated with other past, present, and reasonably foreseeable future activities affecting ESA-listed marine mammals in the ARA, the contribution of SEFSC fisheries research activities to cumulative effects on ESA-listed marine mammals would be minor adverse under all three research alternatives.

Behavioral disturbance of small numbers of ESA-listed marine mammals from use of active acoustic equipment during SEFSC research cruises is possible, but considered minor in magnitude throughout the GOMRA, temporary in duration, and would likely have minor effects on all ESA-listed marine mammals throughout the GOMRA. Given the large number of other commercial vessels' acoustic gear for navigation, fish finding, and seismic exploration, the contribution of SEFSC research to cumulative effects of acoustic disturbance would be minor.

When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting ESA-listed marine mammals in the GOMRA, the contribution of the three research alternatives to cumulative effects on these species through disturbance, direct takes, and prey removal would be minor adverse. However, research conducted by the SEFSC provides valuable information for the conservation and management of marine mammals and this contribution to cumulative effects would be beneficial for ESA-listed species in the GOMRA.

Contribution of the No Research Alternative

Under the No Research Alternative, NMFS would not promulgate rulemaking or issue LOAs for SEFSC fisheries research. SEFSC would no longer conduct or fund research in the GOM, so would not directly contribute to potentially adverse cumulative effects on threatened and endangered species in this region. Indirectly, however, the loss of information obtained through SEFSC ecosystem research on the feeding ecology of marine mammals, oceanographic components of their habitat, and status of prey stocks could have adverse impacts on management decisions and analysis of long-terms trends affecting the marine ecosystem. The indirect contribution of the No Research Alternative to cumulative effects is difficult to ascertain for individual species, but will likely impact long-term monitoring of ecosystem changes important to marine mammals and increase uncertainty for management decisions for many ESA-listed marine mammals in the GOMRA. However, given the fact that the SEFSC is not the only source of this type of ecological and oceanographic data, the potential impact of this information loss for management purposes could be compensated by other research programs, at least in part. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting ESA-listed marine mammals in the GOMRA, the contribution of the No Research Alternative to cumulative effects on ESA-listed marine mammals would be minor adverse.

5.5.2.2 Other Cetaceans

External factors in the GOMRA

The cetacean species included in this section are not listed as threatened or endangered. All of the species included here are odontocetes. Habitats are wide ranging, as are preferred prey items. Since these species are all subject to similar types of effects from external activities described above for ESA-listed species (e.g., vessel traffic, oil and gas activity, military operations, and the *Deepwater Horizon* oil spill), they will not be discussed in detail here. Interactions with commercial fisheries are likely to have the greatest effect on most of these species. In addition, impacts of the ongoing UME noted above are affecting bottlenose dolphin stocks in the northern Gulf of Mexico.

There are several commercial fisheries within the GOMRA with reported takes of non-ESA listed cetaceans. Category I and II fisheries in the GOMRA in which incidental takes of non-ESA-listed cetaceans currently occur include Gulf of Mexico large pelagics longline, Gulf of Mexico gillnet, Gulf of Mexico shrimp trawl, Gulf of Mexico stone trap/pot, and the Gulf of Mexico menhaden purse seine (79 FR 77919, December 29, 2014). Among the affected species taken in these Category I and II commercial fisheries are a number also listed as potential takes by the SEFSC in Tables 4.2-20 and 4.2-21, including several stocks of bottlenose dolphins, Atlantic spotted dolphins, Pantropical spotted dolphins, and Risso’s dolphins (79 FR 77919, December 29, 2014). Average annual mortality and serious injury levels from all known sources, as reported in the most recent SARs, and PBR for these species are shown in Table 5.5-3. These numbers are minimum numbers and are likely underestimates of actual serious injuries and mortalities due to a number of unobserved commercial fisheries, poor monitoring and reporting systems for recreational fisheries, the likelihood that all injured or killed marine mammals are not found or reported, and the difficulty in assigning stranded animals with evidence of fishery related injuries to specific fisheries. Table 5.5-3 also include the contribution of requested takes from the SEFSC. There are no shared stocks with requests for takes from the NEFSC in this region.

An ongoing UME was originally declared in 2010 for cetaceans in the northern GOM and includes animals stranded prior to (February 2010), during, and after the *Deepwater Horizon*/BP oil spill in April 2010. As of November 15, 2015, the UME involved 1,440 cetacean strandings in the Northern Gulf of Mexico, 94 percent of which were found dead (NOAA 2015d). The bottlenose dolphin is the primary species involved in the UME (87% of strandings, 2010-2013), but at least ten other species were represented, including spinner dolphins, Atlantic spotted dolphins, and melon-headed whales (Litz et al. 2014). Although the exact causes of this UME are not known, the *Deepwater Horizon* oil spill appears to be a contributing factor. The locations and numbers of dolphin strandings in the year after the oil spill overlap temporally and spatially with areas that received heavy and prolonged oiling, such as a cluster of strandings in Barataria Bay, Louisiana from August 2010 to December 2011 (Venn-Watson et al. 2015a). Follow-up studies confirm substantial decreases in reproductive success and high mortality rates of Barataria Bay dolphins compared with bottlenose dolphin populations not impacted by the oil spill (Lane et al. 2015). Other recent work has shown that dolphins found dead after the *Deepwater Horizon* oil spill had a prevalence of adrenal gland disease and lung tissue lesions that likely were caused by exposure to hydrocarbons from the oil spill and played a major role in their deaths (Venn-Watson et al. 2015b). Other known causes of previous UMEs, such as brevetoxicosis and dolphin morbillivirus, were not prevalent and likely were not contributing factors to the current UME (Venn-Watson et al. 2015b).

The Deepwater Horizon Natural Resource Damage Assessment Trustee Council released the Draft Programmatic Damage Assessment and Restoration Plan in October 2015 along with a supporting Draft Programmatic Environmental Impact Statement (https://www.doi.gov/deepwaterhorizon/draft-programmatic-damage-assessment-and-restoration-planprogrammatic-environmental). The documents provide extensive data on historical cetacean populations, results of field studies on survival and reproductive rates after the oil spill, marine mammal strandings, and toxicity test results. The documents were open for public comment through December 4, 2015 and are currently under review. The conclusions regarding the number of animals affected by the spill and the prospects for recovery of various stocks will not be official until the documents have been finalized.

Climate and oceanographic change could potentially affect habitat and food availability of non-ESA-listed cetaceans in the GOMRA. Migration, feeding, and breeding locations influenced by ocean currents and water temperature could be impacted, as a result.

The activities external to SEFSC fisheries research affecting cetaceans in the GOMRA are likely to continue into the foreseeable future (see Table 5.1-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures. The potential effects of climate change are unpredictable, but are also likely to continue into and beyond the foreseeable future.

Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on non-ESA-listed cetaceans are discussed in sections 4.2.4, 4.3.4, and 4.4.4. The three research alternatives considered in this DPEA include similar scopes of research. The primary differences lie in the number and types of associated mitigation measures for protected species. The contribution of SEFSC fisheries research activities to cumulative effects on non-ESA-listed species is likely to be small.

No collisions with marine mammals have been reported from any fisheries research activities conducted or funded by the SEFSC in the GOMRA. The volume of ship traffic generated by SEFSC fisheries research is miniscule compared to the number of other vessels transiting the GOMRA. Given the relatively slow speeds of research vessels, mitigation measures, and the small number of research cruises, the likelihood of fisheries research vessels causing serious injury or mortality to non ESA-listed species due to ship strikes is considered possible, but the potential risk is minor.

Bottlenose dolphins are the only species for which there are historical takes by SEFSC in the GOMRA. The average annual requested take of bottlenose dolphins by SEFSC is equal to or less than 10 percent of PBR for the continental shelf, oceanic, and three coastal stocks and one BSE stock for which PBR is known (minor magnitude) and between 10 and 50 percent of PBR for four BSE stocks for which PBR is known (moderate magnitude); PBR is undetermined for the remaining 17 stocks for which takes are requested (Table 4.2-20). For other cetacean species and stocks, average annual take requests are well below 10 percent of PBR for most species for which takes are requested (Table 4.2-21). Estimates for species not taken historically are based on species analogous to those taken historically or on historical takes of similar species in analogous commercial fisheries. The SEFSC does not think these numbers will actually be taken in the next five years, but used a precautionary estimation procedure to ensure accounting for a maximum level of potential take. According to the impact criteria described in Table 4.1-1, the level of mortality of the species considered here, if they occurred, would be considered minor to moderate in magnitude.

The lack of recent population information for many bottlenose dolphin stocks prevents a quantitative assessment of the potential impact of requested takes for stocks with undetermined PBR. If new population estimates for one or more stocks of bottlenose dolphins are developed in the future, NMFS will consider the potential impacts of its ongoing fisheries research program and requested take authorizations on an adaptive management basis, including the potential for additional mitigation measures as necessary.

The potential effects from use of active acoustic devices for research activities would likely involve infrequent and temporary behavioral disturbance and avoidance effects, particularly for the mid- and high-frequency hearing odontocetes. Relative to the volume of other ship traffic and anthropogenic sources of acoustic disturbance, the contribution of noise from SEFSC research would be minor.

Although there is some overlap in prey of non-ESA-listed cetaceans and the species collected during SEFSC research surveys, the total amount sampled is minimal compared to overall biomass and commercial fisheries removals. The contribution of research catches to the effects on cetaceans through competition for prey is therefore considered minor adverse.

When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting non-ESA-listed cetaceans in the GOMRA, the contribution of the three research alternatives to cumulative effects on these species through disturbance, direct takes, and prey removal would be minor adverse. However, research conducted by the SEFSC (e.g., the Marine Mammal and Ecosystem Assessment Survey) provides valuable information for the conservation and management of these species and this contribution to cumulative effects would be beneficial for non-ESA-listed cetaceans in the GOMRA.

Contribution of the No Research Alternative

Under the No Research Alternative, the SEFSC would no longer conduct or fund the fisheries and ecosystem research considered in the scope of this DPEA, so would not directly contribute to cumulative effects on non ESA-listed cetaceans in the GOMRA. Indirectly, however, the loss of information obtained through this research on the feeding ecology of marine mammals, oceanographic components of their habitat, and status of prey stocks could adversely affect management decisions and analysis of long-term trends affecting the marine ecosystem. The indirect contribution of the No Research Alternative to cumulative effects is difficult to ascertain for individual species, but would likely impact long-term monitoring of ecosystem changes important to marine mammals and increase uncertainty for management decisions for many cetaceans in the GOMRA. However, given the fact that the SEFSC is not the only source of this type of ecological and oceanographic data, the potential impact of this information loss for management purposes could be compensated by other research programs, at least in part. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting non ESA-listed cetaceans in the GOMRA, the contribution of the No Research Alternative to cumulative effects would be minor adverse.

Table 5.5-3 Cumulative M&SI Compared to PBR with Requested Number of Marine Mammal Takes in the GOMRA

This table summarizes the contribution of requested SEFSC takes of marine mammal stocks in the GOMRA with other known sources of M&SI for each stock, if known. All population estimates, PBR values, and total annual M&SI data are from the most recent stock assessment reports (Waring et al. 2014, 2015a, b).

Species (Stock)	Minimum Population Estimate	PBR	Average Annual M&SI from All Sources[A]	Average Annual M&SI as % of PBR	SEFSC Average Annual Requested Take	SEFSC Average Annual Take Request as % of PBR
Melon-headed whale (Northern Gulf of Mexico)	1,274	13	0	0	0.6	4.6%
Risso's dolphin (Northern Gulf of Mexico)	1,563	16	7.9	49.4%	0.2	1.3%
Short-finned pilot whale (Northern Gulf of Mexico)	1,456	15	0.5	3.33%	0.2	1.3%
Atlantic spotted dolphin (Northern Gulf of Mexico)	unknown	undetermined	unknown	unknown	0.8	unknown
Pantropical spotted dolphin (Northern Gulf of Mexico)	40,699	407	4.4	1.1%	0.8	0.2%
Striped dolphin (Northern Gulf of Mexico)	1,041	10	0	0	0.6	6.0%
Rough-toothed dolphin (Northern Gulf of Mexico)	311	3	0	0	0.2	6.7%
Spinner dolphin (Northern Gulf of Mexico)	6,221	62	0	0	0.6	1.0%
Bottlenose Dolphin Stocks[B]						
Northern Gulf of Mexico Continental Shelf	46,926	469	0.8	0.2%	0.8	0.2%
Northern Gulf of Mexico Oceanic	4,230	42	6.5	15.5%	0.8	1.9%
Northern Gulf of Mexico Western Coastal Stock	17,491	175	0.6	0.3%	0.6	0.3%
Northern Gulf of Mexico Northern Coastal Stock	6,004	60	0.4	0.7%	0.6	1.0%
Northern Gulf of Mexico Eastern Coastal Stock	11,110	111	1.6	1.4%	0.6	0.5%
Northern Gulf of Mexico Bay, Sound, and Estuarine Stocks (31 stocks below)						
Laguna Madre	unknown	undetermined	unknown	unknown	0.2	unknown
Nueces Bay, Corpus Christi Bay	unknown	undetermined	unknown	unknown	0.2	unknown
Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espirtu Santo Bay	unknown	undetermined	unknown	unknown	0.2	unknown
Matagorda Bay, Tres	unknown	undetermined	unknown	unknown	0.2	unknown

Species (Stock)	Minimum Population Estimate	PBR	Average Annual M&SI from All Sources[A]	Average Annual M&SI as % of PBR	SEFSC Average Annual Requested Take	SEFSC Average Annual Take Request as % of PBR
Palacios Bay, Lavaca Bay						
West Bay	unknown	undetermined	unknown	unknown	0.2	unknown
Galveston Bay, East Bay, Trinity Bay	unknown	undetermined	unknown	unknown	0.2	unknown
Sabine Lake	unknown	undetermined	unknown	unknown	0.2	unknown
Calcasieu Lake	unknown	undetermined	unknown	unknown	0	0%
Atchalfalaya Bay, Vermilion Bay, West Cote Blanche Bay	unknown	undetermined	unknown	unknown	0	0%
Terrabonne Bay, Timbalier Bay	unknown	undetermined	unknown	unknown	0.2	unknown
Barataria Bay Estuarine System	unknown	undetermined	0.8	unknown	0.2	unknown
Mississippi River Delta	170	1.7	unknown	unknown	0.2	11.8%
Mississippi Sound, Lake Bornge, Bay Boudreau	551	5.6	2.2	39.3%	0.6	10.7%
Mobile Bay, Bonsecour Bay	unknown	undetermined	unknown	unknown	0.2	unknown
Perdido Bay	unknown	undetermined	unknown	unknown	0.2	unknown
Pensacola Bay, East Bay	unknown	undetermined	unknown	unknown	0.2	unknown
Choctwhatchee Bay	173	1.7	0.4	23.5%	0.2	11.8%
St. Andrew Bay	unknown	undetermined	unknown	unknown	0.2	unknown
St. Joseph Bay	142	1.4	unknown	unknown	0.2	14.3%
St. Vincent Sound, Apalachiola Bay, St. George Sound	390	3.9	unknown	unknown	0.2	5.1%
Apalachee Bay	unknown	undetermined	unknown	unknown	0.2	unknown
Waccasassa Bay, Withlacoochee Bay, Crystal Bay	unknown	undetermined	unknown	unknown	0.2	unknown
St. Joseph Sound, Clearwater Harbor	unknown	undetermined	unknown	unknown	0	0%
Tampa Bay	unknown	undetermined	unknown	unknown	0	0%
Sarasota Bay, Little Sarasota Bay	160	1.6	unknown	unknown	0	0%
Pine Island Sound, Charlotte Harbor, Gasparilla Sound, Lemon Bay	unknown	undetermined	unknown	unknown	0.2	unknown

Species (Stock)	Minimum Population Estimate	PBR	Average Annual M&SI from All Sources[A]	Average Annual M&SI as % of PBR	SEFSC Average Annual Requested Take	SEFSC Average Annual Take Request as % of PBR
Caloosahatchee River	unknown	undetermined	unknown	unknown	0	0%
Estero Bay	unknown	undetermined	unknown	unknown	0	0%
Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay	unknown	undetermined	unknown	unknown	0.2	unknown
Whitewater Bay	unknown	undetermined	unknown	unknown	0	0%
Florida Keys-Bahia Honda to Key West	unknown	undetermined	unknown	unknown	0	0%

A – Total M&SI includes combined estimates of observed and reported commercial and non-commercial fisheries interactions, ship strikes, and entanglements in unidentified gear. All estimates are considered smaller than actual M&SI due to unobserved fisheries and other uncertainties in detecting injured or killed animals.

B. Total annual human-caused mortality and serious injury levels are unknown for the coastal and BSE stocks of bottlenose dolphins for 2009-2013, as these stocks are known to interact with unobserved fisheries and because the most current observer data for the shrimp trawl fishery are for 2007-2011 (Waring et al. 2015b).

5.5.3 Caribbean Research Area

5.5.3.1 ESA-listed Species

<u>External factors in the CRA</u>

The endangered marine mammal species in the CRA include humpback, sperm, blue, fin, and sei whales, and West Indian (Antillean) manatees. Commercial whaling was the single greatest historical source of mortality for the whale species, resulting in substantial population declines through overexploitation (Perry et al. 1999). Humpback whales were protected in 1966 and commercial harvests of sperm whales ended worldwide in 1986 (NMFS 2010c, Perry et al. 1999). Until the mid-1980s, manatees were occasionally captured for special events (USFWS 2009a). Hunting of manatees has not been a problem in Puerto Rico since the last documented case of illegal poaching in 1995 (Quintana-Rizzo and Reynolds 2007).

The CRA encompasses a large area that includes waters of Mexico, Belize, Guatemala, Honduras, Jamaica, Haiti, and the U.S. EEZ of Puerto Rico and the USVI. Since the vast majority of SEFSC research in the CRA occurs within the U.S. EEZ waters, discussion of external factors will focus on Puerto Rico and the USVI.

Various marine vessels frequent the waters of the CRA, from container ships to cruise ships and recreational vessels to small artisanal fishing boats. Ship strikes to whales are a worldwide source of injury and mortality. There are no reported ship collisions with humpback whales in the CRA, although they are a concern elsewhere in the range of western North Atlantic humpback whales. Humpbacks identified off Puerto Rico and the Virgin Islands during winter are from the Gulf of Maine, eastern Canada, Greenland, and Iceland feeding stocks (Katona and Beard 1990, Stevick et al. 2003a) and are, thus, susceptible to anthropogenic impacts, including ship strikes, while on the feeding grounds and during migration. There is one documented ship strike mortality of a sperm whale near Puerto Rico. In 2001, a U.S. Navy vessel stuck and killed a sperm whale 20 miles south of Puerto Rico (Jensen and Silber

2003, Waring et al. 2010). Annual levels of human-caused mortality and serious injury are, however, unknown for the Puerto Rico and U.S. Virgin Islands stock of sperm whales (Waring et al. 2010).

Primary threats to manatees in Puerto Rico are watercraft collisions and habitat degradation (USFWS 2009a). Between 1990 and 1995, approximately 46 percent of deaths were from human interactions, half of which were watercraft (power boat and jet skis) collisions. All of the watercraft deaths were caused by impact, not propeller wounds, suggesting excessive speed as an underlying cause (Mignucci-Giannoni et al. 2000). From 2004 to 2008, the five-year average watercraft-caused mortality was 1.8, or 22 percent of reported mortalities. The only record of multi-individual deaths occurred in 2006 when a large vessel hit and killed 5 adult manatees in a mating herd in San Juan Bay (USFWS 2009a). From 2008 to 2012, there were no records of serious injuries to manatees in Puerto Rico, but 47 manatees were reported dead. Most deaths (79 percent) were either undetermined or natural causes; five (11 percent) of the deaths were watercraft-related (USFWS 2014b). To help alleviate and minimize watercraft collisions, the USFWS signed a Cooperative Agreement with the Puerto Rico Department of Natural Resources (DNER) and HJR Reefscaping in 2012 to install regulatory speed buoys in known manatee areas to help boaters identify navigable waterways and speed zone regulations (USFWS 2013).

Fisheries in the CRA are primarily multi-species, multi-gear, artisanal, and coral reef-based (USFWS 2009a). Commonly used gear includes gillnets, longline, hook-and-line, haul/beach seines, and cast nets (2012 List of Fisheries, 76 FR 73912). Humpback whales are the most commonly entangled large whale in the Gulf of Maine, but there are no reports of interactions with fisheries in the CRA. There is insufficient information available to determine fishery-related mortality and serious injury for the Puerto Rico stock of sperm whales. There were no fishery-related mortalities reported between 1998 and 2008 (Waring et al. 2010 and citations therein). Fisheries interactions with manatees are uncommon and several of previously reported were anecdotal. Both the DNER and USFWS lack data to indicate takes (entanglement, bycatch, collisions with fishing boats) by the commercial/artisanal fisheries (USFWS 2009a). Furthermore, nets, other than shallow small nets for bait fish, have been banned in the U.S. Virgin Islands, haul/beach seine nets were prohibited in Puerto Rico, and gill and trammel nets are prohibited in river mouths, rivers, and lagoons in Puerto Rico (USFWS 2009a). Although USFWS acknowledges that the available data are limited and that some of the deaths for which cause is undetermined may be fisheries-related, incidental mortality and serious injury of manatees due to commercial fisheries in Puerto Rico and the U.S. Virgin Islands is minimal and approaching a zero mortality and serious injury rate. The exception is possible effects of beach seine gear that, beginning in late 2010, is permitted, except within Puerto Rico inner water and river mouths (USFWS 2014b). Population estimates for marine mammals in the CRA are not available and hence PBR values are undetermined; comparisons of M&SI and the requested takes by the SEFSC, as presented in table format for the ARA and GOMRA above, are therefore not possible.

Climate change impacts on ESA-listed species are possible, particularly for the long-distance migrants, such as humpback whales, that spend at least part of the year in high-latitude waters that may be more susceptible to the effects of climate change. Climate and oceanographic change could potentially affect habitat and food availability. Migration, feeding, and breeding locations influenced by ocean currents and water temperature could also be impacted. Changes in sea level, ocean temperatures, and precipitation and storm patterns could impact coastal and estuarine areas (Scavia et al. 2002) important to manatees.

The activities external to SEFSC fisheries research affecting ESA-listed marine mammals in the CRA will likely continue into the foreseeable future (see Table 5.1-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures. The potential effects of climate change are unpredictable, but are also likely to continue into and beyond the foreseeable future.

Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on ESA-listed marine mammal are discussed in sections 4.2.4, 4.3.4, and 4.4.4. The three research alternatives considered in this DPEA include similar scopes of research. The primary differences lie in the number and types of associated mitigation measures for protected species. The contribution of SEFSC fisheries research activities to cumulative effects on ESA-listed species is likely to be small.

Temporary behavioral disturbance of ESA-listed marine mammals from active acoustic gear used by SEFSC research vessels is not expected to occur within the CRA.

There have been no historic takes, serious injuries, or mortalities of ESA-listed species during SEFSC research in the CRA due to ship strikes or entanglement in gear. Given the relatively slow speeds of research vessels, the presence of bridge observers during transits and other mitigation measures, and the small sampling effort, no takes of these species are expected in the future under any of the research alternatives.

When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting ESA-listed marine mammals in the CRA, the contribution of SEFSC fisheries research activities to cumulative effects on ESA-listed marine mammals would be minor adverse under all three research alternatives.

Contribution of the No Research Alternative

Under the No Research Alternative, the SEFSC would no longer conduct or fund fisheries and ecosystem research considered in the scope of this DPEA, so would not directly contribute to cumulative effects on ESA-listed marine mammals in the CRA. Indirectly, however, the loss of information obtained through this research, either directly or indirectly, could have minor adverse impacts on management decisions and analysis of long-term trends affecting the marine ecosystem. The indirect contribution of the No Research Alternative to cumulative effects is difficult to ascertain for individual species, but will likely impact long-term monitoring of ecosystem changes important to marine mammals and increase uncertainty for management decisions for many cetaceans in the CRA. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting ESA-listed marine mammals in the CRA, the contribution of the No Research Alternative to cumulative effects would be minor adverse.

5.5.3.2 Other Cetaceans

External factors in the CRA

The cetacean species included in this section are not listed as threatened or endangered. They are all subject to similar types of effects from external activities as described above for ESA-listed species. With the exception of minke whales, the non-ESA listed cetaceans in the CRA are odontocetes.

Various marine vessels frequent the waters of the CRA, from container ships to cruise ships and recreational vessels to small artisanal fishing boats. Although ship strikes to whales are a worldwide source of injury and mortality, information is lacking on collisions with non-ESA listed marine mammals in the CRA.

Fisheries in the CRA are primarily multi-species, multi-gear, artisanal, and coral reef-based (USFWS 2009). Commonly used gear includes gillnets, longline, hook-and-line, haul/beach seines, and cast nets (2012 List of Fisheries, 76 FR 73912). There have been no documented takes in these fisheries in the past five years (79 FR 77919, December 29, 2014).

Climate change impacts on non-ESA listed species are possible. Climate and oceanographic change could potentially affect habitat and food availability. Migration, feeding, and breeding locations influenced by ocean currents and water temperature could also be impacted. Changes in sea level, ocean temperatures, and precipitation and storm patterns could impact coastal and estuarine areas important to nearshore or coastal species (Scavia et al. 2002).

The activities external to SEFSC fisheries research affecting non-ESA-listed marine mammals in the CRA will likely continue into the foreseeable future (see Table 5.1-1). The level of impact will depend on the application and efficacy of current and proposed mitigation measures. The potential effects of climate change are unpredictable, but are also likely to continue into and beyond the foreseeable future.

Contribution of the Research Alternatives

Direct and indirect effects of the research alternatives on non-ESA-listed marine mammal are discussed in sections 4.2.4, 4.3.4, and 4.4.4. The three research alternatives considered in this DPEA include similar scopes of research. The primary differences lie in the number and types of associated mitigation measures for protected species. The contribution of SEFSC fisheries research activities to cumulative effects on non-ESA-listed species is likely to be small.

There have been no reported vessel collisions or entanglements of non-ESA-listed marine mammals involving SEFSC vessels or gear in the CRA. The volume of ship traffic generated by SEFSC fisheries research is miniscule compared to the number of other vessels transiting the area. Given the relatively slow speeds of research vessels, mitigation measures, and the small number of research cruises, the likelihood of fisheries research vessels causing serious injury or mortality to non-ESA-listed species due to ship strikes is possible, but unlikely. The requested M&SI and Level A takes in fisheries research gear over the five-year LOA application period is one animals for each of five species (Table 4.2-23), a take level considered minor and, given the lack of historical takes, likely an overestimation of potential impacts.

Temporary behavioral disturbance from active acoustic gear used by SEFSC research vessels could affect small numbers of marine mammals throughout the CRA. Given the relatively few vessels and research days at sea, the contribution of the research alternatives to cumulative effects of acoustic disturbance would be minor.

When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting cetaceans in the CRA, the contribution of the research alternatives to cumulative effects on these species through disturbance and prey removal would be minor and adverse. However, research conducted by the SEFSC provides valuable information for the conservation and management of marine mammals and this contribution to cumulative effects would be beneficial for cetaceans in the CRA.

Contribution of the No Research Alternative

Under the No Research Alternative, the SEFSC would no longer conduct or fund fisheries and ecosystem research considered in the scope of this DPEA, so would not directly contribute to cumulative effects on non-ESA-listed marine mammals in the CRA. Indirectly, however, the loss of information obtained through this research, either directly or indirectly, could have minor adverse impacts on management decisions and analysis of long-term trends affecting the marine ecosystem. The indirect contribution of the No Research Alternative to cumulative effects is difficult to ascertain for individual species, but will likely impact long-term monitoring of ecosystem changes important to marine mammals and increase uncertainty for management decisions for many cetaceans in the CRA. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting non-ESA-listed cetaceans in the CRA, the contribution of the No Research Alternative to cumulative effects would be minor adverse.

5.6 CUMULATIVE EFFECTS ON BIRDS

Activities external to SEFSC fisheries research that could potentially affect birds in the ARA, GOMRA, and CRA are summarized in Table 5.1-1 and may include:

- Mortality from avian bycatch
- Potential for ship collisions
- Alteration or reduction of prey resources or habitat
- Loss or injury due to ingestion of or entanglement in marine debris
- Behavioral disturbance

5.6.1 Atlantic Research Area

5.6.1.1 External Factors in the ARA

Seabirds in the ARA are being affected by the cumulative effects of past and present manmade and natural factors.

The following description of factors affecting seabirds in the ARA is summarized from the SAFMC's Fishery Ecosystem Plan (SAFMC 2009a and b). The present status of oceanic and coastal birds listed for special protection or management attention is a result of a variety of factors, including fishing effort, habitat loss, disturbance at nesting sites, pollution, marine debris, disease, and changes in food availability. Habitat loss has been a major cause of decline in population numbers. Introduction and expanding exotic or feral species (e.g., house cats and black rats on nesting islands) is another cause. In addition, certain native species such as greater black-backed, herring, and laughing gulls that prey on the eggs and young of other bird species have greatly increased in number recently and pose a threat to other waterbird species, especially shorebirds. Many seabirds found in the southeast region nest outside the region, where substantial decreases in nesting numbers have occurred due to human disturbance and predation by both humans and introduced species (e.g., see Schreiber and Lee [2000]). Oil spills are one source of pollution damaging to seabirds. Direct or indirect interactions with fisheries also affects some population groups (i.e., open ocean and coastal shelf species), although these interactions are not well documented or understood in the Southeast Region, and the direct impacts (i.e., capture or entanglement in fishing gear) may be small. Climate change and over fishing, may also affect coastal and oceanic bird populations of the Southeast Region by changing the availability of food.

Other factors potentially affecting birds in the ARA include marine debris and offshore wind turbines (SAFMC 2009b).

The factors that have affected seabirds in the ARA in the past are likely to do so in the future. Reasonably foreseeable future actions include continuation and possible expansion of fisheries activities, military operations, oil and gas exploration and production, marine vessel traffic, ocean disposal and discharge, climate change, and ocean acidification.

The cumulative effects on seabirds in the ARA resulting from external anthropogenic factors (past actions, present actions, and RFFAs) are considered major (for some ESA-listed species) to minor (other species).

5.6.1.2 Contribution of the Research Alternatives

Four seabirds (all brown pelicans) have been caught incidentally in SEFSC fisheries surveys in the ARA over the last seven years. While these interactions had an adverse effect, the loss of two birds and disturbance of two more is not expected to affect population levels. Changes in availability of seabird prey resulting from SEFSC research surveys are expected to be localized and insubstantial. The contribution of SEFSC research activities to seabird collisions with vessels and loss or injury of seabirds from interactions with marine debris are expected to be minor. Discharge of contaminants from vessels used during research surveys is possible, but unlikely, and if it occurs, would be isolated in both time and location and likely small in volume. When aggregated with the impacts of past, present, and reasonably foreseeable future actions, SEFSC research activities would make a minor additive contribution to cumulative adverse effects on birds in the ARA due to slight increases in the potential for injury or mortality, changes in food availability due to discards and removal of prey, and alterations to seabird habitat under each of the research alternatives. However, research conducted by the SEFSC provides valuable information for the conservation and management of seabirds and this contribution to cumulative effects would be beneficial.

5.6.1.3 Contribution of the No Research Alternative

The lack of research under this alternative would eliminate any direct effects on seabirds in the ARA. It is important to note that some of the SEFSC projects that would be eliminated under this alternative include bird observers when space is available and generate information on the abundance, distribution, and feeding behaviors of seabirds in the ARA. The loss of this information could indirectly affect resource management decisions concerning the conservation of seabirds. Resource management authorities would lose important information needed to establish management measures in a meaningful fashion, and current conservation measures in place to protect physical properties of the environment would become less effective. There are too many unknown variables to estimate the level of impact this lack of information would have on any particular species of seabirds but the contribution of this alternative to cumulative impacts on seabirds would likely be minor.

5.6.2 Gulf of Mexico Research Area

5.6.2.1 External Factors in the GOMRA

Seabirds in the GOMRA are being affected by the same types of manmade and natural factors described above in the ARA section, and are likely to be affected by the same types of RFFAs. In 2010 the *Deepwater Horizon* oil spill killed an estimated 200,000 birds in the GOMRA (Haney et al. 2014). When aggregated with the impacts of past, present, and reasonably foreseeable future actions, SEFSC research activities would make a minor additive contribution to cumulative adverse effects on birds in the GOMRA under each of the research alternatives. Overall cumulative effects to seabirds in the GOMRA resulting from external anthropogenic factors (past actions, present actions, and RFFAs) would be considered major for some ESA-listed species to minor for other species.

5.6.2.2 Contribution of the Research Alternatives

No seabirds have ever been caught incidentally in SEFSC fisheries surveys in the GOMRA and, changes in the availability of seabird prey resulting from SEFSC research surveys are expected to be localized and insubstantial. When aggregated with the impacts of past, present, and reasonably foreseeable future actions, SEFSC research activities would make a minor additive contribution to cumulative adverse effects on birds in the GOMRA due to slight increases in the potential for injury or mortality and changes in food availability due to discards and removal of prey under each of the research alternatives. However, research conducted by the SEFSC provides valuable information for the conservation and management of seabirds in the GOMRA and this contribution to cumulative effects would be beneficial.

5.6.2.3 Contribution of the No Research Alternative

For the same reasons as described under the ARA section, the indirect contribution of the No Research Alternative to cumulative impacts on seabirds would be minor and adverse through the loss of information used for the management and conservation of seabirds.

5.6.3 Caribbean Research Area

5.6.3.1 External Factors in the CRA

Seabirds in the CRA are being affected by the same types of manmade and natural factors described above in the ARA section, and are likely to be affected by the same RFFAs. The cumulative effects on seabirds in the CRA resulting from external anthropogenic factors (past actions, present actions, and RFFAs) are considered major (for ESA-listed species) to minor (other species).

5.6.3.2 Contribution of the Research Alternatives

No seabirds have ever been caught incidentally in SEFSC fisheries surveys in the CRA and are not likely to be caught in the future. The contribution of SEFSC research activities to seabird collisions with vessels and loss or injury of seabirds from interactions with marine debris are expected to be minor. Discharge of contaminants from vessels used during research surveys is possible, but unlikely, and if it occurs, would be isolated in both time and location and likely small in volume. When aggregated with the impacts of past, present, and reasonably foreseeable future actions, SEFSC research activities would make a minor additive contribution to cumulative adverse effects on birds in the CRA due to slight increases in the potential for injury or mortality and changes in food availability due to discards and removal of prey under each of the research alternatives.

5.6.3.3 Contribution of the No Research Alternative

For the same reasons as described under the ARA section, the indirect contribution of the No Research Alternative to cumulative impacts on seabirds would be minor and adverse through the loss of information used for the management and conservation of seabirds.

5.7 CUMULATIVE EFFECTS ON SEA TURTLES

Activities external to SEFSC fisheries research that could potentially affect sea turtles in the ARA, GOMRA, and CRA are summarized in Table 5.1-1 and may include:

- Loss or injury of turtles resulting from ship strikes
- Loss or injury resulting from turtle bycatch or entanglement in fishing gear
- Alteration or reduction of prey resources
- Loss or injury due to ingestion of or entanglement in marine debris
- Behavioral disturbance
- Habitat loss or degradation

All species of sea turtles that occur in the SEFSC research areas are listed as threatened or endangered, and have therefore been subject to major population-level cumulative effects.

5.7.1 Atlantic Research Area

5.7.1.1 External Factors in the ARA

Sea turtles are susceptible to impacts resulting from natural and anthropogenic factors, both on land and in the water (Table 5.1-1). Effects on land involve habitat degradation, injury, and mortality through numerous mechanisms: beach erosion, beach armoring and nourishment, artificial lighting, increases in human presence, beach cleaning, recreational beach equipment, beach driving, coastal construction, fishing piers, disturbance of dunes and beach vegetation, and poaching. Increases in human presence near nesting beaches have led to the introduction of exotic fire ants, dogs, raccoons, and armadillos, all of which may feed on turtle eggs. Adverse impacts to sea turtles also involve habitat degradation, injury, and mortality through numerous mechanisms: oil and gas exploration, coastal development and transportation, dock construction, marine pollution, dredging, underwater explosions, artificial lighting, entanglement in debris, ingestion of marine debris, fishery interactions, boat collisions, and poaching.

Threats to sea turtles in the ARA include incidental capture, injury, and mortality during commercial fishing operations. This conservation issue has been the subject of numerous conservation engineering studies. The implementation of turtle excluder devices and time/area restrictions in commercial trawl fisheries has reduced the level of captures and mortality in trawl fisheries. Use of circle hooks instead of 'J' hooks and finfish bait instead of squid bait in commercial pelagic longline fisheries has also reduced sea turtle mortalities (Watson et al. 2005). However, capture and entanglement in several types of fishing gear continues to be a conservation concern, especially since all sea turtle species are listed as threatened or endangered under the ESA (NMFS and USFWS 1992 and 2008). Some fisheries may be required to carry sea turtle release gear to help mitigate adverse effects on turtles.

Reasonably foreseeable future actions in the ARA also include oil and gas exploration, development, and transportation. Extensive areas of the South Atlantic have been designated and blocked off for oil and gas development. Environmental Impact Statements have been prepared for Mid-Atlantic Sale 121 and South Atlantic Sale for the exploration of oil and gas offshore of Cape Hatteras, North Carolina. There are currently three natural gas pipeline proposals in Florida that propose to construct pipelines from the Bahamas to southeast Florida. Between 1996 and 2006, NOAA Fisheries Service reviewed 548 applications and support documents associated with pipelines in the South Atlantic area.

The NOAA Fisheries Service Southeast Region Habitat Conservation Division (HCD) office is engaged in three separate EFH consultations for natural gas pipeline projects proposed to be constructed from southeast Florida to the Bahamas. One of three projects (AES Ocean Express) has received Department of the Army (DA) authorization and a Federal Energy Regulatory Commission (FERC) license to proceed with construction. However, to our knowledge, all of these projects are still awaiting the necessary approvals from the Bahamian government.

Currently, the only marine aquaculture program occurring in U.S. federal waters is for live rock for coral and sponges off the Gulf and Atlantic coasts of Florida. In 2009, the *Fishery Management Plan for Regulating Offshore Marine Aquaculture in Federal Waters of the Gulf of Mexico* went into effect to regulate future aquaculture development.

Multiple past and present actions have affected sea turtles in the ARA and many of these impact producing factors are likely to continue for the foreseeable future.

5.7.1.2 Contribution of the Research Alternatives

Fisheries research activities conducted and funded by the SEFSC in the ARA have had no recorded interactions with hawksbill sea turtles, and the contributions of proposed fisheries research to the cumulative effects on this species are considered negligible under each of the research alternatives. In the ARA, there have been 168 loggerhead turtles, 118 Kemp's ridley turtles, 93 green turtles, and three leatherback turtles caught in SEFSC-affiliated research trawl, longline, and trammel net gear from 2010 through 2014 (Table 4.2-25). Most of these turtles have been released without apparent injury and there have been no reported interactions resulting in sea turtle mortality in the ARA. Likewise, contributions of the research alternatives to ship strikes, changes in availability of prey for sea turtles, loss or injury due to ingestion of or entanglement in marine debris, and alterations to sea turtle habitat are expected to be minor. In addition, a number of SEFSC fisheries research projects have been oriented toward reducing turtle bycatch in fisheries and studying habitat needs of sea turtles and therefore contribute to conservation efforts for these species.

Thus, SEFSC fisheries research activities would result in both potentially adverse and potentially beneficial contributions to cumulative impacts on sea turtles in the ARA. When combined with the impacts of past, present, and reasonably foreseeable future actions, the overall contribution of SWFSC research activities to cumulative effects on sea turtles in the ARA would be minor and potentially adverse under each of the research alternatives.

5.7.1.3 Contribution of the No Research Alternative

The No Research Alternative would eliminate any direct impacts to sea turtles that could potentially occur under the research alternatives. However, it is important to note that the SEFSC conducts research on sea turtles, such as stock identification and assessments, studies on abundance, life history, bycatch reduction and anthropogenic impacts. The research that would be eliminated under this Alternative generates data used to reduce sea turtle bycatch by evaluating and addressing priority gear types throughout the Atlantic and Gulf of Mexico. Under the No Research Alternative, the loss of information currently provided by SEFSC research activities would have a minor to moderate contribution to adverse cumulative impacts to sea turtles in the ARA through indirect effects on management decisions important to the conservation and recovery of these species.

5.7.2 Gulf of Mexico Research Area

5.7.2.1 External Factors in the GOMRA

Sea turtles in the GOMRA are being affected by the same types of manmade and natural factors described above in the ARA section, and are likely to be affected by the same RFFAs, but are also affected by oil extraction. Oil extraction has affected sea turtles in the GOMRA through contamination of the environment from spills, including the Deepwater Horizon Oil Spill that affected all five species of sea turtles in the GOMRA. The Sea Turtle Stranding and Salvage Network has documented large numbers of stranded sea turtles in the north-central Gulf of Mexico in 2011 and 2012 (525 and 444 respectively). The majority of these turtles were endangered Kemp's ridleys, loggerhead, and green turtles. Potential causes being investigated include; fishing activities that may result in turtle bycatch and mortality, biotoxins, such as harmful algal blooms, and possible impacts from the Deepwater Horizon Oil Spill.

Offshore wind turbines are currently being considered off the coast of South Texas near South Padre Island (SAFMC 2009b). The projects would include burying eight cables in the sea floor. Potential impacts to sea turtles are being investigated, including the possibility of effect from the electromagnetism from the buried cables interfering with sea turtle’s navigation.

Excelerate Energy is in the process of developing a floating LNG liquefaction export facility in Lavaca Bay on the Texas Gulf Coast. The U.S. Department of Energy has granted Excelerate Energy a long-term, multi-contract authorization to export LNG to free trade agreement (FTA) nations. The company is authorized to export up to 10 million mt per annum (mtpa) of LNG produced from domestic resources for a 20-year term commencing on the date of its first export.

Currently, the only marine aquaculture program occurring in U.S. federal waters is for live rock (coral and sponges) off the Gulf and Atlantic coasts of Florida. In 2009, *the Fishery Management Plan for Regulating Offshore Marine Aquaculture in Federal Waters of the Gulf of Mexico* went into effect to regulate future aquaculture development. Potential effects may include changes in water quality, habitat degradation, and interaction with wild stocks (competition, genetic modification, entanglement).

Multiple past and present actions have affected sea turtles in the ARA and many of these impact producing factors are likely to continue for the foreseeable future.

5.7.2.2 Contribution of the Research Alternatives

Fisheries research activities conducted and funded by the SEFSC in the GOMRA have taken 39 loggerhead turtles, 19 Kemp’s ridley turtles, and one green turtle in SEFSC-affiliated research trawl, longline, and gillnet gear from 2010 through 2014 (Table 4.2-25). Most of these turtles have been released without apparent injury and there has been only one mortality of a Kemp’s ridley on longline gear in this time period. There have been no interactions with leatherback or hawksbill sea turtles. There is clearly risk of injury and mortality for sea turtles, especially with longline gear, but the contributions of SEFSC-affiliated fisheries research to the cumulative effects on these species are considered minor under each of the research alternatives. The contributions of the research alternatives to ship strikes, changes in availability of prey for sea turtles, loss or injury due to ingestion of or entanglement in marine debris, and alterations to sea turtle habitat are also expected to be minor.

5.7.2.3 Contribution of the No Research Alternative

The No Research Alternative would eliminate any direct impacts to sea turtles that could potentially occur under the research alternatives. However, it is important to note that the SEFSC conducts research on sea turtles, such as stock identification and assessments, studies on abundance, life history, bycatch reduction and anthropogenic impacts. The research that would be eliminated under this Alternative generates data used to reduce sea turtle bycatch by evaluating and addressing priority gear types throughout the Atlantic and Gulf of Mexico. Under the No Research Alternative, the loss of information currently provided by SEFSC research activities would have a minor to moderate contribution to adverse cumulative impacts to sea turtles in the ARA through indirect effects on management decisions important to the conservation and recovery of these species.

5.7.3 Caribbean Research Area

5.7.3.1 External Factors in the CRA

Sea turtles in the CRA have been and are being affected by the same types of manmade and natural factors described above in the ARA section with the exception of sand/gravel mining and geophysical activities, which is not known to occur there. The RFFAs that could affect sea turtles include coastal development, commercial and recreational fisheries, dredging, and vessel traffic.

5.7.3.2 Contribution of the Research Alternatives

Fisheries research activities conducted and funded by the SEFSC in the CRA have had no recorded interactions with any sea turtle species. The addition of a longline survey in the CRA under the Preferred Alternative adds a minimal amount of risk to taking sea turtles in that area. The contributions of proposed fisheries research to the cumulative effects on these species are considered minor under each of the research alternatives. Likewise, contributions of the research alternatives to ship strikes, changes in availability of prey for sea turtles, loss or injury due to ingestion of or entanglement in marine debris, and alterations to sea turtle habitat are expected to be minor.

5.7.3.3 Contribution of the No Research Alternative

The No Research Alternative would eliminate any direct impacts to sea turtles that could potentially occur under the research alternatives. However, it is important to note that the SEFSC conducts research on sea turtles, such as stock identification and assessments, studies on abundance, life history, bycatch reduction and anthropogenic impacts. The research that would be eliminated under this Alternative generates data used to reduce sea turtle bycatch. Under the No Research Alternative, the loss of information currently provided by SEFSC research activities would have a minor to moderate contribution to adverse cumulative impacts to sea turtles in the CRA through indirect effects on management decisions important to the conservation and recovery of these species.

5.8 CUMULATIVE EFFECTS ON INVERTEBRATES AND PLANTS

Activities external to SEFSC fisheries research that could potentially affect invertebrates and plants in the ARA, GOMRA, and CRA are summarized in Table 5.1-1 and may include:

- Loss or displacement due to habitat disturbance, turbidity, or contamination
- Competition or predation from invasive species
- Removal and mortality of individuals and biomass
- Creation of new hard substrate habitats on structures
- Bioaccumulation of contaminants
- Disruption due to changes in water temperature resulting from climate change
- Decreased calcification due to ocean acidification

5.8.1 External Factors in the SEFSC Research Areas

Marine invertebrates continue to be susceptible to natural and anthropogenic effects including exploitation through commercial and recreational fishing, habitat degradation, pollution, and climate change. Because marine invertebrates do not regulate their body temperature, changes in water temperature may affect the distribution of certain species as well as affect growth rates, reproductive ability and survival (Harley et al. 2006, Fogarty et al. 2007). In addition, warmer water temperatures affect pH, dissolved oxygen and conductivity of sea water, all of which may have adverse effects on invertebrate species.

Degradation of invertebrate habitat can occur as a result of commercial and recreational fisheries that involve gear coming into contact with the sea floor (See Section 4.2.7.4). Other sources of habitat disruption identified in the RFFAs (Table 5.1-1) include ocean dredging, waste disposal, and offshore development projects. In addition, pollution can negatively affect water quality and chemistry. While intentional discharges of pollutants (including fuel and oil) are relatively rare, accidental discharges may be rather common in some areas and have the potential to cause habitat degradation or direct mortality of invertebrates. Effects include decreased foraging ability and reproductive success and increased mortality (Milligan et al. 2009). Most accidental discharges are likely to be small and localized but some accidental discharges with large vessels or industrial activities may affect large geographic areas and impact benthic habitats for years.

Overexploitation of undersized or immature individuals can have serious implications for the sustainability of stocks, and the overall body size of individuals in a fished population may also change with intense fishing pressure on a single size (Donaldson et al. 2010). Some commercially valuable species of invertebrates (e.g., horseshoe crabs) have had population declines in the past due to overharvest. However, the commercially harvested species are all currently at sustainable population levels, at least in most areas of their range. Commercial fishing is likely to be the dominant factor in cumulative effects on these species in the future, although climate change may also have substantial effects on some species.

Vessel groundings represent a chronic threat to live coral habitat. Large vessel and ship groundings often result in severe injury to live coral colonies and non-living reef framework; and small recreational boat groundings result in numerous strikes to individual coral colonies in both inshore and offshore areas (SAFMC 2009b).

5.8.2 Contribution of the Research Alternatives

SEFSC research surveys remove small numbers of invertebrates from all three research areas, primarily shrimp, pelagic jellyfish, and horseshoe crabs. Mortality resulting from SEFSC fisheries research under each of the research alternatives would make minor contributions to adverse cumulative effects on invertebrates. In the ARA and GOMRA the use of bottom trawl gear would make a minor additive contribution to adverse cumulative effects on benthic invertebrate habitat (Section 4.2.7.3). The contributions of SEFSC research activities to habitat contamination, climate change, and ocean acidification are expected to be insubstantial. SEFSC fisheries research would contribute to future management decisions related to invertebrate populations in all three research areas where commercial fisheries target shrimp, golden crab, and spiny lobster. When combined with the impacts of past, present, and reasonably foreseeable future actions, the direct contribution of SEFSC research activities to cumulative effects on invertebrates would be minor and potentially adverse under each of the research alternatives. However, research conducted by the SEFSC on invertebrates in all three research areas contributes to sustainable management of certain species and this contribution to cumulative effects would be beneficial.

5.8.3 Contribution of the No Research Alternative

The No Research Alternative would eliminate any direct impacts to invertebrates that could potentially occur under the research alternatives. However, increased adverse effects could result indirectly from a loss of scientific information necessary for sustainable fisheries management and conservation of invertebrates and their habitats. Data from SEFSC research activities are used to inform science-based decisions related to the management of commercially fished invertebrates in all three research areas. Without the input of SEFSC data, management authorities would lose important information needed to establish management measures in a meaningful fashion, and current conservation measures in place to protect physical properties of the environment would soon become obsolete. Resource management agencies would have to adequately compensate for this loss of information through changes in management scenarios based on greater uncertainty. The indirect contribution of the No Research Alternative to cumulative effects is difficult to ascertain for individual species, but would likely impact long-term monitoring and management capabilities for commercially important invertebrates in the research areas. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting invertebrates in the three research areas, the contribution of the No Research Alternative to cumulative effects on invertebrates would be minor to moderate.

5.9 CUMULATIVE EFFECTS ON THE SOCIAL AND ECONOMIC ENVIRONMENT

Activities external to SEFSC fisheries research that could potentially affect the social and economic environment of fishing communities along the U.S. Southern Atlantic coast, Gulf Coast, and Puerto Rico and the U.S. Virgin Islands are summarized in Table 5.1-1 and include:

- Provision of jobs and economic opportunity
- Changes in commercial fishing opportunities
- Economic costs of changes in resource availability due to climate change and ocean acidification

5.9.1 External Factors in the SEFSC Research Areas

The intent of this section is to describe the contribution of SEFSC fisheries research activities to the social and economic environment of fishing communities along the U.S. Southern Atlantic and Gulf coast, which is closely related to general socioeconomic conditions in the Nation. The economies of communities in this area are exceedingly large and characterized by great diversity among economic sectors. Potential future socioeconomic cumulative effects from developments in non-fishing industries, such as liquid natural gas terminals, oil extraction, shipping commerce, or climate change cannot be feasibly estimated with available data, but would be expected to dominate the overall economy in the future. The focus of this section will therefore be limited to cumulative effects on fisheries-related sectors.

The cumulative effects on social and economic issues for fishing communities and related industries closely parallel the effects on commercially exploited fish and invertebrates. These include both natural factors such as climate change (including changes in ocean characteristics), and activities associated with offshore development, contamination, and commercial and sport fishing. Since these communities are dependent on the abundance and location of commercially exploitable fish and invertebrates, factors that influence fish and invertebrate stocks also influence the economic well-being of the fishing communities.

RFFAs that could contribute to cumulative effects on fisheries-related sectors include changes to regulations regarding the protection of ESA-listed or other protected species, such as marine mammal take reduction plans, critical habitat restrictions on fishing or marine vessels, new conservation measures for sea turtles, and new fishery management measures that may come into effect (Table 5.1-1). Species take reduction plans could include measures that would lead to increased costs for fishermen through required gear modifications. These plans could also call for time and/or area closures that would have short-term effects to fishing fleets having to alter their fishing locations. The potential effects of climate change on fisheries stocks and distribution is another RFFA of concern. Other effects on fish and invertebrates discussed in Sections 5.4 and 5.8 could have effects on the economies of fishing communities if not carefully monitored and controlled.

Existing fisheries regulations within the Southeast Region have already contributed to cumulative effects to the social and economic environment through numerous regulatory regimes affecting levels of effort for both commercial and recreational fishing. Most fishermen understand the need to protect different marine species and their important habitats. However, depending on locations of closed areas or the level of specificity in regulations, fishermen could feel varying levels of social and economic effects on their daily operations from these regulations.

5.9.2 Contribution of the Research Alternatives

The fundamental purpose of fisheries management is to monitor and counteract the contribution of commercial and sport fishing to the adverse cumulative effects on fish stocks from past, present, and reasonably foreseeable actions. SEFSC fisheries research is one of the most effective mechanisms to monitor the status of exploited stocks and changes in the marine environment, providing substantial beneficial contributions to cumulative effects through scientific input to fishery management and other environmental decision-making processes. Continuation of this research would provide consistent data to allow evaluation of fish stock trends and the effects of actions not related to fishing.

The management of commercial and recreational fisheries in the Southeast would continue to be supported by the proposed fisheries research conducted and funded by the SEFSC under the three research alternatives. This would help promote sustainable fish and invertebrate populations and have substantial benefits for local economies dependent on stable fishing opportunities. Cooperative research programs would also continue to improve the trust and collaboration between the fishing industry and fisheries managers in protecting marine resources. Long-term sustainable catches would be promoted, increasing stability in the fishing communities and reducing boom and bust cycles related to over-exploitation of target species.

Research results contribute to understanding effects not related to commercial or recreational fishing that could threaten species recoveries and sustainable yield levels. Using SEFSC long-term data sets and short-term research projects, resource managers could identify emerging issues in sufficient time to take corrective action before population level effects would be noticed by fishers in the form of reduced abundance and lower catches. This includes potential effects of climate change and ocean acidification.

Finally, SEFSC fisheries research creates jobs and purchases services in fishing communities. Depending on the community, this is a minor to moderate beneficial contribution to cumulative effects.

The importance of federally managed fisheries in the social and economic environment of Southeast communities varies substantially from place to place. When considered in conjunction with other past, present, and reasonably foreseeable future activities affecting the socioeconomic environment in the Southeast, the contribution of the research alternatives to cumulative effects on the socioeconomic environment would be moderate and beneficial in that continued research would support science-based, sustainable fisheries management and provide information important to the assessment of potential effects on fisheries resources from climate change and resource development projects.

5.9.3 Contribution of the No Research Alternative

Under the No Research Alternative, the SEFSC would not contribute to the information base needed for sustainable fisheries management or tracking ecosystem changes. Fisheries research activities conducted by state and private organizations are not likely to be sufficient to identify trends in target fish stocks and set sustainable fishery harvest limits without the contribution from the SEFSC. Some major commercial species would likely receive attention from state and private research efforts, so potential adverse effects would not likely be uniform across the fishing communities. Some fishers that target these major species may continue to benefit from sustainable fisheries management, but others may be affected by lack of information on their target species. Lack of consistent data input into the fisheries management process would have major adverse effects on the quality of the management analyses, and subsequently to the value of the management process. Elimination of at-sea operations would reduce science-based input into fisheries management decisions, which would increase the potential for adverse cumulative effects on commercial fisheries.

The No Research Alternative would contribute a moderate adverse effect to the cumulative effects on the socioeconomic environment because at-sea research efforts of the SEFSC that could detect and anticipate cumulative effects on fisheries resources, which are important for fisheries management decisions that strongly influence the socioeconomic conditions of fishing communities, would not be conducted.

6.1 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

In 1976, Congress passed the MSA (16 USC 1801, *et seq*.). This law authorized the U.S. to manage its fishery resources in an area extending from a State's territorial sea (extending in general and in Alaska to 3 nm from shore) to 200 nm off its coast (termed the [Exclusive Economic Zone [EEZ]).

Two of the main purposes of the MSA are to promote domestic commercial and recreational fishing under sound conservation and management principles, and to provide for the preparation and implementation, in accordance with national standards, of FMPs which will achieve and maintain, on a continuing basis, the optimum yield from each fishery. The 10 National standards of the MSA require that FMPs contain certain conservation and management measures, including measures necessary to prevent overfishing, to rebuild overfished stocks, to insure conservation, to facilitate long-term protection of Essential Fish Habitat (EFH), and to realize the full potential of the Nation's fishery resources. Furthermore, the MSA also declares that the National Fishery Conservation and Management Program utilizes, and is based upon, the best scientific information available; involves, and is responsive to the needs of interested and affected States and citizens; considers efficiency; and draws upon federal, state, and academic capabilities in carrying out research, administration, management, and enforcement.

Certain stocks of fish have declined to the point where their survival is impacted, and other stocks of fish have been so substantially reduced in number that they could become similarly affected as a consequence of (a) increased fishing pressure, (b) the inadequacy of fishery resource conservation and management practices and controls, or (c) direct and indirect habitat losses which have resulted in a diminished capacity to support existing fishing levels.

The resource and research surveys conducted by the SEFSC are designed to meet the requirements of the MSA by providing the best scientific information available to fishery conservation and management scientists and managers, and that will support a management program that is able to respond to changing ecosystem conditions, and to manage risk by developing science-based decision tools.

The U.S. Commission on Ocean Policy has identified the need for more holistic assessments of the status of marine ecosystems. The President's Ocean Action Plan has endorsed the concept of marine Ecosystem-Based Management. Sustained ecosystem monitoring programs are essential for tracking the health of marine ecosystems as part of this overall approach. The individual SEFSC surveys are components of a broader ecosystem monitoring program that meets this emerging critical need. The potential effects of survey activities must be weighed against the risk of in-adequately characterizing the state of the ecosystem and potential human impacts on the system.

The EFH provisions of the MSA require NMFS to provide recommendations to federal and state agencies for conserving and enhancing EFH, for any actions that may adversely impact EFH. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity". Federal agencies must consult with NMFS and assess the effects of their actions on EFH. There is no separate permit or authorization process; EFH consultation is typically addressed during the NEPA process and incorporated into other permits. The SEFSC will use this DPEA to consult with the Southeast Region EFH Coordinator to assess the impacts of SEFSC fisheries research activities on EFH.

Substantial parts of the proposed action meet the definition of scientific research activity conducted by a scientific research vessel and are therefore exempt from the requirements of the MSA. Section 404 of the MSA requires the Secretary of Commerce to initiate and maintain, in cooperation with the Fishery Management Councils, a comprehensive program of fishery research to carry out and further the purposes, policy, and provisions of the MSA. The proposed action is part of a comprehensive program to address this requirement.

The Sustainable Fisheries Act of 1996 is also an amendment to the MSA. Sections 103 and 104 clarify issues surrounding highly migratory fish, and the international treaties that govern fisheries. Among the topics covered by these sections are Atlantic and Pacific fishing in international waters; fishing in the Bering Sea, shared with Russia; and congressional rules setting time limits on approval of international fishing treaties. Sections 116 to 406 of the Sustainable Fisheries Act detail the research necessary to implement the act. These sections specify the agencies responsible for research and the nature of the research to be conducted in each of several specific fishing areas, including the Atlantic Ocean, and include some of the research activities described in this DPEA.

The 1996 amendments to the MSA also require assessment, specification, and description of the effects of conservation and management measures on participants in fisheries, and on fishing communities:

> *Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.*

This DPEA provides an analysis of impacts to the socioeconomic environment from the SEFSC-affiliated fisheries and ecosystem research program as required by the MSA.

6.2 MARINE MAMMAL PROTECTION ACT

The Marine Mammal Protection Act (MMPA) of 1972 (16 U.S.C. 1361 *et seq*.), as amended, prohibits the “take” [13] of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. The primary management objective of the MMPA is to maintain the health and stability of the marine ecosystem, with a goal of obtaining an OSP of marine mammals within the carrying capacity of the habitat. The MMPA is intended to work in concert with the provisions of the Endangered Species Act (ESA). The secretary is required to give full consideration to all factors regarding regulations applicable to the take of marine mammals, including the conservation, development, and utilization of fishery resources, and the economic and technological feasibility of implementing the regulations.

Section 101(a)(5)(A-D) of the MMPA provides a mechanism for allowing, upon request, the "incidental," but not intentional, taking, of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing or directed research on marine mammals) within a specified geographic region. The NMFS Office of Protected Resources (OPR) processes applications for incidental takes of small numbers of marine mammals. Authorization for incidental takes may be granted if NMFS finds a negligible impact on the species or stock(s), and if the methods, mitigation, monitoring and reporting for takes are permissible.

The purpose of issuing incidental take authorizations is to provide an exemption to the take prohibition in the MMPA, and to ensure that the action complies with the MMPA and NMFSs implementing regulations. ITAs may be issued as either: 1) regulations and associated Letters of Authorization (LOAs) under Section 101(a)(5)(A) of the MMPA; or 2) Incidental Harassment Authorizations (IHAs) under

[13] The MMPA defines take as: “to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal." Harassment means any act of pursuit, torment, or annoyance which, 1) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A Harassment); or 2) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B Harassment).

Section 101(a)(5)(D) of the MMPA. An IHA can only be issued when there is no potential for serious injury and/or mortality or where any such potential can be negated through required mitigation measures. Pursuant to Section 101(a)(5)(A) of the MMPA, NMFS, upon application from the SEFSC, plans to propose regulations to govern the unintentional taking of marine mammals, by harassment, incidental to the proposed fisheries research activities by the SEFSC in the Atlantic Ocean, Gulf of Mexico, and Caribbean. The issuance of MMPA incidental take regulations and associated LOAs to the SEFSC is a federal action, thereby requiring NMFS to analyze the effects of the action on the human environment pursuant to NEPA, hence this DPEA.

The SEFSC intends to submit an application for rulemaking and subsequent issuance of LOAs concurrent with the publication of this DPEA for the incidental taking of small numbers of marine mammals that could occur during their future fisheries and ecosystem research activities. This DPEA will provide informational support for that LOA application and the rulemaking process and provide NEPA compliance for the authorization, if granted.

6.3 ENDANGERED SPECIES ACT

The ESA of 1973 as amended (16 USC 1531, *et seq*.), provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The Act is administered jointly by NMFS and the USFWS, with some exceptions - NMFS oversees most marine mammal species, marine and anadromous fish species, and marine plant species and the USFWS oversees several marine mammals (polar bear, walrus, sea otter, and manatee), seabird species, and terrestrial and freshwater wildlife and plant species. NMFS and USFWS share jurisdiction for sea turtles whereby NMFS has jurisdiction in the marine environment and USFWS in the terrestrial environment.

The listing of a species as threatened or endangered is based on the biological health of that species. Threatened species are those likely to become endangered in the foreseeable future (16 USC § 1532[20]). Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range (16 USC § 1532[20]). Species can be listed as endangered without first being listed as threatened.

In addition to listing species under the ESA, the appropriate expert agency (NMFS or USFWS) must designate critical habitat of the newly listed species within a year of its listing to the "maximum extent prudent and determinable" (16 USC § 1533[b][1][A]). The ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. Federal agencies are prohibited from undertaking actions that destroy or adversely modify designated critical habitat. Some species, primarily the cetaceans (whales), which were listed in 1969 under the Endangered Species Conservation Act and carried forward as endangered under the ESA, have not received critical habitat designations.

Federal agencies have an affirmative mandate to conserve listed species. One assurance of this is that federal actions, activities, or authorizations must be in compliance with the provisions of the ESA. Section 7 of the ESA provides a mechanism for consultation by the federal action agency with the appropriate expert agency. Informal consultations are conducted for federal actions that may affect but are not likely to adversely affect listed species and typically result in letters of concurrence from the expert agency. In cases where the proposed action may affect listed species or critical habitat, the action agency prepares a biological assessment to determine if the proposed action would adversely affect listed species or critical habitat. The biological assessment contains an analysis based on biological studies of the likely effects of the action on the species or habitat. The expert agency either concurs with the assessment or provides its own analysis to continue the consultation.

If the action agency or expert agency concludes that a proposed action may have adverse effects on a listed species, including take[14] of any listed species, they must enter formal consultations under section 7 of the ESA. The expert agency must then write a Biological Opinion (BiOp) that determines whether the proposed action places listed species in jeopardy of extinction or destroys or adversely modifies critical habitat. If the BiOp concludes the proposed (or ongoing) action will cause jeopardy to the species or adversely modify its critical habitat, it must also include reasonable and prudent alternatives that would modify the action so it no longer posed jeopardy to listed species. These reasonable and prudent alternatives must be incorporated into the federal action if it is to proceed. Regardless of whether the BiOp reaches a jeopardy or no jeopardy conclusion, it often contains a series of mandatory and/or recommended management measures the action agency must implement to further reduce the negative impacts to the listed species and critical habitat (50 CFR 402.24[j]). If the proposed action would likely involve the taking of any listed animal species, the expert agency may append an incidental take statement to the BiOp to authorize the amount of take that is expected to occur from normal promulgation of the action.

The SEFSC began informal consultation with the NMFS Southeast Regional Office, Protected Species Division, at the onset of developing this DPEA. These consultations have been oriented toward assuring the DPEA covers all listed species and potential effects from fisheries research activities and provides the appropriate analysis in support of formal section 7 consultation, which will begin with the publication of the DPEA.

6.4 ATLANTIC TUNAS CONVENTION ACT

This Act addresses and codifies the obligations of the International Convention for the Conservation of Atlantic Tunas that was signed in Rio de Janeiro on May 14, 1966. The Act allows for an advisory committee to be established to provide advice and recommendations on the conservation and management of any highly migratory species covered by the Convention and allows the Secretary of Commerce to adopt and enforce regulations to carry out the purposes and objectives of the Convention and Act.

Regulations may establish closed seasons, impose size and catch limits, limit incidental take, require fishing records, clearance certificates, and permits, require fishery observes, and other requirements to obtain scientific data. This Act also recommends the prohibition of the use of large-scale driftnet fishing in Convention waters and the adoption of measures for the conservation and management of Atlantic swordfish. Fisheries research conducted by the SEFSC contributes to the scientific information used to implement the Act and research activities are consistent with the Act’s conservation recommendations. The three action alternatives would therefore allow NMFS to continue its compliance with this act while the No-research Alternative would not.

6.5 MIGRATORY BIRD TREATY ACT

The Migratory Bird Treaty Act (MBTA) protects approximately 836 species of migratory bird species from any attempt at hunting, pursuing, wounding, killing, possessing, or transporting any migratory bird, nest, egg, or part thereof, unless permitted by regulations (i.e. for hunting and subsistence activities). Additional protection is allotted under the Bald and Golden Eagle Protection Act for the identified species. Compliance with the MBTA does not require a permit or authorization; however, the USFWS often requests that other agencies incorporate MBTA mitigation measures as stipulations in their permits. In addition, a recently signed Memorandum of Understanding (MOU) between NMFS and USFWS

[14] The term “take” under the ESA means “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct” (16 U.S.C. § 1538[a][1][B]).

focuses on the means and intent to avoid and minimize, to the extent practicable, adverse impacts on migratory birds through enhanced interagency collaboration. In compliance with the MOU, the SEFSC has identified and evaluated the impacts of the proposed actions on migratory birds, which are considered minor. NMFS will provide a copy of this DPEA to the USFWS and will consider all comments from them concerning compliance with the MBTA as necessary.

6.6 FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act (FWCA) requires USFWS and NMFS to consult with other State and federal agencies in a broad range of situations to help conserve fish and wildlife populations and habitats in cases where federal actions affect natural water bodies(16 USC § 661 1934). Specific provisions involve conservation or expansion of migratory bird habitats related to water body impoundments or other modifications. FWCA requires consultation among agencies and the incorporation of recommended conservation measures if feasible, but does not involve a separate permit or authorization process. NMFS provided a copy of this DPEA to the State fish and wildlife agencies in every state affected by the fisheries research activities examined in this DPEA. NMFS will consider all comments from these agencies and take steps to comply with FWCA as necessary.

6.7 NATIONAL MARINE SANCTUARIES ACT

The Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA) (16 U.S.C. 1431) prohibits all ocean dumping, except that allowed by permits, in any ocean waters under U.S. jurisdiction, by any U.S. vessel, or by any vessel sailing from a U.S. port. MPRSA authorizes the Secretary of Commerce (through NOAA) to coordinate a research and monitoring program with the EPA and the U.S. Coast Guard (USCG). The MPRSA established nine regional marine research boards for the purpose of developing comprehensive marine research plans, considering water quality and ecosystem conditions and research and monitoring priorities and objectives in each region. It also launched a national coastal water quality monitoring program that directs the EPA and NOAA together to implement a long-term program to collect and analyze scientific data on the environmental quality of coastal ecosystems, including ambient water quality, health and quality of living resources, sources of environmental degradation, and data on trends. Results of these actions are used to provide the information required to devise and execute effective programs under the Clean Water Act and Coastal Zone Management Act (CZMA).

The National Marine Sanctuaries Act (also known as Title III of the MPRSA) authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities as national marine sanctuaries. The primary objective is to protect marine resources, such as coral reefs, sunken historical vessels or unique habitats.

Section 304(d) requires interagency consultation between the NOAA Office of National Marine Sanctuaries and federal agencies taking actions that are "likely to destroy, cause the loss of, or injure a sanctuary resource." In compliance with the MPRSA, the SEFSC has identified and evaluated the impacts of the proposed actions on National Marine Sanctuaries, which are considered minor. NMFS will provide a copy of this DPEA to the Office of National Marine Sanctuaries and will consider all comments from them concerning compliance with the MPRSA as necessary.

6.8 NATIONAL HISTORIC PRESERVATION ACT

Section 106 of the National Historic Preservation Act NHPA requires review of any project funded, licensed, permitted, or assisted by the federal government for impact on significant historic properties. The agencies must allow the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation, a federal agency, to comment on a project. NMFS will provide a copy of this

DPEA to the SHPOs in every state affected by the fisheries research activities examined in this DPEA. NMFS will consider all comments from the SHPOs and take steps to comply with NHPA.

6.9 EXECUTIVE ORDER 12989, ENVIRONMENTAL JUSTICE

EO 12898 directs federal agencies to take the appropriate and necessary steps to identify and address disproportionately high and adverse effects of federal projects on the health or environment of minority and low-income populations to the greatest extent practicable and permitted by law. No such effects are identified in this DPEA.

6.10 EXECUTIVE ORDER 13158, MARINE PROTECTED AREAS

The purpose of this order is to strengthen and expand the Nation's system of MPAs to enhance the conservation of our Nation's natural and cultural marine heritage and the ecologically and economically sustainable use of the marine environment for future generations. The order encourages federal agencies to use science-based criteria and protocols to identify and prioritize natural and cultural resources in the marine environment that should be protected to secure valuable ecological services and to monitor and evaluate the effectiveness of MPAs. Each federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions. To the extent permitted by law and to the maximum extent practicable, each federal agency, in taking such actions, shall avoid harm to the natural and cultural resources that are protected by an MPA. The SEFSC has considered its potential effects on MPAs in this DPEA and found that the impacts are minor.

6.11 COASTAL ZONE MANAGEMENT ACT

The principal objective of the CZMA is to encourage and assist states in developing coastal management programs, to coordinate State activities, and to safeguard regional and national interest in the coastal zone. Section 307(c) of the CZMA requires federal activity affecting the land or water uses or natural resources of a state’s coastal zone to be consistent with that state’s approved coastal management program, to the maximum extent practicable. NMFS will provide a copy of this DPEA and a consistency determination to the state coastal management agency in every state with a federally-approved coastal management program whose coastal uses or resources are affected by these fisheries research activities. Each state has sixty days in which to agree or disagree with the determination regarding consistency with that state’s approved coastal management program. If a state fails to respond within sixty days, the state’s agreement may be presumed.

Abend, A. and T.D. Smith. 1999. Review of the distribution of the long-finned pilot whale, *Globicephala melas*, in the North Atlantic and Mediterranean. NOAA Tech. Memo. NMFS-NE-117.

Aguilar, A. 2009. Fin whale *Balaenoptera physalus*. Pages 433-437 in W.F. Perrin, B. Würsig, and H.G.M. Thewissen (eds.), Encyclopedia of Marine Mammals, Academic Press, San Diego, CA. 1316 pp.

Allen, S. J., J.A. Tyne, H.T. Kobryn, L. Bejder, K.H. Pollock, N.R. Loneragan. 2014. Patterns of dolphin bycatch in a North-Western Australian trawl fishery. PLoS ONE 9(4): e93178.doi:10.1371/journal.pone.0093178

Alsop, III, F.J. 2001. Smithsonian Handbooks: Birds of North America eastern region. DK Publishing, Inc. New York, NY.

Aquarone, M.C. 2009. Southeast U.S. Continental Shelf - LME #6. Available online : http://www.lme.noaa.gov/index.php?option=com_content&view=article&id=52:lme6&catid=41:briefs&Itemid=72.

Atkinson, L.P. and D.W. Menzel. 1985. Introduction: Oceanography of the Southeastern U.S. Continental Shelf. Page 109 in L.P. Atkinson, D.W. Menzel, and K.A. Bush (eds), Oceanography of the Southeastern U.S. Continental Shelf, Coastal and Estuarine Sciences 2, American Geophysical Union, Washington D.C., U.S.

Atlantic Trawl Gear Take Reduction Team [ATGTRT]. 2008. Draft Atlantic trawl gear take reduction strategy--Final. 51pp. Available at: http://www.nero.noaa.gov/prot_res/atgtrp/meeting/ATGTRT%20Draft%20Take%20Reduction%20Strategy%20FINAL.pdf

Au, W.W.L. and M.C. Hastings. 2008. Principles of Marine Bioacoustics. Springer Publishing, New York.

Baird, R.W. 2001. Status of harbor seals, *Phoca vitulina*, in Canada. Can. Field-Nat. 115: 663-675.

Baraff, L.S. and T.R. Loughlin. 2000. Trends and potential interactions between pinnipeds and fisheries of New England and the U.S. west coast. Mar. Fish. Rev. 64(2): 1-39.

Barco, S.G., W.A. McLellan, J.M. Allen, R.A. Asmutis-Silvia, R. Mallon-Day, E.M. Meagher, D.A. Pabst, J. Robbins, R.E. Seton, W.M. Swingle, M.T. Weinrich, and P.J. Clapham. 2002. Population identity of humpback whales (*Megaptera novaeangliae*) in the waters of the U.S. mid-Atlantic states. J. Cetacean Res. Manage. 4(2): 135-141.

Barlow, J. and R. Gisiner. 2006. Mitigating, monitoring and assessing the effects of anthropogenic sound on beaked whales. J. Cetacean Res. Manage. 7 (3): 239-250.

Barnette, M. 2001. A review of fishing gear utilized within the Southeast Region and their potential impacts on essential fish habitat. NOAA Technical Memorandum NMFS-SEFSC-449. 62 pp.

Baumgartner, M.F. 1997. The distribution of Risso's dolphin (*Grampus griseus*) with respect to physiography in the northern Gulf of Mexico. Mar. Mamm. Sci. 13: 614-638.

Belkin, I.M., P.C. Cornillon, and K. Sherman. 2009. Fronts in Large Marine Ecosystems. Progress in Oceanography 81(1-4): 223-236.

Best, P.B., A. Brandão, and D.S. Butterworth. 2001. Demographic parameters of southern right whales off South Africa. J. of Cetacean Res. and Manage. (Special Issue) 2: 161-169.

Biodiversity and Conservation. 2014. Cory's shearwater bycatch in the Mediterranean Spanish commercial longline fishery: implications for management. January.

Boulva, J., and I.A. McLaren. 1979. Biology of the harbor seal, *Phoca vitulina*, in eastern Canada. Bull. Fish. Res. Bd. Can. 200: 1-24.

Brainard, R.E., C. Birkeland, C.M. Eakin, P. McElhany, M.W. Miller, M. Patterson, and G.A. Piniak. 2011. Status review report of 82 candidate coral species petitioned under the U.S. Endangered Species Act. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-PIFSC-27, 530 pp. + 1 Appendix.

Bureau of Ocean Energy Management (BOEM). 2012. Gulf of Mexico OCS Oil and Gas Lease Sales: 2012-2017 Western Planning Area Lease Sales 229, 233, 238, 246, and 248 and Central Planning Area Lease Sales 227, 231, 235, 241, and 247 Final Environmental Impact Statement. OCS EIS/EA BOEM 2012-019. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region.

Calambokidis, J. and T. Chandler. 2000. Marine mammal observations and mitigation associated with USGS seismic surveys in the Southern California Bight in 2000. Final report. Cascadia Research, Olympia, WA. 13 pp.

Carretta, J. V. and J. Barlow. 2011. Long-term effectiveness, failure rates, and "dinner bell" properties of acoustic pingers in a gillnet fishery. Marine Technology Society Journal 45(5): 7-19.

Caswell, H., S. Bault, and M. Fujiwara. 1999. Declining survival probability threatens the North Atlantic right whale. Proc. Natl. Acad. Science USA 96: 3308-3313.

CETAP (Cetacean and Turtle Assessment Program). 1982. A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the U.S. outer continental shelf, final report. University of Rhode Island Cetacean and Turtle Assessment Program. Washington, DC, Bureau of Land Management. #AA551-CT8-48**:** 576.

Clapham, P. J. (ed.) 2002. Report of the working group on survival estimation for North Atlantic right whales. Available from the Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543.

Clapham, P.J. 2009. Humpback whale *Megaptera novaeangliae*. Pages 582-585 in W.F. Perrin, B. Würsig, and H.G.M. Thewissen (eds.), Encyclopedia of Marine Mammals, Academic Press, San Diego, CA. 1316 pp.

Clapham, P.J., L.S. Baraff, C.A. Carlson, M.A. Christian, D.K. Mattila, C.A. Mayo, M.A. Murphy, and S. Pittman. 1993. Seasonal occurrence and annual return of humpback whales, *Megaptera novaeangliae*, in the southern Gulf of Maine. Can. J. Zool. 71: 440-443.

Clapham, P.J., J. Barlow, T. Cole, D. Mattila, R. Pace, D. Palka, J. Robbins, and R. Seton. 2003. Stock definition, abundance and demographic parameters of humpback whales from the Gulf of Maine. J. Cetacean Res. Manage. 5: 13-22.

Clapham, P.J., S.B. Young, and R.L. Brownell, Jr. 1999. Baleen whales: conservation issues and the status of the most endangered populations. Mammal Review 29: 35-60.

Clark, C.W. 1995. Application of U.S. Navy underwater hydrophone arrays for scientific research on whales. Rep. Int. Whal. Comm. 45: 210-212.

Clark, C.W., W.T. Ellison, B.L. Southall, L. Hatch, S.M. Van Parijs, A. Frankel, and D. Ponirakis. 2009. Acoustic masking in marine ecosystems: intuitions, analysis, and implication. Marine Ecology Progress Series 395: 201-222.

Cole, T.V.N. and A.G. Henry. 2015. Serious injury determinations for baleen whale stocks along the Gulf of Mexico, United States east coast and Atlantic Canadian provinces, 2008-2012. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-05; 43 pp. Available from: National Marine

Fisheries Service, 166 Water Street, Woods Hole, MA 02543- 1026, or online at http://www.nefsc.noaa.gov/publications/

Collie, J.S., G.A. Escanero, and P.C. Valentine. 2000. Photographic evaluation of the impacts of bottom fishing on benthic epifauna. ICES Journal of Marine Science 57: 987–1001.

Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. 2009. Loggerhead sea turtle *(Caretta caretta)* 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009. 222 pp.

Cuyler, L.C., R. Wiulsrød, and N.A. Øritsland. 1992. Thermal IR radiation from free living whales. Mar. Mamm. Sci. 8(2): 120–134.

Curry, B.E. and J. Smith. 1997. Phylogeographic structure of the bottlenose dolphin, *Tursiops truncatus*: stock identification and implications for management. Pages 327-247 in A.E. Dizon, S.J. Chivers, and W.F. Perrin (eds.), Molecular Genetics of Marine Mammals, Spec. Publ. 3., Society for Marine Mammalogy.

Cury, P.M., I.L. Boyd, S. Bonhommeau, T. Anker-Nilssen, R.J.M. Crawford, R.W. Furness, J.A. Mills, E.J. Murphy, H. Österblom, M. Paleczny, J.F. Piatt, J-P Roux, L. Shannon, and W.J. Sydeman. 2011. Global seabird response to forage fish depletion – one-third for the birds. Science 334 (6063): 1703-1706.

Davies, J.L. 1957. The geography of the gray seal. J. Mamm. 38: 297-310.

Davis, R.W., W.E. Evans, and B. Würsig, eds. 2000. Cetaceans, Sea Turtles and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume I: Executive Summary. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geological Survey, Biological Resources Division, USGS/BRD/CR-1999-0006 and Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2000-002. 27 pp.

Department of Energy (DOE). 2008. Potential environmental effects of marine and hydrokinetic energy technologies. Draft Report to Congress, Prepared in Response to Energy Independence and Security Act of 2007, Section 633)b). Available at: http://www.ornl.gov/sci/eere/EISAReport/report.html.

Department of the Navy (DON). 2008. Final Atlantic fleet active sonar training Environmental Impact Statement/Overseas Environmental Impact Statement. Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Available at: http://www.nmfs.noaa.gov/pr/pdfs/permits/afast_eis.pdf

DON. 2013. Atlantic Fleet Training and Testing Final Environmental Impact Statement/Overseas Environmental Impact Statement. Department of the Navy, NAVFAC Atlantic, Norfolk, VA. Available at: http://aftteis.com/

Doeringer, P.B., P.I. Moss, and D.G. Terkla. 1986. Captialism and Kinship: Do Institutions Matter in the Labor Market? Industrial and Labor Relations Review 40(1): 48-60.

Donaldson, A., C. Gabriel, B.J. Harvey, and J. Carolsfeld. 2010. Impacts of fishing gears and other than bottom trawls, dredges, gillnets, and longlines on aquatic biodiversity and vulnerable marine ecosystems. Dep. of Fish. and Ocean Canada Res. Doc. 2010:011. 90 pp.

Dotson, R.C., D.A. Griffith, D.L. King, and R.L. Emmett. 2010. Evaluation of a marine mammal excluder device (MMED) for a Nordic 264 midwater rope trawl. U.S. Department of Commerce, NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-455. 19 pp.

http://docs.lib.noaa.gov/noaa_documents/NMFS/SWFSC/TM_NMFS_SWFSC/NOAA-TM-NMFS-SWFSC-455.pdf

Dow Piniak, W.E., S.A. Eckert, C.A. Harms, and E.M. Stringer. 2012. Underwater hearing sensitivity of the leatherback sea turtle (*Dermochelys coriacea*): Assessing the potential effect of anthropogenic noise. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. OCS Study BOEM 2012-01156. 35 pp.

Duffield, D.A. 1986. Investigation of genetic variability in stocks of the bottlenose dolphin, *Tursiops truncatus*. Final report to the NMFS/SEFSC. Contract No. NA83-GA-00036.

Duffield, D.A., S.H. Ridgway, and L.H. Cornell. 1983. Hematology distinguishes coastal and offshore forms of dolphins, *Tursiops*. Can. J. Zool. 61: 930-933.

Duncan, C.D. and R.W. Havard. 1980. Pelagic birds of the northern Gulf of Mexico. A preliminary summary of distribution and abundance with comments on field identification. American Birds 34: 122-132.

Eckert, S.A. and J. Lien. 1999. Recommendations for eliminating incidental capture and mortality of leatherback sea turtles, *Dermochelys coriacea*, by commercial fisheries in Trinidad and Tobago. A report to the Wider Caribbean Sea Turtle Conservation Network (WIDECAST). Hubbs-Sea World Research Institute Technical Report No. 2000-310.

Edds-Walton, P.L. 1997. Acoustic communication signals of mysticete whales. Bioacoustics 8: 47–60.

Ehrhart, L.M. 1979. A survey of marine turtle nesting at Kennedy Space Center, Cape Canaveral Air Force Station, North Brevard County, Florida. Unpublished report to the Florida Department of Natural Resources, Division of Marine Fisheries, St. Petersburg, FL.

Engelhaupt, D., A.R. Hoelzel, C. Nicholson, A. Frantzis, S. Mesnick, S. Gero, H. Whitehead, L. Rendell, P. Miller, R. De Stefanis, A. Cañadas, S. Airoldi, and A.A. Mignucci-Giannoni. 2009. Female philopatry in coastal basins and male dispersion across the North Atlantic in a highly mobile marine species, the sperm whale (*Physeter macrocephalus*). Mol. Ecol. 18: 4193-4205.

Eno, N.C., D.S. Macdonald, J.A. M. Kinnear, S.C. Amos, C.J. Chapman, R.A. Clark, F. Bunker, and C. Munro. 2001. Effects of crustacean traps on benthic fauna. Journal of Marine Science. 58: 11-20.

Epperly, S.P., J. Braun, and A.J. Chester. 1995. Aerial surveys for sea turtles in North Carolina waters. Fish. Bull. 93: 254-261.

Epperly, S., L. Avens, L. Garrison, T. Henwood, W. Hoggard, J. Mitchell, J. Nance, J.Poffenberger, C. Sasso, E. Scott-Denton, and C. Yeung. 2002. Analysis of sea turtle bycatch in the commercial shrimp fisheries of southeast U.S. waters and the Gulf of Mexico. NOAA Tech. Memo. NMFS-SEFSC-490: 1-88.

Ernst, C. and R. Barbour. 1972. Turtles of the United States. University Press of Kentucky. Lexington, KY.

Federal Register. 2001. Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. Vol. 66, No. 11.

Finneran, J.J., C.E. Schlundt, R. Dear, and S.H. Ridgway. 2002. Temporary shift in masked hearing thresholds (MTTS) in odontocetes after exposure to single underwater impulses from a seismic watergun. J. Acoust. Soc. Am. 111: 2929-2940.

Finneran, J.J., D.A. Carder, C.E. Schlundt, and S.H. Ridgway. 2005. Temporary threshold shift (TTS) in bottlenose dolphins (*Tursiops truncatus*) exposed to midfrequency tones. Journal of the Acoustical Society of America 118: 2696-2705.

Finneran, J.J., C.E. Schlundt, B. Branstetter, and R.L. Dear. 2007. Assessing temporary threshold shift in a bottlenose dolphin (*Tursiops truncatus*) using multiple simultaneous auditory evoked potentials. J. Acoust. Soc. Am. 122: 1249-1264.

Fogarty, M., L. Incze, R. Wahle, D. Mountain, A. Robinson, A. Pershing, K. Hayhoe, A. Richards, and J. Manning. 2007. Potential climate change impacts on marine resources of the Northeastern United States. Report of the Northeast Climate Impacts Assessment Division, Union of Concerned Scientists. Available at: http://www.ucsusa.org

Gannon, D.P., J.E. Craddock, and A.J. Read. 1998. Autumn food habits of harbor porpoises, *Phocoena phocoena,* in the Gulf of Maine. Fish. Bull. 96: 428-437.

Gaskin, D.E. 1984. The harbor porpoise *Phocoena phocoena* (L.): Regional populations, status, and information on direct and indirect catches. Rep. Int. Whal. Commn. 34: 569-586.

Gero, S., J. Gordon, C. Carlson, P. Evans, and H. Whitehead. 2007. Population estimate and inter-island movement of sperm whales, *Physeter macrocephalus,* in the Eastern Caribbean Sea. J. Cetacean Res. Manage. 9: 143-150.

Gerstein, E.R., L. Gerstein, S.E. Forsythe, and J.E. Blue. 1999. The underwater audiogram of the West Indian manatee (*Trichechus manatus*). J. Acoust. Soc. Am. 105: 3575-3583.

Gilbert, J.R. and N. Guldager. 1998. Status of harbor and gray seal populations in northern New England. Final Report under NMFS/NER Cooperative Agreement 14-16-009-1557 to NMFS. Woods Hole, MA, Northeast Fisheries Science Center.

Gillman, E., N. Brothers, G. McPherson, and P. Dalzel. 2006. A review of cetacean interactions with longline gear. Journal of Cetacean Research and Management 8 (2): 215-223.

Gower, J. and S. King. 2011. Distribution of floating Sargassum in the Gulf of Mexico and Atlantic Ocean mapped using MERIS. International Journal of Remote Sensing 32: 1917-1929.

Graber, J., J. Thomson, B. Polagye, and A. Jessup. 2011. Land-based infrared imagery for marine mammal detection. Proceedings of SPIE Vol. 8156. in W. Gao, T. J. Jackson, J. Wang, and N.-B. Chang (eds.). Remote Sensing and Modeling of Ecosystems for Sustainability VIII. 81560B.

Gulf of Mexico Fishery Management Council. 2015. Red Snapper Quotas for 2015-2017+ : Framework Action to the Fishery Management Plan for the Reef Fish Resources of the Gulf of Mexico including Environmental Assessment, Regulatory Impact Review, and Regulatory Flexibility Act Analysis. March 2015. Available online at http://gulfcouncil.org/docs/amendments/Final%20Red%20Snapper%20Framework%20Action%20Set%202015-2017%20Quotas.pdf

Hain, J.H.W., M.A. Hyman, R.D. Kenney, and H.E. Winn 1985. The role of cetaceans in the shelf-edge region of the northeastern United States. Mar. Fish. Rev. 47(1): 13-17.

Hain, J.H.W., M.J. Ratnaswamy, R.D. Kenney, and H.E.Winn 1992. The fin whale, *Balaenoptera physalus,* in waters of the northeastern United States continental shelf. Rep. Int. Whal. Commn. 42: 653-669.

Haney, J.C. 1986. Seabird patchiness in tropical oceanic waters: the influence of Sargassum “reefs”. Auk 103: 141-151.

Haney, J.C., H.J. Geiger, and J.W. Short. 2014. Bird mortality from the Deepwater Horizon oil spill. I. Exposure probability in the offshore Gulf of Mexico. Mar Ecol Prog Ser. 513: 225–237. doi: 10.3354/meps10991

Hansen, L.J., K.D. Mullin, T.A. Jefferson, and G.P. Scott. 1996. Visual surveys aboard ships and aircraft. Pages 55-132 in R.W. Davis and G.S. Fargion (eds.), Distribution and abundance of marine mammals in the north-central and western Gulf of Mexico: Final report. Volume II: Technical report. OCS Study MMS 96- 0027. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA.

Harley, C.D.G., A.R. Hughes, K.M. Hultgren, B.G. Miner, C.J.B. Sorte, C.S. Thornber, L.F. Rodriguez, L. Tomanek, and S.L. Williams. 2006. The impacts of climate change in coastal marine ecosystems. Ecology Letters 9: 228-241.

Heileman, S., and R. Mahon. 2009. Caribbean Sea LME. in K. Sherman and G. Hempel (eds.), The UNEP Large Marine Ecosystems Report: A perspective in changing conditions in LMEs of the world's regional seas. UNEP Regional Seas Reports and Studies No. 182, United Nations Environment Programme. Nairobi, Kenya..

Heileman, S. and N. Rabalais. 2009. Gulf of Mexico: LME #5. Available online: http://www.lme.noaa.gov/LMEWeb/LME_Report/lme_5.pdf.

Henry, A.G., T.V.N. Cole, M. Garron, L. Hall, W. Ledwell, and A. Reid. 2012. Mortality and serious injury determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast and Atlantic Canadian Provinces, 2006–2010. Northeast Fish. Sci. Cent. Ref. Doc. 12-11. 24 pp.

Henry A.G., T.V.N. Cole, L. Hall, W. Ledwell, D. Morin, and A. Reid. 2014. Mortality determinations for baleen whale stocks along the Gulf of Mexico, United States East Coast and Atlantic Canadian Provinces, 2008 - 2012. Northeast Fish. Sci. Cent. Ref. Doc. 14-10; 17 pp. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/nefsc/publications/

Henry A.G., T.V.N. Cole, L. Hall, W. Ledwell, D. Morin, and A. Reid. 2015. Mortality and serious injury determinations for baleen whale stocks along the Gulf of Mexico, United States east coast and Atlantic Canadian provinces, 2009-2013. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-10; 45 p. doi: 10.7289/V5C53HTB.

Henwood, T. A. and W. Stuntz. 1987. Analysis of sea turtle captures and mortalities during commercial shrimp trawling. Fishery Bulletin 85(4): 813-817.

Hersh, S. L. and D.A. Duffield. 1990. Distinction between northwest Atlantic offshore and coastal bottlenose dolphins based on hemoglobin profile and morphometry. Pages 129-139 in S. Leatherwood and R.R.Reeves (eds.), The bottlenose dolphin, Academic Press, San Diego, 653 pp.

Hiddink, J.G., S. Jennings, M.J. Kaiser, A.M. Queiros, D.E.Duplisea, and G.J. Piet. 2006. Cumulative impacts of seabed trawl disturbance on benthic biomass, production, and species richness in different habitats. Canadian Journal of Fisheries and Aquatic Sciences 63: 721-736.

Hildebrand, J.A., G.L. D'Spain, M.A. Roch, and M.B. Porter. 2009. Glider-based passive acoustic monitoring techniques in the Southern California Region. Office of Naval Research Award Number: N000140811124.

Hirth, H.F. 1997. Synopsis of the biological data of the green turtle, *Chelonia mydas* (Linnaeus 1758). USFWS Biological Report 97(1).Holland, S. M. and R. B. Ditton. 1992. Fishing Trip Satisfaction: A Typology of Anglers. North American Journal of Fisheries Management 12(1): 28-33.

Huh, O.K., W.J. Wiseman, Jr., and Rouse, L.J., Jr. 1978. Winter cycle of sea surface thermal patterns, northeastern Gulf of Mexico. Journal Geophysical Research 83(C9): 4523-4529.

Hunter, W.C., L. Peoples, and J. Collazo. 2001. Partners in Flight Bird Conservation Plan for the South Atlantic Coastal Plain (Physiographic Area 03).

Hunter, W.C., W. Golder, S. Melvin, and J. Wheeler. 2006. Southeast United States Regional Waterbird Conservation Plan. Available at: http://www.pwrc.usgs.gov/nacwcp/pdfs/regional/seusplanfinal906.pdf

InfoNatura: Animals and Ecosystems of Latin America [web application]. 2007. Version 5.0. Arlington, Virginia (USA): NatureServe. Available: http://infonatura.natureserve.org. (Accessed: February 20, 2014).

International Maritime Organization (IMO). 2010. International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL). Available from: http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx.

International Whaling Commission [IWC]. 2002. Report of the Scientific Committee. International Whaling Commission. Annex H: Report of the Sub-committee on the Comprehensive Assessment of North Atlantic humpback whales. J. Cetacean Res. Manage. 4: 230-260.

Jefferson, T. and B. Curry. 1996. Acoustic methods of reducing or eliminating marine mammal-fishery interactions: do they work? Ocean Coast Manage. 31(1): 41-70.

Jennings, S., J.K. Pinnegar, N.V. Polunin, and K.J. Warr. 2001. Impacts of trawling disturbance on the trophic structure of benthic invertebrate communities. Marine Ecology Progress Series 213: 127-142.

Jensen, A.S. and G.K. Silber. 2003. Large whale ship strike database. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-OPR-25. 37 pp.

Jett, J., B. Thapa, and R. Swett. 2012. Boater speed compliance in manatee zones: examining a proposed predictive model. Society and Natural Resources 26: 95-104.

Jochens, A., D. Biggs, K. Benoit-Bird, D. Engelhaupt, J. Gordon, C. Hu, N. Jaquet, M. Johnson, R. Leben, B. Mate, P. Miller, J. Ortega-Ortiz, A. Thode, P. Tyack, and B. Würsig. 2008. Sperm whale seismic study in the Gulf of Mexico: Synthesis report. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2008-006. 341 pp.

Johnson, A., G. Salvador, J. Kennedy, J. Robbins, S. Kraus, S. Landry, and P. Clapham. 2005. Fishing gear involved in entanglements of right and humpback whales. Mar. Mamm. Sci. 21(4): 635-645.

Kastak, D., R.J. Schusterman, B.L. Southall, and C.J. Reichmuth. 1999. Underwater temporary threshold shift induced by octave-band noise in three species of pinniped. J. Acoust. Soc. Am. 106: 1142-1148.

Kastak, D.R., B.L. Southall, R.D. Schusterman, and C.R. Kastak. 2005. Underwater temporary threshold shifts in pinnipeds: effects of noise level and duration. J. Acoust. Soc. Am. 118: 3154-3163.

Kastak, D., C. Reichmuth, M.M. Holt, J. Mulsow, B.L. Southall, and R.J. Schusterman. 2007. Onset, growth, and recovery of in-air temporary threshold shift in a California sea lion (*Zalophus californianus*). J. Acoust. Soc. Am. 122: 2916-2924.

Kastelein, R.A., R. Gransier, L. Hoek, and M. Rambags. 2013. Hearing frequency thresholds of a harbor porpoise (*Phocoena phocoena*) temporarily affected by a continuous 1.5 kHz tone. J. Acoust. Soc. Am. 134(3): 2286-2292.

Kastelein, R.A., P. Wensveen, L. Hoek, and J.M. Terhune. 2009. Underwater hearing sensitivity of harbor seals (*Phoca vitulina*) for narrow noise bands between 0.2 and 80 kHz. J. Acoust. Soc. Am. 126 (1): 476-483.

Kasting, N.W., S.A. Adderley, T. Safford, and K.G. Hewlett. 1989. Thermoregulation in beluga (*Delphinapterus leucas*) and killer (*Orcinus orca*) whales. Physiological Zoology, 62(3): 687-701.

Katona, S.K. and J.A. Beard. 1990. Population size, migrations, and feeding aggregations of the humpback whale (*Megaptera novaeangliae*) in the western North Atlantic ocean. Rep. Int. Whal. Comm. (Special Issue) 12: 295-306.

Katona, S. K., V. Rough, and D.T. Richardson. 1993. A field guide to whales, porpoises, and seals from Cape Cod to Newfoundland. Smithsonian Institution Press, Washington, DC.

Keinath, J.A., J.A. Musick, and R.A. Byles. 1987. Aspects of the biology of Virginia's sea turtles: 1979-1986. Virginia J. Sci. 38(4): 329-336.

Kenney, R.D. 1990. Bottlenose dolphins off the northeastern United States. Pages 369-386 in S. Leatherwood and R.R. Reeves (eds.), The Bottlenose Dolphin, Academic Press, San Diego, CA.

Kenney, R.D. 2001. Anomalous 1992 spring and summer right whale (*Eubalaena glacialis*) distributions in the Gulf of Maine. J. Cet. Res. Manage. (Special issue) 2: 209-223.

Kenney, R.D. 2009. Right whales *Eubalaena glacialis*, *E. japonica*, and *E. australis*. Pages 962-972 in W.F. Perrin, B. Würsig, and H.G.M. Thewissen (eds.), Encyclopedia of Marine Mammals, Academic Press, San Diego, CA. 1316 pp.

Kenney, R.D., G.P. Scott, T.J. Thompson, and H.E. Winn. 1997. Estimate of prey consumption and trophic impacts of cetaceans in the USA Northeast continental shelf ecosystem. J. Northw. Atl. Fish. Sci. 22: 155-171.

Ketten, D.R. 1998. Marine mammal auditory systems: a summary of audiometric and anatomical data and its implications for underwater acoustic impacts. NOAA-TM-NMFS-SWFSC-256. 74 pp.

Ketten, D.R. and S.M. Bartol. 2006. Functional measures of sea turtle hearing. Final report for Office of Naval Research, ONR award No14-02-1-0510. 4 pp.

Knowlton, A.R. and S.D. Kraus. 2001. Mortality and serious injury of Northern Right Whales, *Eubalaena glacialis*, in the Western North Atlantic Ocean. J. Cetacean Res. Manage. (Special Issue) 2:193-208.

Knowlton, A.R., S.D. Kraus and R.D. Kenney 1994. Reproduction in North Atlantic right whales (*Eubalaena glacialis*). Can. J. Zool. 72: 1297-1305.

Kot, C.Y., A. DiMatteo, E. Fujioka, B. Wallace, B. Hutchinson, J. Cleary, P. Halpin, and R. Mast. 2013. The State of the World's Sea Turtles Online Database: Data provided by the SWOT Team and hosted on OBIS-SEAMAP. Oceanic Society, Conservation International, IUCN Marine Turtle Specialist Group (MTSG), and Marine Geospatial Ecology Lab, Duke University. http://seamap.env.duke.edu/swot.

Kraus, S.D., P.K. Hamilton, R.D. Kenney, A.R. Knowlton, and C.K. Slay. 2001. Reproductive parameters of the North Atlantic right whale. J. Cetacean Res. Manage. (Special Issue) 2: 231-236.

Kraus, S.D., R.M. Pace III, and T.R. Frasier. 2007. High investment, low return: the strange case of reproduction in *Eubalaena glacialis*. Pages 172-199 in Kraus, S.D. and R.M. Rolland (eds.), The Urban Whale: North Atlantic Right Whales at the Crossroads, Harvard University Press. Cambridge, Massachusetts.

Kraus, S.D. and R.M. Rolland (eds.). 2007. The Urban Whale: North Atlantic Right Whales at the Crossroads, Harvard University Press, Cambridge, MA.

Lagueux, K.M., M.A. Zani, A.R. Knowlton, and S.D. Kraus. 2011. Response by vessel operators to protection measures for right whales *Eubalaena glacialis* in the southeast U.S. calving ground. Endangered Species Research 14: 69-77.

Laist, D.W., C. Taylor, and J.E. Reynolds III. 2013. Winter habitat preferences for Florida manatees and vulnerability to cold. PLoS ONE 8(3): e58978. doi:10.1371/ journal.pone.0058978.

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the Deepwater Horizon oil spill. Proc. R. Soc. B 282: 20151944. Available at: http://dx.doi.org/10.1098/rspb.2015.1944

Leatherwood, S., D.K. Caldwell, and H.E. Winn. 1976. Whales, dolphins, and porpoises of the western North Atlantic. A guide to their identification. NOAA Tech. Rep. NMFS Circ. 396.

Leatherwood, S. and R.R. Reeves. 1983. The Sierra Club handbook of whales and dolphins. Sierra Club Books, San Francisco.

Lefebvre, L.W., M. Marmontel, J.P. Reid, G.B. Rathbun, and D.P. Domning. 2001. Status and biogeography of the West Indian manatee. Pages 425-474 in C.A. Woods and F.E. Sergile (eds.), Biogeography of the West Indies: new patterns and perspectives. CRC Press LLC, Boca Raton, Florida, USA.

Lesage, V. and M.O. Hammill. 2001. The status of the grey seal, *Halichoerus grypus*, in the Northwest Atlantic. Can. Field-Nat. 115(4): 653-662.

Litz, J.A., M.A. Baran, S.R. Bowen-Stevens, R.H. Carmichael, K.M. Colegrove, L.P. Garrison, S.E. Fire, E.M. Fougeres, R. Hardy, S. Holmes, W. Jones, B.E. Mase-Guthrie, D.K. Odell, P.E. Rosel, J.T. Saliki, D.K. Shannon, S.F. Shippee, S.M. Smith, E.M. Stratton, M.C. Tumlin, H.R. Whitehead, G.A.J. Worthy, and T.K. Rowles. 2014. Review of historical unusual mortality events (UMEs) in the Gulf of Mexico (1990−2009): providing context for the multi-year northern Gulf of Mexico cetacean UME declared in 2010. Diseases of Aquatic Organisms 112: 161-175.

Lohrenz, S.E., D.A. Wiesenburg, R.A. Arnone, and X. Chen. 1999. What controls primary production in the Gulf of Mexico? Pages 151-170 in H. Kumpf, K. Steidinger, and K. Sherman (eds.), The Gulf of Mexico Large Marine Ecosystem – Assessment, Sustainability and Management. Blackwell Science, Malden, MA.

Lovell, S., S. Steinback, and J. Hilger. 2013. The Economic Contribution of Marine Angler Expenditures in the United States, 2011. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-F/SPO-134. 188 pp.

Lurton, X. and S. DeRuiter. 2011. Sound radiation of sea-floor mapping echosounders in the water column, in relation to the risks posed to marine mammals. International Hydrographic Review (November 2011): 7-17.

Lyle, J.M. and S.T. Willcox. 2008. Dolphin and seal interactions with mid-water trawling in the Small Pelagic Fishery, including an assessment of bycatch mitigation strategies. Australian Fisheries Management Authority, Final Report Project R05/0996. 49pp. http://www.imas.utas.edu.au/__data/assets/pdf_file/0005/149648/R05_0996_Final-Rep.pdf

Macdonald, D.S., M. Little, N.C. Eno, and K. Hisckock. 1996. Disturbance of benthic species by fishing activities: a sensitivity index. Aquatic Conservation: Marine and Freshwater Ecosystems 6: 257-268.

Mackay, A. and S. Northridge. 2006. Dolphin bycatch in the UK bass pair trawl fishery. Presentation to the ATGTRT meeting, Providence, RI, September 20, 2006.

Mackin, W. and D. Lee. 2008. West Indian Breeding Seabird Atlas. www.wicbirds.net.

Magor, D.M. 1979. Survey of the Caribbean manatee (*Trichechus manatus*, L.) on Vieques Island, Puerto Rico. Unpublished report to the U.S. Navy. 58 pp.

Mansfield, A.W. 1966. The grey seal in eastern Canadian waters. Can. Audubon Mag. 28: 161-166.

Mansfield, A.W. 1967. Distribution of the harbor seal, *Phoca vitulina* Linnaeus, in Canadian Arctic waters. J. Mamm. 48(2):249-257.

Martin, J., H.H. Edwards, C.J. Fonnesbeck, S.M. Koslovsky, C.W. Harmak, and T.M. Dane. 2015. Combining information for monitoring at large spatial scales: First statewide abundance estimate of the Florida manatee. Biological Conservation 186: 44-51.

Maze-Foley, K. and K.D. Mullin 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. J. Cetacean Res. Manage. 8(2): 203-213.

McLellan, W.A., E. Meagher, L. Torres, G. Lovewell, C. Harper, K. Irish, B. Pike, and A.D. Pabst. 2004. Winter right whale sightings from aerial surveys of the coastal waters of the U.S. Mid-Atlantic. 15th Biennial Conference on the Biology of Marine Mammals.

Mead, J.G. and C.W. Potter. 1995. Recognizing two populations for the bottlenose dolphin, *Tursiops truncates*, off the Atlantic coast of North America: morphologic and ecologic considerations. Int. Bio. Res. Institute Reports 5: 31-43.

Melillo, J.M., T.C. Richmond, and G.W. Yohe (eds.). 2014. Climate change impacts in the United States: the third national climate assessment. U.S. Global Change Research Program, pp 841. doi:10.7930/J0Z31WJ2.

Mignucci-Giannoni, A.A. 1998. Zoogeography of cetaceans off Puerto Rico and the Virgin Islands. Caribbean Journal of Science 34: 173-190.

Mignucci-Giannoni A.A., R.A. Montoya-Ospina, N.M. Jiménez-Marrero, M.A. Rodríguez-López, E.H. Williams Jr., and R.K. Bonde RK. 2000. Manatee mortality in Puerto Rico. Environmental Management 25(2):189-198.

Miller, M.H., J. Carlson, P.Cooper, D. Kobayashi, M. Nammack, and J. Wilson. 2014. Status review report: scalloped hammerhead shark (*Sphyrna lewini*). Final Report to National Marine Fisheries Service, Office of Protected Resources. March 2014. 133 pp.

Milligan, S.R., W.V. Holt, and R. Lloyd. 2009. Impacts of climate change and environmental factor on reproduction and development in wildlife. Philosophical Transactions of the Royal Society B 364: 3313-3319.

Mooney, T.A., P.E. Nachtigall, and W.W.L. Au. 2004. Target strengths of a nylon monofilament and an acoustically enhanced gillnet: Predictions of biosonar detection ranges. Aquatic Mammals. 30(2): 220-226. http://www.whoi.edu/page.do?pid=52857

Moore, J.C. and E. Clark 1963. Discovery of right whales in the Gulf of Mexico. Science 141(3577): 269

Morgan, L.E., and R. Chuenpagdee. 2003. Shifting gears addressing the collateral impacts of fishing methods in U.S. waters. PEW Science Series on conservation and the environment. 52 pp.

Morreale, S.J. and E.A. Standora. 1998. Early life stage ecology of sea turtles in northeastern U.S. waters. NOAA Tech. Memo. NMFS-SEFSC-413.

Moser, M.L. and D.S. Lee. 2012. Foraging over Sargassum by Western North Atlantic seabirds. The Wilson Journal of Ornithology 124: 66-72.

Muller-Karger, F.E. 1993. River discharge variability including satellite-observed plume-dispersal patterns. Pages 162-192 in G.A. Maul (ed.), Climatic Change in the Intra-Americas Sea, Edward Arnold, London.

Mullin, K.D. and G.L. Fulling. 2003. Abundance of cetaceans in the southern U.S. North Atlantic Ocean during summer 1998. Fishery Bulletin, US 101: 603-613.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico. Mar. Mamm. Sci. 20(4): 787-807.

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships. Pages 111-172in R.W. Davis, W.E. Evans, and B. Würsig (eds.), Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: Distribution, abundance and habitat associations. Volume II: Technical report. OCS Study MMS 2000-003. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA.

Murphy, M. n.d. Seabirds. South Atlantic Fishery Management Council. http://www.alaskafisheries.noaa.gov/protectedresources/seabirds/SEFSC04seabirds_rev1mm.pdf

Murray, K.T. 2009. Characteristics and magnitude of sea turtle bycatch in U.S. mid-Atlantic gillnet gear. Endangered Species Research 8: 211-224. Available online at: http://www.int-res.com/articles/esr2009/8/n008p211.pdf

Musick, J.A. and C.J. Limpus. 1997. Habitat utilization and migration in juvenile sea turtles. Pages 137-164 in P.L. Lutz and J.A. Musick (eds.), The Biology of Sea Turtles, CRC Press, NY.

New England Aquarium (NEA). 2010. Climate change and the oceans. Available at: http://www.neaq.org/conservation_and_research/climate_change/climate_change_and_the_oceans.php

National Fish and Wildlife Foundation. 2012. Toward a Healthy Gulf of Mexico. Re-establishing Viability of Pelagic Seabird Populations in the Gulf of Mexico/Northern Caribbean Ecoregion.

National Marine Fisheries Service (NMFS). 1991. Recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the Humpback Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, MD. 105 pp.

NMFS. 1998b. Recovery Plan for the Shortnose Sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. 104 pp.

NMFS. 2005a. Recovery Plan for the North Atlantic Right Whale (*Eubalaena glacialis*). National Marine Fisheries Service, Silver Spring, MD.

NMFS. 2005b. Programmatic Environmental Assessment NOAA Coral Reef Conservation Grant Program. National Ocean Service, NOAA, U.S. Dept. Commerce. 101 pp.

NMFS. 2005c. 70 FR 1871. Notice of Intent to prepare an EIS to analyze the potential impacts of applying new criteria in guidelines to determine what constitutes a ‘‘take’’ of a marine mammal under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) as a result of exposure to anthropogenic noise in the marine environment.

NMFS. 2006a. Environmental Assessment, Regulatory Impact Review, and final Regulatory Flexibility Act analysis for a final rule to implement the Bottlenose Dolphin Take reduction Plan and revise the large mesh size restriction under the Mid-Atlantic Large Mesh Gillnet Rule. U.S. Dep Commer., NOAA, NMFS, Southeast Regional Office, Protected Resources Division. 240 pp.

NMFS. 2006b. Final Consolidated Atlantic Highly Migratory Species Fishery Management Plan. National Oceanic and Atmospheric Administration, NMFS, Office of Sustainable Fisheries, Highly Migratory Species Management Division, Silver Spring, MD. Public Document. 1600 pp.

NMFS. 2006c. An overview of protected species commonly found in the Gulf of Mexico. NOAA Fisheries Service, Southeast Regional Office, Protected Resources Division.

NMFS. 2007a. Endangered Species Act Section 7 Consultation on the Northeast Fisheries Science Center Research Vessel Activities. Consultation No. F/NER/2007/01541. NMFS Northeast Region Protected Resource Division. 102 pp.

NMFS. 2007b. Guidance for Social Impact Assessment. U.S. Dept. Commerce, NOAA Instruction 01-111-02. 39 pp. Available at: https://reefshark.nmfs.noaa.gov/f/pds/publicsite/documents/procedures/01-111-02.pdf

NMFS. 2008a. Final Environmental Impact Statement to implement vessel operational measures to reduce ship strikes to North Atlantic right whales. Office of Protected Resources, NMFS, Silver Spring, MD. 850 pp.

NMFS. 2008b. Endangered Species Act Section 7 Consultation on the Northeast Fisheries Science Center Research Vessel Activities [Consultation No. F/NER/2007/01541]. NMFS Northeast Regional Office, Protected Resources Division. 103 pp.

NMFS. 2009a. Environmental assessment, regulatory impact review, and final regulatory flexibility analysis for the Final Pelagic Longline Take Reduction Plan. Southeast Regional Office, Protected Resources Division, NMFS, NOAA, U.S. Dep Commer. St. Petersburg, FL. 55 pp. http://www.nmfs.noaa.gov/pr/pdfs/interactions/pltrt_ea_rir_frfa.pdf

NMFS. 2009b. Fishing Communities of the United States, 2006. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-F/SPO-98. 84 pp.

NMFS. 2010a. Guide to the Atlantic Large Whale Take Reduction Plan: An evolving plan to reduce the risk to North Atlantic large whales (right, humpback, and fin) posed by commercial trap/pot and gillnet fishing gear in the U.S. Atlantic Ocean. Available at: http://www.nero.noaa.gov/whaletrp/plan/ALWTRPGuide.pdf

NMFS. 2010b. Recovery plan for the fin whale (*Balaenoptera physalus*). National Marine Fisheries Service, Silver Spring, MD. 121 pp.

NMFS. 2010c. Recovery plan for the sperm whale (*Physeter macrocephalus*). National Marine Fisheries Service, Silver Spring, MD. 165pp.

NMFS. 2010d. Smalltooth Sawfish 5 year review. Protected Resources Division. 51pp.

NMFS. 2011. Final Recovery Plan for the Sei Whale (*Balaenoptera borealis*). National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD. 107 pp.

NMFS. 2012. Endangered Species Act Section 7 Consultation on the NEFSC Research Vessel Surveys as well as Two Cooperative Gear Research Studies to be overseen by the NEFSC Protected Species Branch (PSB) [PCTS ID: NER-2012-9241]. NMFS Northeast Regional Office, Protected Resources Division. 180 pp.

NMFS. 2013a. Endangered Species Act Section 7 Consultation on the Continued Implementation of Management Measures for the Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass Fisheries [Consultation No. F/NER/2012/01956]. May 20, 2013 DRAFT—NOT FINAL.

NMFS. 2013b. Draft Environmental Impact Statement for amending the Atlantic Large Whale Take Reduction Plan: Vertical Line Rule. National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce.

NMFS. 2014a. Fisheries Economics of the United States, 2012. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-F/SPO-137. 175pp. Available at: https://www.st.nmfs.noaa.gov/Assets/economics/documents/feus/2012/FEUS2012.pdf.

NMFS. 2014b. Commercial Fisheries Statistics, Annual Commercial Landings by Group. National Marine Fisheries Service, Office of Science and Technology. Available online at: http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings-with-group-subtotals/index

NMFS. 2014c. Commercial Fisheries Statistics, Total Commercial Fishery Landings at Major U.S. Ports Summarized by Year and Ranked by Dollar Value. National Marine Fisheries Service, Office of Science and Technology. Available online at: http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/other-specialized-programs/total-commercial-fishery-landings-at-major-u-s-ports-summarized-by-year-and-ranked-by-dollar-value/index

NMFS. 2015a. Commercial fisheries statistics: http://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings/index. Retrieved April 16, 2015.

NMFS. 2015b. Recreational fisheries statistics: http://www.st.nmfs.noaa.gov/recreational-fisheries/access-data/run-a-data-query/queries/index. Retrieved April 16, 2015.

NMFS. 2015c. Status of stocks. 2014 Annual Report to Congress on the Status of U.S. Fisheries. U.S. Dept Commerce, NOAA, NMFS. Available at: http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2014/2014_status_of_stocks_final_web.pdf

NMFS and U.S. Fish and Wildlife Service (USFWS). 1991a. Recovery Plan for U.S. Population of Atlantic Green Turtle. National Marine Fisheries Service, Washington, D.C.

NMFS and USFWS. 1991b. Recovery Plan for U .S. Population of Loggerhead Turtle. National Marine Fisheries Service, Washington, D.C.

NMFS and USFWS. 1992. Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C.

NMFS and USFWS. 1993. Recovery Plan for Hawksbill Turtles in the U.S. Caribbean Sea, Atlantic Ocean, and Gulf of Mexico. National Marine Fisheries Service, St. Petersburg, Florida.

NMFS and USFWS. 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. NMFS, Silver Spring, MD.

NMFS and USFWS. 2005. Recovery plan for the Gulf of Maine Distinct Population Segment of Atlantic salmon (*Salmo salar*). NMFS, Silver Spring, MD.

NMFS and USFWS. 2007a. Leatherback sea turtle, *Dermochelys coriacea*, 5 year review: summary and evaluation. NMFS. Silver Spring, MD. 79 pp.

NMFS and USFWS. 2007b. Kemp's ridley sea turtle, *Lepidochelys kempii*, 5 year review: summary and evaluation. NMFS, Silver Spring, MD. 50 pp.

NMFS and USFWS. 2007c. Green sea turtle, *Chelonia mydas*, 5 year review: summary and evaluation. NMFS, Silver Spring, MD. 102 pp.

NMFS and USFWS. 2007d. Loggerhead sea turtle, *Caretta caretta*, 5 year review: summary and evaluation. NMFS, Silver Spring, MD. 65 pp.

NMFS and USFWS. 2008. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*). Second Revision.

NMFS and USFWS. 2013. Hawksbill sea turtle, *Eretmochelys imbricata*, 5 year review: summary and evaluation. NMFS, Silver Spring, MD and USFWS, Jacksonville, FL. 87 pp.

NMFS, USFWS, and SEMARNAT. 2011. Bi-national recovery plan for the Kemp's ridley sea turtle, *Lepidochelys kempii*. Second revision. NMFS, Silver Spring, MD. 156 pp + appendices.

National Marine Protected Areas Center (NMPAC). 2011. Snapshot of Gulf of Mexico MPAs. May 2011. Available at: http://marineprotectedareas.noaa.gov/

NMPAC. 2012. Analysis of United States MPAs. March 2012. Available at: http://marineprotectedareas.noaa.gov/

NOAA. 2006. NOAA NOS NMSP Silver Fox & Manta UAS Evaluation Project. February 13-19, 2006. Upulo Point Airport, Hawi, Hawaii. 8 pp. http://uas.noaa.gov/projects/demos/silverfox/SilverFoxFinalReport.doc

NOAA. 2010a. Safety and environmental compliance office (SECO); Summary of applicable statutes, regulations, and guideline [cited 2010 October 6]. Available from: http://www.seco.noaa.gov/documents/shipSummary.html

NOAA. 2010b. National Ocean Service. Contaminants in the Environment. Available at: http://oceanservice.noaa.gov/observations/contam/

NOAA. 2010c. Marine Debris. Office of Response and Restoration. Available at: http://marinedebris.noaa.gov/info/impacts.html

NOAA. 2012. Natural Resource Damage Assessment April 2012 Status Update for the *Deepwater Horizon* Oil Spill. 91pp. www.gulfspillrestoration.noaa.gov.

NOAA. 2013. Seaward Limit of U.S. Laws. Accessed at http://www.gc.noaa.gov/gcil_seaward.html#mbta. Updated August 14, 2013

NOAA. 2014. Office of Protected Resources, Sea Turtles. (updated May 15) Available from http://www.nmfs.noaa.gov/pr/species/turtles/ A PDF of the cited paper is included in the zipped file of the downloaded shapefiles.

NOAA. 2015a. DRAFT Guidance for assessing the effects of anthropogenic sound on marine mammal hearing: Underwater acoustic threshold levels for onset of permanent and temporary threshold shifts. Revised version for second public comment period. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. Available at: http://www.nmfs.noaa.gov/pr/acoustics/draft%20acoustic%20guidance%20July%202015.pdf

NOAA. 2015b. 2013-2015 bottlenose dolphin unusual mortality event in the mid-Atlantic. Website accessed 16 November, 2015. http://www.nmfs.noaa.gov/pr/health/mmume/midatldolphins2013.html

NOAA. 2015c. Final essential fish habitat 5-year review for Atlantic highly migratory species. NOAA Fisheries Atlantic Highly Migratory Species Management Division. Available at: http://www.nmfs.noaa.gov/sfa/hms/documents/fmp/am10/index.html

NOAA. 2015d. Cetacean Unusual Mortality Event in the Northern Gulf of Mexico (2010-present). http://www.fisheries.noaa.gov/pr/health/mmume/cetacean_gulfofmexico.htm. Accessed November 17, 2015.

National Research Council (NRC). 1990. Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C. 259 pp.

NRC. 2002. Effects of trawling and dredging on seafloor habitat. National Research Council, Committee on Ecosystem Effects of Fishing, National Academy Press, Washington, D.C., 125 pp.

NRC. 2005. Marine mammal populations and ocean noise: Determining when noise causes biologically significant effects. National Academy Press, Washington, DC. 142 pp.

Northeast Fisheries Science Center [NEFSC]. 2011. Preliminary summer 2010 regional abundance estimate of loggerhead turtles (*Caretta caretta*) in northwestern Atlantic Ocean continental shelf waters. U.S. Dept Commer, Northeast Fish Sci Cent Ref Doc. 11-03. 33 pp. Available at: NMFS, 166 Water Street, Woods Hole, MA 02543-1026, or online at: http://www.nefsc.noaa.gov/nefsc/publications/

Northridge, S. 2003. Further development of a dolphin exclusion device. Final Report to UK Department for Environment Food and Rural Affairs (DEFRA), Project MF0735.

Nowacek, D.P., L.H. Thorne, D.W. Johnston, and P.L. Tyack. 2007. Responses of cetaceans to anthropogenic noise. Mammal Review 37: 81-115.

Olmstead, T.J., M.A. Roch, P. Hursky, M.B. Porter, H. Klinck, D.K. Mellinger, T. Helble, S.S. Wiggins, G.L. D'Spain, and J.A. Hildebrand. 2010. Autonomous underwater glider based embedded real-time marine mammal detection and classification. J. Acoust. Soc. Am. 127(3): 1971-1971.

Osgood, K.E. (ed.). 2008. Climate impacts on U.S. living marine resources: National Marine Fisheries Service concerns, activities and needs. U.S. Dept. Comm., NOAA Tech. Memo. NMFS-F/SPO-89.

Palka, D.L. 1995. Influences on spatial patterns of Gulf of Maine harbor porpoises. Pages 69-75 in A.S. Blix, L. Walloe, and O. Ulltang (eds.), Whales, Seals, Fish and Man. Elsevier Science.

Palka, D.L., A.J. Read, A.J. Westgate, and D.W. Johnston. 1996. Summary of current knowledge of harbour porpoises in U.S. and Canadian Atlantic waters. Rep. Int Whal. Commn 46:559-565.

Palsbøll, P.J., P.J. Clapham, D.K. Mattila, F. Larsen, R. Sears, H.R. Siegismund, J. Sigurjónsson, O. Vásquez, and P. Arctander. 1995. Distribution of mtDNA haplotypes in North Atlantic humpback whales: the influence of behavior on population structure. Mar. Eco. Prog. Series 116:1-10.

Palsbøll, P.J., J. Allen, M. Berube, P. Clapham, T. Feddersen, P. Hammond, R. Hudson, H. Jørgensen, S. Katona, A.H. Larsen, F. Larsen, J. Lien, D. Mattila, J. Sigurjonsson, R. Sears, T. Smith, R. Sponer, P. Stevick, and N. Øien 1997. Genetic tagging of humpback whales. Nature 388: 767-769.

Paquet, D., C. Haycock, and H. Whitehead. 1997. Numbers and seasonal occurrence of humpback whales, *Megaptera novaeangliae*, off Brier Island, Nova Scotia. Can. Field-Nat. 111: 548-552.

Passerotti, M.S., J.K. Carlson, and S.J.B. Gulak. 2010. Catch and Bycatch in U.S. Southeast Gillnet Fisheries, 2009. NOAA Technical Memorandum NMFS-SEFSC-600.

Payne, P.M. and D.W. Heinemann. 1993. The distribution of pilot whales (*Globicephala* sp.) in shelf/shelf edge and slope waters of the northeastern United States, 1978-1988. Rep. Int Whal. Commn._14(Special Issue): 51-68.

Payne, P.M., J.R. Nicholas, L. O'Brien, and K.D. Powers. 1986. The distribution of the humpback whale, *Megaptera novaeangliae*, on Georges Bank and in the Gulf of Maine in relation to densities of the sand eel, *Ammodytes americanus*. Fish. Bull. 84:271-277.

Payne, P.M., L.A. Selzer, and A.R. Knowlton. 1984. Distribution and density of cetaceans, marine turtles, and seabirds in the shelf waters of the northeastern United States, June 1980-December 1983, based on shipboard observations. NOAA/NMFS Contract No. NA-81-FA-C-00023.

Payne, P.M., D.N. Wiley, S.B. Young, S. Pittman, P.J. Clapham, and J.W. Jossi.. 1990. Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine in relation to changes in selected prey. Fish. Bull. 88: 687-696.

Perrin, W.F. 2009a. Common dolphin *Delphinus delphis* and *D. capensis*. Pages 255-259 in W.F. Perrin, B. Würsig, and H.G.M. Thewissen (eds.), Encyclopedia of Marine Mammals, Academic Press, San Diego, CA. 1316 pp.

Perrin, W.F. 2009b. Atlantic spotted dolphin *Stenella frontalis*. Pages 54-56 in W.F. Perrin, B. Würsig, and H.G.M. Thewissen (eds.), Encyclopedia of Marine Mammals, Academic Press, San Diego, CA. 1316 pp.

Perrin, W.F. 2009c. Pantropical spotted dolphin *Stenella attenuata*. Pages 819-821 in W.F. Perrin, B. Würsig, and H.G.M. Thewissen (eds.), Encyclopedia of Marine Mammals, Academic Press, San Diego, CA. 1316 pp.

Perrin, W. F., D.K. Caldwell, and M.C. Caldwell. 1994. Atlantic spotted dolphin. Pages 173-190 in S. H. Ridgway and R. Harrison (eds.), Handbook of marine mammals: The first book of dolphins, Academic Press, San Diego, CA.

Perry, S.L., D.P. DeMaster, and G.K. Silber. 1999. The great whales: history and status of six species listed as endangered under the U.S. Endangered Species Act of 1973. Marine Fisheries Review, 61:1-74.

Pietrafesa, L.J., G.S. Janowitz, and P.A.Wittman. 1985. Physical oceanographic processes in the Carolina Capes. Pages 23-32 in L.P. Atkinson,D.W. Menzel, and K.A. Bush (eds.), Oceanography of the Southeastern U.S. Continental Shelf, Coastal and Estuarine Sciences 2, American Geophysical Union, Washington D.C.

Pollnac, R.B. and J.J. Poggies. 2008. Happiness, well-being and psychocultural adaptation to the stresses associated with marine fishing. Human Ecology Review 15(2):194-200.

Popper, A.N. and R.R. Fay. 2011. Rethinking sound detection by fishes. Hearing Research 273: 25-36.

Quintana-Rizzo, E. and J.E. Reynolds III (compilers). 2007. Regional management plan for the West Indian manatee (*Trichechus manatus*). Caribbean Environment Programme, United Nations Environment Programme, CEP Technical Report. 169pp.

Read, A.J. 1999. Harbour porpoise *Phocoena phocoena* (Linnaeus, 1758). Pages 323-355 in S.H. Ridgway and R. Harrison (eds.), Handbook of marine mammals. The second book of dolphins and porpoises, Academic Press, San Diego.

Recchia, C.A. and A.J. Read. 1989. Stomach contents of harbour porpoises, *Phocoena phocoena* (L.) from the Bay of Fundy. Can. J. Zool. 67: 2140-2146.

Reeves, R.R., P.J. Clapham, R.L. Brownell, Jr., and G.K. Silber. 1998. Recovery plan for the blue whale (*Balaenoptera musculus*). Prepared for the National Marine Fisheries Service, Silver Spring, MD. 42 pp.

Reynolds, J.E. III, J.A. Powell,and C.R. Taylor. 2009. Manatees *Trichechus manatus*, *T. senegalensis*, and *T. inunguis*. Pages 682-691 in W.F. Perrin, B. Würsig, and H.G.M. Thewissen (eds.), Encyclopedia of Marine Mammals, Academic Press, San Diego, CA. 1316 pages.

Richards, W. and M.F. McGowan. 1989. Biological productivity in the Gulf of Mexico: Identifying the causes of variability in fisheries. Pages 287-325 in K. Sherman and L.M.E. Alexander (eds.), Biomass Yields and Geography of Large Marine Ecosystems, Westview Press, Boulder, CO.

Richardson, W.J., C.R.J. Green, C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise. Academic Press, San Diego, CA.

Ridgely, R.S., T.F. Allnutt, T. Brooks, D.K. McNicol, D.W. Mehlman, B.E. Young, and J.R. Zook. 2005. Digital Distribution Maps of the Birds of the Western Hemisphere, version 2.1. NatureServe, Arlington, Virginia, U.S.A.

Rolland, R.M., S.E. Parks, K.E. Hunt, M. Castellote, P.J. Corkeron, D.P. Nowacek, , S.K. Wasser, and S.D. Kraus. 2012. Evidence that ship noise increases stress in right whales. Proc. R. Soc. B. doi:10.1098/rspb.2011.2429.

Ross, J.P. 1996. Caution urged in the interpretation of trends at nesting beaches. Marine Turtle Newsletter 74: 9-10.

Rowe, S.J. 2007. A review of methodologies for mitigating incidental catch of protected marine mammals. DOC Research & Development Series 83. Science & Technical Publishing, Dept of Conservation, Wellington, NZ. Available at: http://www.conservation.co.nz/documents/science-and-technical/drds283.pdf

Sasso, C.R. and S.P. Epperly. 2006. Seasonal sea turtle mortality risk from forced submergence in bottom trawls. Fisheries Research 81: 86-88.

Scavia, D., J.C. Field, D.F. Boesch, R.W. Buddemeier, B.V. Burkett, D.R. Cayan, M. Fogarty, M.A. Farwell, R.W. Howarth, C. Mason, D.J. Reed, T.C. Royer, A.H. Sallenger, and J.G. Titus. 2002. Climate change impacts on U.S. coastal and marine ecosystems. Estuaries 25(2): 149-164.

Schlundt, C.E., J.J. Finneran, D.A. Carder, and S.H. Ridgway. 2000. Temporary shift in masked hearing thresholds (MTTS) of bottlenose dolphins and white whales after exposure to intense tones. J. Acoust. Soc. Am. 107: 3496-3508.

Schmidly, D.J., C.O. Martin, and G.F. Collins. 1972. First occurrence of a black right whale (*Balaena glacialis*) along the Texas coast. Southwestern Nat. 17 (2): 214-215

Schneider, D.C. and P.M. Payne. 1983. Factors affecting haul-out of harbor seals at a site in southeastern Massachusetts. J. Mamm. 64(3): 518-520.

Schreiber, E.A. and D.S. Lee. 2000. Status and Conservation of West Indian Seabirds. Society of Caribbean Ornithology.

Scott, T.M. and S.S. Sadove. 1997. Sperm whale, *Physeter macrocephalus*, sightings in the shallow shelf waters off Long Island, New York. Mar. Mammal Sci. 13: 317-321.

Sea Around Us. 2007. A Global Database on Marine Fisheries and Ecosystems. Fisheries Centre, University British Columbia, Vancouver, Canada. Available online: www.seaaroundus.org/lme/SummaryInfo.aspx?LME=6.

Southeast Data Assessment and Review (SEDAR). 2009. Caribbean fisheries data evaluation. SEDAR Procedures Workshop 3. 195pp.

SEDAR. 2013. SEDAR 32A - Gulf of Mexico menhaden Stock Assessment Report. SEDAR, NorthCharleston, S.C. 422 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=32A

SEDAR. 2015. SEDAR 40 – Atlantic Menhaden Stock Assessment Report. SEDAR, North Charleston SC. 643 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=40.

Sherman K., P. Celone, and S. Adams. 2004. NOAA Fisheries Service's Large Marine Ecosystems Program: Status Report. NOAA Tech Memo NMFS NE 183. 21 pp.

Sherman, K. and G. Hempel (eds). 2008. The UNEP Large Marine Ecosystem Report: A perspective on changing conditions in LMEs of the world's Regional Seas. UNEP Regional Seas Report and Studies No. 182. United Nations Environment Programme. Nairobi, Kenya.

Sibley, D.A. 2000. The Sibley guide to birds. National Audubon Society. Alfred A. Knopf, New York. 554 pp.

Silber, G.K. and S. Bettridge. 2010. Vessel operations in right whale protection areas in 2009. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-44. 44 pp.

Smith, C. and P.M. Clay. 2010. Measuring subjective and objective well-being: analyses from five marine commercial fisheries. Human Organization 69(2): 158-168.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals 33:411-521.

Southall, B.L., T. Rowles, F. Gulland, R.W. Baird, and P.D. Jepson. 2013. Final report of the Independent Scientific Review Panel investigating potential contributing factors to a 2008 mass stranding of melon-headed whales (*Peponocephala electra*) in Antsohihy, Madagascar.

SAFMC (South Atlantic Fishery Management Council). 2009a. Fishery Ecosystem Plan of the South Atlantic Region. Volume II: South Atlantic Habitats and Species – Marine Mammals, Sea Turtles and Birds.

SAFMC (South Atlantic Fishery Management Council). 2009b. Fishery Ecosystem Plan of the South Atlantic Region. Volume IV: Threats to the South Atlantic Ecosystem and Recommendations. April 2009.

SAFMC. 2012. Bermuda petrel species account. Accessed May 21, 2012 at: http://www.safmc.net/Portals/0/ProtRes/New_PR/Spaccounts_sptable/pdf%20versions/Bermuda%20petrel.pdf

SAFMC. 2013. Managed Areas webpage. Accessed January 18, 2013 at: http://www.safmc.net/EcosystemManagement/Management/ManagedAreas/tabid/75/Default.aspx

Southwest Fisheries Science Center (SWFSC). 2013. Draft Programmatic Environmental Assessment for fisheries research conducted and funded by the Southwest Fisheries Science Center. NMFS, La Jolla, CA. 300 pp. Available at: https://swfsc.noaa.gov/uploadedFiles/Divisions/PRD/Administration/Draft_SWFSC_Fisheries_Research_EA_public_release_draft_v2_18Apr2013_bookmarks.pdf

Spendelow, J.A. 1995. Roseate tern fact sheet. U.S.G.S. Biological Survey. Available at: http://www.mbr-pwrc.usgs.gov/mbr/tern2.htm

Spotila, J.R., A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: are leatherback turtles going extinct? Chelonian Conservation and Biology 2(2): 290-222.

Steinback, S., K. Wallmo, and P.M. Clay. 2009. Saltwater sport fishing for food or income in the Northeastern U.S.: Statistical estimates and policy implications.Marine Policy 33(1): 49–57.

Stephenson, P.C. and S. Wells. 2008. Evaluation of the effectiveness of reducing dolphin catches with pingers and exclusion grids in the Pilbara trawl fishery. Final report to Fisheries Research and Development Corporation on Project No. 2004/068. Fisheries Research Report No. 173, Department of Fisheries, Western Australia. 44pp.

Stevenson, D., L. Chiarella, D. Stephan, R. Reid, K. Wilhem, J. McCarthy, and M. Pentony. 2004. Characterization of the fishing practices and marine benthic ecosystems of the Northeast U.S. Shelf, and an evaluation of the potential effects of fishing on essential fish habitat. NOAA Tech. Memo. NMFS-NE-181.

Stevick, P.T., J. Allen, M. Bérubé, P.J. Clapham, S.K. Katona, F. Larsen, J. Lien, D.K. Mattila, P.J. Palsbøll, J. Robbins, J. Sigurjónsson, T.D. Smith, N. Øien, and P.S. Hammond. 2003a. Segregation of migration by feeding ground origin in North Atlantic humpback whales (*Megaptera novaeangliae*). J. Zool. 259: 231–237.

Stevick, P.T., J. Allen, P.J. Clapham, N. Friday, S.K. Katona, F. Larsen, J. Lien, D.K. Mattila, P.J. Palsbøll, J. Sigurjónsson, T.D. Smith, N. Øien, and P.S. Hammond. 2003b. North Atlantic humpback whale abundance and rate of increase four decades after protection from whaling. Mar. Ecol. Prog. Ser. 258: 263-273.

Swartz, S.L., A. Martinez, J. Stamates, C. Burks, and A.A. Mignucci-Giannoni. 2001. Acoustic and visual survey of cetaceans in the waters of Puerto Rico and the Virgin Islands: February-March 2001. NOAA Technical Memorandum NMFS-SEFSC- 463. 62 pp.

Swingle, W.M., S.G. Barco, T.D. Pitchford, W.A. McLellan, and D.A. Pabst. 1993. Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia. Mar. Mamm. Sci. 9: 309-315.

Tillin, H.M., J.G. Hiddink, S. Jennings, and M.J. Kaiser. 2006. Chronic bottom trawling alters the functional composition of benthic invertebrate communities on a sea-basin scale. Mar. Ecol. Prog. Ser. 318: 31-45.

Toth, J.F. and R.B. Brown. 1997. Racial and gender meanings of why people participate in recreational fishing. Leisure Sciences 19(2): 129-146.

Turtle Expert Working Group (TEWG). 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. NOAA Tech. Memo. NMFS-SEFSC-409.

TEWG. 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Tech. Memo. NMFS-SEFSC-444.

TEWG. 2007. An Assessment of the Leatherback Turtle Population in the Atlantic Ocean. NOAA Tech. Memo. NMFS-SEFSC-555. 116pp.

Torres, L.G., P.A. Rosel, C. D'Agrosa, and A.J. Read. 2003. Improving management of overlapping bottlenose dolphin ecotypes through spatial analysis and genetics. Mar. Mamm. Sci. 19: 502-514.

USFWS. 1997. Synopsis of the biological data on the green turtle, *Chelonia mydas* (Linnaeus 1758). Biological Report 97(1). U.S. Fish and Wildlife Service, Washington, DC.

USFWS. 2001. Florida Manatee Recovery Plan, (*Trichechus manatus latirostris*), Third Revision. U.S. Fish and Wildlife Service. Atlanta, Georgia. 144 pp. + appendices.

USFWS. 2007. West Indian manatee (*Trichechus manatus*) five-year review: Summary and evaluation. U.S. Fish and Wildlife Service, Southeast Region, Jacksonville Ecological Services Office, Jacksonville, FL and Caribbean Field Office, Boquerón, Puerto Rico. 86pp.

USFWS. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. [Online version available at <http://www.fws.gov/migratorybirds/>]

USFWS. 2009a. Stock Assessment West Indian manatee (*Trichechus manatus*), Puerto Rico stock (Antillean subspecies, *Trichechus manatus manatus*). U.S. Fish and Wildlife Service, Caribbean Field Office, Boquerón, Puerto Rico. http://www.fws.gov/northflorida/Manatee/SARS/20091230_rpt_Final_Antillean_Manatee_SAR.pdf

USFWS. 2009b. Stock Assessment West Indian manatee (*Trichechus manatus*), Florida stock (Florida subspecies, *Trichechus manatus latirostris*). U.S. Fish and Wildlife Service, Jacksonville, Florida. http://www.fws.gov/northflorida/Manatee/SARS/20091230_rpt_Final_Florida_Manatee_SAR.pdf

USFWS. 2010. Least tern, *Sterna antillarum* species profile. Available at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B07N

USFWS. 2011. Birds of Management Concern and Focal Species, U.S. Fish and Wildlife Service, Migratory Bird Program. November.

USFWS. 2013. 2012, Important Year for Manatee Conservation in the Caribbean. U.S. Fish and Wildlife Service—Southeast region. Ecological Services in the Caribbean. http://www.fws.gov/caribbean/2013Manatee.html. Website accessed June 18, 2013.

USFWS 2014a. Stock Assessment West Indian manatee (*Trichechus manatus*), Florida stock (Florida subspecies, *Trichechus manatus latirostris*). U.S. Fish and Wildlife Service, Jacksonville, Florida. http://www.fws.gov/northflorida/manatee/SARS/FR00001606_Final_SAR_WIM_FL_Stock.pdf

USFWS 2014b. Stock Assessment West Indian manatee (*Trichechus manatus*), Puerto Rico stock (Antillean subspecies, *Trichechus manatus manatus*). U.S. Fish and Wildlife Service, Caribbean Field Office, Boquerón, Puerto Rico. http://www.fws.gov/caribbean/es/documents/201401_FinalSARWIMPuertoRicoStock.pdf

USFWS. 2014c. All About Piping Plovers. Accessed February 12, 2014 at http://www.fws.gov/plover/facts.html .

USFWS and NMFS. 1992. Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). National Marine Fisheries Service, St. Petersburg, Florida.

Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles. 2015a. Demographic clusters identified within the northern Gulf of Mexico common bottlenose dolphin (*Tursiops truncates*) unusual mortality event: January 2010 - June 2013. PLoS ONE 10(2): e0117248. doi:10.1371/journal.pone.0117248.

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G.

Lovewell, H. Whitehead, D. Rotstein, W. McFee, E. Fougeres, and T. Rowles. 2015b. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the *Deepwater Horizon* oil spill. PLoS ONE 10(5): e0126538. doi:10.1371/journal. pone.0126538.

Wang, J., J. Barkan, S. Fisler, C. Godinez-Reyes, and Y. Swimmer. 2013. Developing ultraviolet illumination of gillnets as a method to reduce sea turtle bycatch. Biology Letters 9: http://dx.doi.org/10.1098/rsbl.2013.0383.

Ward-Geiger, L.I., A.R. Knowlton, A.F. Amos, T.D. Pitchford, B. Mase-Guthrie, B.J. Zoodsma. 2011. Recent sightings of the North Atlantic right whale in the Gulf of Mexico Gulf of Mexico Science 29(1): 74-78.

Waring, G. T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream features off the northeastern USA Shelf. ICES [Int. Counc. Explor. Sea] C.M. N:12.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1993. Sperm whales associated with Gulf Stream features off the northeastern USA shelf. Fish. Oceanogr. 2(2): 101-105.

Waring, G.T., E. Josephson, C.P. Fairfield, and K. Maze-Foley. 2007. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments – 2006. NOAA Tech. Memo. NMFS-NE-201, 378 pp.

Waring G..T, E. Josephson, K. Maze-Foley, P.E. Rosel. 2010. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2010. NOAA Tech Memo NMFS NE 219. 598 pp. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/nefsc/publications/

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2012. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments-2011. NOAA Tech Memo NMFS NE 221. 319 pp. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/nefsc/publications/.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2013. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments-2012. NOAA Tech. Memo. NMFS-NE 223. 425 pp. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nmfs.noaa.gov/pr/sars/pdf/ao2012.pdf

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2014. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments-2013. NOAA Tech. Memo. NMFS-NE 228. 464 pp. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2015a. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments—2014. NOAA Tech. Memo. NMFS-NE-231.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2015b. Draft U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments—2015. NOAA Tech. Memo. NMFS-NE-XXX.

Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood, and S. Baker. 2001. Characterization of beaked whale (*Ziphiidae*) and sperm whale (*Physeter macrocephalus*) summer habitat in shelf-edge and deeper waters off the northeast U.S. Mar. Mammal Sci. 17(4): 703-717.

Wartzok, D., and D.R. Ketten. 1999. Marine mammal sensory systems. Pages 117-175 in J.E. Reynolds III and S.A. Rommel (eds.), Biology of Marine Mammals, Smithsonian Institution Press, Washington, D.C.

Watkins, W.A., M.A. Daher, N.A. DiMarzio, A. Samuels, D. Wartzok, K.M. Fristrup, P.W. Howey, and R.R. Maiefski. 2002. Sperm whale dives tracked by radio tag telemetry. Mar. Mamm. Sci. 18: 55-68.

Watson, C., and K. Malloy. 2005. The South Atlantic Migratory Bird Initiative Implementation.

Watson, J.W., S.P. Epperly, A.K. Shah, and D.G. Foster. 2005. Fishing methods to reduce sea turtle mortality associated with pelagic longlines. Canadian Journal of Fisheries and Aquatic Science 62: 965-981.

Whitehead, H. 2009. Sperm whale *Physeter macrocephalus*. Pages 1093-1097 in W.F. Perrin, B. Würsig, and H.G.M. Thewissen (eds.), Encyclopedia of Marine Mammals, Academic Press, San Diego, CA. 1316 pp.

Wiley, D.N., R.A. Asmutis, T.D. Pitchford, and D.P. Gannon. 1995. Stranding and mortality of humpback whales, *Megaptera novaeangliae*, in the mid-Atlantic and southeast United States, 1985-1992. Fish. Bull. 93: 196-205.

Williams, R., S. Gero, L. Bejder, J. Calambokidis, S.D. Kraus, S. Lusseau, A.J. Read, and J. Robbins. 2011. Underestimating the damage: interpreting cetacean carcass recoveries in the context of the *Deepwater Horizon*/BP incident. Conservation Letters 0 (2011): 1-6.

Witherington, B.E. and L.M. Ehrhart. 1989. Hypothermic Stunning and Mortality of Marine Turtles in the Indian River Lagoon System, Florida. Copeia 1989(3): 696-703.

Witherington, B., R. Herren, and M. Bresette. 2006. *Caretta caretta* – Loggerhead sea turtle. Chelonian Res. Monographs 3: 74-89.

Wood LaFond, S. 2009. Dynamics of Recolonization: a study of the gray seal (*Halichoerus grypus*) in the Northeast U.S. Ph.D. Dissertation. University of Massachusetts, Boston. 83 pp.

Wusinich-Mendez, D. and C. Trappe (eds.). 2007. Report on the Status of Marine Protected Areas in Coral Reef Ecosystems of the United States Volume 1: Marine Protected Areas Managed by U.S. States, Territories, and Commonwealths: 2007. NOAA Technical Memorandum CRCP 2. NOAA Coral Reef Conservation Program. Silver Spring, MD. 129 pp. + Appendices.

Wynne, K. and M. Schwartz. 1999. Guide to marine mammals and turtles of the U.S. Atlantic and Gulf of Mexico. Rhode Island Sea Grant, Narragansett, RI.

Zollett, E.A. 2005. A review of cetacean bycatch in trawl fisheries. Literature review prepared for the Northeast Fisheries Science Center. Available at: http://nero.noaa.gov/prot_res/atgtrp/ai/gr/16.pdf

Zollett, E.A. 2009. Bycatch of Protected Species and Other Species of Concern in U.S. East Coast Commercial Fisheries. Endangered Species Research 9: 49–59.

Zug, G.R., and J.F. Parham. 1996. Age and growth in leatherback turtles, *Dermochelys coriacea* (Testudines: *Dermochelyidae*): a skeletochronological analysis. Chelonian Conservation Biology 2(2): 244-249.

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[Note: This work was primarily completed by consultants from URS Corporation in Anchorage, Alaska. In October 2014, URS was purchased by AECOM, Inc. and the final stages of the project were completed by some of the listed personnel as AECOM staff, although the service contract remained under the URS name.]

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